Abstract: The advent of Augmented Reality (AR) is taking the world by storm. Creating a perfect interplay between the Virtual and Real time worlds, AR knows how to augment and tap the interests of not one, but many lives. Technology has taken over immensely with developments of various sorts at every nook and corner. Conceptualize a world where everyday objects can be used in ordinary ways. Users can view ordinary objects in a virtual 3D format and further interact with them using Finger Tracking. The sole objective behind Finger Tracking is to enhance the entertainment quotient and effortless usage using natural hand gestures. Our work in this paper revolves around real time interaction with virtual content, primarily focusing on finger tracking and hand gestures. Augmented reality environment uses image processing software to track the human gestures, thus enabling a perfect relationship with the virtual content.

Keywords - Augmented Reality, Virtual and Real time, Finger tracking, Virtual content, Human Gestures

I. INTRODUCTION:

Computers transform and change lives every day, the transition from manual to automation, especially on traditional physical activities is not satisfactory. Software designers are prone to making minute errors that may result in lamentable errors. According to [6], typing is not very agreeable. Studies prove that Repetitive Strain Injuries (RSI) due to keyboard overuse has become the major source of workmen’s compensation claims in the United States resulting in an unending list of surgeries over the years. It is not much of a surprise to know that computers have a little or no impact at all on white-collar workers and productivity. However, this is not restricted to the IT industry alone. The field of Medicine is booming with the advent of medical devices and diagnostic equipment coupled with some of the best technology available. However, despite the rise of brilliant technology, they still resort to the conventional paper and pencil method of recording medical charts. This is where AR finds its way to enable people to make use of their existing skills to interact virtually, with their everyday physical objects.

What is Augmented Reality (AR)? AR serves as the perfect platform to append virtual elements with the real world. One of the greatest blessings bestowed upon humankind is the ability to communicate with the help of actions and vocals. Human-Machine interaction till recent years have only been with the help of the mainstream input devices. Picture this! An interaction solely based on actions and gestures. This is where AR finds its place in the ideal world. AR was misconstrued to be a futuristic concept, when in reality it’s been lurking around the globe since time immemorial. With each passing decade, AR has
become seamless and robust thus fabricating a compound environment bridging both the real and virtual worlds. With the dawn of applications like Pokémon-Go, Ink Hunter and WallaMe creating quite a rage, AR encompassed us in a world of its own.

According to [3], the human-machine interaction and recognition revolves around two main approaches; Hand Detection and Soft Computing. The former comprises of techniques to detect hand gestures in the image, followed by pre-processing which involves approaches based on applications and models. Soft computing solely revolves around concepts like Neural Networks, Fuzzy Systems, Machine Learning, Probabilistic Reasoning; The Hand-Gestures to be used can be in the form of Sign Languages or any other pre-defined language involving the hands which is recognized by the system to be used by the user.

In 1994, Paul Milgram and Fumio Kishino defined a mixed reality as “anywhere between the extrema of the virtuality continuum”. The case at the left consists solely of real time objects and the one at the right time comprises of virtual objects. The Virtual Continuum was given with an aim to describe that there is a continuous scale ranging between the completely virtual and completely real.

Narrowing it down to the comparison between Augmented Reality and Virtual Reality, the latter is a computer-generated, artificial to be precise, stimulation, primarily fueled by the desire of a user to experience immediate stimulated reality. With respect to [4], Virtual Environment can be reached out using two methods; first, one is by generating a command or an event for a functional interaction. The other, is to control the object directly. The former, on the other hand is a stark contrast. It provides means to augment and extend the virtual world into the real world.

II. RELATED WORK

Kendon [5] gives a general definition of gestures as voluntary and expressive movements of the body. With reference to [1], the history of hand gesture recognition for computer control boils down to the invention of glove-based control. According to the researchers, glove-based control is fueled by basic sign language and gestures. Sign Language Recognition (SLR) and gesture-based control are two of the most important applications. This soon gave way to the development of much accurate accelerometers, infrared cameras and fiber optic bend-sensors. The development in glove based system led to the abilities to connect with the virtual objects without attaching sensors to the gloves; merely using hand gestures.

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One of the most widely and conventionally used component for hand gestures recognition is data glove. However, the incommodious property limits the hand movements of the users thus becoming the biggest snag of the data glove. Evolution and Development has gone to the extent of enhancing gesture control by replacing the data gloves with non-wearable devices. This is more user-friendly and feasible, thus urging users to move forward.

The other approach used in gesture-based recognition is Electromyogram (EMG). A single channel EMG sensor is used to detect the control signs in the gesture. EMG sensor is placed on the inside of the
forearm. This method links a human’s neural signals with computers; these neural signals (bio-signals) can be acquired from specialized cell, tissue or organ. The contraction and relaxation of muscles produces electrical currents, which is measured by EMG. Various applications like clinical applications, human computer interaction and interactive computer gaming use EMG.

A gesture may be defined as a physical movement of the hands, arms, face, and body with the intent to convey information or meaning. Vision is one of the physical senses in the human body. While engaging in a conversation with humans, the computer is instantiated. Research proves that Vision based approaches have taken over Wearable-Device approaches. Normally, any Vision based approach is a three-stage concept: Image Pre-processing, tracking and gesture recognition.

Image Pre-processing is performed based on Color, shape, pixel, 3D model. The first stage in Vision based Gesture recognition mainly focuses on hand recognition and removing the background from the image. In [9], it all begins with locating the hand in the frame, discarding the background from the image and to be insensitive to the lighting conditions. Every step in the process is an abstract of another. To prove the former, skin recognition is required to locate the hand in the frame. Moving on, the shape of the hand plays an equally important role as well. The two methods employed to figure out the shape of the hand are Contour-based shape representation and Region-based shape representation. The former includes Handoff distance, Fourier descriptor, shape signature. The latter includes Convex Hull, Media Axis, and Eccentricity. The second step in Vision based approach, tracking, can be quite arduous as the hands move very fast and they change from time to time. In [9], tracking is defined as the frame-frame correspondence. It works on two approaches: Correlation based feature tracking and Contour based tracking. The third step in Vision based approach is recognition, which is the interpretation of the semantics that the hand’s location, posture or gesture conveys.

III. CASE STUDY:

Microsoft has a vision: one that engulfs you into a glimpse of the future. For time immemorial, software has been trapped behind the glass of a monitor. Introducing Microsoft’s HoloLens, an AR headset that freezes the content with the real world and brings it right in front of your own eyes. However, that same world is transfigured into a holographic world with 3D objects floating midair, virtual screens on the wall and your living room covered in virtual characters running amok. Promising a future with their augmented reality headset, HoloLens is a bold piece of hardware with a head mounted display. The entire unit is connected to an adjustable, cushioned inner headband, which can tilt the HoloLens up, down, forward and backward. This brilliant wearable and portable device connection-free and can tag along wherever you go.
A. DESIGN

The whole unit primarily consists of holographic lenses and a depth camera as well as speakers above the ears and on-board processing. This is done with the help of Intel 32-bit architecture, an unspecified GPU and HPU (holographic processing unit). The whole thing is backed up by 2GB of RAM and 64GB of onboard storage. Overheating of the headset is done using a vent. Moving on to the connectivity, it will support both Bluetooth and Wi-Fi.

B. HARDWARE

According to [11], the device contains an Intel Cherry Trail Soc central processing unit (CPU) and graphical processing unit (GPU). A special co-processor called holographic processing unit (HPU) is featured, which is custom made by Microsoft especially for HoloLens. The Soc and the HPU each have 1GB LPDDR3 and share 8MB SRAM, with the SoC also controlling 64GB eMMC and running the windows operating system.

[11] Clearly states that the lenses employed in the HoloLens uses optical waveguides to color blue, green, and red across three different layers each with diffractive features. A “light engine” above each combiner lens projects light into the lens, which in turn produces a wavelength that hits a diffractive element and is reflected repeatedly along a layer until it becomes an output to the eye. HoloLens also features IEEE 802.11ac Wi-Fi and Bluetooth 4.1 Low Energy (LE) wireless connectivity. The headset uses the Bluetooth LE to pair with Clicker, a thumb-sized finger operating input device that can be used for interface scrolling and selecting. The Clicker features an elastic finger loop for holding the device, and a USB 2.0 micro-B receptacle for charging its internal battery.
C. APPLICATIONS

HOLOTOUR – Explore the enchanting view of The Eiffel Tower and walk the streets of Rome without a passport and a ticket. No wires needed as well. For starters, it is a combination of panoramic video, holographic scenery, and spatial sound creating a virtual travel experience with a touch of reality. While holidaying virtually, you can also experience incredible panorama and cinematic moments that no real-world tourist could ever possibly see. And it doesn’t end there. Tagging along is Melissa, a personal tour guide to give you an insight into the historical and local facts.

SKYPE – Skype by itself is a brilliant platform that transformed and helped not one, but countless lives. Picture a world where you can let your loved ones see what you see and place holograms into your world. Skype brings people together, lets you collaborate, create new memories or draw and place images in your space. Get all the required instructions without an ounce of distraction. It mainly revolves around the concept of keeping your hands free to while working.

IV. CONCLUSION

In our work, Augmented Reality: Virtual and Real Time Interplay using Hand Gestures, we have explored the nuances of the concept and how real-time objects can be accessed virtually in an augmented reality using hand gestures.

- Initially, we stated the stark contrasts between virtual and augmented reality using The Virtual Continuum proposed by Paul Milgram and Fumio Kishino.
- The paper then gradually moved to the different types of Gesture Based Recognitions and Interfaces; giving an insight into the Human-Machine Interaction and Communication as well.
- Moving on, we brought in one of the latest and booming device of AR; Microsoft’s HoloLens as our Case Study.
- The Design and the Hardware were dealt with along with the Applications.

To put it all in a nutshell, AR is creating a revolution and will continue to do so at least for a while. It is indeed leaving people utterly astonished and waiting for more; enabling users to get the ability to interact with the application from a distance without any physical interaction like the keyboard or mouse.
REFERENCES


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