

IMPLEMENTATION OF VIRTUAL REALITY IN XD BASED ENVIRONMENT

Ms. C. Arul Sugana¹, Mrs. S. Arokia Magdaline², Mrs. Dr. G. Gandhimathi³

¹*B.Tech., M.E Communication systems, Department of ECE,*

²*M.E, Assistant Professor, Department of ECE,*

³*M.E,P.hd, Professor, Department of ECE,*

Parisutham Institute of Technology & Science, Thanjavur

Abstract—It is a virtual reality based concept in which application has been created it is used in a virtual reality environment for virtual tours which has been increasingly recognized as an alternative to traditional real life tours for various campuses. The proposed concept hold three steps of processes. The photographic images will be created using image acquisition followed by area selection which can be operated using Bluetooth with joystick and then quality of virtual reality will be analyzed using fuzzy logic. The virtual reality of a campus can be viewed by the user with the help of a VR headset and smartphone. This virtual reality for campuses can be used for both indoor and outdoor navigation. The outcome of virtual reality will be interfaced with the computer to check the response of the field experiments.

Index Terms-VR head phone, fuzzy logic.

I. INTRODUCTION

Reality is the state of things as they actually exist, rather than as they may appear or might be imagined. Reality includes everything that is and has been, whether or not it is observable or comprehensible. A still broader definition includes that which has existed, exists, or will exist.

Reality is often contrasted with what is imaginary, illusory, delusional, (only) in the mind, dreams, what is false, what is fictional, or what is abstract. At the same time, what is abstract plays a role both in everyday life and in academic research. For instance, causality, virtue, life, and distributive justice are abstract concepts that can be difficult to define, but they are only rarely equated with pure delusions. Both the existence and reality of abstractions are in dispute: one extreme position regards them as mere words; another position regards them as higher truths than less abstract concepts. This disagreement is the basis of the philosophical problem of universals.

II. VIRTUAL REALITY

Virtual reality (VR) is a computer interface that maximizes our natural perception abilities. Static two-dimensional images are often deceiving; it may be hard to reconstruct scales and distances between objects. Thus, it is important to implement the third dimension and to bring depth to objects.

There are two major components of three-dimensional virtual reality: movement and stereoscopy. Our eye can easily reconstruct the third dimension if the object moves (movement). VR use separate images for the right and left eyes. Pre-determined movement is implemented using a movie or animated image. Arbitrary user-defined movement is implemented using the Virtual Reality Modeling Language (VRML) which is a standard language for describing interactive 3-D objects and worlds delivered across the Internet. VRML-images can be rotated and magnified interactively.

Best virtual reality implements both movement and stereoscopy. However, at this point you can view it only using special graphical computers (SGI).

III. TYPES OF VIRTUAL REALITY

However, there will remain a number of different types of Virtual Reality systems. One way to distinguish one from another will be the mode with which it interfaces with its users. The following are just some of those modes.

a. Window on World

This particular Virtual Reality system is perfect for the field of medicine. Typically using a desktop monitor rather than an HMD, it allows its user to visualize complex medical procedures such a surgeries or colonoscopies. What's more, it can also be used for the simulation of a number of training

scenarios.

b. Immersive System

The next step beyond the Window on World view is the immersion using a virtual headset. By removing its users from the physical world, and placing them in a virtual world, the sharp visuals and crisp audio delivered via the HMD can help them escape everyday life and explore a far-off land.

c. Telepresence

Telepresence is exactly what it sounds like: tele, —at a distance, and presence, —being present. The sensors are therefore controlled and operated remotely by the user. Consider bomb disposal robots, undersea exploration, and drones as being operated via telepresence VR.

d. Mixed Reality

The final kind of Virtual Reality that we will be looking at is Mixed Reality. This is where computer generated inputs are brought together with the previously mentioned telepresence inputs or the user’s view of the real world to create a valuable output. This could be a fighter pilot’s view of maps or key data points displayed inside his helmet, or a surgeon being able to view real-time patient information during a complex surgery while wearing an HMD.

Types of Virtual Reality Devices:

The majority of Virtual Entertainment (VE) systems that are currently available to purchase require a personal computer to power them. And these systems also need an HMD to help deliver the imagery integral to creating an immersive virtual world. There are a number of different HMDs on the market at the moment, ranging from affordable to expensive. Also, some of these devices are more accessible than others. Google Cardboard, for example, is not only cheap, but due to the fact that it has been developed for use with a smartphone, just about anyone can experience Virtual Reality.

a. Oculus Rift

At the top of the price range, Oculus Rift plans on being the gold standard of Virtual Reality HMDs. Specifically designed for video gaming, it has a high field of view, delivering the very best in immersive virtual experiences.



Figure 1.1 Oculus Rift b. HTC Vive

HTC’s VR system – brought to us in partnership with Valve, and powered by Steam VR – is the leading VR headset and controller combo on the market today.



Figure 1.2 HTC Vive

Its best-in-class technology and content mark it out as a powerful, sleek, and innovative piece of kit. HTC are delivering breakthrough room-scale technology and fully immersive gaming experiences, and they’ve chalked up a fair few awards to further underline their capabilities.

c. Samsung Gear VR

A little bit more affordable than the Oculus Rift, Samsung’s VR headset is still powered by Oculus all the same. It does require a smartphone device to power it, and naturally works best with Samsung brand phones such as the Galaxy S6, S6 Edge, S7, and S7 Edge.



Figure 1.3 Samsung Gear VR

d. Google Cardboard

Another VR headset option for use with your phone, this one is, as previously mentioned, a great deal cheaper than most other HMDs. And it couldn't be easier to use. Simply order one, and once it's in your possession, fold it, slot your phone in, and explore a whole host of VR apps. The perfect option for those who wish to only dip their toe into the world of Virtual Reality.



Figure 1.4 Google Cardboard

IV. AUGMENTED REALITY

Augmented reality (AR) uses computer-aided graphics to add an additional layer of information to aid understanding and/or interaction with the physical world around you. This is commonly exemplified through adding additional, rich digital information (or computer models), which are displayed through some sort of visual output screen.

Very often AR is defined as a type of —virtual reality where the Head Mounted Display (HMD) is transparent. The goal of augmented reality systems is to combine the interactive real world with an interactive computer-generated world in such a way that they appear as one environment. As the user moves around the real object, the virtual (i.e. 8

computer generated) one reacts as it is completely integrated with the real world. Furthermore, the virtual object may move but still the movements are registered with respect to the real world.

Many authors agree to define AR in a way that requires the use of Head-Mounted Displays (HMDs) . However, in order to avoid limiting AR to specific technologies, we propose to define AR as systems that have the following characteristics:

- 1) combines real and virtual
- 2) interactive in real time
- 3) registered in 3-D.

V. PRINCIPLES OF 3D VISION

The complex human visual system allows us to perceive the surrounding world in three dimensions: To width and height of observed objects we add the notion of "distance" (or "depth"). As photons travel through their optic components, they create a two-dimensional representation on the retina, once for each eye. The human brain uses this planar picture from both eyes to reconstruct a three-dimensional model of our environment. This is possible because the images are disparate. The ability to perceive 3D does not solely depend on the eyes though: Several other factors allow for a more precise modeling of depth.

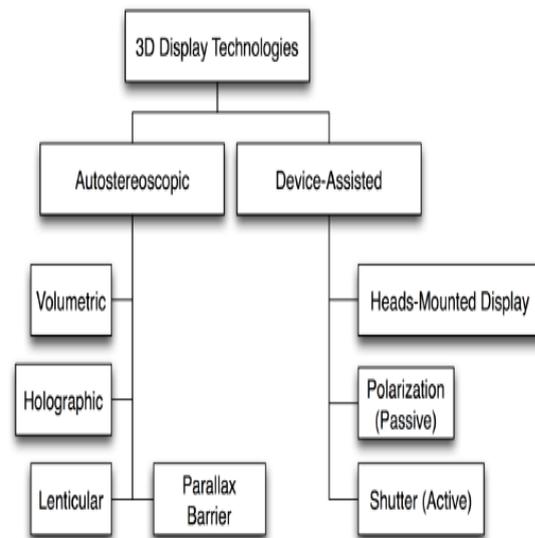


Figure 1.5 Classifications of 3D Display Technologies

It is a virtual reality based concept in which application has been created it is used in a virtual reality environment for virtual tours which has been increasingly recognized as an alternative to traditional real life tours for various campuses.

The proposed concept hold three steps of processes and they are,

1. Image Acquisition
2. Area Selection
3. Quality of Virtual Reality

The photographic images will be created using image acquisition followed by area selection which can be operated using blue tooth with joystick and then quality of virtual reality will be analyzed using fuzzy logic. The virtual reality of a campus can be viewed by the user with the help of

a VR Headset and Smartphone. This virtual reality for campuses can be used for both indoor and outdoor navigation. The outcome of virtual reality will be

interfaced with the computer to check the response of the field experiments. For example, if the user is viewing the canteen in the VR Headset, using XD concept we can provide heat which can be feel by the user. So, not only viewing the campus they can feel that they are in canteen.

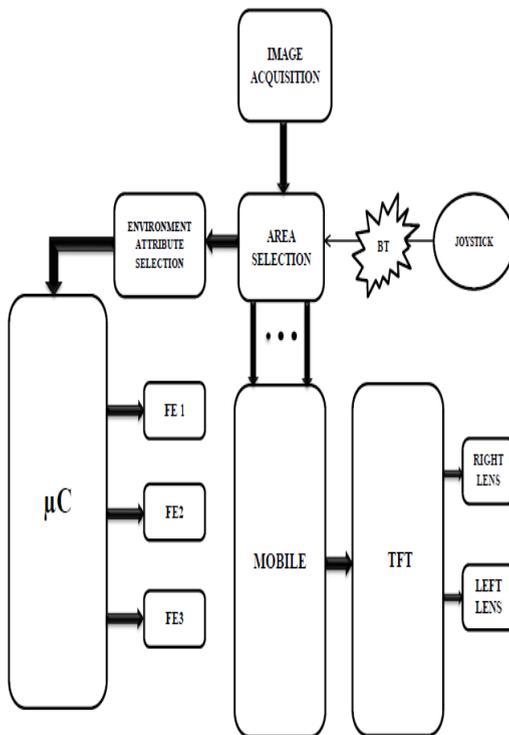


Figure1.6 Block Diagram of Proposed System

The system is represented by three major blocks (i.e. Image Acquisition, Area Selection and Environment Attribute Selection) and carried by verification of XD based environment, if it is matched the field experiment gets ON otherwise it will be in OFF condition.

i) Image Acquisition

Digital imaging or digital image acquisition is the creation of photographic images, such as of a physical scene or of the interior structure of an object. The term is often assumed to imply or include the processing, compression, storage, printing, and display of such images.

The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks required today.

However, if the image has not been acquired satisfactorily then the intended tasks may not be achievable, even with the aid of some form of image enhancement

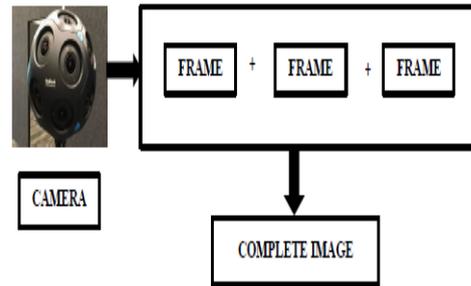


Figure 1.7 Process of image acquisition

ii) Area Selection

A Bluetooth stick is a pointing device used mainly but not exclusively for computer games. A Bluetooth stick has a base, on which control buttons can be mounted, and a vertical stem, which the user can move in any direction to control the movement of an object on the screen; the stem may also have control buttons. The buttons activate various software features, generally producing on- screen events.

iii) Environment Attribute Selection

The image for a particular position will have particular sensor values. If the sensor values of image matches with the sensor values of microcontroller the field experiment gets ON else it will be in OFF condition.

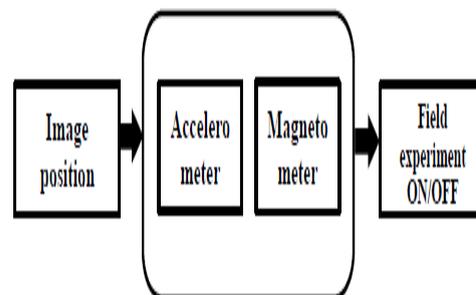


Figure 1.8 Quality of virtual reality

VI. FUZZY LOGIC

Fuzzy logic studies reasoning systems in which the notions of truth and falsehood are considered in a graded fashion, in contrast with classical mathematics where only absolutely true statements are considered.

The process of fuzzy logic is explained in Algorithm 1: Firstly, a crisp set of input data are gathered and converted to a fuzzy set using fuzzy linguistic variables, fuzzy linguistic terms and membership functions. This step is known as fuzzification. Afterwards, an inference is made based on a set of rules. Lastly, the resulting fuzzy output is mapped to a crisp output using the membership

functions, in the defuzzification step.

The Fuzzy Logic algorithm follows:

1. Define the linguistic variables and terms (initialization)
2. Construct the membership functions (initialization)
3. Construct the rule base (initialization)

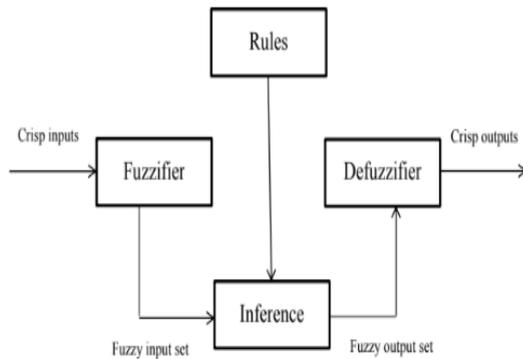


Figure 1.9 Block diagram of Fuzzy Logic

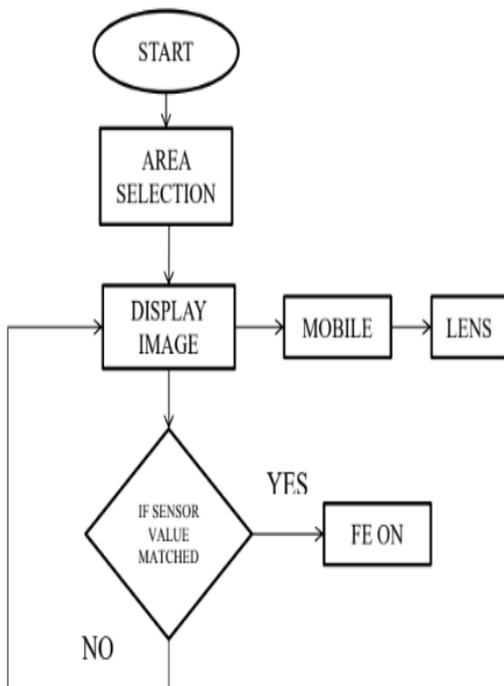


Figure 1.10 Flow diagram of Proposed system

VII. SOFTWARE DESCRIPTION

In Virtual Reality XD based environment Terminal software can be used to analyze the performance of field experiments.

A. TERMINAL

Serial communication is one of the simplest ways of communication between a microcontroller and PC or vice versa. It requires only single wire for transmission of data and another for receiving. This communication can be used for controlling the robot from a PC manually or the computer program controls it.

B. PORT PARAMETERS

1. Baud Rate – No. of bits transmitted per second Commonly used baud rate values- 1200,2400,4800,9600,19200,etc
2. Size of the data-8 bit or 9 bit
3. Stop Bits- No of stop bits you want to use.(normally 1 is sufficient)
4. Parity bit-Odd or Even Parity (Not necessary in short distance communication)

VIII. HARDWARE DESCRIPTION

PIC MICROCONTROLLER

PIC is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Peripheral Interface Controller".

HIGH PERFORMANCE RISC CPU

- Only 35-75 single-word instructions to learn
- All single-cycle instructions except for program branches, which are two-cycle
- Operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle
- Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM),
- Up to 256 x 8 bytes of EEPROM Data Memory Pin out compatible to other 28-pin or 40/44-pin PIC16CXXX and PIC16FXXX microcontrollers

MEMORY ORGANIZATION

There are three memory blocks in each of the PIC16F87XA devices. The program memory and data memory have separate buses so that concurrent access can occur and is detailed in this section. The EEPROM data memory block is detailed in —Data EEPROM and Flash Program Memory. Additional information on device memory may be found in the PIC microcontroller Mid-Range MCU Family Reference Manual (DS33023).

DATA EEPROM AND FLASH PROGRAM MEMORY

The data EEPROM and Flash program memory is readable and writable during normal operation (over the full VDD range). This memory is not directly mapped in the register file space. Instead, it is indirectly addressed through the Special Function Registers. There are six SFRs used to read and write this memory:

- EECON1
- EECON2
- EEDATA
- EEDATH
- EEADR
- EEADRH

ACCELEROMETER SENSOR

Accelerometer sensor can measure static (earth gravity) or dynamic acceleration in all three axis. Application of the sensor is in various fields and many applications can be developed using this sensor. Accelerometer sensor measures level of acceleration where it is mounted this enable us to measure acceleration/deceleration of object like car or robot, or tilt of a platform with respected to earth axis, or vibration produced by machines.

HEAD MOUNTED DISPLAY

The head-mounted display (HMD) was the first device providing its wearer with an immersive experience. Evans and Sutherland demonstrated a head-mounted stereo display already in 1965. It took more than 20 years before VPL Research introduced a commercially available HMD, the famous "Eye Phone" system (1989).



Figure 1.11 Head Mounted Display

IX. RESULTS AND DISCUSSION

In this project, we evaluate the virtual reality in which application has been created. The mobile which is inserted in the VR Headset will get calibrated first. After calibration the required area can be selected for viewing using Bluetooth.

If pictures particular area's sensor value matched with the microcontroller's programmed sensor values it will ON the particular field experiment else it will be in OFF condition. It can be viewed by connecting PC to serial port. It is analyzed with the help of Terminal Software.



Figure 1.12 Application

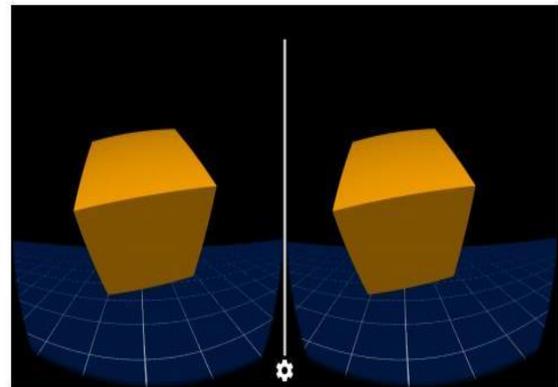


Figure 1.13 Calibration of a Mobile



Figure 1.14 VR View in VR Headset

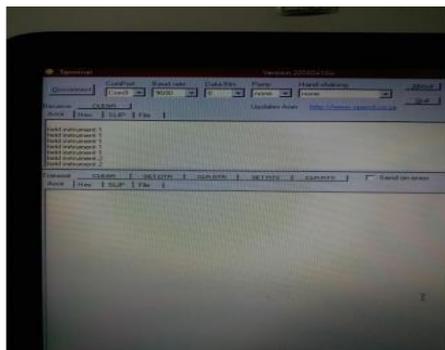


Figure 1.15 Terminal Output

X. CONCLUSION AND FUTURE WORK

A. CONCLUSION

The above implementation was an effort to understand how an environment can be viewed in Virtual Reality. The application has been created it is used in a virtual reality environment for traditional real life tours for various campus. As the concept holds three steps of processes, the photographic images have been created using image acquisition followed by area selection which can be operated using Bluetooth with joystick and then quality of virtual reality has been analyzed using fuzzy logic. The virtual reality of a campus is viewed by the user with the help of a VR Headset and smartphone. This virtual reality for campuses is used for both indoor and outdoor navigation. The outcome of virtual reality has been interfaced with the computer to check the response of the field experiments.

B. FUTURE WORK

There is a scope of further improvement to execute field experiment output in hardware and to use a point locator as area selector instead of Bluetooth.

REFERENCES

- [1] Chris Morris (Dec 2015), "Is 2016 the year of virtual reality?," *Fortune*, Vol. Tech.,
- [2] Daniel Wright (2015), "Dynamic occlusion with signed distance fields," in *ACM SIGGRAPH*, vol. *Advances in Real-Time Rendering in Games*.
- [3] Google Cardboard – Google VR <https://vr.google.com/cardboard/>
- [4] J. Kim and H. Jun (Aug. 2008), "Vision-based location positioning using augmented reality for indoor navigation," *IEEE Trans. Consum. Electron.*, vol. 54, no. 3, pp. 954–962
- [5] M. Kalkusch, T. Lidy, M. Knapp, G. Reitmayr, H. Kaufmann, and D. Schmalstieg, (2002) "Structured visual markers for indoor pathfinding," in *Proc. 1st IEEE Int. Workshop Augmented Reality Toolkit*, p. 8.
- [6] Pantelidis, V. S. (2010), "Reasons to use virtual reality in education and training courses and a model to determine when to use virtual reality". *Themes in Science and Technology Education*, 2(1-2), 59-70.
- [7] Schofield, D. (2012). *Mass effect: A chemical engineering education application of virtual reality simulator technology*. *Journal of Online Learning and Teaching*, 8(1), 63.
- [8] Tinsley A. Galyean and John F. Hughes. (1991), "Sculpting: an interactive volumetric modeling technique" In *Proceedings of the 18th annual conference on Computer graphics and interactive techniques (SIGGRAPH '91)*. ACM, New York, NY, USA, 267-274.
- [9] Winn, W. (1993), "A conceptual basis for educational applications of virtual reality" (Technical Report TR-93-9). Seattle, Washington: Human Interface Technology Laboratory, University of Washington. Retrieved from <http://www.hitl.washington.edu/publications/r-93-9/>
- [10] Young blut, C. (1997), "Educational uses of virtual reality technology". Executive report. Reprinted from *Educational uses of virtual reality technology (IDA Document Report Number D-2128)*. Alexandria, VA: Institute for Defense Analyses, 1998. *VR in the Schools*, 3(1).
- [8] S. Emmitt and K. Ruikar, *Collaborative Design Management*. Evanston, IL, USA: Routledge, 2013.
- [9] S. L. Joseph, X. Zhang, I. Dryanovski, J. Xiao, C. Yi, and Y. Tian, "Semantic indoor navigation with a blind-user oriented augmented reality," in *Proc. IEEE Int. Conf. Syst., Man, Cybern.*, 2013, pp. 3585–3591.
- [10] M. Kalkusch, T. Lidy, M. Knapp, G. Reitmayr, H. Kaufmann, and D. Schmalstieg, "Structured visual markers for indoor pathfinding," in *Proc. 1st IEEE Int. Workshop Augmented Reality Toolkit*, 2002, p. 8.
- [11] J. Kim and H. Jun, "Vision-based location

- positioning using augmented reality for indoor navigation,” *IEEE Trans. Consum. Electron.*, vol. 54, no. 3, pp. 954–962, Aug. 2008.
- [12] J. B. Kim, “A personal identity annotation overlay system using a wearable computer for augmented reality,” *IEEE Trans. Consum. Electron.*, vol. 49, no. 4, pp. 1457–1467, Nov. 2003.
- [13] S. Kasprzak, A. Komninos, and P. Barrie, “Feature-based indoor navigation using augmented reality,” in *Proc. 9th Int. Conf., ACM Intell. Environ.*, 2013, pp. 100–107.
- [14] A. Mulloni, H. Seichter, and D. Schmalstieg, “Handheld augmented reality indoor navigation with activity-based instructions,” in *Proc. 13th Int. Conf. Human Comput. Interact. Mobile Devices Serv.*, 2011, pp. 211–220.
- [15] L. C. Huey, P. Sebastian, and M. Drieberg, “Augmented reality based indoor positioning navigation tool,” in *Proc. IEEE Conf. Open Syst.*, 2011, pp. 256–260.