1. INTERNATIONAL CONFERENCE ON VIRTUAL REALITY

THE BOOK OF PROOCEEDINGS

04 – 05 APRIL 2019

HARRAN UNIVERSITY, ŞANLIURFA, TURKEY

ISBN 978-605-69577-0-3

Hoş geldiniz

أهلا وسهلا

Welcome

Hûn bi xêr hatin

ܒܫܝܢܐ ܐܬܝܬܘܢ

(bşayno ethaytun)

1ST INTERNATIONAL CONFERENCE ON VIRTUAL REALITY

Harran University, Şanlıurfa, Turkey

July 2019

ISBN 978-605-69577-0-3

Edited by;

Prof.Dr. Saffet ERDOĞAN
Assoc. Prof. Dr. Gencay SARIIŞIK
Assoc. Prof. Dr. Dursun AKASLAN
Assist. Prof. Dr. Fred Barış ERNST

Contents

FORWORD

We have been very pleased to have the opportunity to organize this 1st conference on virtual reality in Turkey. This conference has been conducted in the framework of the ERAMUS+ project “Strengthening of research and training capabilities for Virtual Reality applications in the private and governmental sector”. The main purpose of this project is to strengthen the cooperation between the private sector and higher education institutions in order to increase the capabilities of the regional workforce and improve the overall attractiveness of the western part of the GAP region (Southeastern Anatolia Project). This project is part of the strategic initiative of Harran University to establish a Center for Virtual Reality in cooperation with stakeholders from the university, private sector and several governmental organizations. During this project the opportunities of this technology in the different vertical sectors will be shown and the necessary training requirements elaborated in detail. Partners in this project are Germany's Otto-Von-Guericke-Universitaet Magdeburg in cooperation with Fraunhofer Institute for Factory Operation and Automation, the private company Visionair3D (Netherlands) and as an associate partner, Karacadağ Development Agency/Turkey.

Virtual Reality (VR) lets our dreams become true. It is about visions and about places and times we cannot visit for different reasons. This applies to the past and to the future as well. This has been addressed during this conference by showcasing works about history and the future of city planning. While focus was on the fields of engineering, planning and medicine the presenters covered a much wider range of VR application. During the cultural program, the participants were brought back to point zero of history, the oldest assembly building in the world – Göbekli Tepe and could visit many other locations that prove the cultural and religious richness of this region. Some of them were presented as VR applications for the special field of archaeology during the conference.

We hope that this conference will have a tangible effect on the future development of virtual reality, augmented reality and other related technologies in Turkey. In accordance with the goals of this ERASMUS project, we are looking forward to broadening the cooperation with our international partners in this field by initiating new joint projects.

This conference could only be realızed thanks to the support of the European Union's ERAMUS+ program, the National Agency of Turkey, our partners in Germany, the Netherlands and here in Sanliurfa and the enthusiastic academic and administrative staff of Harran University..

Thank you again for contributing to this conference

Dr. Fred Barış Ernst
Project Manager

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PROGRAM

REGISTRATION

(08:00—08:30)

COFFEE BREAK AND NETWORKING

(08:30—09:00)

OPENING AND WELCOME SPEECHES

(09:00—10:00)

MAJOR HALL / BÜYÜK SALON
4 APRİL 2019

KEYNOTE SPEAKER

(Müh. İdris Güllüce)

(10:00—10:30)

COFFEE BREAK AND NETWORKING

(10:30—11:00)

BALIKLIGÖL HALL / BALIKLIGÖL SALONU
4 APRİL 2019 / THURSDAY / 11:00-12:00

11:00—11:15
Mehmet YILMAZ, "How big is the Virtual reality market?", Harran University, TURKEY

11:15—11:30
Gül GÜNDÜZ, "Virtual Reality: Virtual Reality Approaches In Education And Virtual Reality In Electric Motors", Sakarya University, TURKEY

11:30—11:45
Recep ASLAN, "When will we start to understand and apply the virtual reality?", Afyon Kocatepe Univrersity, TURKEY

11:45—12:00
Alptekin ÖZDEMİR, "With Virtual Reality (Vr) We Can Explain Things In A Different Way", AlpiSmartTech Nordic ApS, DENMARK

OTURUM BAŞKANI / SESSION CHAIR
Assoc. Prof. Dr. Dursun AKASLAN

(VIRTUAL REALITY)

GÖBEKLİTEPE HALL / GOBEKLITEPE SALONU
4 APRİL 2019 / THURSDAY / 11:00-12:00

11:00—11:15

Deniz DEMİRYÜREK, "Using Hologramic Images in Anatomy Education", Hacettepe University, TURKEY

11:15—11:30

Mehmet YILMAZ "How will Education be changed using virtual reality?", Harran University, TURKEY

11:30—11:45

M. Vehbi BALAK, "Implementing Virtual and Augmented Reality Technologies in Technical Drawing Course", Harran University, TURKEY

11:45—12:00

Önder DEMİR, "A Sample Of Benefiting From Augmented Reality Technologies For Increasing Spatial Literacy For Primary And Secondary School Students", Anadolu Univrersity, TURKEY

OTURUM BAŞKANI / SESSION CHAIR
Assoc. Prof. Dr. Gencay SARIIŞIK

(EDUCATION)

HALFETİ HALL / HALFETI SALONU
4 APRİL 2019 / THURSDAY / 11:00-12:00

11:00—11:15
Aytaç Uğur YERDEN, "Using augmented reality for the purpose of CNC Education", Istanbul Gedik University, TURKEY

11:15—11:30
Abdulkadir MEMDUHOĞLU, "3D Map Experience for Youth with Augmented Reality Applications", Harran University, TURKEY

11:30—11:45
Nuray AT, "Making Virtual and Augmented Reality Real via Network Virtualization", Eskisehir Technical University, TURKEY

11:45—12:00
Vehbi BALAK, "The Effects of Virtual And Augmented Reality Technologies on Spatial Visualization Skills of Engineering Freshman Students", Harran University, TURKEY

OTURUM BAŞKANI / SESSION CHAIR
Prof. Dr. Recep ASLAN

(EMPLOYMENT & INDUSTRY)

LUNCH BREAK / ÖĞLE YEMEĞİ

4 APRİL 2019 / THURSDAY / 12:00—13:00

KEYNOTE SPEAKER

(Jun. Prof. Dr. Christian Hansen)

(13:00—13:30)

COFFEE BREAK AND NETWORKING

(13:30—14:00)

BALIKLIGÖL HALL / BALIKLIGÖL SALONU

4 APRİL 2019 / THURSDAY / 14:00—15:00

14:00—14:15

Talha AKSOY, "Use Of VR Technologies In Landscape Design And Urban Design: Eskişehir, R & D, Innovation And Design Valley Design Sample", Eskisehir Technical University, TURKEY

14:15—14:30

İbrahim YENİGÜN, "Commercial Application Approaches To Virtual Reality; Case Of Construction Sector", Harran University, TURKEY

14:30—14:45

Fred Barış ERNST, "Virtual Reality for City Planning", Harran University, TURKEY

14:45—15:00

Nizar POLAT, "3D City Modelling with Airborne LiDAR data", Harran University, TURKEY

OTURUM BAŞKANI / SESSION CHAIR

Assist. Prof.Dr. Nizar POLAT

(City Planning)

GÖBEKLİTEPE HALL / GOBEKLITEPE SALONU

4 APRİL 2019 / THURSDAY / 14:00—15:00

14:00—14:15

İbrahim YENİGÜN, "The Role of Virtual Reality in the True Construction of Environmental Awareness", Hacettepe University, TURKEY

14:15—14:30

Mehmet Emin TENEKECİ, "Motion Platform Design For Human-Computer Interaction In Virtual Reality Environment", Harran University, TURKEY

14:30—14:45

Pınar Naime KIRÇIN, "The Use of Virtual Reality in Cultural Landscapes", Eskişehir Technical Univrersity, TURKEY

14:45—15:00

Nalan DEMİRCİOĞLU YILDIZ, "The Formation, Development And Modeling Process Of 3-Dimensional Development Plans In The Green Infrastructure System: The Case of Üsküdar", Ataturk University, TURKEY

OTURUM BAŞKANI / SESSION CHAIR

Dr. Muhammad Muzammal

(Environment)

HALFETİ HALL / HALFETI SALONU

4 APRİL 2019 / THURSDAY / 14:00—15:00

14:00—14:15

Saffet ERDOĞAN, "Artificial Neural Networks Controlled Reactive Power Compensation in the Perspective of Industry4.0", Harran University, TURKEY

14:15—14:30

Enes BAŞARIR, "Employee Training & Orientation with VR", DHL Supply Chain Turkey, TURKEY

14:30—14:45

Gencay SARIIŞIK, "Virtual Reality Applications in Occupational Work & Safety in the High-Risk Industries", Harran University, TURKEY

14:45—15:00

Mehmet Bedri DOĞRUYOL, "Employment Potential in the Sector of Virtual Reality and Augmented Reality for Our Country", Harran University, TURKEY

OTURUM BAŞKANI / SESSION CHAIR

Assoc. Prof. Dr. Uğur Avdan

(EMPLOYMENT & INDUSTRY)

KEYNOTE SPEAKER

(Prof. Dr. Alias Abdul Rahman)

(15:00—15:30)

COFFEE BREAK AND NETWORKING

(15:30—16:00)

BALIKLIGÖL HALL / BALIKLIGÖL SALONU
4 APRİL 2019 / THURSDAY / 16:00—17:00

16:00—16:15
Jale ORAN, "AR/VR practises in finance: A proposal for financial literacy education", Marmara University, TURKEY

16:15—16:30
Arzu BALOGLU, "An Instagram Marketing Analysis", Marmara University, TURKEY

16:30—16:45
Nizar POLAT, "Low-Cost 3D Model Generation for Virtual Reality", Harran University, TURKEY

16:45—17:00
Ömer ÜNSAL, "Silhouette Analysis with 3D Development Plan: The Bosphorus Case", Üsküdar Municipality, TURKEY

OTURUM BAŞKANI / SESSION CHAIR
Prof. Dr. Alper ÇABUK

(Finance and Marketing)

GÖBEKLİTEPE HALL / GOBEKLITEPE SALONU

4 APRİL 2019 / THURSDAY / 16:00—17:00

16:00—16:15

Nizar POLAT, "The use of social media-based images in 3D documentation of historical monuments", Hacettepe University, TURKEY

16:15—16:30

Mehmet Emin TENEKECİ, "VIRTUAL APPLICATION DEVELOPMENT ENVIRONMENT FOR AUTONOMOUS CARS", Harran University, TURKEY

16:30—16:45

Uğur TURHAN, "The Performance Assessment of Air Traffic Control Trainees in 3D Aerodrome Control Simulation", Eskişehir Technical University, TURKEY

16:45—17:00

Birsen AÇIKEL, "The Scenario Development and Improvement Aspects of 3D Aerodrome Control Training Simulation", Kastamonu University, TURKEY

OTURUM BAŞKANI / SESSION CHAIR

Assoc. Prof. Dr. Saye Nihan ÇABUK

(Simulation)

HALFETİ HALL / HALFETI SALONU

4 APRİL 2019 / THURSDAY / 16:00—17:00

16:00—16:15

Arif YÜCE, "Phygitally Yours: Examination of Virtual Reality Experiences in Digital Sport Games", Eskişehir Technical University, TURKEY

16:15—16:30

Batuhan BİNTAS, "Empowerment of the Imagination through Cyber Space", Cyber Rabbit, United Kingdom

16:30—16:45

Serhat SARI, "Reproduction and Experience of Bauhaus Design School's Iconic Product Design with Virtual Reality (VR) Technologies", Eskisehir Technical University, TURKEY

16:45—17:00

Dursun AKASLAN, "A Model for Grading Virtual Reality Glasses", Harran University, TURKEY

OTURUM BAŞKANI / SESSION CHAIR

Assoc. Prof. Dr. Dursun AKASLAN

(Application Development)

SIRA GECESİ

4 APRİL 2019 / THURSDAY / 19:30—23:00

Traditional dinner with music and dancing, free for members of organizing and scientific committees, invited speakers and presenters

REGISTRATION
(08:00—08:30)

COFFEE BREAK AND NETWORKING
(08:30—09:00)

KEYNOTE SPEAKER
(Dr. Muhammad Muzammal)
(09:00—09:30)

COFFEE BREAK AND NETWORKING
(09:30—10:00)

BALIKLIGÖL HALL / BALIKLIGÖL SALONU

5 APRİL 2019 / FRIDAY / 10:00—11:30

10:00—10:15

Ferhat Kuyucak ŞENGÜR, "Industry Level Effects of Information Technology: The Case of Air Travel", Eskisehir Technical University, TURKEY

10:15—10:30

Arzu BALOĞLU, "New generation SAP with industrial case studies", Marmara University, TURKEY

10:30—10:45

Mehtap Özenen KAVLAK, "Innovative Methods in Industry: Virtual Reality Applications", Eskisehir Technical University, TURKEY

10:45—11:00

Mustafa ULUKAVAK, "Virtual Reality Applications in the Follow-up of Engineering Projects", Harran University, TURKEY

OTURUM BAŞKANI / SESSION CHAIR

Research Asst. Şeyma AKÇA

(EMPLOYMENT & INDUSTRY)

GÖBEKLİTEPE HALL / GOBEKLITEPE SALONU

5 APRİL 2019 / FRIDAY / 10:00—11:30

10:00—10:15

Balca AĞAÇSAPAN, "Importance of Environmental Virtual Observatories(EVOs) for Environmental Conservation", Eskisehir Technical University, TURKEY

10:15—10:30

Zehra Yiğit AVDAN, "Virtual Geographic Environments for Water Ponds Bathymetry", Eskisehir Technical University, TURKEY

10:30—10:45

Mustafa ULUKAVAK, "Photo-Realistic Environmental Modelling For Virtual Reality", Harran University, TURKEY

10:45—11:00

Mustafa ULUKAVAK, "Transferring Historical Ruins to Virtual Reality Environment Using UAV Photogrammetry: A Case Study of Şanlıurfa Castle", Harran University, TURKEY

OTURUM BAŞKANI / SESSION CHAIR

Research Asst. Yunus KAYA

(ENVİRONMENT)

GÖBEKLİTEPE HALL / GOBEKLITEPE SALONU

5 APRİL 2019 / FRIDAY / 10:00—11:30

11:00—11:15

Yunus KAYA, "Building Modelling By UAV Images", Harran University, TURKEY

11:15—11:30

Mustafa ULUKAVAK, "The Availability of Geodetic Data in Virtual Reality Applications", Harran University, TURKEY

OTURUM BAŞKANI / SESSION CHAIR

Research Asst. Yunus KAYA

(ENVİRONMENT)

HALFETİ HALL / HALFETI SALONU

5 APRİL 2019 / FRIDAY / 10:00—11:30

10:00—10:15

Emine Pınar MARTLI, "Augmented Reality Technology In Nursing Education", Kırıkkale Üniversitesi, TURKEY

10:15—10:30

Recep ASLAN, "The Use Of Virtual Reality In The Veterinary Medicine Education", TURKEY

10:30—10:45

Ali UZUNKÖY, "Virtual reality in medical education. Is it a dream or a reality?" Eskisehir Technical University, TURKEY

10:45—11:00

Alper VATANSEVER, "The virtual anatomy of the temporomandibular joint" Balıkesir Üniversitesi, TURKEY

OTURUM BAŞKANI / SESSION CHAIR

Prof. Dr. Mehmet Ali ÇULLU

(MEDİCİNE)

MAJOR HALL / BÜYÜK SALON
5 APRİL 2019

KEYNOTE SPEAKER

(Dr. Rui Filipe Antunes)

(11:30—12:00)

LUNCH AT CENTRAL CAFETERİA

(12:00—14:00)

TOUR

(Göbekli Tepe and visit of Mosaic Museum of Şanlıurfa)

(14:00—17:00)

GALA DİNNER (18:00—19:30)

TRANSFER TO AİRPORT

(19:30—20:30)

FULL PAPERS

USING AUGMENTED REALITY FOR THE PURPOSE OF CNC EDUCATION

Aytac Ugur YERDEN[1*], Nihat AKKUS[2], Fatih YALCIN[3]

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ABSTRACT

It is important in terms of the success of the education to transfer a training about manufacturing technologies to the student in a fast process. Generally, the theoretical explanation of CNC systems is not sufficient for the recognition of the device. Combining the notes in traditional education with today's technologies will have an impact on the quality of education. For this purpose, the stages of establishing a lecture note with augmented reality support for CNC training have been the subject of the study.

Keywords: Augmented Reality, Virtual Reality, CNC Education, UNITY3D, Vuforia

INTRODUCTION

Augmented reality is described as real-time and interactive enabling the real world to be enriched with virtual data and information (Somyürek). The use of traditional looms in manufacturing decreases gradually and is replaced by the use of CNC machines (Kaygısız). CNC machines consist of three basic components; (i)Mechanical System, (ii)Electronic System, (iii) Control Unit (Akkus). Applying real CNC machines, can deal with various accidents. Various simulation systems are used to eliminate these problems. The corresponding meaning of the code written in the simulation environment can first be observed on the virtual CNC machine before it is applied to the actual CNC machine (Aktan). A simulator is presented for both the entire NC machine and the tool path (Ernesto). The advantage of mixed virtual reality simulators is that separate warehouses are not needed to store the large machines or physically move them for comparative testing. (Galambos). A strong and growing area is the manufacturing applications using AR technology. (Ong).

METHOD

This research aims to improve the preparation of a traditional course note with the use of augmented reality application for the purpose of CNC training. A course material has been prepared including the definition, purpose and use of CNC. Students will provide an augmented reality supported CNC training application to their mobile devices (smartphone, tablet computer, etc.) with the help of a QR code on this course material. It will be ensured that a CNC machine will work with the installed AR application and provide information as a 3D model on the traditional course note. In CNC training, the advantages and disadvantages of AR application are assessed and the results are attempted to be revealed.

FINDINGS AND DISCUSSION

The training's goal, objective and training outcomes should be determined during the stages of forming a course note for training purposes. The objective of basic CNC training is to be informed about the working principle and construction properties. Figure 1 shows that augmented reality application development flow chart for the purpose of CNC education.

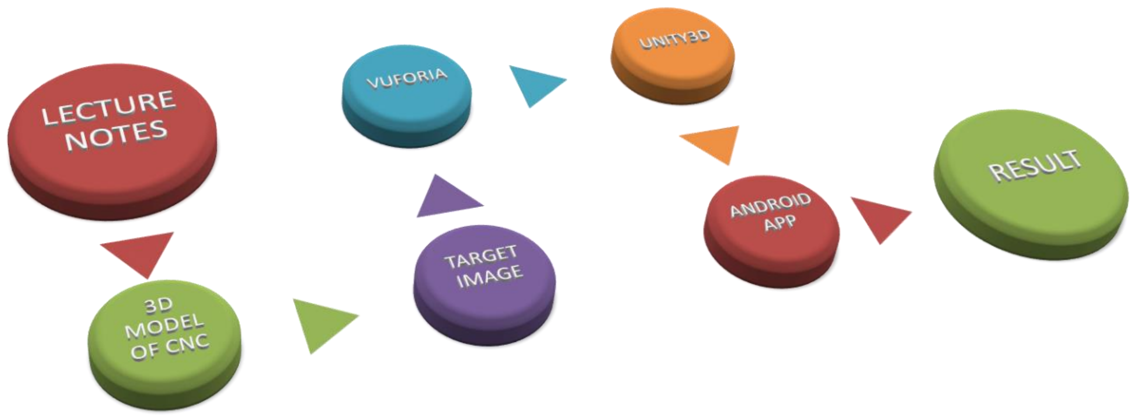

Figure 1: EDUCNC Application Development Flowchart

The 3-D models of the 2-D shapes in the course note are prepared for this purpose in the computer environment and then introduced to the development stages of the application supported by augmented reality. A pointer is set to display the 3D model. The pointer may be designed as a two - dimensional shape in course note or another shape. A package is created by registering to the Vuforia developer website(Vuforia) to identify the designed pointer. The package created will be imported into the UNITY3D software (UNITY3D). In figure 2 shows Vuforia License Manager that use in create a licence for app.

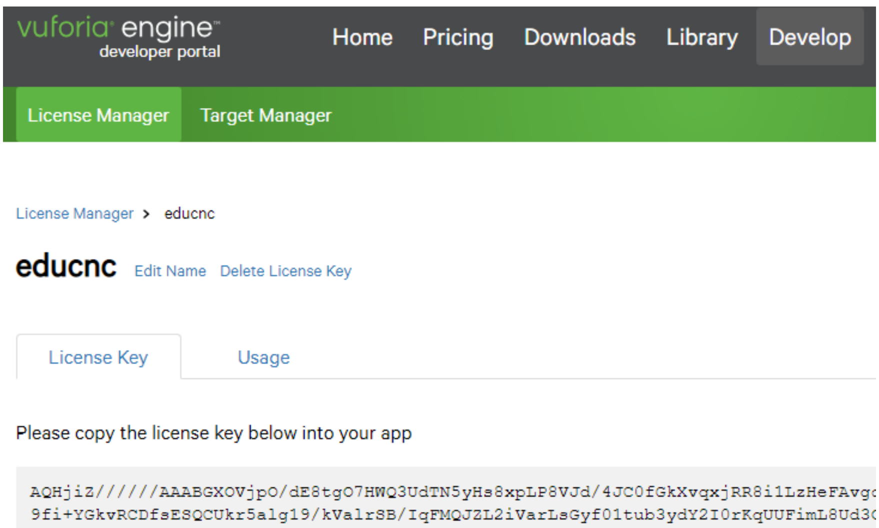

Figure. 2: Vuforia License Manager Screenshot

Figure 3 shows the Vuforia Target Manager used to add the necessary marker images to the library for the application to run.

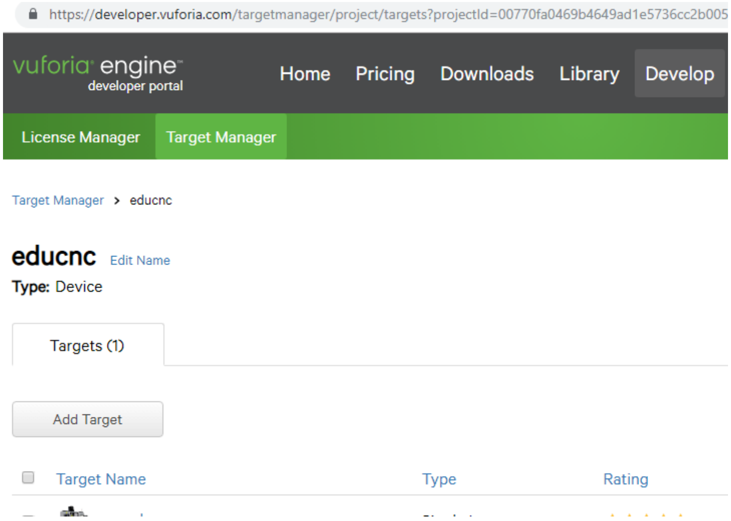

Figure 3: Vuforia Target Manager Screenshot

The reason UNITY3D and Vuforia are preferred is because they offer solutions that are quick and easy. In addition to these software, it is possible to use different options. UNITY3D first window view screenshot shows in Figure 4. The 3D model that is generated is imported into UNITY3D.

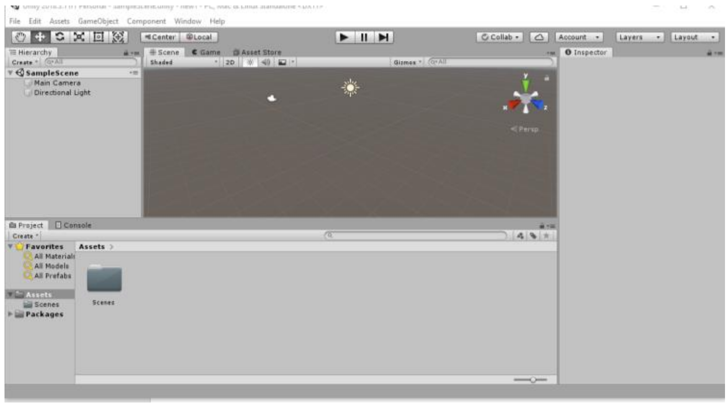

Figure 4: UNITY3D Screenshot

Animations, explanations and similar improvements are added to the 3D model with the help of UNITY3D and then exported as an android application.

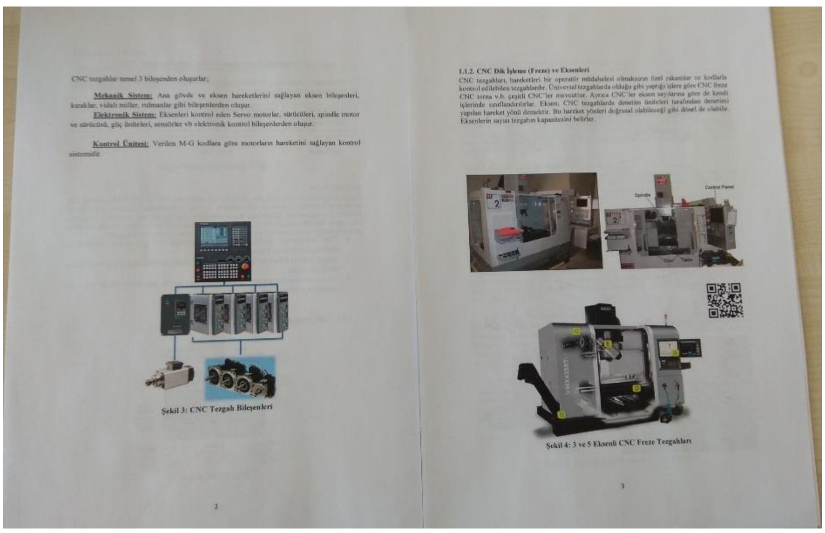

Figure 5: A Part of Lecture Notes

Access to the exported application is installed under a server or on an android market. In order to access the application, a QR code is created and placed on the course note shows in Figure 5. The application created with these steps is ready for the phase of testing.

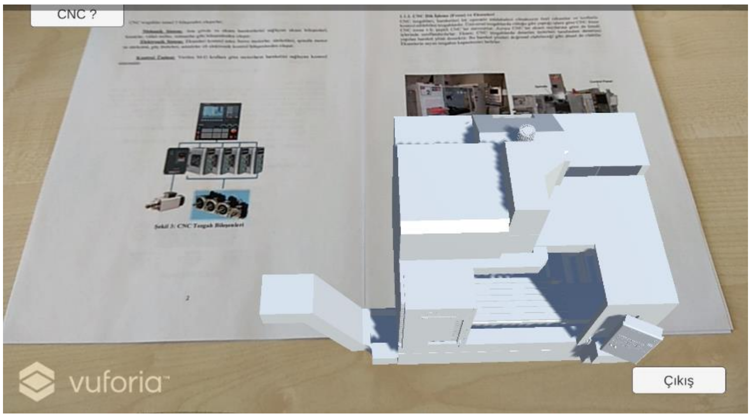

Figure 6: EDUCNC Android Application Screenshot

CNC Education purposed augmented reality android application screenshots shown in Figure 6 and Figure 7.

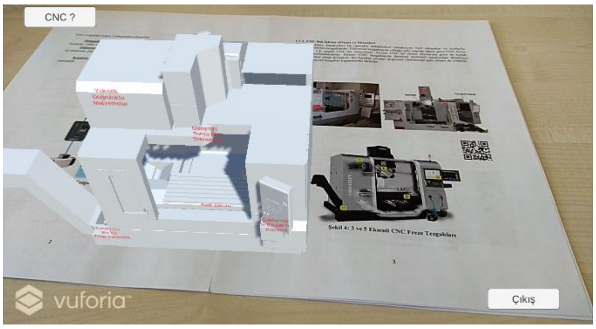

Figure 7: EDUCNC Android Application Screenshot on use

In the study, the advantages of the application in CNC training will be listed: (1) Lecture notes on a 2-dimensional shape of the device, which provides them with the opportunity to examine three-dimensional model, (2) Information about the construction of CNC on the model can be learned, (3) Knowledge of the operating principle of CNC can be provided.

The disadvantages of the application in CNC training will be listed: (1) The 3D CNC model shows a uniform model, (2) Hardware requirements may exist for a realistic 3D model visualization, (3) The application may not work if the print quality of the pointer is problematic.

CONCLUSIONS AND RECOMMENDATIONS

As a result, the educational contribution to such an application developed for the purpose of the CNC training base is quite high. When comparing the advantages and disadvantages, it is important to have a basic knowledge of the 3-dimensional model rather than the device's actual size. Occupational safety issues can be avoided in this way. The developed application will be tested on student groups in future studies, and the results will be shared.

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A SAMPLE OF BENEFITING FROM AUGMENTED REALITY TECHNOLOGIES FOR INCREASING SPATIAL LITERACY FOR PRIMARY AND SECONDARY SCHOOL STUDENTS

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Keywords: Spatial Literacy, Augmented Reality, Vuforia, Unity, Geography Classes

1. Introduction

From our prehistoric ancestors, mankind tries to understand their environment better to avoid from its dangers and to benefit from its rich resources. To achieve this mankind tried to mark his environment. This behaviour is a basic example of spatial literacy. Success in today's world is not different either. An individual need to understand his environment better than others to get ahead. The modern human needs various of skill sets like literacy, economical literacy, healthy literacy, political literacy, spatial literacy etc. to success in our modern world. It is not wrong to assume that many career paths in our modern life needs an individual to visualize 2D projection into 3 dimension(S. W. Westgard, 2010). The purpose of this study is to evaluate, the impact of modern high-tech technologies, especially Augmented Reality (AR), on spatial literacy learning of primary and secondary school students.

2. The Purpose Of This Study

In the scope of this study a puzzle game powered by Augmented Reality technologies is created. The idea to create this game is to boost the degree of spatial literacy of secondary school students. The puzzle game is limited to a basic political map of Republic of Türkiye. Powered by Augmented Reality technology, the goal of this study is an increase the interest of secondary school students in Geography classes. In addition, it is expected to increase knowledge of political map of Türkiye and the local traits of cities of Türkiye such as traditional foods, trait animals, trait artefacts etc.

3. The Conceptual Framework

It is highly spoken by some researches that the ability to visualize 2D representation in the third dimension is the basic skill for many career paths such as; engineers, urban planners, Department of Defense employees, architects, pilots, neurologists, and air traffic controllers etc. Because in this career paths an individual should be able to project 2D blueprints, maps, location intelligence, magnetic resonance imaging (MRI), or radarscopes into three-dimension. So countries like Canada and America added spatial literacy to their curriculum. Spatial literacy is the degree to infer and interpret the location, distance, direction, relationships, change, and movement over space. Spatial literacy or spatial thinking can be described in four basic features(Kastens & Ishikawa, 2006; King, 2006):

- An individual to recognize, observe, record, describe, classify, remember, and communicate the two- or three-dimensional shapes, structures, orientations, and positions of objects, properties, or processes
- To be able to manipulate those shapes, structures, orientation and positions by rotating, translating, deformation or partial removing
- To be able to infer about those objects structure, shape, orientation and positions
- To be able to predict the consequences of those shapes and structures positons

To summarize, spatial literacy is the know-how of relationships of objects in environment. Augmented reality generally can be confused with Virtual Reality(Chavan, 2014). Virtual Reality is an artificial environment created by using an software. The user accepts this virtual environment as real environment. Though, Augmented Reality can be described as integration of 3 Dimensional virtual objects into 3 Dimensional real world in real time(R. T. Azuma, 1997).The main differences between the concept can be seen at Figure 1.

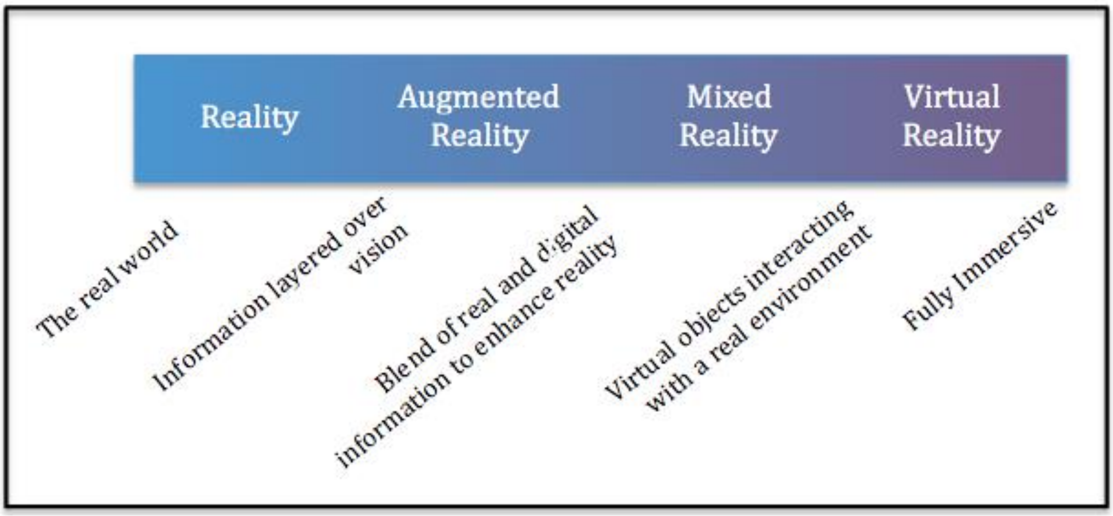

Figure 1.The differences of Reality definitions

Augmented Reality has lots of usages in our modern world such as medical, engineering, military applications, entertainment etc. an Augmented Reality application should have at least three major properties such as(R. Azuma et al., 2001); combining the real world with virtual objects, should run in real time and should register virtual and real objects mutually.

The main instruments of Augmented Reality are computers and input devices. Nowadays the main devices are head mounted displays, handheld displays and pinch gloves (Kesim & Ozarslan, 2012). An example of pinching gloves and head mounted displays are shown in Figure 2.

Figure 2. Head mounted display and pinching glove (Bowman, Wingrave, Campbell, & Q Ly, 2001)

Head mounted displays have either one or two optical displays on eye. Pinch gloves are used to grab a virtual object with pinching gestures. Nowadays pinching gloves gives its place to image processing methods to identify the pinching gesture (Microsoft). An example of modern headmounted displays which does not need pinching gloves can be seen at Figure 3.

Figure 3. Microsoft Hololens with pinching gesture (Microsoft, 2019)

On the contrary, handheld displays are the most used tools for Augmented Reality because of their affordable price and worldwide usages. The most famous ones are our everyday Smart-phones, PDAs and Tablets.

Using Augmented Reality is not a new idea in military, medical, engineering design, consumer design, gaming etc (R. Azuma et al., 2001). Augmented Reality applications make an individual to interact with the real world such a way that never happened before by displaying various information about an object in real time. In Turkey the usage of

Augmented Reality application has risen after the Fatih project. After that project nearly, all classes have smart boards. But the Augmented Reality applications are not enough. An example of AR application can be seen at **Figure 4**.

Figure 4. An AR application for 10th of November

There are many ways of usage of Augmented Reality applications in education. For example, a student can move, dismantle, put together a 3-dimensional object as it was real. Another interesting application may be augmented reality textbooks(Kesim & Ozarslan, 2012). By using some special software and applications this written plain 2-dimensional textbooks may turn to 3-dimensional dynamic information sources. For example, a student with a smart phone can see the 3-dimensional elephant object just scanning a 2-Dimensional elephant image by his smartphone camera shown in Figure 5.

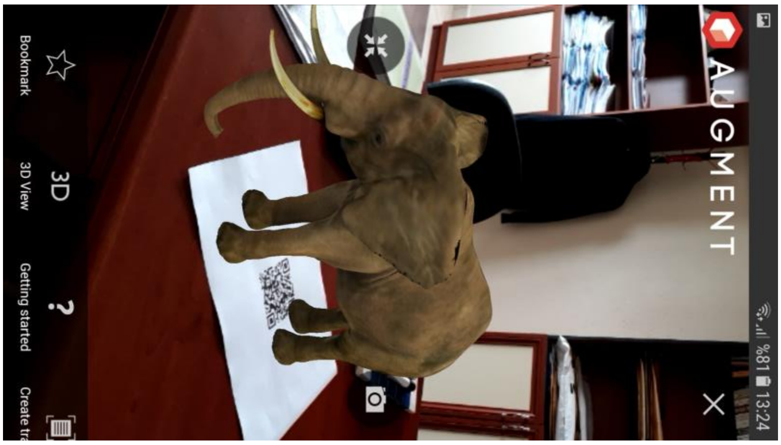

Figure 5. An example for alive 2D textbooks

4. Method

The main instrument of this study is to create a classic puzzle game powered by Augmented Reality. There are two main steps. First is to create the puzzle. To achieve this the political map of Türkiye has been laser cut by the city’s borders. The second part is the create the special application for android smartphones. Some special software are used to create the application. Unity is an award winning game engine that supports many platforms(Christel et al.). By developing in Unity, an application could be ported to android, IOS, several headsets and several operating systems. Microsoft Visual Studio is the basic Integrated Development Environment to develop and modify Unity scripts. Vuforia is a partially free software development kit created by Qualcomm(Vuforia, 2019). It is mostly used to register 2-dimensional image layers or texts. In this study image registration is used. There are different usage types of Vuforia, but in this study the device database is used. To be able to use

Vuforia, first an image database should be created and the images should be registered in this database. The basic working algorithm of Vuforia can be seen at **Figure 6**.

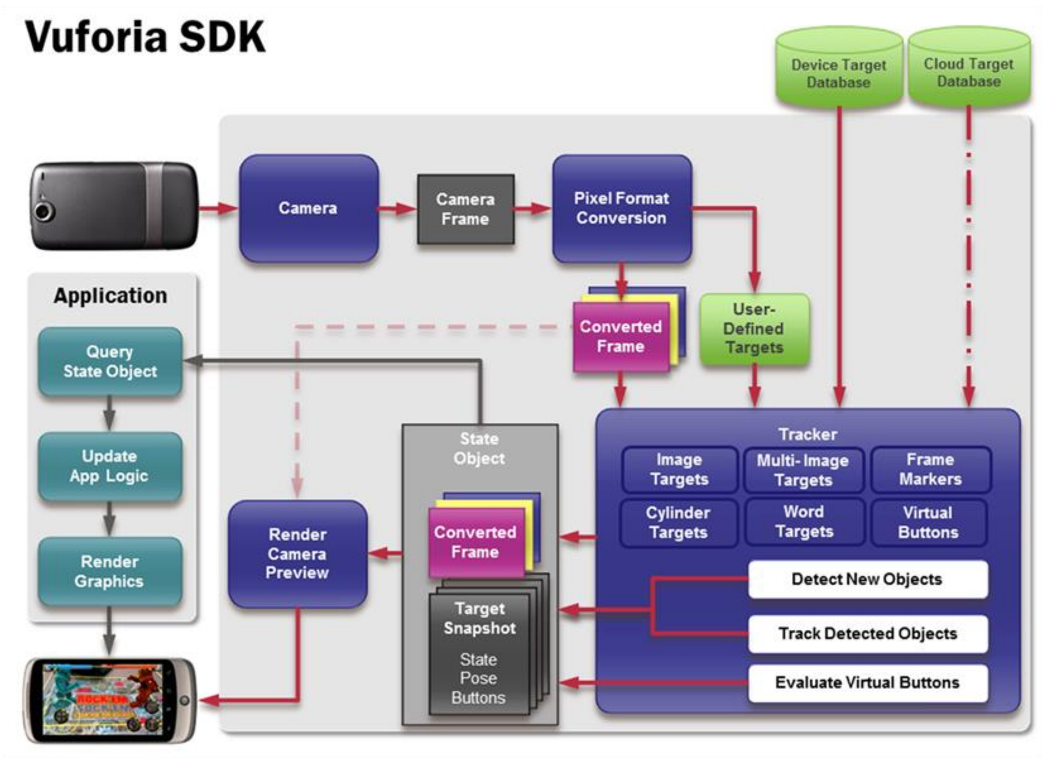

Figure 6. The working algorithm of Vuforia (Tsai & Yen, 2014)

In this study all the images of puzzle pieces, taken by camera are registered in Vuforia. After a puzzle piece is scanned by an android smartphone, a trait of that piece appears on screen as 3-dimensional object. That object can be rotated and moved by the user.

When the puzzle piece is scanned through a headmounted display or a smartphone, a trait of the city will be shown with three city names as options. While one of the options is the correct name of the scanned city the other two are only beguilings. If the correct answer is picked the application shows a congratulation message otherwise the application shows another trait of the scanned city. The working flow of the application can be seen at Figure 7.

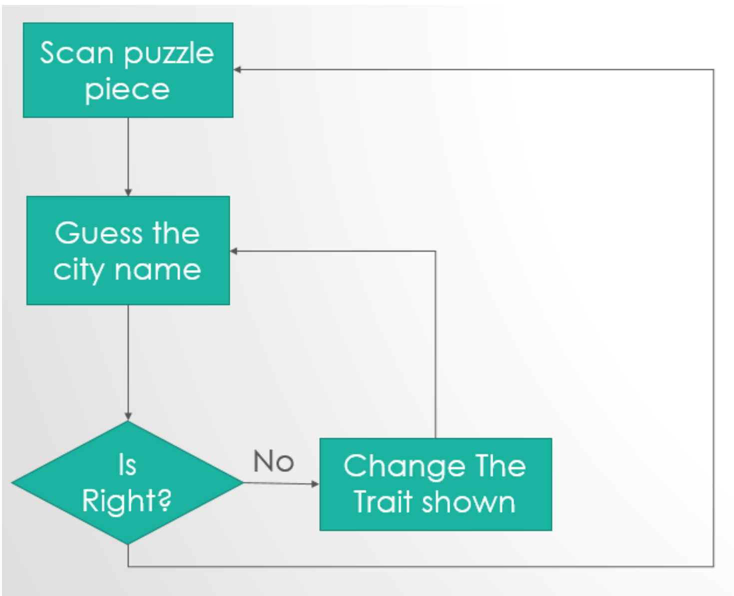

Figure 7. The working flow of application

A screen shot of working application can be seen at **Figure 8** and **Figure 9**.

Figure 8. A Screen shot of working application

Figure 9. A Screen shot of working application

5. Findings and Discussions

The application and puzzle game hasn't been tested yet. It will be tested in fall of 2019-2020 academic year. It is expected to see an increase of interest in geography classes and the knowledge of political map of Türkiye and the traits of cities of Türkiye through primary and secondary school students. The benefits of the application will be compared through surveys.

6. Conclusions and Recommendations

Spatial literacy is the degree to infer and interpret the location, distance, direction, relationships, change, and movement over space. It is a very important concept which is included into the curriculum of some countries like USA and Canada. In Türkiye, the basics of spatial literacy are given to students in geography classes. After the FATIH project, although nearly all classes have computers and smart boards, the applications for education are not enough. Hence in this project, an application to increase the interest to geography class and the knowledge of cities of Türkiye is presented.

The application is empowered by Augmented Reality. Augmented Reality is a concept which merges real life with virtual 3D models to offer more information. Augmented Reality has lots of usages in our modern world such as medical, engineering, military applications, entertainment, education etc.

In this project a political map puzzle and an AR software is presented. To create the software Unity and Vuforia are used. All the puzzle pieces are registered into Vuforia. When a puzzle piece is scanned through head mounted computer or smartphone, a trait is shown on the puzzle piece and it is expected to find the name of the city.

The application is evolving by the opinions of geography class teacher and will be tested on 2 class of primary and secondary school students in fall of 2019-2020 academic year. And the academic success of students will be compared via surveys.

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IMPORTANCE OF ENVIRONMENTAL VIRTUAL OBSERVATORIES(EVOS) FOR ENVIRONMENTAL CONSERVATION

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ABSTRACT

Advance technologies in the last century can be used to solve the environmental problems and make the world more livable. Environmental sensors, data portals, environmental data visualisation and monitoring platforms, environmental modelling platforms/decision support systems are the types of Environmental Virtual Observatories(EVOs). EVOs makes science and data more accesible. It informs and empowers citizens, increases data generation, facilitates collaboration between diverse stakeholders. By using these advances in technology, it can help people gain a deeper appreciation of environmental challenges, such as climate change and extinction of species. This study aims to explain EVOs and their contribution for environmental awareness and environmental problem solving process.

Keywords: Environmental Technologies, Environmental Conservation, Environmental Virtual Observatories

INTRODUCTION

The earth's environment is under severe stress from uncontrolled human activities. 260 million tons of plastic in the world produced each year, about 10 percent ends up in the Ocean (GreenPeace, 2006)According to The International Telecommunication Union (ITU) 2017 reports, by 2016, the world generated 44.7 million metric tonnes (Mt) of e-waste and only 20% was recycled through appropriate channels (Baldé, Forti, Gray, Kuehr, & Stegmann, 2017)These human caused environmental problems reveal the necessity of the adoption of the sustainability phenomenon that requires the protection of natural resources and effective use.

In this context, the success of environmental conservation activities is gaining importance. However, there are some challenges facing on the protection, preservation, management, or restoration of natural environments and the ecological communities processes. First of all natural processes and interaction with human activities should be understand correctly. In this process, various disciplines and related organizations that need expertise should work together. Secondly, required data should be determined and the data must be collected, stored and shared. In addition to all these, the most appropriate decision should be made in the shortest time by using various kinds of data. It is important to ensure that all stakeholders, including decision makers and practitioners, as well as citizens are involved in achieving the goal of a sustainable World ((EEA), 2016).

In this regard, developing technology can contribute to solving environmental problems and provide the effective use of available resources in the context of reducing environmental degradation. Environmental observatory techniques and environmental Virtual Observatory (EVO) techniques are the sample of advance geospatial technologies that can be used to solve environmental problems and provide environmental awareness as tools to facilitate the access to information and to enable the processing and association of the information gathered, to make the data meaningful and to enable multiple stakeholders to work in a common platform.

In this study, virtual observatories and EVOs are explained, the potential role to be played by Environmental Virtual Observatories(EVOS) in resolving today's environmental problems examined.

ENVIRONMENTAL VIRTUAL OBSERVATORIES TECHNIQUES (EVOs)

Earth science includes the main disciplines (eg.engineering) that need a modelling and visualising the earth environment. Especially in environmental managemet process, obtaining earth data, integrating with different platforms, simulating environmental process and making correct desicion making is important for sustainability.

With this regard, collected earth observation data by using sattelite technology has increased considerably over the last decades. Each day several terabytes of data per day collected and transmitted to earth. Managing this huge data is the major problem for various agencies forinstance ESA (European Space Agency), NASA(National Aeronautics and Space Administration) and European National Space Agencies. To make the accesible these huge environmental observation data with end users, agencies designed and implemented technologies for developing Environmental Virtual Observatories(EVOs). One of the example application is TELEIOS which has designed and implemented technologies for developing EVOs. Environmental virtual earth observatories enable satellite data together with other kinds of external data (e.g., maps or information from the Web) to be combined, to extract knowledge that is the basis for the development of applications targeting Environmental Observatory scientists, decision makers and the general public.

Generally, EVOs enable rapid exchange of new information and decentralisation of information flows from various data archives and sensors, whether ground-based or remote, to any web-enabled device such as computer tablets and smartphones. A review of EVOs indicates wide-ranging applications as a decision support tool for the management of water resources, natural hazards, biodiversity etc. These Technologies enable integrated representations of complex, multi-dimensional environmental processes, for instance, visualisation of flooded areas in multiple river basins or large scale weather systems. Karpouzoglou et al.,(2016) summarizes the types of EVOs and their properties in Table 1.

By using EVOs, scientific data become more accessible. EVOs provide decision makers to inform and empower citizens more easly. Thanks to these possibilities, data generation increases, making collaboration between diverse stakeholders become easier. By using EVOs, solutions can be produced for such environmental problems (Environmental Virtual Observatory, 2012);

- How would a major drought affect water availability for power generation?
- How can land managers manage flood risk?
- How can we develop a better understanding of catchment functioning using the Virtual Observatory
- How can we bridge the gap between scientific modelling and decision making?
- How can we better predict floods and improve flood risk management?
- How would a major drought affect water availability for power generation?

Table 1. Types of EVOs and their properties (Karpouzoglou et al., 2016)

Types of EVOs and properties

Classification	Description	Properties of interest	Sources of uncertainty	Examples
Environmental sensor networks	Technologies that support measurements of the physical environment	Decentralised communication of observations	Measurement errors (biases, equipment failures)	Weather stations, Earth-observing satellites
Data and knowledge hubs/portals	Web-hosted platforms that allow upload and download of content	Openness, anonymity, (a-) synchronicity	Unverified content	EPA STORET/WQX[a] Data Observation Network for Earth (DataONE)[b] USGS National Water Information System[c] EarthCube[d] WeAdapt[e], Mountain Observatories[f]
Environmental data visualisation and monitoring platforms	Web-hosted platforms that enable visualisation of spatiotemporal data on real-time and non-real time basis	Openness, timeliness	Errors from interpolation and rescaling of measurements	Weather forecast websites NCSA Virtual Sensor System [12] TELEIOS [13] Mid-Atlantic Watershed Atlas [14]; World Bank's eAtlas[g]
Environmental modelling platforms/decision-support systems	Web-hosted platforms that allow exploration and analysis of data under various scenarios/decision pathways with partial or total control over the scenarios and methods of analysis	Openness, anonymity, (a-) synchronicity, feedback loops, collaborative learning	Errors from interpolation and rescaling of measurements, simplification of known processes, and non-representation of unknown processes.	EVOp [15] Water2Invest [16] eHabitat-GEOSS (Global Earth Observation System of Systems) [10] BioVel [17] Model Information Knowledge Environment (MIKE) [18] Water World [19]

[a] Source: http://epa.gov/storet/; URL snapshot, https://archive.is/OlmOj [archived 09.06.15]
[b] Source: https://www.dataone.org/; URL snapshot, https://archive.is/k50Ep [archived 09.06.15]
[c] Source: http://waterdata.usgs.gov/nwis; URL snapshot, https://archive.is/A0Tp4 [archived 09.06.15]
[d] Source: http://earthcube.org/; URL snapshot, https://archive.is/1XQm [archived 09.06.15]
[e] Source: https://weadapt.org/; URL snapshot, https://archive.is/4imAV [archived 09.06.15]
[f] Source: https://www.google.com/maps/d/u/0/viewer?mid=zhfDZt-F7c_g.k9ONzFyPYChQ; URL snapshot, https://archive.is/q08Dg [archived 09.06.15]
[g] Source: http://data.worldbank.org/products/data-visualization-tools/eatlas; URL snapshot, https://archive.is/VffzZ [archived 09.06.15]

EVOs can make significant contributions to environmental protection applications as an effective tool in data management, data analysis, simulation process and decision-making. The ability to create a platform to bring together the knowledge of scientists and people with local knowledge provides reaching the right decision. BY using EVOs, it can produce real-world simulations, games, interactive group exercises. These applications can be increased by increasing the number of participants, making the right decision in environmental projects and moving all stakeholders to a common goal.

In addition, interactive groups made with observatory techniques used in the education, medicine and health, travel, culture, sport and recreation, games, experiences exercises. These practices have also contributed to environmental awareness, sustainability and environmental conservation. For example in 2016, The Virtual Human Interaction Lab (VHIL) released a short documentary and an interactive VR game about the issue of ocean acidification, or how excess CO2 in the atmosphere is turning the ocean waters more acidic, affecting marine life (The Stanford Ocean Acidification Experience, 2016). The other good example is in the Museum of the City of the New York, Future City Lab Kubi Ackerman, Director of the Future City Lab, makes an innovative, interactive applications for trying to improve the environment of New York City (Museum of the City of Newyork, 2019). The Lab invites citizens to consider the big challenges facing New York City today and to imagine approaches and solutions for a better future. The exhibition captures the pulse of the city through creative design games, immersive data-driven animated maps, dynamic data visualizations, and artistic interpretations of New York's diverse subcultures, street life, and the sometimes invisible but prevalent patterns of city living. Together they bring contemporary history to life and invite citizens to help imagine the city's future. There is lots of applications for environmental awareness. NASA's "Earth Now" app displays real-time global satellite data of planet's vital signs. This 3D app can be human activities go-to source for carbon dioxide conditions, gravity anomalies, ozone levels over Antarctica and more. NASA's educational game Offset, is part-pong, part-resource management and 100 percent retro. The goal in that game is to slow the pace of global warming, and players learn about the global carbon cycle, different carbon sources and ways alternative energy and reforestation can help offset those sources (Climate Mobile Apps, 2019).

FINDINGS AND DISCUSSION

In this study, it is seen that in our world where the necessity of effective management of natural resources is increasing day by day, efficient management processes of natural resources can be utilized by using advanced technology tools such as EVOs. Thanks to these systems that facilitate the understanding of complex processes by collecting, storing, managing, sharing and analyzing data, natural resources can be more accurately managed in the future. In addition, it is seen that EVOs are an effective tool in facilitating the participation of various stakeholders, which is an important criterion in the right decision making process. In addition, by using geospatial products produced through this platform, benefits are provided for various purposes such as ensuring the participation, training and persuasion of stakeholders.

CONCLUSIONS AND RECOMMENDATIONS

In this study EVOs are explained and wants to show with the examples how EVOs supports the sustainable resource management and environmental protection-conservation processes. As a result of the research, it is seen that EVOs applications are gaining importance and increasing the data every day and it is seen that EVOs applications are an effective tool in data protection, visualization of data, sharing with decision makers and all other stakeholders, high persuasion ability and environmental protection applications. Also, by using these advance technologies, it can help people gain a deep appreciation of environmental challenges.

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INNOVATIVE METHODS IN INDUSTRY: VR APPLICATIONS

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ABSTRACT

The birth of virtual reality has begun in the 1950s and 1960s with a device named "the ultimate display". Today, the augmented reality and virtual reality have reached their current state as a result of interest in virtual reality and rapid advancement in technology. Nowadays, interest in virtual reality is continuously increasing. Computer games and videos take first place among the sectors demanding virtual reality applications. In addition, virtual reality technologies have recently become popular in medical, educational and military fields. For the companies, on the other hand, virtual reality applications are a matter of research and interest in terms of their applicability to minimize the costs during a variety of operations.

In the manufacturing sector, it is possible to use virtual reality applications efficiently both for production and marketing stages. During the first phase of the production process, virtual reality technologies can be valuable tools to minimize the time and money losses resulting from trial and error methods. Besides, virtual reality is supposed to provide attractive and useful solutions to the market and present a diversity of products to customers, especially in cases where the products are in different types, models, volumes, designs and difficult to be transported. In this case, virtual reality applications can help the companies to present most of their product ranges and give customers the opportunity to experience as many of them as possible. Within this context, the main idea of this study is to examine the possible application fields and cases of virtual reality applications in the field of industry and administration so that value-added solutions are proposed to facilitate the operational processes.

Keywords: Cost Saving, Industry, Virtual Manufacturing, Virtual Marketing, VR.

Introduction

Augmented Reality (AR) and Virtual Reality (VR) have been seen as entertainment-oriented technologies due to their ability to bring the digital and real world together. However, in reality, it has much more use than just entertainment. AR and VR technologies have the potential to have more practical applications beyond a virtual game. Experts agree that AR and VR are efficient technologies for modifying information communication and sharing as a consumption activity. In the business sector, VR can offer significant advantages on processes such as production, marketing, design, and communication.

The concept of virtual manufacturing was presented by researchers from the University of Maryland in 1995 (Lin, Minis, Nau, & Regli, 1995). The major challenge in designing and producing a new product with a marginal benefit is the lengthy design process and the extra cost. Such a problem is seen in large, small and medium-sized enterprises (SMEs). Observed problems in SMEs are generally not solved by computer-aided technologies, which cause time and money losses. The integration of sector-leading companies with new and developing technologies in the AR / VR area aims to reduce the time and money losses associated with all processes from product design to marketing. Besides, VR allows customers to experience a product even if it is not in a physical environment. VR provides a different, catchy and impressive environment for potential consumers (Pine & Gilmore, 1998, 1999; Schmitt, 1999). The effect of this environment is beyond traditional two-dimensional (2D) screens. Research has shown that in some cases this effect may even exceed the actual situation (Villani, Repetto, Cipresso, & Riva, 2012). The key application of VR is brand management. For example, with an exclusive partnership with Oculus Rift, Nissan IDx provided the opportunity for its customers to design their own cars using VR at the Tokyo Motor Show in March 2018 (Sidhu, 2019). The Volvo XC90 presents customers a VR based driving experience before buying a new car (Volvo, 2019). Honda also has a VR application to experience the use of the ultra-fast Honda motorized Dallara (Honda, 2016).

To sum up, the AR and VR technologies can provide data that can help detect, correct, and modify flaws in product design. Additionally, companies may influence their potential customers by providing a more realistic approach to marketing and advertising through these technologies. Thus, the companies which do not produce a real prototype or show a real product in the showrooms save considerable time and money by using AR and VR technologies. Within this context, the aim of this study is to examine the possible application fields and cases of VR applications in the field of industry and administration. Accordingly, value-added solutions will be proposed to facilitate operational processes. In addition to using VR applications in gaming, design, retail, industry, and marketing, the course of investments in the market has been evaluated. Specific examples have been presented for the use of these applications. As a result, the current state of these technologies has been determined. Innovative recommendations have been presented about how to evaluate this technology in the future.

What are AR and VR?

There are many definitions for AR and VR. AR and VR are a way of expressing a virtual object in the real world. According to Aukstakalnis and Blatner (1992) “VR is a way for humans to visualize, manipulate and interact with computers and extremely complex data”. In other words, VR is “a rapidly developing computer interface that strives to immerse the user completely within an experimental simulation, thereby greatly enhancing the overall impact and providing a much more intuitive link between the computer and the human participants” (Mujber, Szecsi, & Hashmi, 2004). Nasa (2016) defines VR as “the use of computer technology to create the effect of an interactive three-dimensional (3D) world in which the objects have a sense of spatial presence”. AR is “an enhanced version of the physical, real-world reality of which elements are superimposed by computer-generated or extracted real-world sensory input such as sound, video, graphics or haptics” (Schueffel, 2017).

VR applications have been used for a long time. Recently, however, the use of VR has accelerated. This is because the amount of money that consumers have to pay to have a VR equipment has decreased rapidly. The purpose of the VR goggles is to create an environment capable of displaying an unlimited 3D object that cannot be associated with a normal screen TV or computer monitor (Figure 10). The position of AR and VR between the real world and the virtual world is shown in Figure 11 with the continuity of reality-virtuality. According to Milgram and Kishino (1994), reality decreases from left to right, and virtuality increases. The main idea in AR is to support the real world with digital content while the main concept in VR is to replace the real world.

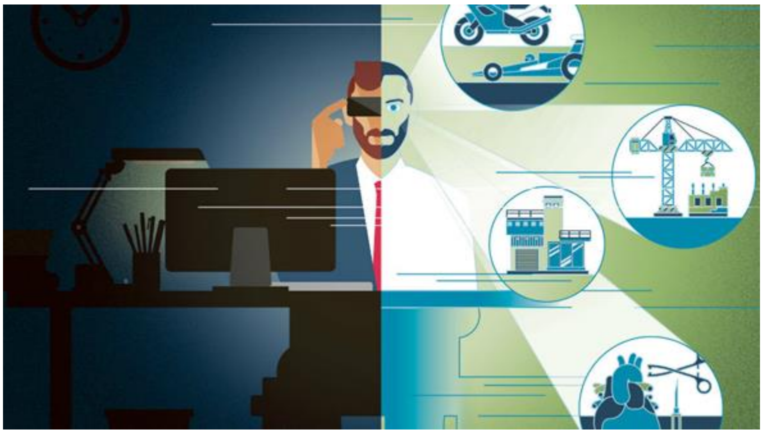


Figure 10. Representation of VR (Alkan, 2019)

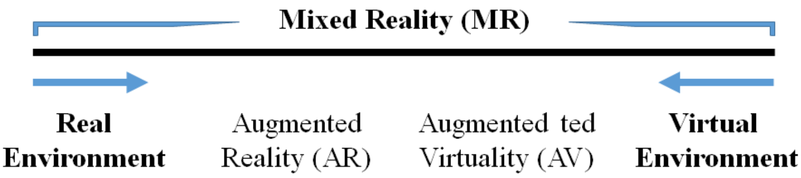


Figure 11. A simplified representation of a "virtuality continuum" (Milgram & Kishino, 1994)

It is necessary to mention some basic information on VR before getting into details. Three basic components are required in order to set up and use a VR application successfully. The first one is a computer, console or smartphone that can run an application or game. The second component is a headset that holds the screen in front of the eyes (this may be a smartphone screen). The final components are head tracking, hand monitoring, controls, audio, buttons on the device or touch panels and various inputs in the device control algorithm. VR devices are commonly referred to as Head Mounted Display (HMD).

Two different broadcasts are sent with one or two screens for each eye by the VR devices. There are also lenses placed between the eye and the broadcast device. For this reason, VR devices are commonly referred to as VR glasses. These lenses allow the image to be focused and reformatted for each eye. It gives a new perspective to the 2D image and creates a stereoscopic 3D image where the user can see the world in a different way ever than before. In order to create a satisfactory image in the eyes of the user, the image converted to 3D must have at least 60 frames per second (Alkan, 2019).

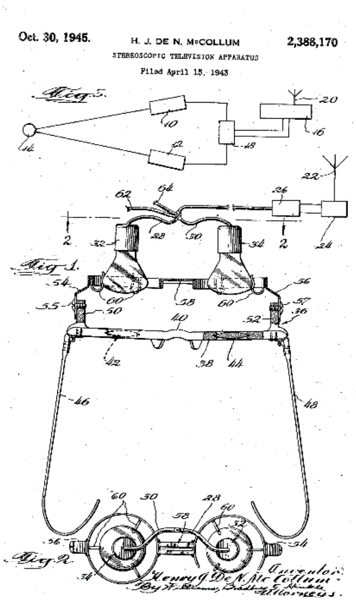
Through AR, virtual content can be used in the real world. This is possible with the help of digital functions. These help functions can be used to provide information such as the shortest route to a product in the supermarket, the method to assemble a new shelf group or the operating instructions of the satellite navigation in the car. In the entertainment industry, "AR" is widely used in games. Possible applications of "AR" are mainly dependent on the device. With an AR application, the dinosaurs on the table can come alive or virtual toy cars can be passed from the living room, which is furnished with virtual furniture selected from a catalog. AR and VR are new technologies that branding companies and advertisers can use in many different ways to attract consumers' attention. This technology provides users with an immersive experience with high emotional intensity and it supplies a more significant impact than traditional methods. Thus, it affects both customer relations and brand recognition positively. The use of such strategies at the right time with high-quality content can provide the best possible final result for customers and brands.

A Brief History of VR

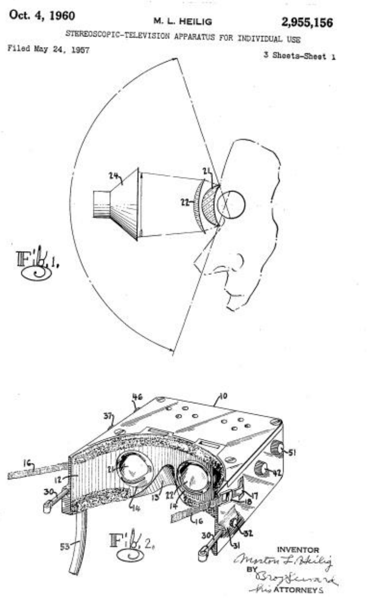
The birth of VR has begun in the 1950s and 1960s with the device named “the ultimate display” (Sutherland, 1965). The AR and VR have reached their current states as a result of the interest in VR and the rapid advances in technology. Given some of the studies contributing to this development, the chronological ranking is seen as follows.

The first idea of an HMD was patented by Thelma McCollum in 1943 (Figure 12.a.) (Thelma, 1945). Morton’s Telesphere Mask was designed to provide stereoscopic television and sound, and it was patented in 1960 (Figure 12.b.). In 1962, Sensorama machine was built by Heiling after years of work. This machine was an arcade-style cabinet with a 3D display with a wide field of view, sound, vibrating seat, and scent producer (Figure 12.c.) (M. L. Heilig, 1960). Comeau and James Bryan developed the Headsight in 1961 which was actually the first fabricated HMD (Figure 12.d.) (Comeau, 1961). In 1968, Ivan Sutherland developed the first HMD system called “Sword of Damocles”, which displayed output from a computer program in a 3D stereoscopic display (Figure 12.e.) (Steinicke, 2016).

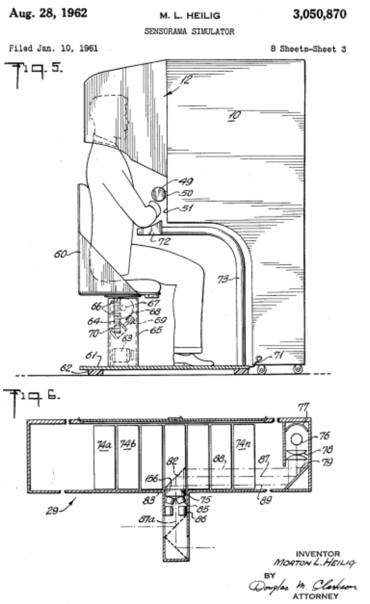
Nearly the same time in 1968, Thomas A. Furness, from U.S. Air Force, designed and built visual display systems for the cockpits. These systems were the first VR-based prototypes of flight simulators. After 20 years of work, this system has become a special program known as the “Super Cockpit”. Thus; In the 1980s, Thomas A. Furness became the owner of the title “grandfather of VR” (Figure 12.f.) (Delaney, 2014).



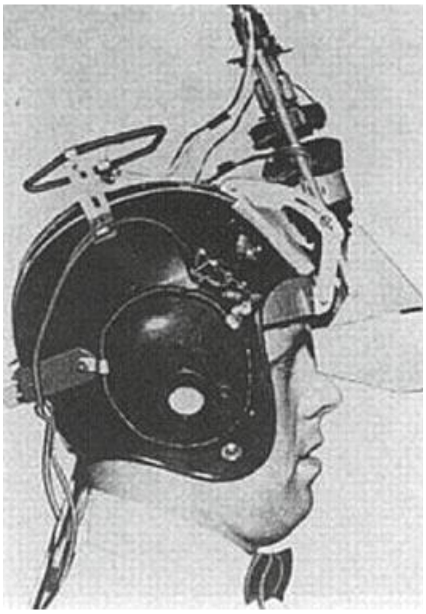
a) McCollum’s stereoscopic television apparatus (Thelma, 1945)



b) Morton Heilig’s Telesphere Mask (M. L. Heilig, 1960)

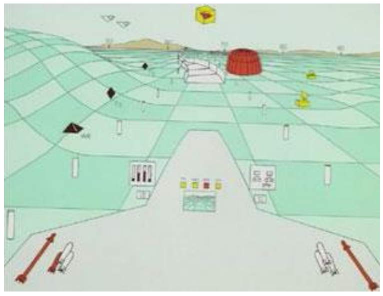


c) Morton Heilig’s Sensorama simulator (M. L. J. U. S. P. Heilig & Trade Office)



d) The first HMD – Headsight (Comeau, 1961)

e) Ivan Sutherland's "Sword of Damocles" (Steinicke, 2016)



f) Super-Cockpit project (Furness III, 1986)

Figure 12. Development of VR

In the 1990s, Virtuality Group PLC produced the first VR games. In virtual game machines, players played these games with real-time stereoscopic images, joysticks, and other players on networked units (Delaney, 2014). Followingly, in 1999 Ford began using VR for design and production of its vehicles (Gaudiosi, 2015). And since then, the use of VR has become widespread and has been preferred in manufacturing industries.

The development of VR has accelerated in the 21st century, mainly due to the rapid decline in prices in computer technologies. On the other hand, smartphones allowed lightweight and practical use in VR. Thus, AR has become part of everyday life. It would not be wrong to say that one of the sectors that most quickly adapted to VR technology is the entertainment sector. With the education sector, which is one of the disciplines that VR technology is most efficiently utilized, distant education started to become of better quality. Thanks to these technologies, students were able to comprehend the lessons easier with the created virtual environment, in particular, for physics and geography lessons during which 3D environments were easily developed. The 3D presentation of the human body in the health sector has also increased the practical achievement in various topics and especially risky surgical applications. Additionally, the use of VR technologies in architecture and construction sector, which is one of the areas where visuality is the most necessary aspect, has become very important. VR technologies provide many possibilities and opportunities for the construction industry. Before construction, this technology allows clients to walk into a VR model and realistically see their future house. It is now possible to present natural beauties, historical sites and museums in a 3D and realistic environment with VR technologies without going to the real place. The fact that VR is an application that can be quite useful for the international promotion of countries inevitably proves that it is also important and extremely useful in the tourism sector. To sum up, today, VR, which has a significant place in the industry sector, is also used in many different areas of the business sector, such as education, production, marketing, and advertising.

Use of AR and VR in The Game, Design and Retail Sector

Digital technology is rapidly evolving. Concordantly, enterprises also develop themselves in the same direction. According to the surveys conducted in 2018, the expected investments for AR or VR technologies are expected to be around 59% in the game sector, 26% in education and health sectors, and 20% in marketing and advertising sectors. These rates are followed by daily living activities (such as sports and concerts) and military activities (19%), cinema-television (18%), and retail (17%) (Figure 13**Hata! Başvuru kaynağı bulunamadı.**). Market monitoring reports show that the AR market is estimated to increase from the US $ 2.6 billion in 2016 to the US $ 80.8 billion in 2022 (Karl et al., 2018). According to Digi-Capital (2018), with AR technology (mobile AR, smart glasses) 85 -90 billion dollars and with VR technology 10-15 billion dollars of income can be obtained in the next 5 years. The reason for this great difference is the opportunity to access AR technologies and applications much easier than VR. It is predicted that AR and VR applications will become more and more widespread day by day in every sector. Today, many companies use this technology.

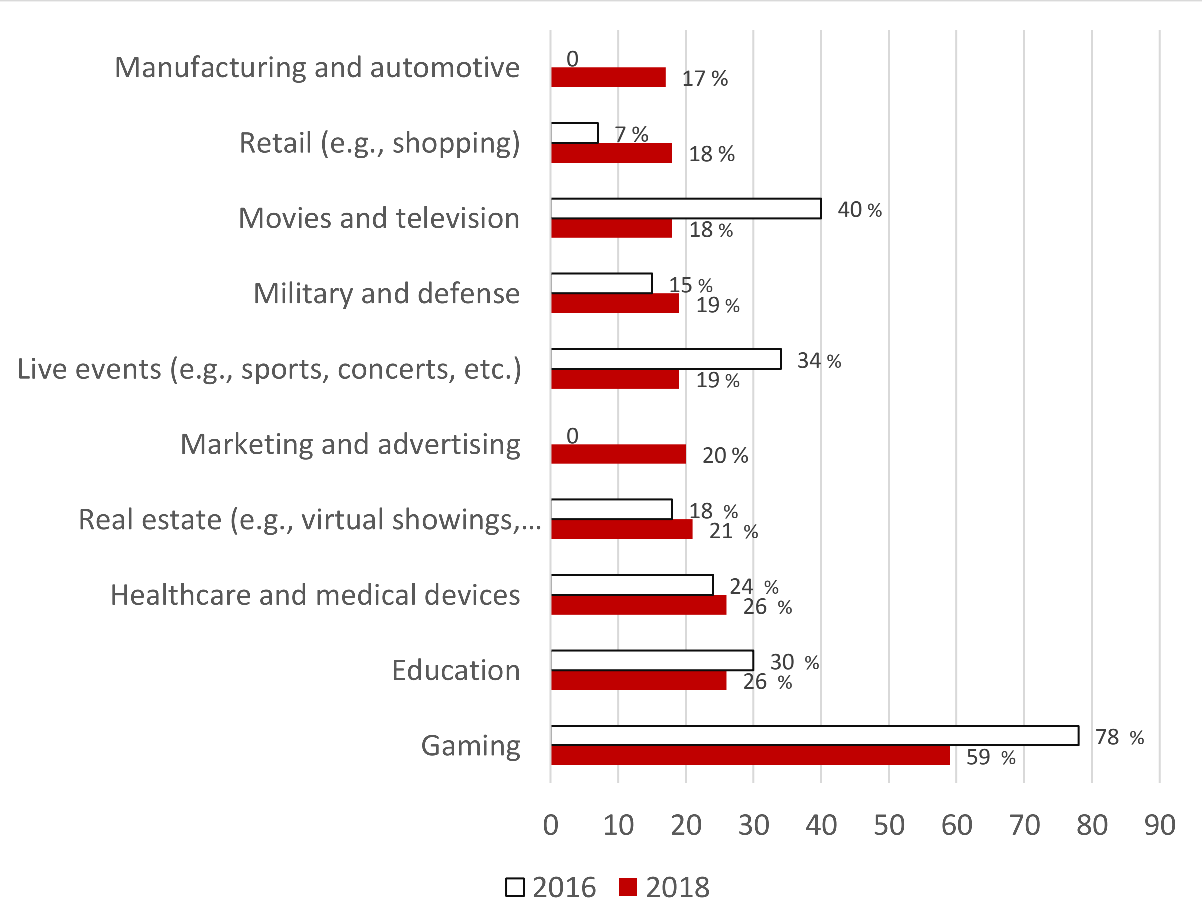


Figure 13. Sectors which expected to see the most investment directed to the development of AR or VR technology or content in the next 12 months (Karl et al., 2018)

When some of the popular applications are investigated it is noticed that Pokemon Go is amongst the well-known AR game for IOS and Android devices developed by Niantic Inc on 6 July 2016 (Figure *14*). The purpose of this game is to find, capture, fight and train the virtual creatures that appear on the screen of the device which gives an impression that creatures are popping out in the real-world environment. Hence, Pokemon Go application needs to use a GPS device and a camera. By the end of 2016, this application had been downloaded by 500 million people around the world ("Pokémon Go," 2018).

Figure 14. Pokémon Go: AR mobile game ("Pokemon Go Updates," 2019)

Facebook Camera Effects Platform (Figure 15) which was announced in the Facebook Developer Conference, also uses AR technologies ("Facebook for Developers," 2017). With this application, developers and artists may design popular themes such as photo frames, interactive camera effects, and masks.

Figure 15. Facebook: AR camera effects (Constine, 2017)

The Google Lens, announced at the Google I / O 2017 conference which was organized on 17-19 May 2017, combines the phone camera with artificial intelligence (Figure *16*). With this application, the objects detected by the camera are processed and saved, then the information about the objects is given by directing the camera to the recorded objects (Kulaklı, 2018).

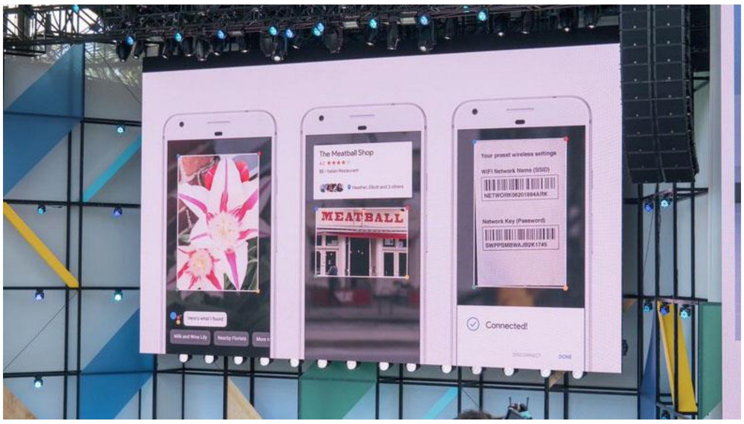


Figure 16. Google Lens AR application example (Kulaklı, 2018)

The Apple ARkit application, introduced at The Apple Worldwide Developers Conference 2017 (WWDC) on 5-9 June 2017, aims to facilitate solutions for daily problems (Figure *17*). This AR application that can be downloaded to iPhones and iPads, can be used in various ways, such as measuring object dimensions, home interior design, and finding routes without looking at the map in complex navigation ("iOS için Artırılmış Gerçeklik," 2019).

Figure 17. AR for Apple IOS ("iOS için Artırılmış Gerçeklik," 2019)

In August 2017, Google promoted ArCore, which is an AR platform (Swanner, 2018). On 23 February 2018, ARCore's v1.0 was released to be compatible with more than 100 million Android devices (İçözü, 2018). ARCore (Figure 18) allows the smartphone to detect and understand the world and to interact with the information by using different APIs (Application Programming Interface) ("ARCore Overview," 2018).

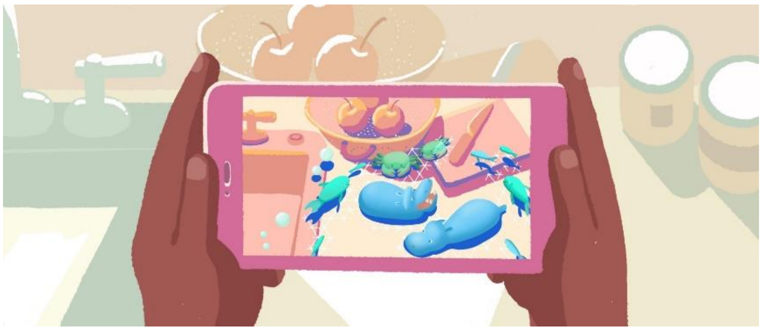


Figure 18. Google ARCore AR for Android ("ARCore Overview," 2018)

With the IKEA Place AR mobile application that was developed in 2013 and implemented in 2014, the products are shown in the desired location via smartphones and tablets (Figure 19). Using the AR mobile application, IKEA offers an opportunity for customers via the internet to place the products in their own homes and see how it would look like before buying them (IKEA, 2017). AR is a breakthrough innovation that helps retail sales to become a more accessible tool for real-life decision-making problems.

Figure 19. IKEA AR application ("IKEA's new catalogue and augmented reality," 2013)

To give an example of a game played with VR, this will be the Oculus Rift ("Oculus Rift ", 2019). Oculus Rift is a gaming device. As soon as the player wears the HMD, he or she can move freely, browse around, see under or behind objects in a new world. With Oculus Rift, users can meet and play with each other in the virtual world.

Figure 20. VR game: Oculus Rift ("Oculus Rift ", 2019)

Nowadays, such applications have become quite widespread and have started to be seen frequently in most major brands. Examples of such brands there are Adidas, Burberry, Converse, Gap, Kate Spade, Lacoste, Nike, Zara, Lowe's, Starbucks, Sayduck (Alvarez, 2017; Dahlstrom, 2017; Davor, 2018; Köllinger, 2018; McDonald, 2018; Ori, 2018).

The Use of AR/VR in Industry

The industrial sector has come a long way since the 18th century. The first Industrial Revolution (1.0) emerged with mechanical manufacturing systems using water and steam power. In the second Industrial Revolution (2.0), mass production was introduced with the help of electrical power. In the third Industrial Revolution (3.0), production was further automated with the development of the digital revolution, the use of electronics and the development of Information Technology (IT). Industry 4.0 or the fourth Industrial Revolution is a collective term that involves many modern automation systems, data exchanges, and production technologies (Kesayak, 2019). This revolution is a set of values consisting of the Internet of objects, services of the Internet and cyber-physical systems. At the same time, this structure plays an important role in the formation of an intelligent factory system (Figure 21)Figure 21. Structure of Industry 4.0 (Kesayak, 2019).

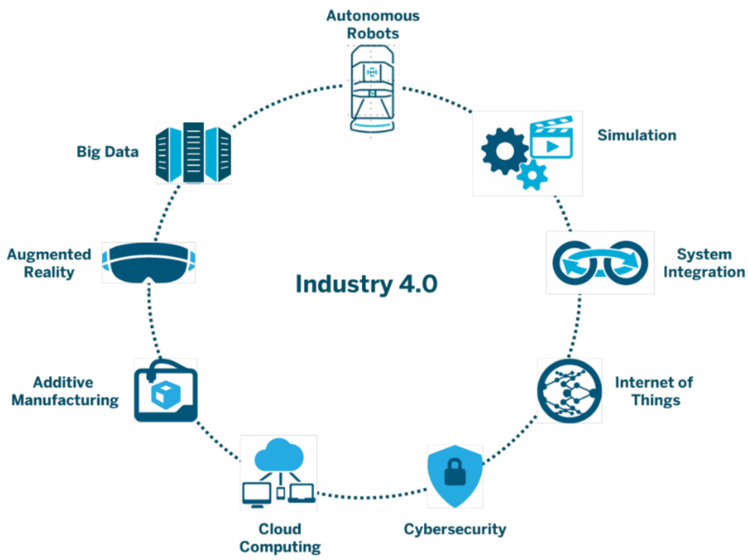


Figure 21. Structure of Industry 4.0 (Kesayak, 2019)

This revolution will allow more efficient business models to be created in the production environment, as each data will be collected and analyzed in a good way. Within the content of the smart factories with modular structure with Industry 4.0, it is aimed to monitor the physical processes with cyber-physical systems, to create a virtual copy of the physical world and to make decentralized decisions. The Internet of objects and cyber-physical systems will be able to communicate and collaborate in real time with each other and with people. The Internet of services will provide both internal and cross-organizational services and will be evaluated by the users of the value chain. The unification of these advances and the implementation of VR technology in the fourth Industrial Revolution, which offers new production techniques, modes of operation, more efficient methods and opportunities, may be able to change the shape of the industrial view. Nowadays, VR is no longer just a technology used for entertainment. Industrial producers think that this potential application can supply a wide range of needs. In light of this progressing revolution in the industry, VR applications will be on the side of industry workers to meet their needs.

Today, thousands of factory workers are trained with VR devices. Because VR applications give employees an unlimited space by simulating the factory operations correctly. With this application; logistics, IT, repairs, assembly processes are taught step by step to the workers. Thus, they can do these works in a short time independent of a second person. In addition, minimum costs and errors in learning development can be estimated with this learning programme. Furthermore, training can begin before the physical installation of the factory or while the factory is being built. Other uses of VR in the industry are summarized below (Karapınar, 2019).

Product development and design: In product design, VR application types are divided as virtual prototyping (VP) and simulation-based design (SBD). SBD is created via the VP models of computer simulation techniques in product design and the interactive construction of a virtual prototype on a virtual environment. SBD is a useful method for obtaining the most suitable design solution when evaluating product design alternatives (Kan, Duffy, & Su, 2001). When new products are needed to be tested and evaluated, AR applications give productive results during the review phase of the product. AR offers product evaluation with 3D virtual models without wasting time and money of producing real prototypes. For example, Volkswagen uses AR to compare the calculated and actual crash test images (Lima et al., 2017). Aviation, automotive, real state, and other industry sectors also use AR and VR technology for the design of their products.

Maintenance and Installation: In the event of a failure, the AR application can diagnose the problem of the machine and visually guide the operator for quick maintenance and easy repairing. Through the AR program, the operator can monitor the overlapping information about how to perform certain repairs via the tablet. Factory and warehouse employees as well as employees performing on-site service, while doing manual work such as maintenance or repair, can benefit from AR devices that regulate workflow by providing access to information without the need for hand use. Boeing, BMW, and Volkswagen use AR in the assembly line to improve manufacturing and assembly processes (BMW, 2019; Boeing, 2018).

Supply chain: GE Healthcare employees producing MR device parts in South Carolina can easily supply and deliver incoming orders via smart glasses. Employees are directed to the area where the ordered item is stored. Thus, the order can be sent as soon as possible. Research shows that this application provides a 46% increase in productivity (Karapınar, 2019; Kloberdanz, 2018).

Education: Education is one of the areas where producers take advantage of VR. The British engineering company BAE gives training to its engineers on virtual ships. Engineers can inspect and analyze systems with virtual tours and test them in a virtual environment by making necessary changes (VR Brief, 2016). GE engineers also test the Evolution series locomotives in a virtual environment (GE, 2017).

Safety applications: New AR applications allow the user to see inside a closed metal cabinet and allow a problem to be identified without having to physically open the box. Thus, it is possible to evaluate the internal environmental conditions while the equipment continues to operate. This increases overall security and reduces security risks. VR allows the simulation of hazardous situations such as chemical spread, dangerous machines, and noise in factories. Thanks to VR, what to do in such cases can be determined without risking the employees.

Considering the current applications and planned applications of VR in the industry sector, it is foreseen that VR technology will be widely used in the industrial area in the future. Accordingly, the expected revenue from the AR and VR sectors is shown in Figure 22. HMDs which are widely used by mass consumers will soon be seen on the heads of factory workers.

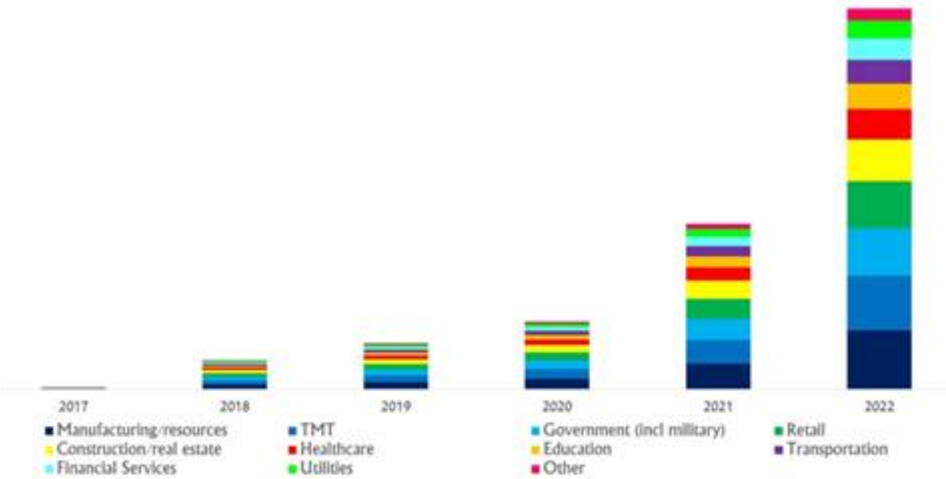


Figure 22. Expected Revenue from Enterprise AR and VR Industry Sector (Digi-Capital, 2018)

Results and Suggestions

Through recent advances in VR applications, VR is now used in different engineering and business activities such as modeling, product design, process simulation, and marketing. VR is of great importance for time and cost savings in the industry. VR interacts with objects to supply an environment for visualization of products in a 3D environment. At the same time, it provides more effective decision-making.

The products can be tested with virtual prototyping before the goods are produced, with the help of VR and other advanced technologies. In this case; there is no need for iterative production of goods in order to provide the best product. This task can be done in a virtual way. The cost of the test is much lower than the use of actual prototypes as a result of the VP product design (Dai, 1998). In addition, when a product is physically tested, the product either passes this test or not. This stage usually lacks the detailed information on the reason of the failure in case the product does not pass the test. Besides, it is not possible to know how long the successful product will withstand the actual conditions. However, with a simulation application, it is possible to reach detailed information before producing the product (Uysal, 2005). Finally, some developments that can be achieved in the industry by using VR are listed below.

- Users can control all elements of factories with remote collaboration support in live environments.
- VR applications can be widely used at trade fairs for almost all global industrial manufacturers.
- Companies can use VR applications to build intelligent new technologies for industrial applications.
- Users can share information with web-based systems in the physical systems of factories.
- Robots and smart products using VR can make decisions and communicate with each other to provide flexibility in the factory production.
- Automated logistics systems operating with robotic machines can be adjusted to their production needs.

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3 BOYUTLU İMAR PLANLARIYLA SİLÜET ANALİZİ: İSTANBUL BOĞAZI ÖRNEĞİ

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ÖZET

Son yıllarda üretilen verinin birçoğu mekânsal bir boyut kazanmıştır. Mekânla ilişkili olan bu veriler genellikle iki boyutludur. Yakın geçmişte büyüyen yapıların yönetilme zorlukları, iç mekân navigasyonuna olan ihtiyaç, gerçek dünyada hayata geçirilmeden önce proje ve planlar üzerinden yapılan analiz ve görsel çalışmalara olan ihtiyaç, mekânsal verilere üçüncü boyutun kazandırılmasını gerekli hale getirmiştir. Üçüncü boyuta sahip mekânsal veriler kentsel çalışmalarda mimariden, yer altı modellemesine kadar çok çeşitli alanlarda kullanılmaktadır. Yerel yönetimler özellikle yer üstündeki nesnelerin üçüncü boyutta temsili, modellenmesi konusuna ağırlık vermektedir. Kentleri meydana getiren en önemli bileşenlerden olan yapılar, 3 boyutlu (3B) kent modellerinin önemli bir parçasıdır. 3B kent modelleri ile afet, kirlilik, görünürlük ve siluet analizleri gibi birçok çalışmada kullanılmaktadır. Görünürlük analizleri içinde yer alan siluet analizi, kentsel planlamada kent mimarisini korumak ve imar planlarının üretilmesinde doğru kararlar verebilmek açısından büyük öneme sahiptir.

İstanbul silueti, 1950'li yıllardan itibaren yoğun kentleşme nedeniyle birçok değişim yaşamıştır. Bu siluet değişimi panoramik fotoğraflar üzerinden tespit edilebilmektedir. Öte yandan masaüstü yazılım eklentisi geliştirilerek siluet çıkarımı, silueti bozan binaların tespiti ve bu binaların en fazla kaç katlı olabileceği tespit edilebilmektedir.

Bu çalışma kapsamında, imar planındaki yapılaşma değerlerine göre yapılacak binaların İstanbul Boğazı boyunca daha önceden belirlenmiş olan siluet alanında bir değişikliğe neden olup olmayacağı araştırılmıştır. Bununla birlikte siluetin bozulmaması için nereye ne kadar yükseklikte bina yapılması gerektiği, farklı noktalardan bakıldığında siluetin nasıl değiştiği araştırılmıştır. Yapılan çalışmalar sayesinde imar planına göre yapılacak binalar ile mevcut binalar arasındaki fark 3B olarak görselleştirilebilmiştir. Çalışmada, yazılım ve modül olarak CityEngine ve ArcGIS Pro yazılımları ve ArcToolbox 3D Analyst araçları kullanılmıştır. Veri olarak, sayısal yükseklik modeli, mevcut bina, plan adası, parsel, siluet alanı kullanılmıştır. Sayısal yükseklik modeli 5 m mekânsal çözünürlüğe sahiptir. Mevcut bina katmanı Kent Bilgi Sistemi'nde sürekli güncellenen bina katmanından elde edilmiştir. Zemin altı ve zemin üstü kat sayısı kullanılarak mevcut binalar 3 boyutlu hale getirilmiştir. Plan adası katmanı, taban alanı kat sayısı (TAKS), kat alanı kat sayısı (KAKS), ön, yan ve arka bahçe çekme mesafeleri, bina yüksekliği ve kat sayısı gibi temel öznitelik bilgilerine sahiptir. Siluet alanı katmanı ise İstanbul Büyükşehir Belediyesi'nden temin edilmiştir. Çalışmanın sınırını İstanbul Boğazı siluetinin Üsküdar'da kalan kısmı oluşturmaktadır. Çalışma kapsamında, CityEngine ortamında mevcut binalar kat yüksekliğine göre topografik model üzerinde LoD1 düzeyinde 3 boyutlu hale getirilmiştir. Ardından parsel verisine ilgili plan adasının yapılaşma değerleri yazdırılmıştır. Parsel verisi CityEngine ortamında plan yapılaşma değerlerine göre 3 boyutlu hale gelmiştir. Bu işlem CityEngine yazılımında kural yazılarak yapılmıştır. Bu sayede mevcut durum ile plana göre yapılacak binaların durumu 3 boyutlu olarak görselleştirilebilmiştir. Bu binalar plana göre yapılacak binaları temsil etmektedir. 3 boyutlu hale gelen plan binaları, bulunduğu konumdaki yükseklikten itibaren yükseltilmiştir. Siluet analizi için Avrupa yakasının çeşitli yerlerinde sahil kesiminden ortalama insan yüksekliğinde gözlemci noktaları oluşturulmuştur. Bu noktalardan imar planına göre yükseltilen siluet alanındaki bazı binalara doğru CityEngine yazılımında görünürlük analizi yapılarak bir insanın o binaları görüp göremediği tespit edilmiştir. Siluet analizi için diğer yöntem olarak ArcGIS Pro yazılımında Skyline,Construct Sight Lines (CSL), Line Of Sight (LOS) aracı kullanılmıştır. CSL aracıyla gözlemci noktalarından seçilen parsellerde imar planına göre yapılabilecek binalara doğru görüş hatları oluşturulmuştur. Ardından LOS aracıyla bu gözlemcilerin plana göre yapılacak binaları görüp göremediği tespit edilmiştir. Skyline aracıyla ise siluet alanı imar planındaki yapılara göre yeniden hesaplanmıştır. Bu sayede mevcut siluet alanı ile plana göre çıkan siluet alanı karşılaştırılarak hangi yeni binaların değişikliğe neden olduğu tespit edilmiştir.

Çalışma ile imar planı taslağı oluşturulurken hızlıca siluet analizi yapılarak kat sayısına göre siluetin bozulup bozulmadığı tespit edilebilmiştir. Çalışma sonunda Üsküdar'daki siluet alanında imar planına göre yapılacak binaların siluette herhangi bir bozulmaya neden olmadığı tespit edilmiştir. Bunun başlıca sebebi siluet alanının çoğunlukla bodrum kat hariç 4 katlı binalara izin verilmesidir.

Keywords: 3 boyutlu imar planı, Siluet Analizi, Boğaziçi, Mimari Doku, Kent Planlama

SILHOUETTE ANALYSIS WITH 3D DEVELOPMENT PLAN: THE BOSPHORUS CASE

ABSTRACT

Many of the data produced in recent years have gained a spatial dimension. These data are generally used in two dimensions. In the recent past, the need for management of growing structures, the need for indoor navigation, the need for analysis and visual studies on projects and plans before being implemented in the real world has made it necessary to obtain the third dimension to spatial data. Three-dimensional spatial data are used in urban studies in a wide range of areas, from underground modeling to architecture. Local governments focus on representation and modeling of the above ground objects in the third dimension. Structures which are the essential components of cities are an important part of three-dimensional (3D) urban models. 3D urban models are used in many studies such as disaster, pollution, viewshed and silhouette analysis. Silhouette analysis which is included in the visibility analysis is of great importance to protect the urban architecture in urban planning and to make the right decisions in the production of development plans.

Since the 1950s, Istanbul silhouette has undergone many changes due to intensive urbanization. Different methods have been used to detect the silhouette changes in Istanbul. Silhouette changes in Istanbul can be determined through panoramic photographs. On the other hand, by developing desktop software, silhouette extraction can be performed; and it is possible to determine the buildings that distort the silhouette along with the number of floors.
In this study, it was investigated whether the buildings to be constructed according to the construction values in the development plan will cause a change in the previously determined silhouette area along the Bosphorus. At the same time, in order to prevent silhouette from being disturbed, it is investigated how high the building should be constructed and how the silhouette changes when viewed from different points. Through the study, the difference between the buildings to be built according to the development plan and the existing buildings can be visualized as 3D. The boundary of the study is the remaining part of the Bosphorus silhouette in Üsküdar. In this study, CityEngine and ArcToolbox 3D Analyst tools of ArcGIS Pro were used as software and module. Digital elevation model (DEM), existing buildings,

development plan, parcel, and silhouette area were used as data. The DEM has 5-meter spatial resolution. The existing building layer was obtained from the building layer which was constantly updated in the Üsküdar Municipality Urban Information System. The existing buildings are made in 3D by using the number of floors. Development plan layer has basic attributes such as base area coefficient, floors area coefficient, pull distance of front side and back yard, building height, and the number of floors. The silhouette area layer was obtained from the Istanbul Metropolitan Municipality. In the scope of the study, the existing buildings in CityEngine were rendered in 3D on the topographic model in Level of Detail 1 (LOD1) according to the floor height. Then the construction values of the relevant planning area are calculated on the parcel layer. Parcel layer has become 3D in CityEngine according to plan construction values. This was done by writing the rule in CityEngine software. In this way, the status of buildings to be constructed according to the current and plan situation can be visualized in 3D. These buildings represent the buildings to be constructed according to the plan. The planned buildings which were made three-dimensional were raised from the height in which they were located.

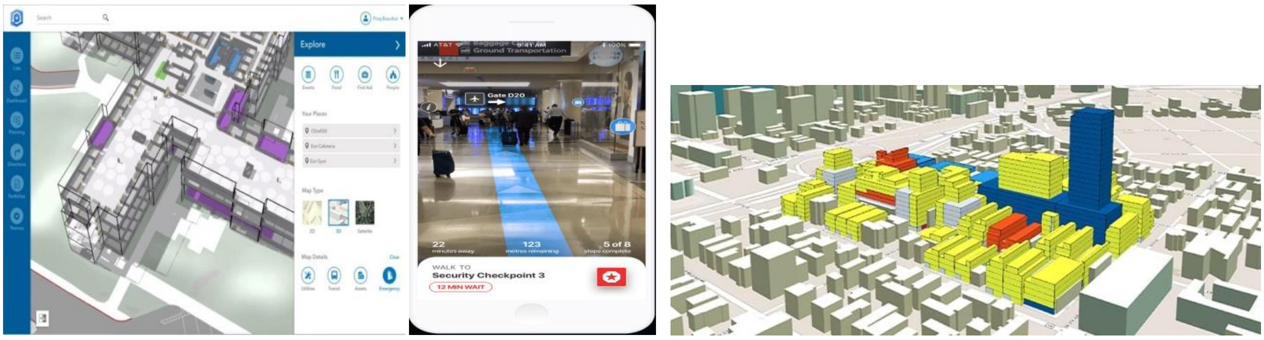
For the analysis of silhouette, observer points were created at the average height of people at the coastal area in various parts of the European side. From these observer points towards the buildings in the silhouette area that were raised according to the development plan were analyzed for visibility in CityEngine software and it was determined whether a person could see those buildings. In the ArcGIS Pro software, Construct Sight Lines (CSL), Line of Sight (LOS), and Skyline tools were used as the other method for silhouette analysis. With the CSL tool, lines of sight were formed from the observer points towards buildings that can be constructed according to the development plan in selected parcels. Then, by the LOS tool, it was determined whether these observers could see the buildings to be constructed according to the plan. With the Skyline tool, the silhouette area was recalculated according to the buildings in the development plan. In this way, it was determined that the new buildings were changed by comparing the existing silhouette area and the silhouette area according to the plan. Some of the methods used in this study were applied for İstanbul Zincirlikuyu-Maslak region in order to determine the change of silhouette in the past .

With this study, it was determined by silhouette analysis whether the silhouette was deteriorated according to the number of floors while creating a draft of development plans. At the end of the study, it is determined that the buildings to be constructed in the silhouette area of Üsküdar cause deterioration in some places in the silhouette. The main reason for this status, in the silhouette area, mostly four-story buildings are allowed except the basement floor.

Keywords: 3D Development Plan, Silhouette Analysis, Bosphorus, Architectural Texture, City Planning

GİRİŞ

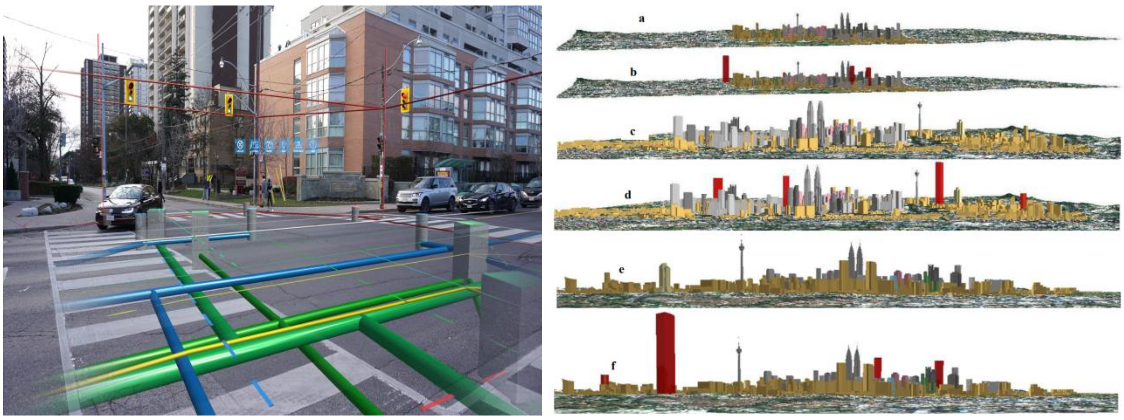
Son yıllarda teknolojinin gelişmesine paralel olarak elde edilen verilerin çoğu mekânsal boyut kazanmıştır. İlk zamanlar elde edilen mekansal verilerin 2 boyutlu olması, özellikle analizlerin değerlendirilmesi ve anlaşılması aşamasında yetersiz kalmaktadır (Stoter ve Zlatanova, 2003). Bilgisayarlardaki gelişmeye bağlı olarak 3 boyutlu veriye ilginin artması, mekansal verilerin üçüncü boyuta taşınmasını sağlamıştır (Zlatanova vd, 1998) (Şekil 1). Güncel tasarım çalışmalarında, bilginin dışa aktarımında coğrafi verinin üç boyutlu görselleştirilmesi yaygın hale gelmiştir (Appleyard, 1977; Monmonier, 1996).



Şekil 1. 3 boyutlu verilerin kullanım alanlarından örnekler (URL1, URL2, URL3)

Kent merkezlerinde yer alan binalar, yollar, ağaçlar ve enerji hatları gibi objeler bilgisayar ortamında 3 boyutlu olarak gösterilerek (Şekil 2), 3 boyutlu kent modelleri geliştirilmiştir. 3-boyutlu kent modelleri tasarımları mevcut durum içinde görüp değerlendirme yapılabilmesi için mimarlar, şehir plancıları ve karar vericiler tarafından yoğun olarak kullanılmaktadır (Ross vd. 2009). 3-boyutlu kent modelleri, şehrin algılanmasında ve değerlendirilmesinde yoğun olarak kullanılmaktadır (Döllner vd. 2006; Kibria vd. 2009). Tasarımsal hataların giderilmesinde ve düşünülen çalışmaların karşılaştırılmasında 3 boyutlu kent modelleri güzel olanaklar sunmaktadır (Lange vd. 2004; Song vd. 2009).

Günümüzde, uygulama alanlarının genişlemesi, 3 boyutlu modelleme ve analizlere talebin artması coğrafi bilgi sisteminin de önemli çalışma konusu haline gelmiştir.



Şekil 2. 3 boyutlu verilerin kentsel alanlarda kullanım örnekleri (URL4, URL5)

3 boyutlu olarak tasarlanan kent modellerinde, yerleşim alanları, arazi biçimleri, bitki örtüsü gibi öğeler dijital olarak temsil edilmektedir. Oluşturulan bu modeller afet yönetimi (Schulte ve Coors, 2008; Lee ve Zlatanova , 2008), kent planlamaları (Ban vd. 2011; Sadek vd. 2002), bilgisayar oyunları (Tüzün, 2006), gayrimenkul değerlendirmeleri ve eğitim (Yılmaz vd. 2014; Alrayes ve Sutcliffe, 2011) gibi pek çok alanda kullanılmaktadır.

1970'li yıllardan beri, rüzgâr türbinleri, baz istasyonları ve güneş enerjisi sistemlerinin kurulacağı alanların belirlenmesi gibi pek çok alanda görünürlük analizi yoğun olarak kullanılmaktadır (Yang vd., 2007). Görünürlük analizleri içinde yer alan siluet analizi, imar planları konusunda doğru uygulamaların geliştirilmesi ve kent mimarisinin korunmasında önemlidir (Kılıçer, 2018). Özellikle kentin simgesi haline gelmiş binaların siluetini korunmasında önemli bir analizdir. Kentsel siluet kent ortamında yer alan binaların görüntüsü olarak ifade edilmektedir.

Gassner (2009)'e göre, siluet, ufuk çizgisinde bulunan çok sayıda binanın dış hatları olarak tanımlanmıştır. Çok katlı binalar tarihsel süreçte yer almadıkları, kent dokusuna sonradan eklendikleri için oluşturdukları siluet etkisi tartışmalara neden olmaktadır. Siluet analizleri ile inşa edilen binaların sonrasında silueti bozduğu için yıkım kararı verilmesinin önüne geçilmesi ve ekonomik kaybın azaltılması sağlanır.

Mak vd. (2005), Hong Kong'da, Yusoff vd. (2014), Kuala Lumpur'da, Tafahomi vd. (2016) Mashhad (İran)'da, Tavernor ve Grassner (2010) Londra'da, Güney vd. (2012), İstanbul (Türkiye)'da kentsel alanlarda yer alan binaların siluetlerini üreten çeşitli çalışmalar yürütmüşlerdir.

Siluet analizleri önceleri panaromik görüntülerden elde edilirken (Şevkin, 2017) ArcGIS yazılımında yer alan, "3D Analyst" modülü ile veriler 3boyutlu olarak temsil edilmekte ve yapılan analiz ile yapıların siluet görüntüleri oluşturularak, yeni binaların, eski ve tarihi bina dokusuna zarar vermemesi için gerekli yükseklikleri hesaplanmaktadır.

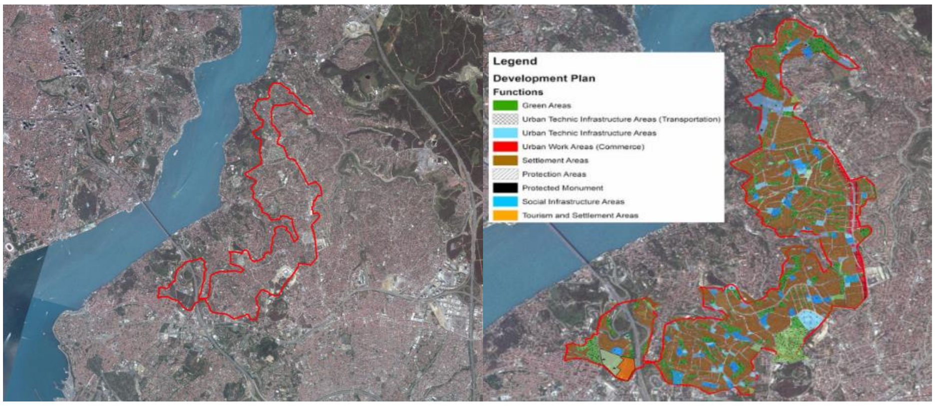
İstanbul Kenti'nde gelişen teknoloji ile beraber yüksek katlı binalar kent kimliği ve kent imajını bozar şekilde topografyada yer almaktadır. Bu yapılar özellikle dünya miras listesinde yer alan, tarihi ve doğal değere sahip Boğaziçi siluetini bozmaktadır.

Bu çalışmada, imar planındaki inşa edilmesi düşünülen binaların çalışma alanında yer alan Boğaz siluetinde bir değişikliğe neden olup olmayacağı araştırılmıştır. Aynı zamanda, siluetin bozulmasını önlemek için, binanın ne kadar yüksek yapılması gerektiği ve farklı noktalardan bakıldığında siluetin nasıl değiştiği araştırılmıştır. Çalışma ile imar planına göre inşa edilecek binalar ile mevcut binalar arasındaki fark 3boyutlu olarak gösterilmiştir.

2. MATERYAL VE METOD

2.1. Materyal

Çalışma alanı olarak İstanbul iline ait Üsküdar ilçesinde yer alan Boğaziçi siluet alanı seçilmiştir (Şekil 3). Toplam 6,22 km^2 alana sahip çalışma alanında 8424 bina bulunmaktadır. İmar planına göre %52,5 oranında yerleşim alanına sahip alanda, %16,7 yeşil alan bulunmaktadır (Tablo1). Siluet alanı katmanı, İstanbul Büyükşehir Belediyesi'nden temin edilmiştir.



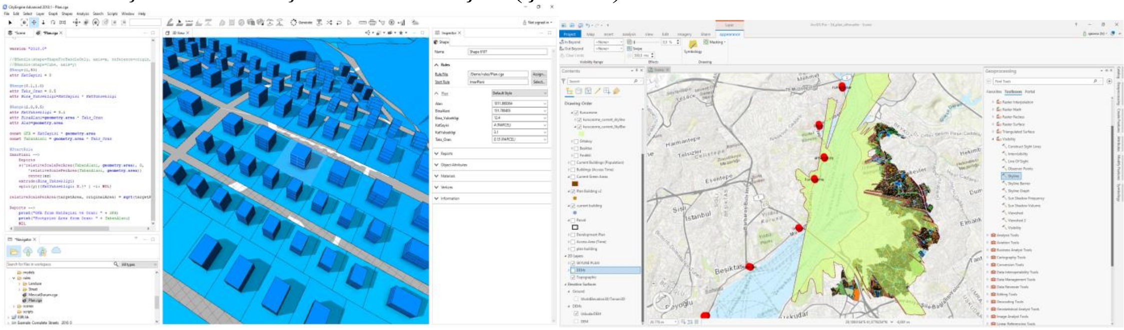
Şekil 3. Çalışma alanı

Tablo 1. Çalışma alanına ait alan kullanımı

FONKSİYON	Alan(m^2)	Oran (%)
Yerleşim alanı	3159369,8	52,5
Koruma alanı	1009620,0	16,8
Yeşil alan	1007202,4	16,7
Sosyal hizmet alanı	532152,2	8,8
Ticari alan	259481,0	4,3
Türizm alanı	55067,2	0,9

2.2. Metod

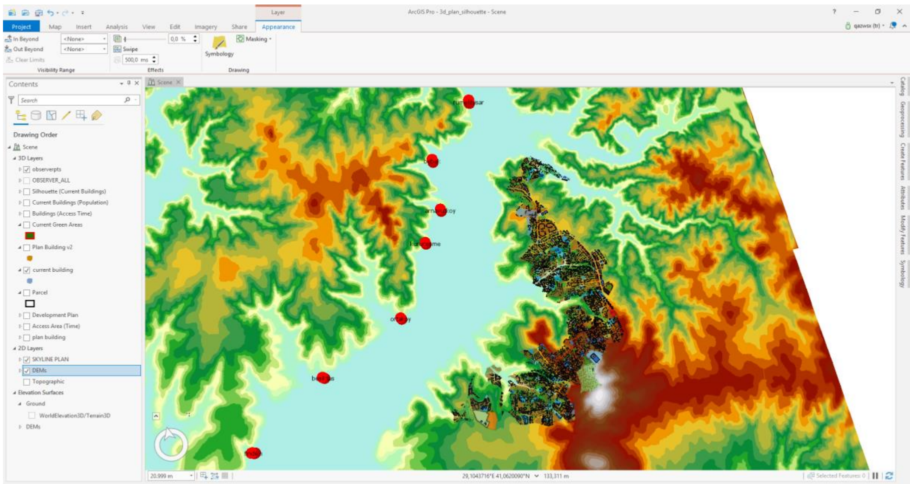
Çalışmada ArcGIS Pro'da yer alan 3D analist modülu araçlarından Skyline, Construct Sight Lines (CSL), Line Of Sight (LOS) araçları siluet analizinde ve görselleştirmede kullanılmıştır. CityEngine ise imar planındaki yapılaşma değerlerine göre inşa edilecek binaların oluşturulması ve çıkarılması için kullanılmıştır (Şekil 4).



Şekil 4.Çalışma alanına ait CityEngine yazılımı ve Skyline aracı görüntüleri

5 metre uzamsal çözünürlüğe sahip sayısal yükseklik modeli (DEM) üzerine mevcut binalar, imar planı, parsel, gözlemci noktaları işlenerek siluet alanı belirlenmiştir (Şekil 5). Üsküdar Belediyesi Kent Bilgi Sisteminden elde edilen yapı katmanı ve kat sayısı kullanılarak 3boyutlu olarak modellenmiştir. İmar planı katmanı, taban alanı katsayısı (TAKS), kat alanı katsayısı (KAKS), ön ve arka bahçenin çekme mesafesi, bina yüksekliği ve kat sayısı gibi temel yapılaşma değerleri kullanılmıştır.

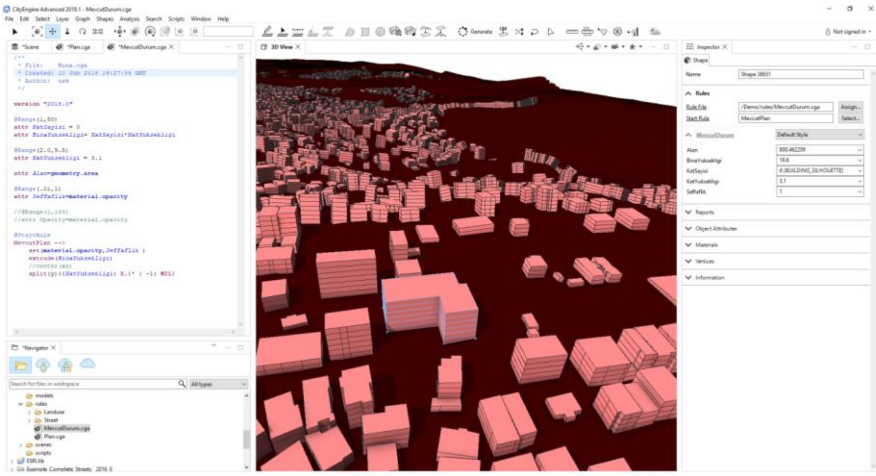
Bu çalışma için siluetin bozulup bozulmadığını analiz etmek için 7 adet gözlemci noktası oluşturulmuştur.



Şekil 5. Çalışma alanına ait DEM haritası üzerine işlenen gözlem noktaları

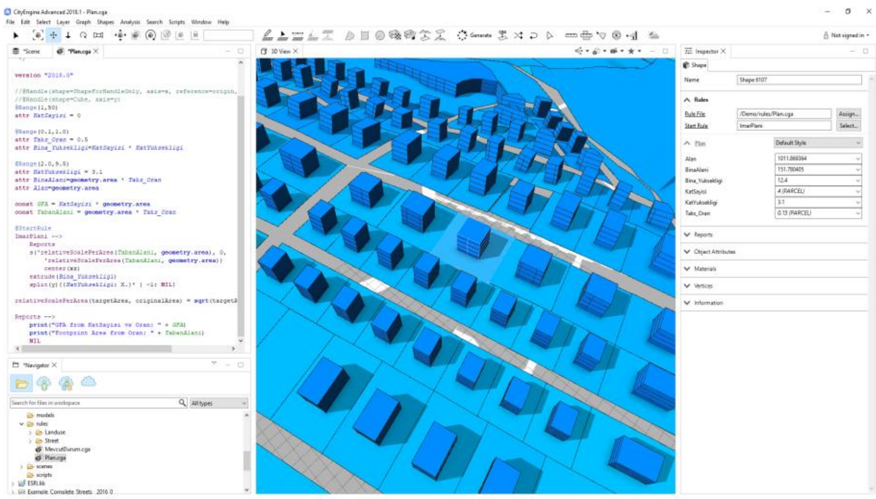
3. BULGULAR

Çalışma kapsamında CityEngine programına işlenen mevcut binalar, kat yüksekliğine göre Şekil 6'da topoğrafik yapı üzerine 3 boyutlu olarak yerleştirilmiştir.



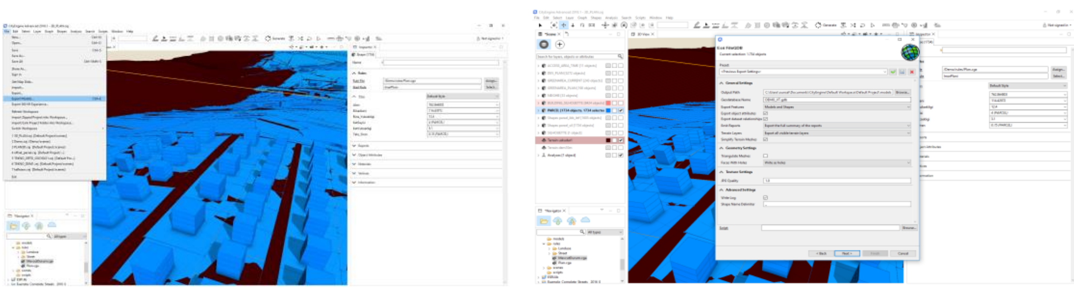
Şekil 6. Çalışma alanındaki mevcut verilerin kat yüksekliklerine göre topoğrafik yapıda gösterimi

Çalışma alanında imar planına göre yapılması düşünülen binalar, taban alanı katsayısı, kat alanı katsayısı, ön ve arka bahçenin çekme mesafesi, bina yüksekliği ve kat sayısı gibi özellikleri değerlendirilerek CityEngine yazılımı ile parsel alanları üzerine yerleştirilmiştir (Şekil 7).



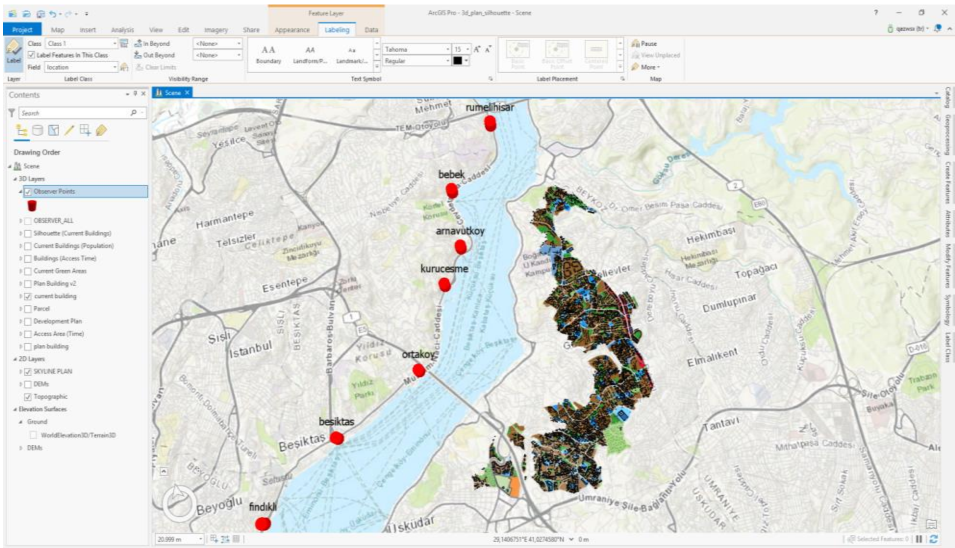
Şekil 7. İmar planı yapılaşma değerlerine göre oluşacak binaların parsel alanları üzerinde gösterimi

Çalışmanın bu aşamasında, plan ve mevcut bina modelleri ArcGIS Pro'da siluet analizi yapılabilmesi için CityEngine'den Esri FileGDB Multipach formatına aktarılmıştır(Şekil 8).



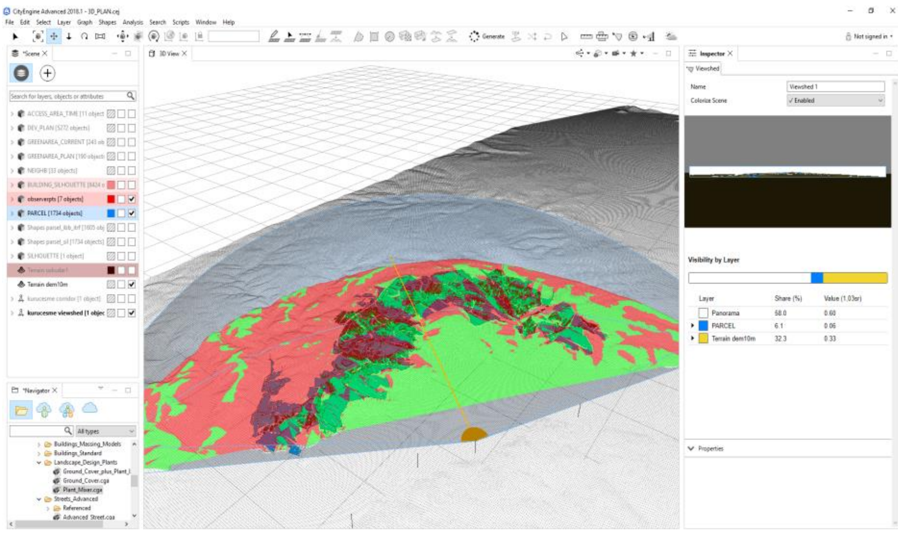
Şekil 8. CityEngine'dan plan ve mevcut bina modellerinin dönüştürülmesi

Siluet analizleri için, Avrupa yakasının çeşitli yerlerinde kıyı bölgelerinde yaşayan insanların ortalama yüksekliğinde 7 adet gözlemci noktaları oluşturulmuştur (Şekil 9). Gözlem noktalarının seçiminde insan yoğunluğuna ve silueti alanının karşısında olmasına dikkat edilmiştir. Ayrıca bu noktalar turistler ve yerel halkın yoğun olarak kullandığı mekânlardır.



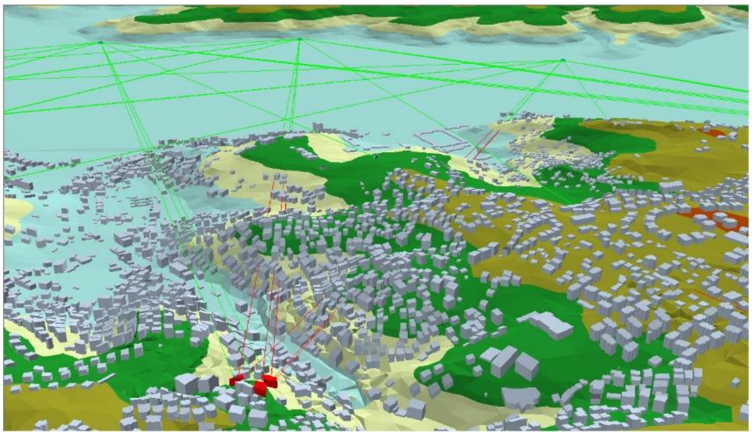
Şekil 9. Siluet analizi için belirlenen gözlem noktaları

Gözlem noktalarından, imar planına göre kaldırılan siluet alanındaki binalara doğru, CityEngine yazılımında görünürlük (viewshed) analizi yapılarak, bir kişinin bu binaları görüp göremeyeceği belirlenmiştir (Şekil 10). Şekildeki kırmızı alanlar görünmeyen, yeşil alanlar ise görünen alanları temsil etmektedir.



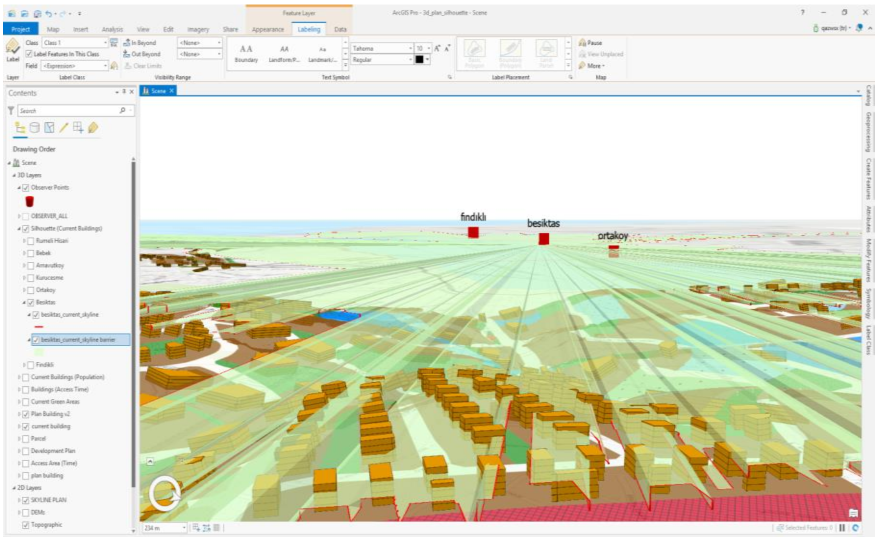
Şekil 10. Gözlem noktalarından elde edilen görünürlük analizi

Siluet analizini değerlendirmek için ArcGIS Pro yazılımında, Construct Sight Lines (CSL), ve Line of Sight (LOS) araçları kullanılmıştır. CSL aracı ile gözlemci noktalarından seçilen parsellerdeki imar planına göre inşa edilebilecek yapılara doğru görüş hatları oluşturulmuştur (Şekil 11). LOS aracı ile bu gözlemcilerin plana göre inşa edilecek binaları görüp göremeyeceği belirlenmiştir. Örnek olarak alınan kırmızı binaların Avrupa yakasından görünüp görünmediği CSL ve LOS araçları ile oluşturulan çizgilerle bulunmuştur.Çizginin yeşil kısmı görünebildiğini, kırmızı kısmı görünmediğini temsil etmektedir.



Şekil 11. CSL ve LOS araçlarından elde edilen görüş hattı analizi

Skyline ve Skyline Bariyer araçlarıyla (URL-6),siluet alanında kalan ve imar planına göre yapılacak binaların siluet alanını bozup bozmadığı belirlenmiştir. Beşiktaş'tan bir kişinin örnek yere baktığında görebileceği alanlar yeşil alanla gösterilmiş, bu yeşil alanın üstünde kalan turuncu renkli bina katları ise siluetin değiştiğini göstermektedir (Şekil 12).



Şekil 12. Skyline ve Skyline Barrier araçlarıyla yapılan siluet analizi

4- SONUÇ ve TARTIŞMA

Ortaçağ'dan beri siluet kavramı, simgesel yapıların belli olduğu, bir kentin tüm görünümünü yansıtacak çizgi olarak tanımlanmaktadır. Gelişen dünyada yüksek katlı binaların kentlerin siluetini etkilediği bilinen tartışma konusudur. Sanayi devrimiyle beraber gelişen göç hareketleri, yeşil alanların değişimi, kıyı bölgelerindeki dönüşümler ve giderek artan yüksek katlı binalar İstanbul Kenti'nin siluetini değiştirmektedir. İmar planı yapım ve uygulama aşamalarında kentsel alanların siluet görüntülerinin yapılması ve oluşacak değişimin belirlenmesi önemlidir. Kentin estetiğinin sağlanması ve yaşam kalitesinin artırılmasında kent siluetinin korunması önemlidir.

Çalışma ile imar planı taslağı oluşturulurken siluet analizi yapılarak kat sayısına göre siluetin bozulup bozulmadığı tespit edilmiştir. Çalışma sonunda Üsküdar'daki siluet alanında imar planına göre yapılacak binaların siluette herhangi bir bozulmaya neden olmadığı tespit edilmiştir. Bunun başlıca sebebi siluet alanının çoğunlukla bodrum kat hariç 4 katlı binalara izin verilmesidir.

Sonraki çalışmalar için imar planına göre yapılabilecek binaların çatı payları, daha hassas sayısal yükseklik modeli kullanılarak çalışma daha kaliteli hale getirilebilir. Ayrıca CityEngine ile yapılan mevcut ve plan binaları web ve mobil ortamlar için yayınlanarak daha şeffaf bir yapı kurulabilir. CityEngine ile Oculus Go ve Samsung Gear VR başlık seti için uygulamalar yapılandırılabilir. Bu sayede plana göre yapılacak çalışmalar daha gerçekçi halde yerinde gözlemlenebilir.

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THE USE OF SOCIAL MEDIA-BASED IMAGES IN 3D DOCUMENTATION OF HISTORICAL MONUMENTS

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ABSTRACT

Today digital 3D models are used widely in different areas such as games, tourism, city models and cultural preservation. In recent years, with the rapid progress of technology such as Laser Scanners, Photogrammetry, and Computer Vision technology, it is becoming easier to generate 3D models. But data collection is always a challenge due to different reasons. Today, the use of smartphones and social media has made the internet a data warehouse. This study, it is investigated the usability, advantages, and disadvantages of images obtained from the internet to produce 3D monument models. In this regard the images of three selected monuments of the UNESCO world heritage list for Turkey were obtained from social media accounts. Then, these monuments were modeled by using open source software. The scenario of the study starts from the unconditional images browsing from internet and finally ends with the 3D model generation.

Keywords: Photogrammetry, SfM, Social Media, Cultural Heritage, 3D modeling

1. RESEARCH AIMS

There are more than fifteen archeological sites registered in the UNESCO world heritage list in Turkey. These sites are frequently visited by domestic and foreign tourists. Hundreds of thousands of images are taken by tourists in these areas and shared with the social media with the location and name tags. The main aim of this paper is to inspect the capability of 3D model generation of ancient monuments by using images obtained from social media and to examine advantages and disadvantages. In this context, 3 monuments; Lion Gate of Hattusha, The Medusa Head in the Basilica Cistern, and The Ivriz Cultural Landscape from UNESCO world heritage list of Turkey were selected. The images are browsed in the social media tags and modeled.

2. INTRODUCTION

Within the last decades, an increasing number of studies have been published about digital three-dimensional (3D) model generation, thanks to the development of sensor technology such as laser scanning and digital cameras. These technologies are classified as range based and image based. The 3D model may be needed for different disciplines in different purposes such as modeling of terrain, city, and archeological artifacts, and digital prospection or archiving of cultural heritages. Due to the laser scanning allows to get highly dense, accurate, and reliable 3d point clouds of an interested object (Rau, 2015), it has been a popular tool in recent decades.

Nowadays, with the remarkable advancement of Computer Vision and Photogrammetry, the image-based modeling becomes as a rival for laser scanning (Vosselman, 2012). Some remarkable advantages of image based modeling are that: it is low cost and contains color information (Shao et al., 2016); any kind of camera (calibrated or un-calibrated) can be accepted (García-Gago, 2014; Tanskanen, 2013) and it may produce point cloud denser than a laser scanner (Remondino, 2014). This image-based approach, named as

Structure from motion (SfM) is a newly popular low-cost Photogrammetry method compared to its competitors.

As is well known, the rapid development and widespread use of smartphones, cameras and internet technologies can provide digital images at almost any time and in any environment. So much so that people now record their moments digitally, from the places they visit to their own image (Selfie). Moreover, these images are shared in internet with social media such as Instagram and twitter with location information. This situation has become so intense that according to the Daily Mail report in 2016, 729 new images were uploaded to Instagram every second (Daily Mail Online, 2016).

Considering that the Internet is a large cloud data warehouse, these shared images also constitute a serious source of data. This data collection method can also be called unconscious crowd source. Because, those who acquired the images do not share any common purpose. There are several academic studies that are relevant to this approach. In the literature, Snavely (2009) worked on the automatic collection of images of desired locations and the calculation of photo shooting positions in the doctoral dissertation. Basher (2017) modeled a few sculptures using video from the internet . Tanskanen (2013) made a similar work in the museum by taking a video by smartphone. This study examines the advantages and disadvantages of images shared in social media in 3D modeling of cultural heritage monuments. In this context, the images of three selected monuments of the UNESCO world heritage list for Turkey were obtained from social media and modeled in open source software.

3. METHODOLOGY

Although the SfM approach is developed by the computer vision community in order to get an automatic feature-matching algorithm, yet it operates under the same essential conditions as Stereoscopic Photogrammetry (Westoby et al., 2012; Micheletti, 2015). The overlapping images are used in order to get a 3D form of interested object. However, there is a fundamental difference between traditional Photogrammetry and SfM. In traditional Photogrammetry, 3D position of the camera(s) or 3D position of ground control points (GCP) have to be known to determine the 3d location of points within an image. In contrast, the SfM determines the geometrical parameters (orientation, internal and external parameters) automatically without any pre-defined set of known GCP (Westoby et al., 2012). Instead, these parameters are solved synchronously using a highly overlapped image set with automatic identification of matching same features (Snavely, 2009). Then, an iterative non-linear least-squares minimization process estimates the camera positions and object coordinates by tracking matched features image to image.

Comparing with the traditional Photogrammetry, the determined camera positions are in the image space which means there is no scale and orientation, considering the object space. This issue can be overcome with a 3D similarity transformation by using a small number of GCPs (Westoby et al., 2012). To get a useful 3d geometry of the object, the images have to fully cover of the object which means the camera captures the images from different positions by means of moving, as the named structure from motion (moving sensor) in the scientific literature.

The first step of a SfM workflow is to determine the positions of matching features in numerous images captured from various angles, but firstly, the feature points has to be identified in every single image. To pass this step, Scale Invariant Feature Transform (SIFT) developed by Snavely (2008) as a feature recognition approach. The SIFT establish the structural relationships between the image capturing locations in an arbitrary 3-D coordinate system by identifying common feature points across the image set (Micheletti, 2015). The measured image coordinates transformed into a 3d point of interested objects by using a sparse bundle adjustment (Snavely, 2009). As the result, 3d sparse point cloud object is obtained at the local 3d coordinate system. It should consider that, some data-based conditions such as texture, resolution, and illumination may affect the feature points and final point cloud.

Then the sparse point cloud is intensified by applying the Clustering View for Multi-view Stereo (CMVS) and Patch-based Multi-view Stereo (PMVS2) algorithms (Furukawa, 2010). CMVS separates the overlapping input images into clusters by using camera positions obtained from SIFT as input. Then PMVS2 produces a dense point cloud from these clusters. A summary workflow is at Fig. 1.

The obtained dense point clouds are manually cleared from redundant points. Then the Poisson surface construction algorithm which is proposed by Kazdan et al. (2006) is applied to get 3D models. This algorithm indicates that a surface reconstruction can be expressed as a Poisson problem. Getting this allows a fine detailed surface from a noisy point data.

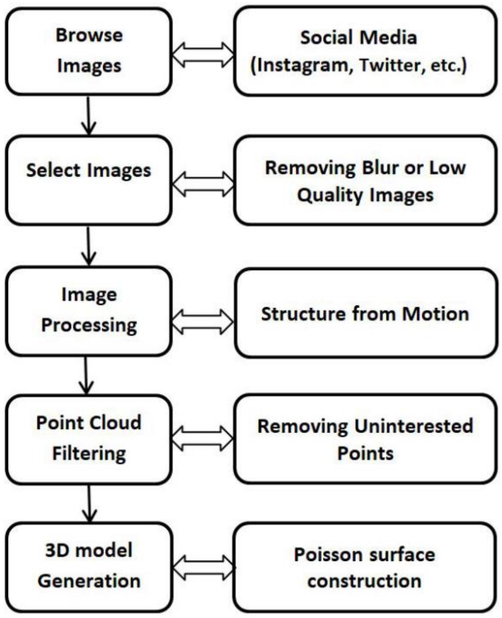

Fig. 1. The basic workflow from image browsing to 3D model generation.

4. APPLICATION PIPELINE

The application is performed in VisualSFM open source software (Wu, 2013). VisualSFM is a GUI software for 3D reconstruction using SfM. VisualSFM runs SIFT for detection and matching feature, and bundle adjustment. For dense reconstruction, this software executes PMVS/CMVS algorithm. The first step is uploading the photographs into the software. After all photographs are recognized by the VisualSFM, the feature matching step begins by selecting the tool. The interface of GUI is very simple and user friendly.

The sparse point cloud is produced after matching step. Then, the dense point cloud is generated by using PMVS/CMVS algorithm tool. Once the process has completed the dense reconstructed point cloud shows up in the main window of VisualSFM. All steps are recorded at a created new folder in the original dataset folder automatically. The final dense cloud is saved in a sub folder of "models" as ".ply" format.

For further processing, the dense point cloud is uploaded into the MeshLab software (Wu,2013). It is also an open source, extensible, and portable system for the editing, cleaning, healing, inspecting, rendering and converting of 3D data. The final model of the object is generated here by using the Poisson Surface Reconstruction tool after the cleaning process.

5. SELECTED MONUMENTS

5.1. Lion Gate of Hattusha: the Hittite Capital

Hattusha, the Hittite Capital, was added to the world cultural heritage list by UNESCO in 1986, is located in Çorum Province, in Turkey (Hattusha, UNESCO). An ancient wall more than 8 km in length encloses the whole city. There are many well conserved remains of rock art. The city has five gateways such as: the Lion's Gate (Fig. 2), the King's Gate, and the Sphinx Gate. In brief, Hattusha is a remarkable archaeological site with its incredible settlement organization and rock arts.

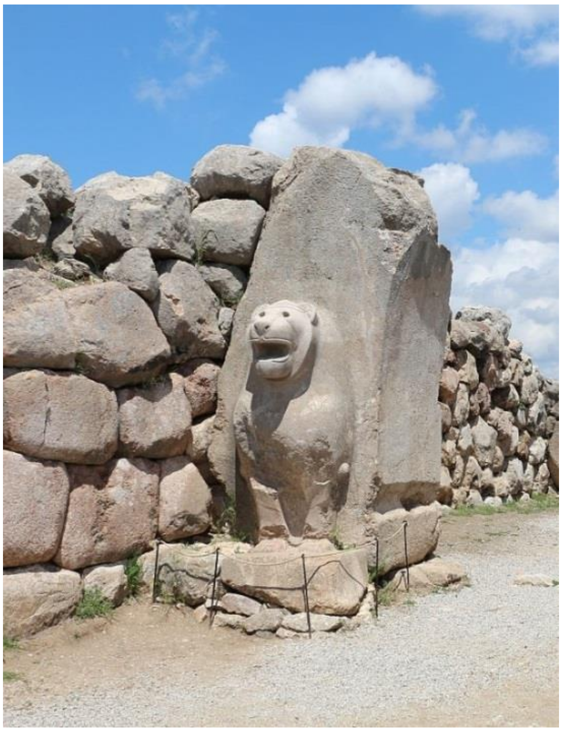

Fig. 2. The Lion's Gate of Hattusha, the Hittite Capital.

The application starts with the image browsing from social media as mentioned figure 1. Totally 120 adequate ones from 196 images selected. Then more than two hundred raw and more than one hundred cleaned points generated for the Lion (Fig. 3).

Fig. 3. The raw point cloud of Lion's Gate of Hattusha.

The generated 3D model has more than eighty thousand faces. The textured 3D model and depth map of the Lion are shown in Fig. 4.

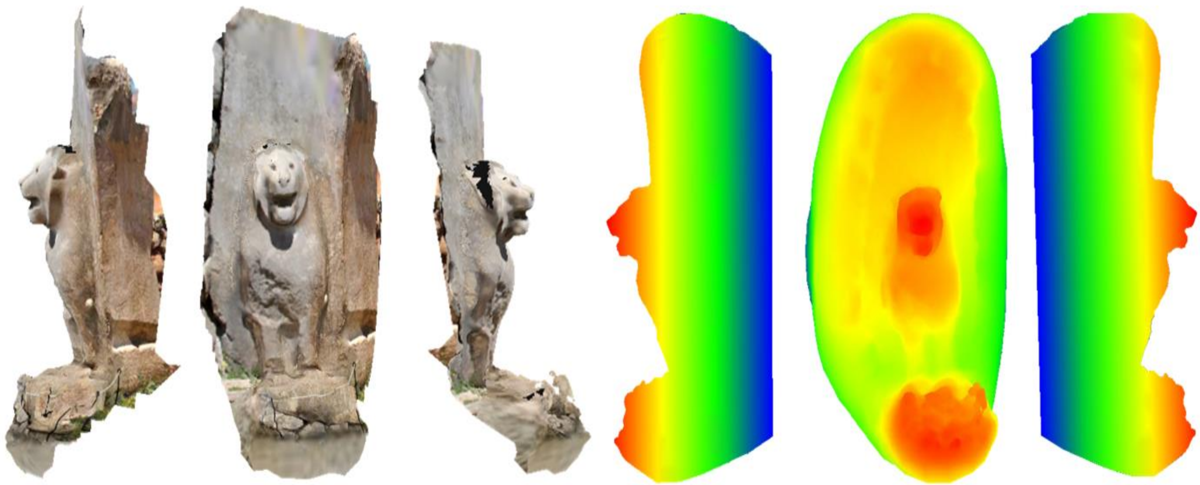

Fig. 4. The textured 3D model and depth map of the Lion's Gate of Hattusha.

5.2.The Medusa head in the Basilica Cistern

The Basilica Cistern, one of the glorious ancient construction of Istanbul dating from the Roman period, was added to the world cultural heritage list by UNESCO in 1985 (Historic Areas of Istanbul, UNESCO). The cistern is established as a rectangular shape with the dimensions of 140 m long and 70 m wide. There are 336 columns, each of which is 9m. Two of these columns have Medusa heads as a supporter at the northwest edge of the cistern (Fig. 5).

Fig. 5. The Medusa head in the Basilica Cistern.

Totally 79 adequate ones from 136 images selected from social media. Then more than one hundred raw and more than sixty thousand cleaned points generated for the Medusa Head (Fig. 6).

Fig.6. Raw point cloud of Medusa Head.

The generated 3D model has nearly thirty-three thousand faces. The textured 3D model and depth map of the Medusa head are shown in Fig. 7.

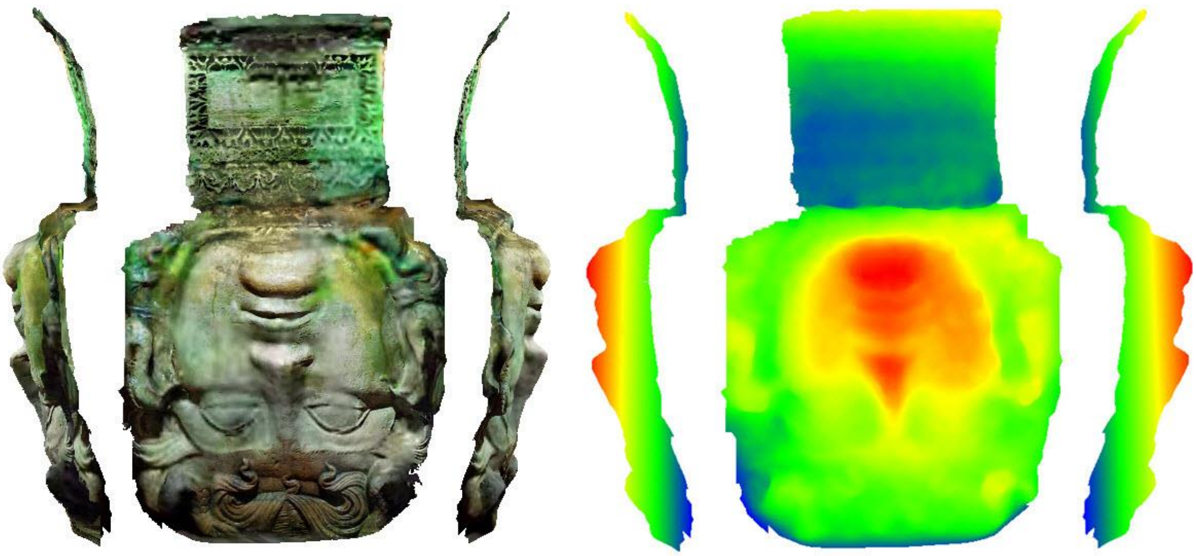

Fig.7. The textured 3D model and depth map of the Medusa head.

5.3.Ivriz Cultural Landscape

The Ivriz Neo-Hittite Rock Relief was registered as cultural property in 1981 (Ivriz Cultural Landscape, UNESCO). The dimension of relief is about 4.20 m long and 2.40 m wide. It is carved-up on a rock wall near a river (Fig. 8). It depicts King Warpalawa and the god Tarhunza holding bunches of wheat and grapes.

Fig.8. The Ivriz Neo-Hittite Rock Relief.

Totally 63 adequate ones from 149 images selected from social media. Then more than two hundred fifty thousand raw and more than one thousand cleaned points generated for the Ivriz Rock Relief (Fig.9).

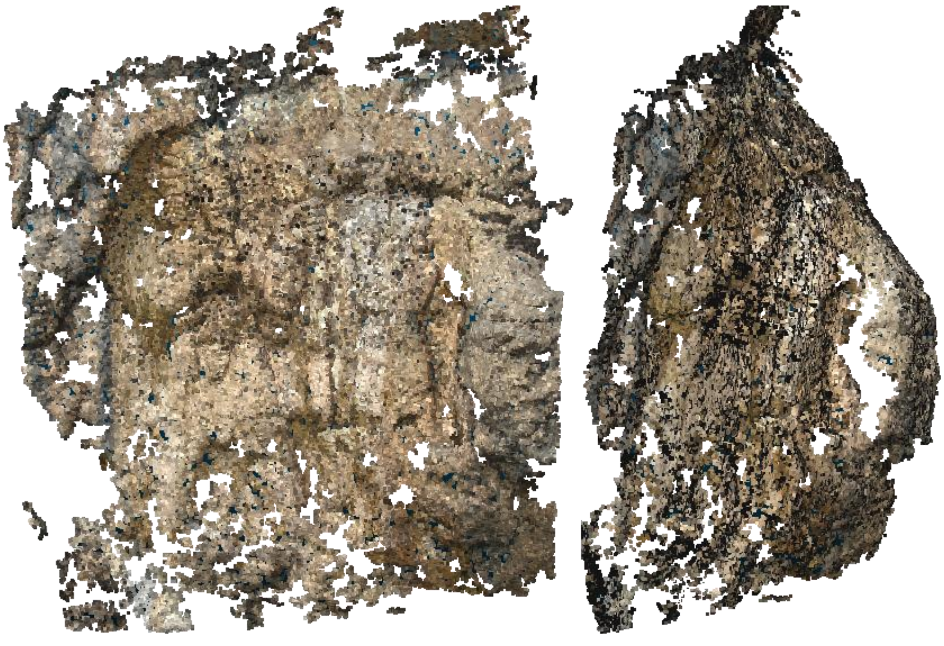

Fig.9. The raw point cloud of Ivriz Rock Relief.

The generated 3D model has nearly ninety thousand faces. The textured 3D model and depth map of the Ivriz Rock Relief are shown in Fig. 10.

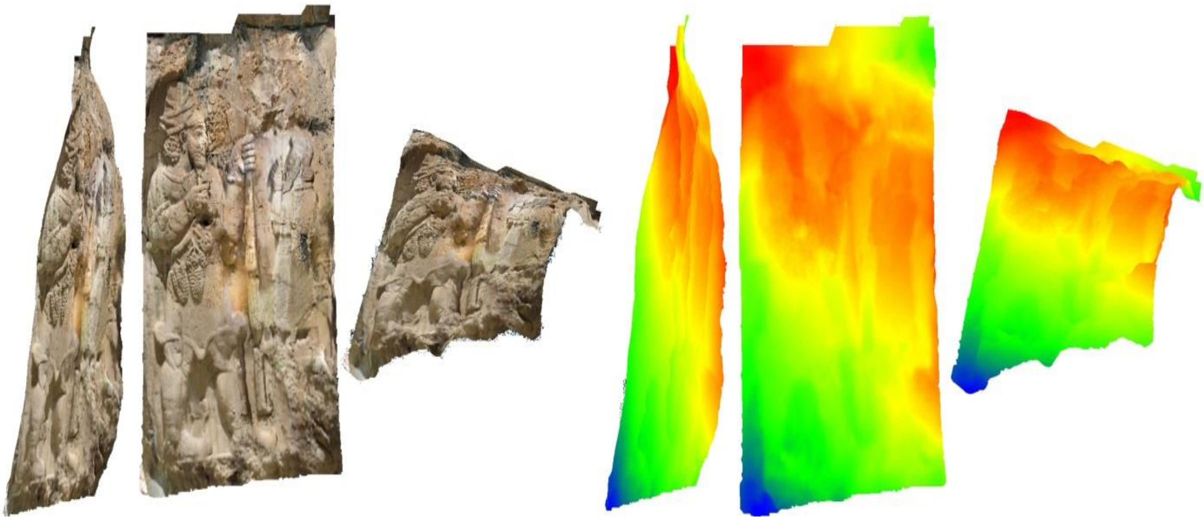

Fig.10. The textured 3D model and depth map of the Ivriz Rock Relief.

During application, the non-suitable images were not imported into the process. These kinds of images are generally either selfie/group images or have low quality due to light shadow and far distance conditions. Moreover, the generated raw point clouds are filtered by removing redundant points.

6. RESULT AND DISCUSSION

Even though the internet is a mass of knowledge, it is really a huge data source. The images of an object can be obtained from the internet with partial sufficiency. This approach reduces the costs and labors and is often a faster solution than a professional image collecting study. Depending on the camera specification, the resolution of the obtained images alters. One of the greatest advantages of internet-based images is that they are mostly at different angles (except some repeated famous images). Group photographs and selfie are disadvantageous due to containing irrelevant objects. In addition, blurry and old dated images have poor quality. This fact is a problem for both image matching and texture coverage. Some social media websites also disrupt the original footage in order to get low storage. Similarly, in non-professional images that contain low quality of the light and shadow conditions also affect the matching and texturing.

As is known, in order to protect historical monuments, it is within a certain approach. So, the circumstance of monuments does not meet the needs to capture images from every angle sometimes. Similarly, historical wall or high rock reliefs make it difficult to take pictures from different angles. Nevertheless, the images obtained from the social media can be used in relatively complete and accrued 3D model generation with open source software. Even if the real object size is known, it is also possible to re-scale these models to its actual dimensions. These models can also be published in the web or 3D printing for tourism purposes.

7. CONCLUSION

The use of 3D content has dramatically increased in different disciplines. Considering the rapid progress of laser scanners, Photogrammetry, and computer vision technology, this situation is not surprising. In today's world, almost everybody has a mobile phone with camera. People, without exaggeration, take hundreds of thousands of images every day and share them on the internet and social media. Although these Internet-based images have some disadvantages, it is obvious that they are a serious source of information and the suitable ones of these images can be used in the 3D modeling of historical objects which are cultural heritage. This study indicates the usability of shared images in social media for 3D modeling of historical monuments by modeling three selected monuments of the UNESCO world heritage list for Turkey with open source software. As camera and smartphone technology progresses, better results will be obtained.

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LOW-COST 3D MODEL GENERATION FOR VIRTUAL REALITY

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Abstract

As it is known, the digital 3D models are widely used in different fields such as games, tourism, city models, archaeological documentation and virtual reality. In recent years, with the rapid advancement of technologies such as Laser Scanners, Photogrammetry and Computer Vision technology, 3D models have become easier to produce. Particularly thanks to photogrammetry and computerized vision technology, image-based 3D modeling, cost and color information is a serious alternative to laser scanning. As a term used in recent years, it is possible to say that, Structure from Motion (SfM) is a combination of photogrammetry and image processing. In this study, the usability of mobile phone and open source software for image-based 3D model of a small object is investigated.
Keywords: Photogrammetry, 3D model, Virtual reality

1. INTRODUCTION

Today digital 3D models are used widely in different areas such as games, tourism, city models and cultural preservation. In recent years, with the rapid progress of technology such as Laser Scanners, Photogrammetry, and Computer Vision technology, it is becoming easier to generate 3D models. But data collection is always a challenge due to different reasons. Today, the use of smartphones and social media has made the internet a data warehouse. Especially smartphones with high resolution camera allow us to collect image data in easier way.

Within the last decades, an increasing number of studies have been published about digital three-dimensional (3D) model generation, thanks to the development of sensor technology such as laser scanning and digital cameras. These technologies are classified as range based and image based. The 3D model may be needed for different disciplines in different purposes such as modeling of terrain, city, and archeological artifacts, and digital prospection or archiving of cultural heritages. Due to the laser scanning allows to get highly dense, accurate, and reliable 3d point clouds of an interested object (Rau, 2015), it has been a popular tool in recent decades. Nowadays, with the remarkable advancement of Computer Vision and Photogrammetry, the image-based modeling becomes as a rival for laser scanning (Vosselman, 2012). Some remarkable advantages of image based modeling are that: it is low cost and contains color information (Shao et al., 2016); any kind of camera (calibrated or un-calibrated) can be accepted (García-Gago, 2014; Tanskanen, 2013) and it may produce point cloud denser than a laser scanner (Remondino, 2014). This image-based approach, named as Structure from motion (SfM) is a newly popular low-cost Photogrammetry method compared to its competitors.

In this study, the usability of mobile phone and open source software for image-based 3D model of a small object is investigated.

2.METHODOLOGY

The term Structure-from-Motion has evolved from the machine vision community, specifically for tracking points across sequences of images occupied from different positions (Spetsakis and Aloimonos, 1999; Boufama et al., 1993; Szeliski and Kang, 1994). SfM owes its existence to innovations and mathematical models developed many generations ago, particularly in photogrammetry. This method provides the opportunity for very low-cost three-dimensional data acquisition with strongly reduced user supervision and required expertise. The ability to extract high resolution and accurate spatial data using cheap consumer grade digital cameras appears truly remarkable. As in traditional photogrammetry, SfM photogrammetry employs overlapping images acquired from multiple viewpoints. However, SfM photogrammetry differs from traditional photogrammetric approaches by determining internal camera geometry and camera osition and orientation automatically and without the need for a pre-defined set of "ground control", visible points at known three-dimensional positions (Westoby et al., 2012). Whilst the exact implementation of SfM may vary with how it is coded, the general approach has been outlined by other authors (Westoby et al., 2012; James and Robson, 2012; Fonstad et al., 2013; Micheletti et al., 2014). Most SfM platforms are now fully automated. The advantage of SfM is that it provides a black-box tool where expert supervision is unnecessary.

Since this method is image-based, the main problem is in data collection. Because the data collection procedure for model production is not always easy due to different reasons such as time, economy and accessibility. It is the ability of these techniques to generate very high-resolution datasets, whilst isolating and removing gross errors, which is now allowing such visually impressive 3-D models to be generated so easily when compared to traditional stereo based modelling (Remondino et al., 2014). Effectively, because of the ease with which sensor distortion can be modelled, all consumer grade digital cameras, including the ubiquitous "smartphone", can acquire valuable geomorphic data (Micheletti et al., 2014). Furthermore, the recent development of low-cost, sometimes free, internet-based processing systems enable the upload, processing and download of the derived 3-D data in just a few minutes, potentially during field data collection. This is in direct contrast to traditional photogrammetric software, where the user is forced to define and to determine interior and exterior orientation parameters explicitly. Most SfM platforms are now fully automated. The advantage of SfM is that it provides a black-box tool where expert supervision is unnecessary. It may also be a disadvantage in that the user has much less involvement in data quality control and the origins of error in data may not be identifiable. Today, considering the cost of professional cameras and laser scanning systems, smartphones can be considered as an inexpensive data source to produce image-based 3D models. In this study, the usability of mobile phone and open source software for image-based 3D model of a small object is investigated.

3. APPLICATION

The application is performed in VisualSFM open source software (Wu, 2013). VisualSFM is a GUI software for 3D reconstruction using SfM. VisualSFM runs SIFT for detection and matching feature, and bundle adjustment. For dense reconstruction, this software executes PMVS/CMVS algorithm. The first step is uploading the photographs into the software. After all photographs are recognized by the VisualSFM, the feature matching step begins by selecting the tool. The interface of GUI is very simple and user friendly.

The sparse point cloud is produced after matching step. Then, the dense point cloud is generated by using PMVS/CMVS algorithm tool. Once the process has completed the dense reconstructed point cloud shows up in the main window of VisualSFM. All steps are recorded at a created new folder in the original dataset folder automatically. The final dense cloud is saved in a sub folder of "models" as ".ply" format.

For further processing, the dense point cloud is uploaded into the MeshLab software (Wu,2013). It is also an open source, extensible, and portable system for the editing, cleaning, healing, inspecting, rendering and converting of 3D data. The final model of the object is generated here by using the Poisson Surface Reconstruction tool after the cleaning process. A basic work flow of the study is given in figure 1.

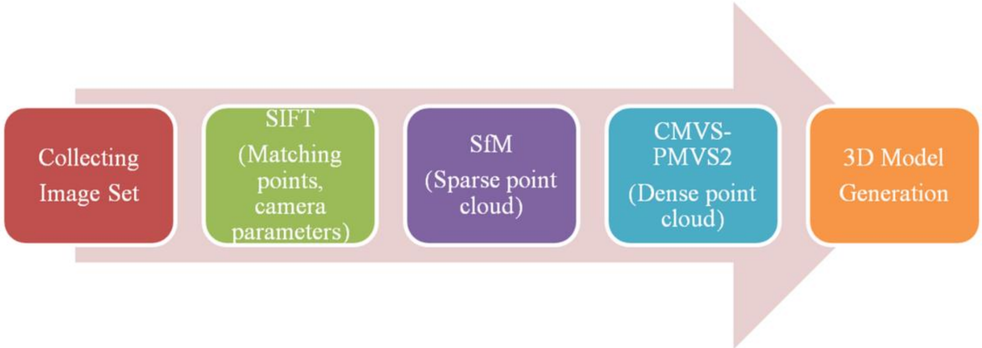

Fig. 1. The basic work flow of the study.

80 images are captured with a smartphon. The 8 MP camera has a 4 mm focal length. There are no zoom and flash or any other enhancement in the images. The captured images are given in figure 2.

Fig. 2. The captured images with smartphone.

These digital images are processed. The sparse and dense point clouds are generated (Fig. 3). The colored triangles represent the image locations.

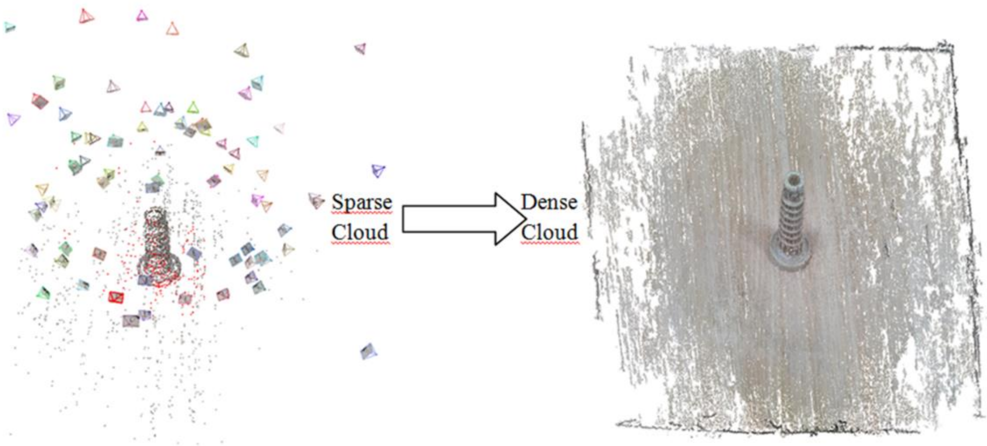

Fig. 3. The generated sparse and dense point clouds.

For subsequent operations, the dense point cloud is loaded into the MeshLab software. It is a portable open source, and an extensible system for rendering, cleaning, inspecting, editing, rendering and converting 3D data. The final pattern of the object is created here using the Poisson Surface Reconstruction tool after the cleaning process (Fig. 4).

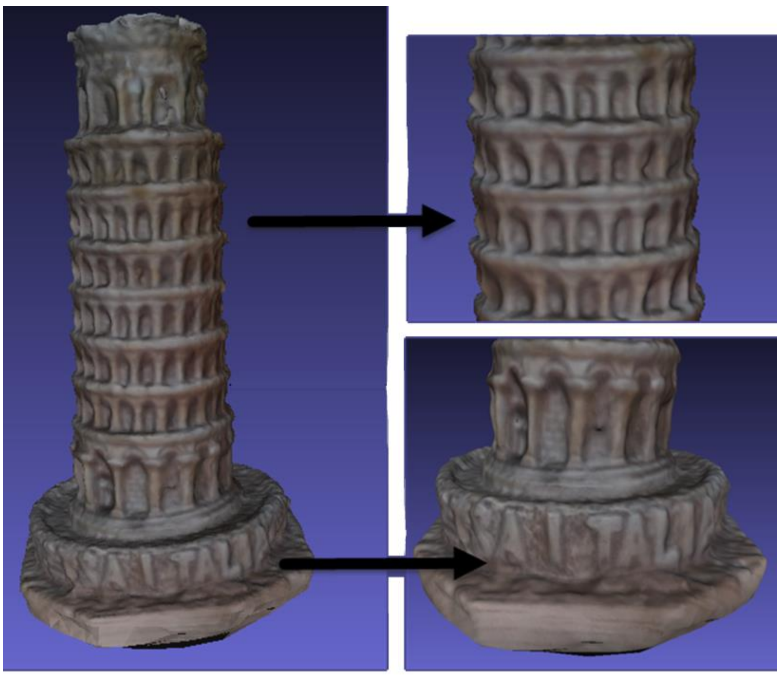

Fig. 4. The 3D model of interested object.

4. CONCLUSION

The use of 3d content has significantly increased in different disciplines. Given the rapid progression of laser scanners, photogrammetry and computer vision technology, this is not surprising. In today's world, everyone has a mobile phone with camera and personal computer. This study is intended to succeed that anyone can only produce 3d models of any object using a mobile phone. For this purpose VisualSFM and MeshLab open source soft goods are used in the process of creating a 3d model. The research shows that everyone can produce 3d models of any object using only mobile phone and open source software with enough detail and texture. You can also use 3D printers to make model copies.

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3D CİTY MODELLİNG WİTH AİRBORNE LİDAR DATA

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ABSTRACT

Nowadays 3D modelling of objects is widely used in different purposes such as city modelling, digital game industry, cultural heritage, virtual reality and medicine. According to computer technologies and data collection methods, it is possible to produce 3D models with different properties. Particularly thanks to the progress in laser scanning devices, it is possible to obtain millions of 3D location data with high accuracy in a short time. This data can be used in the production of topographic products for mapping purposes and as well as can be used in 3D model production. In this study, a 3D city model produced by using airborne laser scanning (LiDAR) data in Bergama / İzmir is presented. In this context, firstly the LiDAR data is filtered in order to obtained noise-free dataset. Secondly, the buildings, power transmission lines and trees are classified in LiDAR data and the borders are determined as vector format. In the last part of the study, building models were produced and a 3D city was created.
Keywords: LiDAR, modelling, 3D city

1. INTRODUCTİON

There are several well-known applications that greatly benefit from the availability of 3D city models, such as telecommunication network planning, line-of-sight analysis, run-off modelling, and urban climate simulation. In many cases, including those just mentioned, a perfect visual appearance of the model and the highest-possible level of geometric detail are not required. It is, however, important that the models can be created fully automatically, even more so as different applications may require different degrees of detail, and the optimal level depends on accuracy requirements at one hand and on computational feasibility of the application at the other.

Much research focuses on extracting building outlines, and they may combine different data sources, for example photogrammetric data or existing landline data. The traditional method for building extraction depends on the raw imagery, which is carried out manually and a highly labor-intensive, time-consuming and very expensive (Sohn and Dowman 2007). To develop automatic or semi-automatic approaches for building extraction and reconstruction, the researchers in Photogrammetry, Remote Sensing and computer vision society expend energy (Gruen et al., 1997; Mayer, 1999). Depending on the approach, the inputs for extraction process are generally images and airborne LiDAR data. Maas and Vosselman (1999) used geometric moments, segments and intersect planar surfaces to extract different type of buildings. Alharthy and Bethel (2002) used an orthogonality hypothesis for building extraction on LiDAR data. Shan and Sampath (2007) use straight lines and least squares adjustment to get building boundary. Morgan and Habib (2002) separated building and tree measurements to get the plane surface of buildings. Elberink and Maas (2000) used a height measures texture for segmentation of LIDAR data. Alharthy and Bethel (2002) distinguished building and tree using the height difference between the first- and last return of

LiDAR data (Vosselman, 2001; Overby et al., 2001) used the Hough transform to identify building points in a LiDAR data set. Some other researches are carried out by Wang et al. (2006), Haala and Brenner (1999), Früh and Zakhor (2003), Vinson and Cohen (2002), Weidner and Förstner (1995), Fischer et al. (1998), Baillard and Zisserman (2000).

In this study, a 3D city model produced by using LiDAR data in Bergama / İzmir is presented. 3D City Models in VR can be simply described as computerized graphical representations or visualizations of any city and its components. 3D City Models are used in transportation modelling, GIS and public participation planning and decision support, urban morphology, spatial analysis, telecommunication and virtual cities.

In this context, firstly the LiDAR data is filtered in order to obtained noise-free dataset. This step is necessary for an accurate classification of every single point in lidar data. Secondly, the buildings, power transmission lines and trees are classified in LiDAR data and the borders are determined as vector format. In the last part of the study, building models were produced and a 3D city was created. All processes were performed in Envi Lidar software automatically with a few decided parameters. The main goal of the study is to produce a 3D city model by using LiDAR data for VR environment.

2. METHODOLOGY

LiDAR system also known as Laser Ranging, Laser Altrimetry, Laser Scanning and Laser Detection and Ranging, Radar-like operates but unlike Radar systems it uses laser beams instead of radio waves (Jiang et al., 2005). Developed in the late 1960s. the first commercial LiDAR mapping system is used in topographic map production in 1993 (Liadsky, 2007; NOAA, 2012). LiDAR systems can be grouped into two groups based on the platforms on which they are installed: Air LiDAR systems - Airborne LiDAR Systems (ALS) and Terrestrial LiDAR Systems (TLS).

Nowadays, horizontal and vertical accuracy of the measurements obtained with ALS has reached photogrammetric methods. An ALS system can be mounted as a platform to aircraft, helicopter or unmanned aerial vehicle (UAV). As shown in Figure 3, the system consists of a laser scanner, GPS and IMU. The laser scanner is mounted under the aircraft. There is also a computer and a recording device. The photographing machine can also be included in the system if desired. The basic logic of the LiDAR is based on the location of the laser beam from the known sensor to the object. The flight time of an ALS beam is:

$$t = 2R / C \quad (1)$$

where R is the distance between the ALS sensor and the object. The R value is calculated as follows:

$$R = (1/2)\, tC \quad (2)$$

The Calculated three-dimensional position of the object using this determined time and the angle of the laser. As a result of distance measurement, point data which is called point cloud and which is distributed according to the time along the flight line, is obtained. As shown in Figure 1, the artificial and natural objects in the direction of flight are scanned.

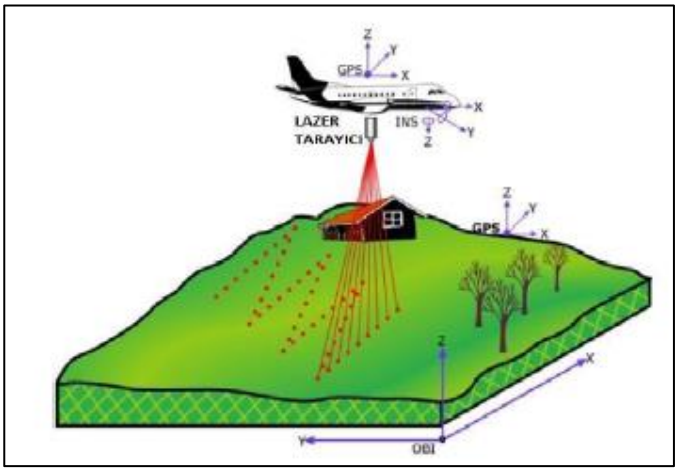

Fig. 1. Airborne LiDAR Systems

For a 3D model study, the lidar point cloud must be classified. This process is necessary to properly modelling interested object. Otherwise, the generated models cannot be realistic.

3. APPLİCATİON

The study area was selected in Bergama/İzmir. The lidar data was released by General Directorate of Maps (Kayı et al., 2015). The LiDAR data has over 18.5 million point for an approximately 4.5 km2 area with a nearly 4.5 points/m2 (Figure 2).

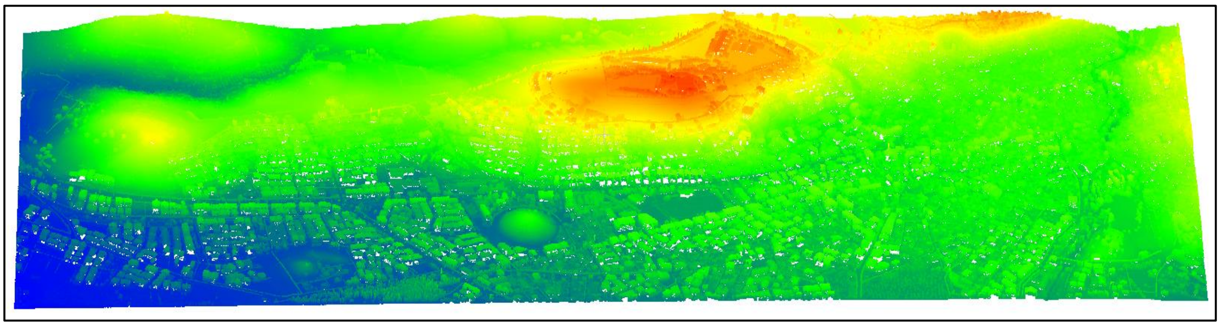

Fig. 2. Lidar point cloud of the study area

The data first classified in mainly 4 classes, Ground, Trees, Buildings, Enrgy lines (Figure 3). The main goal is to produce building models for virtual reality.

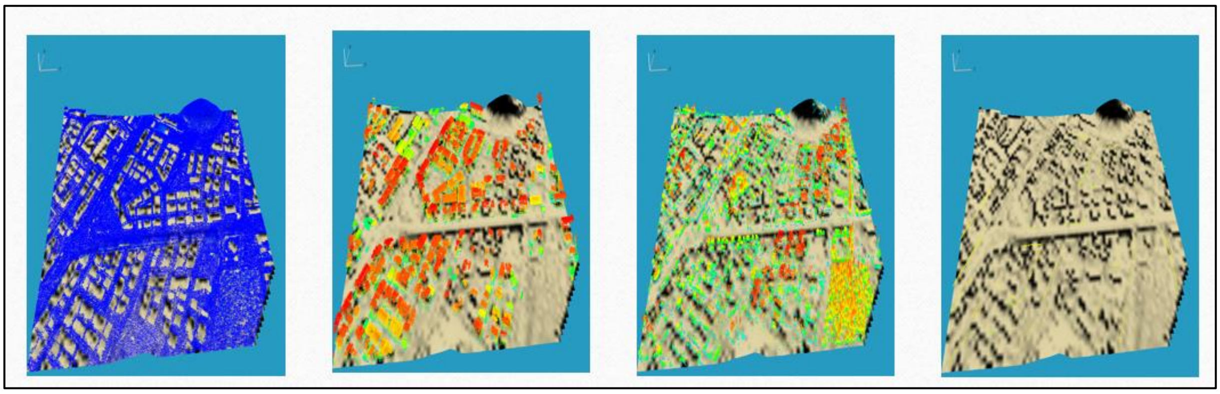

Fig. 3. Classified Lidar point cloud of the study area

The model generation is performed in Envi Lida software. The generated building model is covered with textures that are already exist in the software library (Figure 4). Because the Lidar data set has not any RGB data.

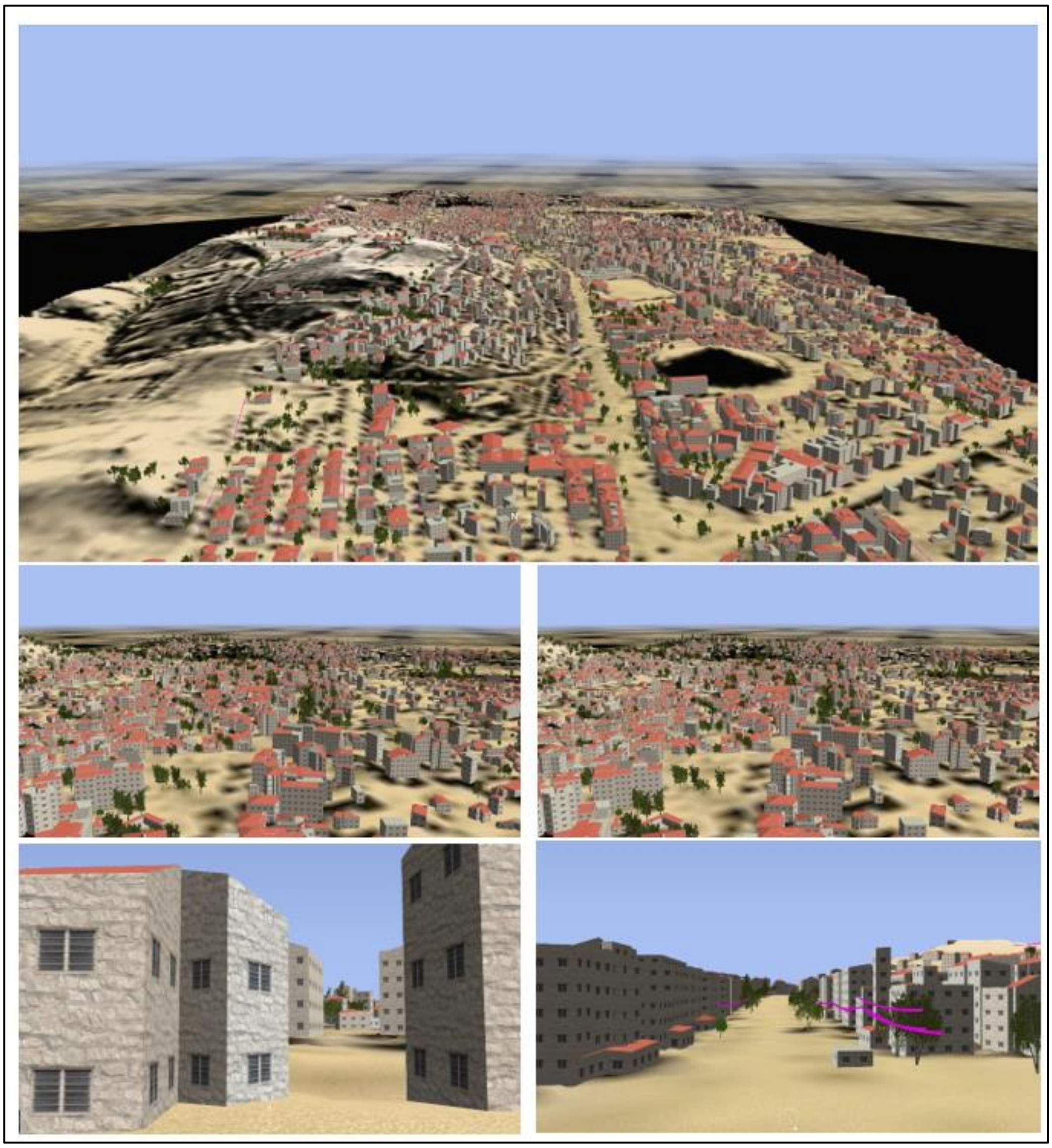

Fig. 4. Generated 3D city model from Lidar point cloud

4. CONCLUSION

In this study, a 3D city model produced by using LiDAR data for VR environment in Bergama / İzmir is presented. According to study, 3D city model produced by using LiDAR has a few advantages. Due to high accuracy of the lidar data, it allows us to explore urban context easily, Freedom of movement (Freedom of viewpoint), serves different purposes (educational, municipal, commercial etc), Portability (Can be used in different devices PC, Laptops, Phones..), Multiuser (disciplines) and update via internet. In brief, LiDAR based 3D city models can be used in VR environment for fulfilling various requirements. However, for a realistic model's real texture may require. Moreover, the misclassification of LiDAR point cloud effects the 3D model accuracy. A final reminder is about Hardvare and data storage because huge data set of lidar point cloud.

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3D MAP EXPERIENCE FOR YOUTH WITH VIRTUAL/AUGMENTED REALITY APPLICATIONS

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ABSTRACT

Human beings have started using maps since prehistoric times. The first man has made maps to the cave walls but nowadays the maps are being used with virtual/augmented reality (VR/AR) applications. With the use of 3D VR/AR applications, traditional map education can be given to the youth explicitly. With this technology, students can learn the maps enthusiastically and develop their spatial abilities. In this study, a 3D model of the Harran University Osmanbey Campus was created and prepared for the use of VR/AR applications. This model was then transferred to the Unity Game Engine Software for augmented reality application that students can see on tablets and smartphones. The resulting application was presented in a science festival where students experienced these technologies. It has been observed that students approached more enthusiastically to these technologies as a learning material because of the interactive nature of these technologies.

INTRODUCTION

Maps were used as a tool to answer the questions What? Where? and How? by human beings since prehistoric times. These maps have been used in the past on the cave walls, animal skins, parchments and recently on papers. Nowadays, maps are benefiting from developing technologies such as computers and virtual/augmented reality (VR/AR) applications. VR is defined by Fisher and Unwin (2001) as 'the ability of the user of a constructed view of a limited digitally- encoded information domain to change their view in three dimension causing update of the view presented to any viewer (the user)'. In addition to this definition, it can be said that VR is the use of glasses, motion sensors, computer and 3D projection systems to create a virtual environment for the user's perception. On the other hand, AR integrates visual objects to the actual environment of the user. Although, immersive technologies such as VR have been used for educational purposes since the past years, they have been used frequently in recent times since their prices have become cheaper (Stojšić et al., 2016). AR technology has been defined as a next-generation media that will improve the quality of learning by researchers due to its ability to integrate virtual objects into real environments (Dede, 2008). VR/AR technology can explain educational content better than text and this makes AR/VR unique for education (Hussein & Nätterdal, 2015). It is also possible that VR/AR can be used to bring textbook content to life (Bastiaens et al. 2014).

VR/AR technology has entered our lives for entertainment purposes and then evolved to serve other sectors such as education. Students can use the advantages of this technology since it offers to learn by doing virtually in almost all domains. Learning our world from maps is one of these domains. Geography education starts from early ages in schools. Classically young students learn the earth from 2D school atlases and wall maps. Since it is hard to perceive 3D objects from these 2D products, students can struggle to understand the earth and other spatial phenomena. Learning the portion of the earth and spatial phenomena through VR/AR technologies, which are memorable and stimulating senses, will save students from this challenge. In this context, experiencing the 3D earth by using VR/AR technology instead of the traditional 2D paper, will make a great contribution to students learning and spatial perception skills.

This study shows an example of how maps and spatial model can be uses in conjunction with AR/VR technologies. A 3D model of Harran University Osmanbey Campus was created and used as 3D map in VR/AR environment to present it to the young students.

RELATED WORK

A literature review will be presented in this part about VR/AR applications related with maps and education.

Bobrich & Otto (2002) carried out an application using pattern-recognition techniques where a topographic map of a region and a digital terrain model can be displayed in 3D in the study. Schmalstieg & Reitmayr (2007) discussed the implementation of augmented reality to the field of cartography and maps. In this study, two applications are presented: a map which is projected to the top of a desk with the help of projector and used interactively with PDA devices and showing various virtual signs in the real environment by using the portable smartphone’s camera and screen. Yovcheva et al. (2012), developed an application by using location-based augmented reality maps for tourists. In this way, map-based additional information could be given to tourists coming to the city for the first time. Quaye-Ballard (2008) pointed out that visualization of geographic analyzes based on static models restricts visual analysis, and in this study, he aimed to give a 3D perspective to these models by using VR technologies. In this context, the author draws attention to the importance of transferring geographic data from a paper medium to a visually highly capable environment, such as VR. Morrison et al (2009) developed a location-based mobile game, MapLens, using augmented reality technology. The authors also stated that the use of augmented reality maps as a collaborative tool has a great potential. Stojšić et al. (2016) conducted a study on how VR technology can be used in geography education. In this study, a broad literature review of using VR technology in education is also presented.

Billinghurst & Dünser (2016) argued how mobile AR can contribute to students learning and conclude that this technology can be a valuable teaching tool. Chen et al. (2016) stated that the development of technology has accelerated the augmented reality-supported mobile learning and the notion of concept-mapped AR was revealed in order to develop the applications that would attract students' interest. Radu (2014) stated that augmented reality technology is an increasingly popular educational material for young users. In his study, he examined 26 publications in which education with augmented reality was compared with classical education and revealed the good and bad aspects of this technology. Zhang et al. (2014) developed an augmented reality-based sphere to make astronomical observations easy and understandable for students. In addition, this method has been found to increase the interest of students in astronomical observations. Wojciechowski & Cellary (2013) investigated the effect of AR technology on students. An experimental chemistry lesson was prepared for use in the research. The results of the study indicate that the use of AR provides a beneficial and fun environment. Freina & Ott (2015) reviewed publications based on VR technology in education between 2013 and 2014. The study revealed that most of the publications were aimed at students at university and high school level. It is also stated that there are some studies on adult education.

In most of the studies examined here, it has been revealed that VR/AR applications are useful for students as a learning material which is easier to understand than classical methods.

METHODS

In order to be used in VR/AR applications, firstly 3D model of Harran University Osmanbey Campus was prepared. For this purpose, flights were made on the campus with GPS assisted unmanned aerial vehicle. Orthophoto, Digital Surface Model and 3D point cloud were obtained from the photographs of the campus (Figure 1).

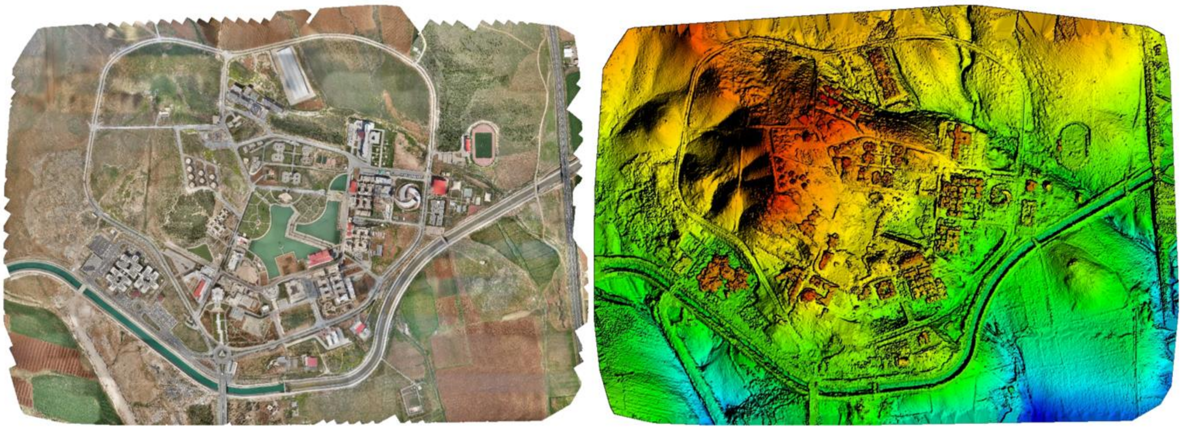

Figure 1. Orthophoto (left) and Digital Surface Model (right) of the Osmanbey Campus

In addition, infrastructure data was obtained during model creation and these data were arranged through GIS software for use in CityEngine environment. Then the facade photographs of the campus buildings were taken by fieldwork. These photographs were used to produce the building models at the LOD2 (Level of Detail 2). In order to take advantage of the procedural modeling technique of the CityEngine software, .cga files were prepared by writing proper codes in the software for the creation models. With these codes, the buildings belonging to the campus area were modeled according to their characteristics (Figure 2). Finally, this model is ready for use in AR / VR applications.

Figure 2. Some modelled buildings and their facades of the Osmanbey Campus

VR/AR Applications for Students

The 3D model of the Harran University Osmanbey Campus was prepared for use in VR/AR applications. The 3D model of the campus was created by using ESRI CityEngine software from the photographs which obtained using an unmanned aerial vehicle (Figure 3).

Figure 3. A general view of 3D model of the Osmanbey Campus

All of the prepared building models was exported as one model file and made ready for the Unity 3D environment and then transferred to the Unity 3D -game engine software- and rendered on the tablet screen using Vuforia platform. When the pre-defined visual target (paper and cardboard) is detected by the tablet’s camera, this target is displayed as a 3D model of the campus on the tablet screen and the details can be shown (Figure 4). The user can explore different parts of the model by rotating the tablet's camera around the visual target.

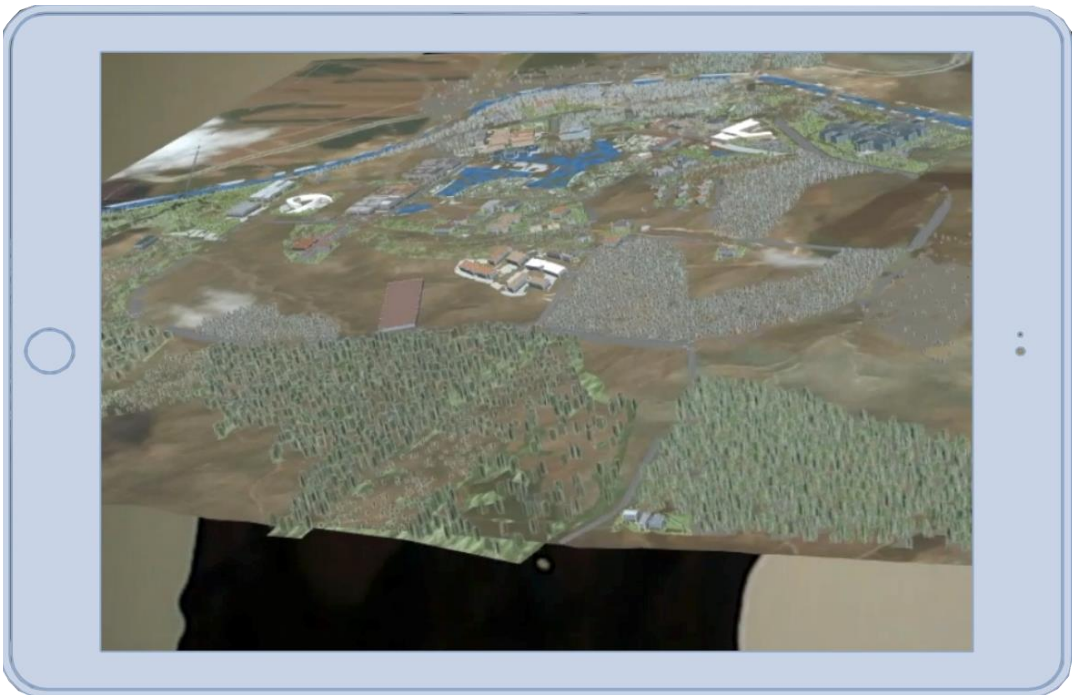

Figure 4. An example view of AR application from tablet screen

As a second application, the campus model was transferred to the VR environment using Unity and Mixed Reality Toolkit and ready for use with VR glasses. Thus, the user can navigate in the model using VR glasses and explore the campus in 3D (Figure 5).

Figure 5. An example view of VR application which user see from the VR glass

AR application was presented to young students which in the high school and their equivalent age groups as a workshop in the Sanliurfa Science Festival organized within the scope of a project which funded by The Scientific and Technological Research Council of

Turkey (Tubitak No: 4007). Within the scope of the workshop, students from different high schools discovered the 3D campus model of Harran University with the application of augmented reality. The students were able to examine the Osmanbey Campus, which is 25 km away from the center of the city, in an interactive way on the tablet screen.

CONCLUSION

In this study, a 3D model of the Harran University Osmanbey Campus was prepared using an unmanned aerial vehicle and used in the AR/VR application to present it to students. As some students were familiar with such augmented reality applications from the games, they easily get used to the application and explored the campus virtually. These spatial models, which are presented in 3D with new technologies, have been carefully and enthusiastically studied by young students who participated in workshops. In this context, teaching maps with new technologies such as VR/AR will contribute positively to the development of spatial perception and map skills in young students. Future studies will focus on creating VR/AR games that will provide fun map learning for students of different ages.

Keywords: Virtual Reality, Augmented Reality, 3D City Modeling, Map Education

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PHOTO-REALISTIC ENVIRONMENTAL MODELLING FOR VIRTUAL REALITY

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ABSTRACT

Virtual reality is a term used for computer-aided three-dimensional (3D) environments where technically people feel the sense of being in the scenario. Users are included in the scenario prepared by the experts through various peripherals. From the moment when the user enters the environment, the user is disconnected from reality and the feeling of being in an environment where virtual reality is created starts to happen. In order for users to truly experience the experience of virtual reality, the scenario in which virtual reality designs are found must be flawless and be able to convey this feeling to the user better. The environment model used in the virtual reality environment is selected from the real environment/users of the users. For this purpose, photogrammetric modelling of real land surface using air photographs and transferring it to virtual reality will increase user satisfaction and credibility. In this study, the 3D model was produced by using aerial photographs of Harran University Osmanbey Campus obtained by unmanned aerial vehicle. Produced model is covered with real color information and obtained a photo-realistic environment and it has been made suitable for use in a virtual reality environment.
Keywords: Virtual reality, Photo-realistic, three dimensions, unmanned aerial vehicle, 3D model

1. INTRODUCTION

Today, there are many areas of application in which virtual reality is being used. These usage areas, which are created by taking advantage of the virtual reality, aim to give users a virtual sense of reality. Application areas where virtual reality is used;

- Military
- Education
- Health care
- Entertainment
- Fashion
- History
- Business
- Engineering
- Spore
- Media
- Scientific Visualization
- Telecommunication
- Construction
- Film
- Programming Languages

as seen (URL-1, 2019).

The most important feature that distinguishes virtual reality from many other applications is that it gives the user a sense of reality. In order to fully sense this feeling, the objects in the model must reflect the truth in terms of texture and size. The most important point in the preparation of the three-dimensional models created by using ground or aerial photography is the true size control of these models as geodetic. For this, in order to convey the reality of the scenario to the feelings of the person, the environment and objects in the scenarios must be created in a real scale. Photogrammetric modelling is a complex and multi-faceted process. To get a better reality feeling, it is necessary for deciding the current state of the structure (shape and position) in three-dimensional space. There are a few techniques for

3D modelling such as traditional surveys, topographic techniques, photogrammetric surveys and scanning technique (Uysal, Toprak, & Polat, 2013). Nowadays, the reconstruction of building in the 3D model is very popular due to the developments in UAV and digital photogrammetry parallel to computer technology. UAVs are to be understood as uninhabited and reusable motorized aerial vehicles which are remotely controlled, semi-autonomous or have a combination of these capabilities, and that can carry several types of payloads, making them capable of performing specific tasks within the earth's atmosphere, or beyond, for a duration, which is related to their missions. In this study, a model of the forest area in Harran University Osmanbey Campus were monitored with UAV and three-dimensional (3D) modelling of the area was performed. This model was saved as a proper format to transfer into a virtual reality environment for the use of as a game scene.

2. METHODOLOGY

In this study, the TurkUAV Octo V3 UAV was used to capture images. It uses microcopter electronic. The weight of the UAV is approximately 8kg and the payload is maximum of 3 kg. Flying time depends on both battery and payload weight. A lot of features of this model are available such as Altitude Hold, GPS Hold, CareFree, Coming Home, Fail Safe, Low Battery Protection, Auto Take Off and Landing, Waypoint Flight. Mikrocopter (MK Tools) software let us to view the navigation and flight status information in real time. It is possible to perform autonomous flight plan over the online maps. Moreover, some details such as horizontal and vertical speed, altitude, direction, waiting time at willing points, coordinate information, and camera angle are also can be specified. Waypoint Flight electronic is capable of autonomous flight in a 1000m radius area and 250m fly height for a standard route. The digital camera was a Sony RX100 MII. It has featured with 20.2 Megapixel and 13,2x8,8mm CMOS image sensor. Single, continuous, and self-timer drive abilities are among the digital camera features. The Body weight of the device is 281g. The technical data of the unmanned aircraft and the camera are shown in Figure 1 and Figure 2, respectively.

- ✓ 90x90x50cm dimensions
- ✓ 6kg total weight
- ✓ 18 minutes flight time
- ✓ 36km/hour horizontal speed
- ✓ 12km/hour vertical speed
- ✓ 35km/hour wind resistance
- ✓ 2km controller range
- ✓ 3kg weight lifting capacity
- ✓ 0.8-1.69cm/pixel resolution

Figure 1. Technical specifications of TurkUAV Okto V3 UAV.

- ✓ 5472 x 3648-pixel resolution
- ✓ 20.2 MP Exmor R BSI CMOS sensor
- ✓ 28-100mm focal length
- ✓ 1/2000 seconds shutter speed
- ✓ ISO 12800 low light precision
- ✓ F1.8 – F4.9 lens aperture
- ✓ 281 gr total weight

Figure 2. Technical specifications of the Sony RX100II compact camera

Multiple parameters should be taken into consideration when working with UAVs. First of all, the flight plan should be done well and the scenarios of any errors that may arise should be reviewed carefully. The weather conditions (temperature, pressure, humidity) at the time of flight of the region should be checked. In order to identify the obstacles that may be encountered in the area where the flight will take place, it is necessary to check the dangerous high objects on the land by going to the area before the flight. A flat surface should be chosen as far as possible for the UAV to be able to take off smoothly. Before starting the flight, pre-flight preparations should be checked step by step and then the flight should be started.

3. CASE Study

In this study, a model of the forest area in Harran University Osmanbey Campus were monitored with UAV and three-dimensional (3D) modelling of the area was performed. It was difficult to prepare a flight plan with the available software for a UAV surveying application. However, MK Tools allow us to pass this obstacle. The main advantage of this software is to require minimum user interferences. After some parameters such as overlapping of photos, waypoints, flight path, and altitude had been defined on an online map and uploaded, the UAV carried out the flight plan automatically. It is necessary to remember some precautions: Weather condition of the study area, daylight status for better photos, backup battery depends on the study area, and controls of flight, engine, and navigation of UAV against any errors (Polat & Uysal, 2017). When all the necessary controls had finished, online maps were uploaded to OSD. The flight plan was prepared based on this map with 6 column and 28 points route and the altitude were 80 m and was uploaded to the UAV. Then the automatic flight was started. Existing software's can generate a 3D point cloud such as; Pix4D (commercial software) that has been used in this study. The software is advanced in UAV applications and allows to generate DEM and orthophoto in a willed coordinate system. For full performance of software, it is recommended to use a powerful computer due to the huge amount of data. The data processing is easy. It starts with uploading photos from camera to computer. We used 120 selected images. Existing software's can generate a 3D point cloud such as; Pix4D (commercial software) that has been used in this study (Figure 3).

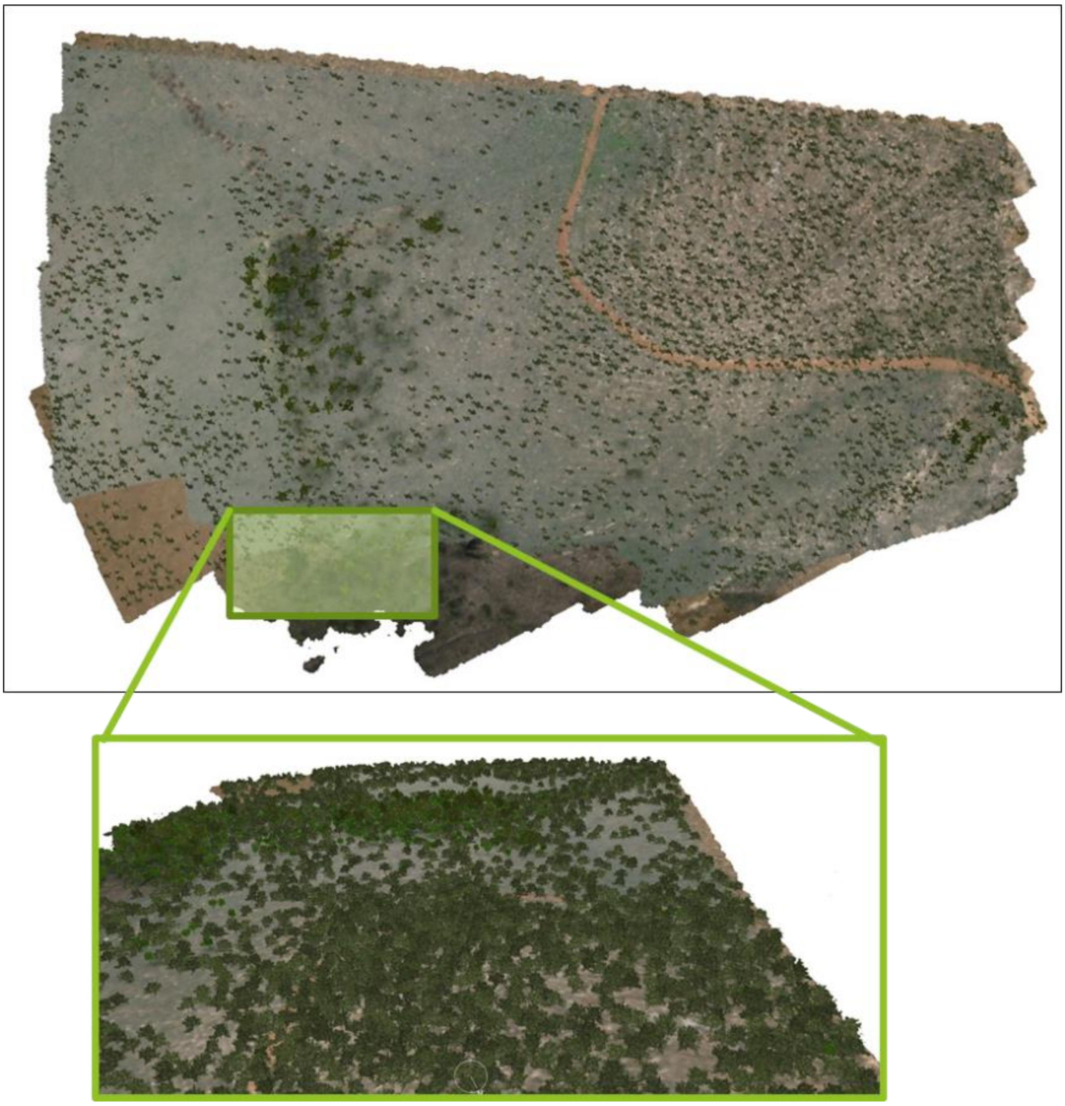


Figure 3. Point clouds of the study area

In Figure 3, UAV flights and point clouds of the study area is shown. At the end of image processing over 8,000,000 points are obtained with a density of 14.34 (points/m^2). From this 3D point cloud data, the surface model of the study area was obtained (Figure 4).

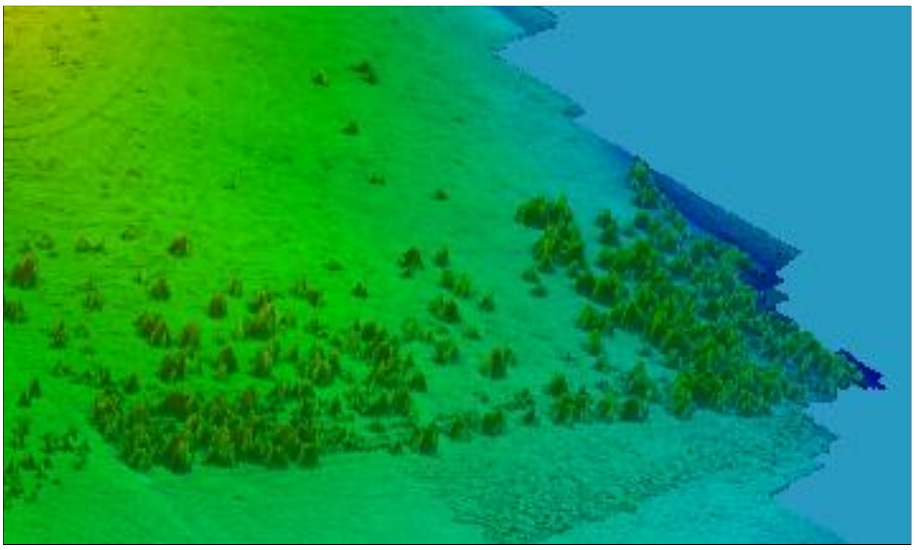
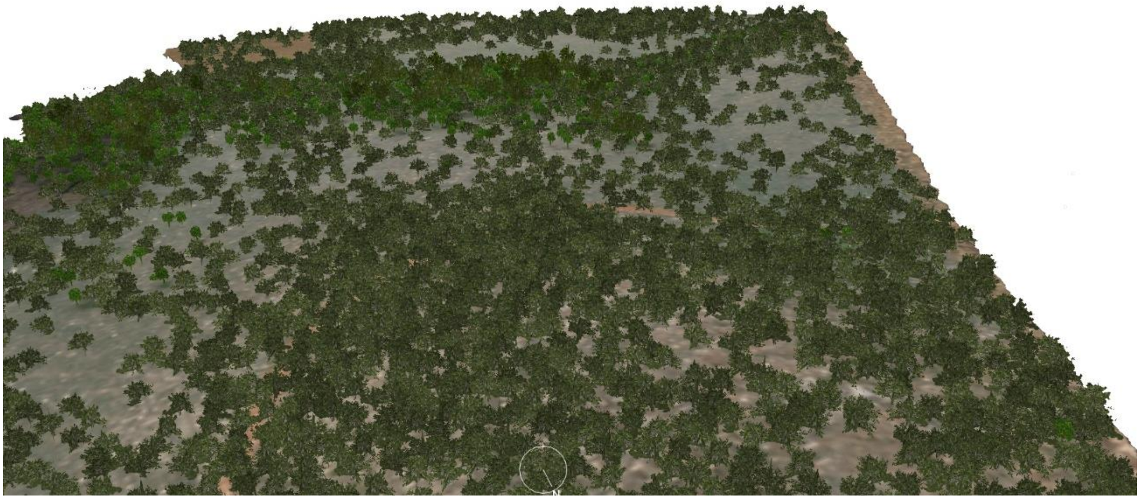


Figure 4. Surface model of the project area

In Figure 4, surface model of the area is shown. After the production of the surface model of the study area, the modelling of trees on the region can be made. The modelling process is carried out by a method called surface mesh (Figure 5).

(a)



(b)

Figure 5. Meshed surface models of the study area

In Figure 5a and b, the produced models is covered with real color information and obtained a photo-realistic environment and it has been made suitable for use in a virtual reality environment. In this way, the surface model can be used for the virtual reality environment and game scene.

In virtual reality applications, it is more important to prepare a scene for the game or environment scenario. Therefore, transferring the models of these three situations to a scenario in a virtual reality environment is the main element of this study. In this study, Unity Game Engine was used to visualize the scenario of the study area. This model was transferred to the virtual reality environment to prepare the game scene. Virtual reality glasses were used to show this virtual reality environment to the user. This study supports the establishment of medium or large-scale game arena for players.

4. CONCLUSION

In this study, the 3D model was produced by using aerial photographs of Harran University Osmanbey Campus obtained by unmanned aerial vehicle. In the end, the produced model is covered with real color information and obtained a photo-realistic environment and it has been made suitable for use in a virtual reality environment and game scenes.

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BUILDING MODELING BY UAV IMAGES

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ABSTACT

Unmanned Aerial Vehicles (UAV) can be defined as vehicles with no pilot and no passengers and can be controlled remotely. UAV technology which has been developing rapidly in parallel with the development of technology has been used in many areas such as field control, surveillance, inspection, map production and 3 dimensional (3D) modeling today. UAV technology has become a preferred method against classical methods in many areas due to its fast, sensitive and low cost. Especially, it has become a common method used in image based point cloud and 3D model production studies. In addition, produced 3d models can be used for virtual reality because of they are realistic(photo-realistic) and scalable.

Virtual reality can simply be defined as the use of computer technology to create a simulated environment. With the rapid development of computer technology, virtual reality technology has been used in many disciplines. One of the first areas that come to mind when talking about virtual reality is building modeling with photogrammetry. In this study, 3D point cloud and building model were obtained by using UAV images of Afyon Kocatepe University Faculty of Engineering Laboratory Building.

INTRODUCTION

Unmanned Aerial Vehicle/System (UAV/UAS or drone) is a kind of plane which has neither a pilot nor passengers on board and only carries fit-for-purpose equipment such as video camera, camera, GNSS receiver, laser scanner, etc (Kahveci and Can, 2017). UAV technology has been used intensively in the last 15 years and it has become widespread in time. UAV technology is used in military activities, fire fighting, search and rescue works, scientific researches etc. in different fields. In addition to these areas, the field of UAV technology is widely used today, photogrammetry and remote sensing studies. With the UAV technology, great progress has been made in the areas of map production and 3D modeling. UAV technology is used frequently in mapping activities because it is more sensitive, more economical and more practical than classical methods.

Yakar et al. (2013) in a study in the province of Afyonkarahisar Doğer Caravanserai images were obtained by terrestrial photogrammetry and the 3D model of the structure was created. In this way, the documentation of a structure that is of historical importance has been obtained. Yakar et al. (2015) modeled the Bezariye Inn in Konya province in another study. In the study, control points were used to model UAV images. The model is an important study in transferring historical and cultural heritage to the next generations.

Ulvi A. et al. (2017) carried out a study on the 3D model of the theater by using kite photographs of the theater in Uzuncaburç Diocaesarea of the ancient theater in the Silifke district of Mersin province. As a result, archaeological documents were determined at sufficient intervals by using photogrammetric techniques with unmanned aircraft.

Virtual Reality (VR) is a 3D simulation model which lets the users to immerse into a computersimulated environment and allows them interact with imaginary environments (Bayraktar and Kaleli, 2007). Virtual Reality literally makes it possible to experience anything, anywhere, anytime. It is the most immersive type of reality technology and can convince the human brain that it is somewhere it is really not. With the rapid development of computer hardware and software technologies, the virtual reality technology that has gone a long way in a short period of time provides convenience to users in many areas. The virtual reality devices used today have become quite comfortable and useful compared to the devices used in the past. Therefore, virtual reality technology is used in almost every discipline from health to industry, computer games to archeology. For example, in order to gain experience for doctor candidates in the health sector, performing operations in a virtual reality environment allowed doctors to gain experience more easily. In the real estate sector, customers have been able to navigate inside their homes with the help of virtual reality glasses. One of the first areas that come to mind when talking about virtual reality is building modeling with photogrammetry. Building modeling is a very important issue both for the introduction and protection of historical artifacts and for the use of 3D building models for different purposes. Nowadays, UAV technology is a frequently used method in photogrammetry studies. Especially, it has become a common method used in image based point cloud and 3D model production studies. The fact that both field work and office work are facilitated according to classical measurements are the main reasons for this situation.

Interdisciplinary interactions are now very high and interdisciplinary studies are increasing day by day. On the other hand, virtual reality technology is used in almost all disciplines. In this context, three-dimensional building modeling and virtual reality issues interact with each other in the form of sensitive, easy-to-produce and visual presentation is created. In this study, a study on how 3D building modeling can be used in the virtual reality environment is presented.

METHODOLOGY

Afyon Kocatepe University Engineering Faculty Laboratory building was preferred as the study area (Figure 1).

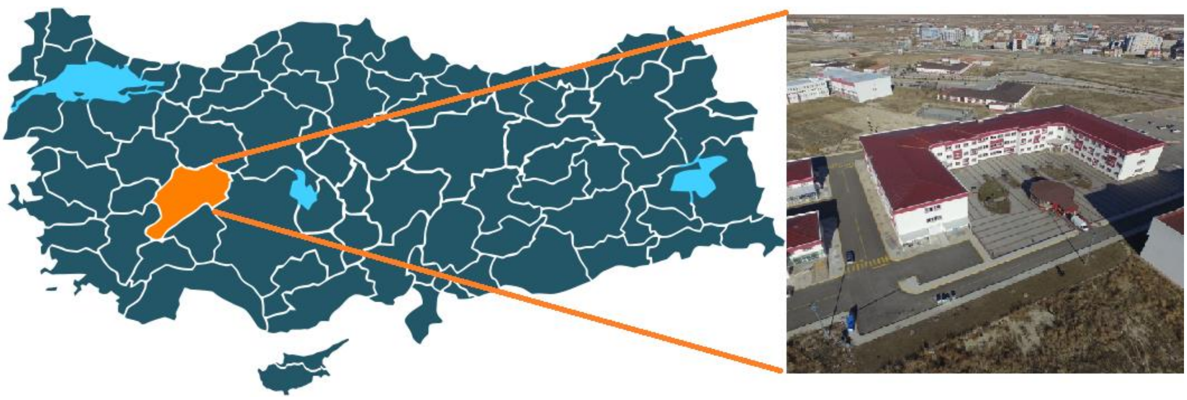

Figure 1. Study area

In this study, 370 UAV images were taken from different angles and different heights. Then, the appropriate images were selected from the images obtained (Figure 2). After obtaining UAV images, 3D point cloud and 3D building model were created. Daha sonra üretilen model fotoğraflarla kaplandı ve gerçek dokulu bir model elde edildi. (Figure 3).

Figure 2. UAV images from different angles

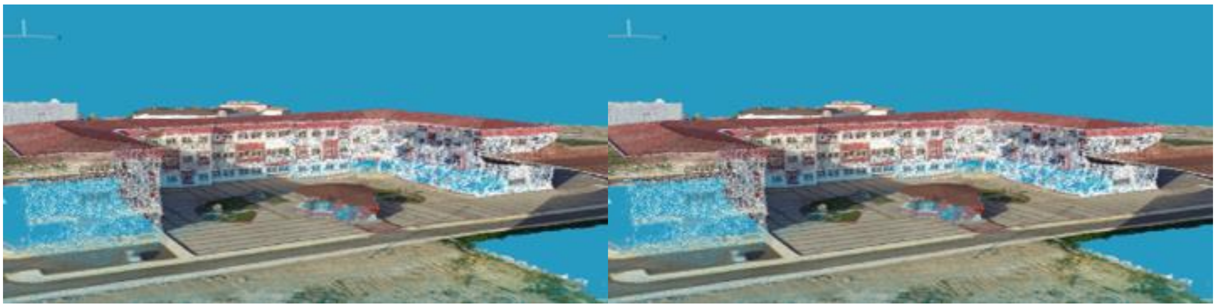

Figure 3. Point cloud

Height difference map is created to be able to detect buildings from the point cloud. In the height difference map, the ground with the lowest height is shown in blue. En yüksek yüksekliği olan zemin kırmızı ile gösterilir. A low-to-high color scale was formed from blue to red (Figure 4). After the buildings in the study area were successfully identified, 3D modeling process was started.

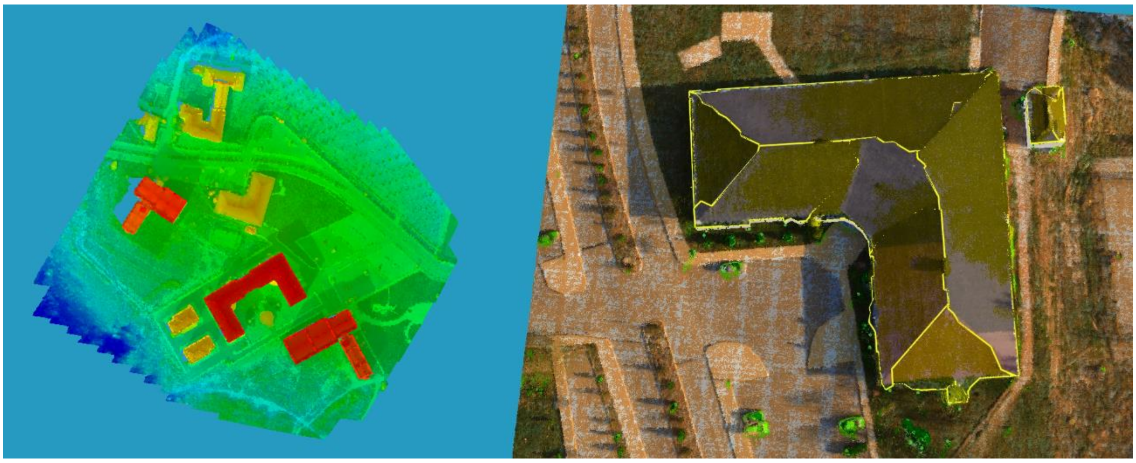

Figure 4. Height difference map and building detection

Figure 5. 3D model

CONCLUSION

3D building modeling obtained by Unmanned Aerial Vehicles for many years has formed a base for many different disciplines. Building modeling is very important for virtual reality technology which has attracted great attention in recent years. Especially one-to-one modeling of buildings with historical structures or special structures is very important in terms of recording the documentation of these structures and showing them to the user in virtual environment. Photogrammetry is a very successful method for transferring specific structures to a virtual reality environment. In addition, UAVs are suitable platforms for both building modeling and modeling large areas. The use of UAV technology in photographing large areas is more advantageous in terms of time, cost and workload.

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TRANSFERRING HISTORICAL RUINS TO VIRTUAL REALITY ENVIRONMENT USING UAV PHOTOGRAMMETRY: A CASE STUDY OF ŞANLIURFA CASTLE

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ABSTRACT

Museums are the main places where cultural heritage is stored, preserved, and exhibited. However, with the development of computer technologies, the use of virtual reality systems in daily life can be used to exhibit historical areas as well as different disciplines. The basic problem is that the object or space that is planned to be transferred to the virtual environment can be modelled in three dimensions (3D). Today, there are many technologies and scientific methods used for 3D modelling. One of them is the UAV photogrammetry, can be used in the modelling of historical areas as a method which has been used very intensively in recent years. In this study, as a result of the evaluation of the aerial photographs obtained after the flight on the Şanlıurfa Castle by an unmanned aerial vehicle, an application has been made for the infrastructure work needed to transfer the historical ruins in the region to the virtual reality environment.

Keywords: 3D Modelling, Archaeology, UAV, Virtual Reality, Historical Ruins

INTRODUCTION

Sanliurfa is a city full of historical monuments. Museums are the main places where cultural heritage is stored, preserved, and exhibited. But the museums appeal only to the people living in the city and the tourists visiting the museums (Figure 1).

Figure 1. Şanlıurfa Museum

With the development of computer technologies, the use of virtual reality systems in daily life can be used to exhibit historical areas as well as different disciplines. In addition, to produce spatial accuracy and real-size models of archaeological sites (Guidi G., 2009) is also very important in recording these regions. Another important issue is creating high accuracy surface areas where archaeological sites are located and thus can comment on the surface of the archaeological site (Drap P. et al., 2007). The models obtained and transferred to the virtual reality environment are used to record archaeological sites and to see the development of the excavation areas. In addition, 3D models are also used as base data for restitution projects. If the archaeological work has been damaged due to various reasons, these artefacts can be reconstructed in a realistic way thanks to the real-size model produced. The case of the archaeological site of the Palmira, Syria is a bitter example of why archaeological sites should be recorded (Figure 2).

Figure 2. The ancient city of Palmira

RELATED WORK

A literature review will be presented in this part about VR/AR applications related to maps and education.

Senol, H. I., et al. (2017) studied the ruins of the ancient city of Harran which was destroyed by the Mongols in the Harran district of Şanlıurfa province. In this application, modelling and recording of archaeological excavation areas have been examined. In this direction, the application area was scanned and modelled by using laser scanning method and the thus archaeological area was documented.

Uysal, M. et al. (2013) model Gedik Ahmet Pasha mosque with the data obtained by the photogrammetric method. The actual model is processed through modelling software. In this way, it is aimed to increase the important effects for the regional economy such as tourism activities.

Yakar, M., & Yilmaz, H. M. (2008) in their work, which is an important cultural heritage of Horozluhan photogrammetric method of modelling and obtaining the subject of the measurement and was taken. In this direction, various field studies and office work have been done and the results have been produced. As a result, it is emphasized that the storage of this important cultural heritage in 3D will be important for touristic purposes.

STUDY AREA

Castle of Sanliurfa was built in B.C. 2000 and has played an important role in the crusades. The castle, which was restored in the Ottoman period, was also used by them. In time, the castle lost its importance and the structures on the castle area have remained under the ground. However, with the importance of archaeological sites such as Göbeklitepe, the fortress has started to regain its historical importance. In order to reveal the past of the Şanlıurfa castle, the Şanlıurfa Museum Directorate and the Harran University Archeology Department are continuing the excavations together (Figure 3).

Figure 3. Excavation area

Archaeological studies on this castle, which is one of the most important symbols of the city, will illuminate the period B.C. 2000. Therefore, it is important to record the archaeological excavations and the castle in structural form. In addition, with the transfer of the produced model to the virtual reality environment, the castle can be seen in the virtual environment. In this way, tourism can be expected to gain vitality and increase the importance given to the region.

METHODOLOGY

The study was requested by the Şanlıurfa Museum Directorate and the models and photographs produced by the archaeological studies on the castle were added in their reports. For this reason, the necessary permissions were taken with the museum directorate before the flights made in the study area. After obtaining the permit, the study area was investigated and the areas suitable for UAV application were determined. During the study, the staff from the archaeological excavation accompanied the study team and gave information about the situation of the archaeological structure (Figure 4).

Figure 4. The study team and the staff from the archaeological excavation

The basic problem is that the object or space that is planned to be transferred to the virtual environment can be modelled in three dimensions (3D). Today, there are many technologies and scientific methods used for 3D modelling. These include laser scanning applications, ground photogrammetry applications, and unmanned aerial vehicle applications. One of them is the UAV photogrammetry, can be used in the modelling of historical areas as a method which has been used very intensively in recent years. With the laser scanning application, one can obtain millions of real points from the surface with air or ground laser scanning devices and textured models very close to reality can be obtained. In addition, 3D modelling can be performed by ground photogrammetric methods. In this study, the UAV photogrammetry method was used and applied.

Unmanned aerial vehicles today are often used for taking amateur aerial photographs or military espionage but are also used for ground surveys. Depending on camera accuracy and systems located above the UAV, very detailed location measurements can be made, and the results can be obtained by modelling the terrain. In addition, these devices can be used in deformation measurements, archaeological measurements, modelling of archaeological remains, the structural works, agricultural works and city planning.

The 8-propeller octocopter UAV used in this study, named Octo V3 produced by Turkuav (Figure 5).

Figure 5. Turkuav Octo V3 UAV

It is equipped with a 16-megapixel camera with the other equipment of the device. For measurements made with UAV, it is necessary to draw up a good plan for the region to be researched. The heights in the area should be determined well and the flight height of the UAV should be adjusted accordingly. Persons using the devices should be the same person from the beginning to the end and thus human errors should be minimized.

There were two 34-meter tall historical towers in the area of application and 50 meters of flights were made to avoid any risk of crashing the UAV (Figure 6).

Figure 6. Historical towers on Sanliurfa Castle

It is important to make a constant-height flight ensure that the data obtained are consistent and easy to perform. The flights were made in the morning, where the shadow was as small as possible. Pix4d software was used for the evaluation of the photos. The application area is modelled by applying the images to the point cloud. The measurements made in the field of the application were evaluated and orthophoto map, digital elevation model and digital terrain models were created. However, the 3D model of the remainder is produced through the ENVI application.

As a result of the evaluation of the aerial photographs obtained after the flight on the Şanlıurfa Castle by an unmanned aerial vehicle, an application has been made for the infrastructure work needed to transfer the historical ruins in the region to the virtual reality environment. The 3D model obtained in this direction has been transformed into the 'obj' format, which is the appropriate format to be transferred to the virtual reality environment (Figure 7).

Figure 7. 3D point cloud of the Sanliurfa Castle

Unity is a game designing software. In addition, it provides the realization of the virtual reality environment with virtual reality glasses within the virtual reality models produced by the game engine. Therefore, the obtained model was transferred to the Unity platform (Figure 8).

Figure 8. 3D model of the Sanliurfa Castle in a VR environment

It is transformed into a virtual reality environment after adding various environment arrangements on the model and adding the necessary characters for navigation. The model obtained through virtual reality glass was observed in a virtual reality environment. It was also visited within the study area with virtual reality glasses.

RESULTS

The resulting products, images, and models; could use as archives of historical sites, modelling of important artefacts found in archaeological excavations, and constructing bases for restitution projects. In this way, it is possible to guide the tourists who want to visit the region and the people who want to get information about the region through these models. Recording of archaeological sites has important implications for the benefit of society and will have important consequences for the benefit of engineering and architecture. In this way, the registered model can be used as a base project for the planned architectural projects and engineering studies. In addition, thanks to the model transferred to the virtual reality environment, for the tourists planning to see Sanliurfa Castle can be given a preview. Thanks to the ease of access to virtual reality tools today, such studies can spread and create a virtual reality environment for archaeological sites. In this way, all people in the world can be reached through virtual reality and have the opportunity to experience important archaeological sites in our country.

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VIRTUAL REALITY APPLICATIONS IN THE FOLLOW-UP OF ENGINEERING PROJECTS

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ABSTRACT

The development of engineering projects at medium and large scales is critical to following the progress of the project. In such various scales of the engineering projects, monitoring of the process takes a long time with classical methods and needs a lot of human effort. In this context, human labour can be minimized by using current technologies such as an unmanned aerial vehicle (UAV) and virtual reality. These methods, which result in faster than classical methods, make positive contributions to the project follow-up in terms of economy and time. In this context, the pre-construction status of the solar power plant project, the levelling of the land and the installed status of the panels in Harran University Osmanbey Campus were monitored with UAV and three-dimensional (3D) modelling of the project area at each phase was performed. These models were saved as an appropriate format to transfer into a virtual reality environment for the use of administrators and decision makers.
Keywords: UAV, Solar Power Plant, 3D Modelling, Follow-up Project, Virtual Reality

1. INTRODUCTION

Following the development of engineering projects at various scales is critical to the healthy progress of the project. In such large and medium-scale engineering projects, monitoring of the process takes a long time with classical methods and needs a lot of human effort. In this context, human labour can be minimized by using current technologies such as an unmanned aerial vehicle (UAV) and virtual reality. These methods, which result in faster than classical methods, make positive contributions to the project follow-up in terms of economy and time.

The comfort of technology in daily life has been used in many business areas to facilitate practical applications. At its early stages, virtual reality applications were being used in the defence industry and entertainment sectors to reveal the visual presentation of intermediate products. This technology then expanded to many different areas. Virtual reality studies, which were introduced first in the 1950s, have been widely used by companies in the UK for the last 20 years (Steed, 2017). The virtual reality technology is developing in many areas such as construction, industry, education, health and so on. Computer systems and their monitors are under development over three decades and their capability to create more complex 3D models and displaying these visual objects is improving day by day. With the production of extremely high-performance image processing equipment, today there are applications that offer nearly real-time 3D models of these projects. Many automotive manufacturers have been using this technology since 2006. The management staff of these companies can see the changes in the production process and the resulting product of the vehicle model through virtual scenarios. A similar method can also be applied to the construction sector. Designers can create a 3D model of both the interior and the exterior of the buildings. In this context, managers can follow the positive and negative situations that may occur before the project starts. Therefore, monitoring and presenting the project process in the construction sector has become one of the most common uses of virtual reality (Bouchlaghem & Liyanage, 1996). A company that started to work in 2001 is presenting models to managers and real-time project tracking applications. Today, many of these applications are still being monitored in two dimensions with the help of computer screens or projections. The future of this and many other applications are intended to include the users in that scenario and to keep them alive in a 3D environment.

In this context, the pre-construction status of the solar power plant project, the levelling of the land and the installed status of the panels in Harran University Osmanbey Campus were monitored with UAV and three-dimensional (3D) modelling of the project area at each phase was performed. These models were saved as an appropriate format to transfer into a virtual reality environment for the use of administrators and decision makers.

2. RELATED WORKS

There are studies that use virtual reality technology in the follow-up, control, measurement and reporting of projects. Especially in engineering projects, the visualization of these applications by virtual reality with the realization of the electrical, mechanical, design, planning and measurements of the structures in accordance with the project enables managers and engineers to make the right decision.

Abdelhameed (2012), has focused on the management of construction projects and how they can be visualized spatially and put into practice the theory that he planned with a virtual reality application in his work. As a result of the study, it has been revealed that reporting such project phases as virtual reality is critical for decision makers who are not architectural and engineering experts.

Goulding et al. (2012) mention that virtual reality technology, which is one of the non-site production types under the umbrella of modern construction methods, can turn the market needs into a sector which can provide sustainable solutions with high performance and a new vision. In the study, an application has been made on the understanding of the jobs which are considered as risky in the construction areas by the virtual reality technologies and by the employees to have better results.

A similar study was conducted by Sacks et al. (2013) and trained the construction workers in a virtual reality environment and focused on ensuring occupational safety through this method, where the risk of work accidents is minimal. For this purpose, 66 persons received occupational safety training with virtual reality and their occupational safety information was measured before, during and after the training, just after the training and one month after the training. As a result, it was found that virtual reality and education were more effective than classical methods and more effective in terms of time and education. In addition to the mentioned advantages, it is also observed that the preparation of virtual reality materials is disadvantageous in terms of cost.

Zhao & Lucas (2015) also used virtual reality technology for training on large scale projects and pointed out that virtual reality-based training could be successfully completed without jeopardizing the safety of people. The author stated that the invisible accident situations which are dangerous like an electric with these technologies can be modelled and the users can live the danger virtually. In this way, users will be more careful with occupational safety measures by experiencing the accidents that may occur before they happen in a virtual environment.

Rankohi & Waugh (2013) investigated the availability of augmented reality applications in areas such as visiting the site in the pursuit of architecture, engineering and construction projects, comparing the planned situation and the situation built, and increasing the opportunities for cooperation. These considerations for authors' increased reality applications can be used in virtual reality applications.

Dodevska & Mihić (2018) demonstrated the effect of virtual and augmented reality technologies on project management with SWOT analysis. He analyzed the answer to the question of whether these technologies could change the flow of current project management.

3. CASE STUDY

In this study, the construction phases of the 5-megawatt solar power plant built in the Harran University Osmanbey Campus were monitored in 3D and traceability of the project in the virtual reality environment was investigated. An orthophoto of the study area is shown in Figure 1.

Figure 1. An orthophoto of the study area

The solar power plant installed in the campus area has been set up to meet the energy needs of Harran University Research and Application Hospital. In order to follow up the processes from the beginning of the project, in accordance with the demand from the university management, three separate flights were made with the unmanned aerial vehicle in the region while the solar power plant project was in progress.

4. METHODOLOGY

In this study, UAV, which is fully automatic flight capable after the take-off, is used with the model named TurkUAV Okto V3 produced by Robonik Mechatronics Technologies company. According to the prepared flight plan, the UAV was manually ventilated without entering the project site, and according to the predetermined route, photographs of the project study area were obtained automatically and downloaded manually. Photo shooting was performed using the Sony RX100II compact camera with a 20.2MP resolution placed underneath the UAV. The technical data of the unmanned aircraft and the camera are shown in Figure 2 and Figure 3, respectively.

- ✓ 90x90x50cm dimensions
- ✓ 6kg total weight
- ✓ 18 minutes flight time
- ✓ 36km/hour horizontal speed
- ✓ 12km/hour vertical speed
- ✓ 35km/hour wind resistance
- ✓ 2km controller range
- ✓ 3kg weight lifting capacity
- ✓ 0.8-1.69cm/pixel resolution

Figure 2. Technical specifications of TurkUAV Okto V3 UAV.

- ✓ 5472 x 3648-pixel resolution
- ✓ 20.2 MP Exmor R BSI CMOS sensor
- ✓ 28-100mm focal length
- ✓ 1/2000 seconds shutter speed
- ✓ ISO 12800 low light precision
- ✓ F1.8 – F4.9 lens aperture
- ✓ 281 gr total weight

Figure 3. Technical specifications of the Sony RX100II compact camera.

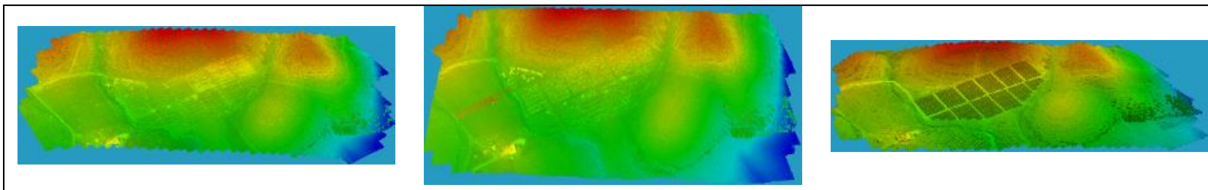
Multiple parameters should be taken into consideration when working with UAVs. First of all, the flight plan should be done well and the scenarios of any errors that may arise should be reviewed carefully. The weather conditions (temperature, pressure, humidity) at the time of flight of the region should be checked. In order to identify the obstacles that may be encountered in the area where the flight will take place, it is necessary to check the dangerous high objects on the land by going to the area before the flight. A flat surface should be chosen as far as possible for the UAV to be able to take off smoothly. Before starting the flight, pre-flight preparations should be checked step by step and then the flight should be started.

The flight plan of the land was prepared in the office before the data collection process with the UAV. The flight plan was prepared with TurkUAV Ground Station v2.1.0, which is the control software of the UAV. The flight was planned to be 1.37cm / pixel and the flight height was 80m. The image overlay ratios of the images to be captured are set at 80% width and 60% longitudinal overlap. After all the controls were completed, the flight was carried out. The flight lasted 12 minutes and a total of 243 pictures were taken. A total of 240 aerial photographs were obtained for each flight and the point cloud data of the project area were created by evaluating these images. Existing software's can generate a 3D point cloud such as; Pix4D (commercial software) that has been used in this study (Figure 4 a, b, and c).

(a) (b) (c)

Figure 4. Point clouds of the project area in three different periods.

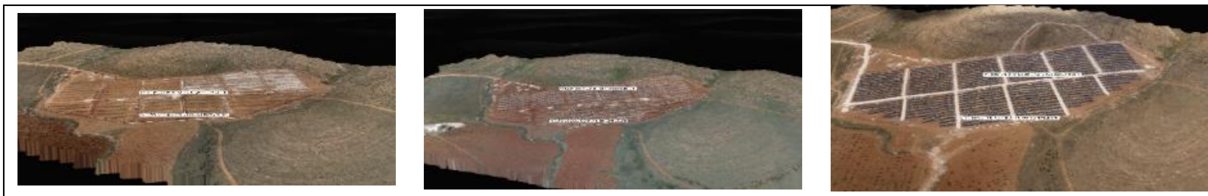
In Figure 4 a, b and c three UAV flights in different period and point clouds of the project area is shown. At the end of image processing over 25,000,000 points are obtained with a density of 14.34 (points/m^2). From this 3D point cloud data, the surface models of the project region were obtained (Figure 5).



(a) (b) (c)

Figure 5. Surface models of the project area in three different periods.

In Figure 5 a, b, and c three UAV flights in different period and surface model of the project area are shown. After the production of the surface model of the study area, the modelling of solar panels in the region can be made. The modelling process is carried out by a method called surface mesh (Figure 6 a, b, and c).

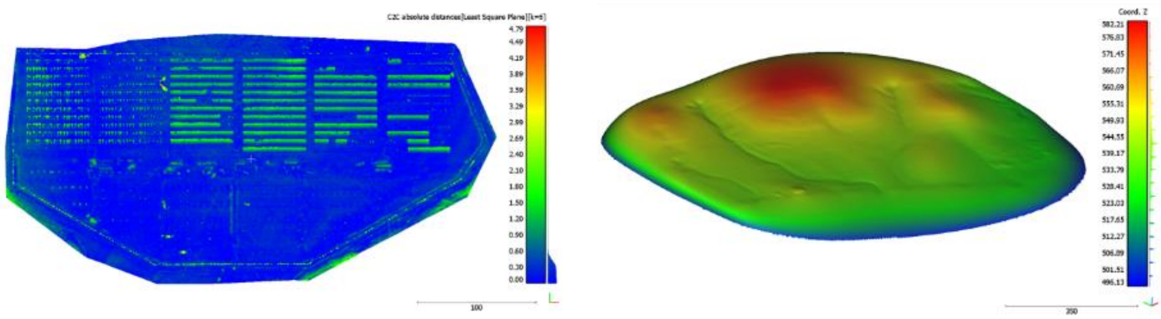


(a) (b) (c)

Figure 6. Meshed surface models of the project area in three different periods.

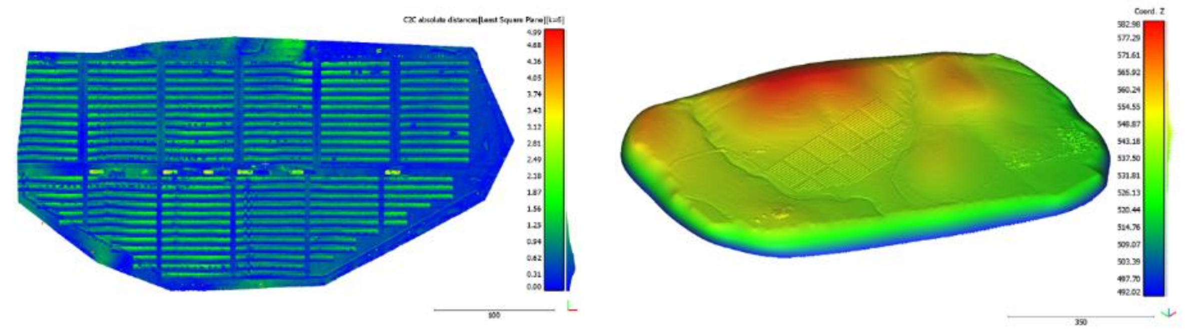
The produced model is covered with real colour information and obtained a photo-realistic environment and it has been made suitable for use in a virtual reality environment. In this way, the surface models from the measurement for each period were shown to the administrators from the computer monitor and the project was followed up.

In this study, changes in the project process were also analyzed by using point clouds and height changes obtained after periodic flights. The final product of this study is an analysis of the surface changes by using point clouds data and showing the surface changes to the administrators (Figure 7 a, b and Figure 8 a, b).



(a) (b)

Figure 7. Surface change analysis of the project area (Period 1 and 2).



(a) (b)

Figure 8. Surface change analysis of the project area (Period 1 and 3).

In Figure 7 a, b and Figure 8 a, b shows the results of the surface change analysis of the project area. Figure 7 a and Figure 8 a show the changes between the first and second periods and the point clouds of the project area created in the first and third periods, respectively. The figure legends for the left graphs in the blue colours indicate areas where there is no change. Figure 7 b and Figure 8 b show the analysis of changes in surface patterns of the project area created in the first and second periods and in the first and third periods, respectively. The figure legends for the right graphs indicate the height change of the project area.

In virtual reality applications, it is more important to show the process of a project on this scale. Therefore, transferring the models of these three situations to a scenario in a virtual reality environment is the main element of this study. In this study, Unity Game Engine was used to visualize the scenario of the project site. These models were transferred to the virtual reality environment both to explore the project site and monitor the change in the project. Virtual reality glasses were used to show this virtual reality environment to the user. This study supports the establishment of an infrastructure that can be used for informing managers in the pursuit of large and medium-scale projects while under construction.

5. CONCLUSIONS

In this study where the use of virtual reality technologies with the data obtained from the unmanned aerial vehicle for the monitoring of the engineering projects, the two new technologies will be successful in project monitoring and reporting. These models were made transferable to the virtual reality environment to explore both the project site and the change in the project. The data can be displayed in the simplest form to the managers who do not have engineering expertise, such as the course of the project, the scale of the project area, whether the plans are made in accordance with the project plan and by making the data obtained in a fast and reliable manner into 3D and scale models. In this context, virtual reality technologies have the potential to radically change the monitoring and reporting of large and medium-sized engineering projects, along with other technologies that provide data such as unmanned aerial vehicles.

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COMMERCIAL APPLICATION APPROACHES TO VIRTUAL REALITY; CASE OF CONSTRUCTION SECTOR

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ABSTRACT

Technology is one of the key areas of rapid change and development in our world. The pioneering of the subject of technology stems from the fact that human beings use their knowledge and skills to produce the tools, equipment and services they need and use them effectively. The technological advances that come up with each passing day are rapidly involved in our lives and increase our quality of life and comfort. Technology is used intensively in many sectors such as communication, construction, education, health and industry, and makes important contributions to the theoretical and application areas. Among these contributions, the sectors that are benefiting from this contribution are the trade sector.

The rapid change in the communication and interaction of commercial organizations with their customers necessitates technological renewal. The technology world, which progresses at the same pace, meets the new needs that arise due to social changes with effective methods. The same parallelism of the world of trade and technology has brought them together at the same intersection. The new driving force in this association is the virtual reality applications, one of the most important technological developments of recent years. Virtual reality, a new generation method for meeting the needs and expectations of the business world as in many other areas, is a new exposure tool that uses three-dimensional computer graphics based technologies that allow the individual to feel as if they are in a physical virtual environment by misleading their senses. In this context; The main objective is to convey the effects of the high and permanent interaction power of the virtual reality with the cognitive and sensory experiences and the effects of the construction sector.

Keywords: Commercial approaches, virtual reality, construction

1.INTRODUCTION

One of the basic characteristics of human beings is development. At the same time, this nature, which is a requirement of its nature, is the main reason of the engineering profession and consequently technological developments. In the 21st century, technological developments were the most intense. Many areas, especially important areas such as science, trade, medicine and communication, have benefited greatly from technological developments.

This interaction, which will continue depending on the existence of human beings, is of great benefit for the dissemination of knowledge and the discovery of new inventions. In fact, the ability of human discoveries has increased so much that it is possible to witness more than one innovation at the same time. Therefore, the technological developments that push the boundaries of intellect and witness a new one at every moment take human life to a different point.

Developments in technology provide significant contributions to numerous disciplines in the field of theory and practice. Developed countries, behind their success, benefit from these technological developments and, more importantly, their realization. At the beginning of the topics where the countries in question achieve significant success, the information is processed, evaluated and communicated. The success of the studies on this subject has led the countries that want to plan their future in the right direction to follow the technological developments in which information, sound and moving images are provided. Because tomorrow's societies build their infrastructures on technologies called today's information technologies. Therefore, the current technological infrastructure needs to be positioned in the most accurate and healthy manner. Otherwise, societies will be confronted with more complex and difficult-to-solve issues in the future. Virtual reality (VR) applications take a substantial and significant place in many sectors, given the benefits they provide, depending on these conditions.

2. A BRIEF OVERVIEW OF VR TECHNOLOGY

VR can be defined as a human-computer interface that allows the user to interact and integrate with a computer-generated environment (Liu, 2005). VR, also referred to as a type of interaction method, is a special environment that uses the capabilities of effects to enhance the user's real-world experience with computer-generated screen, sound, and text content (Loijens et al., 2017). VR is a computer simulation using a special digital system equipped with sensors that allows for a realistic interaction within a three-dimensional image or environment (Whyte, 2003).

The thesis that was prepared by Ivan Sutherland in 1963 was the biggest and first step in the name of virtual reality. As experience in the virtual environment influences one's real-life experiences, VR acts as a bridge between virtual experiences and real-life experiences. This study, which pioneered computer-aided drafting studies, has led to a significant number of researches in the business world (Bridges, 1986).

3.VR LOCATION IN CONSTRUCTION SECTOR

Although VR is generally seen as an entertainment tool, it has recently opened up new horizons for commercial applications and approaches to engineering problems (Bayraktar & Kaleli, 2007). One of the areas where VR is ambitious is the construction sector and management. Numerous application opportunities in the construction sector have led experts to research for effective use of VR. It has significant potential for successful implementation areas in the planning of construction projects, progress monitoring, work management, worker training, time and cost analysis, quality management and sales processes (Ahmed, 2019).

The construction industry is one of the largest industries in the world. The construction industry has undergone major changes from the beginning of its history. Especially in the last century, we have witnessed many developments in the construction sector. The construction sector, where major transformation and change has taken place, has gone over great distances in terms of new approaches, methods, techniques and strategies to make bigger and better activities (Escamilla and Ostadalimakhmalbaf, 2016). In this process, the construction sector, which benefited the most from the technological developments, created important usage areas in VR. The construction industry considered the three-dimensional and realistic experience of VR as an important material used in the interactions of individuals in many ways (Dunleavy and Dede, 2014). However, VR is a modern and effective facility management system that facilitates the work of project authorities more satisfactorily than ever before (Koch et al., 2014). In recent years, focused studies on this subject have brought successful results. VR, with its solutions that respond to the desired expectations from the project owner, its executor and its workers, also makes great contributions to the future (Behzadi, 2016).

4. APPLICATION APPROACHES OF VR IN CONSTRUCTION SECTOR

VR, which offers a unique experience with its three-dimensional feature in the world of civil engineering and management, offers the same benefits for the consumer (Park et al., 2013). In this way, while allowing the consumer to have an opportunity to experience realistic experience, it enables the project authorities to see the errors and risks before the project occurs and to take necessary measures accordingly (Lin et al., 2013). Before entering VR technology into the world of construction, the error management system was an expensive and time consuming issue. However, with the help of VR technologies, error management becomes very easy and effective, and there is no need for physical labor. Thus, resource management is achieved in the management of labor, cost and time issues.

VR, which has shaped the future of the projects with its high predictive feature, also has significant gains in the training of workers working in the construction sector. The construction industry is considered to be one of the most dangerous industries due to its inherent risk and uncertainty (Rozenfeld et al., 2010). Therefore, one of the biggest concerns felt in construction projects is the training of employees. Because the quality and safety of the construction of the workers depends mostly on the correct, permanent and effective training of the employees (Demirkesen and Arditi 2015; Rumane 2016). However, this problem is not easy to achieve at the desired level or at the standard level. With its use in this phase, VR technologies are both a helpful resource for providing effective training to employees and applying the safety management system as a specification.

The VR technologies used to reduce the accident rate on the site open large windows for the training, monitoring and control of the safety management of construction companies. Thus, VR-supported educational platforms will play an important role in avoiding serious negativities that threaten possible occupational health by provoking a sense of one-to-one (Ahmed, 2019). However, the fact that the new generation is a technology enthusiast has made it necessary to pass the training model to new technologies that offer the opportunity of engaging and experiencing instead of giving up passive teaching tools (Bhoir, 2015) Also, a research done to reveal the effectiveness of VR training has shown that VR usage provides excellent education as soon as possible. On the other hand, it has proved that the longest duration of information in individuals (Sekizuka et al. 2017).

Thanks to these highlighted qualities of VR, the definition of timing in the construction sector has also changed in recent years (Meza et al., 2015). Visualization of the studies carried out on this subject compared to the timeline is important for the follow-up of the planned process VR, which provides a visual comparison between the planned structures and constructed shows that it is one of the most used and practical functions in project management (Park et al., 2013).

VR provides great opportunities not only in the planning and realization stages of the construction sector but also in the sales process after the completion of these stages. Competition in the construction sector and the awareness of the society made it necessary for the sector to use modern marketing strategies. Although VR is a solution that meets the necessity of this issue, it also closes a very important gap by having a promotion and marketing argument that increases the prestige of the company. In the process of introducing and selling the projects to the customer, the fact that they are close to the distance by eliminating the necessity of going to the physical environment and providing an effective and strategic marketing opportunity once again reveal the advantage of VR. In addition, the VR is an important contribution to the fact that the customers in the customer group have the opportunity to experience the features they want, to find out if they meet their expectations and to get information in advance. This practical and time-saving solution to the people living in today's societies will provide significant comfort to the buyer.

5.RESULTS

Our world, which is shaped by technological renewal, is becoming more and more computer-oriented life. This transformation, which takes place quite quickly, eliminates the possibility that our life will be the same as before. Moving from mobility to the life of today's human, the boundaries of a universe, fast access to the axis of the need to ensure the communication evolves towards the living model (Bayraktaroglu, 2008). The necessity of this change and development brings many innovations to the use of humanity.

VR technology, one of the promising innovations of today's world, can bring people to a new dimension with the fact that it provides realistic experience. This environment, which resembles real life and is digitally generated, brings experience to an important depth. Thus, VR technologies allow a project to be truly experienced before it is built. In addition, employee training, security management system, progress tracking, labor management, error management etc. It is a basic tool for subjects.

Recent research shows that VR technology will play an important role in the future of construction management. With the integration of various subjects in the construction sector, it will provide cost, time and energy savings, and will increase productivity through the permanent impact on work and worker health. Nevertheless, it will be considered as an effective communication tool in the sales phase, which is the most important process of the construction world and will eliminate the need for physical environment and provide effective time usage.

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THE ROLE OF VIRTUAL REALITY IN THE TRUE CONSTRUCTION OF ENVIRONMENTAL AWARENESS

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ABSTRACT

Mankind is an impossible entity which cannot be thought separately with the environment. This indispensable association brings a dynamic interaction. In this process, the human being, who is forced to continue his / her life, uses the various aspects of the environment in which he / she lives. However, factors such as increasing population, industrialization and change in the life perception of the last period have increased this utilization to the highest limits. In addition to the positive results, this situation has brought with them negative quandaries such as human-nature irresponsibility and ecology-economy power struggle. What is happened has been the century of environmental problems that could bring an end to the human generation. This necessitates the rational implementation of all opportunities for our planet, which gives warning signals. Within the scope of these studies, ”environment and education” topic has been one of the prominent topics. It is a controversial issue whether the person who is the lead actor of the point is to realize that the solution also needs to correct himself and environment perception . Therefore, environmental awareness to be transferred to individuals will bring a radical and effective solution to most problems. In addition, environmental awareness constitutes the boundaries of civil society behavior, including basic human rights, equality and justice. It is important that individuals in the society be educated for the correct positioning of the environmental perception that includes these values. Environmental education is an education aiming each person to know the ecology and natural balance, not to see him / herself out of this cycle and to realize the position and weight in the system, to be aware of the factors affecting the environment and to display the proper behaviors accordingly. The training model in achieving these important objectives should be comprehensive and effective, which could lead to strong change in social behavior. These conditions necessitates the environmental education models to be applied within the scope of virtual reality, away from a utopian expectation. The reality of VR that people will experience in the education process is an effective tool for creating a high environmental impact. Virtual reality, which will be an effective recipe for sustainability and knowledge, which is one of the basic problems experienced in education systems, will be able to provide significant contributions to environmental education and our future depending on the experiences it will experience.
Keywords: Environmental Awareness, Education, Virtual Reality

1. INTRODUCTION

Mankind is an entity which cannot be thought separately with the environment. This indispensable association brings a dynamic interaction. In this process of interaction, people who are obliged to maintain their lives benefit from the environment in which they live. This extremely natural operation has become a weighted model with unilateral utilization over time. This situation caused the human-environment equilibrium to unbalance unevenly. These serious problems have started to be on the agenda of national and international platforms as one of the priorities of today's globalizing world.

These environmental issues, which show a continuous increase, have been forgotten or ignored due to technological developments, and the disasters, which are increasing today, have begun to be discussed in the last fifty years, albeit late, due to urban and environmental problems. The main reasons for these problems are increased population, industrialization, excessive consumption of resources and intensive urbanization. However, lifestyles based on luxury and comfort have expanded the size of existing problems. This growth in the negative sense has hit the face of humanity in the fact that environmental problems threaten not only certain regions but also the whole planet and its future.

The history of mankind is full of deep-rooted innovations and changes, such as great discoveries, global changes, industrialization, urbanization and modernism in the world of science and technology. However, this has not always been a positive result, but also the negative dilemmas such as human-nature irresponsibility and ecology-economy power struggle. What has happened has been the center of environmental problems that could bring an end to the human generation. This situation necessitated the rational implementation of all opportunities in order to prevent environmental damage. The people who attempted to make every effort for a chain of these important problems that threatened the planet and its future began to resort to all possible remedies and evaluations. The need for effective environmental education, which is thought to be made a great contribution by taking this effort into consideration, will ensure the correct construction of environmental consciousness. By fulfilling this need, the concepts most needed by today's societies such as value, virtue, morality, balance and unity can be underlined again. At the same time, it is an important gain to raise educated and conscious with eco-individuals in society in order to re-experience human and nature's desired harmony (Atasoy and Ertürk, 2008).

2. ENVIRONMENTAL EDUCATION AND PURPOSE

In today's world, problems called environmental problems are considered as identical with the disappearance of the foundations of life (Çepel, 2006). The main actor of this dangerous situation is the human being and the main reason is unconsciousness. The first factor causing this negative situation is the lack of education and wrong education. Therefore, environmental awareness to be provided by an effective education to individuals will provide a radical and long-term solution for many problems (Karataş, 2011).

Environmental consciousness is a common understanding and obligation that covers every aspect of life. In addition, providing environmental awareness constitutes the limits of civil society behavior, including basic human rights, equality and justice. In order to increase the environmental awareness that encompasses these values, individuals in the community should be educated (Dedeler, 2004). Although different ways are suggested for the solution of environmental problems, the most effective way is to prevent problems before they occur. It is accepted that the most powerful method to provide this is education (Şimşekli, 2004). Because the desired level of development related to the human-environment duo will only be ensured by the environmental awareness to be achieved due to a sound education.

Among the main reasons of today's problems are the inadequacies in the process of acquiring knowledge and consciousness. Societies cannot comprehend that the environment in which they exist and use it will be used by the latter after these shortcomings. However, the environment is not an inheritance, but a trustworthy transfer to future generations. For this reason, in today's societies, there is much more need for people who are compatible, friendly and trained in their environment (Atasoy, 2005).

It is possible to reach the origin of environmental problems, to produce remedies for these problems and to provide positive changes in the attitudes and behaviors of individuals towards the environment through environmental education. Because, it is an indisputable fact that individuals with adequate level of education and sensitivity play a more constructive, protective and active role in solving environmental problems. From this point of view, it is aimed that individuals become conscious with environmental issues and problems, develop solutions and abilities related to these problems and create a willingness to make effective decisions by means of environmental education (Cole, 2007).

It is possible to summarize the objectives of environmental education as follows: to perceive the environmental and natural phenomena experienced by individuals through sensory organs and to provide them with sensitivity, to know the concepts of artificial and natural environment comparatively, to comprehend the interaction between them with their results, to learn and apply the methods for conducting environmental studies.To comprehend the connections between other branches of science and to be a close follower of environmental issues. Together with this, environmental education should adopt the concepts of luxury and need with the differences and aim to bring fundamental benefits to social progress by this separation (Khodabandeh, 2010)

3. VIRTUAL REALITY AND ADVANTAGES IN EDUCATION

Countries should develop new educational models based on ecology and environment by the collaborative method, due to the global nature of environmental issues, regardless of their structure and viewpoints. What is happening on the planet makes this a necessity rather than a utopian expectation. Therefore, education policies need to be developed both in terms of content and method and to be dealt with in a long-term way. It should be emphasized that environmental education is not only a specific time and activity within the program, but also has an interdisciplinary field of education. However, transferring the problems through the environment in which they are experienced and their interactions is very important in terms of permanence. However, the societies that will be educated with this perspective will continue to find place in the world hosting them.

Education is one of the effective areas where today's technology is important. Students' ever-increasing computer literacy is the most important factor that nurtures this situation (Knight, 2006). The penetration of technology into every field and the increase in demand due to related innovations have suggested the use of virtual reality (VR) in the field of education. In addition to being a safe and fully controllable practice of VR technologies, it has provided the student with the opportunity to learn with realism and interaction experience. This new style has been promising for easier and more complex training (Kartiko and all, 2010).

An effective education should provide individuals with strong technical knowledge and the ability to develop feasible solutions. Providing innovative solutions and enabling sufficient skills to achieve employment in challenging business life. VR makes a significant contribution to individuals with the motivation and confidence that it will create. The technology, which is highly adopted due to all these returns, also satisfies the expectations of the current generation of students (Abulrub and all, 2011).

In 1963, Ivan Sutherland's thesis was the first step towards virtual reality. This study, which pioneered the computer-aided drafting studies, has been the source of a significant number of studies in the field of education (Bridges, 1986). Research on VR and similar technologies has inspired new models for learning and teaching (Chen and Tsai, 2012).

In 1980, the term VR proposed by Jaron Lanier in the United States (Fuchs and all., 2011) is briefly referred to as the computer-generated on world (Rheingold, 1991). From a technical point of view; the user can view that can be seen from a particular camera in three dimensions thanks to the software that manipulates a series of photographs . In more complex systems, it allows the user to interact with the environment by getting help from various instruments (Tuggy, 1998).

Virtual technologies have the potential to make students feel more determined and motivated (Kerawalla and all, 2006). VR, one of the leading applications of virtual technologies, is an innovative educational tool that enables students to solve real-life complex problems with on-the-spot approach (Kartiko and all, 2010).

VR provides a rich, interactive, engaging educational environment that supports experimental learning (Mantovani, 2003). Improving the learning process, student motivation and awareness raising are seen as other benefits (Horne and Thompson, 2008).

VR enables students to explore new areas, make predictions, design experiments and interpret results with real-life experience (Steinberg, 2000). Because this constructivist approach is based on student-centered experience, it makes that it easy for students to unleash knowledge (Winn, 2002). VR, which enables the student to be active, allows autonomous exploration with the interaction making complex concepts understandable and teaching by living. In this way, students can achieve learning outcomes and cognitive skills through more real-time interaction and reach more conclusive decisions (Kotrenza and all., 2009).

In addition, the opportunity of accessibility and experience provided by VR brings great convenience to disadvantaged students in the society and increases the opportunities for participatory training (Lange and all., 2010).

4. VIRTUAL REALITY IN ENVIRONMENTAL EDUCATION

Environmental awareness is expressed as the realization of the importance of a human being's relation with his environment for his own existence (Erten, 2004). In recent years, serious efforts have been made to create this sensitivity of societies and new searches are being used. Environmental education is directly related to environmental problems. Environmental education is an education aiming each person to know the ecology and the natural balance, to realize their position and weight in this cycle, to be aware of the factors affecting the environment and to display the correct behaviors related to them (Uğurlu and Demirer, 2008).

Environmental education aims to develop a positive outlook on all environmental values, to raise the level of knowledge, to develop a holistic approach to environmental problems and to take responsibility (Thomson & Hoffman, 2003). By achieving these goals, the natural environment will be protected and will not be damaged. However, the training model in achieving such important goals should be comprehensive and effective, which could lead to strong change in social behavior (Yıldız et al., 2008).

Developing environmental awareness in humans and creating environmental behavior depend mainly on three factors. These are cognitive, affective and situational factors. Cognitive factors correspond to environmental problems and ecological knowledge of individuals. Emotional factors affect the environmental behavior and include the emotional dimension of the ecological phenomenon. Situational factors affecting environmental behavior include the status of individuals, their demographic structures and economic conditions.

The success of VR on these three factors suggests that it will create the desired effect on environmental education. If concrete examples are given in this sense; thanks to VR, it is possible to allow students to visit a place which is not practical in real life, and to visit places that are not suitable for transportation, health and safety opportunities with realistic feelings. It provides the opportunity to observe the processes that are important both in terms of close proximity and the importance of in-situ inspection. It will be appropriate to give this subject to composting, which has a great place in environmental engineering. The fact that composting processes are not present in many places, and they have drawbacks in their close observation, make it difficult to reach the practical information on this subject. VR, on the other hand, prevents the lack of education and provides a holistic approach.

Likewise, another study by Stanford and Oregon Universities supports the success of VR. In a study to draw attention to the climate change and its consequences, it was aimed to reveal the danger of extinction of marine ecosystems, one of the most insidious effects of increasing CO2 emissions. Having discovered that VR is a powerful tool for improving environmental learning gains and attitudes, researchers have proven that simulating the effects of ocean acidification is significantly encouraging people's environmental awareness (URL).

VR, which is a complementary material for the distance education method which is also used by environmental engineering, is considered as an attractive source for today's students. VR,which has proven effective in both face to face and distance education models; construction, space, underwater, military and nature. The effective success it has provided has inspired other areas of specialization and pushed them into new research that they can use (Burnley, 2007).

5. RESULTS

Along with the changing world, the structure and impact dimensions of environmental problems vary considerably. These environmental problems are the problems that affect the quality of life of societies deeply and even reach the life threatening dimension. It is known that the solutions of these problems will occur with the permanent environmental consciousness to be provided to the people (Gürcüoğlu, 2013). Environmental education is one of the topics that will be discussed in order to create environmental consciousness and to achieve healthy future. Therefore, the contribution of individuals to environmental education has to be prioritized by other contributions. Because all aspects of societies, states, and ultimately those who manage the environment in which they live, are people living in that environment. Individuals need to be educated according to their needs, owning the future, taking care of the ecological balances, sensitive and environmentally conscious. For this purpose, all kinds of social factors should be taken into consideration with a living process and they should be continuously questioned and reflected on the educational models depending on the results.

The training model for achieving such important goals should be comprehensive and effective, which could lead to strong changes in social behavior. These necessary conditions necessitate the model of environmental education to be applied within the scope of virtual reality. The real and experienced feelings that the virtual reality will bring to the people in the education process will create a high environmental impact. At the same time, virtual reality, which is one of the main problems experienced in education systems and a highly effective prescription for living knowledge, will make significant contributions to environmental education and hence our future with the experiences it will experience.

As a result, it is clear that the VR is a new learning model that better meets the needs of the 21st century student. Therefore, it is adopted with a rising trend among the newly discovered educational models (Elmqaddem, 2018). Because of all these gains, it will be of great benefit to benefit from VR technology which makes learning easy and efficient in order to ensure environmental awareness permanently at all levels of education from primary to higher education (Gutierrez, 2017).

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VIRTUAL REALITY FOR CITY PLANNING

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ABSTRACT

City planning as all kind of planning is about something unreal requiring much imagination capabilities by those involved in this process. Therefore, the traditional means to show the results of planning consisting mainly of lengthy reports and 2D maps are insufficient. Although considerable research has focused on different visualization techniques including heat maps, glyph annotated maps and tradition 2D graphs, studies on the effectiveness of Virtual Reality (VR) in modeling the future of cities and on demonstrating the impacts of "what-if" scenarios to policy-makers and communities is lacking. The purpose of this research was to develop a largely automated workflow from a 2D map of a city block to a 3D model and finally to a VR environment that can be used without expert knowledge. This will bring urban planning to a new level by visualization of big development projects on the spot. The development of this workflow has been explained in detail. Deficiencies in the current approach are discussed and directions for future research are given.
Keywords: City planning, GIS, GeodesignHub, CityEngine, Unity, Virtual Reality

1. INTRODUCTION

City planning as all kind of planning is about something unreal, something about to happen in the future. How this future will look like is left to the imagination of those who are doing the planning and those who will be affected by this planning. Traditionally, the results of this planning have been laid down in the form of lengthy reports and 2D maps. For the preparation of these maps, the use of Geographic Information Systems (GIS) has become standard. The disadvantage of such a planning is that most people are reluctant to read through hundred of report pages and have difficulties to read and understand 2D maps in the right way. This applies not only to the general public that thus is excluded from the planning process but also to most decision-makers as well. Not surprisingly, a world-wide poll conducted for the National Geographic Education Foundation/USA revealed that only about 20 percent of the participants could identify hot-spots like Afghanistan, Iran and Iraq on a map (National Geographic Education Foundation and Roper ASW (National Geographic). 2002).

Given these circumstances, it is no wonder that in many cases, city planning cannot be considered to be very efficient. The classical products of city planning are difficult to understand sometimes even for experts and resemble hieroglyphs for the layman. As KACAR et al. (2015) put it "Prepared plans are not being implemented in the way they were intended to, which forms complex and ineffective differences between the plans and their implementation."

In 2015, Ballal described a web-based Geodesign software called "GeodesignHub" that he had developed in cooperation with Carl Steinitz. He mentioned the challenges of 2D and 3D visualization technologies when applied to large geographies or on regional planning problems. According to him, this is due to the uncertainty of impacts given the long time scales, multiple factors affecting the site and competitive interests and actors involved and the unsatisfactory process of creation of design, which is largely disjointed from that of analysis and visualization. In this thesis, he described an effective bridge between GIS analysis and the creativity of design into a seamless process. Using simple digital sketching and a rational design analysis process based on GIS technology a digital workflow that enables collaboration has been developed.

Most recent research results in neuroscience help to shed light on the question how the spatial component of man's environment can be displayed more effective. In 2014, J. O'Keefe M.-B. Mose and E. Mose won the Nobel prize for Medicine for their research on how the brain manages to orientate itself in its environment (Moser et al. 2017).

The use of Virtual Reality (VR) tools brings urban planning and architectural design to a new level. It allows a reality like experience of the results of planning efforts in the presence. Moreover, interactive tools of VR offer even the opportunity to see the results of changes to this planning immediately. Ivan Sutherland, one of the pioneers of VR, stated already in 1965 "make that (virtual) world in the window look real, sound real, feel real, and respond realistically to the viewer's actions" (Sutherland, 1965). For the purpose of this paper we use the definition of VR from Schweber et al. (1995). "Virtual reality lets you navigate and view a world of three dimensions in real time, with six degrees of freedom. (...) In essence, virtual reality is clone of physical reality."

For communication of complex spatial information such as virtual 3D city models immersive 3D virtual environments have been created. Such an immersion is related to user experience and can be described as a 'psychological state characterized by perceiving and experiencing oneself to be enveloped by, included in, and interacting with an environment'(Witmer & Singer, 1998).

Engel et al. (2012) described requirements and concepts of a system for visualizing virtual 3D city models in large-scale, fully immersive environments and sketch its applications in e-planning. According to this concept, stakeholders including citizens and decision-makers, can explore a virtual 3D city model and examine different alternatives of an urban project "in situ". In their study, they identified hardware and 3D rendering requirements that have to be fulfilled to achieve a high degree of immersion. As an example for such a system, they show the Elbe Dom facility at the Fraunhofer IFF (Magdeburg, Germany), a multiuser 360° cylindrical projection system 6.5m in height and with a diameter of 16m suitable for large-scale interactive visualization.

Based on the findings of earlier studies of Hermund et al. (2016) and Hermund et al. (2017) indicating similarities between the perception of architectural space experienced in physical space conditions and in virtual reality, Hermund et al. (2018) discussed the opportunities of architectural representation models in new media such as virtual reality, seen in the context of perception, and neurology. They clarified to what extend subjective and objective attributes of architectural space can be conveyed through a direct use of BIM (Building Information Models) in Virtual Reality. By analyzing eye tracking of 60 test persons they found out that virtual reality representation models are less demanding on the cognitive load of the brain than three- dimensional models seen on two-dimensional computer screens.

Mullins (2006) compared aspects of spatial perception in architecturlal application in a physical environment, CAVE and at Aalborg University's 'Panorama' theatre, a facility of the Virtual Reality Media Lab. The results of his study showed that that depth perception in physical reality and its virtual representations in CAVE and Panorama are quantifiably different, that differences are attributable to prior contextual experience of the viewer, and that spatial ability is an important contributing factor. Results indicated significantly better overall accuracy of response in the CAVE than in the Panorama VR environment, which was attributed to the relatively higher degree of immersion and movement possible in the first VR environment..

Considerable research has focused on different visualization techniques including heat maps, glyph annotated maps and tradition 2D graphs, but studies on the effectiveness of VR in modeling the future of smart cities and on demonstrating the impacts of “what-if” scenarios to policy-makers and communities is lacking (Jamei et al. 2017).

Kersten et. al. (2018) described a complete VR workflow covering the steps of data recording, 3D modeling, texture generation, implementation in a game engine and visualization by means of VR systems. Their research dealt mainly with the generation of 3D models for cultural heritage objects like the Selimiye mosque in Turkey and Solomon's temple. They presented a workflow that results in the creation of models featuring a high degree of precision. Ernst et al. (2018) set up a workflow consisting of the usage of GeodesignHub, CityEngine and Unity software to create future scenarios for a district of Şanlıurfa/Turkey and display it in a VR environment.

The purpose of this research was to develop a largely automated workflow from a 2D map of a city block to a 3D model and finally to a VR environment that can be used without expert knowledge. This will bring urban planning to a new level by visualization of big development projects on the spot.

2. METHODOLOGY

To use GeodesignHub, ESRI's City Engine and Unity software, a high level of software knowledge and a considerable amount of time is required. In order to overcome these drawbacks a custom-made solution based on the API provided by GeodesignHub was developed. By means of an user-friendly graphical user interace (GUI) a largely automatic workflow has been created from Geodesignhub to City Engine and Unity3D, which facilitates the selection of parameters and the flow of information from one system to the other.

The workflow consists of these three steps: 1) In GeodesignHub, the user has to select a system (like agriculture or low-density housing). Then, he selects an user name and a new development project in form of a polygon. For this project, he has to define several parameters like the type of neighborhood and average amount of floors. 2) The selected polygon is automatically transferred to CityEngine where it is modeled according to the selected parameters. 3) In the last step, the user can easily transfer the modeled project to the Unity game engine. It is automatically applied to the virtual reality environment in Unity. By using VR glasses or other VR means, the user can experience the planned development project as it was real.

Prior to passing through the workflow as described in more detail below, a database using GIS (ArcGIS and QGIS) had been developed and works started on building evaluation models. These models basically consisted of suitability maps created by means of multi-criteria analysis (MCA) within the GIS. The MCA was implemented according to rules described in MS Excel sheets. In this research, the whole workflow was implemented only for the system named “Mihxed Use”. The evaluation maps were imported into GeodesignHub (GDH), an online decision support system. In any case, these preparation works have to be carried out by experienced users of GIS in cooperation with subject-matter experts.

After these preliminary works had been finished the first step of the workflow could start. The evaluation maps served as a background, on which the area of new projects within the system “Mixed Use” could be drawn using the user-friendly tools of GDH (see figure 1). Then, the impact of such new projects like construction of new apartment buildings could be investigated not only on its own system (mixed use) but, also on any of the 9 other systems e.g. green infrastructure. Using this instant feedback, suggested projects could be edited using 2D maps until an optimal solution had been found. All the details of this step using GDH will not be explained further here. They can be found in Rivero et al. (2015).

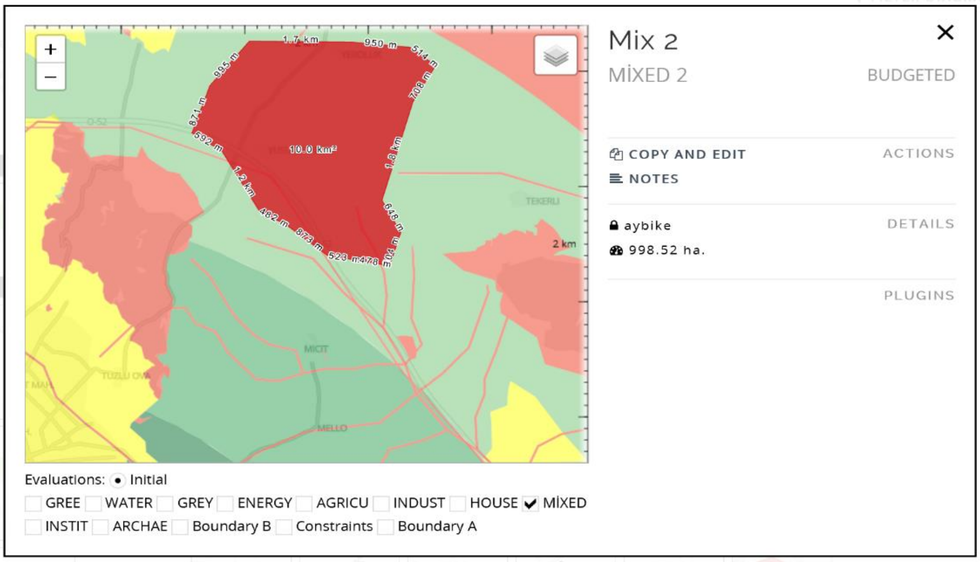

Figure 1: 2D map showing a newly drawn project against the background of an evaluation map.

During the second step, one selected project had to be imported into CityEngine where its 3D model was created. While this could have be done manually we programmed it in a way that the user had only to select a certain project and define its characteristics. Then, the respective geometric data together with its attribute data were transferred into CityEngine and the 3D modeling process automatically initiated.

To implement this step the API offered by GDH was used. For this, more information can be found under the following link: https://www.geodesignhub.com/api/ Using Python's "Spyder" module, a simple user interface was created that included options to select the three following parameters: a) Prevailing house type, b) Amount of flooes, and c) District type. (see figure 2). The selected parameters are imported into CityEngine by means of a Python script (see figure 2).

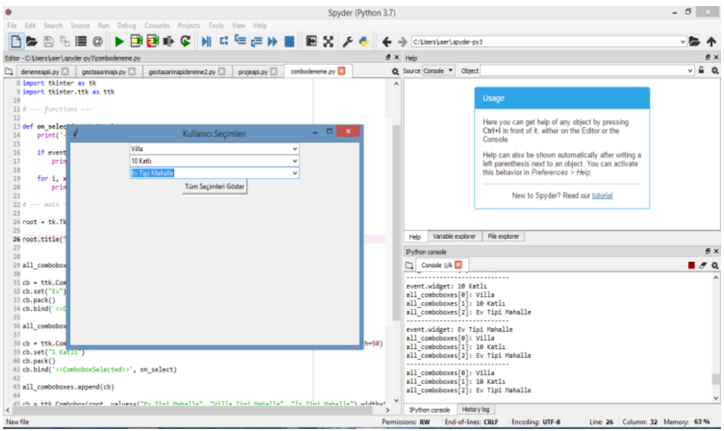

Figure 2: GUI for selecting parameters of newly created project.

Within CityEngine, the imported parameters are interpreted as "rules" that are included in a rule file. During the modeling process a 3D model is created based on the rule file. For this study, the 3D models are created on-the-fly within seconds. The amount of different 3D models depend on the amount of rules that have been created before. According to the likelihood to be applicable in our region only a limited amount of rules had been created and stored withiin CityEngine. The respective rule is loaded depending on the combination of selected 3 parameters. At the moment, due to the limited parameters that can be defined the created 3D model is a relatively simple one corresponding only to CityGML's LOD2 specifications (Open Geospatial Consortium, 2012).

During the third step, the 3D model created within CityEngine was rendered using the game engine Unity. By using Unity's Holotoolkit library a new project selecting the most appropriate parameters for our model had been prepared. This library provides the necessary connection between the model and the VR glasses that have been selected to consume the model.

Figure 3: 3D model created automatically in CityEngine

After the last step had been completed the project was ready to be consumed by any of the different VR tools available on the market. In our case, we used the PC based LENOVO Mixed Reality headset. The user has just to wear the VR glasses of this system and and adjust it according to his eyes.. Now, he finds himself within the selected project and can move around it.

FINDINGS AND DISCUSSION

We used a participatory GIS for entering and editing of spatially referenced data. These data consist of proposed projects to be included in the plan for a respective area in the form of polygons. By means of a simple user interface for any selected polygon certain parameters can be defined.

In a second step, these definitions are forwarded to ERSI's CityEngine, a 3D modeling software based on parametric modeling. This software interprets these definitions according to predefined rules and creates automatically 3D objects like apartment buildings, office buildings or shopping malls. Although in this research only a very limited number of parameters were defined this list could be extended as long as required by the purpose of the respective planning study. CityEngine virtually accepts an unlimited amount of parameters, for which of course the rule files have to be set up by an experienced user of the software. Depending on the complexity of the rule file one set-up might take up to 3 hours.

In this research, a system with only three parameters having 4 categories offering a total of 24 different options has been developed. For a system with 4 parameters each offering 4 categories, which in turns includes another 4 sub-categories, the total would rise to 64 different. However, the question is whether such a big amount of options is feasible keeping in mind that the whole system has been designed for a certain user group (general public and non-expert decision-makers) lacking the required expertise to drill down into the finest details of a planning study.

So far, the system has been set-up only for the development of one city block that poses a severe limitation for the development of more comprehensive plans. Furthermore, such a city block can currently consist only of the same building type like apartment, office, shopping mall, etc. In order to be realistic, a city block should contain different building types for example. Here, the limitations are imposed by the simplicity of the used GIS software that does not allow for a further subdivision of a project, which could define the footprints of different buildings types present in the city block. And, without clear footprints the CityEngine cannot produce 3D models because as a GIS its whole modeling procedures starts from such polygons.

Another limitation lies in the lacking capability to create rules on the fly. Instead the rules have to be created beforehand and stored wıthin CityEngine from where they are loaded depending on the selected parameters As hundreds of different combinations can be chosen even with three parameters the creation of models for only a limited selection of parameters is feasible at the moment.

In a third step, the 3D models created by CityEngine are forwarded to Unity, a game rendering machine that create the environment to be used in a Virtual Reality application. Virtual Reality consists of two components: While it is relatively easy to create a virtual environment (any digital game that has been developed even 50 years ago was virtual), to present this environment in a way that a human being interprets it as real is something totally different. It requires that the 3D models used to be of high complexity showing so many details that it can be felt to be “real”. As discussed before, a lot of input parameters should be available if such a high fidelity model should be produced, something that might not be possible during this kind of planning process. Certainly, there is a trade-off between practicability of the planning process and high-fidelity of the virtual environment to be created. However, if all stakeholders involved in the planning process including those setting-up the system are aware of this situation a compromise that is reasonable for the special purpose of the respective study could be found.

CONCLUSION

Advanced visualization in urban planning and urban design provides three main benefits: (1) it assists in understanding the consequences of design schemes from multiple perspectives;(2) it helps to understand the different layers of information about urban planning and urban design; and (3) it offers an effective platform for communicating with others.

Key benefits of using VR in combination with Geodesign for designing smarter cities include the following: 1) Capability to assess design ideas in real time and within a 3D space during the design and planning phase; 2) Effective communication among different stakeholders including academics, planning professionals, and communities; 3) Saving of a significant amount of time by excluding guesswork in design; 4) Integration of all aspects in the design and, thus, achieving a resilient sustainable city design with the least amount of time/funds; and 5) Promotion of participatory planning.

A key challenge in implementing VR in urban planning is cost. Until now, the use of VR has been limited to private companies and educational institutions that have access to high-end workstations and trained staff. In addition, the visualization and simulation of urban built environments require the extensive use of integrated software solutions to include GIS, computer-aided designs (CAD), multimedia data, and different VR techniques. Future works are necessary to determine how urban designers who work in small companies will benefit from VR systems in their urban design or planning practices.

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HOW BIG IS THE VIRTUAL REALITY MARKET?

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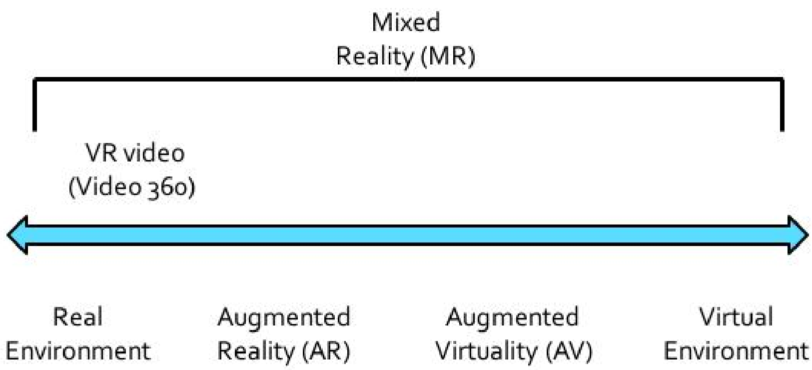
ABSTRACT

Virtual reality (VR) and augmented Reality (AR), as the new form of technologies are developing and evoking public interest. These are immersive technologies that provide new and powerful ways for people to generate,use and interact with digital information. These technologies take traditional media beyond conventional screens and use photographic images, video or computer generated graphics (sometimes provided as an 360-degree view within your field of vision) as a new communication and interaction medium that can be used across your company from marketing and sales to field services, training and data visualization. There are lots of examples of how VR and AR can reshape existing ways of doing things— from buying and selling a new home, interacting with a doctor, or watching a football game. As the technology advances, price points decline, and an entire new marketplace of applications (both business and consumer) hit the market. It is believed VR/AR has the potential to spawn a multibillion-dollar industry, and possibly be as game changing as the advent of the PC. This paper aims to show what VR/AR's potential market could be in the World today and in the future.
Keywords: Virtual reality, marketing, digital information, prediction.

1.INTRODUCTION

Virtual reality (VR) is a powerful technology that promises to change our lives unlike any other. Our senses are stimulating artificially, so that our bodies become tricked into accepting another version of reality[1].

virtual reality can take many forms in generally and can be considered to range on a virtuality process from the real environment to fully virtual environment[2]. The following diagram shows various forms along that process:



The real environment is the real world that we live in. Augmented virtuality (AV) is the result of capturing real-world subject and bringing that subject into VR. Augmented reality (AR) refers to systems in which most of the visual stimuli are propagated directly through glass or cameras to the eyes, and some additional structures appear to be superimposed onto the user's World [3,4].

True virtual environments are artificially created without capturing any content from the real world. Altough there are many differences between Augmented reality (AR) and virtual reality (VR), but also there are many similarities, however the experiences may still be very different. The consumer are transported to a different World by VR whereas virtual reality elements are added to the local real World by augmented reality. Nevertheles, the same hardware might be used for both while consuming or experiencing the content in practice [5].

An entire spectrum that encompasses VR, AR, and normal reality is used the term mixed reality (MR). MR refers to bringing 3D virtual objects such as holograms into the real world without the need to use any headset for watching in some cases. XR has also been lately used to refer to the all fore-mentioned forms.

VR video (video 360 degrees) contains experience that lets users to turn in any direction to view the content. On the other hand, the viewer lacks the ability to interact, move around, and can be considered a passenger, watching as the content plays out. Live events such as festivals have seen remarkable uptake for this type of VR because of the low technical overhead associated with delivering such experiences to smartphones.

Visual rendering specifies what the visual display should show through an interface to the virtual world generator (VWG). Similarly aural rendering involves aural processing and haptic rendering haptic representation related to virtual world generator as presented in the following figure 1:

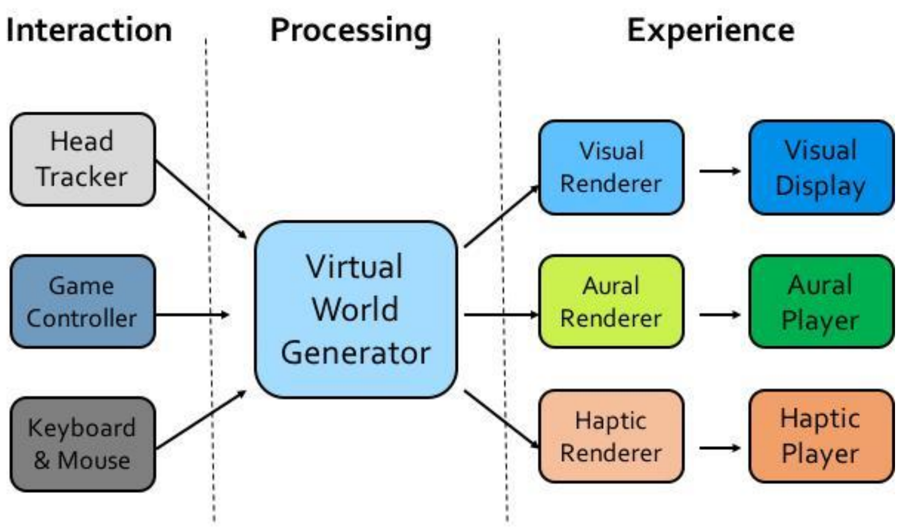


Figure 1: Virtual World Generator[2]

Today, low-cost consumer VR technology is surpassing professional head mounted device (HMD) systems. The latest technological components, mainly arising from the smartphone industry, have enabled high-resolution, low-cost, portable VR headsets to provide compelling VR experiences.

2.Overview of the VR/AR Market

VR/AR market will grow fast during the next few years according to the various predictions. The general trend pointed out in all predictions is that the growth gains first from consumer buying of VR gear and content. This is primarily based on games. Later on the growth comes mostly from the industrial buying of AR technology and services.

The VR/AR market will grow during the period of 2017-2021 by around 100% annually according to International Data Corporation (IDC)[6]. Total spending on VR/AR products and services is expected to grow from USD 17.8 billion of 2018 to USD 215 billion by 2021[7]

USA ($6.4 billion), Asia/Pacific excluding Japan ($5.1 billion) and Western Europe ($3.0 billion) are the biggest regions in 2018. USA will hold its major position by the end of the forecast period but Western Europe will pass Asia/Pacific excluding Japan area. VR market by region can be seen in Figure 2 [8].

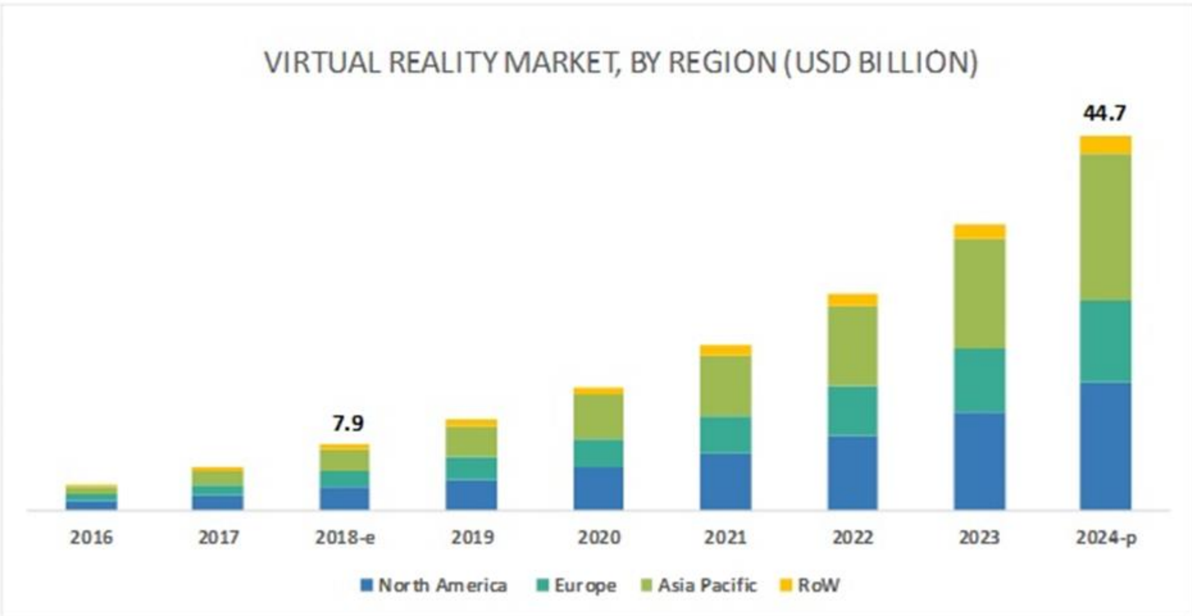


Figure 2: Virtual reality market, by region (USD Billion)

The biggest source of VR/AR revenues in 2017 is consumers according to International Data Corporation (IDC). However, other segments such as process manufacturing, government, retail, construction, transportation, and professional services will pass the consumer segment during the following years.

The consumer segment spending will largely consist of games with total spending growing to predicted $9.5 billion by 2021.

According to IDC forecast, spending on VR systems (including gear, software, consulting services, and systems integration services) will be greater than AR-related spending in 2017 and 2018, largely due to consumer buying of hardware, games, and paid content., AR spending will pass VR spending due to the industrial AR buying after 2018.

Digi-Capital's prediction is highly modest as its forecast for VR/AR revenue in 2021 is around USD 120 billion even if the VR/AR industry would outperform [9]. In case of underperforming the revenue in 2021 would be around USD 90 billion in the bad case.

Out of the other research companies that the value of all kinds of VR content (360, interactive and immersive video) will generate USD 6 billion by 2022 according to ABI Research predictions [10]. PwC's prediction [11] is that VR video revenue will exceed interactive application and gaming revenue by 2019. SuperData Research expection is [12] that VR revenue (excluding AR) will total USD 30 billion by 2020.

As a conclusion, the fore-mentioned forecasts predict the same trends: the VR/AR market will grow fast during the next few years, but the "hockey stick" growth will not be seen until the 2020's.

The following diagram (Figure 3) shows the distribution of the companies according to their focus application areas:

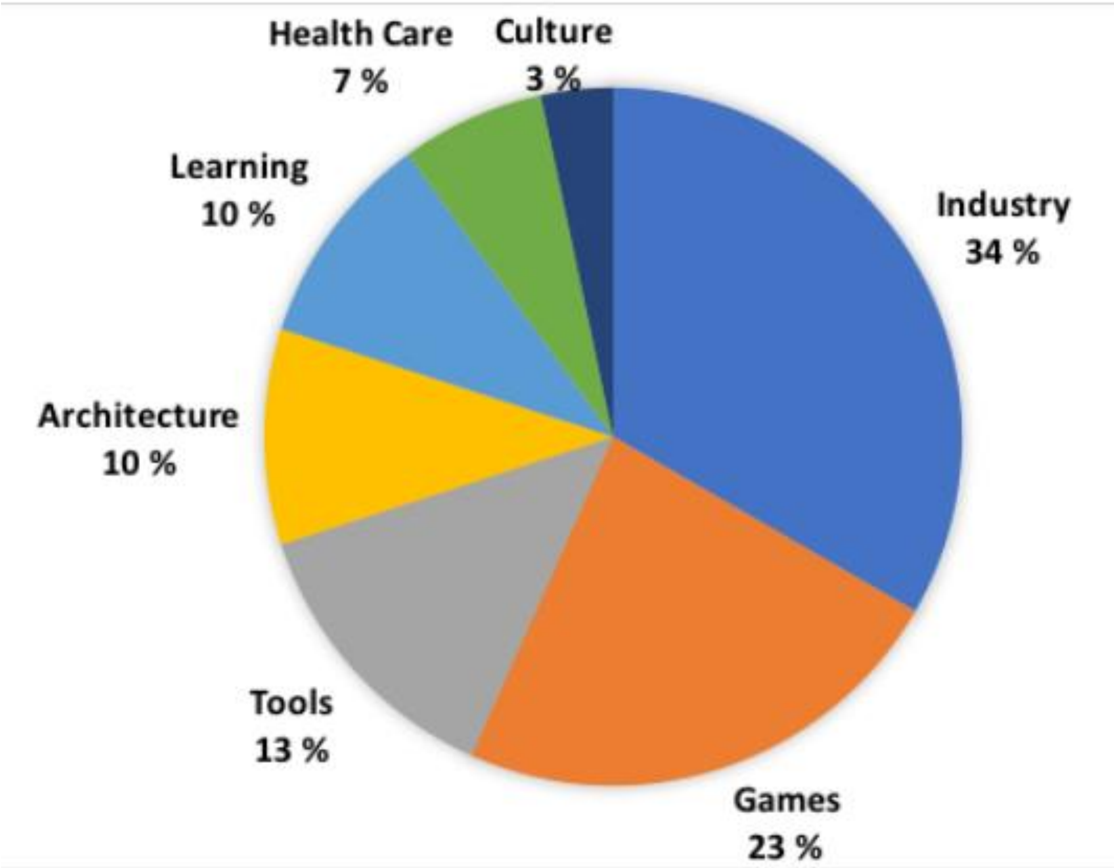


Figure 3: Distribution of the companies according to their focus application areas.

VR/AR is a relatively new area. Therefore most of the companies are also very young. Figure 4 shows the age division of the VR/AR companies:

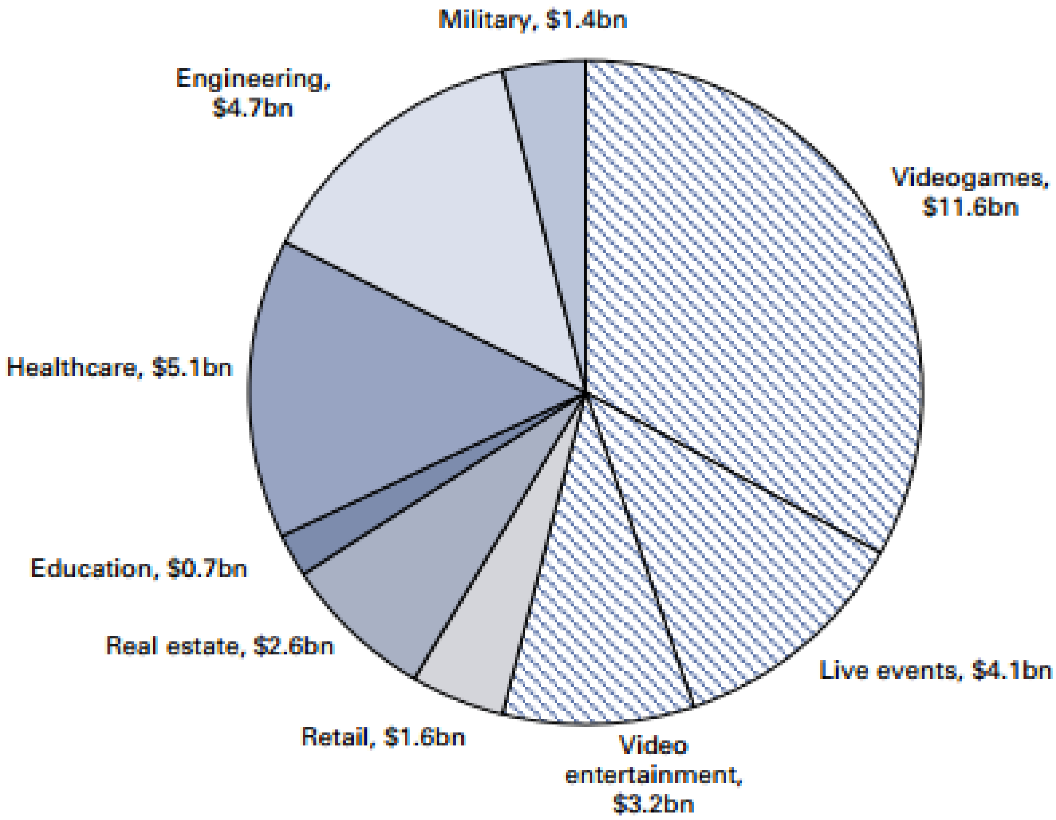


Figure 4: VR/AR software assumptions for year 2025

According to the marketsandmarkets.com, VR market by region can be seen in Figure 5.

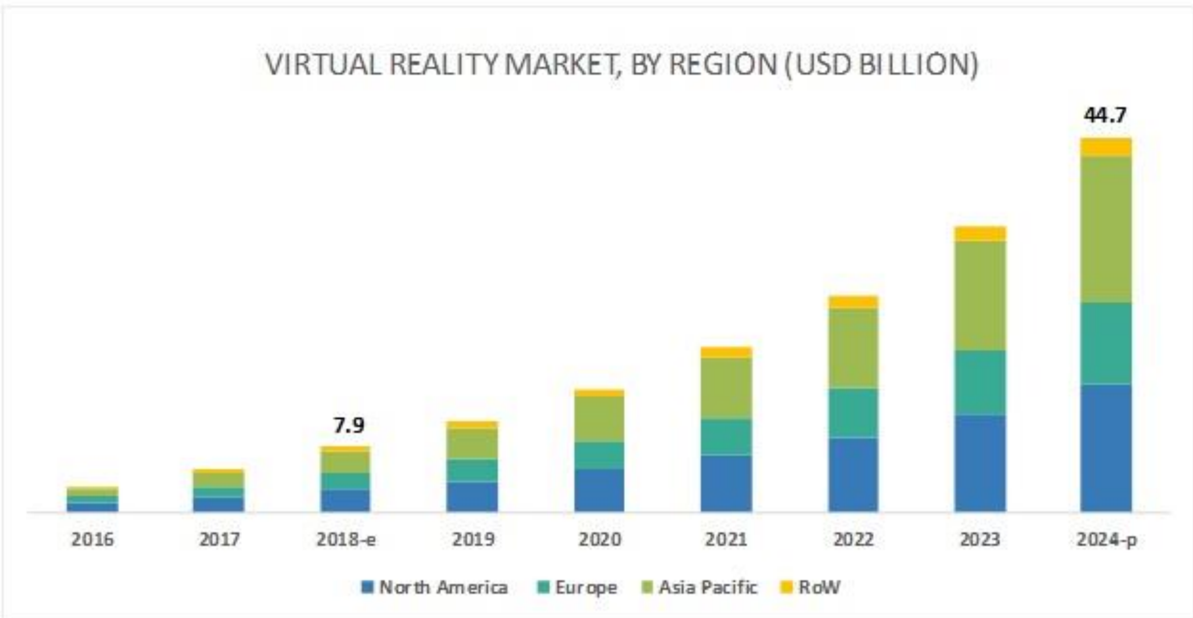


Figure 5: Virtual reality market, by region (USD Billion)

The progression of base case hardware and software forecasts can be seen in Figure 6.

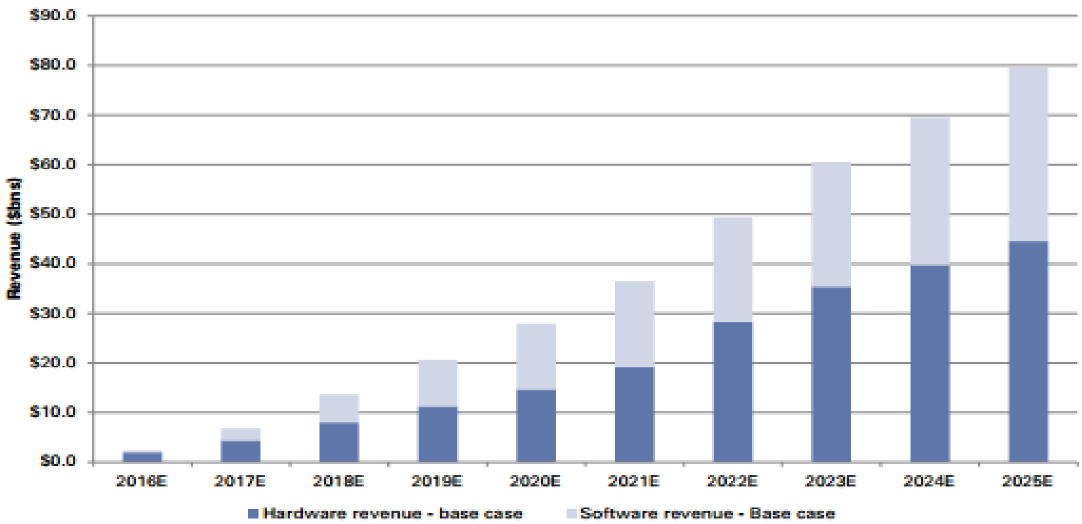


Figure 6: The progression of base case hardware and software forecasts

3. CONCLUSIONS AND RECOMMENDATIONS

The VR/AR market is developing fast on global level. In order to run successful business VR companies have to establish themselves swiftly both in local and in global markets. The strategies of VR companies have to be based on the already strong skills and develop them further. This requires more co-operations between the companies and also with academic research institutions.

The biggest challenges are ensuring financing, and keeping and acquiring scarce talent in some part of the World especially undeveloped countries. The next few years are challenging especially for the start-ups to survive before the market starts growing substantially.

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AUGMENTED REALITY TECHNOLOGY IN NURSING EDUCATION

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GİRİŞ

Günümüzde teknolojik değişim ve gelişim, eğitim ortamlarını, öğretim strateji ve materyallerini etkilemekte ve değiştirmektedir. Son yıllarda digital eğitim teknolojileri; içinde bulunduğumuz çağın gereksinimleri doğrultusunda ve bu yüzyılın genç nüfusu olan Z kuşağı gençlerinin ihtiyacını karşılayacak şekilde, sağlık eğitimi alanında da yaygınlaşmaktadır. Hemşirelik eğitimi de yüzyılın bu değişimine ayak uydurarak öğrencilerin kritik düşünme becerilerini geliştirecek, öğrenme motivasyonunu artıracak ve öğrenmeyi pekiştirecek teknolojik yenilikleri kullanmaya başlamıştır (Silveira & Cogo, 2017). Bu teknolojik yeniliklerden; simülasyon mankenleri, sanal ortam simülatörleri, videolar, eğitsel oyunlar ve mobil uygulamalarının hemşirelik eğitiminde son yıllarda öğrenilmesi zor, uygulaması kapsamlı beceri öğretiminde kullanıldığı görülmektedir (Silveira & Cogo, 2017; Cant & Cooper, 2010; Gündoğdu & Dikmen, 2017). Artırılmış gerçeklik teknolojisi de deneyime dayalı öğrenmeye katkı sağlayan, gerçek ve sanal dünyayı bir araya getirme özelliğiyle eğitim alanında kullanımı yaygınlaşan yeni nesil teknolojik yenilikler arasında yer almaya başlamıştır (Küçük, Kapakin & Göktaş, 2015). Sağlık bakım sisteminin yapı taşlarından olan hemşirelik mesleğinin eğitim ve öğretiminde de artırılmış gerçeklik teknolojisi uygulamalarının yaygınlaştığı görülmektedir (Wüller, Behrens & Garthaus, 2019; Zue, 2016).

Tüm bu bilgiler doğrultusunda bu derlemede, ortamının gerçekliğini arttıran ve soyut kavramları somutlaştırarak öğrenmeye katkı sağlayan artırılmış gerçeklik teknolojisinin tanımı, hemşirelik eğitimindeki yeri, önemi ve bu konuda yapılan araştırma sonuçları tartışılmıştır.

ARTIRILMIŞ GERÇEKLİK KAVRAMI

"Augmented Reality" olarak adlandırılan artırılmış gerçeklik, "gerçek" ile "sanal"ın, gerçek zamanlı olarak bir araya gelmesi ve etkileşime girmesini sağlayan ve aynı çerçevede bulunmasını hedefleyen uygulamalardır (Özaslan, 2011). Azuma'ya (Azuma, 1997) göre artırılmış gerçeklik; gerçek ve sanalın gerçek ortamlarda harmanlanması, gerçek zamanlı etkileşim ve üç boyutlu ortamlarda bu unsurların konumlandırılması şeklinde üç temel özelliğe sahiptir. Milgram ve Kishino'ya (Milgram & Kishino, 1994) göre ise gerçek bir ortamın görüntülenmesinin sanal nesneler aracılığı ile arttırıldığı tüm durumlar "Artırılmış Gerçeklik" olarak tanımlanmaktadır.

Artırılmış gerçeklik, optik temelli ve video temelli teknolojiler olmak üzere iki şekilde oluşturulmaktadır. Her ikisinde de gerçek dünya ile sanal dünya aynı platformda görülmektedir. Optik temelli teknolojinin kullanımında sanal dünya, kullanıcının başına yerleştirdiği gözlük şeklinde cihazlar yardımı ile gerçek dünya ile bütünleşmektedir. Video temelli sistemlerde ise, video kameralar kullanılarak, gerçek dünya ile sanal dünya bilgisayar ekranında bütünleştirilmektedir (Azuma, 1997). Artırılmış gerçeklik uygulamaları günümüzde, akıllı gözlük, akıllı saat, kulaklık, kask bağlantılı ekran, t-shirt, gibi giyilebilir teknolojilerle birlikte, tabletler, akıllı telefonlar gibi mobil araçlarla uygulanmaktadır (Erbaş, 2014; Wüller, Behrens & Garthaus, 2019).

İlk olarak askeri alanda, savaş pilotlarının uçuş sırasında kullandıkları artırılmış gerçeklik uygulamaları, günümüzde birçok alanda ve hatta günlük yaşantımızda kullanılmaya başlanmıştır. Reklam, sanat, pazarlama, mühendislik, mimari, ticaret, GPS, coğrafi etiketleme, eğlence, oyun, sağlık, müzecilik gibi alanlarda kullanımının yanı sıra eğitim alanında da kullanımı giderek yaygınlaşmaktadır (İçten & Bal, 2017; Somyürek, 2014). Artırılmış gerçeklik ile gerçek dünyada çeşitli imkânsızlıklar sebebiyle ulaşılamayan ya da somutlaştırılamayan eğitim ile ilgili uygulamalar zenginleştirilebilir (Özaslan, 2011).

ARTIRILMIŞ GERÇEKLİK UYGULAMALARININ EĞİTİME SAĞLADIĞI KATKILAR

Artırılmış gerçeklik uygulamalarının da içinde bulunduğu digital eğitim teknolojileri ile öğrenciler, öğrenme ortamlarının fiziksel alanı dışına çıkarak, içeriğe gerçek zamanlı olarak ve nerede olursa olsun erişebilme olanağına sahip olurlar (Lahti, Hatönen, & Valimaki, 2014). Artırılmış gerçekliğin eğitim alanında kullanımı ile öğrencilerin ilgili konuyu öğrenmeleri üzerine birçok fayda sağladığı görülmektedir. Artırılmış gereklik teknolojisi kullanılarak oluşturulan ders materyalleri ile öğrencilerin sadece ders başarısı değil, aynı zamanda derse olan ilgisi artmakta, kavramların ve süreçlerin öğrenilmesine katkı sağlanmaktadır. Soyut kavramlar somut hale getirilerek ve görselleştirilerek öğrenme kolaylaştırılmaktadır (Radu, 2014; Somyürek, 2014).

Sağlık eğitimi alanında da çeşitli bilgi ve becerileri kazandırmaya yönelik artırılmış gerçeklik uygulamaları geliştirilmektedir. Sağlık eğitimi ile ilgili artırılmış gerçeklik uygulamalarını içeren araştırma sonuçları, öğrencilerin artırılmış gerçekliği bir öğrenme teknolojisi olarak kabul edebileceğini ve artırılmış gerçekliğin tıbbi kavramların anlaşılmasıyla, öğrenmenin kalıcılığını artırarak öğrenme etkisini artırabileceğini göstermiştir. Artırılmış gerçeklik teknolojisi ile öğrencilerinin öğrenme stillerine hitap ederek öğrencilere daha kişisel ve keşifçi bir öğrenme deneyimi sunulmaktadır. Ayrıca artırılmış gerçeklik teknolojisi ile beceri eğitimi sırasında hata yapılırsa hastaların güvenliği korunmaktadır (Küçük, Kapakin & Göktaş, 2015; Zue, 2016).

Hemşirelik eğitimi de değişen ve gelişen teknoloji düşünüldüğünde ve içinde bulunduğumuz çağın genç nesli düşünüldüğünde bu teknolojik değişimlere ayak uydurmak durumundadır. Böylece öğrenciye aktarılması zor, hastalara zarar verebilecek girişimler, tekrar tekrar uygulanarak beceri öğretimi kalıcı bir şekilde gerçekleştirilecektir.

HEMŞİRELİK EĞİTİMİNDE ARTIRILMIŞ GERÇEKLİK İLE İLGİLİ YAPILAN ÇALIŞMALAR

Artırılmış gerçeklik teknolojisinin hemşirelik alanında kullanımına yönelik ilgili literatür incelendiğinde çalışmaların hemşirelik klinik ortamları ve hemşirelik eğitimi olmak üzere iki alanda toplandığı görülmektedir. Hemşirelik klinik ortamlarına yönelik artırılmış gerçeklik teknolojisinin kullanıldığı çalışmalar incelendiğinde, yara bakım yönetimi (Aldoz, Shluzas, Picham & Eris, 2015; Wüller, Behrens & Garthaus, 2018) uzaktan hasta takibi (Gonzalez, Villegas, Ramirez & Sanchez, 2014), yaşlı hastaların damarlarını görselleştirme (Fumagalli, Torricelli, Massi & Calvani, 2016), ameliyathane hemşirelerinin farkındalığını artırma (Yoshida, Sasaki, Sato & Yamazaki, 2015) ve ameliyathanede kullanılan tıbbi cihaz yönetimi (Nilsson & Johansson, 2007) gibi konuların ele alındığı çeşitli araştırmalar bulunmaktadır. Hemşirelik eğitimi alanında ise çalışmaların sayısının az olduğu ancak son yıllarda giderek artmaya başladığı görülmektedir.

Bu derlemede, sonuncusu Mayıs 2019'da yapılan, "hemşirelik eğitimi", "artırılmış gerçeklik" ve "nursing education", "augmented reality" anahtar kelimeleri ile kombinasyonlar yapılarak taramalar yürütülmüştür. Türkçe ve İngilizce dilinde yazılan, tam metnine ulaşılan hemşirelik eğitiminde artırılmış gerçeklik kullanımını inceleyen araştırma makalelerine ulaşılmaya çalışılmıştır. Artırılmış gerçeklik teknolojisinin hemşirelik eğitiminde etkisinin incelendiği çalışmalar Tablo 1'de sunulmuştur.

Tablo 1: Artırılmış gerçeklik teknolojisi kullanılarak yapılan hemşirelik araştırmalarının özellikleri

Araştırmanın yazarı ve yılı	Araştırma deseni	Örneklem Grubu	Sonuçlar
Aebersold ve ark. (2018)	Nitel ve nicel karma desen	Hemşirelik öğrencileri (n=69)	Nazogastrik sonda yerleştirme beceri eğitimini artırılmış gerçeklik yöntemi ile gerçekleştiren öğrencilerin, tüm kontrol listesi maddelerine göre doğru yerleştirme oranı, kontrol grubu ile karşılaştırıldığında istatistiksel olarak anlamlı bulunmuştur (p <.011).
Tilghman ve ark. (2018)	Nitel çalışma	Hemşirelik birinci sınıf öğrencileri (n=25)	Juxtopia® CAMMRAD Medic prototip gözlükleri ile uygulama yapan öğrenciler, kontrol grubuna göre materyali anlama konusunda kendilerinden emin hissetmişlerdir ve beceri ile ilgili güven duymuşlardır.
Vaughn ve ark. (2016)	Pilot çalışma, karma desen	Hemşirelik öğrencileri (n=12)	Google Glass kullanılarak uygulanan artırılmış gerçeklik uygulaması ile öğrenciler, gerçek hayattaki bir hastayla etkileşim halindeymiş gibi hissetmişlerdir ve güven duymuşlardır.
Pugoyl ve ark. (2016)	Pilot çalışma	Hemşirelik öğrencisi (n=17)	Artırılmış gerçeklik teknolojisi kullanılarak oluşturulan çizgi roman şeklindeki prototip ile İngilizce öğrenme, basılı materyallere kıyasla daha iyi bir öğrenme sağlamaktadır.
Rahn ve ark. (2014)	Karma desen	Hemşirelik birinci sınıf öğrencileri (n=14)	Artırılmış gerçeklik kullanımı ile öğrencinin öğrenmesi kolaylaşmıştır ve anlama düzeyi artmıştır.
Garrett ve ark. (2015)	Pilot çalışma, karma desen	1. ve son sınıf öğrenciler (n=72)	Yatak başında artırılmış gerçeklik kaynaklarına ulaşım öğrenmeyi desteklemektedir ancak artırılmış gerçeklik uygulaması sırasında yaşanılan teknik sorunlar öğrenme deneyimini olumsuz etkilemektedir.

İncelenen çalışmalardan biri olan, Aebersold ve arkadaşlarının (Aebersold, Voepel-Lewis & Cherara, 2018) 69 hemşirelik öğrencisi ile yaptığı çalışmada, öğrencilerin nazogastrik sonda yerleştirilme becerisi, iPad teknolojisi ile düzenlenmiş artırılmış sanal simülasyon eğitimi modeli ile gerçekleştirilmiştir. Özellikle öğrencinin nazogastrik sonda yerleştirme işlemi sırasında anatomik bölgeleri görebilmesine imkan tanıyan bu uygulamanın sonuçlarına bakıldığında, nazogastrik sondayı tüm kontrol listesi maddelerine uygun yerleştirme düzeyinin deney grubunda kontrol grubuna kıyasla anlamlı derecede daha iyi olduğunu görülmektedir (p=0.011). Katılımcılar artırılmış gerçeklik uygulamasını, gerçekçi, kullanımı kolay, zevkli ve beceri eğitimi için yararlı bir araç olarak gördüklerini belirtmişlerdir. Ayrıca, hemşirelik öğrencileri artırılmış gerçeklik programının standart eğitim yöntemleriyle karşılaştırıldığında üstün bir eğitim yöntemi sağladığını bildirmiştir. Bu uygulama ile öğrenci, rahat hissetmekte, tüm adımları hatırlamakta ve işlemi etkin ve güvenli bir şekilde gerçekleştirebilmektedir.

Konu ile ilgili başka bir çalışma olan Tilghman ve arkadaşlarının (Tilghman, Doswell, Collington, Utili, & Watties-Daniels, 2018) simülasyon ve artırılmış gerçekliği kullanarak yaptıkları araştırmada, 25 birinci sınıf hemşirelik öğrencisinin, intravenöz ilaç verme ve kadın mesane kateterizasyon becerilerini uygulama düzeylerine bakılmıştır. Veriler, Juxtopia® CAMMRAD Medic prototip gözlükleri ile sağlanmıştır. Uygulamaların tamamlanmasıyla ilgili olarak, kontrol grubu gerekli işlemleri deney grubundan daha hızlı bir şekilde tamamlamıştır. Araştırma sonucunda deney grubu öğrencilerin, materyali anlama konusunda kendinden emin hissettiği ve beceri ile ilgili güven duyduğu bildirmiştir. Bu çalışma sonucunda araştırmacılar, hemşirelik eğitiminin temelini oluşturan, ders anlatımı, laboratuvar uygulamaları ve klinik deneyimlere ek olarak teknolojinin kullanılmasının, hasta bakımı ve klinik beceri kazandırmada değerli bir yardımcı olduğunu belirtmişlerdir. Artırılmış gerçeklik ile sunulan bilgi, öğrencinin öğrenmesini önemli ölçüde etkilemektedir.

Benzer başka bir araştırma olan Vaughn ve arkadaşlarının (Vaughn, Lister, & Shaw, 2016) 2015 yılında Amerika Birleşik Devletleri'nde bulunan bir hemşirelik okulunda yaptıkları pilot çalışmaya 12 hemşirelik öğrencisi katılmıştır. Yüksek doğrulukta bir simülasyon mankeni ile artırılmış gerçeklik teknolojisini birleştirerek, "Augmented Reality Headset (ARH)" adı verilen gerçekçilik algısını artırmak için yenilikçi bir hibrid simülasyon oluşturulmuştur. ARH cihazı olarak Google Glass kullanılmıştır ve bu cihaza akut solunum sıkıntısı yaşayan bir hastanın senaryosunu içeren bir video yüklenmiştir. Öğrencilerden bu hastayı değerlendirmeleri istenmiştir. Öğrenciler bu uygulama sonucunda, ARH'ı yararlı ve etkili bir öğretim kaynağı, motivasyonel ve bağımsız problem çözmeye katkı sağlayan bir araç olarak değerlendirmişlerdir. Manken üzerinde aktarılması zor olan sorunlar, artırılmış gerçeklik kullanılarak gerçek hayattaki bir hasta ile etkileşim halindeymiş gibi hissettirmektedir. Öğrencilere ARH ile ilgili engeller sorulduğunda ise deneyim eksikliği ile ilgili sorun olduğu bildirilmiştir ve yalnızca bir öğrenci bu uygulamayı dikkat dağıtıcı bulmuştur.

Hemşirelik eğitimi alanında yapılan artırılmış gerçekliğe yönelik araştırmaların sadece klinik beceriye yönelik olmadığı, Pugoyl ve arkadaşlarının (Pugoyl,& Ramos, 2016) yaptıkları çalışma ile görülmektedir. Pugoyl ve arkadaşları, 17 katılımcı ile hemşirelerin İngilizce yeterliliklerini geliştirmeye yardımcı olmaları için klinik senaryodan oluşan, İngilizce hemşirelik iletişimi üzerine çizgi roman şeklinde bir öğrenme materyali prototipi geliştirilmişlerdir. Bu uygulama, kullanıcının mobil cihazı çizgi roman şeridi üzerine getirmesi ile birlikte, hem okuyup hem sesini duyabilmesine imkan tanımaktadır. Böylece kelimelerin doğru telaffuzu ve ifadeleri doğru anlaması sağlanmaktadır. Ankete katılanların çoğu, artırılmış gerçeklik ile geliştirilen malzemenin yalnızca basılı malzemeden daha iyi olduğu ve öğrenme deneyimlerini geliştirdiği konusunda hemfikirdir.

Yapılan bir başka araştırma ise anatomi öğretiminde artırılmış gerçeklik uygulamasına yöneliktir. Rahn ve arkadaşları (Rahn& Kjaergaard, 2014) Danimarka'da bir hemşirelik okulunda 14 birinci sınıf hemşirelik öğrencisinin katılımıyla iPad ile artırılmış gerçeklik teknolojisini kullanarak akciğer anatomisinin görselleştirmesine olanak veren bir uygulama geliştirilmişlerdir. Uygulama sonrasında araştırmaya katılan öğrenciler, bu yeni öğretim yöntemi ve teknolojiyi yardımcı ve umut verici bulmuşlardır. Ayrıca öğrencilerden bazıları, artırılmış gerçeklik uygulaması kullanılarak görselleştirilen akciğer anatomisinin, bir ders kitabından çok daha gerçekçi bir görüntü sağladığını ifade etmektedir.

Yapılan bu çalışmaların yanı sıra artırılmış gerçeklik ile öğretimin öğrenci öğrenmesi üzerinde olumlu etkileri olduğu gibi kullanılan teknoloji ile bağlantılı olarak olumsuz bir takım sonuçları da içerdiği görülmektedir. Garrett ve arkadaşlarının (Garrett, Jackson, & Wilson, 2015) klinik beceri laboratuvarı eğitimini desteklemek amacıyla yaptıkları pilot çalışmaya birinci ve dördüncü sınıf toplam 72 lisans öğrencisi katılmıştır. Hemşirelik öğrencilerinin klinik beceri laboratuvarında kullandıkları bazı materyaller ve protokoller görsel işaretleyiciler ve QR kodları kullanılarak etiketlenmiştir. Öğrencilere, klinik el yıkamanın ve solunum oskültasyonunun nasıl yapıldığını, solunum değerlendirmesinin ardından uygun oksijenasyon ekipmanının nasıl seçileceğini gösteren Web tabanlı videolar sunulmuştur. Araştırma sonunda yatak başında artırılmış gerçeklik kaynaklarına ulaşımın öğrenmeyi desteklediği yönünde olumlu geri bildirim alınırken yavaş yükleme, uyumsuz akıllı telefonlar, internet bağlantısı aksaklıkları gibi teknik sorunların öğrenme deneyimini olumsuz etkilediği bildirilmiştir. Ayrıca, öğretmenlerin de artırılmış gerçeklik ile ilgili pedogolojik eğitim almaları gerekliliği sonucu belirlenmiştir. Artırılmış gerçekliğin hemşirelik eğitimine sağladığı pozitif yönlü katkılar dışında yaşanılan teknik zorluklar, olumsuz özellikleri içermektedir.

SONUÇ VE ÖNERİLER

Artırılmış gerçeklik uygulamalarının, gözle görülemeyen soyut yapıları üç boyutlu olarak görselleştirerek içeriği somutlaştırdığı ve anlaşılması güç konuları daha anlaşılır hale getirdiği böylece anlamlı ve etkili öğrenmeyi kolaylaştırdığı belirtilmektedir (Wu, Wang, Liu, Hu & Lee, 2014; Kipper, Rampolla, 2012). Hemşirelik eğitiminde de artırılmış gerçekliğin kullanılmasına yönelik yapılan araştırma sonuçlarının çoğu, bu yöntemin öğrencilerin öğrenmesi üzerine olumlu etkileri olduğunu, öğrenmeyi desteklediğini ve beceri performanslarını artırdığını göstermektedir.

Hemşirelik lisans müfredatı içerisinde yer alan, anlaşılması zor teorik içeriğin yanı sıra maket üzerinde öğreniminin güç olduğu, soyut yapıları barındıran ve öğrencilerin uygulama alanlarının kısıtlı olduğu psikomotor becerilerin de artırılmış gerçeklik teknolojisi kullanılarak hemşirelik öğrencilerinin bilgi ve klinik becerilerine olumlu katkı sağlayacağı görülmektedir. Ayrıca bu teknolojik gelişmenin, mobil cihazlara entegre edilmesi ile daha çok öğrenciye ulaşılacağını, öğrenmeyi pekiştireceğini ve öğrenciye uygulamalar ile ilgili özgüven kazandıracağını düşünmekteyiz.

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INNOVATION IN EMPLOYEE TRAINING AND ORIENTATION WITH VIRTUAL REALITY

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ABSTRACT

This paper presents a concept for a new educational method which, develop with Virtual Reality. Technology can be used in especially repetitive and important educational process. Employee orientation is compulsory operational process in hiring. Current employee orientation programs are dull not so efficient and dull. Virtual Reality designed to create immersive experience with realistic visuals. In the globalized and technologically developing world we are living in, education becomes faster and digital. With the increasing importance of education in daily life, lots of tools have been developed. Virtual Reality, satisfy these needs with immersive and easy to use functions. With Virtual Reality tools, the long educational process becomes shorter and effective. Educational contents are developed based on scenarios, thus it is easy to understand. As an example, global companies hire lots of employees periodically. With VR solutions, the orientation processes digitalized and take less time than before. That's why educational softwares can be developed in companies which have innovation center. With wide spreading standalone VR hardware like Oculus Go, integration of developed software becomes easier.

Educational VR software developed for android operating system, due to hardware mostly works with android. According to educational contents, modelling the environment and characters with software like 3DSMax then animating with Unity. Quality of the educational process has been increasing with, users that directly included the educational contents without any middleman. Contents of VR solutions mostly focused on Health and Safety scenarios, thus users experience the accidental scenarios with as safest possible and gain essential information that needed. With this educational process, health and safety awareness of blue and white collars have been increased. As output, interactively and easily learned educational contents can be provided with Virtual Reality tools.
Keywords: Virtual Reality, Education, Innovation, Health and Safety

INTRODUCTION

Orientation processes for new employees have crucial importance. Employee orientation is a way to introduce new employees with company rules and regulations, organizational culture environment and other major thing directly relates with organization. Employee retention is the first impression or perception of employee about their job organization. Employee orientation is a very constructive way to give positive feeling to newly hired employees for welcoming them and make them comfortable and provide them opportunity to absorb them within organization [1]. Orientation programs have big role for creation good first impression to newcomers. For getting better feedbacks, orientation programs should be fast, interactive and afar from dullness.

Orientation with VR decrease the time spent to orientation besides increasing efficiency. ASTD survey suggests that seven percent of all training and development expenditures are spent on orientation. Today, there is increasing interest in what has been termed “rapid-onboarding.” That is, getting new employees up to speed as quickly as possible [2]. Furthermore specific health and safety scenarios should be told to the newcomers. Health and safety rules are the necessary part of the orientation program. Especially work areas like factory or warehouse have high possibility of accident. Without any information about protection methods from the accidents, accidents risks get higher. New employees or current employees who are transferred from another project must attend a project-specific new-hire safety orientation. This program provides each employee the basic information about the company worksite safety and health rules, federal and state OSHA(Occupational Safety and Health Act) standards, and other applicable safety rules and regulations. Employee attendance is mandatory before working on the construction project [3].

Health and Safety rules consists possible accidental scenarios, emergency procedures and protection methods. Mostly in companies there are more than one person dedicated to orientation program. While the process is repetitive and absolutely necessary, with developing technology improved ways can be used. Virtual reality, great tool for educational process. VR was shown to be very effective for learning procedural tasks, in which students learns sequence of steps to accomplished a task requiring maneuvers in tree-dimensional space. Examples include as operating a vehicle, fixing on a complex piece of machinery and finding your way around an otherwise unfamiliar landscape [4]. Repetitive educational methods can be use as content. Beside, with interactivity feature education methods can be change with learners’ capacity.

Learners could effect and change the education scenarios according to their choice. Thus, newly hired employers can virtually practice the accidental scenarios. Based on standard learning pyramid, generally, the adult learners remember only about 5-10% of what they are told and read, about 30% of what is actually demonstrated, and about 75% of what they practice [5]. With Virtual Reality technology, corporate life educations like employee orientation and health and safety rules will become more effective and immersive. Due to lack of the middle man with learners and education material, they can be adopting new environment and its rules more easily. VR technology that tested for orientation program and contents of it will be explained in this article.

VIRTUAL REALITY HISTORY

Virtual Reality is a technology that known for years. Based on watching and experiencing the realistic environment with specific device. Virtual reality is high-end user-computer interface that involves real-time simulation and interactions through multiple sensorial channels. These sensorial modalities are visual, auditory, tactile, smell and taste [6]. The first known Virtual Reality device is Sensoroma, which developed by Morton Heilig in 1962. It was device for watching colorful display with stereo sound system. After Sensorama Head Mounted Display (HMD) has been developed by Ivan Sutheredland with the inspiration of Heiling’s work.

Virtual Reality devices become less heavy with HMD’s. Hence with HMD’s spreading of Virtual Reality notion, become easier and faster. After knowledge of Virtual Reality concept spreading, it has been used, in other purposes than entertainment. The National Aeronautics and Space Agency (NASA) was another agency of the American government interested in modern simulators. It needed simulations for astronaut training, as it was difficult or impossible to otherwise recreate conditions existing in outer space or distant planets.

In 1981, on a very small budget, NASA created the prototype of a liquid crystal display (LCD)-based HMD, which they named the Virtual Environment Display (VIVED) [7]. After simulation examples, VR technology has been improved with educational contents. MHD Virtual Reality is widely considered to be one of the most viable technology applications for use in education [8].

VIRTUAL REALITY IN EDUCATION

With developing technology, educational processes evolved like everything else. Virtual Reality tools provide great opportunity for learning. Educational Contents like Health and Safety is crucial topic for employees who work in places have accidental risks like production facility or warehouses. It is the fact that experiencing is good way to learn but situations like accidental scenarios are too dangerous even practice it. Especially educational contents which focusses on practices, took digital shape. That's why Virtual Reality create new digital environment for experiencing the situations. Studies emphasized that VR does not furnish only passive copy of reality, but its reconstruction is a model where users can act. It reacts and behaves as in real environment. This important feature overcomes the inherent limitations of perception, which should be applicable only to objects physically perceptible.

As technology continues to improve, VR systems will become pervasive instrumentation for research in education across the disciplines [9]. For testing VR technology in orientation program, an application developed.

Figure 1. Health and Safety education program in DHL warehouses

Application based on watching corporate videos with VR. An application that developed for Virtual Reality devices, have 5 different modules Fig. (2). Introduction, Innovation, Health and Safety, Fun and City Tours. Each module can rename. Also contents of the modules can removed or replace with some other videos. In introduction module user can watch the basic information about the company that newly hired. These videos may include the rules and work environment. In second module, Innovation user can watch the innovation that company made.

In health and safety module consists Health and safety rules and simulation of accidental scenarios. Scenarios modeled and designed for this application and decided with Health and Safety specialists Fig. (3). Arrangements have done for coherence with VR. In the development process of scenarios, gamification principle is considered. For a longer using time, user should have motivation. After the creation of development planning and scenarios, visuals of location, environment and characters decided. Models created with 3DSMax. While the modelling of visuals like fire, particle effects have been used. According to scenarios, animations have been produced.

The application developed in Unity 3D. In the first phase, user can only watch and react the situation around. As planned second phase, application will be developed as interactive. With interactivity feature, user will decide the way of scenario is going. Application deployed as android application. Oculus Go has been used as device for using in orientation process. In fun and city tour module, the entertainment videos are created and found for employee's break time. This application can be modified and spread easily. Application firstly transferred as "apk" format with memory devices. Then, it has been uploaded to Oculus Go Market which is content download area of the Oculus Go. With given key code to users, Oculus Go owners can download application and transfer the contents optionally.

Figure 2. User Interface of VR Application

Figure 3. Accidental scenarios in Health and Safety Module

CONCLUSION

As an emerging technological application area of human-machine convergence and more effective uses of technology for the good and benefits of humans, VR is proposing one of the most promising values for the last couple of years. Therefore, a new and innovative implementation of VR technology in logistics was explained in this paper. This impressive development in health and safety conditions was carried through DHL Research and Development Center in Turkey and was prepared for all possible uses in logistics sector.

It has seen that newcomers who used VR applications for health and safety rules have justified and learned more in comparison with newcomers who attend lessons with classic teaching methods. As given feedback from VR orientation participants, increase of the employee engagement can be seen. With interactivity feature of Virtual Reality tools, scenarios can be change according to user's choices. Thus, users can experience the results of their decision just like in real life. The main focus is not replacing the classical teaching method; the purpose of the project is increasing the awareness especially in health and safety rules.

As a result, an educational VR software system, was developed by modeling the environment and characters for unlimited number of users whom can directly receive educational contents without any interference. Starting with health and safety scenarios as the first module of content base, users can experience the accidental scenarios with as safest possible and may gain essential information about possible actions to take. Due to a successful implementation of this educational process, health and safety awareness of blue and white collars was increased. Following this perspective, there will be many different contents available for people to be trained or to get the experience of any new educational issues in the future.

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3 BOYUTLU İMAR PLANLARININ YEŞİL ALT YAPI SİSTEMİNDE OLUŞUM, GELİŞİM VE MODELLEME SÜRECİ: ÜSKÜDAR ÖRNEĞİ

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Giderek artan çevre sorunlarına yönelik olarak doğal dengenin korunması insanların yaşam kalitesinin korunması açısından önemli hale gelmiştir. Biyolojik çeşitliliğin korunmasına yönelik yeni bir takım çözüm önerileri gerekmektedir. Bu çözümlerden birisi de yeşil alt yapı sistemleridir. Yeşil alt yapı sisteminin amacı, doğal alanlar ile açık alanlar aralarındaki kopukluğun yeşil koridorlar oluşturacak şekilde planlanması böylece bölgelerin ekolojik, sosyo-ekonomik ve sosyokültürel zenginliği artırılması ve kentsel yaşam kalitesinin geliştirilmesine fayda sağlamasıdır. Yeşil altyapı çalışmalarında amaç; insan/canlı eylemliliğini ve hareketini temel alarak, parçacıl alanlar planlamaktan çok bir ağ/network planlamasının sağlanmasıdır.

Bu çalışmada, yeşil altyapı sistemlerinin amaçları, hedefleri ve uygulama sistemleri dünyadan uygulamalar verilerek, İstanbul-Üsküdar örneğinde incelenmiştir. çalışma alanına ait yeşil alanlar CBS kullanılarak, yeşil alt yapı sisteminde kurgulanmıştır. Kente ait imar planları ve uydu görüntüleri üzerinde belirlenen yeşil alanlar, yeşil alt yapı sistemini oluşturan ekolojik ve sosyo-kültürel odak ile ekolojik ve sosyo-kültürel koridorlar olarak belirlenmiştir. Fiili ve imar planındaki tüm parklar ağ analizleri yardımıyla erişilebilirliği analiz edilmiştir. Analiz sonucunda erişilebilirlik kavramı, binalarda yaşayan nüfus bazında irdelenmiştir. Bu çalışma ile belediyelerin çağrı merkezine gelen park yapım talepleri ve erişilebilirlik karşılaştırılarak daha doğru ve etkin hizmet verilmesi sağlanabilir.

THE FORMATİON, DEVELOPMENT AND MODELİNG PROCESS OF 3-DİMENSİONAL DEVELOPMENT PLANS IN THE GREEN INFRASTRUCTURE SYSTEM: THE CASE OF ÜSKÜDAR

ABSTRACT

Towards the increasing environmental issues, the conservation of natural balance has become important in terms of protection of people’s quality of life. A set of new solutions are required to protect biodiversity. One of these solutions is green infrastructure systems. The aim of the green infrastructure system is the planning to create green corridors in the gap between natural areas and open areas with the purpose of improving the ecological, socio-economic and sociocultural richness of the regions as well as improving the quality of urban life. The aim of green infrastructure studies is to provide network planning based on human / living being activities and movements, rather than planning partial areas.

In this study, the aims, objectives and application systems of green infrastructure systems were investigated based on giving applications from around the world. The public open-green areas of the study area were designed within the scope of the green infrastructure system using remote sensing and geographical information systems. First of all, with the use of the city's development plans, up-to-date satellite data, and data from field works, the existing open-green areas were identified. Following that, ecological focus areas, ecological corridors, socio-cultural focus areas, and socio-cultural corridors were defined as components of the green infrastructure system. The accessibility analysis was performed using network analysis for all parks in the actual and development plans. As a result of the analysis, the concept of accessibility was examined based on the population living in buildings and transferred to 3-dimensional development plans. With this study, more accurate and efficient service can be provided by comparing the park building demands coming to the call center of the municipalities and the park accessibility.

Keywords: Urban Planning, 3D Development Plan, Accessibility, Open-Green Area

GİRİŞ

Nüfus artışında meydana gelen değişimler ve buna bağlı olarak artan yapılaşma doğal kaynakların yok olması gibi pek çok çevre sorununu beraberinde getirmektedir (Oğuz ve Zengin, 2009). Tarımsal alanların amaç dışı kullanımı, yanlış alan kullanımları doğal ve kültürel peyzajların bozulmasına, ekolojik yapısının değişmesine, yaşam ortamlarının bozulmasına, parçalanmasına ve benzer ekosistemler arasındaki bağlantıların zayıflamasına ve kopmasına neden olmaktadır (Şatır and Berberoğlu, 2000, Mansuroğlu ve ark, 2005, Bairoch, 1988, Stanners and Bourdeau, 1995).

Ekolojik sistemlerin bozulmasının önlenmesi, doğal kaynaklar üzerindeki baskının azaltılması peyzaj yaşam alanların sürdürülebilirliğinin sağlanması için bu alanların korunması ve yönetilmesi bütüncül planlama yaklaşımıyla sağlanabilir. Pek çok ülke ekosistemi içeren parçaları korumak ve değerinin geliştirmek amacıyla mekansal planlama stratejileri hazırlamaktadır. Doğal ve kültürel alanların sürdürülebilirliğinin sağlanması amacıyla pek çok ekolojik planlama yöntemi oluşturulmaktadır. Ekolojik değerler arasında bağlantıların sağlanması ve bir bütün olarak değerlendirilmesine dayanan ekolojik planlama yaklaşımlarından biri de yeşil alt yapı sistemidir (McDonald et al., 2005). Yeşil yollar, ekolojik ağ, ekolojik altyapı, yeşil kama, yeşil kuşak, doğal çerçeve gibi peyzaj ekolojisinde küçük farklarla birbirinden ayrılan planlama yaklaşımlarının bütüncül olarak değerlendirilmesine yeşil alt yapı denilmektedir.

Yeşil alt yapı sistemi, çekirdek alanlar, ekolojik koridorlar ve peyzaj sisteminin oluşturduğu, ekonomik, çevresel ve sosyal sürdürülebilirliğinin sağlandığı ekolojik bir çevredir (Chang vd., 2012, Benedick and McMahon, 2002, Lerner, 2003; Mell, 2010,).

Yeşil alt yapı terimi ilk defa 1994 yılında Florida'da arazi koruma stratejilerinin belirlenmesine yönelik hazırlanan raporda yer almaktadır (Firehook, 2010). Benedick ve McMahon (2006)'a göre yeşil altyapı, parklar, doğal yaşam alanları, yeşil yolların stratejik olarak planlanması ve yönetilmesidir. Yeşil alt yapı sistemi uygulamaları, sürdürülebilir kentlerin bugün ve gelecekte, doğal kaynakları ve doğal alanları korumak geliştirmek ve ekolojik sağlığını ve canlılığını sağlamaktır (Kaplan, 2010; Kaplan, 2012).

Pek çok ülkede yeşil alt yapı sistemi yaklaşımı ile çalışmalar gerçekleştirilmiştir. Weber et al.(2006), Maryland'da (ABD), Kuttner et al.(2013), Neusiedl gölü(Avusturya-Macaristan) ve çevresinde örnek değerlendirmeler yapmışlardır.

Ölçeksel anlamda yeşil alt yapı bileşenleri farklılık göstermektedir. Doğal peyzaj alanlarında orman alanları, korunan alanlar, sulak alanlar ve yaban hayatı geliştirme sahaları vb. iken, kentsel peyzaj alanlarında bu bileşenleri kent ormanları, park ve çocuk oyun alanları, ev bahçeleri, yollar vb. oluşturmaktadır (Benedict and McMahon, 2006; Kaplan, 2012, Mansor vd., 2012). Ahern (2007)'e göre ise yeşil alt yapı bileşenleri kentsel yama, kentsel koridor ve kentsel matris olarak sınıflandırılmıştır.

Kaplan, (2012)' a göre yeşil alt yapı sistemi, parklar, kamusal alanlar, meydanlar, suyolları, yaya bölgeleri ve yeşil yollardan faydalanılarak yapılmalıdır.

Bu çalışmada, Üsküdar ilçesinin ekolojik değerlerini koruyarak bölge-kent ilişkisini bütüncül bir ekolojik planlama yaklaşımı olan yeşil altyapı sistemi ile kurgulanmıştır. Yeşil altyapı sistemi, kent ölçeğinde, peyzaj sistemi bütünlüğü kapsamında ekolojik ağların sürdürülebilirliğini sağlayan, doğal ve kültürel yaşam ortamlarını koruyup geliştiren sistematik bir yaklaşımla tasarlanmıştır. Mevcut açık-yeşil alanlar, CBS ve UA kullanılarak imar planları ve uydu verileri aracılığı ile belirlenip, ekolojik koridorlar, sosyo-kültürel koridorlar, ekolojik odaklar ve sosyo-kültürel odaklar olarak tanımlanmış, kentin ekonomik, fiziksel ve sosyal yapısı da dikkate alınarak caddeler ile çizgisel olarak birleştirilmiştir. İlçede yeşil alt yapı planlaması ile kişi başına düşen açık yeşil alan miktarı artırılmaya çalışılmıştır.

MATERYAL METOT

Çalışmanın materyalini 40°99' ve 41°08' kuzey enlemleri ile 29°00' ve 29°09' doğu boylamlarında yer alan İstanbul iline ait Üsküdar ilçesi oluşturmaktadır. Üsküdar ilçesinin toplam alanı, 35,2 km^2'dir (Şekil 1).

Şekil 1. Çalışma alanına ait yer bulduru

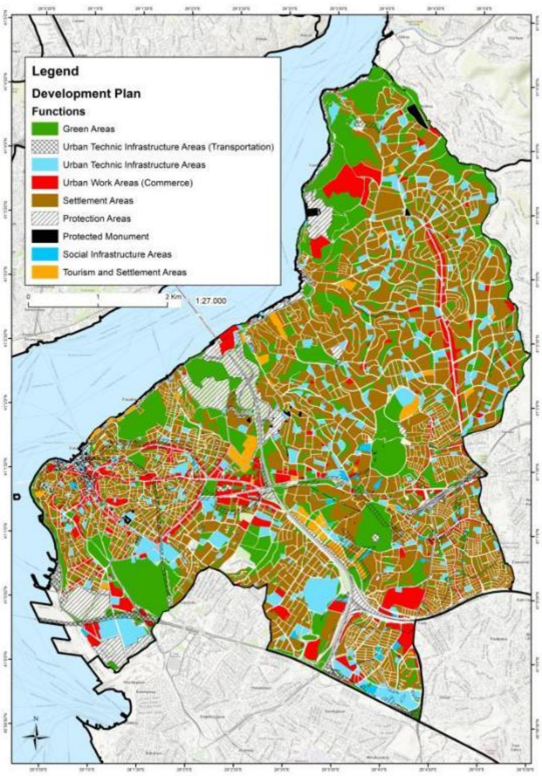
Çalışmanın ilk aşamasında, literatür verileri incelenerek, imar planları ve uydu görüntüleri değerlendirilmiş ve alan kullanım haritaları oluşturulmuştur. İkinci aşamada CBS ve UA yardımıyla belirlenen park, spor ve çocuk oyun alanları ekolojik odaklar olarak, tarihi, kültürel yapılar ve meydanlar sosyo-kültürel odaklar olarak belirlenmiştir. Sosyo-kültürel ve ekolojik odaklar arasında bulunan bağlantılar ise ana caddeler kullanılarak birleştirilmiştir. Çalışmanın üçüncü ve son aşamasında mevcut yeşil alt yapı sistemi değerlendirilerek yeni bir yeşil alt yapı sistemi kurgulanmıştır.

Mevcut yeşil alt yapı sistemi erişilebilirlik açısından değerlendirilerek, kurgulanan yeşil alt yapı ile mukayese edilmiş ve öneriler getirilmiştir. Erişilebilirliğin değerlendirilmesi aşamasında, bina katmanı, bina ile ilişkili bağımsız bölüm tablosu, ağ veri seti kurmaya uygun sokak katmanı, mevcut park ve yeşil alanlar katmanı, imar planındaki park ve yeşil alanlar katmanı, mahalle katmanı, TÜİK'den alınan mahalle nüfusları verileri ArcGIS for Desktop, ArcGIS Network Analyst modülü, Esri CityEngine kullanılarak işlenmiştir.

Kent Bilgi Sisteminde (KBS) bulunan Mekansal Adres Kayıt Sistemi'ne (MAKS) entegre mesken türündeki bağımsız bölüm sayıları (daire) mahalle bazlı çıkarılmıştır. Mevcut halka açık park ve yeşil alanlar park bahçeler müdürlüğünden alınan verileri ile güncellenmiştir. Bir insanın saatte ortalama 4 km yürüdüğü farz edilerek Ağ veri seti, ArcMap ara yüzünde ağ analizi (network analyst) araç çubuğu kullanılarak hizmet alanlarını (service area) hesaplayacak şekilde ayarlanmıştır. Standartlar üzerinden yeşil alanların erişilebilirliği belirlenmiştir.

BULGULAR

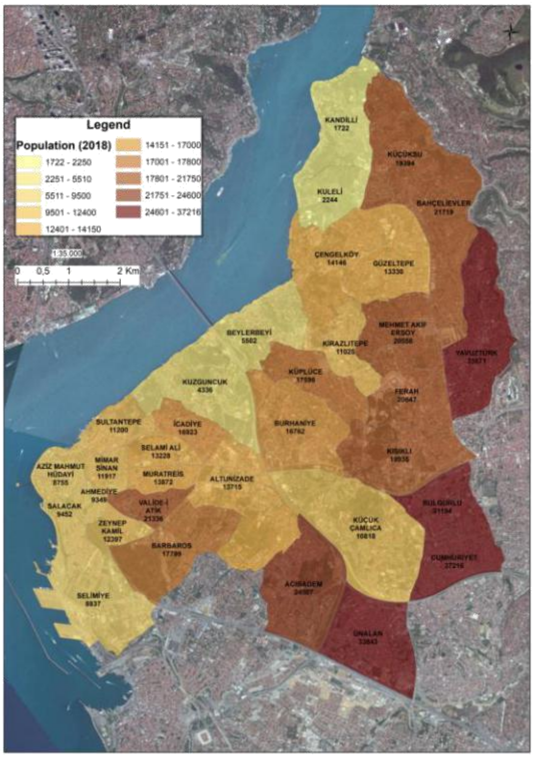
Çalışmanın amacı, kentsel ölçekte kurgulanan yeşil alt yapı sistemini ile kültürel ve doğal varlıkları korumak, geliştirmek, uygulama ve yönetim çalışmalarını desteklemektir. Yürürlükte olan koruma planları ve uygulamaları doğal ve kültürel varlıkların bütünlük göstermemesine, sürdürülebilirliğin sağlanmamasına neden olmaktadır. Bu alanların parçaçıklı yapı göstermesinin engellenmesine yönelik bütüncül koruma ve uygulama yeşil alt yapı sistemi ile geliştirilebilir. Üsküdar ilçesine ait mevcut arazi durumu değerlendirildiğinde, 33 adet mahallede, konut alanları 1421 ha yer kaplarken, kentsel çalışma alanları 308 ha olarak görülmektedir (Şekil 2).



Functions	Area (m^2)
Yeşil Alanlar	10641157,1
Kentsel Çalışma Alanları	3083133,193
Kentsel Sosyal Altyapı Alanları	2989750,024
Kentsel Teknik Altyapı	258232,8922
Kentsel Teknik Altyapı (Ulaşım)	245729,1318
Konut Yerleşme Alanları	14213289,96
Koruma Alanları	2879493,426
Özel Koşullu Alanlar	397543,1677
Turizm Yerleşme Alanları	558178,7885
Total	35266507,68

Şekil 2. Çalışma alanına ait mevcut arazi kullanım durumu

Üsküdar ilçesinde toplam 1064 ha yeşil alan bulunmaktadır. İlçenin nüfus verileri değerlendirildiğinde toplam 529.145 kişinin, özellikle Ünalan, Cumhuriyet, Bulgurlu ve Yavuztürk mahallelerinde yoğunlaştığı görülmektedir (Şekil 3).



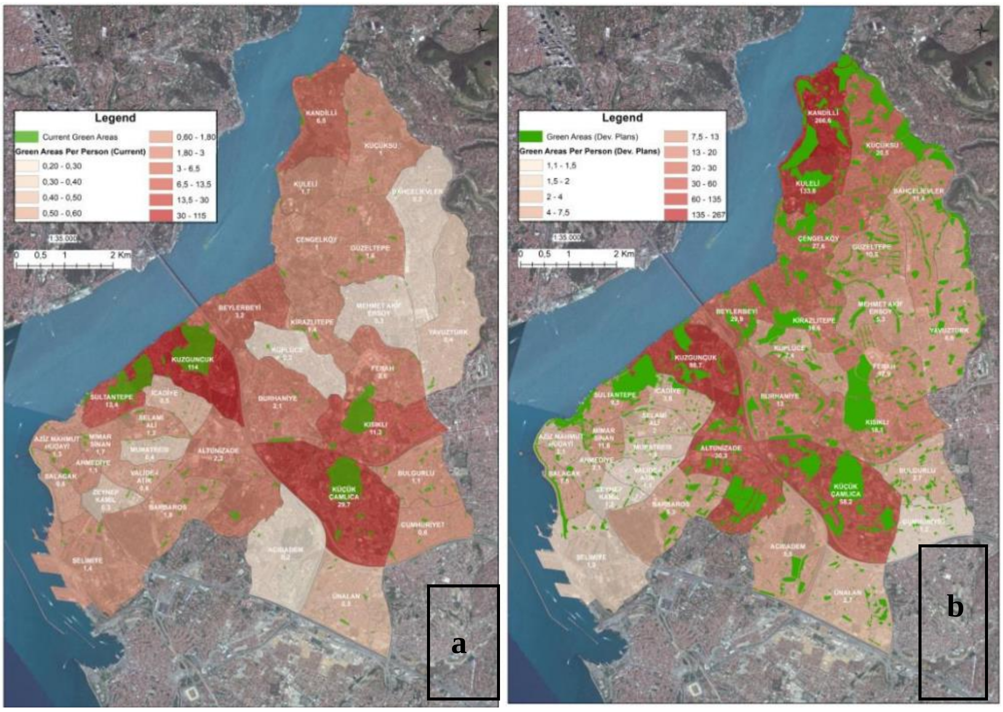
Şekil 3. Üsküdar ilçesine ait nüfus verileri

Çalışma alanında bulunan açık yeşil alanlar değerlendirildiğinde mahallelerde bulunan yeşil alanlar ve içerdiği fonksiyonların alansal verileri Tablo 1'de verilmiştir. Kısıklı, Kuzguncuk ve K. çamlıca mahallelerinde yoğun şekilde yeşil alan varlığı görülmektedir.

Tablo 1. Çalışma alanına ait mahallelerde toplam yeşil alan miktarı ve içerdiği fonksiyonların alansal dağılımı

Mahalle	Yeşil alan TOPLAM (m²)	Gezi dinlenme alanı(m²)	Çocuk oyun alanı(m²)	Fitness alanı(m²)	Spor alanı(m²)	Havuz alanı(m²)	Koşu parkuru(m²)
Acıbadem	2641	1564	526	233			
Ahmediye	837	455	201	62			
Altunizade	29659	9010	1660	3018		211	242
Aziz Mahmut Hüdayi	7809	3539	435	231	202	30	
Bahçelievler	2523	2052	598				
Barbaros	16944	10524	2107	2617		18	
Beylerbeyi	5585	1441	197				
Bulgurlu	27983	12066	2053	597		127	
Burhaniye	10875	2965	1009	492		301	135
Cumhuriyet	16428	3893	1164	262		92	466
Çengelköy	6818	2241	816	40	3162	62	
Ferah	8981	3242	1102	527			
Güzeltepe	14891	5595	625	1044	103	215	571
İcadiye	3649	2583	1093	458		95	
Kandilli	12422	96	104	183			
Kısıklı	263168	7560	1160	649		432	
Kirazlıtepe	5696	2248	179	469			
Kuleli	7847	398	165	33			
Kuzguncuk	643603	911	283	354			
Küçük çamlıca	312546	6551	880	322			333
Küçüksu	27366	4704	988	669		64	
Küplüce	9476	1552	285	306			
Mehmet Akif Ersoy	2091	461	331	145			
Mimar Sinan	19017	3024	154			150	
Murat reis	2453	923	449	89			
Salacak	5013	516	82			5	
Selami ali	12494	6097	1076	2656		87	
Selimiye	3478	2464	427	33		5	
Sultantepe	10728	1597	362	285		80	
Ünalan	17086	7628	513	436			
Valide-i atik	7334	2545	507	516	204		
Yavuztürk	9631	1808	577	878			
Zeynep kamil	3160	1913	210	73		5	314

Kişi başına düşen yeşil alan miktarı mevcut duruma göre değerlendirildiğinde, en fazla 114 m^2 ile Kuzguncuk mahallesinde iken, en az 0,2 ile Bahçelievler ve Acıbadem mahallelerinde bulunmaktadır. Öneri yeşil alan miktarı değerlendirildiğinde, 266 m^2 ile Kandilli mahallesi en yüksek yeşil alan miktarına sahip olacaktır (Şekil 4; Tablo 2).

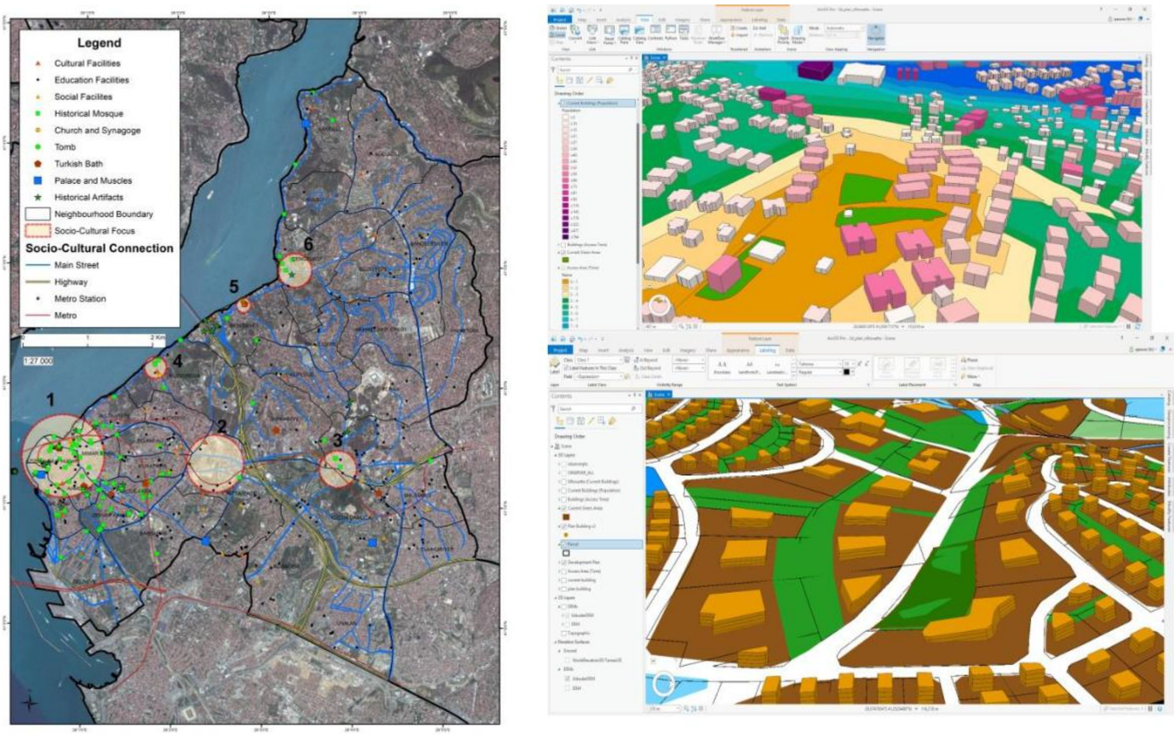


Şekil 4. Kişi başına düşen yeşil alan miktarı (a-mevcut durum, b-öneri yeşil alan)

Tablo 2. Çalışma alanına ait mevcut ve öneri yeşil alanların kişi başına düşen miktarları

Mahalle adı	Nüfus 2018 (kişi)	Mahalle Alanı (m^2)	Toplam yeşil alan_ Mevcut(m^2)	Mevcut yeşil alanın nüfusa oranı (m^2/kişi)	Toplam yeşil alan_plan(m^2)	Plandaki yeşil alanın nüfusa oranı (m^2/kişi)
Kandilli	1722	1234466,139	11184,5	6,5	459015,6981	266,6
Kuleli	2244	734794,8787	3864,5	1,7	300307,799	133,8
Kuzguncuk	4336	1512743,444	494325,1	114,0	428115,5036	98,7
K. Çamlıca	10818	2437509,263	321061,5	29,7	629470,1719	58,2
Altunizade	13715	1771589,322	31834,2	2,3	414939,4183	30,3
Beylerbeyi	5502	1168396,094	17478,3	3,2	164622,8089	29,9
Çengelköy	14146	1673048,087	14084,7	1,0	390391,3749	27,6
Küçüksu	19394	1612656,7	18893,9	1,0	398310,1004	20,5
Kısıklı	19935	1512611,947	225692,7	11,3	361253,1907	18,1
Kirazlıtepe	11025	697934,2756	15014,1	1,4	182679,1136	16,6
Burhaniye	16762	1535216,965	35270,5	2,1	218602,1939	13
Ferah	20647	1068197,047	54192,6	2,6	265657,2585	12,9
Mimar sinan	11917	508515,0676	19762,7	1,7	140544,2592	11,8
Bahçelievler	21719	1587229,275	4495,1	0,2	246817,9043	11,4
Güzeltepe	13330	1015936,341	21288,1	1,6	139954,8993	10,5
Sultantepe	11200	527209,1243	150033,3	13,4	106315,7527	9,5
Salacak	9452	436655,9374	5629,7	0,6	70634,1531	7,5
Küplüce	17596	856091,7056	4666,2	0,3	130817,9146	7,4
Yavuztürk	33871	1707026,646	12848,4	0,4	229286,0001	6,8
Acıbadem	24507	1625172,488	4950,4	0,2	134185,9311	5,5
Barbaros	17799	1447035,951	31802,2	1,8	94733,26582	5,3
Mehmet akif ersoy	20558	1072579,81	5389,7	0,3	108327,224	5,3
İcadiye	16923	502201,1522	7749,4	0,5	63526,82977	3,8
Aziz mahmut hüdayi	8755	342341,2538	11028,1	1,3	27030,25427	3,1
Ünalan	33843	1462617,825	15907,3	0,5	91340,04725	2,7
Bulgurlu	31194	890970,6398	33811,5	1,1	83524,3358	2,7
Ahmediye	9349	225280,1133	10215,2	1,1	19657,65326	2,1
Selami ali	13228	447501,5913	17465,8	1,3	26753,63413	2
Selimiye	8837	1701404,707	12512,7	1,4	16933,12664	1,9
Muratreis	13872	374558,5842	5430,2	0,4	21572,34929	1,6
Zeynep kamil	12397	371599,3092	4193,8	0,3	15217,59964	1,2
Cumhuriyet	37216	868906,5114	22655,8	0,6	43490,90088	1,2
Valide-i atik	21336	424071,272	11821,4	0,6	23853,7172	1,1

Sosyo kültürel odak noktaları ve bağlantılarının belirlenmesi, yeşil alt yapı sisteminin oluşturulmasında önemlidir. Sosyo kültürel odak noktalarını birleştirmek için, ekolojik koridor olarak kentin ana caddeleri ve bulvarları kullanılmıştır (Şekil 5).



Şekil 5. Üsküdar ilçesine ait sosyo-kültürel alt yapı analizi

1 numaralı odak, Üsküdar Meydanı, ulaşım aktarma istasyonları, Boğaz ve Kız Kulesi manzarası ve tarihi yapılarından dolayı seçilmiştir. Bu odakta Üsküdar-Ümraniye-Çekmeköy metro hattının ilk durağı, Ankara'dan yola çıkan yüksek hızlı treni ve Gebze-Halkalı tren hattının durağı bulunmaktadır. Ayrıca otobüsler için kalkış noktasıdır. Deniz ulaşımı olarak boğaz hattı için önemli bir istasyondur. Osmanlı dönemine ait birçok eserle beraber, Mimar Sinan tarafından yapılan birçok esere ev sahipliği yapar.

2 numaralı odak, Üsküdar-Ümraniye-Çekmeköy metro hattı ve metrobüs hattının Altunizade durağına, birçok iş merkezine ve şirket merkez ofisine ve Üsküdarın merkezine ulaşan en önemli kavşak noktasıdır. Aynı zamanda yaklaşık 50 yıldır Avrupa yakasına geçişte kullanılan boğaz köprüsüne erişim sağlanır.

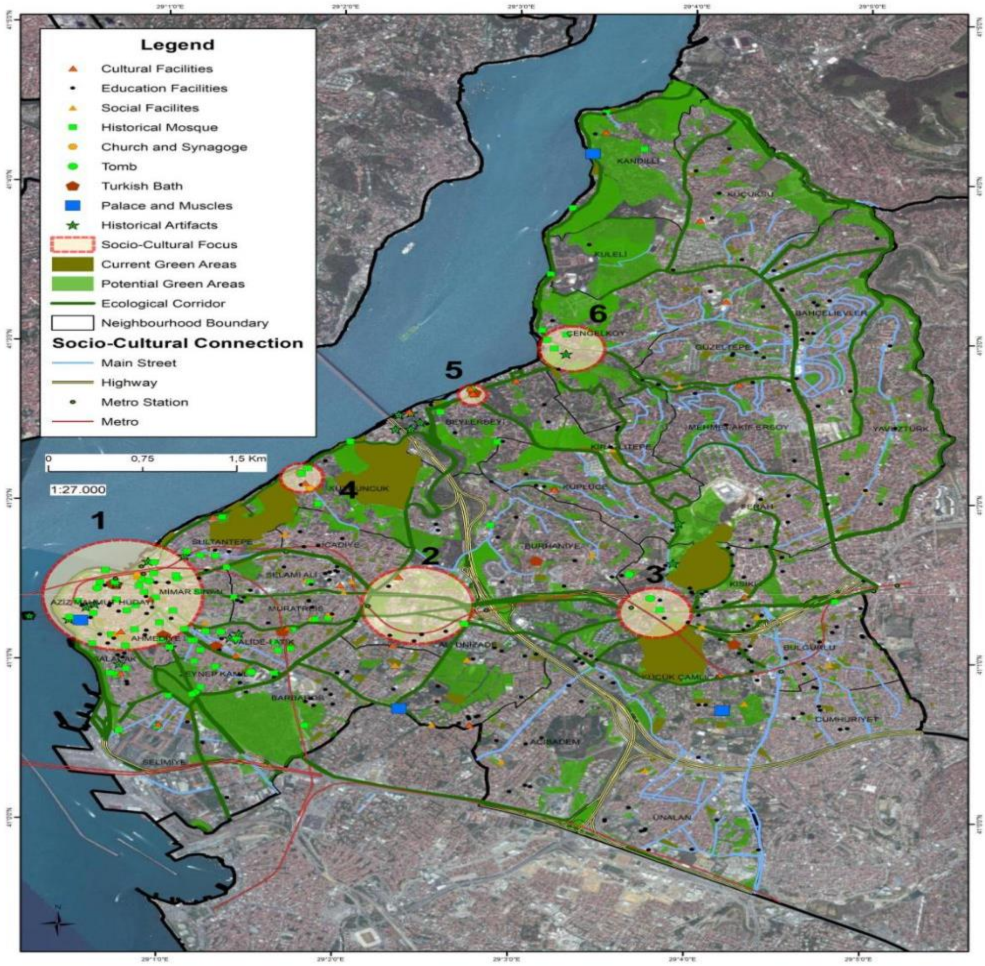
3 numaralı odak, Üsküdar-Ümraniye-Çekmeköy metro hattının Kısıklı durağına ev sahipliği yapar. Ümraniye ve Şile ilçelerinin Üsküdar ve boğaz köprüsüne bağlantısı için önemlidir. Kuzeyinde bulunan büyük çamlıca korusu İstanbul’da yaşayanlar için önemli bir rekreasyon ve manzara balkonu olma özelliğini taşır. Osmanlı dönemine ait tarihi yapıları yakın çevresindedir.

4 numaralı odak, Kuzguncuk bölgesini içine alır. Bu bölgede toplumsal hoşgörünün en önemli örneği olan Cami, Kilise ve Sinagog birbirine çok yakındır. Ayrıca tarihi konutları, güneybatısındaki Fethipaşa Korusu, güneydoğusundaki Nakkaştepe Kent Parkı Üsküdar içinden ve dışından birçok insanın uğrak noktasıdır. Üsküdar merkezden boğaz köprüsüne ve boğaz hattının devamı için tercih edilir. Ayrıca çevresinde Paşa Limanı İskelesi bulunur.

5 numaralı odak, Beylerbeyi bölgesini içine alır. Bu bölgede Beylerbeyi Sarayı, Beylerbeyi Camii gibi tarihi yapılar bulunur. Ayrıca doğusunda bulunan bölgelerin ulaşımı için kullanılan bir alandır.

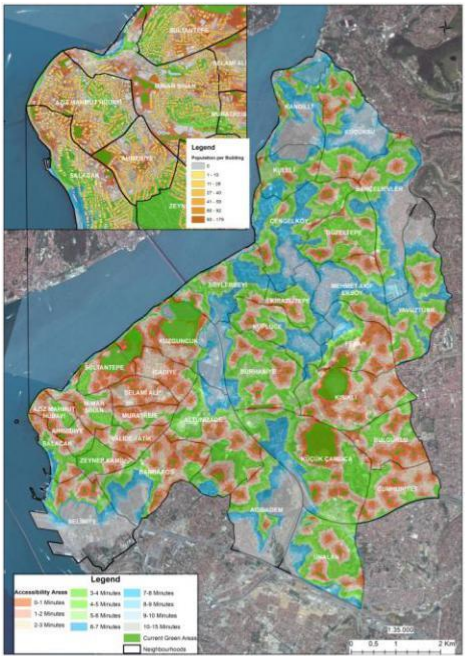
6 numaralı odak, Çengelköy bölgesinin içine alır. Tarihi yapılar, konutlar bulunur. Deniz ulaşımı ve boğaz hattı ulaşımı için önemli bir duraktır. Kuzeyinde bulunan boğaz manzarası, yalıların bulunduğu Kuleli ve Kandilli bölgeleri yakın bir çevresinde bulunur.

Yeşil altyapı sisteminde gerek analitik verilerin üretildiği ve yorumlandığı peyzaj yapı analizi sonuçları, arazi gözlemleri ve ilgili kurum, kuruluş ve kullanıcılarla yapılan görüşmeler ışığında Üsküdar ilçesine yönelik yeşil alt yapı sistemi kurgusu oluşturulmuştur (Şekil 6).



Şekil 6. Üsküdar ilçesi yeşil alt yapı kurgusu

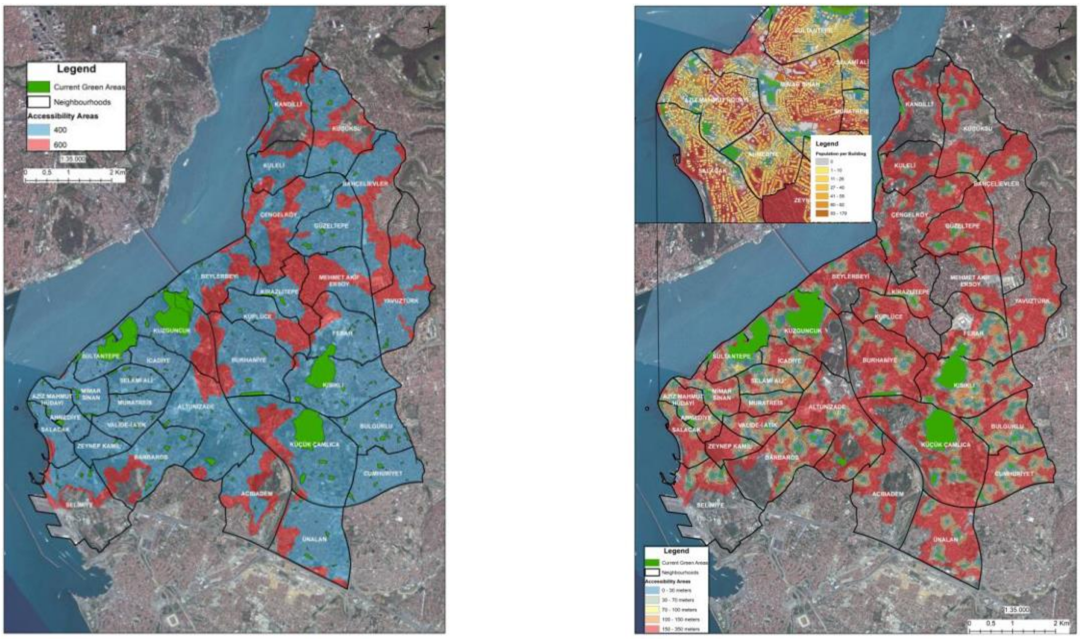
İlçede oturan kişi sayısı ve yeşil alanların erişilebilirliği değerlendirildiğinde, toplam nüfusu 529145 kişi olan yerleşim alanın %14,7 si 1 dakikalık mesafe içerisinde bulunmaktadır. %2,8'i ise 10 dakikadan daha uzun bir zamanda yeşil alanlara erişmektedir (Şekil 7).



YÜRÜME SÜRESİ DAKİKA	BİNA SAYISI	OTURAN SAYISI
0 - 1	5568	77923
1 - 2	7639	107160
2 - 3	7686	103919
3 - 4	5640	70617
4 - 5	4597	56500
5 - 6	3194	29666
6 - 7	2251	20241
7 - 8	1783	17804
8 - 9	1489	15972
9 - 10	1320	14145
> 10	970	15198

Şekil 7. Binalarda oturan kişi sayısına göre yeşil alanların erişilebilirliği

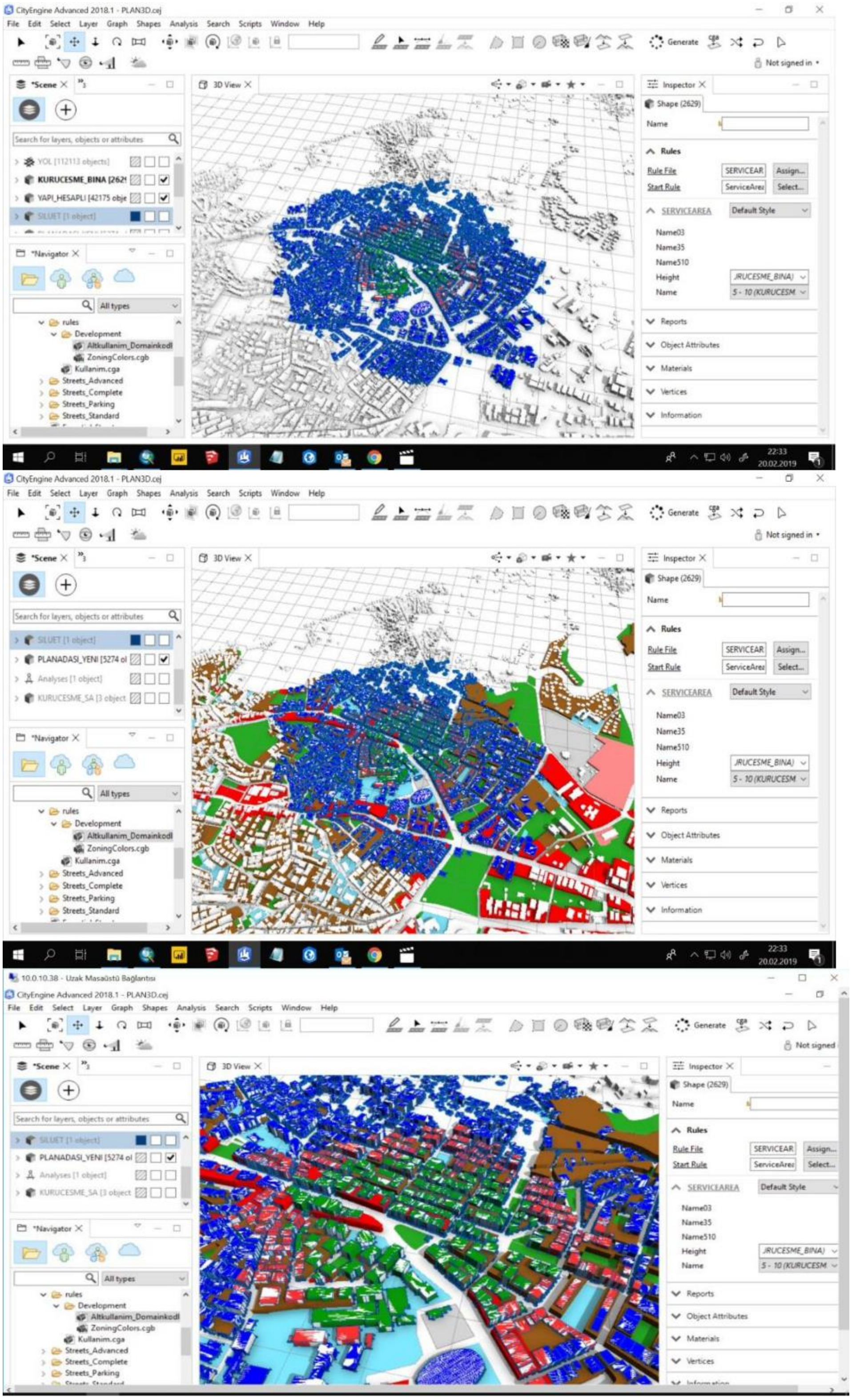
Üsküdar ilçesinin toplam alanı35,2 km^2'dir. Bu alanın % 71'ı 400 m erişim mesafesi dikkate alındığında ulaşılabilirken, çocuk oyun alanları için 30 m erişim mesafesi % 7'dır (Şekil 8).Erişilebilirlik durumu 3 boyutlu imar planlarında da işlenmiştir (Şekil 9).



Erişilme mesafesi (m)	Kapladığı Alan (m^2)
0–400	25065030
400 – 600	7071859

Erişilme mesafesi (m)	Kapladığı Alan (m^2)
150 – 350	15039877,36
100 – 150	3679415,311
70 – 100	2026575,83
30 – 70	2365746,977
0–30	2253960,975

Şekil 8. Park ve çocuk oyun alanları için erişilebilirlik mesafeleri



Şekil 9. 3 boyutlu imar planlarında erişilebilirlik

SONUÇ VE TARTIŞMA

Üsküdar ilçesinin imar planına göre, toplam 10641157,1 m^2 yeşil alan bulunmaktadır. Bu veriler değerlendirildiğinde, kişi başına düşen açık ve yeşil alan miktarının 20,11 m^2/kişi olduğu hesaplanmıştır. Mevcut durum değerlendirildiğinde, aktif park alanı 3,13 m^2, yeşil alan varlığı ise kişi başına 11,42 m^2 düşmektedir. Yeşil alanların mekansal bütünlüğünün sürekliliğinin sağlanması ve kesintisiz bağlantının gerçekleştirilmesi amacıyla bütüncül bir planlama yaklaşımı ile yeşil alt yapı sistemi oluşturulmuştur.

Üsküdar İlçesi'nin toplam alanı 35,2 km^2 'dir. Yeşil alanların erişilebilirliği 400 m olarak düşünüldüğünde bu alanlara %71 oranında ulaşılabildiği, çocuk oyun alanları erişilebilirliği 30 m olarak değerlendiğinde ise %7 oranında erişim sağlandığı belirlenmiştir. Üsküdar'ın %78'inin parklara 5 dakikadan daha kısa sürede erişebildiği tespit edilmiştir.

İlçe merkezinde yeşil alt yapı sisteminin oluşturulması için, ekolojik koridorların kesiştiği alanlar ile diğer yeşil alanlar ile birleştirilmiştir. Yeşil alanlar yeşil yol ağaçlandırması ile birleştirilerek, kent merkezinde yer alan ekolojik ve sosyo kültürel odakların uygun genişliğe sahip caddelerin ağaçlandırılması ile yatay ve dikey yeşil akslarla birbirine bağlanarak çizgisel bir form kazandırılmıştır. Yeşil alan miktarının yetersiz olduğu mahallelerde, çatı ve dikey bahçe uygulamalarına yer verilmelidir. Kamu ve eğitim bahçeleri farklı tasarımlar ile kullanım süresi artırılabilir.

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EMPLOYMENT POTENTIAL IN THE SECTOR OF VIRTUAL REALITY AND AUGMENTED REALİTY FOR OUR COUNTRY

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ABSTRACT

Virtual reality is a technology that senses the phenomena of the physical world, interacting with us in a virtual environment . Augmented reality can be expressed as the use of virtual reality in the real world through virtual objects. In this way, virtual reality technology through the virtual world and real-world simultaneous work with each other medicine, education, entertainment, architecture, research, etc. many areas of software and programming through the new professional fields have revealed. Growing by 72 percent in 2017, the augmented and virtual reality consumer market reached a value of $3.2 billion according to analytics firm IHS Markit. In the same report, it is predicted that the use of the global virtual reality (VR) market in terms of applications and content will increase from 28 million to 75.7 million by 2021 and accordingly the market size will increase to $ 5.9 billion. Similarly, in the report prepared by the Ecorys research firm, the VR & AR market in Europe will increase steadily and the total production value is expected to be between 15 billion euros and 34 billion Euros, and by 2020 it is expected to do directly or indirectly between 220.000-450.000 jobs. In this paper, virtual reality and software industry in Turkey's current status and future employment situation in this sector it is explained.

Keywords: Virtual reality, augmented reality, employment potential

ENTERING

Virtual reality is a developed technology which has lived that perception of reality simultaneously in a cyber platform by computer, gaming, console, smartphone etc. devices. Whereby augmented reality has included the individual's own physical movement using voice,video and graphic visuals in cyber world, it wakes a feeling and an impact like physical environment on an user.The basis of virtual reality (VR) technology is based on the Sensorama produced by Morton Heilig in 1956.Sensorama had provided to us the feeling of 3D reality for the first time.The virtual reality (also known as the Sward of Damocles), which was used in 1968 by the head-mounted display produced by Ivan Sutherland, began to be used in various fields in many occupational groups with the changing world and the changing physical phenomena.At the same time health, education, military, architecture and etc. many professions were incorporated into technology and created new jobs in these areas.Virtual reality technology, which shows itself mostly in computer games in the world market, provides convenience to today's world with time and experience especially in areas where experience is risky or high costs are required.In this respect, military and military aircraft training and war simulation, parachuting training, forensic medicine and wound detection, surgical training in surgery, astronauts space walk simulation, pre-prototype of projects to be applied in engineering (infrastructure, road, bridge, and car design, production in the cinema and advertising sectors, production stages in factories,psychological disorders, eating disorders, stress and phobia are also used in the treatment of diseases such as[5].However, it has an active field of use with applications created via smartphones through augmented reality technology.For example, the PokemonGo mobile gaming application, an augmented reality application, generated $ 2 billion in 811 days from its launch in 2016[8].

Besides, the development of the digital economy plays an important role in the development of the virtual reality sector. Since industrial revolution, production, industry, education, health and so on. technology, which will bring innovation in many areas, is also referred to as the virtual reality revolution.Virtual reality technology brings employment in three areas: hardware, software and content creation.The virtual reality and augmented reality market, which has a multi-billion-euro market expectation in the context of European Union countries, is also the area of income for many firms.According to look at European companies working in this field;

OPTIS (FR) one of their clients in the automotiveindustry reduced the physical prototypes from 30 to 7 real prototypes complemented by VR 3D models, thus having a significant effect on cost reduction. A number of established companies are active in 3D visualisation withVR, offering solutions with different methods (photography, virtual imaging), functions (levelof interactivity with the content), quality andcosts. Some big companies actively offer such solutions for engineering and manufacturing, such as Fraunhofer (DE), Lumiscaphe (FR), ZeroLight (UK), TechViz (FR), Immersion (FR), PS-Tech (NL) and Light & Shadows (FR). When we look at the company practices in Europe, Jungle VR (FR), CLARTE(FR), Saint-Gobain (FR) and Antycip Simulation (UK) create such trainings and simulations. The Industrial group Bouygues (FR) uses immersive technologies to transform and upgrade construction processes, but also to view real estate property. Dreamplex (PL) combines VR with 3D printing to trulyemerge a client into their real estate or architecture presentation. IKEA has also created the "IKEA virtual reality kitchen experience", made in collaboration with Allegorithmic (FR). Cityscape VR (UK), opusVR (DE), NeutralDigital (UK), TruVision VR (UK), VMI Studio (UK), and Kaouenn Studio (FR) are just some of the companies enabling architects, interior designers, property developers and their clients to immersethemselves in creations throughout different stages of the design process, and so allowing them to get a better feel of what the model could look like once finished. ZEISS (DE) also focuses on VR hardware for manufacturing and produces VR lenses. Timescope (FR) and Realtime Robotics (FR), create hardware for exploring cultural content in VR [2].

As we looked the state of virtual reality technology in the world market,growing by 72 percent in 2017,the augment and virtual reality consumer market reached a value of $ 3.2 billion according to analytics firm IHS Markit.Projected growht estimates the VR global install base will rise from 28 million to75.7 by 2021,and that revenues will reach $ 5.9 billion[7].Similarly, in the report prepared by Ecorys research firm,it is expected that VR & AR markets, which are expected to grow steadily in Europe and around the world, will have a total production value of 15 billion euros and 34 billion euros in terms of software, hardware and content, and will directly or indirectly employ 220,000-450,000 people by 2020[2].

In the report prepared by the Munich Technical University Strategy and International Management Unit; According to Deutsch Bank research data, the augmented reality market is estimated to be 7.5 billion euros by 2020, while it will be 500 million euros in 2015.The VR & AR global market is expected to grow up to $ 80 billion by 2025, and the market is expected to be $ 182 billion by 2025 if it rises fast. (Goldman Sachs,2016). In the report, it is stated that VR & AR technologies will increase between the years 2020 -2040 and it will be the technology of the future considering the 41 industrial areas. In addition, in 2016, VR hardware devices sold 11.2 million units worldwide [3].

Virtual reality technology in Turkey, a virtual reality laboratory established in Bahcesehir University which is a private university and companies such as Vizera Labs, Pandora, Hangaar Lab, Blippar Türkiye, Arox Bilişim, Codemodeon, SpaceWalkerVR, Monolab, Yeti Interactive, Hologram LTD.C,VrOtto started to take the first steps of this technology in our country with its works similiar to earth in the fields of shopping, museums, games, education, architecture, cinema, construction, interior architecture, industrial education, medicine, occupational safety and health.In addition, the virtual reality gaming cafes in Istanbul, Ankara and Eskisehir serve to those who want to experience virtual reality technology.

New technologies lead to radical transformations in all areas, leading to the collapse and destruction of old technologies and companies, sectors and even economies that cannot realize this transformation. This process affects all economies in the World.It is imperative to develop new strategies and policies at the company and country level in order to minimize the destructive effect of benefiting from the p ositive aspects of the process. (TUSIAD,2018)

Implementation of new technologies is possible with a new digital conversion. Human resources is the most important factor in order to realize digital transformation.

According to Tüsiad's 2018 report;

In the last 15 years, there has been a sector programming (software) sector which has the most positive and significant development among digital technology sectors. Employment and value-added in the software sector increased rapidly and regularly since 2004. At the same time the proportion of total employment of information technology professionals in Turkey in 2016 according to OECD data is at the level 1,06%. This ratio is 6.24% in Finland, employing the highest number of ICT experts in OECD countries, with an average of 3.64% and proportional. If Turkey's international economy in the OECD average computing in order to maintain the current position is assumed to need to employ experts, when based on current employment level of employment 484 000.Additional information specialist is needed.

If the realization of the potential of digital technologies and Turkey to Finland in order to capture a sustainable growth pace above average assumed to be achieved and the information specialist employment rate in 2016, the IT specialists deficit rises to nearly one million people.

More than half of this gap consists of professional staff of Information Communication Technologies. According to the data of the Higher Education Institution, in 2016 only 665 people received a bachelor's degree in these fields. In the same year, the number of engineers graduating in the fields of electronics and automation is 15,435 and the number of graduates of all departments of engineering and architecture is 59,137.If all the architectural and engineering graduates since 2016 employ as "information and communication professionals" they even reach the OECD average of Turkey in case of employment will last more than 8 years.As the software sector is a sector that includes low investment, high employment and high added value, the virtual reality technology which has not yet demonstrated its effectiveness for our country constitutes an innovative area to provide employment in the field of information communication Technologies[1].

The virtual reality and the augmented reality market constitute a great employment potential in terms of content creation, application development, as well as mobile application development for occupational groups, given the above mentioned market value changes. As it is understood from the statistics mentioned above, employment is needed in this field and meeting this need carries great potential for our country where middle income level is discussed. In the era of digitalization, virtual reality technology will both raise our economy and mobilize our national software industry in domestic and world markets. Virtual reality technology of the future technology will add new horizons to the World. In the words of Ivan Sutherland; with appropriate programming such a display could literally be the wonderland into which Alice walked.

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THE USE OF VIRTUAL REALITY IN CULTURAL LANDSCAPES

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ÖZET

Teknolojinin ilerlemesiyle birlikte, birçok alanda bilginin kullanımına yönelik yeni anlayışlar ve yöntemler geliştirilmiştir. Özellikle içinde bulunduğumuz Bilgi Çağında, daha az yoruma yer verilirken, nitelik olarak sınırları olmayan imgeler temel alınmaktadır. Bu bağlamda teknolojinin bugün geldiği noktada arkeoloji bu olanaklardan en çok faydalanan bilim dallarından biri olmuştur. 1930'lu yıllara kadar daha çok doğal gözlemlere dayanan ve tanımsal olarak kayıtlarda yer bulan arkeoloji ve teknolojinin etkileşimi, bu yıllardan itibaren bilgisayarların hayatımızda var olması ile birlikte veri depolama ve analiz imkânı sunma kolaylıkları sayesinde önemli bir gelişim sürecine girmiştir. Hızla ilerleyen teknoloji sistematik, kurallara bağlı ve varsayıma dayalı teoriler gelişmesine olanak tanımış; bu sayede arkeolojide modelleme ve simülasyon, görselleştirme, Coğrafi Bilgi Sistemleri, yapay zeka ve webography önemli kullanım alanları haline gelmiştir. Günümüzde başvurulan bu yöntemler ışığında yüzey araştırmaları ve kazı verilerinin değerlendirilmesi ile müze ve arkeolojik değere sahip ören yerlerinin ziyaretçilere sunumunda teknolojik ve görsel kolaylıklar sağlanmaktadır. Bu teknolojilerin başlıcalarından olan sanal gerçeklik teknolojisi, geçmiş-gelecek etkileşimini ziyaretçilere hızlı bir şekilde yansıtmanın kolay bir yolu olduğu gibi, gerçeğe yakın görüntüler ve ses efektleri ile de algılama kolaylığı sunmaktadır. Böylelikle geçmişe duyulan merak, ilgi ve farkındalığın artması ile doğru orantılı olarak kültürel miras değerlerinin korunması ve sürdürülebilirliği konularında da bilinçlilik seviyesini yükseltmektir. Bu araştırmada, gelişen teknolojinin bir ürünü olarak sanal gerçekliğin arkeoloji biliminde edindiği yer ve gelişim sürecinden bahsederek, arkeolojik değere sahip kültürel peyzajlar üzerindeki etkisi örnekler üzerinden incelenerek değerlendirilmektir. Bu sayede, kültürel miras alanları olarak kabul edilebilen peyzajların korunması, sürdürülebilirliği ve gelecek nesillere aktarılabilmesi açısından farkındalık oluşturulması amaçlanmıştır.

Anahtar Kelimeler: Sanal Gerçeklik, Kültürel Peyzaj, Peyzaj Tasarım, Kültürel Miras, Yeniden Yapılanma.

ABSTRACT

Along with the advancements in technology, new approaches and methods have been developed for the utilization of information in many fields. Especially in the information age, based on less comments, as attribute is based on unlimited images. In this context, archeology has become one of the most benefiting disciplines of technology today. The interaction between archeology and technology, which was based on natural observations until 1930s and

was included in the records with definitive definitions, entered into a significant development process thanks to the convenience of computers in our lives as well as data warehousing and analysis opportunities. Rapidly advancing technology has enabled the development of systematic, rules-based and hypothetical theories; In this way, modeling and simulation in archeology, visualization, Geographic Information Systems (CBS), artificial intelligence and webography has become important areas of use. In the light of these methods applied today, the surveys and excavation data are evaluated, and technological and visual conveniences are provided in the presentation of the ruins with museums and archaeological sites to the visitors. The virtual reality technology, which is one of these technologies, is an easy way to reflect the past-future interaction to the visitors quickly, and offers ease of detection with realistic images and sound effects. In this way, the level of awareness, awareness and awareness of the past to be directly proportional to the protection and sustainability of cultural heritage values is to increase the level of awareness. In this research, the effect of virtual reality on archaeological science as a product of developing technology and its development process, and its impact on the cultural landscapes with archaeological value are examined through examples. In this way, it is aimed to create awareness in terms of preservation, sustainability and transfer to future generations of landscapes which can be considered as cultural heritage areas.
Keywords: Virtual Reality, Cultural Landscape, Landscape Design, Cultural Heritage, Reconstruction.

1. GİRİŞ

Günümüz araştırmalarında, kentsel, sosyal ve kültürel alanlardaki pek çok gelişme yeniden doğuş olarak değerlendirilmektedir. Aynı zamanda internet ve teknolojinin sunduğu imkânlar aracılığı ile oluşturulan sanal yerleşmeler de kültürel miraslara dair tarihsel gerçekliği biçimlendirmektedir. Bu bağlamda zengin tarihi ve kültürel verilere sahip olan arkeolojik sit alanlarının, insan yaşamının izlerini taşıyan geçmişin önemli bilgi kaynakları olarak teknolojik imkânlardan faydalanarak sanal ortamlarda yorumlanması ve sunulması büyük öneme sahiptir. Kültür ve Tabiat Varlıklarını Koruma Yüksek Kurulu'nun 5.11.1999 gün ve 658 sayılı ilke kararına göre arkeolojik sit; "İnsanlığın varoluşundan bugüne kadar ulaşan eski uygarlıkların yer altında, yer üstünde ve su altındaki ürünlerini, yaşadıkları devirlerin sosyal, ekonomik ve kültürel özelliklerini yansıtan her türlü kültür varlığının yer aldığı yerleşmeler ve alanlardır" olarak tanımlanmıştır. Arkeolojik sit kavramının yerleşmesi ile geniş arkeolojik alanların sınırları çizilerek yasal olarak korunmalarına olanak veren düzenlemeler getirilmiştir. Çağdaş toplumlarda tarih bilinci ve kültürel belleğin oluşması kültürel mirasın sürekliliğine dayanmaktadır. Kültürel mirasın sürekliliği ise, öncelikli olarak mirasın korunması ve topluma aktarımı ile sağlanabilmektedir. 2008 yılında ICOMOS'un hazırladığı "Kültürel Miras Alanlarının Tanıtımı ve Sergilenmesi" tüzüğünde kültürel varlıkların sergilenmesi, topluma tanıtılması ile ilgili temel ilkeler tanıtılmıştır. Bu bağlamda arkeolojik alanların sergileme yaklaşımları kapsamında sanal gerçeklik kavramı son dönemlerde sıklıkla gündeme gelmektedir.

Tarihsel değere sahip pek çok kent ve yerleşim alanının interaktif şekilde yapılandırılması, hızla gelişen bilgisayar teknolojileri bilginin önemi ve kullanımı konusunda yeni anlayışların ortaya çıkmasına olanak sağlamıştır. Bilgilerin toplanması, depolanması, analiz edilmesi ve kullanıma sunulması bilginin ileriye dönük sağlayacağı avantajlar nedeniyle önemli olmaktadır. Yeni teknolojilerin yorumlanması, gelişen teknolojiler ile birlikte son yıllarda ortaya çıkan en önemli sorunlardan biridir. Bilginin elde edilmesi yanında doğru bilginin, doğru yere, zamanında, hızlı, güncel, tam ve bir bütün içinde sunulması gerekmektedir. Sanal eğitim ya da sanal gerçeklik bu konuda 1990'ların en önemli gelişmelerinden birisini oluşturmaktadır. Sanal eğitim fikir aşamasında dahi insanların görüş açılarını değiştirmiş, popüler kültürde yerini bulmuştur. Günümüzdeki teknolojik araştırmalarda sanal gerçeklik çok önemli pozisyonlar bulmaktadır. Bu alanda ne yapabileceği, nasıl kullanılabileceği ve nasıl kullanıldığı ise son yıllarda önem kazanmıştır.

Bilişim teknolojilerinin bugün geldiği noktada ise sanal mekânların yaratılması gerekliliği ve yöntemleri ile ilgili çalışmalar hız kazanmıştır. Bununla birlikte sanal mekânların gelişiminde olumlu ve olumsuz iki farklı sonuçtan bahsetmek mümkün olmaktadır. Olumsuz sonuçta, yeni teknolojinin sosyal ve mekânsal izolasyona yol açan etkileri yer almaktadır. İnsanlar sanal mekânları gerçek kentlere tercih etmektedirler. Olumlu sonuca göre ise sanal kentler, gerçekte tahribe uğramış kentler üzerinde tamamlayıcı özelliğe sahip olmaları sebebiyle, araştırmalar ve kalıntılar sonucunda edinilmiş bilgiler ışığında birbirinden kopuk sosyal ve coğrafi parçalarını sanal olarak birbirine bağlamak mümkün olmaktadır.

Sonuç olarak bu araştırma, sanal gerçeklik teknolojisinin önemli kullanım alanlarından alanlarından olan arkeoloji ile etkileşimi ve arkeolojik değere sahip kültürel miras alanlarındaki uygulamalarına dünyadan ve Türkiye'den örnekler vermeyi amaçlamaktadır. Bu doğrultuda, arkeolojik sit alanlarını içeren kültürel peyzajların korunması, sürdürülebilirliği ve gelecek nesillere aktarılabilmesi açısından farkındalık oluşturulması hedeflenmiştir.

2. SANAL GERÇEKLİK VE ARKEOLOJİ DİSİPLİNİNDE KULLANIMI

İnsanlığın geçmişten günümüze yaşadığı tüm gelişmeleri ve izleri gün yüzüne çıkararak, gelecek nesillere koruyarak ve yorumlayarak aktarmayı hedefleyen bilim dalı arkeolojinin teknoloji ile etkileşimi M.Ö. 150-100 yıllarına dayanmaktadır. Buna göre, teknoloji alanındaki belki de en önemli donanımız olan bilgisayar, 1901 yılında Ege Denizi'ndeki Girit ile Kythera adaları arasındaki Antikytheira adacığı yakınında ele geçen ve yaklaşık 2000 yıl öncesine tarihlenen bronz bir aygıt olarak dünyanın en gizemli arkeolojik buluntularından biri sayılmaktadır (Görsel 1-2).

Görsel 1. Ankhtyera Aygıtı

Görsel 2. Aygıtın Rekonstrüksiyonu

Alman filolog ve epigraf Albert Rehm, 1905 yılında, buluntunun astronomik olaylarla ilgili bir hesaplama aleti olduğunu ilk anlayan kişi olmuştu. Nitekim Rehm'den sonraki tüm bilim adamları, ayrıntılardaki bazı farklı fikir ayrılıkları dışında, Antikytheira Aygıtı'nın İ.Ö. 150 ile 100 yılları arasında Yunanlı bilim adamları tarafından, ay ve gezegenlerin pozisyonlarını önceden tahmin etmek üzere yapılmış bir analog astronomi bilgisayarı olduğu konusunda birleştiler.

Günümüzde ise teknolojinin geldiği noktada, önemli özelliklere sahip bilgisayar donanımları ve bilişim sistemleri, arkeolojinin daha iyi yorumlanması ve arkeoloji bilim dalına ait uygulamaların nesiller tarafından anlaşılırlığının artmasında büyük önem teşkil etmektedir. 1930'lu yıllara kadar daha çok doğal gözlemlere dayanan ve tanımsal olarak kayıtlarda yer bulan arkeoloji ve teknolojinin etkileşimi, bu yıllardan itibaren bilgisayarların hayatımızda var olması ile birlikte veri depolama ve analiz imkânı sunma kolaylıkları sayesinde önemli bir gelişim sürecine girmiştir. Zamanla kurallara ve varsayıma dayalı teorilerin gelişmesi ile simülasyonlar, uzaktan algılama, coğrafi bilgi sistemleri ve yapay zeka önemli kullanım alanları haline gelmiştir.

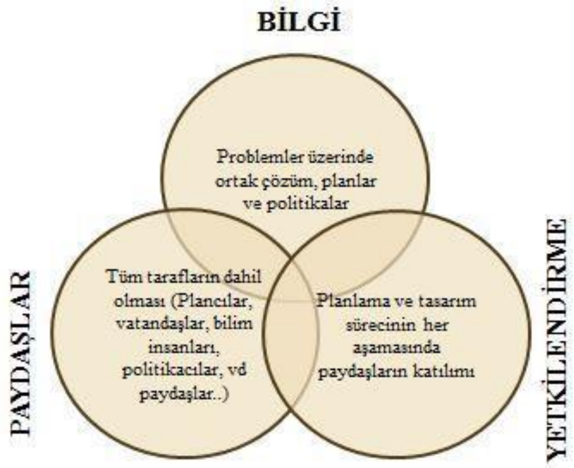
Günümüzde başvurulan bu yöntemler ışığında yüzey araştırmaları ve kazı verilerinin değerlendirilmesi ile müze ve arkeolojik değere sahip ören yerlerinin ziyaretçilere sunumunda teknolojik ve görsel kolaylıklar sağlanmaktadır. Bu teknolojilerin başlıcalarından olan sanal gerçeklik teknolojisi, geçmiş-gelecek etkileşimini ziyaretçilere hızlı bir şekilde yansıtmanın kolay bir yolu olduğu gibi, gerçeğe yakın görüntüler ve ses efektleri ile de algılama kolaylığı sunmaktadır.

Geliştirilen bu yöntemler sayesinde teknoloji ve sanal gerçeklik uygulamaları arkeolojinin önemli bir ihtiyacı haline gelmiştir. Dolayısıyla yüksek gerçekliğe sahip simülasyon teknolojileri son zamanlarda kültürel peyzajlara yönelik görsel araştırmalarda odak noktası olmuştur. Bunun önemli bir nedeni; Gerçek dünyada karmaşık ve çok sayıda parametresi olan bir alanın, tümüyle taranması ve yeniden inşası gereksiz ve gerçekçi olmayacaktır. Yeniden canlandırmada ise belirli içerikler, nesneler ve seviyelere gereksinim duyulmaktadır. Örneğin; kültürel kalıntıların korunmasında, gerçekçi bir modelleme için modelin geometrisi ve dokusu önemlidir. Amaç turizm hacminin genişlemesi ise görsel değerlere sahip manzaralara ait özelliklerin tanımlanması önemli bir gereksinimdir.

Bilgi teknolojileri (IT) ve bilgi ve iletişim teknolojileri (ICT) alanında gelişen bir disiplin olan sanal gerçeklik, farklı bilimler arasında etkileşim için bir platform oluşturmaya, planlama, koruma ve kullanma politikalarında karşılıklı öğrenme ve şeffaflığı desteklemeye, farklı taraflar ve disiplinler arasında güçlü ortaklıklar kurmaya önemli ölçüde katkıda bulunmaktadır. Bu yönüyle sanal gerçeklik, geleneksel bir problem çözme yaklaşımından çok, farklı taraflar arasında katılımcı planlaması yapılmasına yardımcı olur. Şekil 1, katılımcı planlamanın temel unsurlarını göstermektedir.

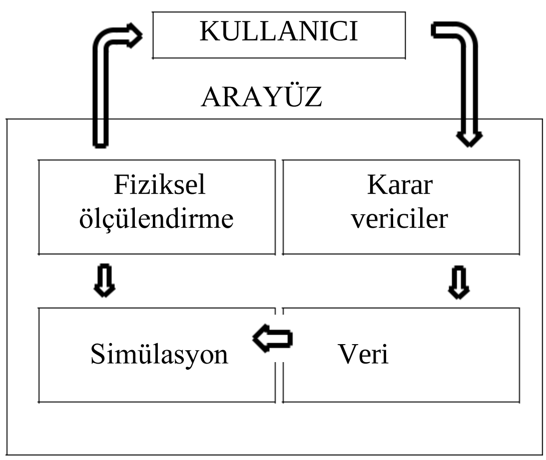
Arkeolojik sit alanlarında koruma öncelikli sürdürülebilir yaklaşımların benimsenmesinin sonucu olarak kültürel peyzajlarda planlama çok paydaşlı bir sürece gereksinim duymaktadır. Şekil 1'in gösterdiği gibi, katılımcı planlama, plancılar, vatandaşlar, bilim insanları ve politikacılar dâhil olmak üzere çeşitli taraflar arasındaki aktif etkileşim yoluyla karar alma ve politika oluşturmanın ortak meselelerde gerçekleştiği, planlama konusunda yeni bir politik yaklaşım ortaya koymaktadır.

Bu nedenle, yalnızca sorun çözme üzerine odaklanmak yerine, katılımcı planlama esas olarak karşılıklı öğrenmeyi, ortaklıkların kurulmasını ve paydaşların güçlendirilmesini destekleyen bir etkileşim platformundan oluşur. Aynı zamanda, karar vermenin ilk planlama sonucunun taslağından daha fazla vurgulandığı kolektif bir analiz, öğrenme ve politika eylemi sürecidir.



Şekil 1. Katılımcı planlamanın temel boyutları (Jamei, 2017).

Sanal gerçeklik yoluyla veri görselleştirmesi, daha sonra belirli bir topluluğun spesifik ihtiyacını en iyi karşılayan planlama kararlarını belirleyen topluluklar, planlamacılar ve paydaşlar için farklı görüşler, seziler, vizyonlar ve deneysel bilgiler hakkında yeterli bilgi sağlar (Şekil 2). Aynı zamanda sanal gerçeklik yoluyla veri görselleştirme, topluluğun ve paydaşların faydalanacağı karar verme sürecinde sorumlulukların paylaşılmasını içerir.



Şekil 2. Sanal gereçklik katılımcı planlama sistemi öneri şeması (Jamei, 2017).

3. KÜLTÜREL PEYZAJLARDA SANAL GERÇEKLİĞİN KULLANIMINA ÖRNEKLER

Sanal gerçeklik uygulamalarının materyali olan kültür varlığının türü, uygulamanın kullanım amacı ve kullanıcı profili, uygulamada kullanılan donanım, yazılım ve sistemler, kültürel miras alanında yapılan sanal gerçeklik uygulamalarının çeşitlilik göstermesindeki başlıca etkenlerdir. Bu alanda yapılan çalışmaların asıl hedefi kültürel mirasın korunması, yaşatılması ve aktarılması olsa da izlenen yol ve yöntemler farklılık göstermektedir. Örneğin bir sanal gerçeklik uygulaması, konunun uzmanı olmayan kişiler için deneyim ortamı sunarken, diğer bir uygulama uzmanlar için bilimsel analiz ortamı sağlayabilmektedir.

2011 yılında arkeologlar tarafından Avusturya'daki Tuna nehri kıyılarında keşfedilen bir Roma gladyatör okulu olan Rome Gladiators School (Carnuntum/ Antik Roma), sanal gerçekliğin kültürel peyzajlarda kullanımına gösterilebilecek önemli bir örnektir. Araştırmanın yayınlandığı makaleye göre, Ludus (eski Roma'da gladyatör yetiştiren okullara verilen isim) yüzeyde çok az görülebilecek bir alanda tespit edilmiştir. Tespitin ardından yapılan çalışmalarda Roma'daki Colessium'un arkasında bulunan ünlü Ludus Magnus'a rakip olacak büyüklükteki bir alanı kapsadığı anlaşılan kalıntılar, gelişmiş hava görüntüleri ve yer radarı kullanılarak haritalanmıştır (Görsel 3-4).

Görsel 3-4. Rome Gladiators School sanal gerçeklik çalışmaları.

Vlahakis ve arkadaşlarının (2002) geliştirmiş oldukları ArcheoGuide projesi bu bağlamdaki özgün çalışmalardandır. ArcheoGuide adından da anlaşılacağı üzere arkeolojik sit alanlarında kişiye özgü rehberlik sunmaktadır. İlk prototip için, çalışma alanı olarak Yunanistan'ın Olimpiya Antik Kenti seçilmiştir. Olimpiyat Oyunları'nın doğum yeri olması, yüksek ziyaretçi kapasitesi ve mevcut kalıntıların harabe halinde olması Olimpiya'nın seçilmesinde önemli etkenler olmuştur.

Görsel 5'de Hera Tapınağı'na aynı bakış noktasından çıplak gözle bakan bir ziyaretçi yalnızca mevcut kalıntıları görmekte iken; Görsel 6'da, ArcheoGuide kullanan ziyaretçi mevcut yapılı ve doğal çevre içerisinde Hera Tapınağı'nın rekonstrüksiyonunu görmektedir.


Görsel 5. Hera Tapınağı mevcut hali**Görsel 6.** Hera Tapınağı sanal gerçeklik çalışması

Bir proje olarak, arkeologlar, bilişim sistemleri uzmanları ve içerik dağıtımcılarından oluşan dokuz kişilik bir ekiple başlayan bir sanal gerçeklik girişiminin 2015 yılında üzerinde çalıştığı pilot projeler arasında Antalya'nın antik Hadrian Kapısı (Üçkapılar) da bulunmaktadır. Projede yer alan Hadrian Kapısı'na ait sanal gerçeklik örneklemesi Görsel 7'de görülmektedir.

Görsel 7. Hadrian Kapısı (Üçkapılar) sanal gerçeklik çalışması.

4. SONUÇ

Geçtiğimiz yüzyılda öncelikle somut kültür varlıkları, sonrasında ise somut ve somut olmayan kültür varlıkları uluslararası kurumlarca insanlığın ortak mirası olarak değerlendirilmiş ve deklare edilmiştir. Kültürel mirasın korunması, sürdürülebilirliği ve gelecek nesillere aktarılması, ulusal ve uluslararası yasalar, tüzükler ve sözleşmelerle çağdaş toplumların temel sorumlulukları, ülkelerin politikaları arasında yerini almıştır. Koruma ve sürdürülebilirliğe verilen önem ve bu alandaki başarı ise toplumlararası çağdaşlaşmanın bir göstergesi haline gelmiştir (Sürücü, 2016).

Kaybedilen, vandalizm ve bilinçsizlik gibi nedenlerle tahribata uğrayan kültür varlıklarının çokluğu, koruma eyleminin yalnızca yasa(k)lar ile sağlanamayacağını göstermiştir. Sürdürülebilir koruma ve yaşatmanın gerçekleşebilmesi, koruma konusunda farkındalık oluşturmaya ve toplumun bu konudaki bilinçlenmesine bağlıdır. Bu farkındalık ve bilinçlendirme ihtiyacı güncel teknolojilerin kullanımını gerektirmiştir. Bu bağlamda kültürel peyzajlarda yapılacak olan sanal gerçeklik uygulamaları kültürel mirasların anlaşılmasını kolaylaştırarak bilinçlilik düzeyinin artmasına sağladığı katkı ile bu alanların değer kazanmasına imkân sunacaktır.

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SANAL GERÇEKLİK: EĞİTİMDE SANAL GERÇEKLİK YAKLAŞIMLARI VE ELEKTRİK MOTORLARINDA SANAL GERÇEKLİK KULLANIMI

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ÖZET

Bir kullanıcının, bilgisayar destekli ortamlar sayesinde meydana getirilen taklit bir ortamı, teknolojik aygıtlar kullanarak gerçek ortamda bulunma algısını veren ve bu taklit ortamla etkileşim halinde olmasını sağlayan teknolojiye "sanal gerçeklik" denilmektedir.

Bu araştırma makalesinde, son yıllarda eğitim alanındaki sanal gerçeklik kullanımının yaygınlaşmasına, eğitimdeki sanal gerçeklik yaklaşımlarına ve spesifik olarak teknik eğitim veren mekatronik, elektrik, bilgisayar mühendisliği gibi bölümlerde ciddi önem arz eden elektrik motoru kullanımı, tasarımı gibi işlemlerin sanal gerçeklik ile ifade edilme biçimlerine dair bilgiler vermek amaçlanmıştır.

Makale, sanal gerçekliğin eğitim alanında kullanımıyla araştırmaların yanında, sanal gerçeklik ve elektrik motorları hakkındaki literatür çalışmalarının çerçevesini, elektrik motoru tasarımı ve kullanımı için mühendislik fakültelerine kolaylık sağlayacak çalışmaları ele alarak yeni öneriler de sunmayı planlamaktadır. Çalışma, sanal gerçeklik konusunda eğitimde var olan uygulamaları paylaşmanın yanı sıra eğitime yeni bakış açıları kazandırmayı da hedeflemektedir.

Anahtar Kelimeler: Sanal gerçeklik, eğitim, elektrik motoru, elektrik motoru tasarımı ve kullanımı

ABSTRACT

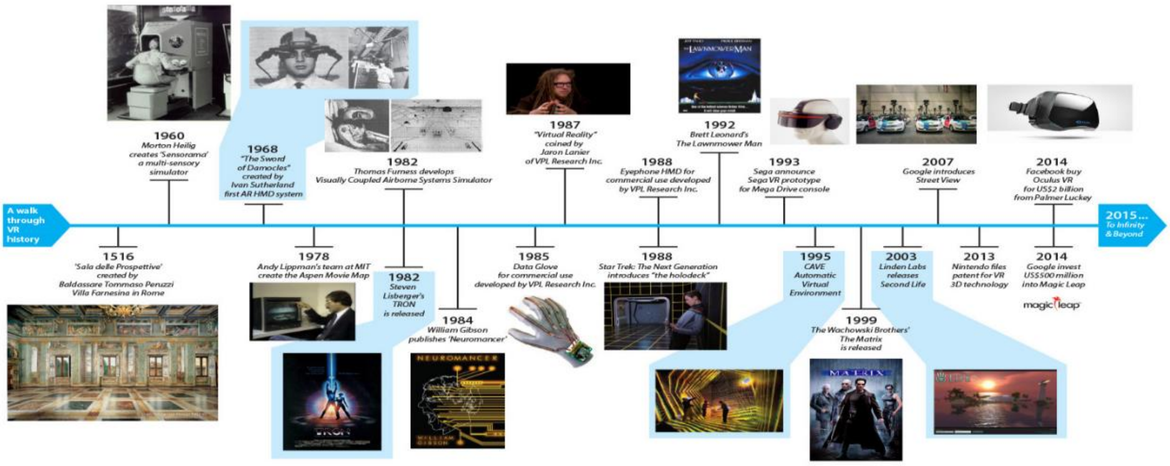
The technology is called virtual reality, which enables a user to perceive being in a real environment using technological devices and interacting with this imitation environment by using a simulated environment created by computer-aided environments. In this research article, in the recent years, the use of virtual reality in education, widespread use of virtual reality approaches in education, and specifically technical education in mechatronics, electrical engineering, computer engineering, such as the use of electric motor usage, design, such as the way in which the virtual reality expression intended to give. In addition to research on the use of virtual reality in the field of education is examined. The paper also aims to present the framework of the literature studies on virtual reality and electric motors, and also to present new suggestions to the engineering faculties for the design and use of electric motors. The study also aims to provide new perspectives on education as well as sharing existing practices in the field of virtual reality.

Keywords: Virtual Reality, Education, Electric Motor, Electric Motor Design and Usage

1. GİRİŞ

1970' li yıllarda Jaron Lenier tarafından ilk defa kullanılan sanal gerçeklik kavramı; var olmayanın, bilgisayar yazılım ve donanımlarını kullanarak oluşturulan üç boyutlu dünya ile etkileşim sağlamamız ile gerçek dünyada algılanabilen nesnelere dönüşmesi amacıyla kullanılmaktadır.

Sanal gerçeklik ile ilgili çalışmalar tarihsel süreçte ilk olarak 16. Yüzyıla dayanmaktadır ve bilgisayar teknolojilerindeki ilerlemelere paralel olarak günümüzde bu teknoloji hızla yayılarak ve gelişerek devam etmektedir[1].



Şekil 1. Sanal gerçeklik tarihçesi [2]

Sanal Eğitimde teknolojinin kullanımı her geçen gün hızlanarak artmaktadır. Bunun nedeni teknolojinin günlük hayatı kolaylaştırdığı gibi, eğitimde anlaşılmayı ve öğretmeyi de kolaylaştırdığını benimseyen kişilerin teşvikidir. Gerçekçi veya hayali bir çevre içerisinde, bir kullanıcının taklit ortamı algılayarak etkileşimde bulunmasını sağlayan sanal gerçeklik teknolojisi, reel dünyayı algıladığı gibi bilgiyi kullanıcı görüş alanına yerleştiren teknolojiyle Artırılmış Gerçeklik ismini almıştır. Artırılmış gerçekliğin bir alt elemanı olan Karma Gerçeklik ise gerçek ve sanal dünyanın algılanan bileşiminin, birbirleriyle etkileşime girebileceği yeni ortamları simüle ederek görselleştirir. Sanal gerçeklik eğitim alanında hem öğrenciler hem de öğretmenler açısından oldukça kullanışlı ve olumlu sonuçlar doğuran teknolojik bir araçtır. Sanal gerçekliğin eğitimde kullanılması eğitmenlerin yükünü ciddi ölçüde azaltmaktadır. Sanal gerçeklik ortamlarında eğitmenler, öğrencilerin keşfetme ve öğrenme yeteneklerini kolaylaştırmayı sağlayan bir figür üstlenmektedir. Öğretmenler, öğrenci sorularını sadece cevaplayan kişiler olmaktan ziyade, öğrencilerin kendi kendilerine keşfetmelerinde ve yeni fikirler üretmelerinde rehberlik yaparlar. Sanal gerçekliğin eğitim alanında kullanılmasının öğrenci açısından pek çok yararları bulunmaktadır [3].

Bu makalenin ana konusu, sanal gerçekliğin eğitim alanında kullanımıyla araştırmaların yanında, elektrik motoru tasarımı ve kullanımı için mühendislik fakültelerine kolaylık sağlayacak çalışmaları ele almak ve bu konuya yeni öneriler ile destekte bulunmak amaçlanmıştır. Bölüm 1'de giriş yapılmış, Bölüm 2'de ilgili literatür taranmıştır. Bölüm 3'te elektrik motoru tasarımı ve kullanımında sanal gerçeklikten bahsedilmiş son bölümde sonuç ve önerilerle makale tamamlanmıştır.

2. SANAL GERÇEKLİĞİN EĞİTİMDE KULLANIMI

Eğlenceden, reklama, tıptan, eğitim alanlarına kadar her alanda teknolojiden faydalanılmaktadır. Sanal gerçekliğin eğitim amacıyla kullanıldığı uygulama alanlarından bazıları şunlardır: İki boyutlu kitaplara üçüncü bir boyut kazandırma, bilişsel bakım ve onarım görevleri hakkında eğitim verme, fizik, kimya, biyoloji gibi alanlarda kavramların üç boyutlu gösterimi ya da sanal laboratuvarlarda deneylerin gerçekleştirilmesinde, mühendislik eğitiminde araçlar ve malzemeler hakkında bilgi ve beceri kazandırma bunlardan bazılarıdır[4]. Teknolojinin eğitimde, özellikle mesleki ve teknik eğitimde kullanımını yaygınlaştırmak amacıyla bu alanda dünyada uygulanan yenilikler fark edilmelidir. Sanal eğitimin mesleki ve teknik eğitimde kullanılması ise yeni bir uygulama sayılsa da bu kullanım gün geçtikçe artmaktadır. Mesleki ve teknik eğitimde sanal eğitim uygulaması: beklentiler ve öğrenci başarısına etkisi üzerine hazırlanan doktora tezi örneğinde, mesleki ve teknik eğitim alan öğrencilerin ve mesleki ve teknik eğitim veren eğitmenlerin sanal eğitimden beklentileri, mesleki ve teknik eğitimde uzaktan eğitim modelinde uygulanan sanal eğitimin öğrenci başarısına etkisini araştırmayı amaçlamıştır. Mesleki ve teknik eğitim alan öğrencilerle nitel araştırma modeli kullanılarak yapılan araştırmada elde edilen bulgulara göre, sanal eğitimle, bilginin uygulamaya konuluşunun gösterilmesi, yapıcı geri besleme, tekrar etmeksizin sorulara cevap verebilme, etkili dönüt, daha çok öğrenciye eğitim olanağı sağlama, zaman ve mekân bağımsızlığı, kesintisiz iletişim, sınıf dışında olması, kendi kendine öğrenme, kolay erişilebilirlik, alıştırma olanağı, örgün olmaması, öğrenci katılımlı olması, az masrafla çok bilgi elde edilebilmesi öğrenci beklentilerini oluşturmaktadır. Öğrencilerin tek olumsuz beklentisi, sanal eğitimin sosyalleşmeyi ortadan kaldırmasıdır [5]. Bu olumlu beklentileri göz önüne alarak teknik eğitim içinde önemli bir yer tutan elektrik, elektrik temelleri, elektrik motorları için sanal ortam kullanılarak eğitime katkıda bulunan çalışmalar incelenmiş ve bir öneri sunulmuştur.

Elektrik temellerinde artırılmış gerçeklik üzerine hazırlanmış çalışmada; elektrik temellerinin ortaokullarda popülerliğinin çok düşük bir seviyede olduğunu kabul ederek, bu alandaki artırılmış gerçeklik teknolojilerine dayanan gelecekteki diğer gelişmekte olan araçların takip etme ilgisini test etmek için farklı uygulamalar geliştirilmiştir. Çalışmada, 12 ile 14 yaş arası öğrencilerle test edilen uygulamalardan birinin yeterliliği, öğrencinin katılımı ve öğrencilerin belirli hedeflere ulaşmaları açısından kullanımı açıklanmaktadır. Testin ortaöğretim öğrencileriyle birlikte uygulanmasının yanı sıra teknik bir kısa açıklama da bulunmaktadır. DC devre uygulamalarında kullanılan artırılmış gerçeklik deney sınıflarında öğrencilere sunulmuştur. Bu çalışmanın sonuçları, AR uygulamalarının kullanımının sınıfta deneysel bir araç olarak kullanılma potansiyeli olduğunu, öğrencilerin ders etkinliklerine katılımını teşvik ettiğini ve öğrencilerin AR kullanımı konusunda öğrencilerin kendi öğrenme etkinlikleri için iyi bir belirleyici olmalarını sağladığını göstermektedir [6]. Sanal gerçeklik yazılımı kullanarak elektrik itmesinin incelenmesini konu alan çalışmada ise, bir elektrikli scooterı iten sabit mıknatıslı senkron motorun kullanımına ilişkin sayısal analizin ana sonuçlarını sunmaktadır. Elektrikli scooter sanal bir ortamda çalıştırmak gerekiyordu. Sanal gerçeklik (VR) ara yüzü özel bir yazılım olan Prescan ile geliştirilmiştir. Bu yazılımda, gerçek sürüş koşulları simüle edilebilir, hatta trafik ışıkları ve işaretleri, yayalar, özel sürüş koşullarına sahip diğer arabalar. İtme ünitesinin modeli ve kontrol tekniği Matlab / Simulink ile uygulanır. Bu eş-simülasyon sayısal ortamı, elektrikli otomobiller için gerçek çalışma koşullarının daha kesin bir tahmini için faydalı olabilir. Ayrıca, bu sayısal ve sanal platform, gerçek zamanlı kontrol cihazlarına kolayca adapte edilebilir ve bu yaklaşımla, elektrikli otomobillerde gelişmiş bir enerji yönetimi düşünülebilir [7].

Konvansiyonel Elektrikli Makinelerin Sanal Laboratuvarlarını işleyen çalışma incelenmiştir. Bu çalışmada, elektrik makineleri dersinin, elektrik mühendisliği eğitiminden mezun olan öğrenciler için büyük bir öneme sahip olduğu vurgulanmıştır. Elektrik makineleri ortamı, özellikle elektronik sürücülerin, bilgisayarların ve gemi sistemleri sistemlerinin tanıtılmasıyla sürekli olarak değiştiği için, müfredatlarının gözden geçirilmesi ve deney laboratuvarlarının modernizasyonu kaçınılmaz bir gereklilik olmuştur. Bu makale, çoğu geleneksel makinenin sanal laboratuvarlarının geliştirilmesinden oluşan dersi modernize etmenin bir yolunu önermektedir. İndüksiyon makineleri, tek fazlı transformatörler, göze çarpan kutuplu senkron makineler ve DC makineleri bunlardan birkaçıdır. Her sanal laboratuvar parametrik bir tanımlamadır, MATLAB kullanılarak düşünülen makine diyagramının otomatik olarak çizilmesi ve Simulink Kütüphanesi Güç Sistemleri Bloğu seti kullanılarak yapılan olağan testlerin sanal modelleri ile sunulmaktadır [8].

2.1. ARTIRILMIŞ/SANAL GERÇEKLİK YAZILIMLARI VE MATERYALLERİ

Sanal gerçeklik ile ilgili uygulamalar geliştirmek için kullanılabilen çeşitli yazılımlar bulunmaktadır. Cihazların cisim tanıma özelliği kullanılarak, sanal nesnelerin gerçek görüntülerin üzerine bindirilmiş hali olan artırılmış gerçeklik yazılımları günümüzde oldukça ilgi çeken bir konu haline gelmiştir. Bu yazılımların bir kısmı işletim sistemine kurulmakta, diğer kısmı internet tarayıcısı vasıtasıyla çalışabilmektedir. Sanal gerçeklik yazılımları markerlar üzerindeki siyah karelerin ID bilgilerine göre çalışabilir ya da resim ile yüzey veya nesne tanıma ile de gerçekleştirilebilir. Bu uygulamalarda en sık kullanılan yazılım geliştirme kitleri (Software Development Kit-SDK); artırılmış gerçeklik uygulamaları için ARToolKit, Mixare, Vuforia, Wikitude ve sanal gerçeklik uygulamaları içi Unity3D'dir.Bu yazılımların dışında kullanılan daha birçok platform bulunmaktadır.

Sanal gerçeklik araç ve gereç sistemi ise genel olarak; başa takılı sunum sistemleri, başa giyilen görüntü verici kristal ekran, kabin simülatörleri, özelleştirilmiş odalar, masaüstü gerçeklik, boom, cave, küresel projeksiyon sistemi ve mekanik izleyicilerdir.

Şekil 2 Başa Takılı Sunum Sistemi

Şekil 3 Cave Sunum Sistemi

3. SANAL GERÇEKLİK VE ELEKTRİK MOTORLARI

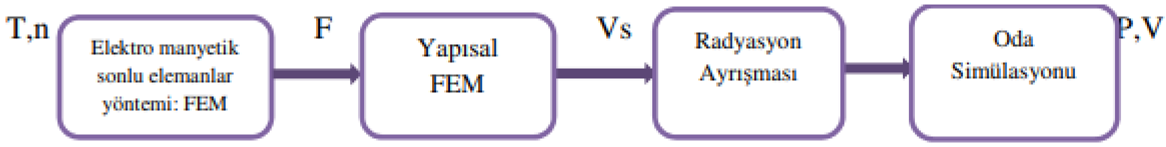
Elektrik enerjisini mekanik enerjiye dönüştüren elektrik makinesine elektrik motor denir. Elektrik motorlarının çoğu döner düzeneğe sahiptir, benzerleri olan üreteçler gibi, bir çekirdek aralığıyla ayrılmış bir sabit öbürü hareketli silindirsel, eş eksenli iki ferromanyetik armatürden oluşmaktadır [9].Elektrik motorları genelde sanayide kullanılmaktadır. En sık kullanılan çeşidi alternatif akımlı elektrik motorlarıdır.

Sanal gerçeklik, gerçek hayatta bulunan ortamların bilgisayarlar aracılığı ile taklit edilmesine denilmektedir. Sanal gerçeklikte esas amaç, sanal gerçeklik kaskını taktığımızda kaskta veya gözlükte bulunan ortama adapte olarak gerçekte bulunduğumuz ortamı unutup sanal ortama odaklanmaktır [10].

Literatürde sanal gerçeklik ve elektrik motorlarını hibrit kullanan ya da elektrik makinaları, elektrik motorları ile ilgili konularda sanal gerçeklikten faydalanan çeşitli çalışmalar mevcuttur. Sanal gerçeklik tekniklerinin sonlu elemanlar yöntemine uygulandığı çalışmada; VTK gibi bilgisayar grafik paketlerinin küçük uyarlamalarla, sonlu elemanlar hesaplama sonuçlarının verimli ve kullanıcı dostu bir şekilde işlenmesi için gerekli tüm işlevleri sağlayabildiği gösterilmiştir. "İMOOSE.trinity.vr" isimli yazılım ve sonlu elemanlar çözümlerinin görselleştirilmesi için grafiksel paket görselleştirme araç setini (VTK) kullanılmaktadır [11].

Elektrik motorları için sanal ürün geliştirmeyi konu alan makalede, zaman kazandıran bir tasarım sürecine olanak tanıyan elektrikli makinelerin sanal gelişimi için uzmanlaşmış bir yazılım sunulmuştur. Bu; elektromanyetik, termal, yapı dinamiği ve akustik özellikler için analitik ve sayısal simülasyon yöntemlerinin bir sürekli yazılım aracında birleştirilmesiyle elde edilir. Artık farklı yazılım paketlerinin birleştirilmesine veya uzmanlaşmasına gerek yoktur. Programın sadeliği, grafiksel kullanıcı ara yüzü ve veri yapısı ile tasarım sürecini kontrol ederek gerçekleştirilir. Veri işleme için XML ve SQLite kullanımı standart doğrulama teknikleriyle yanlış kullanıcı girişi yapılmasını önlemektedir. Ayrıca, dergileri değiştiren, izlenebilir ve geri dönüşümlü kılan uygulamalı tarih özelliği çok kullanıcılı bir işlev sunmaktadır. VTK ve VISTA' ya dayalı görselleştirme bileşeni, sanal gerçeklik ortamlarında da sayısal çözümleri göstermeye izin vermektedir. Sunulan yazılım sanal ürün geliştirme için uzmanlaşmıştır. Bu yazılım elektrik makinelerinin hızlı bir şekilde tasarlanmasına izin verir. Programın sayısal çekirdeği iMOOSE 'dır, diğer tüm hesaplamalar python ve bilimsel python uzantısı ile yapılmaktadır. Sonlu Elemanlar Çözeltisinin görselleştirilmesi için VTK ve VISTA kullanılır, örgü üretimi Gmsh tarafından gerçekleştirilmektedir [12].

Kompleks görsel senaryolardan elektrik makineleri imalatına doğru süreci işleyen çalışmada, bir elektrikli makinenin tüm auralizasyon işleminin modülerleştirilmesi için bir çalışma salonunun içinde bir konsept sunulmuştur. Gerçek zamanlı kısıtlamalar, zaman alıcı simülasyonların ön işleme tabi tutulmasına ve çalışma zamanında işitilmiş binaural sesi elde etmek için önceden hesaplanmış sonuçların birbirine bağlanmasına yol açmaktadır. Simülasyon modülleri arasındaki ara yüzler tanımlanmış ve simülasyon modülleri ile bunların karmaşık arka planı ayrıntılı olarak sunulmuştur. Modüllerin içleri son yıllarda zaten geniş bir araştırma altında olduğundan, bu öğrencilerin bilgisinin birbirine bağlanması, bu yeni auralizasyon kavramını ortaya çıkarmaktadır. Ayrıca, makinenin sinyal ve transfer özellikleri farklı, ayrı çalışma noktaları için simüle edilmiştir ve enterpolasyon, belirli bir aralıktaki çeşitli koşullar altında işlenmesini sağlamaktadır [12] .



Şekil 4 İşlenen verilerin alışverişinde kullanılan fiziksel miktarları içeren önerilen konseptin blok şeması [12]

Elektrik makinaları modelleme sanatını anlatan makalede ise; elektrikli makinelerin sayısal olarak hesaplanmasının hala zor olduğundan bahsedilmiştir. Elektromanyetikte hesaplamanın özelliklerine yenilikçi bir dürtü kazandırmak için, otomatik bir hesaplama zincirinin sunumundan başlayarak, elektrikli makineler için son teknoloji tasarım metodolojisi sunulmuştur. Daha hızlı simülasyonlar için sebep-sonuç analizinin yanı sıra daha hızlı simülasyonlar için genişletilmiş eşleme haritalaması sunulmuş olup, kayıp hesaplaması için detaylı bir araştırma metodolojisine yol açmıştır. Gelişmiş dinamik histerezis yaklaşımı manyetik skaler potansiyel gerektirdiğinden, çözücüyle ilgili düşünceler daha sonra sunulmuştur. Buraya kadar olan tüm modellerde simetrik bir makine davranışı olduğu varsayıldığında, elektrik makinelerinin stokastik analizi tartışılmış, akustik hesaplama ve VR'deki makine sunumu ile ilgili kavramlar tartışılmıştır. Makale, toplanmış parametrelerin hesaplanmasıyla sona ererek ve sonunda makine kontrolleri için modeller oluşturulmasına izin vermektedir. Bu tasarım zincirinin ardından, elektrik bir makine gibi elektromanyetik cihazların hesaplanması ve analizinin daha iyi anlaşılmasını sağlamaktadır [13].

Gelişen teknoloji öğrencilerin karmaşık içerikli konuları, sanal gerçeklik cihazları aracılığıyla eğlenceli ve kolay bir şekilde öğrenmelerini sağlamaktadır. Ayrıca öğrenciler bu ortamdaki nesneler ile etkileşime geçerek onlar hakkında daha çok şey öğrenebilme imkânı elde etmektedir [14].

Örneğin öğrenciler, elektrik makineleri dersinde anlatılan makine ve motorları sanal gerçeklik sayesinde daha detaylı görüp keşfetme fırsatı yakalarken, eğitmenin anlattıklarını dinleyebilecek ve yaşayabileceklerdir. Bu sayede öğrencilere istenilen bilginin çok net ve açık bir şekilde anlatılabilmesi ve öğrencilerin konuyu doğru şekilde anlayıp ve öğrenme yüzdesini artırması hedeflenmektedir. Bu hedef doğrultusunda elektrik makineleri ve elektrik motorlarının sanal ifadesiyle ilgili yapılan çalışmalar ele alınmıştır. Çalışmaların detaylı incelenmesi sağlanarak elektrik ile ilgili derslere sanal gerçeklik uygulanması için fikir vermesi istenmiştir.

4. SONUÇ

Sanal gerçeklik kavramını ele alarak eğitimde kullanımını vurgulayan çalışmada, elektrik dersleri veren eğitmenler ve elektrik ile ilgili dersler alan öğrenciler için konuya bu alandan bakış açısı kazanılması amaçlanmıştır. Konu hakkında detaylı literatür taramasına yer verilmiştir. Çalışmalar incelendiğinde, elektrik motoru veya makinelerinin tasarımı, çalışması, üretilmesi gibi konuların sanal gerçeklik ile simüle edilmesi sayesinde karmaşık durumların basitleştirildiği görülmüştür. Bu karmaşık, zor düzenekleri ve işlemleri sanal ifade ederek, ayrıntılarda kaybolan küçük detayların kolay yakalanması sağlanmıştır.

Şekil 5 Sanal Gerçeklik ile bir Elektrik Motoru Görünümü [15]

Sanal gerçekliğin elektrik makineleri ve motorları alanına uygulanmasının yaygınlaşması gerektiğini belirten bu çalışmayı destekleyen literatür arka planı bir araya getirilerek, bu konuya destek sağlanmıştır.

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THE AVAILABILITY OF GEODETIC DATA IN VIRTUAL REALITY APPLICATIONS

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ABSTRACT

Virtual reality is conceived as a scene where users can experiment with many applications in a realistic scenario. In order to achieve the closest visualization to the virtual reality environment, it is necessary to use models close to reality. Transferring the sense of reality to the user is realized by realistic modeling of the environment. Real-world models of real-life models, such as the accuracy of modeling, the use of the type of data to be used in this scenario also requires knowing. As a geodetic, real-world object is modeled and transferred to a virtual reality environment. Real-size models of objects produced by classical measurement or technological imaging techniques from different terrestrial and aerial will more easily adopt and adopt the scenario in this environment with the proportional dimensions and real textures of the objects related to the real world. The most important point in the preparation of the models is the geodetic determination of ground and air measurements in three dimensional models. In this study, the importance of obtaining the geodetic data types to be used in the virtual reality environment and providing the necessary sensitivity for the model were investigated. The observations were based on the experiences of the researchers as a result of the tried and tested virtual reality applications. In order not to adversely affect commercial competition, source and name information of the sample images are not used.
Keywords: Virtual Reality, 3D Modelling, Geodetic Data, Object Dimensions, Surface Pattern

1. INTRODUCTION

Virtual reality is the environments where the scenarios are created by using realistic models created in computers and similar environments to be transferred from the minds of people to their feelings. At the same time, virtual reality is thought of as a scene where users can experiment many times with their environment modeled with a realistic scenario. The models designed in this environment increase the power of perception, perception and feeling in people significantly and interactively in the created scenarios. Virtual reality allows the individual to escape from the limitations of the world in which he lives and to discover a new and different universe. Virtual reality is used in many fields such as education, medicine, city modeling, industrial production, and it is also used effectively in engineering applications (Bayraktar & Kaleli, 2007; Ergün, 2010).

Today, there are many areas of application in which virtual reality is being used. These usage areas, which are created by taking advantage of the virtual reality, aim to give users a virtual sense of reality. Application areas where virtual reality is used;

- Military
- Education
- Health care
- Spor
- Media
- Scientific Visualization

- Entertainment
- Fashion
- History
- Business
- Engineering
- Telecommunication
- Construction
- Film
- Programming Languages

as seen (URL-1, 2019).

The most important feature that distinguishes virtual reality from many other applications is that it gives the user a sense of reality. In order to fully sense this feeling, the objects in the model must reflect the truth in terms of texture and size. The most important point in the preparation of the three-dimensional models created by using ground or aerial photography is the real size control of these models as geodetic. For this, in order to convey the reality of the scenario to the feelings of the person, the environment and objects in the scenarios must be created in a real scale. The fact that this model to be created reflects the reality depends on the data type and resolution (Çavaş, Çavaş Huyugüzel, & Taşkın Can, 2004; Kayabaşı, 2005). Nowadays, the data used in the preparation of 3D models can be classified into three groups. These are;

- Image and image-based data (Raster Data).
- Line data produced by measuring process (Vector Data).
- Point cloud data generated by laser scanner or photogrammetric methods (Figure 1).

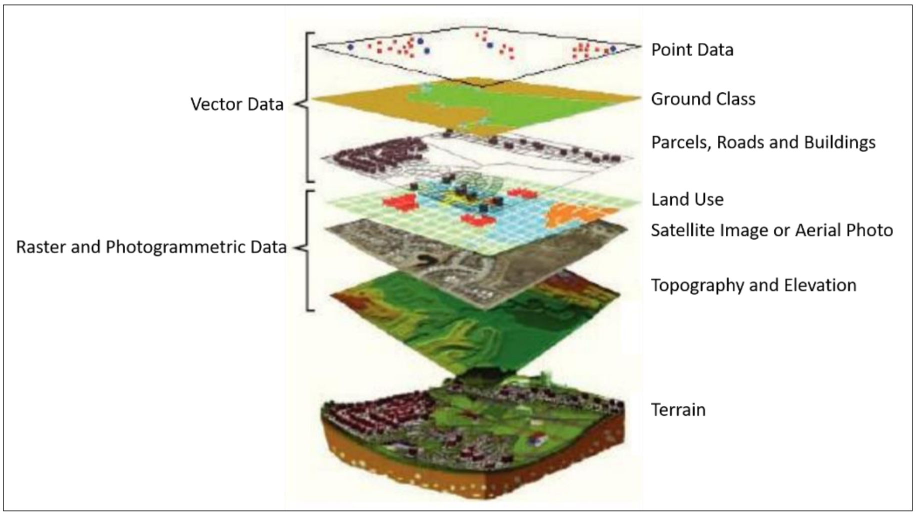

Figure 1. Geodetic data types used in three-dimensional models

One of the most important issues in three-dimensional modeling is the acquisition of digital surface models. In addition to the real size models of the objects produced by different terrestrial and airborne measurement techniques, automatic or semi-automatic digital surface model production is performed with the help of a function using the software produced especially for this job. The objects produced in the virtual reality environment can be realistic (Uçar & Ergün, 2004). It gives detailed information about the coordinate information of the points forming the real models, the geometry and the size of the object. This ensures that objects are displayed in different environments with the dimensions they are actually in. The most obvious example is the three-dimensional maps. Because three-dimensional maps based on the coordinate information of geodetic details on a certain scale of land is the representation of the structure. In this respect, the realization of three-dimensional objects in the real world is one of the basic steps to be taken. Therefore, the accuracy of the coordinate information of the points in the virtual reality is of great importance. Models to be created with coordinate data; Measurements such as distances, areas, volumes, heights can be obtained from geodetic data. The data used in the scenario to understand the dimensional relations of the objects with their environment and to obtain information about them are of great importance. In this context, the geodetic data obtained from the models of the objects created by using computer technology will enable the user to feel more realistic in the virtual reality environment.

2. EXPERIENCES AND FINDINGS

In order for users to truly experience the experience of virtual reality, the scenario in which virtual reality designs are found must be flawless and should be able to convey this feeling to the user in more detail. The virtual connection that the user creates with the virtual reality environment can only occur with the reality of the scenario. In this study, many objects and scenery prepared for the virtual reality environment were examined and the obtained examples were interpreted by our experiences and the realization of the dimensional relations of the objects that were modeled in the scenario with their surroundings were conveyed. Figure 3 shows the difference between a tree that gives a sense of reality and a tree that does not make sense of reality. As shown in the example, the image on the left of the tree cannot fully reflect the sense of reality (in shape and size), while the image on the right reflects the truth.

(a) (b)

Figure 2. Real world tree prepared for the virtual reality environment

When these two different tree models prepared for the virtual reality environment are examined in Figure 2, it is seen that the modeling in Figure 2b is depicted more realistically than in Figure 2a. Precise creation of the basic base that enables the three-dimensional models to be depicted in the computer environment is possible with the use of geodetic data but with a high cost. Because it will be an economic burden to obtain information about the geometry and dimensions of each object and to apply the findings to the model.

Although virtual reality applications have been transformed into image processing techniques, geodetic rendering of each surface with certain scales provides the most accurate geometric representation of virtual reality. In fact, the accuracy in determining the object position and size also means that the most accurate trajectory is vertical (Ergün, 2010; Kersten, 2004). One of the negative examples of revealing the accuracy of the dimensions of the environment or objects in the scenario is that the perspective cannot be transferred to the user (Figure 3).

Figure 3. The scenario is not well designed as a perspective.

When Figure 3 is examined, it is seen that the scenario to be used in virtual reality is not well-constructed in perspective. The vertical modeling of the walls between the ceiling and the floor in the image will make the scene more realistic. In the scenario, the harmonious relationship between objects can reflect the reality better. The modeling of objects in accordance with the perspective rules will reveal the depth relationship between the objects as well as the size relationship between the objects in detail (Figure 4).

Figure 4. Example of the scenario of objects designed to scale with each other.

When the stage design in Figure 4 is examined, it can be seen that when the relation of size of the objects in the scenario is examined, it can be seen that the dimension perception in the real world can be easily transferred to the people who will use this scenario. The colors on the stage are chosen according to the colors of the real life and reflect the real life rather than the stage feeling. Again, the dimensional relation between the objects created in the virtual reality environment has to be considered when creating the scenario (Figure 5).

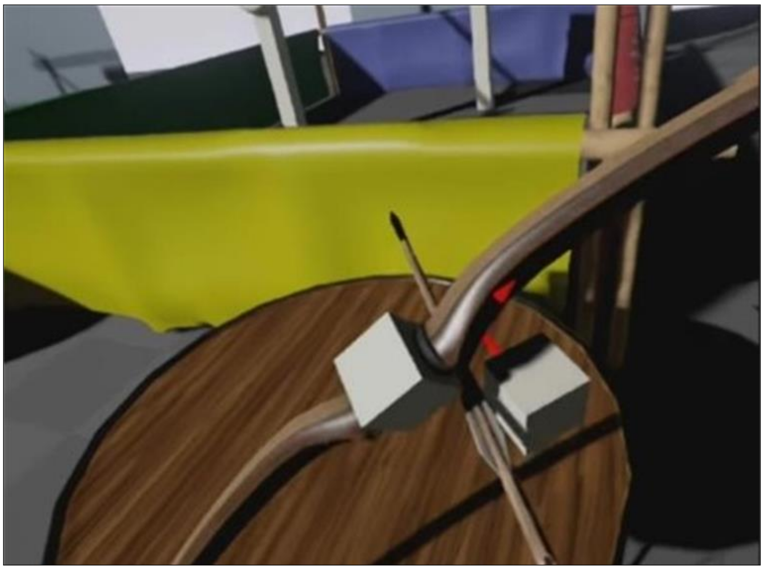

Figure 5. Dimensional relationship error of objects between each other.

When the visual in Figure 5 is examined, an example of the size relationship between the objects used in the real life and the exaggerated proportions can be seen. It would be difficult for users to feel that they were included in the scenario if this visual historical scene had the use of a visual or archery sport in a virtual reality environment. The disproportionate models of the prepared bow and arrow models will remove the users from the feeling of reality. In another case, virtual reality or simulation environments are met in the scenario model, model of the dimensional relations with the environment cannot be understood. It is very important that the real-life sampling of the education to be taken in the simulation environment and the creation of a scenario based on it (Figure 6).

Figure 6. Relationship between object and scenario in simulation environment

Figure 6 shows a scenario for driver training in the simulation environment. Traffic lights and pedestrians in the scenario are almost in the same size. In addition, the relationship between buildings and other environmental objects is not complementary in size. In such simulations, where driving training is provided in a feature that distinguishes this scene from other scenes, it has been successfully incorporated into the perspective scenario. In many edited scenarios, it will make users ready for real-life operations. For this reason, models created closer to reality will enable the individuals in the education process to adapt themselves better to the scenario and enable the training process to be more efficient.

3. RESULTS

The most important feature that distinguishes virtual reality from many other applications is that it gives the user a sense of reality. In order to fully sense this feeling, the objects in the model must reflect the truth in terms of texture and size. Three-dimensional modeling techniques can be created in a computer-like manner and predictions and analyzes can be made with these models. When such opportunities are achieved, virtual reality will be an application that users cannot give up with visualization in every imaginable area of life. Although this application is not possible for today, it will be ensured by increasing the quality of data in the future and improving accuracy. Today, the coordinate information of the points that make up the real models, the geometry and the size of the objects give us more detailed information about the object. Therefore, the accuracy required by visualization of the object in the three-dimensional model is quite important. In this way, objects will be displayed in different environments with their actual size. On the basis of these recommendations, the dimensional accuracy of the three-dimensional models obtained from different types of data sets as well as the geometrically prominent objective accuracy are gaining importance.

4. SUGGESTIONS

In this study, it was mentioned the importance of obtaining geodetic data for virtual reality scenarios. The most important point in the preparation of the three-dimensional models that are created by using ground or aerial photography is the real size control of these models as geodetic. For this, it is necessary to create a real-scale scale of the environment and objects in the scenarios in order to convey the reality of the scenario to one's feelings. In many edited scenarios, it will make users ready for real-life operations. Therefore, models created closer to reality should enable the individuals in the education process to adapt themselves better to the scenario and allow the educational process to be more efficient. Obtaining geodetic data of models created by using computer technology will enable the user to feel more realistic in a virtual reality environment.

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ARTIFICIAL NEURAL NETWORKS CONTROLLED REACTIVE POWER COMPENSATION IN THE PERSPECTIVE OF INDUSTRY4.0

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Keywords: Reactive power compensation, artificial neural networks, learning algorithm, Industry 4.0

1. INTRODUCTION

Efficiency in electrical energy means that doing the same work using less energy without compromising the quality of service. Reactive Power Compensation is one of the most important ways to improve efficiency and energy saving in energy systems. There are many types of compensation techniques such as static and dynamic VAR. With the reliable and faster processors and the better control devices, now it is possible to design and implement more efficient Reactive Power Compensation systems. Moreover, advances in Information and Communication Technologies(ICT) have made it easier to balance the Demand and Supply of energy and have led the creation of the smart grid. The integration of machines and tools with ICT systems has resulted in the Fourth Industrial Revolution and Industry 4.0 applications. Industry 4.0 enables real time monitoring and controlling of the devices while collecting more data in order to make better and smarter decision. Artificial intelligence methods often find a place in designing of intelligent systems.

In this study, a reactive power compensation system will be designed by using artificial neural networks (ANN) according to the data obtained from the industrial 4.0 compliant devices.

2. INDUSTRY 4.0

The industrial revolution dates back to the invention of wheel. Simple mechanical systems were produced by using simpler hand-tools. This usage of labor and tools is considered as Industry 0.0. The First Industrial revolution (1.0) began with the invention of the steam engine in 1712[1]. While mechanical production systems based on the use of water and steam power had appeared, social classes also emerged in this era. In the second industrial revolution (2.0), mass production with electric power had been introduced. It is accepted that Henry Ford started mass production first time for car production[2]. The telegraph (1840) and the telephone (1880) were also invented. Moreover, the idea of Taylorism advocating Scientific Management System emerged in 1920. In the third industrial revolution (3.0), a digital revolution took place with the use of electronics and the development of Information Technology(IT). The first microcomputer Altair 8800 (1971) and Apple I (1976) were produced. Programmable Automated production system had been implemented in manufacturing. The fourth industrial revolution was started by the Germans in 2011. Industry 4.0 is a combination of Cyber Physical Systems which integrate complicated machines and tools with supporting IT technologies such as Internet of Things and make them autonomous and smart systems through collected data and intelligent controller,

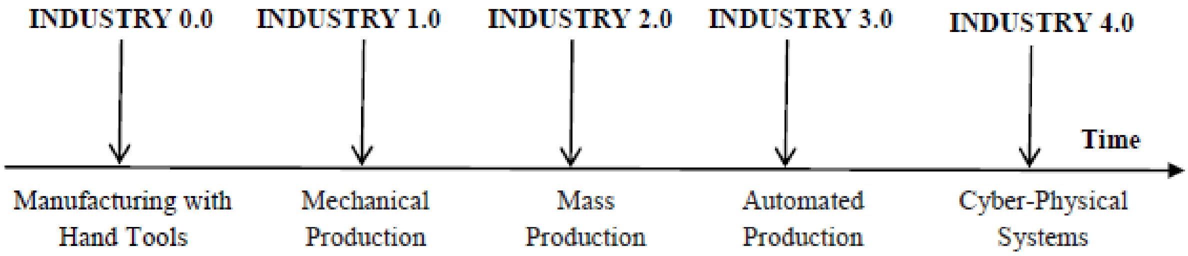

Figure 2.1. Development of Industry

3. ARTIFICIAL NEURAL NETWORKS

An Artificial Neural Network (ANN) consists of interconnected nodes similar to neurons in the human brain. As seen from Fig. 3.1, in a node, inputs from a data set are combined with the weights defining the significance of each input to desired outputs. The values of ANN weights are determined through learning algorithms using the previously collected data[3].

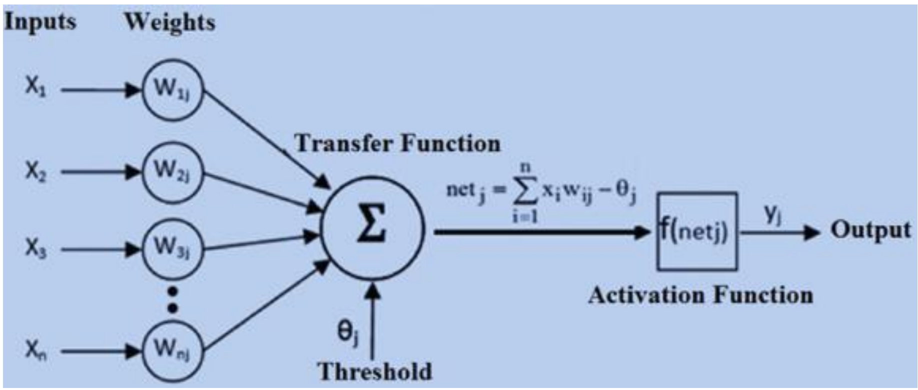

Figure 3.1. Artificial nerve cell [4]

Inputs: Data from outside to the artificial nerve cell.
Weights: Inputs to the neuron are multiplied by these values as coefficients. These coefficients can be positive, negative and zero. The input with zero weight has no effect on the output.
Transfer Function: It is the layer that calculates the net input to a cell. The best method of determining transfer function is to calculate by trial and error.
Activation Function: Processes the net input to the cell and determines to output that corresponds to this input. Different formulas can be used to calculate output. Generally, the sigmoid function is prefered as activation function[3].
Cell output: The output value of the cell determined by the activation function. The output can be transmitted to the outside of cell or transmitted to another cell[5]. Artificial neural networks consist of input layer, hidden layer and output layer.
Input layer: The input from the external environment is transmitted to the interlayers of ANN.
Hidden (Search) Layer: In this section, data from the input layer is further processed.
Output Layer: The cells in this layer produce the output data of the network by processing the data from the hidden layer. The number of the layer and function may be chosen according to the desired network structure.

4. REACTIVE POWER COMPENSATİON

The electrical energy is generated as alternating current consists of two components, active and reactive. The active power, which is useful for consumers, consists of the active current. For example, this power component is transformed into mechanical power in motor shafts, thermal power in heat centers[7]. Electrical machines such as generators, transformers, coils and motors operate according to the electrodynamics principle. The magnetizing current that provides the necessary magnetic field for the operation of these machines is called reactive current. Reactive power is not converted to useful power as active power is done[7].

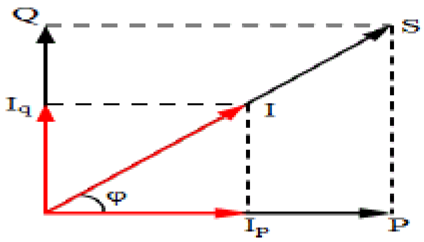

Figure 4.1. Phasor diagram representation of current, voltage and power.

When the phasor diagram shown in Fig. 4.1. is examined, Active Power(P) is equal to cosine product of the Apparent Power(S). The angle between Apparent and Active Powers is the phase angle of the fundamental voltage and the current. The cosine value of this angle(φ) is defined as the Power Factor(P.F.)[6]. Electrical loads can be catagorized in three classes: 1.Resistive: The current and the voltage are in phase and PF is 1, 2.Inductive: The current lags the voltage and PF is zero and 3. Capacitive: The current leads the voltage and PF is zero. For a resistive load, all power is consumed in a usefull way. Therefore, to make an electrical system more efficient, PF must be closer to 1.This process is called as reactive power compensation. Various methods are used for reactive power compensation. In these methods, the reactive powers that are needed by the loads are statically compensated by capacitors and/or reactors and dynamically synchronous motors [7,8].

In the compensation method using capacitor groups, the capacitor groups are gradually switched on. In this method, it may not be possible to fully compensate the reactive energy needed by the load. The time delay also occurs when the stages are activated. This can cause excessive or low compensation of the load over the energy transmission line[8,9]. In the compensation made by synchronous motors, the motors can be operated capacitively or inductively by changing the excitation current[10].

5. REACTIVE POWER COMPENSATION WITH ARTIFICIAL NEURAL NETWORKS

In this study, a reactive power compensation system is designed by using artificial neural networks (ANN) according to the data obtained from the Industrial 4.0 compliant devices. ANN learning algorithms is used on the data set to create a proper compensation system. In order to form the data set, the values of U, I, cos , P, Q, THDI and the reactive power of capacitor and the shunt reactor ratios belonging to the system are taken from the real system with the help of Industry 4.0 compatible devices.

5.1. Design of ANN

There can be many performance metrics such as modeling or training time for an ANN estimator. But the best and most important performance criterion is the accuracy of the estimation. The accuracy criterion is defined as the difference between the actual value and the estimated values. This difference is called the estimation error. The ANN model, which will be used for estimating the capacitor power, the shunt reactor currents and the steps required to be taken by the relay, is developed in MATLAB using ANN toolbox (Neural Network Toolbox-nntoll). Development of the ANN model is done in 9 stages.

1. Establishment of training and test data from input and output data in hand.
2. Entering the training and test set into the MATLAB program.
3. Creation of the network.
4. Selecting network parameters.
5. Training the network.
6. Establishing the test simulation of the network.
7. Comparison of estimated output values with actual values as a result of simulation.
8. Determination of the minimum error rate.
9. Termination of network training.

Of the 350 data received from the real system, 70% is used for network training, and 30% for testing the network. In the ANN model created with Matlab ANN toolbar; In the three stages of advanced feeding network and consulted network structure, back propagation learning algorithm, input, secret and output layer, 3 neurons and logarithmic sigmoid activation function in secret layer, 1 neuron and linear (purelin) activation function in the output layer were used.

5.2. Design of User Interface and Test System

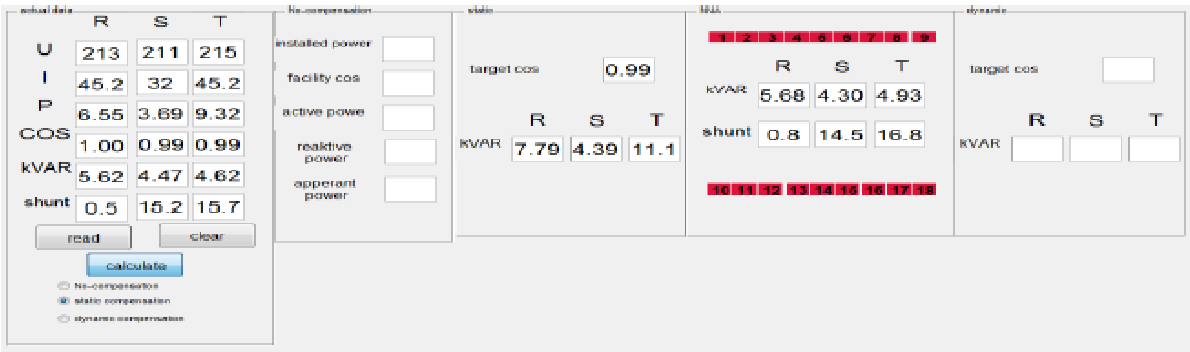

Figure 5.1. User Interface

The sample application system is designed in MATLAB Simulink. The User Interface consists of five sections. The first section contains the data collected from the real system and the calculation methods(No-compensation, Static or Dynamic). Before the compensation calculation, one of the options of no compensation, static or dynamic compensation should be selected.

Active, reactive and apparent powers of the system with no compensation will be calculated by selecting No-compensation option. When the static compensation option is selected, the required capacitive power and the shunt reactor currents will be calculated as in classical systems according to the targeted cos value. The status of the relay is also estimated. When the dynamic compensation stage is selected, the capacitor powers, the shunt reactor currents and the relay status will be estimated by the ANN based Controller. Moreover, a synchronous motor such as a ventilation motor can be used to correct Power Factor by controlling the excitation current. When the plant is in operation with a reactive power consumption, the motor will be run with the calculated necessary excitation current. In this case, both ventilation and compensation will be done at the same time. Since the capacitor groups will not be activated in this stage, energy saving will be ensured.

6. RESULTS AND RECOMMENDATIONS

In this study, ANN based power compensation system is designed and simulated. For different scenarios, the capacitor powers, the current of the shunt reactors and the relay status are estimated by the ANN controller. More sensitive reactive power control is performed. After traning the ANN controller, test results show that the ANN controller produces 98% correct outputs.

The capacitor power required by artificial intelligence was estimated at 23.2257 kVAR when using a 24.4 kVAR capacitor in real time. The margin of error is 1.1743%.

In the real system, while the shunt reactor current in R phase was 0.3948, the current was estimated as 0.3949 by artificial intelligence. 100% of the estimation rate here.

The comparison of the new system is done in terms of performance, initial investment and operation cost.

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WHEN WE WILL START TO UNDERSTAND AND APPLY THE VIRTUAL REALITY?

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ABSTRACT

Regardless of the subject, in reaching a goal, the first step in solving a problem, the perception to be occured on that subject. This is the method is we call it Perception Management. The term "perception management", which expresses the misuse of this technique, is not within the scope of this study. Man has natural reactions to every "new" that he does not know, he does not internalize, and because of this fear and anxiety, he has a tendency to preserve the existing one. The use of virtual reality, augmented virtual reality, and hologram technologies in the experience and acquisition processes in areas such as education, health, transportation, economics, tourism, and even widespread use can be increased, but can be increased by perception management. The dissemination of virtual reality applications in every field can be possible with the perception created in minds open to development, science and technology and innovations. The first condition of this is perception management for the realization of individual and social perceptions of virtual reality projects and applications, economic, ecological, effective, entertaining, motivating and successful. If human beings do not live by occuring new techniques in every field, applying existing ones to life, and being respectful to environment and all environmental stakeholders, sustainable development is not possible. This important definition is known as a global expression in the form of breathing with the world: Breathe with the world, produce local solutions.

Key Words: Knowledge, perception, perception management, virtual reality, augmented virtual reality, hologram virtual technologies, Z generation.

INTRODUCTION

Virtual reality is an agenda that has become a phenomenon of the modern development of society (LaValle 2019). The answer to the question in tag is directly related to the word perception, which refers to the "early meaning" that occurs when the information reaches the final acceptance level. Of course, to make a perception on a subject is not the final stage, but it also uses the fact that the importance of information is being spoken, and the first step of our application is through perception. In every subject, to reach a goal, if we want to solve a problem, the first step to be taken, the perception to be created on that subject, it is a technique, the method, we call it Perception Management. Perception management is essential for sustainable success in every subject. The most valid method of any kind of struggle is to eliminate a mistake, threat or risk at the source. To understand the virtual reality universe, adult education, Z generation, and then to create a correct perception with this database is a process that must be managed. The stakeholders of this process are engineers, academicians, local governments, non-governmental organizations and students (Thevendran and Mawdesley 2004).

Firstly, for the use of virtual reality, augmented virtual reality, hologram and real image viewing technologies, an ecosystem of these technologies must be formed. For this reason, there is a need for real-time VR, AVR and hologram ecosystem in order to achieve a performance in our country. This is possible with the awareness of public and local administrators, academicians, civil society and students. Global VR situation provides important opportunities in terms of VR ecosystem in our country. The most ready mass for this ecosystem are students and youngs. Students must to request for using this technology in education. This demand is vital for the conditions that will encourage or even force the perception of public administrators, local governments, educators and academicians to use these technologies (Yılmaz 2019, Ustakara 2011, Lee Choong 2004).

TRANSFORMATION OF KNOWLEDGE INTO PERCEPTION

In the occurring of a new technique, quality and output control, "perception management" is the first step that should be taken in the development of the achievements, but it is generally not used properly. Man has a natural reaction to every "new" that he does not know that he does not internalize; the use and even the widespread use of virtual reality, augmented virtual reality and hologram technologies in the fields of education, health, transportation, economy and tourism can be increased and sustained by a perception management that will eliminate this anxiety. The dissemination of virtual reality applications in every field can be possible with the perception occured in minds open to science and technology and innovations (Özer 2012). There are two forms of knowledge; expressed information, felt information. It is the first step of perception management to recognize these two important stages of knowledge and to make this distinction a consciousness (Dündar 2016).

We have some fundamental advantages to be a true and sustainable stakeholder of the virtual reality sector on international platforms, if we can make perception management accurate and timely. This technology does not require large spaces, and does not require a technology memory that began centuries ago. The conditions for competition are not challenging, but the respondent mass is open to these technologies and expects to be satisfied. For software, hardware, and applications, there is a highly visible environment and a young audience. And the investment costs are not very large. For example, compared to the automotive sector, there is a need for software infrastructure rather than capital. Considering that a minimum of $ 500 billion was planned in the automotive industry in the next decade, the virtual reality ecosystem is a modest but high-yielding start-up area. Considering favorable conditions such as international market and opportunities, global branding and competitiveness, a strong national demand area within the country, not only education but also a great expectation in all sectors, software processes and product transformation should be encouraged simultaneously with perception management. In addition, the legal regulations and incentive exemptions to promote the use of virtual reality and more advanced technologies in education, health and other sectors are very important. Naturally, it is imperative that societies seeking to take part in quality, efficiency and sustainability in international competition should make and implement industrial, legal and psychological action plans so that they can see and start up the existing start up opportunities in virtual reality technologies (La Valle 2019, Yılmaz 2019).

CONCULISION

In recent years the human mind has occured the attractive concept of virtual reality. This was due to the effective imagination and success of the engineers as well as the rapid development of computer technologies with multidiscipliner studies. It is a technique that economic, ecological, effective, entertaining, motivating and success-enhancing new techniques and brings respect to the environment and environmental stakeholders in doing so. It is also open to breathing and competition with the world. For the use of virtual reality, augmented virtual reality, hologram and real image tracking technologies, an ecosystem of these technologies must be formed. For this reason, there is a need for real-time VR, AVR and hologram ecosystem in order to achieve a performance in our country. This is only possible with the awareness of public and local administrators, academicians, civil society and students. Considering favorable conditions such as international market and opportunities, global branding and competitiveness, not only education but also a great expectation in all sectors, software processes and product transformation should be encouraged simultaneously with perception management. In addition, the legal regulations and incentive exemptions to promote the use of virtual reality and more advanced technologies in education, health and other sectors are very important. As a result, it is imperative that societies seeking to take part in quality, efficiency and sustainability in international competition should make a strong and true "perception management" and implement industrial, legal and psychological action plans.

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THE USE OF VIRTUAL REALITY IN THE VETERINARY MEDICINE EDUCATION

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ABSTRACT

Expectations for the use of new technologies are increasing at all levels of education. The length of medical education such as medicine, veterinary, dentistry, the limitations and the difficulty of practicing, the physician education, which is a skill and experience profession, today the classical methods are insufficient to meet the expectations. It is inevitable to utilize the opportunities provided by information technologies, such as the transfer of current knowledge and technologies to the student, the ability to conduct experiments and tests in a simulation environment without using live subjects, and the concentration of each student taking one-to-one training in a virtual reality environment. Another important fact is that both student and instructor profiles have changed and this necessitates new generation learning techniques. As a result, virtual reality in Turkey, especially in the medical and veterinary fields is the awareness stage yet, so the projects, researches, applications and discussions are inadequate. For this reason, virtual reality projects, applications and researches in medicine and veterinary medicine should be subjected to positive discrimination.

Keywords: medical education, veterinary medicine applications, virtual reality, augmented virtual reality, hologram, real image viewing

INTRODUCTION

In veterinary medicine education like medical disciplines, the main goal is to transfer knowledge and skills with the latest data and techniques with the highest success rate, to take out the outputs. For this purpose, advanced and applicable educational techniques are included as learning tools. Experience is required in all fields as well as in medical education; Quality indicators in the undergraduate and postgraduate education, which are internationally important economic sectors, are constantly changing and determining as reference factors. The change should be included only in accounts where the source of the change is not technical facilities. For individuals who use products containing these techniques in daily life; learning a page with a textual description can be much more engaging, memorable and fast with a short video or virtual reality equipment. It is an important question that the possibility of practicing all students in medicine, veterinary medicine and health discipline training is not available. Virtual reality, augmented reality emerges and hologram as an effective tool to remove them (Mıdık 2010, Yusoff at all 2011, Von Jan 2012).

THE BASIC PROBLEM: UNDERSTANDING THE "Z" GENERATION

Sociologists, according to their interaction with communication tools; The X generation, born between the years 1961-1980, defines those born in 1980-2000 as generation Z and those born after 2000 as generation Z. For Y and Z generations with a weighted cross-section in education, virtual reality and internet-supported education create an attractive educational environment. All over the world, the human resource during the learning and training phase is predominantly the Y and Z generations. Characteristics of these groups are useful for the widespread use of techniques involving virtual reality products. Virtual reality enables the 3D images and animations created in the virtual environment to interact with these objects by creating a real sense of environment in the mind with helmets and other technological tools. Another step of this is to increase the virtual reality with hologram technique. In physician education, it is an important problem that all students do not have the opportunity to practice and to experience each experiment or test individually. Virtual lab facilities aimed at medical education and practice can help students to perform numerous trials in a virtual environment and increase their knowledge and skills. The skills and experience process that the students will achieve in a virtual environment is an ecologically and economically preferable method. Studies on the virtual reality in veterinary medicine are insufficient. Supporting the lessons, classrooms, course materials and books with augmented reality, the use of VR applications in the courses is a common goal that all of the students in the Z generation are waiting for (Aslan and Erdoğan 2017, Scalese and Issenberg 2005)

Table: Virtual Reality (VR) and Augmented Virtual Reality (AR) predictions on education and healt sector according to Goldman Sachs.com (Yılmaz M, 2019).

Sectors	Current Market Size	Datapoints on the population that could use VR/AR	2020 Base case Forecasts		2025 Base case Forecasts	
			Users	Software Revenue	Users	Software Revenue
Education	Education software market $5bn for K-12, $7bn for higher education	200mn primary and secondary students in developed markets in US 50mn K-12 and 20mn College students	7mn	$0.3bn	15mn	$0.7bn
Healthcare	$16bn patient monitoring device market	8mn physicians and EMTs in developed markets in US, 800k physicians and 240k EMTs	0.8mn	$1.2bn	3.4mn	$5.1bn

CONCLUSION

Today, it is a very important necessity for VR and AR to be aware of the concepts such as the predicted 2000 Mbps fast internet access, remote sensing techniques, holographic imaging techniques and especially virtual reality, and to reflect them in the classroom, laboratory and application fields. The virtual reality is a greener and more ethical tool that can both provide them and minimize the use of animals in experiments. In addition, in much studies, it is reported that students medicinal disciplines want to use the AVR applications as a means of learning individually, they find these applications useful and they are satisfied with them. Virtual reality and hologram, not only in education but also in diagnostic methods can improve in veterinary medicine. In this focus, virtual reality studies and practices related to veterinary medicine, which is a very important medical discipline, are available but not sufficient in Turkey and all other countries. Of course, there are many innovative learning tools and approaches in veterinary medicine education, because it is a must to advance with new methods but we want to say virtual reality is a irreplaceable technique in all medicine. Nowadays, many classical methods are no longer preferred which can lead to damage to animals and animals (sometimes defensive reflexes) by students and academics. In education and medicinal applications, the main aim is to provide the student with veterinary training and experience without harming animal welfare and animal rights. For this, especially in veterinary medicine, advanced applications such as virtual reality and hologram are essential for education and practices. The three-dimensional simulation technology will be prominent in the challenging training, diagnosis and intervention processes of veterinary medicine with its exciting and non-negligible development. The availability of facilities such as virtual reality and 3D simulation techniques for qualified, competent veterinarians is important in keeping up with rapid changes and scientific innovations in clinical applications. This is very important difficulty in veterinary practice: We live some limitations on patient animals during training due to animal welfare. The use of simulations in veterinary medicine education should be considered and concentrated in order to provide safe and ethical alternative opportunities for students to develop their basic experiments, clinical skills and to supply animal welfare conditions. Because computer graphics and virtual reality environments are ideal for visualizing complex 3D spatial relationships, in virtual reality applications, information is interdependent by data from real and virtual images. This is an ethic and environmentalist advantage of VR and hologram.

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VIRTUAL REALITY IN MEDICAL EDUCATION. IT IS A DREAM OR A REALITY?

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Key Words: Virtual reality, medical education, surgery.

Virtual reality (VR) is a simulation model that are increasingly used in medical education. It provides a three dimensional (3D) and dynamic view of the structures which the user interacts (1).

VR is a 3-D simulation model that gives real feel and allows mutual communication with a dynamic environment created by computers. The VR environment includes the senses of touching, hearing, changing the places of objects in the virtual environment and feeling their physical characteristics. It gives us the opportunity to work in an unreal area that we have created with our own hands.

Using interactive scenarios and virtual environment that reflect real-life events in the virtual reality simulation, students perform skills practices, evaluate themselves and they are evaluated objectively by the instructors (2).

The field of medical education includes both educational and instructional technologies. VR is increasingly going to important in both areas.

The VR system in medicine was first introduced by Robert Mann in 1965. In the 1980s, the use of VR was facilitated by introducing the head-mounted display (HMD) as a wearable device for VR visualizations (3).

The project, developed by the University of Colorado in 1991 and called the Visible Human Project broke importantly ground in the field of medical education. More than 7000 digital anatomical images were included in this project (1). Since then, AR / VR has been increasingly used in medical and surgical education (4-6).

In fact, medical education is difficult, long and time consuming. During the centuries of classical medicine education and especially in anatomy education, drawings, physical models and cadaver dissection are used. It is difficult to find a cadaver for anatomy education and it is impossible for each student to dissect on a limited number of cadavers. The multiplicity of the number of students, the insufficient number of teachers and the necessity of continuous renewal of the skills that should be given to the students are the other challenges of education (7).

Especially in traditional surgical training, the intern surgeon learns to perform surgical procedures on real patients under the supervision of a trained surgeon. This training is time-consuming and also has the potential to cause harm to patients. Likewise, students and assistants may not have the chance to practice sufficiently.

As a solution to these problems, virtual reality will be one of the best ways for medical students and medical assistants to learn in the near future. While both clinical and surgical skills training are carried out with virtual reality, it is also possible to evaluate these skills training. At the same time, surgical operations and emergencies can be managed in a virtual reality environment without harming anyone. In addition, with virtual reality applications, it is possible for all students to practice a sufficient number of subjects until they have fully learned the subject.

It may not always be possible to observe where medical students and assistants make mistakes. Virtual reality allows you to easily evaluate each skill in a virtual environment, at any time, and in any number of times. Storing these materials in a virtual environment makes it easier for a student to be evaluated by more than one instructor (7).

Virtual reality applications are engaging and entertaining because they have a strategy, attracting students 'attention and ensuring their long-term participation in the learning process, as well as enhancing students' motivation (8). After all, virtual reality contributes significantly to the learning processes and improves the quality of education. Virtual reality not only provides learning but also a real experience. Simultaneous learning of different skills may be possible. In addition, dangerous, high-cost and complex experiments can be performed smoothly in the virtual reality system.

One of the most important applications of virtual reality is anatomy education for medical students. 3-D visualizations of the anatomy of the human body can be manipulated and dissected in a more similar and perhaps more precise manner than cadaveric dissections (9). The virtual reality used in medical education allows students to experiment a large number of experiments on a virtual cadaver.

This method supports students' active participation in the learning process. It helps to assimilate information by contributing to a better understanding of abstract issues such as communication skills (10). In real life, it is possible to learn subjects that are difficult or impossible to experience (7). It supports the development of problem solving, critical decision making, and critical thinking skills (11).

Moreover, virtual reality in medical education is a peer learning. Learning together at a study meeting is one of the most effective ways of learning as a medical student (9). It supports working in team cooperation, creates a social atmosphere and contributes to the development of students' creativity (7,12). In addition to providing psychomotor skills, virtual reality is introduced as a unique and useful alternative teaching method to gain more advanced and abstract skills such as problem solving, critical thinking or communication skills, and evaluating these skills (13).

In the VR system, vital procedures on patients can be performed in a virtual environment to better understand the effects of the treatment process. Virtual reality applications without harming patients, vascular access, and basic life support, intravenous injection application, patient interview etc. it supports many skills by giving them the opportunity to experience many times. It gives students the opportunity to apply skills that cannot be observed by students on a real patient in a virtual environment and thus apply the theoretical training they have applied (14).

The use of VR and AR is increasing in all areas of medicine. Virtual reality is used in many fields such as surgery, neuroscience, psychology and cognitive and motor skills rehabilitation, mental health therapy. Various studies on VR and AR in different disciplines have reported more sensitivity, accuracy, efficiency and better results (15-19).

The using of VR in surgical education

VR is used to support anatomy teaching and to simulate procedures for training surgeons. Surgical simulations with visual and tactile feedback to improve technical competence have been accepted in many surgical fields. The literature has shown that VR has been successfully used in all stages of surgery from planning and simulation of surgical operations (15). VR applications are rapidly growing for surgical training (20-24). VR are widely used in some of the planning of preoperative of surgical procedures (15).

Virtual reality directly affects the number of sensory organs involved in the study, because the individual feels himself in that environment. The use of virtual reality simulator in surgical education supports standard training. It develops technical skills. It can be repeated as much as you want. Studies have shown that virtual reality training improves surgical efficacy and operative performance in laparoscopic surgery.

With virtual reality, all anatomical details and structures can be displayed in 3D. Treatment planning of the patient can be done. VR systems help preoperative planning of surgical procedures. All different surgical approaches used for surgical operation can be demonstrated, tried and predicted for the results of these procedures. VR can also be used to simulate operating conditions in surgery. As a result, preoperative planning and intraoperative projection of 3D models can improve surgical outcomes. (15). At the same time, more rapid and realistic surgical training can be provided.

There are many studies on this subject. Eckardt et al. In a 56-year-old patient, they mimicked left mandibular resection before the operation. After the simulation, they prepared the template for the optimum contour of the bone graft (27).

VR were also used in free flap operations. With the guidance of computed tomography angiography, 3D virtual reconstruction has been evaluated for the feasibility of mapping the free flap perforators. (26-28). Gacto-Sanchez reported that preoperative planning with VR reduced the mean operative time by 2 hours and 8 minutes, and this technique reduced the incidence of flap complications and donor area morbidity (29).

In one study, a VR system produced the 3D hologram of the breast tumor from the patient's MR images. This hologram provided a detailed view of the breast and tumor and facilitated volumetric measurements (30).

Tactile feedback is one of the areas that need to be improved in many surgical VR systems. As technology evolves, more realistic work scenarios and more focus on delivering tactile feedback need to be focused (15).

VR in Operating Room

Surgeons in the operating room can be used VR technology in the cases which requires the accuracy of surgical manoeuvres. Intraoperatively, VR often requires the using of head mounted device to display information during surgery (15).

Studies have shown that intraoperatively using of VR systems can help improve surgical procedures and reduce surgical errors (31-38).

With ongoing research and technological advances, we are going to see new VR systems that improve surgical efficacy, reduce surgical morbidity and improve patient outcomes (15).

The most important disadvantage of virtual reality applications is an economic dimension. Furthermore, it may be time consuming to provide users with the skills to use computer virtual reality applications.

CONCLUSION

In conclusion, virtual reality surgical training will be one of the most important parts of standard education in the near future. Virtual reality training modules have many advantages, such as helping to reduce medical errors and providing a more realistic environment for educating doctors and students in the same way.

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