

Augmented Reality through Wearable Computing

Vaishali Garg¹, Dr. Khushboo Tripathi²

PG Student, Department of Computer Science, Amity University, Gurugram, India¹

Assistant Professor, Department of Computer Science, Amity University, Gurugram, India²

ABSTRACT: A wearable computer is a computer that is subsumed into the personal space of the user, controlled by the user, and has both operational and interactional constancy i.e., is always on and always accessible[2]. It is a device that is always with the user, and into which the user can always enter command and execute a set of such entered commands, and in which the user can do so while walking around or doing other activities. The vision behind the concept of a wearable computing is that a mobile computer should not just be a machine that we put into our pocket when we plan on doing some office work while on the road. Instead it will be an integral part of our everyday outfit (hence wearable), always operational and equipped to assist us in dealing with a wide range of situations. We are forming a community of networked wearable computer users to explore, over a long period, the augmented realities that these systems can provide. By adapting its behavior to the user's changing environment, a body-worn computer can assist the user more intelligently, consistently, and continuously than a desktop system[1]. Some memory agent is required towards this approach.[1] Video devices are used for the input and to sense the environment. Additional infrared sensors, audio devices can be used for more better functioning of the devices. Through the inputs of these sensors and devices the actions of the user's can be understood, the needs can be understood and a more better interaction can be provided. Augmented Reality provides more digitalized form of the environment around us which gives us a more view.

KEYWORDS: augmented reality, wearable computing.

I. INTRODUCTION

Wearable computers are computers that are worn on the body. They have been applied to areas such as behavioural modelling, health monitoring systems, and information technologies and media development. Wearable computers are especially useful for applications that require computational support while the user's hands, voice, eyes or attention are actively engaged with the physical environment. With the wearable computer (Wear Comp), this is no exception, e.g. the wearable computer is more than just a wristwatch or regular eyeglasses: it has the full functionality of a computer system but in addition to being a fully featured computer, it is also inextricably intertwined with the wearer. This transformation allows it to be worn constantly, with the goal of becoming a seamless extension of body and mind, equipped with various sensors which measure heart rate, respiration, footstep rate etc., and can help in body maintenance. In addition, augmented reality provides a range of applications. For example interactive games, apps etc. So basically augmented reality refers to a simple combination of real and virtual worlds. Given a real subject, captured on video or camera, the technology augments(=adds to) that real-world image with extra layers of digital information. Commercial use of augmented reality can be seen in QR codes which we scan to get the information. AR in wearable computing adds to the technology which is useful for tremendous results. Wearing the computers with such qualities is just a seamless boon for the mankind. A closer association with the user can be developed which proves very useful. As in the sensors, video and audio devices which are being equipped with the wearable device can sense what the user see, hear and even what the user is typing. By analyzing all the factors the system or agent can provide more relevant results to the user can provide good suggestions or even download the certain files.

II. LITERATURE REVIEW AND BACKGROUND STUDY

Virtual Reality and Augmented reality seems to be similar terms but both of the things are so different. Virtual Reality it has been a different world which does not exist being at the same place but Augmented Reality adds the digital elements to a live view often by using the camera of the Smartphone[6]. Augmented is far different from the virtual reality. It can help us see the environment which does not exist by adding the things into it. Pokemon Go, Lenskart app, Snapchat are some of the good examples of it. Augmented reality is basically of four types[7]:

1. **Marker-based AR:** It requires a special visual object and a camera to scan it. It may include any object, it may be QR codes also. The AR device uses the marker to calculate the position of the object. Thus, a marker initiates digital animations for users to view, and so images in a magazine may turn into 3D models.
2. **MarkerlessAR :** It is location or position based augmented reality. It uses GPS, accelerometer, a gyroscope to provide data based on user’s location. The data then calculates which AR content the user can get on the current location . We can get information about events around.
3. **Projection-based AR:**In this type of augmented reality synthetic light is being projected on the physical surface and sometimes the users can also interact with these lights also.
4. **Superimposition-based AR:** In this type of augmented reality the original image is being super imposed by the rendered image. The super imposing can be fully or partially depending on the project.

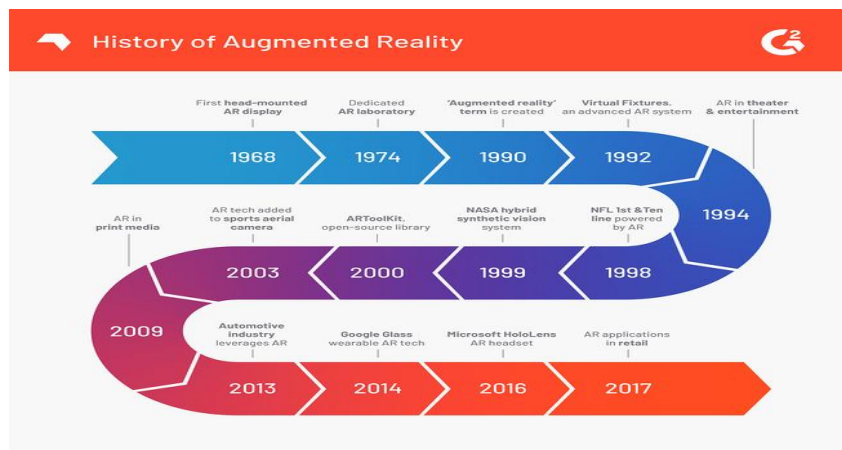


Fig 1 history of augmented reality

Augmented reality technology was invented in 1968, with Ivan Sutherland’s development of the first head-mounted display system. However, the term ‘augmented reality’ wasn’t coined until 1990 by Boeing researcher Tim Caudell. The first AR systems invented were targeted at walkers and hikers with visual impairment and used sound in order to guide the user (Van Krevelen&Poelman, 2010; Azuma et al., 1997). From this, it is clear that AR does not solely revolve around the use of vision[6]. With the passage of time many of the updates came in Augmented Reality. In 2014 Google unveiled its Google Glass devices, a pair of augmented reality glasses that users could wear for immersive experiences. Users wore the AR tech and communicated with the Internet via natural language processing commands. With this device, users could access a variety of applications like Google Maps, Google+, Gmail, and more. In 2017 IKEA released its augmented reality app called IKEA Place that changed the retail industry forever. The app allows customers to virtually preview their home decor options before actually making a purchase.

III. APPLICATIONS

The augmented reality is a growing field It is being updated continuously. There are ample application areas of it because of its properties. AR apps will have billions of turn over per year. The market is developing day by day. People are getting to know about the use of augmented reality. Some are the following application areas of augmented reality:

1. **Medical Training** : Augmented reality is helpful in medical training as it provides medical practitioners the interactive 3D model of the body part like human brain. The surgery can be done very easily[4].
2. **Design and Modeling** : AR helps professional to visualize their product before they are made. In interior designing , architecture and construction the professionals can use AR handsets and glasses to directly step into the buildings and spaces to see how their designs will look on completion.
3. **Tourism Industry** : Tourism industry is also very fast growing industry in the world. Their have many apps come up which provides complete itinerary but what if we can look around through handset and glasses. AR presents a huge opportunity for travel brands and agents to give potential tourists an even more immersive experience before they travel[4].
4. **Repair and Maintenance** :It is one of the major and most important application especially for the maintenance of big machinery and complex machine like that of car. AR handsets and glasses provide them with essential information required so as to repair the machines.
5. **Classroom Education** :Augmented reality can help make classes more interactive and allow learners to focus more on practice instead of just theory. As AR adds virtual objects to the real world, it lets students train skills using physical devices[3].

Paper No and author	Title of papers	Contribution	Method Used	Future Plan
Thad Starner, Steve Mann, Bradley Rhodes (1997)	Augmented reality Through wearable computing	Provided different application areas where wearable computing can be used using augmented reality.	Camera based realities. Camera systems can also enable users with visual disabilities.	The computer must model its user's knowledge , actions, goals and emotions in order to assist the user unobtrusively.
W. Barfield, k. Baird(1998)	Issues in the design and use of wearable computers.	Summarized the capabilities of wearable computers	Issues are resolved which are creating problem In the path.	Lithium-ion polymer batteries can be used for more battery. Processor with more storage space to be built.
Nor Farhah Saidin, Noraffandy Yahaya (2015)	Augmented Reality in education.	AR in education is a boon for the education system. It can help children with the seamless interest in the different subjects.	As in no method is used to support the study.	Various mobile apps can be created which supports the technology i.e. Mobile augmented reality(MAR).
Smitajhaharia, Dr S.K Pal	Wearable computing and its applications	Provided with different application areas of wearable computing with advantages and disadvantages.	Live examples of Mercedes-Benz watch is given to prove the features.	Aim is to provide people with stylish and invisible gadgets that can be boon to the country like India.
Mesut Cicek	Wearable technologies and its	Has told about wearable consumer electronics that can be easily worn and used.	Cleared the characteristics of the wearable	Health related wearable computing need to be enhanced. In order to

	applications		computing through different examples.	help the disabled people.
Huaishu Peng, Jimmy Briggs	RoMA: Interactive Fabrication with Augmented reality and a robotic 3D Printer	Implementation of the robotic arm and 3D printer.	Made a 3D printer using the modeling concept of augmented reality with robotic arm as a construction tool.	Has provided designers with the art of 3D printing.
Sneha Kasetty	Augmented reality in mobile devices	Tells about MAR (mobile augmented reality) which makes environment more better.	Framework of MAR is given to support the functioning .	Cloud computing will support in MAR. Heavy computational task will be done by cloud to save device' power.

Although there is improvement in the augmented reality gradually but at some cases there is a need to improve more. There may occur many security issues. The daily use of such devices is also not preferable as it may be expensive. The expenses of the wearable devices are very high if they get damaged and also may prove inaccessible for small business. There is a need to setup more secure network in order to have better performance. One of the major issues with the wearable devices is the rays coming out of them which may prove to be harmful in long turn and the person might get some health issues. These are some of the areas over which some of the improvement is needed in order to make the augmented reality more better and more useful.

IV. METHODOLOGY AND IMPLEMENTATIONS

There are many resources which are used to implement the augmented reality using the wearable computing. Many of the things are used to build AR. The components are as follows:

1. **Software** :There is already a an Augmented Reality Markup Language (ARML) which is being used to standardize XML grammar for virtual reality. There are several software development kits (SDK) which also offer simple environments for AR development. And for wearable computing the operation system is WOS (wear comp OS).The software plays a very important role in very application.fig 3.1 shows the unity software that is helpful in making apps and websites based on augmented reality. Software are updated time to time to fix the bugs so that the important in future might not affect the projects.

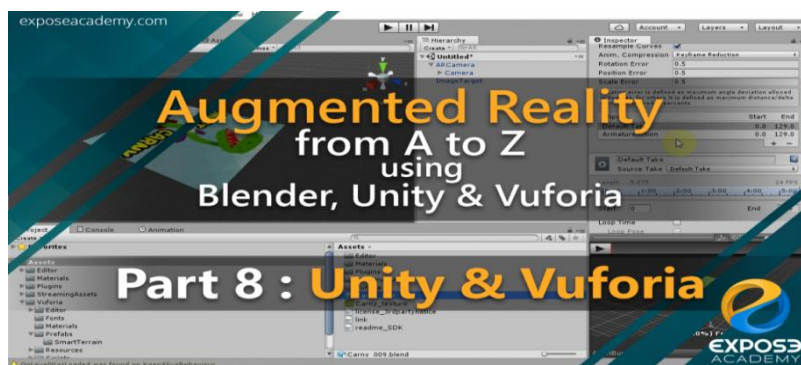


Fig 2 software for Augmented Reality.

2. **General Hardware Components** :Prices of wearable computers tend to be in "thousands of dollars" whether you buy old or new. But now a days a smart phone contains a processor, a display, accelerometers, GPS, camera, microphone etc. and



Fig 3 hardware used

contains all the hardware required to be a an AR device. Fig 3.2 shows the update in the hardware that are being used for wearing in the augmented reality. The overall cost to build a wearable computing now cuts down.

3. **Display** :The maximum cost in the implementation is of the display devices. The monitor is itself capable of the display. While there are available devices for the display like common portable LCD Display which provides high resolution other one is HMD(head mounted display) a typical HMD has either one or two small displays with lenses and semi-transparent mirrors embedded in a helmet, eye-glasses or visor. The display units are miniaturized and may include CRT, LCDs, Liquid Crystal on Silicon (LCos), or OLED.
4. **Power Sources** :A good power resources is required to make the use to the fullest. If the device is our smart phone then we are confined to the given battery but if we are on other device the battery back up of the device can be increased. The device can be made in such a way that it can recharge its battery by human touch or sunlight.

Implementation

The wearable computing along with the augmented reality adds to the parameters and functions of the device. The device captures the image in its memory, if there is someone’s face then his or hers facial expressions are detected , if it is something then its measurements are taken accordingly. The image which is captured its enhancement is done, geometric correction is done. Side by side its 3d scene is also created like in case of snapchat application. The camera detects our face,corrects it then applies the different filters and we can see our image with different filters. In the figure 3.3 the framework is explained how the image is captured and then processed. First 3D content is created it is processed then augmented reality concept is created.

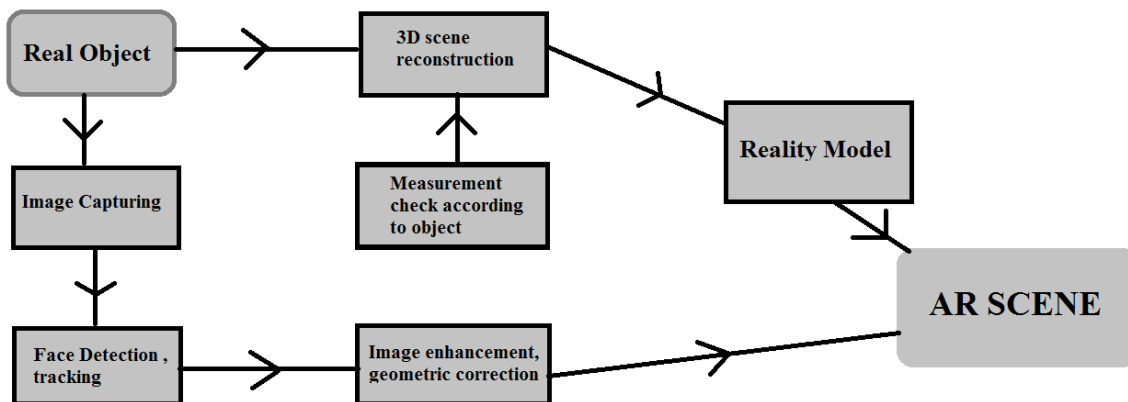


Fig 4 Conceptual framework

In order to implement the framework we need to understand the following things:

- **Working of augmented reality :** First of all the computer vision analyzes the environment surrounding us with the help of the camera of the device. Then the relevant and similar things are known what the user really wants to know. This digital content is then displayed in realistic way and this content is called rendered content. The computer vision processes the raw image and analyzes its accurate size, position. All this processing takes place in 30 sec as after 30 sec new frame comes into the scene. In all this camera is delayed by some nano seconds which our brain does not analyzes.
- **Need of computer vision in AR:**Its quite a tricky question why we actually need this. Humans can understand shapes, images very well but it is quite difficult for a computer system to understand it. Augmented reality needs to understand the world in terms of substance and 3D geometry both. Substance gives the answer of “what” and geometry answers the question “where”. Without these it is impossible to show the content at a correct place to make it look real.
- **Display of digital content in AR :**Now the computer vision has the substance and geometry. Inverse rendering takes place in order to display the content. First the image is rendered into 3D as computer vision understands this form only and then it is again converted to 2D format in order to show it on phone screens.

V. RESULTS AND DISCUSSION

Augmented reality has now become a very hot topic in discussion as it has become part of evolution but not revolution. It is influencing the industries in all the possible way it can in order to make the things interactive and easy. Like it provides 3d models we can see how our space is going to look after the completion or helps in surgery with stepping into human brain or different parts. It has reached technical maturity and is gradually becoming the presence of the society. AR will push innovations to new levels which will create functional and flexible tools for the society. These tools can become either boon or bane depending on their usage. Every object or thing in this world has both sides negative and positive, its up to us how we use and prove it to be beneficial for ourselves and others.

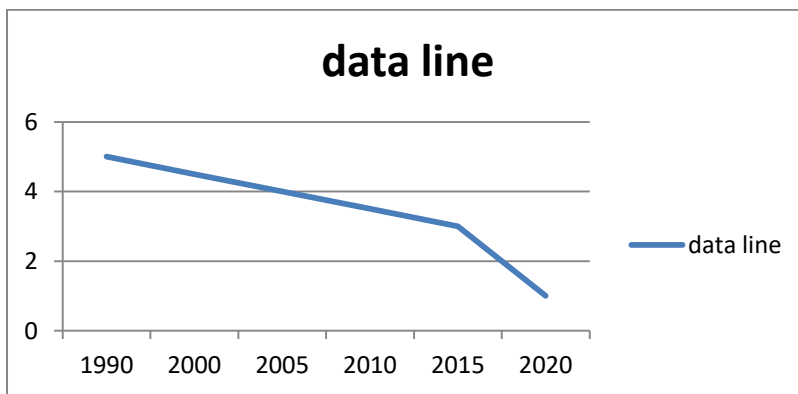


Fig 5 fault ratio declination over the years.

Fig 4.1 shows the decline ration of fault over the years compare to implementation ratio. There has been a constant decline in the faults over the years.

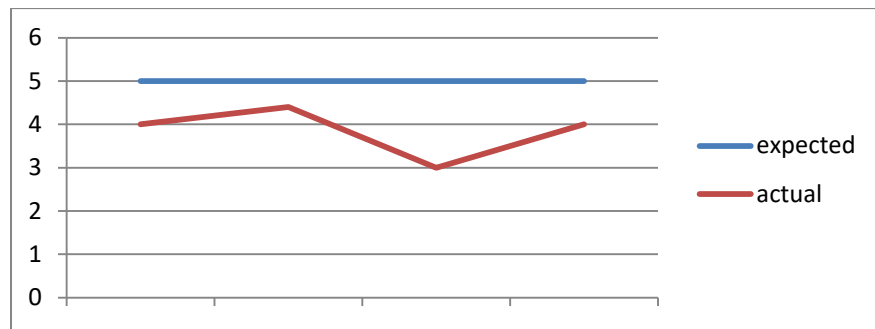


Fig 6 Actual and Expected results

There is major difference in what is expected and what we actually get. A computer vision can be correct most of the times but many a times it may get confused fig 4.2 shows the same. Expected rate is always high but what we get is near by to it only.

VI. CONCLUSION AND FUTURE SCOPE

In this paper, review of augmented reality through wearable computing, its functionalities benefits, applications are mentioned. It is the next step further into the digital age that we will see the environment, change gradually via smart phone, lens, glasses in the future to display the content in front of us. It will soon blur the difference between the real and reel life objects by enhancing what we hear, see or speak. The future aim of augmented reality is to come up such apps or such user interfaces which can help out disabled people. There are more people who are visually disabled, less percentage is of deaf and dumb people. Ultimately we are moving in a direction to help out these disabled people in best possible manner we can.

REFERENCES

- 1 Starner, T., Mann, S., Rhodes, B., Levine, J., Healey, J., Kirsch, D., ... & Pentland, A. (1997). Augmented reality through wearable computing. Presence: Teleoperators & Virtual Environments, 6(4), 386-398.
- 2 Jhajharia, S., Pal, S. K., & Verma, S. (2014). Wearable computing and its application. International Journal of Computer Science and Information Technologies, 5(4), 5700-5704.
3. Bacca, J., Baldiris, S., Fabregat, R., & Graf, S. (2014). Augmented reality trends in education: a systematic review of research and applications.
4. Mekni, M., & Lemieux, A. (2014). Augmented reality: Applications, challenges and future trends. Applied Computational Science, 205-214.
5. Oda, O., Lister, L.J., White, S., & Feiner, S. (2008). Developing an Augmented Reality Racing Game. Proceedings.
6. Palmarini, R., Erkoyuncu, J. A., Roy, R., & Torabmostaedi, H. (2018). A systematic review of augmented reality applications in maintenance. Robotics and Computer-Integrated Manufacturing, 49, 215-228.
7. Edwards-Stewart, A., Hoyt, T., & Reger, G. (2016). Classifying different types of augmented reality technology. Annual Review of CyberTherapy and Telemedicine, 14, 199-201.
8. Patkar, R. S., Singh, S. P., & Birje, S. V. (2013). Marker based augmented reality using Android os. International Journal of Advanced Research in Computer Science and Software Engineering, 3(5).
9. Vyas, D. A., & Bhatt, D. (2017). Augmented Reality (AR) Applications: A survey on Current Trends, Challenges, & Future Scope. International Journal of Advanced Research in Computer Science, 8(5).
10. Sudarshan, S. K. (2018). Augmented reality in mobile devices. San José State University.