Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015

JOURNAL OF INFORMATION SYSTEM AND TECHNOLOGY MANAGEMENT (JISTM)
www.jistm.com

GLOBAL ACADEMIC EXCELLENCE

AR: PENVISUALAN SINDROM TEROWONG KARPAL DAN JARI PELATUK

AR: VISUALIZATION OF CARPAL TUNNEL SYNDROME AND TRIGGER FINGER CONDITION

Ts. Suzidiana Sulaiman[1*], Sheikh Mohamad Hafiz Abu Bakar[2], Khairun Nabilla Mohd Kamal[3]

[1] Fakulti Seni Lukis dan Seni Reka, Universiti Teknologi MARA, Malaysia
Email: suzidiana@uitm.edu.my
[2] Fakulti Seni Lukis dan Seni Reka, Universiti Teknologi MARA, Malaysia
Email: hafiz63@uitm.edu.my
[3] Department of Creative Multimedia Technology, Universiti Kuala Lumpur, Malaysia
Email: hannah@unikl.edu.my
[*] Corresponding Author

Article Info:

Article history:
Received date: 17.04.2025
Revised date: 30.04.2025
Accepted date: 13.05.2025
Published date: 24.06.2025

To cite this document:

Sulaiman, S., Abu Bakar, S. M. H., & Kamal. K. N. M. (2025). AR: Penvisualan Sindrom Terowong Karpal Dan Jari Pelatuk. *Journal of Information System and Technology Management, 10* (39), 225-237.

DOI: 10.35631/JISTM.1039015

Abstrak:

Carpal tunnel syndrome (CTS) ialah keadaan perubatan mampatan saraf median di sekitar pergelangan tangan, yang memberi kesan kepada 5% daripada populasi dunia berumur 40 - 60. Sementara itu, trigger finger condition (TFC) ialah tendon yang meradang yang berlaku dalam kawasan jari, yang berlaku kepada kira-kira 3% daripada populasi dunia (> 50 tahun). Kedua-dua keadaan ini menyebabkan ketidakselesaan, kebas, dan kesukaran pergerakan di kawasan yang terjejas. Walau bagaimanapun, masih kurang pemahaman tentang keadaan ini, terutamanya dalam kalangan pesakit, penjaga, dan orang dewasa muda khususnya pelajar universiti, kerana kekurangan alat untuk menggambarkan keadaan ini sepenuhnya. Alat realiti terimbuh (AR) termaju boleh memberikan penyelesaian alternatif kepada masalah ini. Oleh itu, penyelidikan ini bertujuan untuk membangunkan aplikasi AR (Tunnel VisionAR) sebagai alat visualisasi kepada pesakit, penjaga, dan pelajar untuk lebih memahami dan menguruskan sindrom. Kajian ini menggunakan kaedah analisis, reka bentuk, pembangunan, pelaksanaan, dan penilaian (ADDIE). Keberkesanan Tunnel VisionAR diukur dengan ujian pengguna melalui kaedah soal selidik. Keputusan menunjukkan bahawa peserta mendapati aplikasi itu baik dan berkesan dalam menyampaikan maklumat yang jelas tentang CTS dan TFC, terutamanya dalam kalangan mereka yang mempunyai pengetahuan sedia ada yang agak terhad. Hasil dari soal selidik juga mencadangkan bahawa Tunnel VisionAR mempunyai potensi untuk membantu memberi pendidikan dan kesedaran penjagaan kesihatan dengan lebih jelas, seterusnya membawa kepada kesihatan dan kualiti hidup yang lebih baik untuk pengguna.

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015

Kata Kunci:

Carpal Tunnel Syndrome, Trigger Finger, Realiti Terimbuh

Abstract:

Carpal tunnel syndrome (CTS) is a median nerve compression medical condition in the vicinity of the wrist, which affects 5% of the worldwide population aged 40 - 60. Meanwhile, trigger finger condition (TFC) is an inflamed tendon occurring within the finger's region, which affects approximately 3% of the worldwide population (> 50 years old). These two conditions cause discomfort, numbness, and loss of motion in the affected area. Nevertheless, there is still a lack of understanding about these conditions, especially among the patients, caregivers, and young adults specifically university students, due to the lack of tools to visualize and understand the conditions entirely. A cutting-edge augmented reality (AR) tool could provide an alternative solution to these problems. Therefore, this research aims to develop an AR application (Tunnel VisionAR) as a visualization tool for patients, caregivers, and students to better understand and manage the syndrome. This study adopts the method of analysis, design, development, implementation, and evaluation (ADDIE). The effectiveness of Tunnel VisionAR is measured by user testing through a questionnaire. Results indicate that participants found the application intuitive and effective in delivering clear information about CTS and TFC, particularly among those with limited prior knowledge. These findings suggest that Tunnel VisionAR has the potential to significantly enhance healthcare education and awareness, ultimately leading to improved health outcomes and quality of life for users.

Keywords:

Carpal Tunnel Syndrome, Trigger Finger, Augmented Reality

Introduction

Carpal tunnel syndrome (CTS) is a medical condition where numbness, discomfort, and tingling sensations are present in one’s wrist (Padua et al., 2016). This syndrome is mainly caused by median nerve compression at the wrist area (Genova et al., 2020). It is primarily associated with a vigorous angular gesture, lesion, or other medical conditions, such as obesity, diabetes, pregnancy, genetic predisposition, and exposure to oscillation movement (Osiak et al., 2022). CTS is commonly experienced by the elderly, aged 45 to 54 for women and 75 to 84 for men (Genova et al., 2020).

Trigger finger condition (TFC) is a health mechanical condition occurring around the tendon, attachment of muscle to bone that controls the fingers. This tendon is surrounded or covered by a sheath layer acting as protection. Inflammation of the sheath covering layer mainly causes this mechanical problem (Mayo Clinic, n.d.). TFC generally causes clicking, discomfort, and loss of motion of the affected finger (Makkouk et al., 2008) .

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015

Both CTS and TFC affect the nervous system and are challenging for most people to envision. Patients often struggle to understand CTS, leading to negative perceptions of treatments, especially surgeries. Reference (Department of Orthopedics and Traumatology, Faculty of Medicine, Medical University of Gdańsk, Gdańsk, Poland et al., 2021) found that over 90% of patients who underwent surgery experienced anxiety due to insufficient information, with nearly 50% concerned about post-surgery pain and outcomes. TFC complicates diagnosis and management due to its varied symptoms and treatments, emphasizing the need for comprehensive platforms (Blough et al., 2022) . Moreover, the majority of patients prefer non-invasive treatments but often lack adequate knowledge (Blough et al., 2022). It was revealed that the majority of university students had mild symptoms and functional severity of CTS based on a recent study at a public university in Selangor, Malaysia (Majid et al., 2022) . Reference (Majid et al., 2022) highlighted the importance of raising CTS awareness among university students in Malaysia, where prolonged laptop use increases the risk of CTS and TFC, underscoring the need for effective awareness programs and platforms.

Augmented reality (AR) is a cutting-edge technology that has been rapidly applied in various fields such as education, medicine, and architecture. It is defined as an exhibition of media with a combination of real and virtual formats (Gerup et al., 2020). This combination aids in improving situational visualization, which could facilitate people's ability to comprehend information.

Therefore, this study aims to develop an AR application of CTS and TFC, known as Tunnel Vision AR, to better visualize the circumstances at hand. Incorporating this technology with medical imaging of CTS and TFC could be beneficial in visualizing the syndrome more effectively for patients, their caretakers, and university students. Tunnel Vision AR also helps to provide a better portrayal of the treatments needed according to their specific conditions.

Literature Review

Definition of Carpal Tunnel

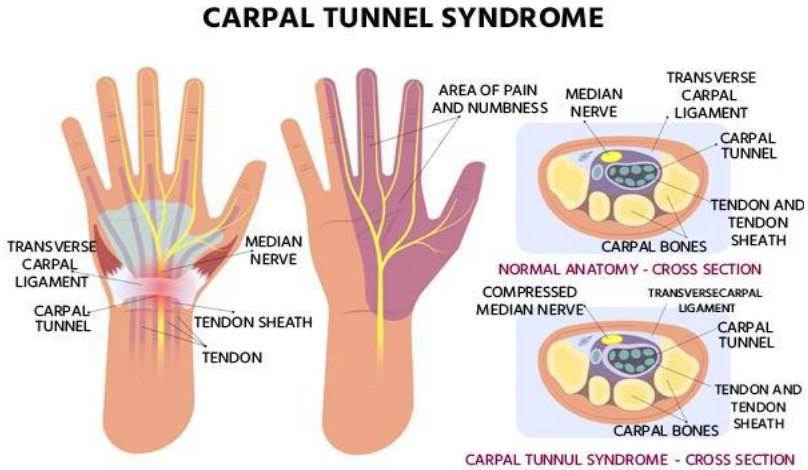

Figure 1. Anatomy of CTS. From Carpal tunnel syndrome - symptoms and treatment at Medicover, by Medicover Hospitals, n.d.
(https://www.medicoverhospitals.in/diseases/carpal-tunnel-syndrome/). Copyright 2024 by Medicover Hopitals.

Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015

According to Genova (Genova et al., 2020). CTS is a median nerve problem commonly faced by the elderly aged 40 to 60. Firstly, the median nerve is located within the wrist joint, consisting of a carpal tunnel, which acts as a channel for tendons and the stated median nerve to pass through the wrist bone and carpal ligaments at the top and bottom (Osiak et al., 2022). Genova et al. (2020) also mentioned that this condition occurs from the compression of the tunnel, which results in inflammation of the tissues surrounding the area. Similarly, a past study has reported that the limited space of the carpal tunnel causes the compression of the median nerve at the wrist (Padua et al., 2016). Factors that can contribute to the increment of this condition are mechanical trauma, which is mainly influenced by the damage of the myelin sheath, ischemic injury, which is a capillary injury, and increased pressure due to repetitive motion or rotation of the wrist (Genova et al., 2020). Other than that, diabetes mellitus, pregnancy, menopause, obesity, hypothyroidism, and arthritis are also risk factors for CTS (Padua et al., 2016).

Symptoms of Carpal Tunnel

Primarily, patients with CTS will suffer from pain, numbness, and pins and needles sensation in the thumb and radial half of the fingers. Patients also awake with burning and numbness sensation in the hand due to the wrist flexion during sleep (Wright & Atkinson, 2019). Furthermore, the symptoms of CTS can be subdivided into three stages. In the initial stage, patients begin to feel numbness and swelling in their hands, mainly circulating the wrist region, which can be felt until their shoulders (Genova et al., 2020). At this stage, the symptoms can be subsided by shaking the affected hand (Genova et al., 2020). In the second stage of CTS, the symptoms the patients feel are commonly sustained for a prolonged amount of time following hand repetition activity, leading to persistent clumsiness, and causing difficulty in gripping any objects (Osiak et al., 2021). At the final stage, a condition where tiny fibres are not fully developed or attained their average diameter, called hypotrophy or atrophy, occurs at the thenar eminence, and causes the involvement to engage with other sensory symptoms by patients (Genova et al., 2020).

CTS can be diagnosed through clinical examinations such as Tinel's and Phalen's tests (Keith et al., 2009). During the Tinel’s test, symptoms in the same median nerve distribution following repeated tapping along the carpal tunnel indicate a positive Tinel sign (Osiak et al., 2020). According to the author, patients who undergo the Phalen's test will be asked to flex their wrists to 90 degrees, and the occurrence of symptoms in the median nerve distribution following this manoeuvre is reported as a positive Phalen test (Osiak et al., 2020). Other than that, patients are also advised to complete a questionnaire known as the Katz Hand Diagram to further specify CTS's position in their hands (Genova et al., 2020).

Journal of Information System and Technology Management
EISSN: 0128-1666
JISTM
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015

Definition of Trigger Finger

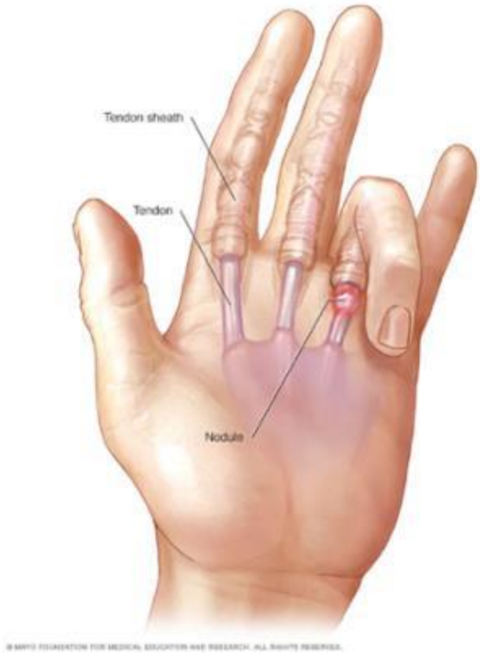

Figure 2: Anatomy of TFC. From Trigger Finger, by Mayo Clinic, 2022.
(https://www.mayoclinic.org/diseases-conditions/trigger-finger/symptoms-causes/syc-20365100). Copyright 2024 by Mayo Clinic.

Trigger finger condition (TFC) is a mechanical condition occurred around the tendon, attachment of muscle to bone, that controls fingers. Beneath the anatomy of one's hand, it consists of muscles and bones connected by tendons. The linkage of the forearm muscle and fingers' bones via the tendons causes the action of bending as the tendons pull on the bones and contract the muscle (Shah & Bae, 2012). This tendon is surrounded or covered by a sheath layer as protection (Bordoni et al., 2023).

The sheath layer consists of bands of tissue termed pulleys, which grasp the bones and tendons as one during the flexion of fingers (Gil et al., 2020). A1 pulley, as shown in diagram 2.2.2, is the pulley located at the base of each digit that meets the palm and is primarily associated with TFC (Gil et al., 2020). Inflammation of the stated pulley mainly causes this mechanical problem (Mayo Clinic, 2022). TFC is commonly experienced by middle-aged individuals, primarily women (Vasiliadis & Itsiopoulos, 2017)

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015

Trigger Finger Condition

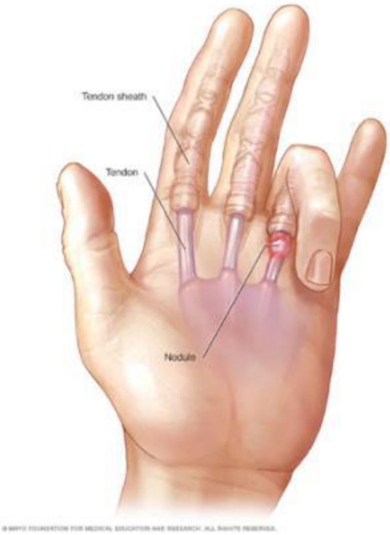

Figure 3: Anatomy of TFC. From Trigger Finger, by Mayo Clinic, 2022. (https://www.mayoclinic.org/diseases-conditions/trigger-finger/symptoms-causes/syc-20365100). Copyright 2024 by Mayo Clinic.

Trigger finger condition (TFC) is a mechanical condition occurred around the tendon, attachment of muscle to bone, that controls fingers. Beneath the anatomy of one's hand, it consists of muscles and bones connected by tendons. The linkage of the forearm muscle and fingers' bones via the tendons causes the action of bending as the tendons pull on the bones and contract the muscle (Shah & Bae, 2012). This tendon is surrounded or covered by a sheath layer as protection (Bordoni et al., 2023).

The sheath layer consists of bands of tissue termed pulleys, which grasp the bones and tendons as one during the flexion of fingers (Gil et al., 2020). A1 pulley, as shown in diagram 2.2.2, is the pulley located at the base of each digit that meets the palm and is primarily associated with TFC (Gil et al., 2020). Inflammation of the stated pulley mainly causes this mechanical problem (Mayo Clinic, 2022). TFC is commonly experienced by middle-aged individuals, primarily women (Vasiliadis & Itsiopoulos, 2017).

Definition of Augmented Reality

The cutting-edge technology known as augmented reality, or AR, has been quickly incorporated into several industries, including education, medicine, and architecture. Gerup et al. (2020) describe it as a media that combines real and virtual formats. This combination helps to improve situational visualization, which may make it easier for people to understand information in its entirety.

AR Application in Medical Field

The number of AR applications has risen in recent years, especially in the medical field, due to the practical benefits. This can be supported by a recent study which uses AR as a mobile application for medical education to visualize the human skeleton system (Hossain et al., 2021). Moreover, AR may also help to lessen the cognitive burden cognitive load that multi-modal imaging data places on clinicians when they intervene with patients from various sources (Coertze, 2020). The use of AR has been applied through in vivo view of 3D patient-specific bone geometries (Coertze, 2020). However, the study used a head-mounted display (HMD)

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015

instead of a hand-held device to view the 3D bone geometries. Furthermore, an interactive 3D application has been developed by BioDigital, which comprises a comprehensive visualization of anatomy, disease and treatments that benefit both educators and students (Sack, 2021).

Marker-based AR

Marker-based AR functions by using two-dimensional (2D) pictures or quick response (QR), a 2D bar code, to identify the three-dimensional (3D) space that is visible to the camera and to accurately position and orient the virtual information on the screen (Camba & Contero, 2015).

Figure 4: Example of QR Code.

QR code and standard photos are the two elements that can be employed. QR codes or black-and-white markers are the most well-known, consistent, and standard marker-based elements (Gherghina et al., 2013). According to Wang et al. (2019), QR denotes "0" and "1" bit streams that are utilised to convey precise mathematical information and compose the internal logic of computer code collection. These bit streams correlate to binary geometric shapes. As a "see-through" tool, the author also noted that this 2D bar code automatically processes information whenever a camera or image scanning equipment detects an object. Any ordinary smartphone or tablet with a fully functional camera is adequate as the hardware for this type of technology since the AR application depends on the images the camera provides and cannot be used on a device without a camera (Gherghina et al., 2013).

When utilising marker-based augmented reality, a few factors need to be taken into account: occlusion, unfocused camera, motion blur and lighting. Occlusion must be considered since it causes a block in sight, making the scanned item appear behind any actual object. However, the lower precision of the device, error in positioning the marker, and erratic movement led to issues with the unfocused camera and motion blur.

When utilising marker-based augmented reality, a few factors need to be taken into account: occlusion, unfocused camera, motion blur and lighting. Occlusion must be considered since it causes a block in sight, making the scanned item appear behind any actual object. However, the lower precision of the device, error in positioning the marker, and erratic movement led to issues with the unfocused camera and motion blur. The presence of uneven lighting in the surrounding area may make it challenging to identify the marker, disrupting the ability to view the 3D object. (AJIT et al., 2021).

Methodology

ADDIE Model

This research adopts the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) instructional design approach, which encompasses five stages to systematically guide the project's progress from pre-production to post- production. In the analysis stage, a thorough

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015
assessment is conducted to identify and understand the deficiencies that need rectification, defining the research's purpose, questions, scope, and limitations. This phase is crucial as it establishes the foundation for addressing the identified problem, setting the primary guiding principles for the subsequent stages.

In the design stage, data from the analysis phase is utilized to create a suitable framework, starting with the development of sitemaps, flowcharts, storyboards, and prototypes. The design process considers the behavior and preferences of the target audience, focusing on essential elements such as typography, color palette, graphics, layout, and interface to ensure a user-friendly experience. Special attention is given to selecting appropriate fonts and color schemes to enhance readability, reduce eye strain, and cater to users with vision impairments.

The development stage involves creating media elements that align with the design framework and research requirements via Adobe Illustrator, Blender, and Unity Engine. This includes translating storyboards into educational materials, organizing content, and developing 3D models while ensuring authenticity and avoiding copyright issues. The implementation stage deploys the developed products for actual use, involving user testing and gathering feedback to refine the application. In the evaluation stage, user feedback is collected through questionnaires to identify strengths, shortcomings, and areas for improvement. This comprehensive approach ensures that the product effectively meets the research objectives and provides valuable insights for future iterations.

User-Testing

User testing in this study involves two types: alpha testing among experts, which provides recommendations, and beta testing with the target audience. For the beta testing, users will be invited to provide feedback through structured questionnaires, prompting them to evaluate their satisfaction with the product and assess its performance. This systematic approach to gathering user feedback informs iterative improvements, enhancing the overall usability and functionality of the application. A set of questionnaires has been distributed to 30 patients or caregivers of CTS or TFC in the Klang Valley and Universiti Kuala Lumpur - Malaysian Institute of Information Technology (UniKL MIIT) students after their utilization of the application concluded. This beta testing phase took place over a two-week period with the purpose of determining whether participants' satisfaction and comprehension of the portrayal of CTS or TFC via Tunnel VisionAR align with the study's objectives.

Result

The evaluation of Tunnel VisionAR is measured via a set of questionnaires which consist of section A, section B, section C. Section A focuses on the participants' demographic data, Section B on the assessment of Tunnel VisionAR's user interface and user experience (UI/UX), and Section C on the impact of the coherent portrayal of CTS and TFC via Tunnel VisionAR. Both Section B and Section C use a 5-point Likert scale, with 1 representing a high level of disagreement and 5 representing high level of agreement in relation to the provided statements.

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015

Demographic Data

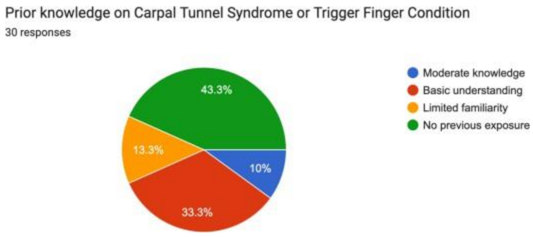

Figure 4: Pie Chart Of Participants' Prior Knowledge On CTS And TFC.

The results of the questionnaire showed that the 30 participants' levels of CTS and TFC knowledge varied. With 43.3% of the data reported, the most common category was no previous exposure. This was followed by 33.3% of basic understanding, 13.3% of limited familiarity, and 10% of moderate knowledge.

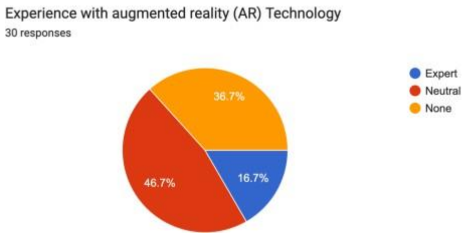

Figure 5: Pie Chart Of Participants' Level Of Experience With AR Technology.

Most participants (46.7%) generally indicated a neutral degree of familiarity and involvement with AR technology, according to the findings. Significantly, 16.7% of participants claimed to have expert level experience with AR, whereas 36.7% of individuals retained no experience with the technology mentioned above.

UI/UX Evaluation

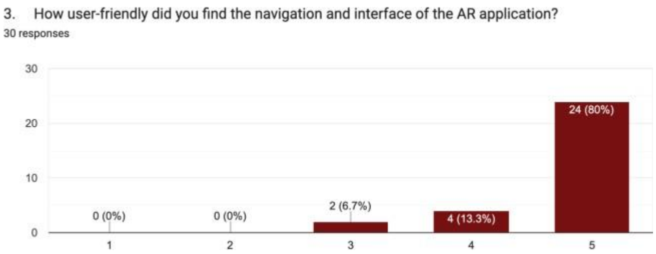

Figure 6: Bar Graph Of User-Interface (UI) And User- Experience (UX) Evaluation.

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015
The bar chart reported participants' feedback on the user- friendliness of the navigation and interface of Tunnel VisionAR. Majority of the participants responded with "Completely," accounting for 80% of the responses. This was followed by 13.3% who "Significantly" agreed with the statement. Additionally, 6.7% selected "Moderately," indicating a moderate level of indicating a moderate level of satisfaction with the application's navigation and interface.

Evaluation on The Impact of Coherent Portrayal of CTS And TFC via Tunnel VisionAR

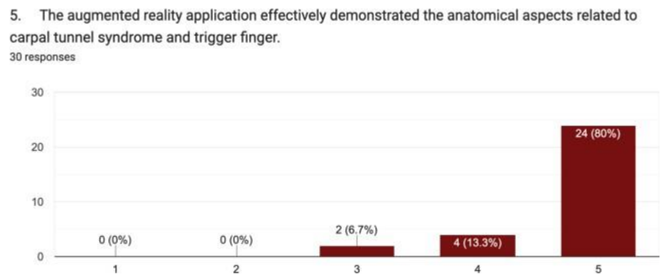

Figure 7: Bar Graph Of User Agreement On Tunnel Visionar's Effective Anatomical Demonstration For CTS And TFC.

The bar chart reveals that the augmented reality application effectively illustrates the anatomical aspects related to carpal tunnel syndrome and trigger finger, with a strong agreement from 80% of participants. Additionally, 13.3% of respondents agree with this effectiveness, while 6.7% expressed neutrality.

Discussion

The results of this study provide insightful observations regarding the participants' perceptions and experiences with the Tunnel VisionAR application. The feedback collected ranges from positive to neutral, reflecting diverse levels of familiarity with both AR technology and the medical conditions of Carpal Tunnel Syndrome (CTS) and Trigger Finger Condition (TFC).

Reference [9] highlights the importance of raising awareness of Carpal Tunnel Syndrome (CTS) among young adults, particularly university students, in Malaysia. The majority of respondents in their study exhibited mild symptoms and functional severity of CTS, indicating a lack of awareness about the condition among this demographic. However, the results of our study suggest that the Tunnel VisionAR application has taken an initial step towards addressing this gap in awareness. A significant majority of participants with 80%, expressed complete agreement regarding the application's user- friendly interface and its effectiveness in delivering clear information about CTS and Trigger Finger Condition (TFC). This positive reception suggests that the application has successfully enhanced awareness and understanding of CTS and TFC among users, including university students who may have had limited prior knowledge about these conditions. Therefore, our results support the need for cost-effective and appealing awareness programs, such as the Tunnel VisionAR application, to educate young adults about CTS symptoms and functional severity, especially those who frequently engage in activities like playing mobile games.

Moreover, the results highlight Tunnel VisionAR's substantial impact on the coherent portrayal of CTS and TFC. 73.3% of participants strongly agree with statements about the application's effectiveness in clarifying the complexities of these conditions. This suggests that Tunnel

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015
VisionAR effectively bridges the knowledge gap and enhances awareness among users. The AR application's ability to provide an interactive 360-degree view of the conditions is particularly valuable for visual learners, offering a novel way to engage with and understand these medical issues. This contrasts with findings from a previous study indicating that patients often struggle to adequately address the severity of their condition due to limited exposure and understanding [8].

However, a minority of participants expressed a neutral stance on the topics presented. This neutrality can be attributed to several factors. Participants' varying levels of familiarity with AR technology could significantly shape their perceptions of the application. Those with previous experience using more advanced AR applications might compare Tunnel VisionAR unfavorably, leading to more critical evaluations. Additionally, participants with a moderate familiarity with CTS and TFC might question the omission of certain treatments and procedures within the application, impacting their overall assessment. For instance, while Tunnel VisionAR currently covers open surgery, the lack of information on other surgical options could be seen as a limitation by more knowledgeable users.

Addressing these inquiries and concerns has the potential to increase user satisfaction and enhance the overall efficacy of the application to better cater to the diverse needs of all users. By expanding the range of treatments and procedures covered and incorporating feedback from users with varying levels of AR experience, Tunnel VisionAR can be further refined to meet a broader array of educational needs. needs.

Conclusion

The study's exploration of Tunnel VisionAR as a visualization tool for understanding CTS and TFC has yielded significant contributions and implications. The application's success in providing a user-friendly platform for patients, caregivers, and UniKL MIIT students underscores its potential to enhance awareness and comprehension of these medical conditions. Moreover, the positive outcomes observed in the evaluation of Tunnel VisionAR highlight its effectiveness in serving as a visualization resource, particularly for individuals with limited prior knowledge of CTS and TFC. Beyond mere awareness, the study's findings suggest practical implications for patients, caregivers, and students, who can utilize the knowledge gained from Tunnel VisionAR to better manage these conditions and provide care. Looking ahead, future research should focus on expanding the range of treatment options within the application and incorporating additional languages to ensure comprehensive coverage and accessibility. Overall, the study underscores the transformative potential of AR technology in healthcare education, paving the way for improved healthcare outcomes and enhanced quality of life.

Acknowledgements

We would like to acknowledge and extend special gratitude to the University Teknologi MARA Selangor Branch and Creative Multimedia Department of University Kuala Lumpur for encouragement the process of this project.

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015

References

Blough, C., Najdawi, J., & Kuschner, S. (2022). Patient preference for trigger finger treatment. *World Journal of Orthopedics*, *13*(11), 1006–1014. https://doi.org/10.5312/wjo.v13.i11.1006

Bordoni, B., Black, A. C., & Varacallo, M. (2023). *Anatomy, Tendons* (30020609). StatPearls Publishing, Treasure Island (FL); PubMed. http://europepmc.org/abstract/MED/30020609

Camba, J. D., & Contero, M. (2015). *From reality to augmented reality: Rapid strategies for developing marker-based AR content using image capturing and authoring tools*. https://doi.org/10.1109/fie.2015.7344162

Department of Orthopaedics and Traumatology, Faculty of Medicine, Medical University of Gdańsk, Gdańsk, Poland, Napora, J., Gryglewsk, K., Piotrowicz, M., Nowicka-Sauer, K., & Mazurek, T. (2021). Analysis of concerns among patients operated for carpal tunnel syndrome. *Chirurgia Narządów Ruchu i Ortopedia Polska*, *86*(4), 115–121. https://doi.org/10.31139/chnriop.2021.86.4.4

Genova, A., Dix, O., Saefan, A., Thakur, M., & Hassan, A. (2020). Carpal Tunnel Syndrome: A Review of Literature. *Cureus*. https://doi.org/10.7759/cureus.7333

Gerup, J., Soerensen, C. B., & Dieckmann, P. (2020). Augmented reality and mixed reality for healthcare education beyond surgery: An integrative review. *International Journal of Medical Education*, *11*, 1–18. https://doi.org/10.5116/ijme.5e01.eb1a

Gherghina, A., Olteanu, A. C., & Tapus, N. (2013, January). A marker-based augmented reality system for mobile devices. In 2013 11th RoEduNet *International Conference* (pp. 1-6). IEEE.

Gil, J. A., Hresko, A. M., & Weiss, A.-P. C. (2020). Current Concepts in the Management of Trigger Finger in Adults. *JAAOS - Journal of the American Academy of Orthopaedic Surgeons*, *28*(15). https://journals.lww.com/jaaos/fulltext/2020/08010/current_concepts_in_the_management_of_trigger.5.aspx

Majid, N., Ismail, M. A. E., Masar, M. L., & Sitti Syabariyah. (2022). Mobile Games among University Students: A symptom and functional severity for Carpal Tunnel Syndrome. *Environment-Behaviour Proceedings Journal*, *7*(20), 255–260. https://doi.org/10.21834/ebpj.v7i20.3479

Makkouk, A. H., Oetgen, M. E., Swigart, C. R., & Dodds, S. D. (2008). Trigger finger: Etiology, evaluation, and treatment. *Current Reviews in Musculoskeletal Medicine*, *1*(2), 92–96. https://doi.org/10.1007/s12178-007-9012-1

Mayo Clinic. (n.d.). *Trigger finger* [Trigger finger]. https://www.mayoclinic.org/diseases-conditions/trigger-finger/symptoms-causes/syc-20365100

Napora, J., Gryglewsk, K., Piotrowicz, M., Nowicka-Sauer, K., & Mazurek, T. (2021). Analysis of concerns among patients operated for carpal tunnel 83 syndrome. *Chirurgia Narządów Ruchu I Ortopedia Polska*, *86*(4), 115–121. https://doi.org/10.31139/chnriop.2021.86.4.4

Osiak, K., Elnazir, P., Walocha, J. A., & Pasternak, A. (2022). Carpal tunnel syndrome: State-of-the-art review. *Folia Morphologica*, *81*(4), 851–862. https://doi.org/10.5603/FM.a2021.0121

Padua, L., Coraci, D., Erra, C., Pazzaglia, C., Paolasso, I., Loreti, C., Caliandro, P., & Hobson-Webb, L. D. (2016). Carpal tunnel syndrome: Clinical features, diagnosis, and management. *The Lancet Neurology*, *15*(12), 1273–1284. https://doi.org/10.1016/S1474-4422(16)30231-9

Journal of Information System and Technology Management
JISTM
EISSN: 0128-1666
Volume 10 Issue 39 (June 2025) PP. 225-237
DOI: 10.35631/JISTM.1039015

Sack, J. D. (2021). BioDigital: Powering the World's Understanding of the Human Body. *The American Biology Teacher*, *83*(1), 71–71. https://doi.org/10.1525/abt.2021.83.1.71

Shah, A. S., & Bae, D. S. (2012). Management of Pediatric Trigger Thumb and Trigger Finger: *Journal of the American Academy of Orthopaedic Surgeons*, *20*(4), 206–213. https://doi.org/10.5435/JAAOS-20-04-206

Vasiliadis, A. V., & Itsiopoulos, I. (2017). Trigger Finger: An Atraumatic Medical Phenomenon. *The Journal of Hand Surgery (Asian-Pacific Volume)*, *22*(02), 188–193. https://doi.org/10.1142/S021881041750023X

Wright, A. R., & Atkinson, R. E. (2019). Carpal Tunnel Syndrome: An Update for the Primary Care Physician. *SOCIAL WELFARE*, *78*(11).