

# Future Reality is Immersive Reality

Ch. Chandra Sekhar, Shiv Sankar Ch, G. Nageswara Rao

**Abstract:** Reality is defined as set of all that is real and has existence unlike imaginary. Immersive Reality is a path breaking technology which bridges the gap between imagination and reality. Virtual Reality (VR), Augmented Reality (AR) and the latest Mixed Reality (MR) together are called as Immersive reality. It has been a quite a few years that way that people interact with content has not changed. Productivity across businesses is not in an encouraging position. This paper highlights how Immersive technologies are going to alter how we interact with content fundamentally. For example, Companies such as GE Renewable Energy and its technology partner Upskill worked together to develop head-mounted display (HMD) which helped employee to receive wiring installation instructions instead of reading a traditional paper manual. Using virtual reality headset, we can take ourselves to imaginary environment. Another development in this field is Microsoft HoloLens which is self-contained holographic computer, helps us in accessing digital content and interact with the holograms in the world around us. The design of all these products aim same goal – being part of human efforts to create better world for people to live in. These kinds of developments can transform the current entertainment, gaming, Education, Training, real estate, hospitality, shopping experience, healthcare, marketing experiences and travel communication businesses. As there are two sides for a coin, there are many issues which Immersive Reality must tackle before it makes global presence. This paper also focuses on the ethical dilemmas that Immersive reality faces.

**Index Terms:** Immersive Reality, Virtual Reality, Augmented Reality, Mixed Reality.

## I. INTRODUCTION

Immersion in Immersive Reality is a feeling that person is present physically in a non-physical world. Oliver Grau, [1] the perception is created by surrounding the user of the VR system in images, sound or other stimuli that provide a total virtual environment. In contrast to cinematic experience, user can interact with the environment here with all his senses. Frank Popper, [2] artificial environment is created in virtual reality in such a way that it will make user think as if person is present in real environment. Environment is created using special software and presented to the user. User can use only two of his five senses while working on a computer where as in Augmented Reality, user is enabled to involve with all his senses. Adams et al., [3] have explained about three types of immersions. Augmented reality is achieved by integrating the digital data to the user's environment in real time. In contrast to virtual reality which uses artificial environment, augmented

reality uses the existing environment and places the information on top of it. Immersive Reality will help us in developing the current businesses and taking the human interaction with content to next level. It will leverage devices in making the world a better place to live.

K. Tcha-Tokey et al., [4] Immersion generally different levels like least immersive to fully immersive. User engagement varies from one individual to another due to their differences. User will be engaged more if the environment created is able to replicate the real. User engagement will not be great if the environment is inadequate. User could have unpredictable psychological effects if the individual is kept in environment which simulates real life environment. Essentials of virtual environments that increase the immersion of the experience:

**Surroundings:** The user should be able to view in all directions in his surrounding environment. There shouldn't be any blockage in view.

**Conformance to human vision:** Visual information from VR must follow some things that allow human beings to understand their surroundings. For example, things which are far must be sized accordingly to our understanding when they are distant from us. Motion parallax helps in changing our view of objects whenever our perspective does.

**Freedom of movement:** It is necessary that user is enabled to move freely within the boundaries of the Environment. This can be achieved in dedicated VR rooms and room-scale VR. It is difficult to achieve this in seated VR and Stationary VR as it requires complex hardware.

**Physical interaction:** Interaction between user and the things should not change in virtual environment. They should be like what user does in real life. For example, Data gloves, will allow making motions like turning and pushing to interact with objects in natural fashion.

**Physical feedback:** Haptic feedback must be given to user to simulate the real-life experience. For example, when they are turning doorknob, they should feel the object in their hand.

**Narrative engagement:** The user should have control on the flow of the narration. The user should be able to utilize the environment cues for interesting developments.

## II. LITERATURE REVIEW

AR and VR are going to expand the market and make it reach about 95 billion dollars by the year 2025. Slater M et al., [5], currently the industries going for innovations are looking for IR technologies. These industries are Gaming, video, retail and live events. Eventually other industries will also look for these technologies as they are path breaking. IR will change the way the user creates and experience information or content in 4 ways:

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### A. Moving from Observation to Immersion

IR technologies will provide a new creative platform completely. All the existing rectilinear devices will be replaced with the devices that display the content in a new style, providing new experience and immersive feeling to the user that he has never observed before.

Users will no more deal with the traditional content display methods but will be kept in virtual worlds and is involved so much in the scheme of things. Hence the technology is called as “immersive”.

### B. Reduced Production Costs in Creative Activities

To reduce the cost and time of cycle in the development of product, “Virtual prototyping” plays an important role along with the aspect of improving quality taken care. Companies, which use the virtual prototyping, can reduce the expensive prototypes needed and the duration between conceptual stage to production stage and commercialization stage. Using immersive technologies, designers are offered a new experience such as walk, interact and fly with their prototypes, either in an VR or AR environment. As a result, high accuracy in design is achieved through immersive technologies. Therefore, the product with cheaper cost and higher quality is developed better than what traditional prototyping methods can offer.

### C. Lower Barriers to Entry for New Creators

IR technologies will support even new firms to develop cost effective quality content. The technology is in place already to process 360-degree imagery in time span of hours which would take days’ time until this technology has come. Filmmakers having small budgets will be utilizing this technology to achieve their output. Similarly, we can see now that apps and smartphones introduced photography outside users other than professionals and hobbyists. IR technologies will create more avenues such as this for all of us.

### D. As a Tool for Empathy and Cognitive Enhancement

IR technologies will evoke a feeling of empathy in the minds of people towards global issues such as humanitarian crises. Even though there is an assumption that empathy is declined when we use digital media profoundly, but this technology will be called as “ultimate empathy machine” developing a society with people developing respect on other identities and communities. IR technologies have promise to provide immersive learning experiences.

*Garau M.et al., [6] Factors influenced by Immersive Reality:*

**Cost-** Let’s see this factor in detail by taking property marketing example. The expenses for property marketing are very high. This is true in case of residential projects having off plan sales. Budget for marketing can reach between 5 to 10 % of development cost and often include TV, customer ads or commercials from radio as some important marketing channels. Commissions and salaries are high for on-site and telesales employees. Establishing marketing suites and sales offices at on site for big projects can easily cost large amount to construct and it will be in demolished stage by the time it is completed. Marketing suites and Sales offices are accommodated in leased office or retail space for smaller projects which are little expensive. Few examples of important marketing materials are brochures, videos and high-end presentations. Thousands of dollars are being spent

for the 3D renders present in the technology. As sales speed and sales are important, most of the developers don’t mind spending much on marketing and they don’t even question that. Therefore, there is no surprise that property marketing has turned into an industry. Contrastingly, an IR solution provides more cost-effective solutions and uses a fraction of budget used in the above scenarios.

**Reach-** This factor is also very important when deciding how good the technology is. Let’s take an example, the complete residential sales procedure purely depends on the buyers who visit the marketing area. This is effective only when the people really visit and the sales are bad when they don’t visit. It is very difficult for the buyers who are staying far from marketing suite to visit. The marketing suites are also not kept open all the time so that people can visit at any time they like. In case of foreign buyers, they rarely go to marketing suite as they need to travel lot. To reach them by crossing all the hurdles, IR solutions offer digital solutions which are accessible and available throughout the time and from any part of the world. These IR solutions will add social media friendly and powerful channel to the existing process. They will not make on-site sales and marketing suites obsolete. Take the example of omni channel craze in the retail sector. IR solutions will eventually bring more prospective buyers besides increasing the customer reach and hence the count of marketing suite visits. Anyone who had observed earlier virtually will have clear idea on what to look for and afterwards won’t have to visit the suite again and again. This will result in faster decision making and saves lot of time to sellers and buyers.

**Measurement-** This factor can also be explained using property marketing. One of the important problems of traditional property marketing is that it is hard to measure. IR solutions can be easily fit into digital marketing operation as it is digital by nature. It is very easy to measure digital marketing using analytics tools like Similarweb or Google Analytics. Using analytics, it is easy to track origin and engagement apart from tracking amount of traffic. For digital marketing, this is very useful in examining return on investment. If you see the developers’ websites, the quality and quantity from traffic is different to ideal. It also discloses that when it comes to leveraging to digital marketing, the real estate industry is lagging.

**Experience-** Currently the marketing tools which are present provide only limited experience. 3D renders and sample layouts in brochures, presentations and videos are static in nature and mock ups too will be like universal fit. There is no scope for personalization. IR solutions will offer a simulation regarding how it will be if we live in that location where as this is not seen in conventional marketing tools. Immersive solutions are still being developed but will provide advantage when they offer immersive experience. Personalization can be better achieved through IR solutions by changing views, materials, daylight, colors or interiors or even furniture. Using VR goggles, the experience can be intensified by feeling the ceiling height, depth of area or how furniture will look like in the new house.

**Engagement-** If you observe the real estate developers' presence online, you can make out how limited engagement. This is like a paradox considering that the internet is the primary source of information. The content is the one which drives the engagement or online traffic. IR solutions provide the relevant information or content. It is pro social medial medium and can be fit into digital marketing operations easily to provide a better customer engagement. Developers will be able to understand home buyers' choices and improve relationship through enhanced engagement. If IR solutions are merged with AI and machine learning, valuable feedback on buyers' choices can be taken which will be help developers to produce projects that sell the projects at premium/faster rate.

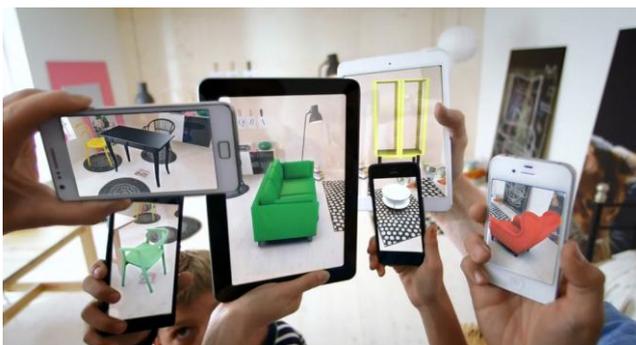
**Areas that are going to be impacted Immersive reality:**

**Education & Training:** Joseph Nechvatal, [7] have explained about different immersive techniques and theories. In our paper, how AR is useful in Education and training and example has been explained. The methods of teaching in training and education are being transformed with VR technology. Educational institutions are looking out for 3D learning solutions to give the students a realistic and interactive experience. Students can wear VR headsets to experience the VR teaching content. This will eradicate the problems caused by ill-informed and poorly trained teachers who are serving across the globe. Accurate content in efficient way can be provided to the students by the virtual teacher. It is also proven that students who have been trained using Virtual teacher have retained information for longer time rather than the students who were trained using traditional methods, videos and books.



Source: Adapted from “The State of Immersive Reality in 2018”, vrfocus

**Retail & e-commerce:** Today’s companies are adding layers to data while displaying across the platforms to the customers. Currently, data is displayed in 2D. But using Virtual reality, companies are trying to display the products more realistic.



Source: Adapted from “The State of Immersive Reality in 2018”, vrfocus

**Real Estate:** Whether you are developing project blueprints, developing safer training scenarios, solving technical issues or demonstrating a completed project, immersive technologies will help in taking construction to a new level of effectiveness and efficiency. Industry leaders and experts are attracted to immersive technologies even though they are developing phase. Because when you can transform the way you observe the world, you will be able to change the world you look. For example, you can see what your home looks like even before it is ready. Buyers will be able to watch their future homes with VR technology integrating 360-degree view of videos and photos with 3D rendered models. Employ VR developers to change old photos into new amazing ones. The CAVE (Cave Automated Virtual Environment) is another virtual reality technique with techniques for construction. This technique has been used by the firms such as Boston-based Suffolk Construction in their construction project sites. This capability has reduced costs and time to a great extent due to less number of changes during mid-project.



Source: Adapted from “3 thrilling construction uses immersive reality”, cdfistributors

**Movies & Entertainment:** VR improves the experience of watching a film which benefits the world of entertainment immensely. VR is heavily utilized in the sci-fi movies to show the things like real to the viewers. VR in game development is also taking to a new level by exploring new dimensions. Gamers generally like something intuitive. For example, while you are going down a hill or on a roller-coaster, your stomach tends to drop out even though you are not really present there. But your body reacts as if you are present there. Even in filmmaking, VR can bring new changes in the making style compared to current cinema and TV processes. New techniques for filming will evolve during this process.

**Travel & Tourism:** Using virtual reality technology, people can visit any place to take virtual tour. Using VR headsets and with the support of 3D mapping, people can virtually visit the places such as national parks, theme parks, museums or other locations anywhere, anytime.

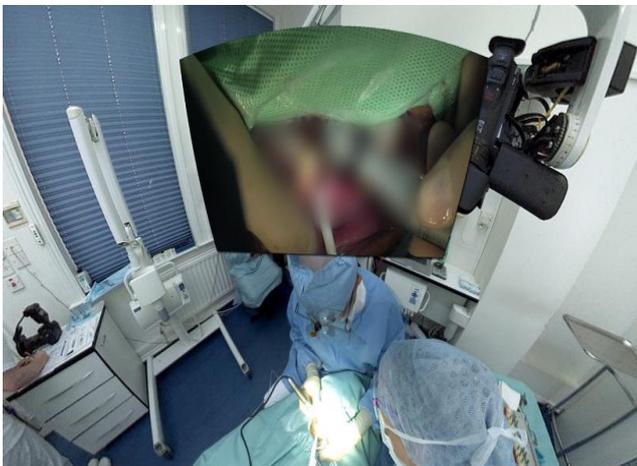
**Automobile Marketing:** Better products are getting produced using Virtual reality by Automobile companies. All aspects of Automobile industry are getting redefined by Virtual reality. These changes are spread across Research and Development labs, factories and showrooms.

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**Training, Military and sports:** Virtual reality brings the biggest change at workplace in the form of simulations and training. Virtual reality helps in providing training to the personnel in simulators which reduces the cost factor and risk involved with costly machinery or equipment. Military forces have adopted this in their various training programs.

**Therapy and Medical:** In medical field, VR can be used in many ways. One example is that now person can talk to a therapist using virtual technology who is also very welcoming and calm instead of being anxious and feeling shy while reporting to a human being.

People will feel weird at first for sharing their problems with non-human but eventually people will start feeling comfortable as their information is not going anywhere. Also, many therapists speak about their clients after consultations behind their backs. This can also be eliminated with virtual therapists. VR will put the person in the environment and AR supports by placing digital things in the environment which is not like video. It will be like an interactive session and safe as well on most conditions. To make a person come out of fear of snakes, it is very risky to make person interact with real snakes all the time. Same fear can be eliminated by making person interacting with virtual snakes. VR also helped in treating a person with PTSD by introducing him with the stimuli that causes the PTSD in a safe method and making the person fight against the trauma at the subject's own speed. VR and AR also helps the people by training them to handle tense situations with no consequences and pressure of committing mistakes. It also helps people in learning things experientially which they can use in real world as well. Knowledge gained through VR and AR can be used in real world safely as many times as we want.



Source: Adapted from “The State of Immersive Reality in 2018”, vrfocus

**Workplace communication:** Joseph Nechvatal, [7] have explained about IR usage at workplace communication. In our paper, how AR is helpful at workplace and example has been explained. AR will be useful in bridging the workforce at workplace. This is how AR will be helpful in filling the staffing gap. You can fill your resource pool with junior members instead of paying hefty amount to team of experts. Also, through AR, the engineer can show in real time what he/she is examining. Without the need of physical presence of engineer at onsite, the expert can observe the inspection and express his views or put his concerns and provide his approvals. AR and VR serve with different purpose in a corporate setting. AR can provide visual examples of work

that is done nicely while VR sets up an immersive experience. This creates a healthy environment for employer, employee and staff, leading to a unified workbench. Facebook has a VR section named Oculus that planned a structure for new technology called “Oculus Connect Conference”. This device provides an advance for the conference that is being collaboratively developed by companies with headphones, device functionalities, headsets etc. This will make the interaction between the people very easy and face-to-face conversations a few steps away. People won't need to leave their homes to get socialized.

**Virtual reality in Courtroom:** In previous times, lawyers used wipe boards and photos to explain the mechanics of an incident or accident or a crime scene to a jury. With the help of VR, lawyer can take the jury into the scene. One of the challenges faced by the lawyers generally is to show the jury or decision makers what happened at the actual moment of impact during dangerous injury or at a crime scene. In the past days, we had used visual aids, demonstrative exhibits and statements of witnesses in attempt to make the jury get convinced of what happened at the incident place. Using virtual reality, we can take the decision makers to the accident scene and place them in incident point for more impact. That's look so powerful – and the feel of ‘presence’ that VR gives has the scope to be a game changer in the field of law.

**Surveillance and Security:** With AR, we can increase the effectiveness of security institution. We can create a miniature model of each floor and observe the real-time happenings of all floors using devices with AR capability. This will help us to know the exact location of an accident with great accuracy. We can also equip the security people with smart glasses to know about the situations in real time rather than giving verbal information during the incidents. After video analytics and AI, AR has emerged as the one of the most transformative technology for security and surveillance activities. Together all these technologies provide the efficiency, safety, reliability and effectiveness to a user and are going to completely change the surveillance standards which are at present.

**Ethical Issues faced by Immersive Reality and Solutions:** Cobb SVG et al., [8] have introduced about Virtual Reality-Induced Symptoms and Effects. Here we describe about the ethical issues that IR faces.

**User protection:** Some physical protection is needed to user depending on the nature of headset. If not provided, users could walk into walls or fail to react to the key dangers posed by the immediate surroundings. Development has started to resolve this issue. Circular walking arc will stimulate straight-line walking and stops user of crossing the boundary.

**User isolation and social effects:** The addiction towards technology has been on rise along with rise in technology. Some are addicted to video games, some are to social media and others to devices etc. what will happen when full immersive worlds are ready for users to explore them.

**Virtual crimes:** How are we going to supervise the crimes in a virtual world when we discuss about crimes. In video games, users are tended to perform aggressive actions such as killing, stealing with the help of controllers and screens. But it is different with realistic environment where users may be executing the actions such as pulling the trigger or stabbing motion etc. which are dangerous.

**Real-world applications:** Once users are too much into virtual environment, it is difficult for them to come back to real world and be like the same way they were before experiencing virtual environment. They may try to jump which they can't due to overestimation of their abilities. They may also try a skill which they have perfected in virtual environment. They will also get desensitized to certain types of interactions or violence, which could spoil their social relationships.



Source: Adapted from "9- ethical -problems -vr- still-solve", the next web

**In-game trauma:** It is not to compulsory to experience an event in physical reality to see the effects of PTSD (Post-Traumatic Stress Disorder). Games that user experiences a harrowing ordeal and requires tough decisions; users may be forced to face long term psychological consequences. VR developers need to prevent this from happening to get VR technology spread worldwide.

**VR as torture:** If you give trauma to someone in a VR world, would it be considered as torture? It's a question raised by many philosophers and we need to explore on this. Military guys may use VR as ethical alternative to regular torture, putting people in stressful situations without causing any physical harm. This seems to be immoral behavior but who needs to control or stop it?

**Virtual travel:** Users can explore the world in VR environment. They can go to locations or places they have never visited or thought of going. But there are few locations which are restricted to public. What if user peeks around his ex's apartment or go into holy place. There should be limits for virtual tour to avoid troubles for the users.

**User privacy:** We also need to care about user privacy with VR technology also as is the case with most of the new technologies. Users will be interacting more with content, performing more actions in VR world than they were doing in normal environment. In this case, who should take care of user privacy? Who should take decision whether to share the user data to advertisers or keep it with user's control? VR developers need to touch upon these questions while developing VR technology.

**Steps to solve above issues:**

**Consult:** VR developers won't be able to have answers to questions which seem to be simple to an individual. Investors and developers should consult philosophers and psychologists to support their conclusions.

**Invest:** We should give equal priority to VR technology and research into the effects of technology. New studies are important to learn how VR will have effect on our minds and behaviors.

**Safeguard:** VR developer should understand the implications of a feature in the technology. Developer should downplay the

realism of a traumatic scene and provide detailed warnings. They also should mention potential effects of new feature or somehow find out the improper user behavior in advance and try to rectify or avoid it.

**III. METHODOLOGY**

Let's get into the methodologies of Immersive Reality Tools in detail. The following section will explain about Microsoft's HoloLens, Teslasuit and Apple's product AR Headset.

**E. Microsoft HoloLens:** Roberts J, [9] have explained about the holoLens and few details about headset. In our paper, detailed process inside holoLens has been covered. The HoloLens is a device on your head and it is not bulky PC which is tied. There are no wires present even. There are couples of things which transform head-mounted device into an effective hologram device. HoloLens contains pair of translucent screens for its eye-pieces, ones that support the incorporating the floating windows into user's line of sight. This doesn't block user from viewing the world. The main thing is not getting a screen in front of our eyes, but to transform the visual information into 3D-object will be a real magic. User should be able to look at the object from all angles and walk around it. This experience can't have achieved with the flat screens which just appear in front of our eyes.



Source: Optics, Microsoft

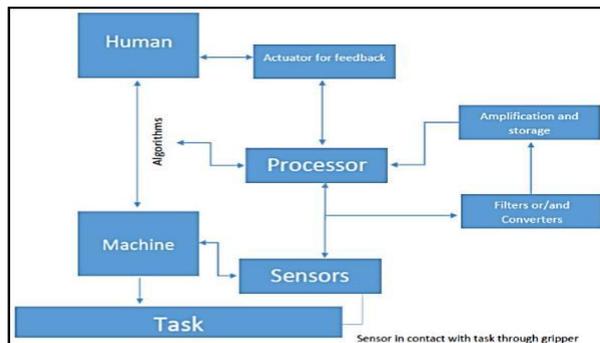
The above functionality is achieved by the rest of the HoloLens' sensors. There are many cameras on top part of the HoloLens visor facing out to scan area and collect data. HoloLens will change the collected data into digital model where the 3D space is filled with holograms. This is achieved using infrared depth-sensing vision and standard video techniques to develop a digital frame of surroundings.



Source: Sensors, Microsoft

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Till now it has come till seeing, which is not enough for great immersion? For making convincing holograms as you move, the device must know where your head position is. Accelerometer is present at end to measure the speed at which your head is moving. Device also contains gyroscope which will calculate orientation and tilt of user head. It also has magnetometer to work like a compass. Holo Lens will use all these sensors to collect data to find the position of head and how your room looks like. After this, Holo Lens will use gathered data to decide the place where holograms be displayed and how they should look like.

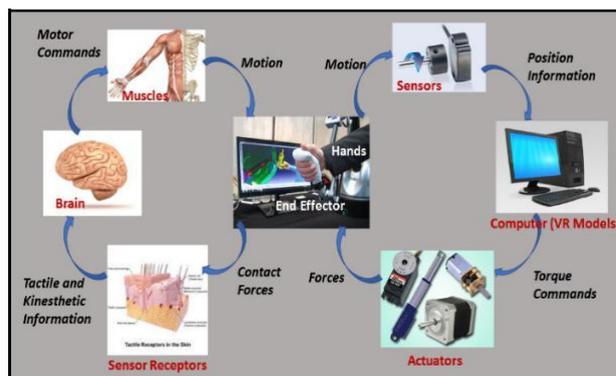


Source: Machine Haptics block diagram

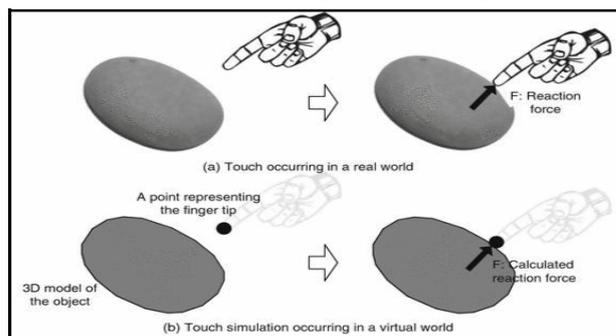


Source: Processors, Microsoft

In this way, device works with lot of data. It is on the scale of terabytes, far more than what a mobile deal with. HoloLens contains high end chip to handle this amount of data. It has HPU (Holographic Processing Unit) chip which works on the entire sensor data. It translates the collected data into smaller and manageable chunks of data. HoloLens' CPU and GPU will use the chunks for further processing. This entire process just happens inside a headset as it doesn't need to connect to mobile phone, computer or anything. Regarding the element of sound in the device, HoloLens has microphone for taking commands through voice control and putting the tabs on sound. It also has speakers for serving two purposes. One thing is that they do not block the real-world sound as general headphones do. Secondly, they use binaural sound to throw your ears into thinking as if they are hearing in 3D space. It is just like stereo sound without the presence of headphones. For example, if you create a holographic TV and then turn your back towards it, then these speakers will produce sound which is like TV sound even though there is nothing behind you. These images and noise which are like real objects as you move your head will create holographic illusions which are convincing enough to immerse users into IR.



Source: Machine Haptics block diagram

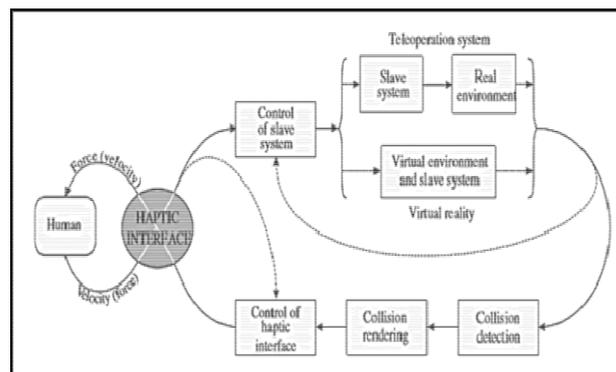


Source: Idea of touch in real and virtual World

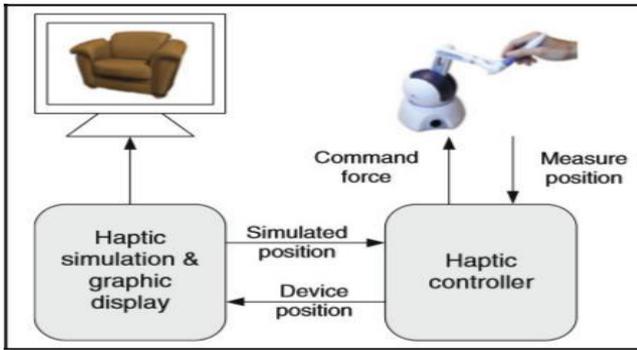


Source: Microsoft

**F. TeslaSuit:** El Saddik et al., [10] have described about the haptic technologies in their paper. In our paper, we tried to elaborate more haptic technology and their components. Teslasuit is an example of new generation Smart clothing. It is a full-body suit which has haptic wireless system. It is made up of smart textile clothing which is integrated with virtual reality components.



Source: Force depiction in a virtual world



Source: Interaction between haptic interface and a human represents a bidirectional exchange of information.

It contains 4 systems:

**a) Haptic Feedback Systems:**

It helps in transmitting haptic sensations from VR/AR/MR through electrical stimulation. It also allows users to create their own effects with the help of haptic library and software that is present in the suit.

**b) Motion Capture and Avatar System:**

This helps in complete body motion tracking with high accuracy. It also includes plugins and software for Unreal/Unity/Motion Builder.

**c) Climate Control System:**

This will help user in sensing the environment temperature changes and feel the cold and heat sensations.

**e) Biometric System:**

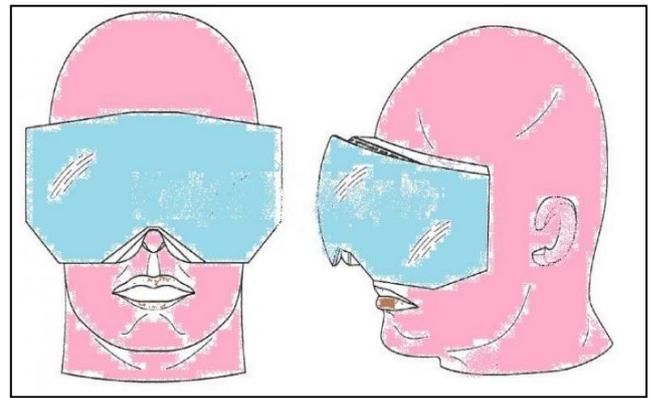
This system will collect different types of metrics which when coupled with machine learning paves way to new world of opportunities. It does tracking of a range of body metrics.



Source: Mepits

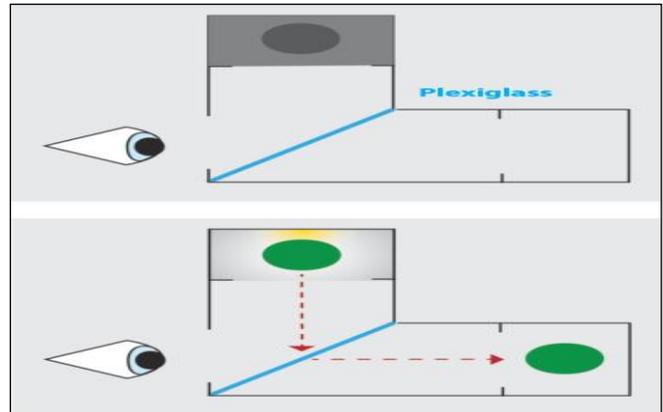
**Apple AR Headset:** Apple is building a super thin and AR headset. The HMD (head-mounted display) will depend on holographic display which resulted in slim headsets. This device will support VR and AR content. This head-mounted display will generate holographic images which look like 3D images. Many sensors are incorporated in device to track the user eyes and surroundings and produce images accordingly. This is how user will see the real 3D images.

The sensors will help in generating illusion of a real image by placing closer objects in a real image plane and far objects in a far image plane. In simple words, user will be able to look 'through the headset in real 3D'.



Source: Patently Apple

Additional array of sensors present in the headset will help usage scenarios such as searching for a place in real-time using VR apps, tracking on the map through GPS and many more. To meet searching requirements, it also contains Apple's Siri voice assistant. External device can be connected to the headset to produce 3D display by feeding images. The entire mechanism can be seen in below images:



Source: Inexpensive Augmented Reality Headset Development, Daniela De Angeli, Eamonn O'Neill



Source: Inexpensive Augmented Reality Headset Development, Daniela De Angeli, Eamonn O'Neill

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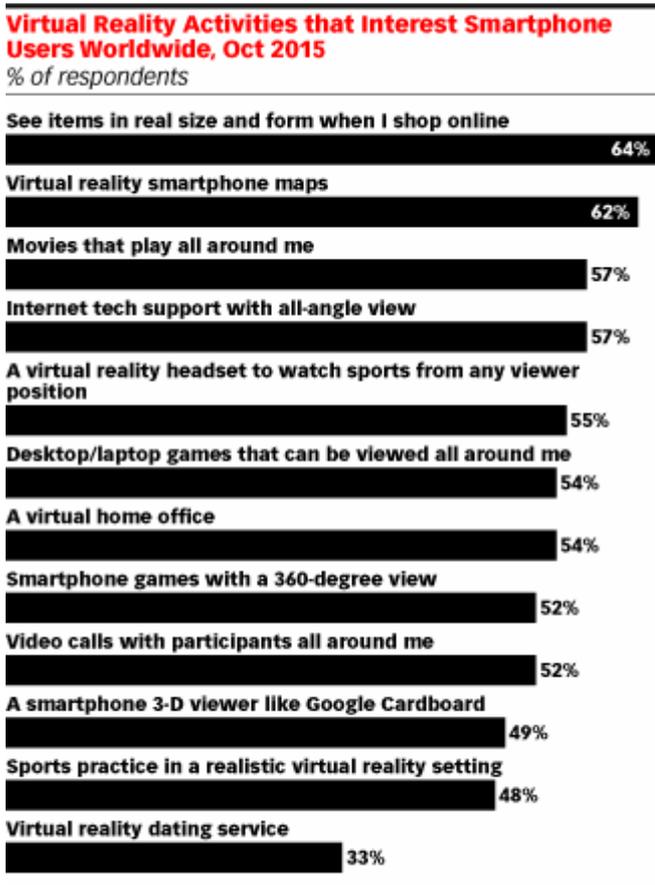


Source: Inexpensive Augmented Reality Headset Development, Daniela De Angeli, Eamonn O'Neill

Similarly, other popular products are Facebook's F8, Google's Tango and Apple's WWDC, ARKit and SceneKit. ARKit and SceneKit have the potential to be very compelling for creating captivating immersive content.

### IV. RESULTS

**Survey 1:** Poll conducted by company eMarketer revealed that 57% of smartphone users like the sound of internet technical support that features "all-angle view" VR for watching mobile games with 360-degree views, watching sports, even a virtual reality dating service and 64% of users like to use VR to "see items in a real form and size."



Note: ages 15-69

Source: Ericsson ConsumerLab, "10 Hot Consumer Trends 2016," Dec 8, 2015

Source: Adapted from "Why immersive video is the new digital marketing reality", clickz

**Survey 2:** The market size of the AR/VR will reach \$215 billion by 2021 as per the estimation provided in the survey by

company Statista. That is the reason why many tech giants are showing interest in developing software that provides users with incredible digital experiences by immersing them in an imaginary world. For example, Ness, an early player in AR/VR technology, offers world's largest fashion retail chains with a mobile mapping solution which is location based, navigation app for car rental company and much more.

**Case Study 1:** Improvements in AR/VR are constantly pushing the marketers to improve their strategies to make use of such technologies to create incredible "experiences" which expands brand awareness and brings more end users. One illustration of this point happened in 2014 Football world cup's Coca cola event held in Brazil. Visitors could experience virtually that they were playing football match with the players in the field at the Coca cola fan kiosk. The visitors were physically guided to virtual locker rooms or dressing rooms to give them feel of it with the use of HMD (head-mounted display). Users were also given opportunity to do salsa dance virtually on the field at the end of the match. Finally, visitors were given Coca cola cans/bottles and World cup merchandise. This helped Coca cola to evolve as a brand leader with this successful and incredible experience of VR.

**Case Study 2:** To justify the uses of VR in terms of education/teaching, a test was conducted among the students pursuing the construction management. They were made into two groups and given coaching or teaching separately. One group was given training using traditional methods where as other group with VR. Tests were conducted after one month. The group with VR experience performed better than the students in another group.

**Case Study 3:** VR also improves the training methods to an extent. To support this point, the following case study which is related medical students. Different batches of medical students were given lessons through traditional methods and VR. The medical students who went through VR lessons could perform operation better on live patients than who followed traditional lessons. VR also brings the advantage of users not getting distracted as their heads are fit into displays and they also can run the lessons how many times they want.

### V. CONCLUSION

AR, VR and MR technologies will disrupt the existing practices across the industries as it significantly advances the quality, fidelity and dimensionality of human-to-computer interactions. It enables to get more productivity from employees, reduces production delays and cost saving technology. All digital giants (Microsoft, Apple, Google and so forth) have significant long-term investments in immersive displays and interactive computer graphics, with emerging ecosystems that will become established platforms.

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