International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

Patient Profiling using Augmented Reality

H S Srihari[1], Prof. Girish Rao Salanke[2], Dr. Sharvani GS[3]

[1] Dept. of Computer Science and Engineering, RV College of Engineering, Bangalore, India.
[2]Professor, Dept. of Computer Science and Engineering, RV College of Engineering, Bangalore, India.
[3]Associate Professor, Dept. of Computer Science and Engineering, RV College of Engineering, Bangalore, India.

Abstract - *A patient's medical record is the most important part of their healthcare journey. Further, there is a constant disconnect between doctors and patients regarding the details of the medical issue at hand due to lack of visual aids. Meanwhile with the rapid development of virtual reality (VR) and augmented reality (AR) technology, people's life will adopt a new way. In this paper, the idea that patient profiles can be constructed based on augmented reality is proposed. The system consists of a server, mobile device and lightweight data gloves. The patient or doctor can not only check the relevant medical information on the mobile device, but also obtain prescriptions through AR. In addition, users can also wear AR/VR glasses and data gloves to operate the 3D organ model in order to get a stronger sense of immersion. Through this system, we can show more pathological information of the anatomy, which can help the communication between doctors and patients and more importantly, can become an important part of the patient's medical history.*

***Key Words*: Augmented Reality, Data Gloves, Patient Profiling, Medical Records, CT Scan**

1. INTRODUCTION

This is an Medical record is the patient's original record of the whole process of diagnosis and treatment in hospital. Medical record contains the first page, course records, inspection results, doctor's advice, surgical records, nursing records and so on. Many people lose their medical records and prescriptions and this loss of vital medical data regarding a patient can be a bane to any doctor. [1]

Augmented reality (AR) technologies for the consumer market are nowadays mature for many potential fields of applications. In the healthcare sector, as demonstrated by the increasing number of publications on AR for surgery, medicine, and rehabilitation, there is a great demand for solutions that are able to improve current clinical practice.

With the rapid development of VR and AR technology, people's life will adopt a new way. At present, we hope to enhance the application of AR/VR technology to electronic medical record of patients and propose a solution that a) stores patient's medical data through 3D images b) creates stronger interactive understanding of the root issue for the patient (and doctor).

In our solution, the onus is not on the patient to take images of his medical data or store such medical papers in files. Instead, the solution does such storing with a single scan. The user of this solution can check the relevant medical information on the mobile device, and use it as a means of medical history.

2. DESGIN OF AR SYSTEMS

The Augmented reality gives a view of the real world where elements are superimposed by computer generated files such as graphics, sounds, videos, or digital information. Although the application of augmented reality technologies in a variety of projects has tremendously increased in recent years, these technologies are still in the research stage and their full potential is not fully achieved. There are limitations that should be addressed before these technologies will become dominant in the industry such as tracking technologies, and rendering software. Moreover, appropriate application areas for different types of AR will continue to evolve. Historically, many AR technologies were not applied due to tracking and alignment problems, instead they were generally used at the home office for simulation or collaboration during the design phase of a project. Moreover, trend analysis shows that web-based and wireless network technologies are becoming more and more popular in recent years, and these types of AR technologies are interesting technologies for further research and application.

3. PROPOSED SOLUTION

1.1 Components of the solution

The patient profiling system based on AR consists of a cloud based server, a mobile device capable of supporting AR and data glove to allow interactivity. The patient goes to the hospital to do shoulder (ball and socket joint) CT as an example. The hospital, in addition to providing the diagnosis of the issue, can also construct the patient's 3D shoulder model by the algorithm of automatic model segmentation and reconstruction from CT scan images [5]. This data will then be stored on the server against the patient ID for easy identification. Almost simultaneously, the 3D model, diagnosis information and all other details of the medical record can be accessed from the corresponding . 3D model will be on the mobile phone screen by AR technology, and user can use gestures to operate the 3D model, such as translation of any position, rotation of any angle, arbitrary size scaling and so on. In addition, user can also wear AR/VR glasses loaded with any phone, and use the data gloves based on Bluetooth.

1.2 Extraction of 3D Models from CT Scan Images

To extract the 3D model we must use an algorithm such as iterative Filtered Back Projection (FBP) [3] to get multiple images at various angles (different cuts of same image). Then we can use an open source software such as 3D Slicer to reconstruct the model. 3D Slicer is an open source software for the analysis and visualization of medical 3D images [4]. The segmentation and reconstruction results are shown in Fig 1. The algorithm flowchart is shown in Figure 2.

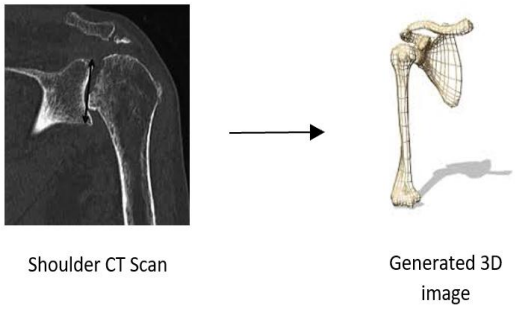

Fig -1: Conversion of 2D Scan to 3D Model

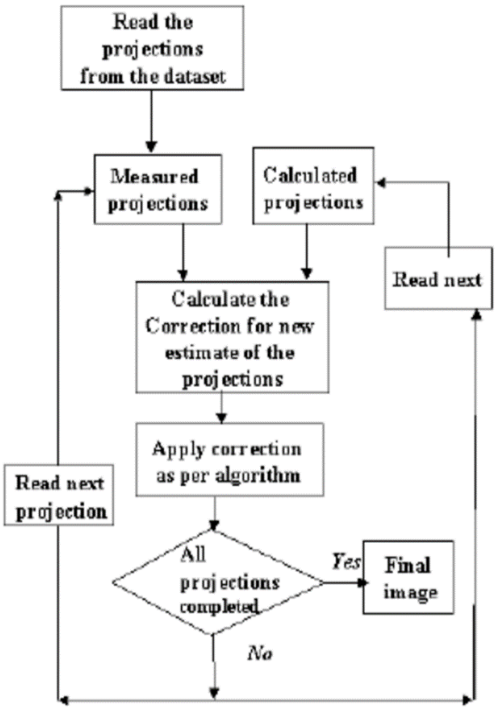

Fig -2: The flowchart of extraction

1.3 Storage on Cloud Server

The extracted 3D model from the software is stored in a secure cloud server against the patient's unique identification (Patient ID). This patient ID can also be known through the mobile app. The usage of cloud makes the data available anywhere and also enhances security of this medical data.

1.4 Basic Implementation Workflow

From Fig 4, the flow of the app can be understood. Upon finishing the CT scan, the scan result images are sent to the cloud server. Here, the 3D Slicer software downloads those images and extracts a 3D model out of the CT Scan. The patient can then access the model by "requesting" the same through the app. Provided the doctor is equipped with a head-mounted device (HMD), he can interact with the model and also through the data gloves. Some basic interaction can also be achieved right from the app itself.

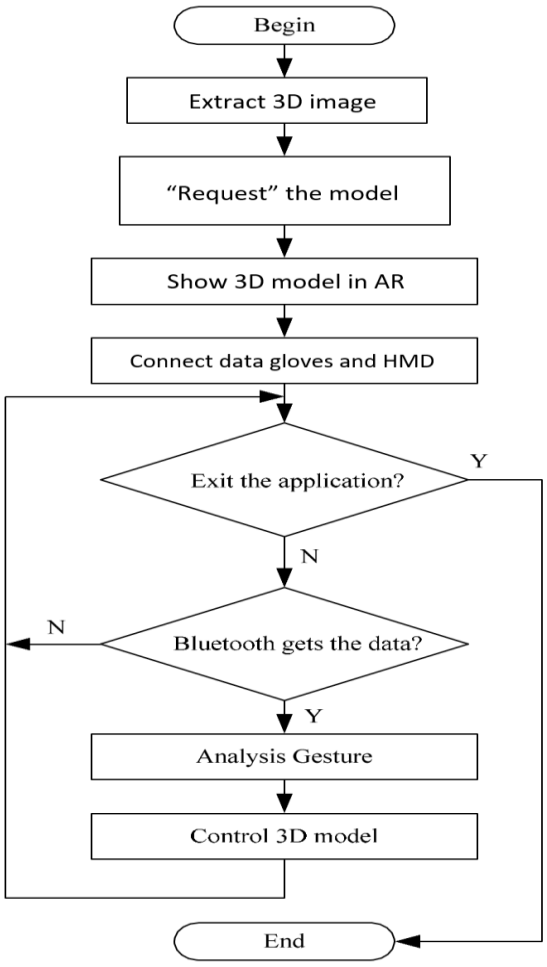

Fig -3: Implementation Workflow

1.5 Components of the solution

The data gloves software is divided into left and right hand part. For MCU we use STM32, using the standard UART interface to control Bluetooth module [2]. This is done in order to communicate with the mobile device. To get the data from various gestures such as pinch, zoom and turn, we employ the I2C interface and SPI interface to control NRF24L01 module to communicate data between gloves [6]. In addition, we use ADC interface to obtain the data of the bending sensor and the LEDs can display the glove status.

Head-Mounted Device: An HMD is used for viewing AR, VR and even Mixed Reality situations. A typical HMD has one or two small displays, with lenses and semi- transparent mirrors embedded in eyeglasses (also termed data glasses), a visor, or a helmet. The display units are miniaturized and may include cathode ray tubes (CRT), liquid-crystal displays (LCDs), liquid crystal on silicon (LCos), or organic light-emitting diodes (OLED). Some vendors employ multiple micro-displays to increase total resolution and field of view. In our use case, the doctor or patient can wear the HMD and then use it to view the generated 3D model.

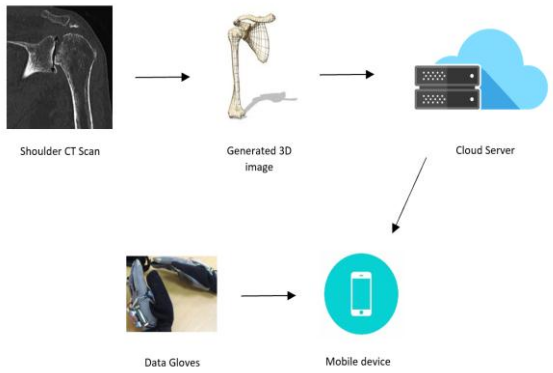

Fig -4: System Workflow

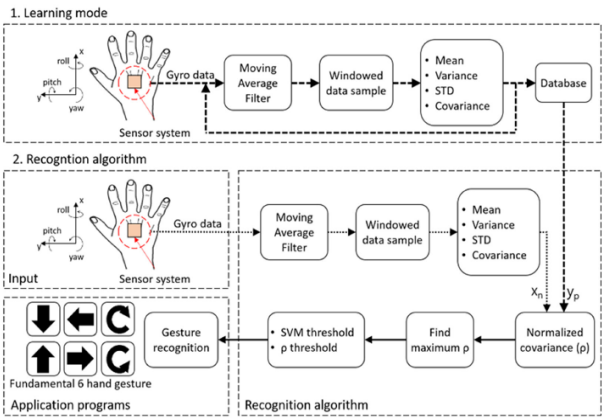

Fig -5: Data Glove Recognition

2. CONCLUSIONS

The proposed solution is not yet completely implemented. However, AR in medical imaging is not a distant reality and in fact, many developer toolkits such as Apple's ARKit and Google'S ARCore accomplish showing 3D models in a blended world in a simplified manner. The proposed open source software, 3D Slicer is very well known in the scientific community, especially in 3D imaging of 2D scans. Further, the data gloves and head-mounted devices are technologies that have been tried and tested. Thus, this paper succinctly establishes a novel and innovative of maintaining patient medical records without putting the onus on them and at the same time encourages the patient's understanding of their own anatomy in a more immersive way through well-established technologies.

There is also further scope to implement patient prescriptions in the same application, thereby even covering small and insignificant ailments such as a sore throat or a common fever.

REFERENCES

[1] Lixin Chen, Rongxia Zhang and Yanchao Liu, "Current situation and development of electronic medical records," Chin J Misdiagn, vol. 9, pp.10, Apr 2009.

[2] BLE https://en.wikipedia.org/wiki/Bluetooth_low_energy

[3] Lianfen Huang, Minghui Weng and Fenglian Gao, "Automatic Liver Segmentation from CT Images Using Single-Block Linear Detection," BioMed Research International, vol. 6, pp. 1-11, July 2016.

[4] Fedorov A., Beichel R., Kalpathy-Cramer J., Finet J., Fillion-Robin J-C., Jennings D., Fennessy F., Sonka M., Buatti J., Aylward S.R., Miller J.V., Pieper S., Kikinis R. 3D Slicer as an Image Computing Platform for the Quantitative Imaging Network

[5] N. Kothari, Y. K. Bhateshvar, A. Katariya and S. Kothari, "3D Image Using X-Rays for CT Scan," *2011 International Conference on Computational Intelligence and Communication Networks*, Gwalior, 2011, pp. 6-10.

[6] M. Weng, L. Huang, C. Feng, F. Gao and H. Lin, "Electronic medical record system based on augmented reality," 2017 12th International Conference on Computer Science and Education (ICCSE), Houston, TX 2017, pp. 753-756.