



DEVELOPMENT OF AUGMENTED REALITY APPLICATION FOR DEMENTIA PATIENT (DARD)

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ABSTRACT

Statistics patient dementia in Malaysia shown that, age play and important role that lead a person to become a memory lost or also know as Dementia patient. Dementia illness is a condition where the patient lost the ability to recall memory 100%. Depending on level of dementia, this illness may cause the patient inability to remember their families or even worst they cannot develop new memory for the long-term life. Thus, many researchers have tried to develop a new alternative to cure this illness unfortunately they are still no one specific treatment to cure this illness. So, in this research a new alternative treatment is proposed by utilizing Augmented Reality (AR) in the treatment. This is not meant to cure, but to enhance dementia patient quality of life. The AR system generates a virtual object in the real world using marked AR system to project 3D image in the patient view or LCD display. A hybrid of case based reasoning will classifying what to be display based on that particular patient requirement. This is based in the patient life style. Extending the previous treatment of using mobile phone to make a note to remind the patient about their daily life, remove the two dimensional image limitation. Based on the survey distribute out of 50 person 90% will prefer 3D image compare to 2D image. It is expected that this research will decrease the memory lost between 9% to 19%. Preliminary data shows that alpha wave brain will increase to about 2 Hz compare the previous brain wave. The patient will able to have a good quality of life, which might able to make a new memory for a long-term life.

Keywords: dementia, augmented reality, brain wave.

1. INTRODUCTION

Augmented reality (AR) has high research interest. A lot of scientists and commercial field has realized AR as a new technology to improve the existing solutions and to unlock new applications that were not possible without AR. Besides gaming and entertainment community, other industrial engineering, medical and engineering field realized the potential of AR to be in medical field. Among the example are preoperative diagnoses, intraoperative navigation and postoperative control [1].

Augmented reality (AR) also being used the image guided therapy (IGT) and becomes considerable research interest for the medical community. Approaches include head-mounted display (HMD) such as simple beam splitters, sophisticated retinal scanning devices, semitransparent mirror, and modified medical instruments as ophthalmoscope, endoscope and operating microscopes. The easiest way to implement an AR solution for IGT is to use standard HMD and display monocular or stereoscopic graphics registered to the operating side [2].

This project is involved to the augmented reality application whose element augmented by computer-generated sensory input such as sound, video, graphics or GPS data. Augmented reality (AR) is related to general concept called mediated reality in which the view of reality is modified by a computer.

2. MOTIVATION, OBJECTIVE AND SCOPE OF WORK

Dementia is a non-specific syndrome in which affected the areas of brain function and affected memory, language, problem solving and attention. Dementia, unlike

Alzheimer's, is not a disease itself. Dementia appears the higher mental functions of the patient are involved initially. Eventually, in the later stages, the person may not know what day of the week, month or year it is, he or she may not know where he is and might not be able to identify the people around him. From that situation the person might have the first symptom that is memory loss. Besides that, there are several symptoms might happen beside memory loss. The symptoms are moodiness and have a difficulty to communicate effectively. Unfortunately, there is no cure for the dementia disease until now, but there is medication and various forms of therapy design to help manage symptoms and improve patient's quality of life. The treatment that we use nowadays actually by giving a medicine or drug to slow down the dementia progress. Besides that, music also one of the alternative treatment for this disease. So, through this problem, this project is exist to be one of the treatment to cure dementia disease.

The objective of this project are to investigate the relationship on augmented reality method in improving dementia quality of life. By design the systems utilizing augmented reality technology for assist the patient in improve their quality of life, we can measure the efficiency of the system to dementia patients.

The scopes of this project are using a combination Microsoft Visual Basic 2010 and Open CV to design AR system. After that, implementing of camera and image display to the system. Then, evaluating the system towards dementia patient's memory using electroencephalogram (EEG).



3. PREVIOUS WORKS

This paper presents a set of Augmented Reality (AR) based interaction techniques for spatial analysis of medical datasets. Computer-aided medical planning tools such as our Virtual Liver Surgery Planning System require precise and intuitive interaction for the quantitative inspection of anatomical and pathological structures. They argue that AR is a superior tool compared to desktop 2D or 3D visualization for performing such analysis, because it allows true direct manipulation of 3D virtual objects in space, while rendering the medical data in the familiar context of the user's own body [3].

Nowadays medical imaging can be used to generate highly accurate 3D images of the interior of patient's bodies. 3D medical data must be presented in a compact way in order not to overwhelm or distract doctors who often work under strict time constraints. Augmented Reality (AR) lets doctors to optimize actual procedures. Surgical decisions usually depend on the extent of the disease. The accurate volume measurement is complicated in most cases. For instance, surgeons can use AR technology to analyze the disease and determine its extent in three dimensional space so diagnosis can be faster and more precise [4].

In Australia, about 88% of stroke survivors live at home with disabilities affecting their daily life activities and quality of their lives. Therefore, there is a need to improve their lost functions and promote their lives via rehabilitation process. One way to improve the stroke rehabilitation process is through human interactive system, which can be achieved by augmented reality technology. This development draws from the work currently being pursued in the gaming industry to make the augmented reality technology more accessible to the medical industry for the improvement of stroke rehabilitation. In this paper, two augmented reality games: Pong Game and Goal Keeper Game were developed. These games have been designed for rehabilitation with consideration to human interactive systems and have features such as on-screen feedbacks and high immersive value to keep stroke victims motivated in the rehabilitation process. The developed games were aimed to replace boring and repetitive traditional rehabilitation exercises. This paper details the success of implementing augmented reality into the rehabilitation process, which will in turn contribute to society by minimizing the number of people living at home with stroke related disabilities and the requirement for direct supervision from therapist [5].

This paper presents an approach to use a semitransparent display as a kind of window into a patient in the context of medical Augmented Reality (AR) applications. Besides the presentation of the non-off-the-shelf display, the tracking aspects of such an application are in focus of the work presented. In order to allow augmentations of real objects by virtual ones on the display, the user (i.e. physician), the display, the object (i.e. patient) and optional instruments have to be tracked. If required, a tracking system consisting of more than one subsystem, e.g. optical tracking combined with

electromagnetic tracking, is used to satisfy all the needs of such a medical application [6].

Vision-based tracking of tissue is a key component to enable augmented reality during a surgical operation. Conventional tracking techniques in computer vision review on identifying strong edge features or distinctive textures in a well-lit environment; however endoscopic tissue images do not have strong edge features, are poorly lit and exhibit a high degree of specular reflection. Therefore, prior work in achieving densely populated 3-D features for describing tissue surface profiles require complex image processing techniques and have been limited in providing stable, long-term tracking or real-time processing. In this paper, they present an integrated framework for accurately tracking tissue in surgical stereo-cameras at real-time speeds. The combination of the STAR feature detector and binary robust independent elementary features to acquire salient features that can be persistently tracked at high frame rates. The features are then used to acquire a densely-populated map of the deformations of tissue surface in 3-D. We evaluate the method against popular feature real algorithms in *in vivo* animal study video sequences, and they also apply the proposed method to human partial nephrectomy video sequences. They extend the salient feature framework to support region tracking in order to maintain the spatial correspondence of a tracked region of tissue or a medical image registration to the surrounding tissue. *In vitro* tissue studies show registration accuracies of 1.3-3.3 mm using a rigid-body transformation method [7].

In the field of computer aided surgery, augmented reality (AR) technology has been successfully used for enhancing accuracy of surgery and making surgeons convenient by visually assisting them in performing a number of complicated and time-consuming medical operations. However, there are still medical operations that do not receive the benefit of AR technology. As a representative one, surgeons still use an ink pen when they mark surgical targets for scheduling an operation. The ink pen is inconvenient because the mark drawn by the foreign matter is not easily modified or deleted. And the ink pen is also unlikely to be sanitary. In this paper, we propose an interactive user interface based on direct-projected augmented reality (Direct AR) technology for handling all these problems with the ink pen and its validity is shown in experimental results [8].

From the previous work, there are two types of technique that use in augmented reality to detect the object. The first technique is marked technique and the second technique is mark less technique. For this project, the marked technique is used to detect the object. Cameras are used as the eyes to capture the object image that has been tagged. The tag of each object will be different due to make the patient easier to use the device. The tag will be represented by bar code. The 3D image will be appeared based on the tagged label. Only 5 important things for dementia patient will be used to test the device. Lastly, EEG will be used to evaluate the improvement of the patient brain.



4. METHODOLOGY

4.1 Hardware development

For this project, the robot AR system is built and designed to prove that the system can work properly and also it can be used for treatment method. Microsoft Visual Basic 2010 is the brain for this AR system. Figure 2 shows the block diagram for the AR system. GUI will activate the programme that is installed in Open CV. There 3D model will appear in LCD display.



Figure-1. Hardware development.

From Figure-1, the image will be detected by the camera. The processor will extract the data of the image. Based on command store in the Open CV the 3d model will appear in GUI build in the software. The 3D model and detail will appear based on the image that been marker from the coding. Figure-2 shows that how the flow for this project.

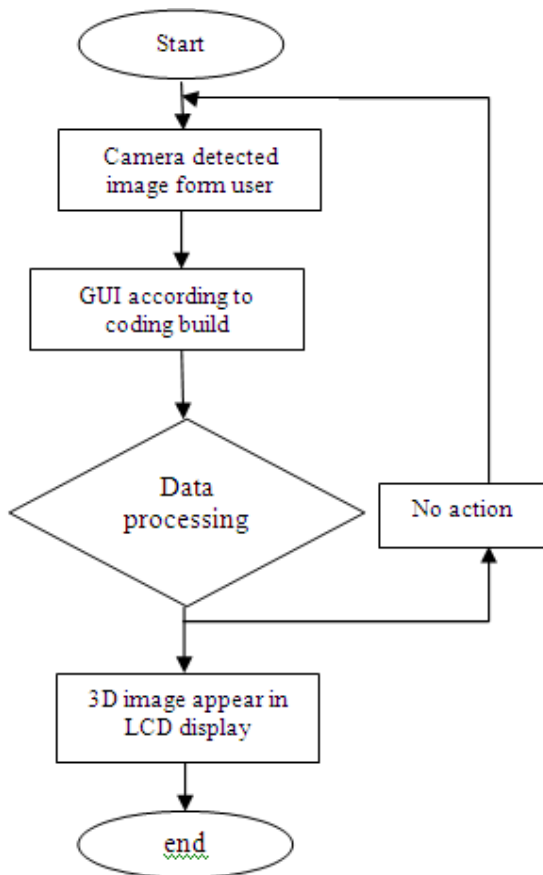


Figure-2. Flowchart processing.

4.2 Software development

4.2.1 Microsoft Visual Basic 2010

Microsoft Visual Basic 2010 usually used to implement the Graphical User Interface (GUI) and it is use high level programming language. In this project, the purpose of using Microsoft Visual Basic 2010 is to interface with Open CV to display the information through webcam. The gui in this project consist of two part which is combination of data panel and the login panel. Using the login panel it will secure and choose the data in the system that we want. Initially, the user needs to use the right combination of username and password to access the panel system. After the panel system appears, the system will find the available webcam that connect with the system. If the webcam is not available, the interface will not responding towards the application. This application will turn of when the system is shut down. During interfacing, the user can interact with the animations that appear through the webcam.

4.2.2 Open CV

Open CV usually aimed at real-time computer vision and used to interface with Microsoft Visual Basic 2010 to make the augmented reality system. In this project, the system used Open CV to detect the object using the marker technique. After the system detects the object, the system will choose the right animation and will be display through the webcam. Case Based Reasoning (CBR) and fuzzy method will be apply in this software to choose the right animation to display in the screen projector.

4.2.3 System communication

This camera will extract image data and converts the data it received and feeds it to Open CV software so that the AR functions and operates its part which is to allow the user to the desired operation he wants. Figure-3 shows the connection between hardware and software. It shows the connection for the whole system.

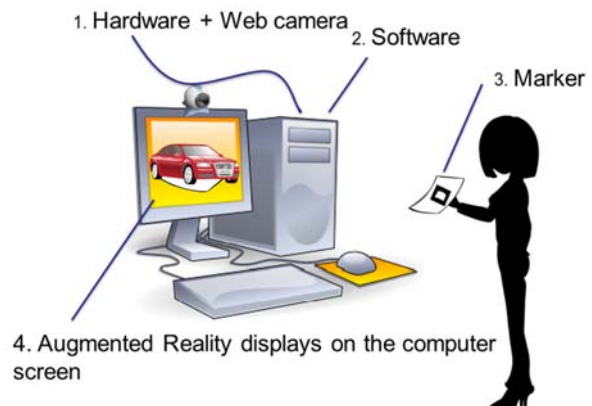


Figure-3. AR displays.



5. RESULT, ANALYSIS AND DISCUSSIONS

5.1 Preliminary result

This case study will function properly in all circumstances. It also can provide benefits to the dementia patient. Thus, the dementia patient will have better life. Other than that this study can be the alternative to make a treatment for the amnesia patient.

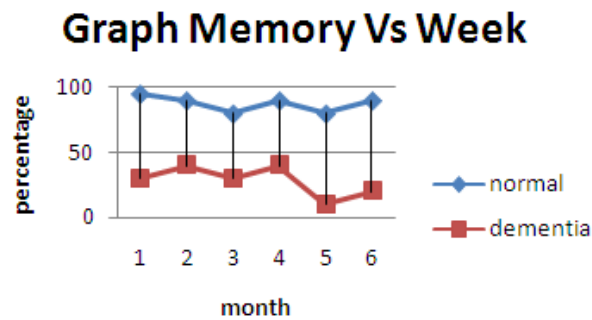


Figure-4. Graph memory vs week.

The hypothesis in Figure-4 indicates that the normal memory will be almost the similar in the seven month which is around 80% to 95%. The dementia patient shows that the percentage of memory is low which 30% to 60%. This is occurred due to difficulty to retain the memory loss to the damage of the brain.

6. CONCLUSIONS

This study is meant for dementia disease by using augmented reality as its method. The AR can be monitored by patient directly using computer. The AR uses camera as its eyes to mark the image that will occur. Thus, patient can get a 3D image from their computer. Lastly, AR will obtain its objective which is to investigate about AR toward dementia patients, to develop and design AR system for dementia patients and to evaluate the system device for dementia patients.

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