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# Study of Hardware and Software used in: Virtual and Augmented Reality Device

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**Abstract**— This paper mainly focuses on working of different virtual and augmented reality device on hardware and software aspects. The main component used in virtual and augmented reality are camera to recognize gesture this gesture can be recognized using free hand, sliced finger or by using infrared laser to detect the motion of hands. Pico projector this is the most generally use component for projection it is a light weight projector that can be integrated with glass so as to see virtual world object and use gesture recognition for interaction. This paper will cover the literature study of different VAR device used in different field and also working of that device in detailed.

**Key words:** Reality Device, VAR Device, Leap Motion

## I. INTRODUCTION

Virtual and Augmented Reality is a magic in tech field and a future scope of technology. Using free hands you can interact with the User Interface of device. And because of this technology Interface of device is not confined in to device surface only. It is now projected in real world and with bare hands one can interact with it. This interaction is possible because of augmented reality. This technology is contributed for solving the real world problem. And some of the VAR devices are cheap and can be easily affordable or one can construct their own VAR device. The most commonly used components in VAR device are for hardware generally use gesture recognition camera and Pico projector. Gesture recognition is the important and essential aspect to consider in the field of virtual and augmented reality because this technology is used to interact with the virtual object. And Pico projector is because this projector is light in weight, wireless and also projector clearly in short distance without affecting vision. Generally each and every VAR device for computing uses mobile or laptop where all the input from different hardware gets integrated, processed and user gets output projected by Pico Projector. In below section hardware and software technology/specification of some of trending VAR technologies are discussed.

## II. LITERATURE REVIEW

### A. Leap Motion:

Leap Motion is an augmented and virtual reality device hardware used in this device are two cameras and three infrared LED's. The camera detects the laser of 850 nm which is outside visible light spectrum. This device has some limited range roughly 2 feet (60 cm) above the device. Beyond that distance it is harder to infer hand position in 3D. In such case the device's USB controller reads the sensor information into its own limited memory and performs any necessary resolution adjustments. This data is then send via USB to the Leap Motion tracking software. In software this device uses advanced algorithm to track 3D object using camera and construct the object that device sees after compensating background and other views. The tracking layer matches the data to extract tracking information such as tools and fingers. The advanced tracking algorithms interpret the 3D data and interpret the positions of occluded objects. Filtering techniques are applied to make sure of smooth temporal coherence of the data. The Leap Motion that feeds the results – expressed as a series of snapshots, or frames, containing all of the tracking data – into a transport protocol. Uses TCP/IP protocol to communicate with applications [1].

### B. Microsoft Hololens:

Microsoft Hololens this is the best ever discovery done in virtual and augmented reality field this device superimpose the virtual world in real world so that one can interact with virtual object in real world and such device gives contribution to make human life better. And this makes Microsoft Hololens far better than other virtual and augmented reality device like oculus rift. This headset is designed in an excellent way and has more power than average laptop and also this headset passively cools up without fans. Hololens has sensor to capture information about what action a person is doing and environment around that person. Hololens uses advanced optics which is a high-definition lenses and uses advanced optical projection system that generate multi-dimensional full-color images with very low latency so that holograms can be seen in real world. Custom holographic processing unit HPU is custom silicon that processes a large amount of data/information per second from the sensors. Microsoft Hololens understands gestures and where you gaze, and map the world around you, all in real time. It also has camera so that it can detect object in real world example table, chair etc and It then uses that information to project 3D images on top of and even inside them .and also has inbuilt speaker[3][7].

### C. Oculus Rift:

Oculus rift is the headset used for gaming purpose only works on virtual and augmented reality so that it can give 3D experience which feels real. The architecture behind this 3D experience is complex involves spitting out two near-square video feeds to the similar screen - think playing a vertically-split-screen two-player game. The two lens have slightly different angle so that the two 2D images can be seen as one 3D images. This device demanding 60 frames per second for smooth and stutter effects. Video is sent to the Oculus Rift via HDMI, with an alternative DVI adapter for laptops and newer graphics cards. It also includes USB, which transfers data and power to the device, and lets your computer know what this bizarre gizmo is. This 10-foot cable is just the right length to provide a constantly good signal without any degradation. Oculus rift has position tracking system in which it has series of infrared laser LED embedded in the headset which is monitored with the help of wireless speaker like system to get to know about the position in 3D plane. It has two pair of lenses which enlarge the screen so it fills your field of view without causing any movement or blurring sickness. And also it has single custom motherboard, which comprises of an ARM processor and control chips for the LEDs. But the most important component in this device is the "Adjacent Reality Tracker" which was developed as an individual for Oculus Rift and has since become a key component. This includes a magnetometer, a gyroscope and an accelerometer, all of which combine to precisely track the rift transversely all three dimensions of three-dimensionality. By adding LED in to rare and front of the headset the oculus rift provide 360 degree view. The frame refreshing rate was 60 Hz makes things smooth and has 100 degree horizontal view because of which there are no blank spaces around edge of display. A huge amount of information is continually sent backward and forward between the positional tracker, the headset, the computer and its software, and the result is an unbelievably smooth VR experience. Adjustments such as brightness and contrast are made via Oculus' software, which also includes the ability to adjust the height and so on. In Oculus Rift for audio uses Head-Related Transfer Function (HRTF) tech, collective with the Rift's head tracking to create a sense of true 3D audio specialization. Because of which users gets realistic sound from all direction [4].

### D. Sixth Sense Device:

Sixth sense device is the first step that took towards the field of virtual and augmented reality this device works on some basics components like camera that used to recognize gesture using marker but advancement is done in this field with concept of finger slicing so that the camera will recognize gesture without markers basically markers are needed since camera can't detect hands and process it further because of background and other disturbing environment which create hindrance to process data through camera .Pico projector is used to project UI in some object so that it can interact apart from that use mirror to adjust the projection. And also with the help of speaker paper can be act as tablet by clipping speaker to paper it will sense the touch vibration in paper and camera will detect the finger on the paper by combining this two input the paper can be act as mobile or tablet and also as an computing device we can use tablet mobile phone or laptop to process data getting from different hardware sources [2][6].

### E. Google Glass:

Google glass this was the trending Virtual reality device launched by Google that guide user, work as per user needs .In this glass as a hardware device used prism and a small projector. This projector project the information to this prism and prism then project it in users eyes The effect is that user feels that his/her eyes is projecting information. And form computing data Google glass uses mobile. And recently Google launch Google cardboard. This is the cheap VR device .Hardware used in this device is Cardboard, Biconvex lens, two magnets so as to interact with computing device ie: mobile[8].

### F. Cast and Meta AR

Apart from that there are different VAR device in the market one device called Cast AR . It has two normal glass in that glass there is camera at middle and this camera capture the surrounding object which is then projected in to glass .and thus using computing device Cast AR acts as VAR device. Meta is also an VAR device which works on Google glass in this the virtual object is imposed in real world and allows freely to manipulate with that 3D object which can be treated as clay and work with it. Gives an unlimited screen in the form of virtual paper.

Today VR technology almost contributed in each and every field whether it might be innovation field, sports, games, movies etc.

Also some VAR device are combined with intelligence to make user experience more excellent we have K-Glass in this category which studies the human needs and accordingly work. It takes input using Visual Attention mode(VAM) technologies and accordingly work for human.

Devices Properties	Leap Motion	Microsoft Hololens	Sixth Sense Device	Oculus Rift	Google Glass	Google Cardboard	Cast AR	Meta AR
Functionality	Good	Excellent	Moderate	Moderate	Excellent	Moderate	Moderate	Excellent
Experience	Fair	Excellent	Moderate	Excellent	Excellent	Moderate	Low	Moderate
Cost	High	High	Medium	High	High	Low	Low	High
Scope	Moderate	Excellent	Moderate	Moderate	Excellent	Moderate	Low	High
Efficiency	Excellent	Excellent	Moderate	Excellent	Excellent	Moderate	Moderate	Excellent
Security	High	High	Low	-	Excellent	High	High	High

Fig. 1: Comparison Table of different VAR Device

### **III. CONCLUSION**

In this paper we are providing a comprehensive literature review of working of virtual and augmented reality device and It has been cleared that day-by-day this field has improvement and making the user experience more excellent, smooth and immersive. People with the help of VAR device can solve their problem one of the best example is Hololens. Out of all this VAR device Hololens has better UX since It integrate and adjust the virtual world in real world and the best part is this device is connected to 3D printer and the object constructed using Hololens SDK can be 3D printed and use in real world. Rest all other VAR device also gives good experience to user but this VAR device is mainly focused on one field ie: gaming movie etc. Based on Microsoft Hololens there are different VAR device that is there in market and this device main aim is to give excellent UX as like Hololens.

### **ACKNOWLEDGMENT**

Our sincere appreciation to our guide Prof. Mahendra Patil for guiding us to achieve a substantial level in our project. We also thank our college for providing us an environment which helps us to undertake this project. We express our gratitude for everyone who wholeheartedly supported the project and gave us their valuable time while making this project. All the inputs given by them have found a place in the project. The technical guidance provided by our guide was more than useful and made the project successful. She has always been a source of inspiration for us. It was memorable experience learning under such a highly innovative, enthusiastic and hardworking teacher.

We are also thankful to our Principal Dr. S.P. Kallurkar, our Project co-ordinator Prof. Deepali Maste and all the staff members of the Computers department who have provided us various facilities and guided us to develop a very good project idea.

Finally, we would also like to thank teachers of our college and friends who guided and Helped us while working on the project.

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