



THE PROCEEDINGS OF THE 5TH INTERNATIONAL CONFERENCE ON VIRTUAL REALITY

15-16 NOVEMBER 2023

HARRAN UNIVERSITY
ŞANLIURFA
TÜRKİYE

ISBN: 978-605-86579-3-9



Welcome
Hoş Geldiniz

सुस्वागतम्

خوش آمدی

خوش آمدید

Karibu

Bem Vinda

Akwaaba

**Harran University
Şanlıurfa
Türkiye**

ISBN: 978-605-86579-3-9

December 2023

Editors:

Dr. Dursun Akaslan
Dr. Ramesh C Sharma

Editor Assistants:

Songül Akdağ

CONFERENCE INFORMATION

Conference Name	5 th International Conference on Virtual Reality
Conference Book ISBN	978-605-86579-3-9
Conference Website	http://virtualreality.harran.edu.tr
Conference Date	15-16 November 2023
Conference Place and Form	Harran University, Şanlıurfa, Türkiye – Online
Conference Chair	Assoc. Prof. Dr. Dursun AKASLAN
Conference Co-Chair	Prof. Dr. Ramesh C. SHARMA
Conference Youtube Channel	https://www.youtube.com/@intlconferenceonvirtualreality

INVITED SPEAKERS

Country	Full Name
Brazil	Ricardo NAKAMURA
Brazil	Manoela M. O. da SILVA
Eswatini	Karen FERREIRA-MEYERS
Ghana	Ebenezer BONYAH
India	Yash Paul SHARMA
Japan	Iwao YAMASHITA
USA	Anna Carolina Muller QUEORIZ

PAPER PRESENTATIONS AND KEYNOTE SPEECHES

Country	No. Of Papers	%	No. of Speeches	%
Brazil	2	7,41	2	5,71
Eswatini	1	3,70	1	2,86
Ghana	1	3,70	1	2,86
India	10	37,04	12	34,29
Japan	1	3,70	1	2,86
Kenya	1	3,70	1	2,86
Libya	1	3,70	1	2,86
Malaysia	2	7,41	2	5,71
Tanzania	1	3,70	1	2,86
Türkiye	5	18,52	11	31,43
USA	1	3,70	1	2,86
Uzbekistan	1	3,70	1	2,86
Total	27	100,00	35	100,00

AUTHORS AND SPEAKERS

No	Full Name	Country	No. of Authorships	No. of Speeches
1	Anna Carolina Muller Queoriz	USA	1	1
2	Burcin Genis Ergun	Türkiye	1	1
3	Dinesh Kumari	India	1	1
4	Dursun Akaslan	Türkiye	2	4
5	Ebenzer Bonyah	Ghana	1	1
6	Farida Abd Karim	Malaysia	1	1
7	Fathia Lahwal	Libya	1	1
8	Husamettin Bulut	Türkiye	0	2
9	Iwao Yamashita	Japan	1	1
10	Janet C. Kimeto	Kenya	1	1
11	Karen Ferreira-Meyers	Eswatini	1	1
12	Kezia H. Mkwizu	Tanzania	1	1
13	Manoela Silva	Brazil	1	1
14	Mehmet Tahir Güllüoğlu	Türkiye	0	2
15	Mohammad Fikrey Bin Roslan	Malaysia	1	1
16	Monika Dagar	India	1	1
17	Mustafa Ulukavak	Türkiye	1	1
18	Parveen Kumar Sharma	Uzbekistan	1	1
19	Rajesh Hooda	India	1	1
20	Ramesh C. Sharma	India	0	2
21	Ricardo Nakamura	Brazil	1	1
22	Shalini Attri	India	1	1
23	Suman B. Kuhar	India	1	1
24	Swati Sharma	India	1	1
25	Tajwinder Singh	India	1	1
26	Varuna Dahiya	India	1	1
27	Yash Paul Sharma	India	2	2
28	Yusuf Isiker	Türkiye	1	1

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Foreword

We have been very pleased to have the opportunity to arrange the 5th edition of the International Conference on Virtual Reality. International Conference on Virtual Reality (VR) started in 2019 to bring together leading and industrial researchers, scientist, engineers, practitioners and students from universities, research institutes, industries and organizations all around the world to exchange their latest research ideas, methods, findings and to share their experiences.

7 invited speakers from Brazil, Eswatini, Ghana, India, Japan and USA participated in our conference. All invited speakers attended our conference and presented their speeches.

Our conference started on November 15, 2023, and ended on November 16, 2023, lasting two days. Additionally, our conference was broadcast live to the public on Youtube and received 325 views.

We hope that this conference will have a tangible effect on the future development of virtual reality, augmented reality and other related technologies.

Thank you again for contributing to this conference.

Dr. Dursun AKASLAN and Dr. Ramesh Chander Sharma

Conference Chairs

Honour Committee

Prof. Dr. Mehmet Tahir GÜLLÜOĞLU
Rector of Harran University
Türkiye

Conference Chair

Dr. Dursun AKASLAN
Harran University
Türkiye

Conference Co-Chair

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India

Organizing Committee

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JNTUK-University College of Engineering Vizianagaram
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Harran University
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Dr. Mehmet Umut SALUR
Gaziantep Islam Science and Technology University
Türkiye

Dr. Yash Paul SHARMA
National Council of Educational Research and Training
India

Dr. Shakini ATTRI
Bhagat Phool Singh Mahila Vishwavidyalaya
India

Dr. Vandna GULIYA
CyberSharp
India

Dr. Kezia H. MKWIZU
Independent Researcher
Tanzania

Scientific Committee

Dr. Deepika Kohli
Khalsa College of Education, Amritsar
India

Dr. Kezia Herman Mkwizu
Independent Reseacher
Tanzania

Dr. Mahmut Kaya
Harran University
Türkiye

Dr. Metin Yildirim
Harran University
Türkiye

Dr. Mehmet Umut Salur
Gaziantep Islam and Technology University
Türkiye

Dr. Mritjunjoy Kaibarta
Educational Technology and Management Academy, Gurgaon
India

Dr. Shalini Attri
Bhagat Phool Singh Mahila Vishwavidyalaya, Sonipa
India

Dr. Parveen Sharma
Amity University, Tashkent
India

Dr. Monal Dewle
Dr B R Ambedkar University Delhi, New Delhi
India

Dr. Deepak Bishla
Dr B R Ambedkar University Delhi, New Delhi
India

Dr. Nayantara Roy
Saurastra University
India

Supporting Universities



Supporting Journals



Supporting Organizations



PROGRAMME

**MAJOR HALL
15 NOVEMBER 2023**

Opening Speech and Welcome Speech by the Chair of Conference
Assoc. Prof. Dr. Dursun Akaslan
(13:00-13:15)

Opening Speech and Welcome Speech by the Co-Chair of Conference
Prof. Dr. Ramesh C. Sharma
(13:15-13:30)

Welcome Speech by the Dean of Engineering Faculty
Prof. Dr. Husamettin Bulut
(13.30-13:45)

Welcome Speech by the Rector of Harran University
Prof. Dr. Mehmet Tahir GÜLLÜOĞLU
(13:45-14:00)

**OPENING SESSION CHAIR
Assoc. Prof. Dr. Dursun Akaslan**

**5TH INTERNATIONAL CONFERENCE ON VIRTUAL REALITY
15-16 NOVEMBER 2023, ŞANLIURFA, TÜRKİYE**

**BALIKLIGÖL HALL
15 NOVEMBER 2023**

Keynote Speech: Exploring the Possibilities of Extended Reality as a Learning Tool

Manoela SILVA (14:00-14:30)

**Implementation of Virtual Reality in School Education in India in the light of
National Education Policy**

Yash Paul SHARMA

(14:30-14:40)

**Teaching Shakespeare: Virtual Reality as Pedagogical Tool for Experiential
Learning**

Shalini ATTRI & Varuna DAHIYA

(14:45-14:55)

**01. SESSION CHAIR
Prof. Dr. Ramesh C. Sharma**

**5TH INTERNATIONAL CONFERENCE ON VIRTUAL REALITY
15-16 NOVEMBER 2023, ŞANLIURFA, TÜRKİYE**

**BASDA VACES HALL
15 NOVEMBER 2023**

Keynote Speech: Virtual Reality for Health: Connecting Engineers and Health Professionals

**Ricardo NAKAMURA
(15.00-15.30)**

Physics in Virtual Reality: Exploring Applications and Advancements

**Suman B. KUHAR
(15:30-15:40)**

Sustainability of National Parks: A Mixed Reality Perspective

**Kezia H. MKWIZU & Janet C. KIMETO
(15:45-15:55)**

**02. SESSION CHAIR
Assoc. Prof. Dr. Dursun Akaslan**

**5TH INTERNATIONAL CONFERENCE ON VIRTUAL REALITY
15-16 NOVEMBER 2023, ŞANLIURFA, TÜRKİYE**

**BİRECİK HALL
15 NOVEMBER 2023**

**Keynote Speech: How XR techniques are introduced and implemented in Japan:
Examples of its practical use**
Iwao YAMASHITA
(16:00-16:30)

Mapping of Research Output on Virtual Reality during 2018-2022: A Bibliometric Study
Dinesh KUMARI & Rajesh HOODA
(16:30-16:40)

A Narrative Review on Challenges and Future Directions of Virtual Reality in Education
Fathia LAHWAL
(16:45-16:55)

**03. SESSION CHAIR
Prof. Dr. Ramesh C. Sharma**

**5TH INTERNATIONAL CONFERENCE ON VIRTUAL REALITY
15-16 NOVEMBER 2023, ŞANLIURFA, TÜRKİYE**

**FIRFIRLI MOSQUE HALL
16 NOVEMBER 2023**

Keynote Speech: Revolutionizing Education: The Implementation of Virtual Reality in Indian Schools

**Yash Paul SHARMA
(13:00-13:30)**

Virtual Reality and the Law: Analysing Legal Challenges and Opportunities

**Monika DAGAR & Tajwinder SINGH
(13:30-13:40)**

Bridging the Gap: The Potential of LTSOFCs in Enhancing VR Headset Performance

**Mohammad Fikrey Bin ROSLAN & Rafidah Abd KARIM
(13:45-13:55)**

**04. SESSION CHAIR
Assoc. Prof. Dr. Dursun Akaslan**

**5TH INTERNATIONAL CONFERENCE ON VIRTUAL REALITY
15-16 NOVEMBER 2023, ŞANLIURFA, TÜRKİYE**

**GÖBEKLİTEPE HALL
16 NOVEMBER 2023**

Keynote Speech: Psychological, Behavioral, and Social Dimensions of Immersive Media

Anna Carolina Muller QUEORIZ
(14:00-14:30)

**The 321 Revolution in Language Learning with AR/VR: Call-To-Action in India and
Uzbekistan**

Parveen Kumar SHARMA & Swati SHARMA
(14:30-14:40)

Immersion in Virtual Reality Games and User Experience

Burcin GENIS ERGUN
(14:45-14:55)

**05. SESSION CHAIR
Prof. Dr. Ramesh C. Sharma**

**5TH INTERNATIONAL CONFERENCE ON VIRTUAL REALITY
15-16 NOVEMBER 2023, ŞANLIURFA, TÜRKİYE**

**HALFETİ HALL
16 NOVEMBER 2023**

Keynote Speech: Learning Outcome Improvement Through The Use of Virtual Reality

**Karen FERREIRA-MEYERS
(15:00-15:30)**

360 Virtual Tour and Map Integration

**Dursun AKASLAN & Yusuf ISIKER
(15:30-15:40)**

Simulation of Seismic Data for Earthquake Prediction

**Dursun AKASLAN & Mustafa ULUKAVAK
(15:45-15:55)**

**06. SESSION CHAIR
Assoc. Prof. Dr. Dursun Akaslan**

**5TH INTERNATIONAL CONFERENCE ON VIRTUAL REALITY
15-16 NOVEMBER 2023, ŞANLIURFA, TÜRKİYE**

HARRAN HALL
16 NOVEMBER 2023

Keynote Speech: Modelling of Monkeypox and COVID-19 Model: In the Context of Fractional Numerical Stochastic With Mittag-Leffler Function

Ebenzer BONYAH
(16:00-16:30)

07. SESSION CHAIR
Prof. Dr. Ramesh C. Sharma

5TH INTERNATIONAL CONFERENCE ON VIRTUAL REALITY
15-16 NOVEMBER 2023, ŞANLIURFA, TÜRKİYE

**MAJOR HALL
16 NOVEMBER 2023**

Closing and Goodbye Speech by the Chair of Conference

Assoc. Prof. Dr. Dursun Akaslan
(17:00-17:15)

Closing and Goodbye Speech by the Co-Chair of Conference

Prof. Dr. Ramesh C. Sharma
(17:15-17:30)

Goodbye Speech by the Dean of Engineering Faculty

Prof. Dr. Husamettin Bulut
(17:30-17:45)

Goodbye Speech by the Rector of Harran University

Prof. Dr. Mehmet Tahir GÜLLOĞLU
(17:45-18:00)

**CLOSING SESSION CHAIR
Assoc. Prof. Dr. Dursun AKASLAN**

**5TH INTERNATIONAL CONFERENCE ON VIRTUAL REALITY
15-16 NOVEMBER 2023, ŞANLIURFA, TÜRKİYE**

ABSTRACTS

Exploring the Possibilities of Extended Reality as a Learning Tool

Manoela Milena Oliveira da Silva¹

Abstract: Extended Reality, in particular, Augmented Reality (AR) has distinct affordances that can positively impact students' motivation and cognitive performance in varied age levels and different contexts, such as visualization, interaction and physicality. However, its use is still not widespread in education. One of the reasons for this is the lack of AR authoring tools considering the educational perspective. In this presentation, we explore the characteristics that are important for AR authoring in education summarized in 11 design principles divided into three aspects: infrastructure, augmented reality and pedagogy. We look at the complete journey to get to this result: from identifying how teachers would like to create AR experiences to understanding their educational needs when authoring AR experiences. This journey followed the Design Based Research (DBR) with the participation of an interdisciplinary team. It also involved prototyping an AR application focused on language learning for children and evaluating it to extract the design principles.

Keywords: Extended Reality, Augmented Reality, Learning Tool, Educational Perspective

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Implementation of Virtual Reality in School Education in India in the Light of National Education Policy

Yash Paul Sharma¹

Abstract: The implementation of Virtual Reality (VR) in school education in India, guided by the National Education Policy (NEP) 2020, presents an exciting and transformative opportunity for the nation's educational landscape. This visionary policy, which emphasizes holistic and multidisciplinary education, lays the foundation for the integration of VR technology to enhance the learning experience, foster innovation, and prepare students for the challenges of the 21st century. The NEP 2020 envisions a future where education transcends traditional boundaries, encouraging students to explore, experiment, and develop critical thinking skills. Virtual Reality, with its immersive and interactive capabilities, aligns perfectly with this vision. Through VR, students can step into a world of experiential learning, breaking away from rote memorization and passive learning. Instead of simply reading about historical events, they can virtually visit ancient civilizations; rather than studying abstract concepts, they can engage with 3D models that make complex subjects more tangible and understandable. To realize this vision, several key steps need to be taken. Firstly, there is a need to establish digital infrastructure in schools across the country. High-speed internet access and the provision of VR-ready devices such as headsets and computers are essential prerequisites. The government must play a pivotal role in ensuring that even schools in remote and underserved areas have access to these resources, bridging the digital divide and promoting equitable access to quality education. Equally important is the training and upskilling of educators. Teachers should be provided with comprehensive training programs to harness the potential of VR technology effectively. These programs should not only cover the technical aspects but also focus on innovative pedagogical approaches that VR can enable. Empowered and knowledgeable educators are pivotal in delivering meaningful VR-based education to students. Content development is another crucial aspect of implementing VR in school education. Collaborating with content developers to create high-quality VR educational modules that are closely aligned with the NEP curriculum is imperative. These modules should cater to the diverse needs and languages of Indian students, ensuring that the content is accessible and culturally relevant. Furthermore, integrating VR into assessments and evaluations can help measure not only knowledge but also critical thinking and problem-solving skills, in line with the NEP's emphasis on holistic development. One of the challenges India faces is the linguistic diversity of its students. To make VR education truly inclusive, content should be developed in regional languages. This ensures that language does not become a barrier to learning, allowing students to engage more deeply with the material. Collaboration and research are essential in this journey. Partnerships between schools, universities, and tech companies can drive innovation and the development of best practices in VR education. Moreover, monitoring and evaluating the impact of VR-based education on student learning outcomes, engagement, and retention is critical for making informed decisions and refining strategies. Involving parents and communities is also crucial. Educating them about the benefits of VR education and actively involving them in the learning process can create a supportive environment that reinforces the educational gains made in the classroom. Given the rapid evolution of technology, flexibility and adaptability are paramount. Schools must remain open to incorporating new VR innovations as they emerge and adapting their strategies accordingly. Public-private partnerships can play a pivotal role in facilitating the development and distribution of VR technology and content in schools. In conclusion, the article will present the integration of Virtual Reality into school education in India, guided by the National Education Policy (2020).

Keywords: Virtual Reality, National Educational Policy (2020), 360degree

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Teaching Shakespeare: Virtual Reality as Pedagogical Tool for Experiential Learning

Shalini Attri¹ and Varuna Dahiya²

Abstract: The paper examines virtual reality as a pedagogical tool for experiential learning and its impact on teaching of drama. Drama is genre in Literature that is enacted, and it presents the storyline narrated through actions and dialogue and has a beginning middle and end. Virtual reality has the potential to tell the narrative intimate forms of storytelling since it puts the user in the centre of the story or scene enabling the audience to absorb information faster without losing focus. The narrative represents thoughts and frames that help us to understand elapsed time or the stage of action. Like traditional story line Virtual reality narratives may feel scripted and the storyteller personalizes the context 'for' the audience and 'guides' the spectator in the immersion (Gayet,2020). The viewer through virtual reality changes from passive to active participant. Hence, the storytelling in Drama becomes experiential that leads to active learning, motivation and transfer of knowledge. The paper will discuss "Hamlet 360: Thy Father's Spirit", the virtual adaptation of Hamlet written by Shakespeare, the dramatist and will illustrate the experiences in virtual space drawing a connection between the participants and the virtual world.

Keywords: Virtual Reality, Drama, Shakespeare, Experiential Learning

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Physics in Virtual Reality: Exploring Applications and Advancements

Suman B. Kuhar¹

Abstract: Virtual reality (VR) has emerged as a powerful technology that allows users to immerse themselves in computer-generated environments. Within the realm of VR, physics simulations play a crucial role in enhancing the realism and functionality of virtual experiences. This research paper explores the integration of physics in virtual reality and its various applications across multiple domains, including education, training, entertainment, and research. We delve into the underlying principles of physics simulations in VR, examine the technological advancements driving this field, and discuss the potential future developments and challenges.

Keywords: Physics, Virtual Reality, Simulation

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Mapping of Research Output on Virtual Reality during 2018-2022: A Bibliometric Study

Dinesh Kumari¹ and Rajesh Hooda²

Abstract: This bibliometric study maps the research output on 'Virtual Reality' from 2018 to 2022. All articles related to VR have been retrieved using the largest indexing and abstracting database named Scopus. The paper carried out various parameters of bibliometric such as total output; year wise distribution of research output; top five sources; most prolific author, country, language etc. The study revealed that 63,651 research papers published during 2018-2022 on Virtual Reality. This study found that the most preferred document form is 'conference paper' with 29,257 (45.96%) publications followed by 'article' with 26,418 (41.50%) publications and most productive year is 2022 with 15,438 (24.25%) publications followed by 2021 with 13,544 (21.27%) publications on VR. The study found that in terms of number of publications among top five authors, Billinghamurst, M., a professor at the University of South Australia in Adelaide, Australia is the most productive author with 128 publications on VR followed by Riva, G. with 114 publications. Lecture Notes In Computer Science Including Subseries Lecture Notes In Artificial Intelligence and Lecture Notes In Bioinformatics (2283) were observed as the top preferred sources of publications on VR. In the institute contribution, "CNRS Centre National de la Recherche Scientifique" contributed a maximum of 610 (0.9%) publications which is a research organization in France followed by the Chinese Academy of Sciences with 500 (0.78%) publications which is a learned society and a system of higher education. In the country-wise contribution, it is observed that the United States produced the highest number of 12,292 (19.31%) articles followed by China 10,825 (17%). In the language-wise contribution, the study demonstrates that the maximum articles published in the English language with 61,349 (96.38%) publications followed by the Chinese language with 868 (1.36%) publications on VR. The study shows that the faculty of universities and research institutes with education systems are on top in contribution to the research progress in Virtual Reality.

Keywords: Virtual Reality, VR, Scopus, Bibliometric, Study, Research, Productivity

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A Narrative Review on Challenges and Future Directions of Virtual Reality in Education

Fathia Lahwal¹

Abstract: The recent advancements in digital technologies have led to exponential progress in many sectors. This narrative review aims to summarize the new challenges and directions in digitalisation that facing the use of Virtual Reality (VR) in education research, policy-making, and industry. In the past few years, applications VR in education have made critical headways. This highlights a novel trend in leading-edge educational research. The directions are moving beyond proof-of-concept demonstrations and applications of techniques, and are beginning to see substantial adoption in many areas of education. The review will presented some recommendations according to its findings, among the most important. We aiming to highlight the latest achievements, challenges and future directions for sustainable development.

Keywords: Virtual Reality, Education, Narrative Review

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Virtual Reality and the Law: Analysing Legal Challenges and Opportunities

Monika Dagar¹ and Tajwinder Singh²

Abstract: With every new opportunity, comes new challenges. Virtual Reality is a new advancement in our technology that can help us experience many different things. Virtual Reality (VR) is a computer-generated simulation or environment that immerses users in a three-dimensional, interactive, and often multi-sensory experience. It started with Video games and entertainment initially but now it covers almost everything including education, business, social life, sports, tourism, etc. Law is also very dynamic like Virtual Reality. Whenever a new technological, social, personal, or economic advancement comes, it has to pass the criteria set up by Law. Similarly, Virtual Reality is subjected to all the legal regulations. On one hand, it provides many opportunities for law enforcement agencies to properly implement the law, and on the other hand, it brings many legal challenges for lawmakers to set up new regulatory agencies and amend the existing laws. For instance, with the help of Virtual Reality, driving tests can be made completely automated which ends all possibilities of corruption or mistakes and makes our roads safer. This is a very big opportunity for our law enforcement agencies as it lowers their workload and makes it more efficient. But take another instance that in virtual space if any offense is committed like defamation, sexual harassment, outraging the modesty of women, etc., under which law it will be covered. Because the person who is causing it to happen is doing it through a virtual person. So, the definition of a 'person' needs to be amended. Also, since the place where it is happening is a virtual space, the question will arise as to the jurisdiction of the court as well. So, for all these challenges, our legal system needs new laws, certain amendments, new regulatory authority, etc. The method of research is purely analytical and doctrinal. The first part of this paper will explain the concept of virtual reality. The second part deals with all the opportunities which it brings to the legal world. The third part will discuss all the challenges and disadvantages that come with Virtual Reality. The last part will conclude the topic by giving suggestions.

Keywords: Virtual Reality, Law, Legal Challenges, Opportunities, Amendments

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Bridging the Gap: The Potential of Low-Temperature Solid Oxide Fuel Cells in Enhancing Virtual Reality Headset Performance

Mohammad Rikrey Bin Roslan¹ and Rafidah Abd Karim²

Abstract: This research paper presents an innovative approach to tackle power-related obstacles in Virtual Reality (VR) technology through an examination of the possible application of Low-Temperature Solid Oxide Fuel Cells (LTSOFCs). VR headsets, despite their potential to deliver immersive experiences, often face power supply limitations that negatively impact their overall performance and efficacy. LTSOFCs demonstrate operational attributes that operate at lower temperatures, thus setting them apart from traditional Solid Oxide Fuel Cells (SOFCs). Due to this distinctive characteristic, LTSOFCs are able to attain exceptional levels of fuel adaptability and efficiency, making them an exceptionally advantageous energy generation alternative for high-demand applications like VR. The purpose of this research is to assess the feasibility of integrating LTSOFCs into virtual reality (VR) headgear in order to enhance functionality by employing a power supply that is both environmentally sustainable and long-lasting. This research employs a mixed-methods strategy, including the development of VR HMD prototypes powered by LTSOFCs and empirical user testing. The objective is to evaluate the efficacy enhancements made by the technology and its influence on the user experience. Nonetheless, successful implementation of this technology would require overcoming a number of obstacles, such as the requirement for reduction, efficient heat management, and a consistent and dependable fuel supply. The incorporation of LTSOFCs has the capacity to significantly alter the VR industry's paradigm. The potential for this integration to stimulate advancements in VR technology and generate innovative prospects for the utilization of LTSOFCs is considerable. This research serves as a foundational investigation for subsequent inquiries concerning the utilization of fuel cells in ubiquitous technology, promoting collaboration and progress across disciplines.

Keywords: Virtual Reality, VR Headsets, Low-Temperature Solid Oxide Fuel Cells, Power Solutions, Energy Efficiency

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The 321 Revolution in Language Learning with AR/VR: Call-To-Action in India and Uzbekistan

Parveen Kumar Sharma¹ and Swati Sharma²

Abstract: The third decade of the 21st century is demanding. We cannot afford to neglect the trends as well as the needs. The rise of connectivity and the change in the professional requisites of employment have brought language learning to the forefront. It is all about communication and skilled use of language now. Primarily, English is still leading the job market and also occupies a significant part of the global map. This paper shows how we are utilising AR and VR to adapt to the new age of learning in the classroom and beyond. The paper also aims to record the impactful ways of integrating AR/VR in the teaching-learning of English. We shall also analyse the best practices and suggest what can be a rational approach to bring newness to the classrooms of India and Uzbekistan.

Keywords: Augmented Reality, Virtual Reality, ELT, Grammar, Pronunciation, Conversation, English

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² DAV Public School, Kurukshetra, India, swatiparvsharma@gmail.com

Immersion in Virtual Reality Games and User Experience

Burcin Geniř Ergun¹

Abstract: Indisputable proof of virtual reality's advantages has advanced from stunning visual displays to yielding outcomes in real-world applications. Furthermore, immersion's main benefit is no longer just a realistic experience. Empirical research demonstrates that different aspects of immersion have distinct advantages; complete immersion is not always required. Immersive virtual environments (VEs) are designed to give users the impression that they are physically present in a computer-generated environment, creating a sense of presence. Due to the components and suggested assessment techniques, the majority of user experience (UX) models for immersive virtual environments (IVE) are only partially accurate. A comprehensive UX in IVE model that integrates key elements and influencing aspects from the most popular applications of virtual reality (education, entertainment, and edutainment) was previously provided by some researchers. It's seen that gathering and comparing data from the proper subjective and objective approaches is the best way to assess user experience (UX) in IVEs. But for the sake of this paper, it is simply discussed the questionnaire approach. In fact, questionnaires can be used to measure the majority of components. In order to pick relevant existing surveys and ultimately select the most appropriate items to develop and offer a new approach. The goal of this study is to rely on the elements of contemporary UX model by examining the surveys. And finally, it suggests expanding the last questionnaires.

Keywords: Immersion, VR games, User experience, Virtual environments, Immersive virtual environments

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Learning Outcome Improvement Through the Use of Virtual Reality

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Abstract: This research aimed to develop a virtual reality-based social studies model. Social studies integrate several concepts of social science disciplines, humanities, science, and various social issues and life problems. Social studies are given to students to develop thinking skills, inquiry, and social skills, as well as build plural human values on a local, national, and global scale. Social studies renewal can be done by synergizing various social studies materials with virtual reality so that these materials are transmitted to their target audience, and are contextual, informative, engaging, and fun to improve optimal student social attitudes and behaviour while also forming a communal spirit in responding to individual and community problems.

Keywords: Social Studies, Learning Outcome, Virtual Reality

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Revolutionizing Education: The Implementation of Virtual Reality in Indian Schools**Yash Paul Sharma¹**

Abstract: The implementation of Virtual Reality (VR) in Indian school education, aligned with the National Education Policy (NEP) 2020, offers a transformative opportunity for the educational landscape. The NEP's emphasis on holistic education and multidisciplinary learning provides a foundation for integrating VR, aiming to enhance the learning experience, foster innovation, and prepare students for the challenges of the 21st century. VR's immersive capabilities align with the NEP's vision of transcending traditional boundaries, enabling experiential learning and critical thinking development. However, successful implementation requires addressing key challenges, including establishing digital infrastructure, providing educators with comprehensive training, developing culturally relevant content, and ensuring linguistic inclusivity. Collaboration among schools, universities, and tech companies, along with involving parents and communities, is crucial for driving innovation and assessing the impact of VR-based education. Flexibility and adaptability are paramount in this rapidly evolving technological landscape. Ultimately, the integration of VR into Indian school education holds promise, requiring concerted efforts to overcome challenges and fulfill the NEP's vision.

Keywords: Virtual Reality, Policy, Flexibility, Education

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Virtual Reality for Health: Connecting Engineers and Health Professionals

Ricardo Nakamura¹

Abstract: This paper deals with the development and evaluation of virtual reality applications for education and training. Particularly, two training simulators, VA Odonto for dentistry students and VA INF Marin for nursing students, have been discussed, both aimed at enhancing practical skills through virtual reality. The challenges in developing health simulators, including the need for specialized teams and reliable validation methods, are highlighted. Transitioning to the education sector, emphasis has been placed on the integration of virtual reality into engineering courses. Recognizing the multidisciplinary nature of virtual reality systems, a project-based course was initiated, incorporating real-world requirements from research partners. This approach aimed to foster student engagement and address practical challenges. The course encouraged students to create interactive prototypes, promoting competence in interaction design and project management. The ongoing nature of the project was acknowledged, expressing a commitment to assessing its results and refining the approach in future iterations. In conclusion, this paper highlights the promising intersection of virtual reality applications in health, training simulations, and project-based learning within engineering programs.

Keywords: Virtual Reality, Engineering, Interaction

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How XR techniques are introduced and implemented in Japan: Examples of its practical use

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Abstract:

This paper reports about the implementation of virtual reality (VR) techniques in the context of medical English ESP (English for Specific Purposes) learning. It focuses on exploring the use of 3D virtual spaces to enhance international collaboration and language learning, particularly focusing on medical-related topics. One of the key advantages highlighted in the presentation is the potential for real-time interaction in English with overseas faculty members and students, fostering a sense of international communication. This approach aims to address the challenges posed by the aging populations in both Japan and Finland, encouraging collaborative learning on topics related to health promotion, gerontechnology, and comprehensive community care. The limitations of conventional online platforms like Zoom, pointing out the difficulty in creating a sense of spatial presence and immersion have been highlighted. The adoption of 3D virtual spaces, specifically using the VR learning platform named Cor, is seen as a solution to overcome these limitations. The platform allows students to use voice chat functions, reflect their movements on avatars, and share screens within the virtual environment. The paper further proposes a "Stepup Coil Collaborative Online International Learning" model which involves graded tasks of increasing difficulty to develop English proficiency, international co-creation skills, and medical literacy. The tasks in this model are intricately designed to promote mutual understanding and awareness of cultural differences, aligning with the specific needs of nursing students from Japan and Finland. The paper acknowledges the criticisms also like some participating students expressed concerns about the lack of a sense of conversation and spatial separation in the virtual environment. Additionally, Finnish counterparts emphasized the challenge of achieving mutual understanding despite recognizing each other's faces on the screen. The paper further explains the use of pre-developed VR learning spaces as a three-step model, focusing on health promotion, gerontechnology, and comprehensive community care. It provides a structured approach to international collaboration and language learning. In conclusion, the paper discusses the integration of VR techniques in language learning, especially in the medical field, showing promise for enhancing international communication and understanding. The proposed model, despite facing some challenges, presents a thoughtful framework for future exploration and development in the intersection of language education and virtual reality.

Keywords: Virtual Reality, 3D, Virtual Spaces

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Psychological, Behavioral, and Social Dimensions of Immersive Media

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Abstract: This paper analyses the impact of virtual reality (VR) on education, specifically focusing on climate change awareness. This paper highlights the motivations and the need for clarity in understanding what type of knowledge VR targets. It further explains the importance of considering the design of VR experiences and how it relates to different types of learning. The findings reveal that VR has a positive impact on knowledge creation, environmental attitude, and psychological aspects of learning. The effects of segmentation, movement, narration gender, and framing in VR experiences, offer insights into their implications for learning outcomes and behavior change. The paper also delves into the social aspects of learning in VR, particularly examining the role of collaboration and group dynamics. Another highlight of this paper is the application of VR in promoting equity and diversity in education, and how VR experiences were introduced to schools in Brazil, aiming to bridge educational gaps. The paper shares information about a longitudinal study on the integration of VR in classrooms and workforce training initiatives using VR for developing soft skills, its positive impacts on learning, cognition, and social interactions. The paper concludes with the challenges and nuances, providing a comprehensive overview of the pros and cons of utilizing VR technology in educational contexts.

Keywords: Virtual Reality, Learning, Classrooms, Workforce

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Modelling of Monkeypox and COVID-19 Model: In the Context of Fractional Numerical Stochastic with Mittag-Leffler Function

Ebenezer Bonyah¹

Abstract: This paper explores the modeling of monkeypox and COVID-19, focusing on mathematical modeling formulation, dynamical behavior of the coinfection model, and the existence and uniqueness of the solution. The historical context of monkeypox traces back to a smallpox-like outbreak in monkeys from Singapore and Copan in 1958, eventually leading to the first human case in 1970 in the Democratic Republic of Congo. The transmission of the disease from animals to humans, particularly through the consumption of wild animals, presents challenges exacerbated by climate change-induced genetic variations in viruses. The characteristics of COVID-19 and its impact on global health are then examined, along with the vulnerability of individuals with underlying health conditions. The concept of coinfection, where an individual experiences two diseases simultaneously, is explored, emphasizing the importance of understanding the dynamics for effective healthcare planning. The discussion advocates for the role of mathematical models in simulating and comprehending infectious diseases. Fractional calculus is introduced as a crucial tool, providing a non-integer perspective that considers historical data and present circumstances for more accurate predictions. The efficiency of the fractional calculus approach in resource utilization compared to deterministic methods is justified. The formulated model integrates monkeypox and COVID-19, considering various compartments representing susceptible, infected, and recovered individuals, as well as animals (hosts). Stability analysis, positivity of solutions, and equilibrium conditions are discussed, demonstrating the suitability of the model for understanding the dynamics of coinfection. The presentation concludes with the incorporation of stochastic components in the model to account for the inherent uncertainties in infectious disease spread. Simulation results depict fluctuating patterns, emphasizing the unpredictability of real-life scenarios.

Keywords: Monkeypox, COVID-19, Virtual Reality

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FULL PAPERS

Sustainability of National Parks: A Mixed Reality Perspective

Kezia H. Mkwizu¹ and Janet C. Kimeto²

Abstract: National parks are among sources of revenues for the economies of many African nations. According to the United Nations World Tourism Organization (UNWTO), the tourism sector for African countries is recovering after the global pandemic. Other African scholars mentioned the need to improve customer services programs and application of Artificial Intelligence (AI) in the tourism industry. However, there are still scant studies on Virtual Reality (VR), Augmented Reality (AR) and even Mixed Reality (MR) despite literature showing that there are advantages of using these technologies. Therefore, this paper aims to explore sustainability of national parks focusing on a mixed reality perspective from Kenya and Tanzania using a literature review methodology. The findings show that although MR technologies exists globally, its use and integration in sustaining national parks experiences is limited. The practical implication is for tourism stakeholders to take advantage of these technologies in order to have sustainable national parks experiences. Future studies may explore the potential of MR and sustainable national parks using quantitative and qualitative approaches.

Keywords: Sustainability, national parks, mixed reality, Kenya, Tanzania, Africa

Introduction

National parks as protected areas play a crucial role in many economies of African nations. The United Nations World Tourism Organization (UNWTO) noted that the tourism sector for African countries is recovering reaching 85% of pre-pandemic levels (UNWTO, 2023). The tourism recovery has challenges particularly tourism services as indicated in a study by Aman and Papp-Vary. In fact, Aman and Papp-Vary (2023) stated that tourism services are under severe threat in the Bale Mountains National Park in Ethiopia. In East Africa, for example, Mkwizu and Kimeto (2022) mentioned the need to improve customer services programs as a strategy to manage customer services education in the post-COVID-19. In addition, Kimeto and Mkwizu (2023) concentrated on game reserves in Kenya during the pandemic with concern on sustainability of national parks.

Sustainability of national parks is covered in studies by Aman and Papp-Vary (2023) and Mkwizu and Kimeto (2023) which have concentrated on tourism services and game reserves respectively. Other scholars like Melo et al. (2022) noted that studies on sustainable tourism in national parks have given less attention on issues of tourism structure and willingness for development that is sustainable. Whilst Melo et al. (2022) focused on issues of structure and willingness for sustainable development in tourism, the study by Kimeto and Mkwizu (2023) did not extend the study of sustainability of national parks to accommodate mixed reality.

On the other hand, past studies such as Dursun and Elmuhammed (2022) and Sharma (2022) highlighted on the application of Artificial Intelligence (AI) and metaverse in education but Anderson (2023) and Kazak et al. (2020) added that AI technologies have potential for the tourism industry. Furthermore, Anderson (2023) stated that innovation and technology like Augmented Reality (AR) and Virtual Reality (VR) are key in sustainable tourism which also support the previous study by Mkwizu (2022) on AR and VR in the post-COVID-19 tourism. However, there are scant studies (Mkwizu, 2022, 2023; Wambui, 2019) on AR, VR and even Mixed Reality (MR) despite existing potentials. In fact, Gil-Lopez et al. (2023) stated that MR technologies such as MR smart glasses impacts decisions of the consumer due to different patterns of interactions with the product. Hence, this paper explores sustainability of national parks with a MR perspective from Kenya and Tanzania using a literature review methodology.

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Literature Review

Key Concepts

Mixed reality

The term Mixed Reality (MR) has been defined by scholars as user's opportunity to interact with contents that enhances their experiences Debandi et al. (2018) while Fadzli et al. (2020) mentioned that MR is the use of technology to add-on real-life through the use of data generated from computers that enable users to interact using VR and AR. The MR definition in this paper is adopted from Rokhsaritalemi et al. (2020) which refers to merging the real objects and virtual worlds objects in a manner that a window is created between them.

Sustainability of National Parks

The concept of sustainability has been differently defined according to various perspectives. In tourism, for example, sustainable tourism is considered as a form of tourism that has the ability to maintain its viability in a particular area for an undefined period of time without degrading or altering the environment (Butler, 1999). In addition, Korir et al. (2013) defined sustainable tourism, as constructively making use of tourism for conservation purposes, cultural heritage reinforcement and the local people benefiting from revenue generated from tourism and related activities. Kimeto and Mkwizu (2023) defined sustainability of national parks and game reserves as the ability of the parks and reserves to cope with changes such as the global pandemic. Sustainability of national parks according to this paper is defined as the ability to sustain national parks experiences of tourists using technologies such as MR.

Theoretical Frame

This paper assumes that sustainability of national parks involves stakeholders in the tourism industry and therefore, the use of stakeholder theory guides this paper. Whilst linking sustainability to firms is important (Chang et al., 2017), this study explores sustainability of national parks by considering that linking sustainability to national parks is also crucial particularly in the post-COVID-19 pandemic which calls for recovering and returning tourist arrival numbers in attractions like national parks to the pre-pandemic levels. The stakeholder theory originated in the 1960s by Stanford Research Institute, and puts emphasis on stakeholders in organizations (Mahajan et al., 2023). This study considers national park authorities, investors, tourists and tourism practitioners as national park stakeholders.

Stakeholder theory has been utilized by past scholars in research to investigate issues on sustainability, organizational performance, strategic management, and stakeholder management (Mahajan et al., 2023). The study by Mahajan et al. (2023) applied a systematic literature review for a period of 1969 to 2021 and used bibliometric analysis with findings indicating that stakeholder theory is widely used and can advance research in areas of management, sustainability and organizational performance. Additionally, stakeholder theory research is evident in multidisciplinary areas such as finance, accounting, economics, marketing, hospitality and tourism (Mahajan et al., 2023). Hence, this paper is guided by the stakeholder theory to explore sustainability of national parks with a focus on MR perspective for Kenya and Tanzania by applying an integrative literature review method as opposed to systematic literature review.

Sustainability of national parks focusing on a mixed reality perspective from Kenya and Tanzania

Globally, MR is a new thing in the tourism industry that is yet to be exploited. Indeed, MR has potential of sustaining national parks in Kenya and Tanzania. A number of authors in Kenya have examined sustainability but very limited scholarly information on MR in tourism. These authors include Akinyi (2019), Ariya (2021), Bird (2023), Korir et al. (2013), Timmins et al. (2022), Western et al. (2015) and Kimeto and Mkwizu (2023). For instance, the study by Korir et al (2013) focused on wildlife-based tourism, ecology and sustainability of protected areas in Kenya. The study concluded by stating that to succeed in wildlife-based tourism, sound plans are required to achieve management of watched population and their habitats (Korir et al., 2013). The article by Western et al. (2015) looked at ways of enhancing strategies, policies and approaches for the purposes of conservation beyond protected areas on Amboseli National Park in Kenya. The findings showed that the rights and responsibilities for biodiversity conservation must be devolved from national to local level (Western et al., 2015). In addition, this will bring back the skills and the idea of seeing wildlife as part of livelihood. This will further lead to maximizing the benefits while minimizing the conflicts and costs involved.

Akinyi (2019) conducted research in Maasai Mara National Reserve on enhancing sustainable tourism. The study found that, for communities to adopt sustainable tourism, their living standards have to be considered by the government and tourism stakeholders by reducing poverty levels. The study also found the importance of having policy guidelines for resolving conflicts between investors, communities and wildlife. Equally, Ariya (2021) focused on tour operators while Kuntai (2020) highlighted issues like management design as some of the drivers of sustainability tourism agenda in Kenya. Ariya (2021) asserts that tour operators have influence in tourism as a system and with that, they can persuade other stakeholders and tourists towards sustainable tourism direction. The Travelife certification program of tour operators should be the focus of every company so as to gain excellent sustainability achievement which is recognized internationally (Ariya, 2021).

The study by Kimeto and Mkwizu (2023) explored sustainability of the national parks and game reserves during the COVID-19 pandemic in Kenya. The findings were as follows; the Kenyan Government promoted domestic tourism by lowering the park fee and collaboration through sensitization, research, partnership and training among tourism stakeholders in sustaining national parks and game reserves which should be enhanced for customer satisfaction and experiences for future generations.

In Tanzania, at least research has been done on MR and sustainability. For instance, on sustainability of national parks, studies such as Mhulafu and Jani (2021) used a qualitative approach of in-depth interviews to cover the issue of lodging operations in designated national parks by suggesting coping strategies like application of good stock management. But also, a study by Mung'ongo et al. (2023) focused on benefit-sharing and managerial capabilities of indigenous wildlife management at Ngarambe -Tapika Wildlife Management Area (WMA). The study aimed to find out if communities have benefited from Ngarambe-Tapika, if they co-manage the WMA as indigenous authority and to assess existence of challenges facing the management of Ngarambe-Tapika WMA. The findings indicate that local communities have benefited from investors and Ngarambe-Tapika WMA. This shows that the expectation of WMA focusing on community-based conservation has been achieved by Ngarambe - Tapika. In regard to indigenous representation, the community has been considered, though, lack of training hinders some members. Therefore, training on laws and regulations in relation to better living standards and conservation for communities is required (Mung'ongo et al., 2023).

Timmins et al. (2023) carried out research on securing communal tenure through a collaboration action in Northern Tanzania and Maasai Mara in Kenya. The study pointed the benefits of communal tenure, that is, conservation goals, resilient to ways threatening sustainability and their way of life. The findings showed that assisting Hadzabe in Tanzania to get communal titles positively changed the well-being of the people, forest and biodiversity was restored. Therefore, communal tenure is an opportunity for Hadzabe to carry on its traditions (Timmins et al., 2023). For the case of Maasai Mara WCA, top-down land privatization should be avoided. Land subdivision has led to fencing and changing of lives for pastoralists as well as interference of migration routes for wildlife. In Kenya, the Maasai Mara Wildlife Conservation Association (MMWCA) stipulate how collective action through collaboration had led to sustainability in the use of land (IUCN World Heritage Outlook, 2020; Timmins et al., 2023).

Mkwizu (2023) conducted research on MR and resilient future in tourism in Tanzania. The findings showed that use of MR in Tanzania is negligible in comparison to resilient future. In conclusion, the study pointed that MR has potential of upgrading the tourism sector in Tanzania. And therefore, this paper extends the literature on MR in tourism by exploring sustainability of national parks with an MR perspective for Kenya and Tanzania.

Methodology

Literature review method was used to gather relevant information on MR and sustainability of national parks in Kenya and Tanzania in order to address the research question which states that: "Is sustainability of national parks experiences involving the use of MR technologies?" Furthermore, this paper adopted the integrative literature review. According to Dhollande et al. (2021), the application of integrative literature review can assist in understanding the research topic. In this study, the research topic is sustainability of national parks. A selection of reviews involved articles from 2013 to 2023. The inclusion criteria involved search words which are "sustainability of national parks in Kenya and Tanzania" and "mixed reality in tourism for Kenya and Tanzania". Articles that did not state the words related to sustainability of national parks and mixed reality for Kenya or Tanzania were excluded.

The necessity of having inclusion and exclusion criteria using an integrative literature review is adapted from a study by Vagharseyyedin (2016). In using the inclusion and exclusion criteria, Vagharseyyedin (2016) found that personal characteristics, work environment and leadership style were among the key factors which determine organizational commitment by nurses in the context of hospital settings. This study applies a similar approach but in the context of tourism settings particularly sustainability of national parks. As per Table 1, after the inclusion and exclusion criteria, this paper found only 12 relevant articles (7 journal articles, 2 book chapters, 1 unpublished Masters Dissertation, 1 report and 1 newspaper article).

Table 1: Summary of reviewed literature for Kenya and Tanzania

Country	Sustainability of National Parks	Mixed Reality
Kenya	(Kimeto & Mkwizu, 2023) (Timmins et al., 2022) (Ariya, 2021) (Kuntai, 2020) (Akinyi, 2019) (Western et al., 2015) (Korir et al., 2013)	Bird (2023)
Tanzania	(Mung'ongo et al., 2023) (Timmins et al., 2022) (Mhalafu & Jani, 2021) (IUCN World Heritage Outlook, 2020)	Mkwizu (2023)

Source: Compiled from Literature

The database for the sources of these relevant articles include the Journal of Tourism, Culinary, and Entrepreneurship; CABI Digital Library; and Journal of Hospitality and Tourism as displayed in Table 2 and Table 3 under the source type column. Table 2 and Table 3 also provide the summary of the findings from the selected reviewed literature for Kenya and Tanzania.

Table 2: Summary of the findings from the reviewed literature for Kenya

SUSTAINABILITY OF NATIONAL	
Source type	Findings
Journal article (<i>Journal of Tourism, Culinary, and Entrepreneurship</i>)	Government of Kenya boosted domestic tourism by reducing park fees and tourism earned some income. Study recommends for tourism stakeholders to collaborate more in ensuring national parks and game reserves are sustained for customer satisfaction and future generations through partnerships, training, research and sensitization (Kimeto & Mkwizu, 2023)
Book chapter	Application of private tenure system in a misaligned cultural setting can fracture cultural and ecological coexistence between communities and land in the areas of the Maasai Mara landscape management in Kenya (Timmins et al., 2022)
Journal article (<i>CABI Digital Library</i>)	In Lake Nakuru National Park, there is a relatively low effect of park image that is likely to contribute to low satisfaction experience, future behavioural intentions and park ecological value (Ariya, 2021)

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Dissertation (<i>Masters Dissertation</i>)	Strategic features, management design, sustainable tourism policy and community participation have a positive and significant contribution towards sustainable tourism in the Maasai Mara National Reserve (MMNR) in Kenya (Kuntai, 2020)
Journal article (<i>Journal of Hospitality and Tourism</i>)	The government should design and operate educational programs and raise sensitivity in order to make communities around the Maasai Mara National Reserve in Kenya conscious enough of the impacts of tourism and understand their effects (Akinyi, 2019)
Journal article (<i>Parks</i>)	Sustainability in terms of Human Wildlife Conflict (HWC) to focus on policies and practices embedded in community-based conservation in Kenya that address HWC through devolved rights and responsibilities for wildlife management (Western et al., 2015)
Journal article (<i>Journal of Natural Sciences Research</i>)	For sustainability of protected areas in Kenya to have successful wildlife-based tourism requires sound plans that use adaptive management approaches which provide the basis for managing the watched populations and their habitats (Korir et al., 2013)
MIXED REALITY	
Source type	Findings
Newspaper article	There is creation of virtual versions of African realities and experiences using VR, AR and MR. For example, Machakos is one of the local governments to use VR in tourism promotion (Bird, 2023)

Source: Authors own compilation from literature

Table 3: Summary of the findings based on the reviewed literature for Tanzania

SUSTAINABILITY OF NATIONAL PARKS	
Source type	Findings
Report (<i>IUCN Report</i>)	At Serengeti National Park, the visitors' awareness around sustainability remains a major challenge. For instance, the majority of people arriving by road enter the park at Naabi gate which is located in the rain shadow of the Ngorongoro Crater (IUCN World Heritage Outlook, 2020)
Book chapter	Sustainability of businesses in national parks particularly lodges shows unpredictable business climate for lodges operating in designated national parks. Recommended that lodgers should not only consider touristic points of attractions but also logistics when setting up lodges in national parks (Mhalafu & Jani, 2021)
Journal article (<i>International Journal of Environment and Climate Change</i>)	For sustainability of Kitulo National Park, the study recommends for increase of more livelihood support benefits and launch of sensitizing programme for clear understanding on the purpose of the park and its benefits to the community (Mung'ongo et al., 2023)

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Book chapter	Application of private tenure system in a misaligned cultural setting can fracture cultural and ecological coexistence between communities and land in Northern Tanzania landscape management (Timmins et al., 2022)
MIXED REALITY	
Source type	Findings
Journal article (<i>International Journal of Advanced Virtual Reality</i>)	Findings show minimal use of MR in reference to resilient future in tourism. The study noted that the use of MR can enhance a resilient future towards revamping Tanzania’s tourism sector. The practical implication is that the tourism practitioners should encourage the use of MR in promotion efforts to ensure a resilient tourism sector (Mkwizu, 2023)

Source: Authors own compilation from literature

Findings and Discussion

The findings have shown that there are limited studies in general dealing with sustainability of national parks and MR in both Kenya and Tanzania as displayed in Table 1 briefly and detailed in Table 2 and Table 3. There was even less literature on MR and its technologies related to tourism for both Kenya and Tanzania. In addition, sustainability of national parks experiences involving the use of MR technologies is limited. This finding supports Mkwizu (2023) for Tanzania whilst for Kenya, the article by Bird (2023) advocated for Kenya to invest on technologies such as MR in order to fully utilize the tourism potential particularly in sustaining national parks to improve tourists’ experiences in the post-COVID-19 pandemic.

This implies that in terms of sustainability of national parks experiences and MR technologies, more research is needed. For instance, the existing literature such as Akiyi (2019), Ariya (2021), IUCN World Heritage Outlook (2020), Mhalafu and Jani (2021), Mung’ongo et al. (2023), and Timmins et al. (2022) have commonly concentrated on issues of low park image, educational programs, livelihood, private tenure system and infrastructure challenges and less on MR. Further findings indicate that for Kenya, the sustainability of national parks according to Kuntai (2020) and Western et al. (2015) should focus on issues like management design, sustainable tourism policy, community participation and HWC whereas this study is of the opinion that due to the potential of MR, more research is needed so that sustainability of national parks embrace the advantages of MR technologies in enhancing tourists’ experiences in national parks in the post-pandemic. Similarly, for Tanzania, sustainability of national parks is focused on benefits to the community (Mung’ongo et al., 2023), and lodge operations (Mhalafu & Jani, 2021) thus less concentration on sustainability of national parks and MR including MR technologies.

In reference to the stakeholder theory, this paper’s integrative literature review approach shows that there are scant studies on sustainability of national parks in relation to MR. This finding implies that more research is needed so that the stakeholders of national parks such as national park authorities, investors and practitioners can encourage the use of MR technologies to enhance tourists’ experiences in sustaining national parks after the pandemic.

Conclusion

This paper concludes that although MR technologies exists globally, its use and integration in sustaining national parks experiences is limited for Kenya and Tanzania. The scant literature on MR in relation to sustainability of national parks for both Kenya and Tanzania suggest that more research is needed so as to tap the potential of MR and its technologies in boosting tourism after the global pandemic.

Implications

Based on evidence from other studies that MR have benefits then the practical implication is for tourism stakeholders to take advantage of these MR technologies like MR smart glasses in order to have sustainable national parks experiences. From an academic implication is that more research in the context of Kenya and Tanzania is needed in order to fully utilize the potentials of MR in sustaining national parks. From a theoretical implication is that the stakeholder theory can be used as a theoretical frame guide in exploring sustainability of national parks with a focus on MR perspectives.

Limitation of the Study and Direction for Future Studies

This paper used only literature review approach. Specifically, the integrative literature review as a methodology to investigate sustainability of national parks focusing on MR. The scope was also limited to Kenya and Tanzania. Future studies may expand the methods by exploring the potential of MR and sustainable national parks using quantitative and qualitative approaches. The suggestion for future study direction may still include Kenya and Tanzania as study locations to further understand the aspect of MR in sustaining national parks. However, this study also encourages further research to include other countries within the East African Community (EAC) and beyond.

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Simulation of Seismic Data for Earthquake Prediction

Dursun Akaslan¹ and Mustafa Ulukavak²

Abstract: The observation and spectral density analysis of seismic electric signals (SES) plays a crucial role in earthquake predictions. Relationships between seismic electrical signals and earthquakes are seriously examined by researchers. The purpose of this study is to implement a simulation of seismic data for earthquake predictions with the support of the TÜBİTAK (122Y365). For this purpose, two targets are specified. Firstly, a station is designed and implemented for the observation of seismic electric signals for earthquake predictions. Secondly, a simulation of seismic data for earthquake prediction is implemented by using charts. Moreover, our findings indicate that several factors should be considered before making any assumptions on earthquake predictions.

Keywords: Seismic, Earthquake, Prediction, Simulation

Introduction

The word “seismic” is defined as a word relating to or caused by an earthquake when the earth shakes and generally used with the words “electric” and “signal” together. The observation and spectral density analysis of seismic electric signals (SES) plays a crucial role in earthquake predictions. The earthquake is described as the instantaneous release of energy caused by deformations in the crust of earth, which spreads in the form of waves and shakes the environments they encounter (Ulukavak & İnanç, 2023).

Relationships between seismic electrical signals and earthquakes are seriously examined by researchers. For example, an updated Varotsos-Alexopoulos-Nomicos (VAN) method competing hypothesis for SES generation and earthquake triggering is reviewed by Helman (2020) to find out whether the VAN method might work to understand the relationship between SES and earthquakes.

Earthquakes are perceived as a natural event in which the stress energy resulting from the breaking of the ground’s crust spreads across the ground and surface in the form of seismic waves and therefore shakes the environments it passes through (Ulukavak et al., 2023). The purpose of this study is to implement a simulation of seismic data for earthquake predictions. For this purpose, two targets are specified.

- Firstly, a station is designed and implemented for the observation of seismic electric signals in earthquake predictions.
- Secondly, a simulation of seismic data for earthquake prediction is implemented by using charts.

Methods

Station Installation

Determination of the Station Location

Şanlıurfa, where Harran University is located, is one of the oldest cities in Anatolia with its history dating back eleven thousand years from Today. Moreover, Şanlıurfa is located approximately 100 km from the Eastern Anatolian Fault Zone and was adversely affected by the February 6, 2023, Kahramanmaraş earthquake. Therefore, Şanlıurfa might be a true location in the observation and spectral density analysis of seismic electric signals in nearest cities in the Mesopotamia. Figure 1 illustrates the location of the station area in the Osmanbey Campus of the Harran University (37.174507°N, 38.993014°E).

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Figure 1. Station Area

The location of the station area is selected due to the several advantages, namely: secure area within the public institution, away from the building's earthings, high support from the institution management, and no power transmission lines in the region, which negatively affects the station geoelectric variations.

Improvement of the Station Location

It is important to improve the station location and working conditions by clearing the area from the undesirable components such as rocks, weed and garbage. For this reason, a permission was taken from the Rectorship of the Harran University. After the permission taken, the station area was cleaned and therefore transformed into a project site as illustrated in Figure 2.



Figure 2. Improvement of the Station Location

As illustrated in the Figure 2, a skid-steer loader was used to clean the station area from undesired components such as rocks, weed and garbage.

Ground Marking for the Lines

The station area where the equipment will be installed in the location where the lines and center will be established was marked on the ground. By using a certain amount of lime, lines namely for North (N)-South (S) and East (E)-West (W) directions were marked to help the excavation operator as illustrated in Figure 3.



Figure 3. Ground Marking for the Lines

Trench Excavations for the Lines

Trenches, where the lines in the North (N)-South (S) and East (E)-West (W) directions will be buried, were excavated by using a backhoe loader as illustrated in the Figure 4. As illustrated the backhoe loader is capable of excavating and removing rocks and soil.

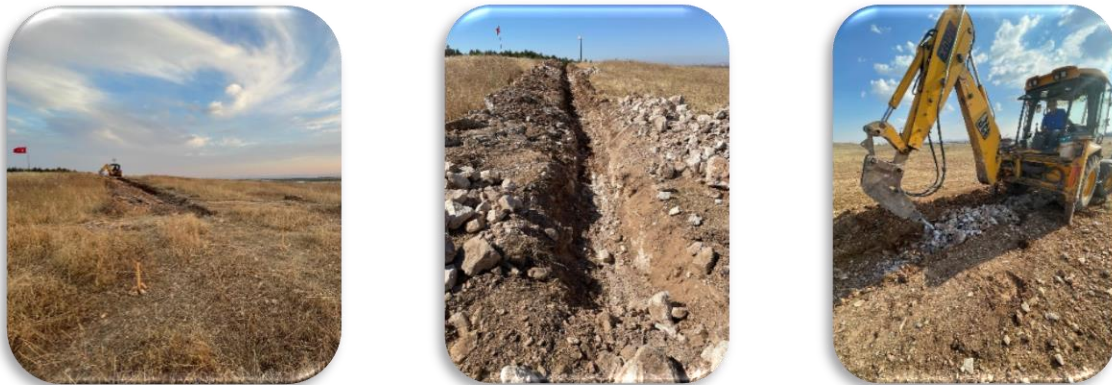


Figure 4. Trench Excavations for the Lines

Copper Electrodes for Earthings

A total of 7 copper electrodes of 1 meter in length were grounded in the excavated channels at intervals of 0, 50, 100 and 200 meters in both north-south and east-west directions as illustrated in Figure 5.



Figure 5. Copper Electrodes for Earthings

As illustrated in Figure 5, a hammer drill with an 8mm diameter diamond tip was used to open the sufficient holes for the copper electrodes with a diameter of 8 millimeters and a length of 1 meter. During the drilling process, 12 millimeter diameter irons were temporarily used as plugs to protect the holes from soil or dust.

Coaxial cables for transmission

With the purpose of measuring the seismic electric signals, coaxial cables (i.e., Rg6/U6 TV Cable Cu/Cu) were used to transmit geoelectric variations through the lines in the North (N)-South (S) and East (E)-West (W) directions as illustrated in Figure 6. As shown in the Figure, coaxial cables are isolated from the external effects such as sharp-edged rocks, wild animals and rains.



Figure 6. Coaxial Cables for Transmission

Connecting Coaxial Cables with Copper Electrodes

Coaxial cables and copper electrodes are connected by using the connection clamps as illustrated in Figure 7. As illustrated in the Figure, the connection to the electrodes was made using only the single-core copper in the coaxial cable. Moreover, the isolation is improved by using a plastic jacket to ensure that there is no connection between inner conductor and metallic shield.



Figure 7. Connecting Coaxial Cables with Copper Electrodes

Covering Trenches with Rocks and Soil

After connecting coaxial cables with copper electrodes, the trenches in the station location were covered with the rocks and soil on the ground as illustrated in Figure 8.



Figure 8. Covering Trenches with Rocks and Soil

Installing Center Station

The center station was set-up by pouring floor concrete and protected with panel fences to ensure that no wild animals might enter the station as illustrated in Figure 9.



Figure 9. Covering Trenches with Rocks and Soil

Testing Geoelectric Variations

A sensitive voltmeter might be used to measure the seismic electric signals. For this purpose, two electrodes are generally used in the ground at a certain depth. However, electrodes must be insulated as illustrated in Figure 10. As illustrated, two electrodes (i.e, A and B) are buried in the ground at a certain depth and insulated copper wires are connected to one end of each electrode that is not buried. The two free ends of the insulated wires are connected to a voltmeter to measure the potential difference between A and B electrodes.

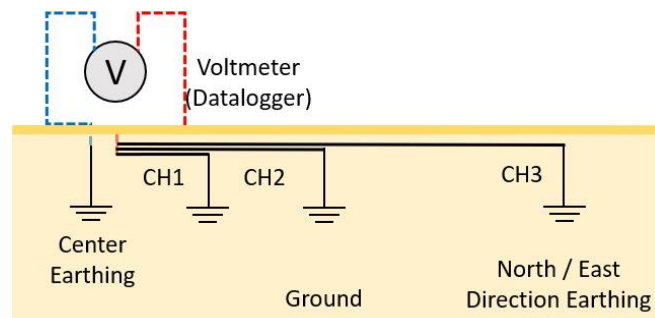


Figure 10. Voltmeter Usage

For testing the geoelectric signals, a voltmeter was used at the beginning of the installation. As illustrated in the Figure 11, a voltmeter was used to measure the voltage between two electrodes in the North (N)-South (S) direction of the station. As shown in the figure below, 46 milivolt was measured between the electrodes. Moreover, oscilloscope was used to observe the seismic electric signals.

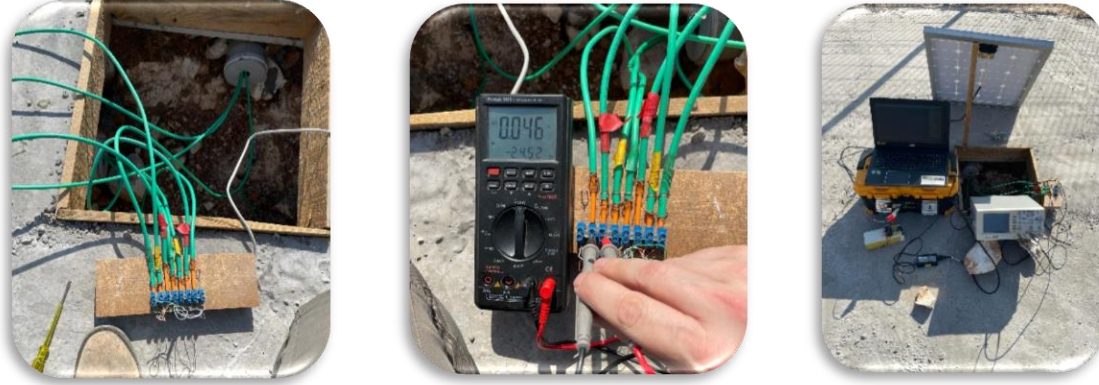


Figure 11. Testing Geoelectric Variations

Supporting Station with Off-Grid Solar Panel Systems

The station was finally supported with an off-grid solar panel system for long term observation of geoelectric variations as illustrated in Figure 12.



Figure 12. Supporting the Center with an Off-Grid Solar Panel System

Findings and Discussion

The geoelectric variations were measured by using a data logger (i.e., Graphtec GL240) with 10-channels. The data logger was used to measure and record geoelectrical variations at 1-second intervals. As illustrated in the Table 1, the data logger recorded the geoelectrical variations between 22 and 28th of the December in 2023. During the 6 days, 518,394 values were measured from each of each channel. Moreover, since we used real-time recording feature of the data logger, 73 seconds were lost during the backup.

Table 1. Information about Start and End of Recordings for 6 Days

Dataset	Start Day and Time of Recording	End Day and Time of Recording	Number of Records	Duration of Records
1	22.12.2023 12:26:14 Friday	23.12.2023 12:26:12 Saturday	86399	73 Seconds
2	23.12.2023 12:27:25 Saturday	24.12.2023 12:27:23 Sunday	86399	72 Seconds
3	24.12.2023 12:28:35 Sunday	25.12.2023 12:28:33 Monday	86399	73 Seconds
4	25.12.2023 12:29:46 Monday	26.12.2023 12:29:44 Tuesday	86399	73 Seconds
5	26.12.2023 12:30:57 Tuesday	27.12.2023 12:30:55 Wednesday	86399	72 Seconds
6	27.12.2023 12:32:07 Wednesday	28.12.2023 12:32:05 Thursday	86399	73 Seconds

Total	22.12.2023 12:26:14 Friday	28.12.2023 12:32:05 Thursday	518394	436 Seconds
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Moreover, the min and max values of geoelectric variations in 6-channels were illustrated in the Table 2. As illustrated in the table, the values measured from each channel differs from each other. For example, the values measured from the channel changes between -0.4 and 11.3 milivolts. It is also important to note here 285,2 mVolt in the channel 3 was measured only once.

Table 2. Min and Max Values

Channels	Length (m)	Direction	Min Value (mVolt)	Max Value (mVolt)
1	50	South-North	-0.4	11.3
2	100	South-North	-14.5	-0.8
3	200	South-North	-28.8	285,2
4	50	East-West	-92.3	16,6
5	100	East-West	-56.5	-4
6	200	East-West	-53.3	2,9

Additionally, several web technologies such as Node.js and React.js were also used to observe the geoelectric variations throughout the web. For this purpose, a website was designed and installed into the Raspberry Pi 4. As illustrated in the Figure 13, geoelectric variations were illustrated as charts to observe the volatage amplitude for each channel. As shown in the figure, time and amplitude of the geoelectric variations at the Channel 1 might be observed visually.

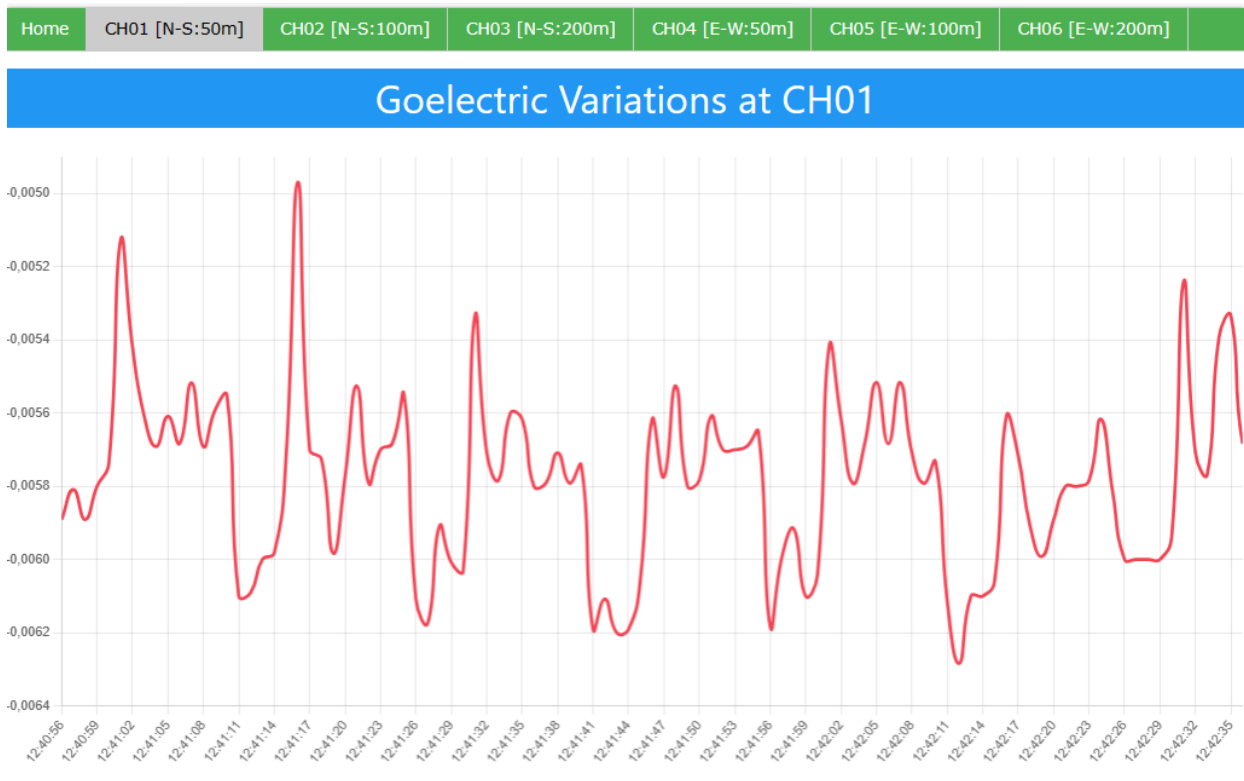


Figure 13. Goelectric Variations at CH01

Conclusions

Earthquakes are perceived as natural phenomena in which the stress energy is released and shakes the ground. In our study, we aim at finding out a solution to the phenomena by setting up a station in Şanlıurfa. With this station, we focused on the behaviours of the geoelectric variations measured from several channels in South-North and East-West directions. Our study illustrated the installation of a station in details from the determination of the station location to the supporting the center with an off-grid solar system. The station is now measuring the seismic electric signals from various points in the station. For the future, we are planning to apply the

Acknowledgements

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360 Virtual Tour and Map Integration

Dursun Akaslan¹ and Yusuf Isiker²

Abstract: Harran University functions with tens of colleges, faculties and institutes within several campuses in the center of Şanlıurfa, namely Eyyübiye, Health and Osmanbey. Since they are far from the city center, it is highly important to properly promote the units of our University using various technology namely 360 virtual tour. 360 degree virtual tours are the most preferred virtual tour application considering panoramic virtual tour technology. The purpose of our study is to find out the best way to visualize our campuses, units and departments through the web by specifying two main targets: having panoramic photographs belongs to our building, floor and classroom within campuses (i) and convert their panoramic photographs into the 360 tour through the web. The JavaScript library “Panellum” was used in our study since it open-source and developable. The panoramic photos of three main units: building, floor and classroom were taken by using Android and iPhone smart phones. A website is implemented to convert the panoramic photos into the 360 virtual tour.

Keywords: Virtual Reality, 360 Virtual Tour, Panoramic Photo, Panellum

Introduction

Harran University is founded in 1002 and located in Sanliurfa in Türkiye. Today, Harran University functions with tens of colleges, faculties and institutes within several campuses in the center of Şanlıurfa, namely Eyyübiye, Health and Osmanbey. Since they are far from the city center, it is highly important to properly promote the units of our University using various technology. 360 degree virtual tours are the most preferred virtual tour application considering panoramic virtual tour technology (Ünver & Ulvi, 2022). The purpose of our study is to find out the best way to visualize our campuses, units and departments through the web. For this purpose, two main targets are specified:

- First, it is essential to capture the panoramic photographs of our institutions by having several images at a certain lens angle. Since there are hundreds of departments and programs, it is important to develop a system that our departments can capture their panoramic photographs through their iPhone or Android phones with ease.
- Second, there should be easy way for our staff to convert their panoramic photographs into the 360 tour. Moreover, staff in our departments might have an opportunity to prepare the 360 tour of their classrooms for their students.

360 tour and map integration will help us to visualize the part of our university with ease. Moreover, classrooms used in the exams carried by the Anadolu University, Atatürk University, Istanbul Universities and the ÖSYM (Measuring, Selection and Placement Center) will be truly illustrated to candidates through their entry documents.

Methods

It is important and essential to have several images at a certain lens angle and to use the appropriate overlap ratio for creating a 360-degree fully rotatic panoramic photograph (Ünver & Ulvi, 2022). Moreover, the focal length of the lenses used is one of the main factors that determine the overlapping rate of the photographs and the number of photographs to be taken.

Panoramic Photographs

The word “panoramic” is derived from the word “panorama”, which is a view of a wide area. Panoramic photographs are described as wide-angle photographs that are created by obtaining wide images from a single angle (Uzun & Özcan, 2015). Studies on obtaining panoramic images in photographic terms were carried out in the late 1800s by merging several photographs captured from different directions in order to obtain a full panorama (Uzun & Özcan, 2015 as cited in Polat & Polat, 2020).

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Panorama Viewer for the Web

There are several ways for creating 360 tour through the web. However, 360 virtual tour and map intergration plays a crucial role in our case since maps should be accessible through the web. For a free and open-source panorama viewer for the web, we used a JavaScript library namely Panellum, which is built using HTML5, CSS3, JavaScript, and WebGL. Since the Panellum can run standalone, it is easy to integrate the 360 tour with the map or other web applications.

Findings and Discussions

Panoramic Photographs

Since the history of the phones, photography has become an integral part of phones including smartphones (e.g., Andorid & iPhone) and featurephone (e.g., Blackberry & Nokia 3310). Today, most smartphone manufacturers include panoramic functionality with their bundled camera apps. By using the smartphones, the panoramic photoes of our units within our campuses were camptured in three stages: Buildings (1), Floors (2) and Classrooms (3) as illustrated in Figure 1.



Figure 1a. Building



Figure 1b. Floor



Figure 1c. Classrooms

As illustrated in Figure a, b and c, the panoramic photos of our units in three stages are captured using an Android and iPhones. Moreover, it is also important for us to ensure that there are no people within the photos during the capture since they will be available through the web.

Source Code for the Web

There are hundreds of software or applications on the Internet about the 360 tour. However, open-source libraries are important for us since they need to be integrated into our current applications. Additionally, open-source libraries are developable. A JavaScript library namely Panellum was used in our case since they can be hosted on virtually any web server. The template source code for the use of the Panellum Library is illustrated in Figure 2.

```
index.html x
index.html > html
1 <!DOCTYPE html>
2 <html lang="en">
3 <head>
4   <meta charset="utf-8">
5   <meta name="viewport" content="initial-scale=1.0, maximum-scale=1.0, user-scalable=1">
6   <title>360 Virtual Tour and Map Integration</title>
7   <link rel="stylesheet" type="text/css" href="css/index.css">
8   <link rel="stylesheet" href="css/panellum.css"/>
9 </head>
10 <body>
11   <div id="panorama"></div>
12
13 <script type="text/javascript" src="js/panellum.js"></script>
14 <script src="js/index.js"></script>
15 </body>
16 </html>
```

Figure 2. Main Source Code for the Panellum

As illustrated in the Figure 2, the Panellum JavaScript Library consists of two main files namely panellum.css and panellum.js for implementing the 360 tour. After that panoramic photographs are used between <script> and </script> tags as illustrated in Figure 3.

```
JS index.js  X
js > JS index.js > ...
1  pannellum.viewer('panorama', {
2    "type": "equirectangular",
3    "panorama": "http://localhost/360tour/images/building.jpg",
4    "autoLoad": true
5  });
6
```

Figure 3. Panoramic Photos

As illustrated, the panoramic photos are published through the web by using `<div>` and `</div>` tags. A subset of the JSON configuration file options can be also used as URL parameters with the Panellum Library such as `type`, `panorama` and `autoLoad`.

Panoramic View through the Web

Panoramic view can be carried out after setting the JSON configuration file. It is also easy to design and implement a relation database system (RDBS) for inserting, updating and deleting the URL of the panoramic photos in the web server to ensure that they might be updated. The 360 tour can be seen through the web by accessing the `index.html` through the web server as illustrated in Figure 4.



Figure 4a. Building: Engineering Faculty



Figure 4b. Floor: Deanship



Figure 4c. Classroom: F301

Conclusion

Building, floors and classrooms are highly important components within universities since students spend a large proportion of their education life. Moreover, classrooms in Harran University are heavily used by the Anadolu University, Atatürk University, Istanbul Universities and the ÖSYM (Measuring, Selection and Placement Center) for carrying out the national exams. Additionally, classrooms are one of the main components in the design and implementation of weekly course schedules. Therefore, it is important to truly illustrate classrooms before they arrive. Therefore, our study was implemented to find out the best way to visualize our campuses, units and departments through the web. For this purpose, two main targets are applied in our study. First, the panoramic photos of buildings, floors and classrooms were captured. Second, the panoramic photos were converted into 360 virtual photos.

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