iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** II **Month of publication:** February 2020

DOI: http://doi.org/10.22214/ijraset.2020.2034

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 8 Issue II Feb 2020- Available at www.ijraset.com

An Approach to Implement an Inbuilt HoloLens in a Mobile Phone with VR Headgear

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Abstract: ***Human innovations have developed to quantify the modern world and it's a deniable fact that technology has reached great heights shaping the future. The perspective vision of the world has been brought into real-time connecting the endpoints by the mechanization of augmented and virtual reality telepresence called 'Holoportation', which serves as the emphasized topic in this paper. This system is a combination of digital elements to present a three-dimensional visual chat with the help of HoloLens which is way more expensive. The overall objective of this study is to explore the concepts of 'Holoportation' and to provide an approach to implement the HoloLens inbuilt in a mobile phone with VR headgear so that it is affordable to every nuance of the world.***

Keywords: HoloLens, holoportation, 3D image, Visualization.

I. INTRODUCTION

Most of us would have already heard of the HoloLens, the latest invention in Mixed Reality headset by Microsoft, has become the latest sensation among people and this hardware is known as Holoportation. Realities have existed for ages now. Virtual Reality is the most anciently invented reality [11].

Then evolved the Augmented Reality into existence which basically does not require any headset. The latest new reality which was invented recent years ago has become the latest sensation.

This latest Reality is a mixture of Virtual and Augmented Reality and it is called Mixed Reality. Now, Microsoft has made it possible to incorporate Mixed Reality by inventing HoloLens emulator. Now many IT companies are interested in developing mobile applications relating to Mixed Reality and HoloLens. This combination of Mixed Reality and HoloLens are called as Holoportation [12].

Holoportation technology makes us enter another person's reality as a full-sized 3D hologram through a combination of mixed reality displays with HoloLens. HoloLens is used to determine the deflection between visualized hologram and its corresponding actual objects [15].

We have already witnessed these things in many movies, but witnessing these things in real life is uber cool. With this technology, communicating with remote users becomes as natural as face-to-face communication.

HoloLens can also be said as a smart-glasses headset which has inbuilt Windows 10 computer and which also is wireless. This three-dimensional head-mounted display contains various sensors inside the device. This project was introduced to the world during the year 2015, but the project was under development for more than 5 years before the release of the device. The Microsoft HoloLens was out for shipping from 30th of March 2016.

Mixed Reality has already proven to be helpful for the public in various ways such as Marketing, Entertainment, Security, etc. An examination shows that there has been significant testing for developing technique evaluate presence and technique regarding factors of presence [17].

Now Holoportation will make everyone's life even more sophisticated as the advancement in this technology is even higher and this technology is even more interactive with people than the previous one [8].

In this research paper, we are aiming to approach a newer idea to invent HoloLens in mobile phones. This approach can be implemented by connecting to the internet with AR/VR. The basic structure for this ideology is to insert a different type of camera inside the smartphones so that it can be activated whenever required. This invention is aimed to have an application on all parts of the world in all sectors. This invention will create a whole new experience just like how the invention of Video chat created a huge impact among people.

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II. CHALLENGES FACED

The greatest challenge experienced was the bandwidth. With innovative approaches, Microsoft has reduced this one by 97%. Furthermore, the human-interaction information has been complex [20]. There were other challenges such as changing lighting, changing background, vibration, etc.

A. In this modern era of technology, there have been a lot of advancements. With so many advancements, our lives are beginning to look like a science fiction movie. Microsoft Research has shown us one great invention which can also be claimed as a new communication medium called as Holoportation. Microsoft has made science fictions as scientific facts. Now, they have also found a way to make highly complex holographic system far from mobile.

B. This system can function with a minimum of two cameras for capturing the depth information to create a 3D representation of an object. There is no limitation as to the number of cameras to be only two, the more the cameras are, the better the quality of the 3D model. The Holoportation process involves combining of the results from the camera feeds together in real time and that combined info will be sent to the remote user. One can easily understand how much heavy computing power and the data bandwidth is required for this process to be successful.

C. Usage of Holoportation in a moving vehicle is another challenge that was faced. The bandwidth requirement for Holoportation is reduced to 30-50 Mbps. With this bandwidth, it is easy to use Holoportation in a moving vehicle, if we are within the Wi-Fi range.

III. SYSTEM OVERVIEW

The Holoportation system is a model of capture technology which enables three-dimensional replica of people to be recreate, assemble and transfer freely anywhere in the world enabling to interact with each other. This technique allows unparalleled quality and peculiarity for 3D capture in real time that permits for low endpoint transmission downtime and further reduces remote supply transmission downtime to avoid disruption [7].

To construct a Holoportation system, Microsoft has planned and plotted a flow diagram as follows:

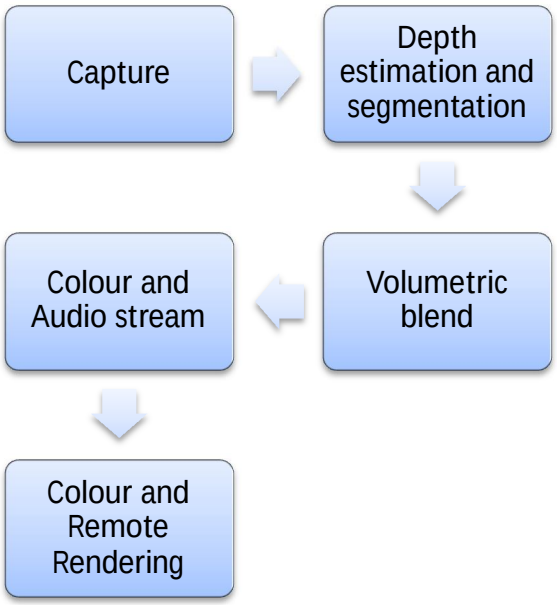

Fig 1: Existing Holoportation technique.

As the above figure depicts the process of building the holoportation system, we set out the explanations starting with the capture of corporeal structure, the algorithm for superlative standard of depth approximation, the pragmatic outline construction, color furnishing, image compaction and remote rendering.

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IV. EXISITNG MECHANISM

As per Microsoft, to seize a physical structure in total 360˚, they utilize 8 camera pods put up in a particular position on the marginal edge of the room pointing inwards to capture a peculiar image. The camera pod comprises of tow Near-Infrared cameras and a color camera ascended above that to make a certain viewpoint. Furthermore, a diffractive optical element and a laser device is utilized to induce a pseudo random figure. In addition to Near-Infrared cameras, NIR filters are incorporated to strain and filter the visible light spectrum scale. From each camera pod, it originates a color range of RGB and depth flow with the use of disparity refinement technique.

The procedure of this plot is to produce depth streams that need internal and external calibrated analysis. Another caliber step make a certain uniform and consistent color details amid of the RGB cameras. When the colors have been separately adapted, one RGB camera is used as a source and curves the other additional cameras to the source operated using linear mapping [7].

Structured light approach towards for precise depth estimation. As a result it collects the color, volumetric blend and determines the size of human figure so as to replicate the same to the opponent's side of holoportation. Spatial audio is well captured and combined with the color and volumetric blend with perfect orientation of local user to remote user ensuring audio and visual prompts match together

V. PROPOSED METHODOLOGY

To prevail over the existing Holoportation system, we would like to propose the methodology creating a mirage of physical illusion and virtual environment blending which can be additionally integrated with hardware [18] on implementing the HoloLens in a mobile phone with the help of a Virtual Reality headgear.

A. Hardware Setup

For a mobile phone, we adopt an inbuilt HoloLens comprising an RGB camera, 2 depth cameras, a flashlight projector and a sensor for discerning the physical structure of a human wearing the VR headgear.

1) *RGB Camera:* The RGB camera generates an additional color pattern to produce an appropriate process of holoportation. This RGB camera is based on navigation system. RGB sensors ;captures the images, which makes easy to receive the depth details at pixel level [1].The main function of the RGB camera is to sense and display the physical model of a human being.
2) *Depth Camera:* The depth camera holds a monochrome CMOS sensor and an infrared projector which helps to construct a three-dimensional image of a person. CMOS sensors replace coupled devices with highest potential, lower cost and lower power requirements. CMOS sensors exhibits better optical performance [2].
3) *Structure Sensor:* Senses the human physical structure in contact and converts into an augmented wave to transmit. This sensor captures the motion swift, and monitors many more factors [9].
4) *Flashlight Projector:* The flashlight projector which is present in the mobile phone helps in fetching the augmented wave signal emitted by the interactor VR headgear and then it protrudes the vivid imagery of the interactor's actual physical body [14].

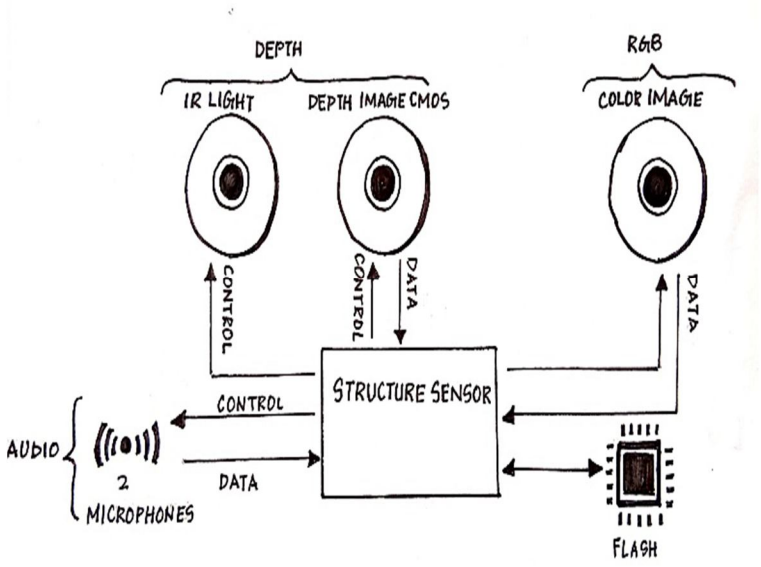


Fig 2: Construction of HoloLens in Mobile

5) *VR Headset:* A VR headset is a device that includes a gyroscope, optical lens, focal adjustment, wave projector, audio adjustment, touchpad and a link port which is connected to the mobile phone. The VR headset utilizes these parameters to enhance the holoportation technique. This headgear gives the feel of real world, as the person turns his/her head throughout the visuals. VR involvement is actually handled individually [3].
6) *Gyroscope:* A gyroscope is a detector which estimates the motion and direction of an environment. Gyroscope has been improved greatly for the effect of temperature variation. This detects the movement of the person and the surrounding temperature for better picturization of the visual [4]. It also helps in the conversion of the static image into a shifting virtual environment.
7) *Optical Lens:* The optical lens in VR headgear enhances the image resolution and generates a clear-cut pixelated holoport image. Optical lens gives the accurate motion of transfer power system. It has an application of digital camera, camcorder and cell phones [5].
8) *Wave Emitter:* A wave emitter tends to generate an augmented wave which is designed to sense our own corporeal model and transmits the wave to opponent interactor who is using the VR headgear. It is important to represent the new wave projection for communication. These waves are replicated as a three-dimensional image known as hologram. It is the transformation from basic Victorian into a modern audio visual display [6].
9) *Wave Receiver:* Receives the augmented wave generated wave from the interactor, retrieves the physical sensing waves into image and passes onto the flashlight projector.
10) *Focal Adjustment:* Focal adjustment is an option to adjust the position and focus of its respective enabling accurate holoport image [19]. The focal adjustment can modify the angle of the interactor.
11) *Audio Controls:* The audio system contains a stereo of volume that features the ability to suppress noise [13].
12) *Touchpad:* A touchpad is situated at the side of the VR headgear which also receives the generated waves to navigate and project ahead.

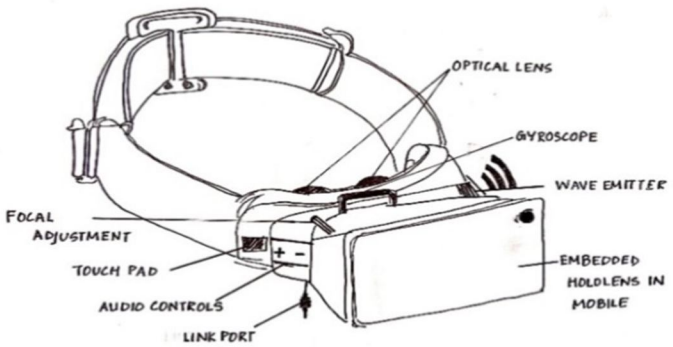


Fig 3: VR Headgear Setup

Steps involved in the VR holoportation methodology can be listed as follows

a) *Step 1:* Construct a HoloLens with the above-mentioned description and implement it in your respective mobile phone.
b) *Step 2:* Connect to the concerned person using video call.

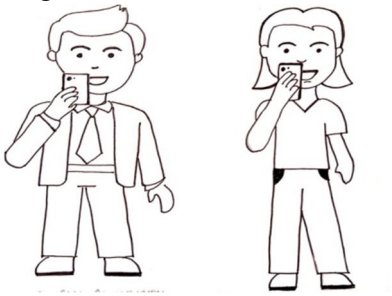


Fig 4: Video Call Connection

c) *Step 3:* As soon as the call is connected, insert the mobile phone into the VR headgear which converts the two-dimensional conversation into augmented reality conversation by switching on the touchpad present in the VR.

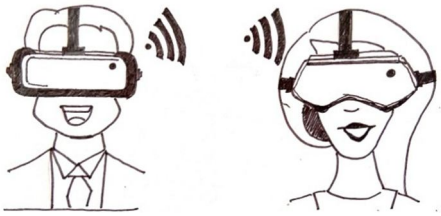


Fig 5: VR initialization .Generates augmented wave and transmits to the receiver.

d) *Step 4:* The VR headgear generates the augmented wave to interactor, accumulates the generated wave from the interactor and projects the imagery of the contacted person.

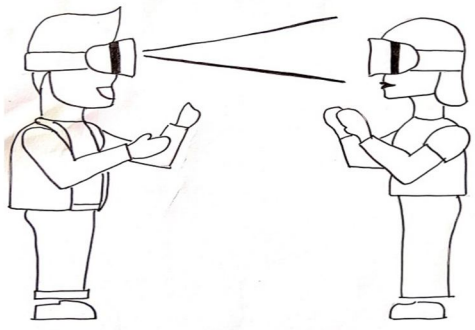


Fig 6**:** Projects the 3D imagery of receiver

This procedure happens to the same as to the interactor.

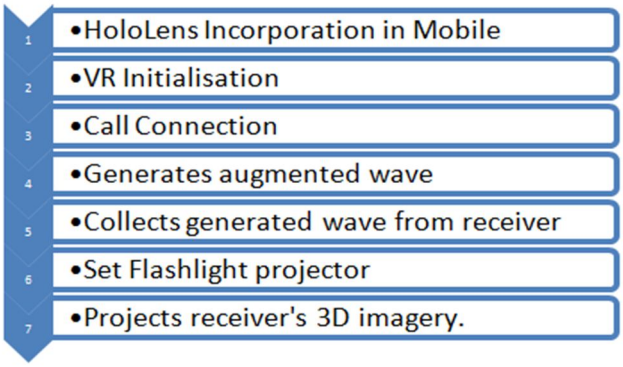


Fig 7: Integration of Holoportation in Mobile Phones

VI. EMBEDDING HOLOLENS IN MOBILES

The counteraction pipeline functions are already set naturally in the background of HoloLens, therefore there are no additional steps required to facilitate it. The frequency of the lens may be high, when the user is shaking. And during low frequency range, the user may experience double images and uneven motion. The technique of HoloLens in mobile phones has the degree of desperation is clinging on the speed of hologram. The foremost support for stability of HoloLens is its frame rate. Displaying the image through HoloLens replenish 240 times per second, which displays unique color fields for each accomplished image , in turn concludes with user acquaintance of 60fps (frames per second).

The placement of HoloLens would require a optimal zone between 1.25m and 5m, which eventually depends on the architecture. The diameter of HoloLens would range from 2-3 mm approximately. Sensor technique is advanced to the holographic processing unit (HPU) precisely designed to progress camera data apprehended by HoloLens to ensure balanced hologram demonstration and natural traverse of gaze and gesture intakes. If the advanced HoloLens are embedded in our mobile phones, we can experience a lot of benefits. Even though the cost of implementing is little higher, the advantages that can be gained after implementing this technique equals the cost factor [21].

VII. POSSIBLE OUTCOMES

Making impossible things to happen has become common in this modern century. The world has witnessed many technological revolutions in recent times. Now, we would like to propose our idea on Holoportation: one-to-one structure virtual capture, conveyance and projecting ourselves in a 3D model. Our idea is to merge an innovative apprehend technology with the Virtual Reality and Augmented Reality to exhibit and make people see, listen, record and communicate in 3D through the mobile phone.
From an auditory point of view, this technology provides you with the best quality sound making you feel very realistic. We have also proposed the steps to illustrate our idea and the hardware required to achieve this ideology. Our ideology is to implement the postulation and holoportation inside a mobile phone. Our idea is to insert these HoloLens inside the mobile phone which enables us to have a virtual treat. Communication can become very realistic if this ideology is implemented. If two persons want to communicate, all they need to do is insert the mobile phone containing HoloLens inside the VR headset and wear the headset to have a virtual face to face communication. Holoportation has never been implemented in mobile phones, so if our ideology gets successful, then this will be a big enhancement in the Reality. We can experience a visual treat with this new enhancement. This ideology can take Holoportation to a new level.
We expect the expounders and researchers to undertake this idea to implement and expand the technology and application to the next level.

VIII.LIMITATIONS

Although we depicted the 360° enthralled 3D holoportation using mobile phones with headgear, it does have a certain limitations. Firstly, the incorporation of HoloLens should be carefully implemented in the mobile phone avoiding complexity. Moreover, this system can record holograms, but only briefly, and while capturing the video content, the resolution can drop lower.

IX. FUTURE WORKS

Embedding HoloLens in a mobile phone is a bit complex. At that point, one has to ensure that HoloLens is capable of being portable in all Smartphones including Android, IoS.etc. Another specification would be the higher resolution of video content while recording holograms to enable quality 3D visual treat that calibrates to internal depth [10].

X. CONCLUSION

Holoportation brings in a lot of applications that one couldn't imagine of. It leads to a perception of physical existence along the indications corresponding to motions in space, gestures. etc. This could be a complex faraway conference.
Envisioned applications include:

A. Enhanced Medical Mixed Reality: Holoporting doctors to patient homes and assess their health diagnosis.
B. Family conversations, where a distant member could converse with their family on special occasions.
C. Universities and Institutions, utilizing the system for education with 3-D diagrams and representations.
D. Personal instructor, who instructs and provides instant response on exercise or dance moves,

One of the most important applications of this technique is live-streaming whereas other technologies are casted with before-hand content. Holoportation is the high tech that modifies location and timings schooling and instructions [16]. Live-telecasting provides a powerful sense of session and experience. In addition to that, the conversational content can be recorded for iteration or broadcasting from any angle. Moreover, the content has the facility to rewind.

REFERENCES

[1] Hindawi , journal sensors , volume 2017. In visual map construction using RGB -D sensor for image- based localization in indoor environment.
[2] Luiz Carlos Paiva Gouveia (School of Engineering, University of Glasgow , U.K) and Bhaskar Choubly (Department of Engineering Science , University of Oxford , U.K). On evolution of cmos image sensors.
[3] Warwick , The University of Warwick . In Kickstart VR.
[4] Dachuan lin , Xiaozhu chi, Jian chi, Longato lin, Qiancheng Zhao, Zhenchuan Yang (National key Laboratory of Micro/Nano Fabrication Technology, Institute of Microelectronics , Peking University, Beijing, 100871, China). In research on temperature dependent characteristics and compensation methods for digital gyroscope.
[5] Hyunseek kim, Jongkil park, Nguyen huu chuc, H.R. Choi, J.D.Nam, Y.Lee, J.C. Koo (Sungkyunkwan University , South Korea) and H.S.Jung(Samsung electro-mechanics company, South Korea). In Development of Dielectric Elastomer Driven Micro-optical zoom lens system .
[6] Deepak kumar , Divanshu Kaushik, Department of information technology, Dhronacharya college of Engineering , Gurgaon, Haryana, India. A Review Paper Holographic Projection .

[7] Sergio Orts-Escolano Christoph Rhemann∗ Sean Fanello∗ Wayne Chang∗,Microsoft- Holoportation: Virtual 3D Teleportation in Real-time.

[8] Hideyuki Tamura, Hiroyuki Yamamoto, and Akihiro Katayama, Mixed Reality: Future Dreams Seen at the Border between Real and Virtual Worlds

[9] Byeong Wan An †, Jung Hwal Shin †, So-Yun Kim, Smart Sensor Systems for Wearable Electronic Devices.

[10] Mathieu Garon∗ Pierre-Olivier Boulet†, Real-time High Resolution 3D Data on the HoloLens

[11] Virtual Reality History, Applications, Technology and Future Tomasz Mazuryk and Michael Gervautz

[12] Minja Silvennoinen Displaying Augmented Reality content on HoloLens environment

[13] HoloPort – A Device for Simultaneous Video and Data Conferencing Featuring Gaze Awareness Martin Kuechler and Andreas Kunz

[14] Alexandru Dancu, Zlatko Franjcic, Morten Fjeld, Smart Flashlight: Map Navigation Using a Bike-mounted Projector

[15] Yang Liu, Student Member, IEEE, Haiwei Dong, Senior Member, IEEE, Longyu Zhang, and Abdulmotaleb El Saddik, Fellow, IEEE . In Technical Evaluation of HoloLens for Multimedia: A First Look

[16] Kangdon Lee, University of Northern ,Colorado,Greely,USA. In Augmented Reality in Education and Training.

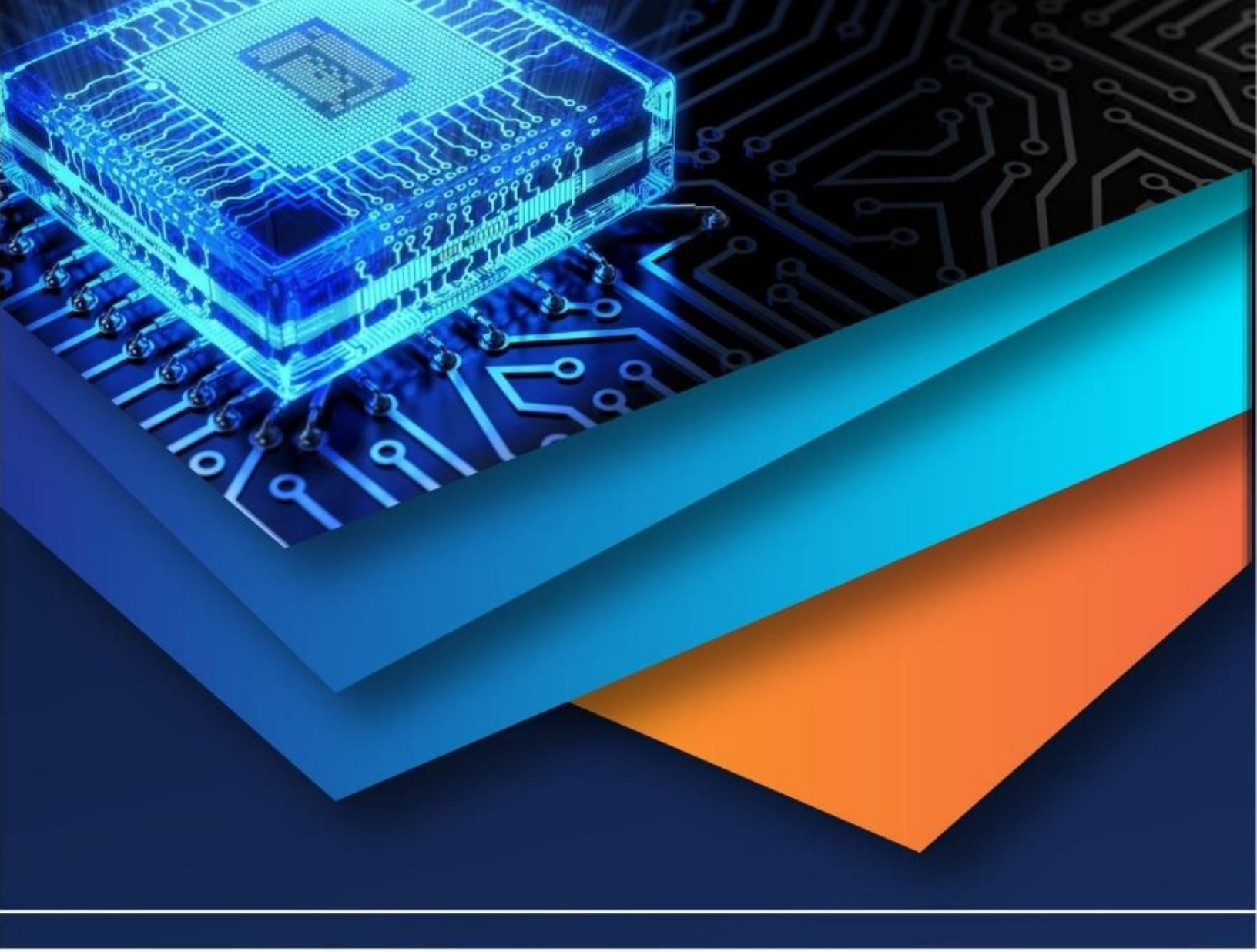
[17] Martijn J. Schuemie, Peter van der StraatenMerel Krijn, Charles A.P.G. van der Mast, in Research on Presence in Virtual Reality: A Survey.

[18] Wong, Kevin Winata, HandsOn: a portable system for collaboration on virtual 3D objects using binocular optical head-mounted display.

[19] Robert KonradStanford University, Stanford, CA, USAEmily A. CooperDartmouth College, Hanover, NH, USAGordon WetzsteinStanford University, Stanford, CA, USA

[20] Ryan P. Spicer, Stephen M. Russell, Evan Suma Rosenberg, The mixed reality of things: emerging challenges for human-information interaction.

[21] Research on Hologram stability- mixed reality, Microsoft , May 20, 2018



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