Design of Mixed Reality (MR) Based Real-Time Vision System forCovid Tracking and Control

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Abstract. The medical field relies on broad usage of various using imaging strategies such radiography, ultrasounds, CT exams etc. for obtaining crucial information about internal organs. Yet, there has been a space in getting information about external body parts, that can now be resolved through the application of 3D scanning technologies. Particularly, during the COVID-19 pandemic, there has been a pressing need for advanced technology to monitor the respiratory systems of patients. This project aims to provide real-time monitoring of COVID-19 health data for the general population, suggesting that monitoring respiratory symptoms could serve as a screening tool to identify individuals with potential mild cases who should consider self-isolation. However, a challenge lies in accurately predicting the infection level of patients, which has led to further research into innovative 3D technologies. Numerous research papers have been examined to understand the impact of different scanning techniques and 3D scanning on medical diagnostics. The proposed technologies blends AR with virtual realities to diagnose diseases in humans, referred to as Mixed-Reality (MR). To facilitate tracking, it generates a scannable Mixed-Reality (MR) code. Additionally, wearable biomedical sensors upload data to a server system via the Internet of Things (IoT). Every individual in the public is expected to possess their own printed or digital MR code. On the receiving end, a personal computer (PC) with three types of sensors is connected to a patient monitoring system. A MR vision camera cum scanner is available, which immediately fetches the individual's biomedical sensor values from the server. Using these values and the database data, the MR vision Software System provides real-time images and details. This proposed method enhances the accuracy of the 3D scanning and diagnosis process.

Keywords: Mixed-Reality,3Dscanning, Body Temperature Sensor, MR vision code.

1 Introduction

In the realm of healthcare, the integration of Virtual realities (VR) and aggressive realities (AR) has revolutionized disease diagnosis in humans. By combining VR and AR technologies, we

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arrive at what is known as Mixed- Reality (MR) technology [1]. This technology enables the viewing of 3D human body structures through a specialized viewer within the system. A notable feature of this system is the utilization of a picking method. When you select the gadget displays a specified portion of an individual's body in the 3D viewers and gives detailed health data on illnesses associated to the chosen region. The 3D-viewers are characterized by its ability to display the vivid and understandable representation of the human’s anatomy. The medical information about diseases is presented in a facile and clear format that includes drives, signs, and feasible therapies, prevention strategies, recommended dietary habits and affiliated medical facilities (e.g., hospitals) equipped to treat the disease [2]. Posture monitoring and near-eye 3D visualizations are used in VR 's to give users an immersive intimacy in a simulation. Activities include those for business (such as virtually meeting), leisure (particularly gaming), and instruction (which includes healthcare and army training). The terms AR and virtual realities, also sometimes known as XR model or AR are variations of VR. Likewise, this business is still in its infancy, standards in the area are constantly changing [3]. To provide genuine sensations and imitate the consumer's role in a virtual space, conventional VR equipment depend on real-world goggles or multi-projection settings. The virtual setting can beactively explored, moved in, and interacted with by users of VR equipment. Using the help of additive reality (AR), individuals’ current surroundings can fluently be combined with electronic data. Unlike VR, that build entirely an artificial environment, AR users perceive the real world with additional digital information overlaying it. AR serves to alter natural environments or provide supplementary information to users. Its primary advantagelies in the fusion of digital and three-dimensional (3D) elements with the user's perception of reality. AR has diverse applications, ranging from aiding in decision-making to entertainment. In medicine, the extensive use of various imaging strategies such radiography, ultrasounds, CT exams etc. has greatly improved our understandingof internal organs. However, there have been limitations in capturing information about external body parts in thepast - a gap that is now being filled by 3D scanning technologies. Extensive research has been conducted on various scanning techniques and 3D scanning to assess their impact and potential avenues for further research [4].At the level of disease diagnosis, 3D modelling is proving valuable for estimating 2 parameters such as haemorrhage in features of pulmonary, haemophilia, and abdomen form. This technology facilitates the measurement of distances, surfaces, volumes and other relevant parameters. The true-to-life facts that the detector recorded has applications in fields such as surveying, medicine and the manufacturing industry. In addition, 3D scanning is used in the recording of places of significance and allows rapid reproduction of objects from differentperspectives [5][6]. In this paper, we attempt to describe the optimal use of 3D scanning technologies in various medical sub specialties to provide physicians and technologists with the means to provide the best possible treatment with minimal risks and maximum benefits. The following part 2 addresses the literature review, accompanied by part 3, this outlines the suggested strategy. Part 4 presents the conclusions and analysis, while part 5 adds a few closing thoughts..

2 Literature Survey

Techniques for 3D copying and printings are demonstrated in significant prospective on various domains, encompassing the development of implants, personalized prostheses, the creation of group of cells and organs, pharmacological study involving clinical trials, physiological theories, and thorough examination. When it comes to customizing medical products, these technologies prove to be more efficient compared to conventional methods, thereby enhancing overall productivity. To create accurate models from medical images, specialized computer software is essential. Notable software applications include 3D Slicers, In Vesalius, Mia Lites, 3DIM Viewers, ITK-SNAP, and Osirix's. These programs employ a process where the physique is meticulously shredded into lean crisscross fragments, enabling the generation of 3D models using various algorithms. Furthermore, these software tools permit necessary modifications to be made to the image [7]. The invaluable information provided by 3D scanners greatly aids radiologists and surgeons in accurately delineating the image testing. The disparting and visualization datum is subsequently transformed into STL compose, as compatible with a wide array of Additive manufacturing machines [8]. In the realm of medical treatment, therapeutic virtual reality (VR) is swiftly gaining traction. This immersive, computer-generated technology is increasingly being integrated into medical practices. In select hospitals and clinics, doctors are prescribing virtual reality experiences to alleviate patient discomfort or anxiety, or to elucidate complex medical procedures or conditions [9]. Virtual realities (VR) and aggressive realities (AR) [10] are revolutionary techies increasingly integrated into critical care medicine. VR immerses users in a three-dimensional virtual whereas AR superimposes simulations over the actual circumstances. These innovations hold immense potential for enhancing critical care, benefiting patients, their families, and healthcare providers. VR shows promise in alleviating patient fearfulness, discomfort, and aching. It aids in observant mobility, rehabilitation, and facilitates improved communication among all parties being a part of the treatment of the persons. On the other hand, AR serves as a valuable tool for ongoing education of intensive care practitioners. It complements traditional learning methods for acquiring vital practical skills like Endotracheal intubation, deployment of median veiny lines, and cardiopulmonary. However, there are notable technical, human, and ethical factors to address. The combining of VR/AR into routine ICU practice is complex. Users may experience undesired effects, commonly known as "cybersickness," during VR/AR sessions, potentially limiting their applicability. Moreover, critically ill patients represent a highly vulnerable group, necessitating special ethical considerations when introducing new technologies into their care. Many studies including AR/VR in emergency healthcare presently offer solely a limited levels of affirmation due to their investigations. This context, provides an overview of background information, current advancements, and critical considerations for more scientific investigations in this domain. Imagine a healthcare application that provides higher-qualities tomographic snaps and 3D datum from X-ray machines and ultrasound scans. This tool could enable immediate presumptive diagnoses or consultations, regardless of the patient's physical presence. The application's capacity to utilize a wide range of patient data could also facilitate effective referrals to specialists in remote locations. Remote assessment of physiological parameters, for instance, heartbeats or pulse, could lead to highly informative remote consultations for further treatment planning. This online monitoring approach supports the seamless transmission of patient data and information about their condition. Additionally, incorporating patient inquiries and examinations would be a valuable complement to remote treatment.

3 Proposed Work

Virtual reality (VR) from the perspective of patient relatives: Insights through virtual ward rounds in the emergency unit. Admitting an infant to a paediatric emergency unit causes immense concern and tension for parents and family members, a situation that was exacerbated circa the transmissible because few possibilities existed for families to take part in therapeutic visits. In response to this challenge, Talent et al. evolved a virtual reality (VR) solution for imaginary ICU visits that, interestingly, didn't extend the unit's stay. [11]. Their researchsuggests that these VRICU zone visits have the potential to facilitate ongoing communication between patients, their families, and medical staff. However, it is noteworthy that no comprehensive study has yet been conducted to assess the specific outcomes for patients or their families in this context.

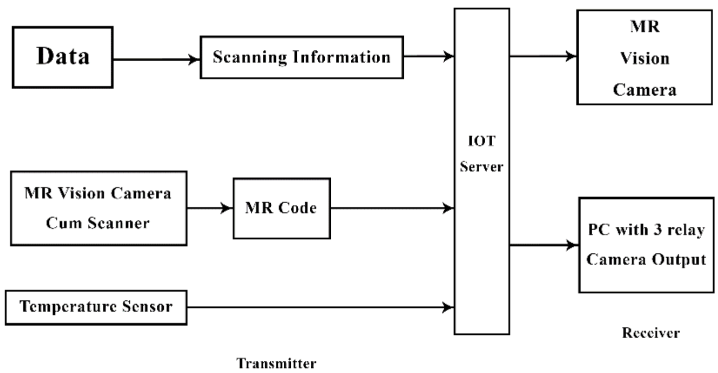

Figure 1: Block Diagram for proposed method.

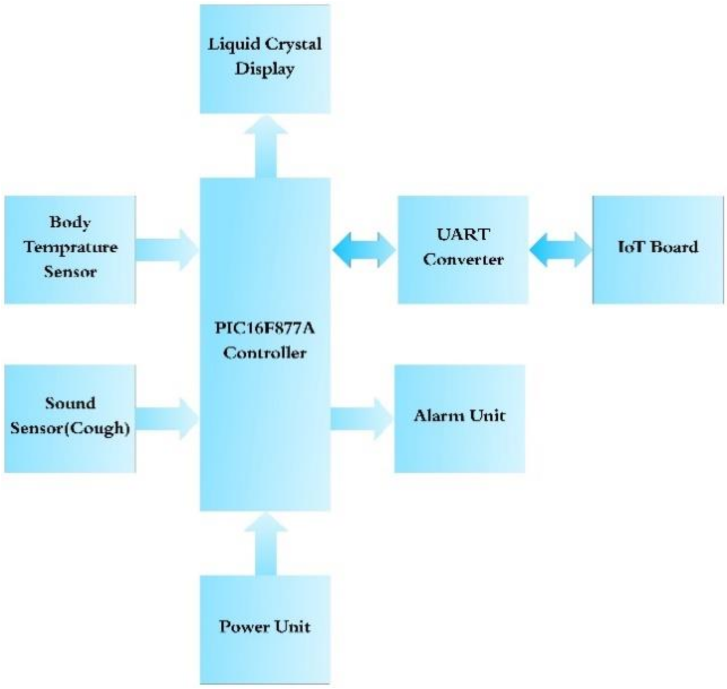

Figure 2: Block Diagram for Wearable Sensor Unit

Figure 1 shows the proposed method for 3D scanning for COVID patient treatment. The scanned information, MR vision camera scanner with code and additionally the patient temperature sensor and patient data are sent through the IoT device. The MR code is the main code that contains the information about the patient's organ.

This information is located in the area of the transmitter. The IoT device becomes the interface for operation by the IoT server. On the receiver side, the view is displayed via a personal computer connected to the MR vision camera. The MR code is the key to displaying the 3D output, which revolves around the camera. The wearable sensor unit consists of the body sensor, the sound sensor, the LCD display, the PIC 16F877A controller and URAT converter, the alarm unit and finally the IoT board as shown in Figure 2.

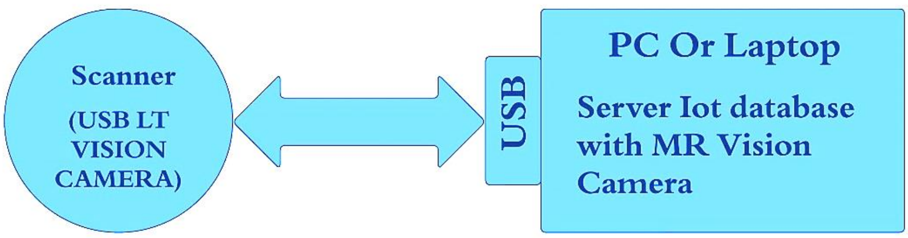

Figure 3: Scanning and Server data base Monitoring Unit

Figure 3 shows that Op Manager, the trusted performance monitor for servers, inherently provides several features for monitoring system performance, such as monitoring CPU, memory and disc at intervals of up to one minute It provides an animated illustration of parameters for actual time monitoring and measurement of the server's operation. One can also drill more to a specific time interval to learn more details about the problem and proactively take the necessary action. This way, you can fix problems before they seriously harm patient care. Network monitoring tools are used to monitor the availability and performance of other network devices such as switches, routers, storage devices, printers and more. The doctor can also get an instant complete view of the status of patient servers by creating a custom dashboard for widgets for site tracking, including widgets for both Linux and Windows servers as well as widgets for tracking server effectiveness, etc.

4 Result Analysis

To facilitate tracking, our system generates a scannable Mixed Reality (MR) code print. The data from the wearable biomedical sensors is also uploaded to the server system via the IoT. Under our proposed system, everymember of the public is required to possess either a printed or digital copy of their unique MR code. When individuals enter public places such as shopping malls, theatres, amusement parks, airports, banks, farmers markets, hair salons, electronic stores, and cafeterias, they are prompted to instantly provide their distinctive MR codes to the on-hand MR sight cam + scanners.

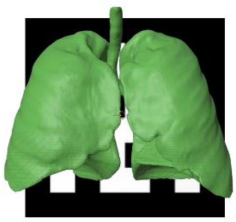

Fig. 4. Outputforpatient1.

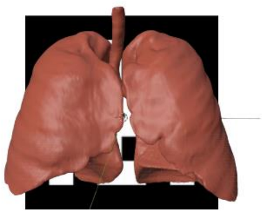

Fig. 5. Outputforpatient2

The MR Vision Software System retrieves an individual's corresponding biomedical sensor data from the server.Based on the current sensor values and database information, the MR Vision Software System provides real-timedetails displayed as shown in Figure 4 and Figure 5. In Figure 4, normal datasets are represented by green MR images, indicating entry permission for individuals. Conversely, red MR images in Figure 5 signify COVID- affected persons, corresponding to their respective datasets.

5 Conclusions

Amid the on-going COVID-19 pandemic, innovative applications of VR and AR are offering novel solutions across various facets emergency medicine is performed every day. The rate of transmission of data proceeds to advance, we are witnessing the emergence of additional applications, including remote distance treatment and care. Currently, there are on-going developments in remote treatments utilizing robotic devices, which hold the 4 potentials to deliver independent, high-quality care in remote areas lacking in expertise. The trajectory of future work indicates that VR and AR are poised to become integral components of ICUs worldwide. To establish knowledge based on evidence, it is imperative to emphasize consistent research design in forthcoming (clinical) trials. 3D scanning technologies are instrumental in designing diverse medical models and tools with remarkablelevel of accuracy. The effective utilization of 3D scanners proves particularly valuable in crucial cases that necessitate tailored treatment of exceptional quality. Consequently, there exists a vast scope for research and development in this field.

References

[1] Kim, SH., Chung, KY. (2013). Interactive Self-Diagnostic System Using Anatomical 3D Human Body. In: Kim, K., Chung, KY. (eds) IT Convergence and Security 2012.

[2]c Lecture Notes in Electrical Engineering, vol 215. Springer, Dordrecht. ttps://doi.org/10.1007/978-94-007- 5860-5_116

"Get Ready to Hear a Lot More About 'XR'". Wired. 1 May 2019. ISSN 1059-1028. Retrieved 29 August 2020.

Abid Haleem, Mohd. Javaid. 3D scanning applications in medical field: A literature-based review. Clinical Epidemiology and Global Health 7 (2019) 199–210.

Chromy A. Application of High-Resolution 3D scanning in medical volumetry. Int J Electron Telecommun. 2016;62(1):23–31.

Singh RP, Singhal S. Investigation of machining characteristics in rotary ultrasonic machining of alumina ceramic. Mater Manuf Process. 2016;32(3):309–326.

Dong Z, Jiang G, Wu Z, Cong H. 3D parametric human modelling for warp-knitted seamless garment. Int J Cloth Sci Technol. 2015;27(4):532–548.

Groenendyk M, Gallant R. 3D printing and scanning at the Dalhousie University Libraries: a pilot project. Libr Hi Tech. 2013;31(1):34–41.

Tayebeh Baniasadi, Seyed Mohammad Ayyoubzadeh, and Niloofar Mohammadzadeh*. Challenges and Practical Considerations in Applying Virtual Reality in Medical Education and Treatment Oman Med J. 2020 May; 35(3): e125. Published online 2020 May 18. doi: 10.5001/omj.2020.43.

Bruno, R.R., Wolff, G., Wernly, B. et al. Virtual and augmented reality in critical care medicine: the patient's, clinician's, and researcher's perspective. Crit Care 26, 326 (2022).

[11] Tallent S, Turi JL, Thompson J, Allareddy V, Hueckel R. Extending the radius of family-centered care in the pediatric cardiac intensive care unit through virtual rounding. J Am Assoc Nurse Pract 2021