MELAKA INTERNATIONAL INTELLECTUAL EXPOSITION

MIIEX '24

12 JUNE '24

Dewan Taming Sari,
Universiti Teknologi MARA Caw. Melaka,
Kampus Alor Gajah, Melaka

"Empowerment of Special Needs through Invention & Innovation"

EXTENDED ABSTRACT

MiiEX'2024

MELAKA INTERNATIONAL INTELLECTUAL EXPOSITION 2024

"EMPOWEREMENT OF SPECIAL NEEDS THROUGH INVENTION AND INNOVATION"

UiTM Cawangan Melaka
KM26 Jalan Lendu,
78000 Alor Gajah
Melaka Bandaraya Bersejarah
Website: https://vmiiex.uitm.edu.my/

MiiEX'2024

MELAKA INTERNATIONAL INTELLECTUAL EXPOSITION 2024

"EMPOWEREMENT OF SPECIAL NEEDS THROUGH INVENTION AND INNOVATION"

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FOREWORD BY THE RECTOR OF UiTM CAWANGAN MELAKA

Professor Ts. Dr. Mohd Rasdi bin Zaidi

Rector, Universiti Teknologi MARA (UiTM)

Cawangan Melaka

Welcome to the Melaka International Intellectual Exposition 2024 (MIIEX ’24). It is an honour for me, on behalf of UiTM Cawangan Melaka, to thank all of you for joining MIIEX ‘24. We are proud to inform you that this is the 13th consecutive year that UiTM Cawangan Melaka is organizing this exposition. Since 2009, UiTM Cawangan Melaka has successfully hosted this innovation exposition. Not only have we succeeded in organizing the exposition, but we have also successfully embarked on commercialized products.

2024 is a special year where MIIEX 2024 emphasizes the development of special needs. As we know, special needs indicate a limitation in a person's ability to engage in and benefit from various aspects, such as daily activities and education. Hence, with the theme "Empowering Special Needs Through Invention and Innovation," it is a platform for industries, professionals, academicians, students, and communities to share their innovative ideas and products to increase accessibility for those with special needs.

The successful implementation of MIIEX ‘24 is our joint success. This event was supported by the Melaka state government through YB Datuk Fairul Nizam bin Roslan, the EXCO of Science, Technology, Innovation, and Digital Communication. I also want to express my

gratitude to Universitas Negeri Padang, Indonesia, Universitas Muhammadiyah, Makassar, Indonesia, the International Association of Economic and Businesses (IAEB), Universiti Sains Islam Malaysia, Ibnu Ummi Maktum Research Center (UMMI), USIM, and The Southeast Asia Minister of Education Organization Regional Centre for Special Educational Needs (SEAMEO SEN) as our co-collaborators for MIIEX 2024.

The collaboration from various parties in MIIEX ’24 is a platform that will improve cooperation and interweaving among industries, professionals, academicians, students, and communities in shaping their potential in developing innovation products. This exposition also serves as a platform to cultivate and uphold the nation’s innovation culture by presenting new ideas and research by young people, especially from academia and universities. Indirectly, MIIEX ‘24 will encourage all inventors towards empowering Science, Technology, Engineering, and Mathematics (STEM), especially in primary and secondary schools.

The new digital landscape also inspires more innovation and new ideas that contribute to various activities, such as business and industries. As a university that encourages “Research and Innovation,” we aim to foster more innovative products that benefit scholars, industries, and communities, addressing issues to improve our present and future life.

This exposition would never happen without dedication, teamwork, and commitment. A round of applause should be given to the committee teams, who are the backbone of this exposition. Their hard work, effort, and time made this exposition possible.

Finally, I would like to conclude this brief remark by thanking all the participants and stakeholders for joining the exposition. We hope that this collaboration never ends here.

Thank you.

FOREWORD BY THE DEPUTY RECTOR (RESEARCH & INDUSTRIAL LINKAGES)

Associate Professor. Dr. Nur Hayati binti Abd Rahman

Deputy Rector (Research & Industrial Linkages), Universiti Teknologi MARA (UiTM) Cawangan Melaka

With much passion and privilege, let me warmly welcome all of you to the Melaka International Innovation Exhibition (MIIEX), UiTM Cawangan Melaka's flagship event. I firmly believe that events such as these demonstrate the gradual evolution of this platform in terms of its significance and its governing principles within the sphere of learning and the broader scholarly society.

The theme for this year, "Empowering Special Needs Through Invention and Innovation," strongly connects to our mission of using research and technology to make a positive impact on the world we live in. Besides enforcing the message of diversity, this theme also reaffirms our focus on creating products to improve the lives of people with disabilities (PWDs). Such innovations are vital as only through focused constructive changes can society become more sensitive to the needs of all members.

MIIEX allows researchers, students, and industry professionals to come together, share their innovative research, and develop viable research partnerships. It has been great to see the enthusiasm of the participants and the efforts they put into their projects, which can offer various social and economic benefits. This is why one can state that MIIEX is a great

opportunity for creating connections between the academic environment and industry, facilitating the implementation of innovative and promising projects.

Finally, I would like to express my sincere appreciation to all the members and supporters of the organizing committee, all the participants, sponsors, and everyone involved in preparing this event. I want to express my gratitude for your commitment and involvement, as the success of MIIEX and the development of an active culture of innovation in our university and beyond is partly owed to your support.

Thank you

FOREWORD BY THE PROJECT DIRECTOR

Dr Zulkefli bin Muhamad Hanapiyah

Senior Lecturer

Assalamualaikum and Warmest Greetings,

It gives me a great pleasure, on behalf of the organizing committee, to welcome all participants and speakers to the Melaka International Intellectual Exposition 2024 (MIIEX '24) with the theme "Empowering Special Needs Through Invention and Innovation." We are honoured and pleased to welcome all participants to this biennial event.

MIIEX ‘24 is a platform that gathers experts from local and international industries, academia, scientists, researchers, and the community to contribute to the advancement of scientific and technological knowledge. This knowledge helps develop disruptive innovation products that improve daily activities for businesses and the community, especially those with special needs.

MIIEX '24 provides an atmosphere for inventors of all levels to gain new exposure and collaborate. Indirectly, this promotes a collaborative and innovative culture that focuses on cutting-edge technologies and new standards in technology and creativity.

MIIEX '24 is anticipated to serve as an arena for participants to acquire and disseminate revolutionary information on ideas and innovation. It is intended that the competition will expose the contestants' minds to the latest technologies and designs, aligning with the government's goal of encouraging innovation in Malaysia.

Finally, I want to compliment my fellow committee members on their amazing efforts, which were vital to the event's success. In addition, I want to thank our co-organizers, event sponsors, and participants. Optimistically, we hope that all new knowledge discovered, invented, or innovated will lead us toward future sustainability.

Thank you.

FOREWORD BY MELAKA STATE EXCO OF SCIENCE, TECHNOLOGY, INNOVATION AND DIGITAL COMMUNICATIONS

YB Datuk Fairul Nizam bin Roslan

Melaka State Exco of Science, Technology, Innovation and Digital Communications

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	KHAIRUL AZHAR BIN LOCHMAN

ABOUT MIIEX'24

MIIEX'24 is an innovation competition annually organised by UiTM Melaka with the intention to bring together ideas and inspiration that could fit in for commercialization needs. This event creates a platform for researchers to establish networking, partnership and opportunities to collaborate with industries.

OBJECTIVES

1. Encourage and instil passion towards inventing and innovating among UiTM Cawangan Melaka staff, students and academicians of local and international higher education institutions;

2. Highlight distinguished talents of skilful inventors and exhibit intellectual products, inventions and innovations among local and private tertiary institutions, government and private agencies, including international participants;

3. Become an effective Business Matching platform for participating research products, matching industries and partnering government agencies;

4. Recognise, inspire and promote invention and innovation products to be patented and commercialized;

5. Increase passion towards inventing and innovating through research and boost interests of government and non-government agencies to obtain consultancy services from a line up experts of higher education institutions and UiTM Cawangan Melaka.

THEME

'EMPOWERMENT OF SPECIAL NEEDS THROUGH INVENTION AND INNOVATION'

Enhancing Chemistry Learning for Secondary Schools Students Using Virtual Reality

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Abstract

Traditional methods of teaching chemistry in secondary schools have proven to be less effective in engaging students and facilitating a deep understanding of scientific concepts throughout the years. Moreover, conducting experiments in a physical setting is limited due to potential costs and safety risks for students. This study aims to enhance the learning process through the development of a virtual reality chemistry learning application called VRChemEd application. VRChemEd application aims to enhance the learning experience for secondary school students by providing immersive and interactive visualization of chemical reactions, resulting in better comprehension of complex concepts. By leveraging the Simulation-Based Edutainment Model within the Analyze, Design, Develop, Implement, and Evaluate methodology, the application offers personalized learning experiences, and self-paced learning education. A usability evaluation was conducted to measure the effectiveness of a VRChemEd application in improving chemistry education. The results are positive, with an average score of 91.25% on the System Usability Score questionnaire. Future work will aim to improve the VRChemEd application by adding realistic simulations, multiplayer capabilities, and enhanced physics realism to enhance its impact and commercial viability.

Keywords: Chemistry Learning, Virtual Reality, Simulation-Based Edutainment

1. INTRODUCTION

Chemistry, as a fundamental branch of science, explores the composition, structure, properties, and changes of matter. It encompasses a broad range of concepts, from the microscopic realm of atomic structure to the macroscopic world of chemical reactions. Understanding chemistry is vital for various fields, including medicine, engineering, and environmental science, as it provides insights into the fundamental processes governing our universe. Learning chemistry can be challenging, as it comprises various concepts ranging from atomic structure to chemical reactions. Due to the complex nature of this discipline, students need to understand abstract theories and apply them to real-world scenarios, making it a difficult task (Le et al., 2022). Furthermore, conventional approaches to teaching chemistry only rely on theoretical instruction and do not provide enough opportunities for hands-on experimentation. This further complicates the learning process, as students find it challenging to connect theoretical knowledge with practical application, which hinders their overall understanding of the subject (Gabbard et al., 2019). There is a need for innovative solutions to simplify the complexities of learning chemistry. One way is to use virtual reality simulations that create engaging, interactive learning environments. This method allows students to experience practical learning without physical laboratories. By virtually simulating lab experiments and chemical reactions, students can grasp abstract concepts, foster curiosity, and hone experimentation skills, all vital for mastering chemistry effectively (Tenaw, 2015; Broyer et al., 2020; Qin et al., 2020).

The proposed system aims to revolutionize chemistry education by introducing a virtual reality simulation platform for secondary school students. It offers a comprehensive range of virtual laboratory experiments covering essential topics in chemistry, like rate reaction. Students can explore complex concepts in a safe and controlled environment through visually immersive and interactive simulations, enhancing their understanding and retention of critical principles (Park & Lee, 2020; Rahman et al., 2022). Additionally, by offering virtual laboratory experiments, a cost-effective alternative to traditional physical chemistry labs, mitigating the financial burden of procuring expensive equipment and hazardous chemicals.

2. OBJECTIVE

The objective of this project is to develop a virtual reality educational tool named VRChemEd for secondary school students. This initiative seeks to establish an immersive and interactive learning environment through the integration of 3D objects in game design, allowing students to grasp intricate chemical concepts and reactions within a VR platform with structured learning phases. Furthermore, the project aims to assess the efficacy and usability of "VRChemEd" ensuring it effectively enhances student comprehension and retention of foundational principles through visually captivating and immersive simulations.

3. NOVELTY & INVENTIVENESS

The landscape of chemistry education is set for a transformation with the innovative application VRChemEd, which utilizes the power of virtual reality. Departing from traditional instructional methods, VRChemEd offers a groundbreaking approach to understanding complex chemical concepts and reactions. This innovative tool showcases the ingenuity of integrating VR technology to overcome the limitations of conventional teaching approaches, providing students with an immersive and interactive learning experience. By presenting chemical phenomena in a dynamic 3D environment, VRChemEd not only enhances student engagement but also revolutionizes the educational landscape by offering a unique and effective method for learning chemistry.

4. PRACTICALITY & USEFULNESS

This study has shown that integrating VR technology into secondary school education can be both practical and useful. A study was conducted on Form Four students at Sekolah Menengah Kebangsaan Putrajaya Precinct 16(1), resulting in an average score of 91.25% on the System Usability Scale (SUS). This indicates that VR-based educational tools are enjoyable and engaging for students and are also easily accessible (Guerci, 2020). Additionally, VR technology offers a safe and controlled learning environment that protects students from exposure to dangerous chemicals and materials during experiments. This enables them to interact directly with the equipment and potentially improve their learning outcomes.

5. CONCLUSION

The development of the VRChemEd application marks a significant milestone in enhancing the understanding of complex chemical concepts among secondary school students. Through the integration of three distinct environments - Main Menu, Lab, and Quiz - within the Unity game engine, the application delivers an immersive and interactive learning experience. By incorporating instructional strategies such as simulations, interactivity, and sequential content structuring, the VR application effectively caters to the diverse learning needs of secondary school students while addressing traditional laboratory challenges like accessibility and safety concerns (Le et al., 2022; Rahman et al., 2022). For future work, continuous evaluation and user feedback are necessary to enhance the effectiveness and relevance of the application in secondary school education.

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