A Survey of Augmented Reality

Nagaraj M. Lutimath*[1], Manjunath S[2], Anupriya A G[2], Navin Maria J R[3]

*[1]Department of Information Science and Engineering, East Point College of Engineering and Technology, Bengaluru, Karnataka, India

[2]Department of Computer Science and Engineering, Cambridge Institute of Technology, Bengaluru, Karnataka, India

[3]Department of Information Science and Engineering, Sri Venkateshwara College of Engineering, Bengaluru, Karnataka, India

ABSTRACT

Augmented Reality is a depiction of the real world with the real and virtual objects combined together. The surrounding environment is enhanced with virtual objects in real time to increase the user experience. The aim of Augmented Reality is to generate a system in which the user cannot tell the distinguish between the real world and the virtual environment. Now a days Augmented Reality is utilized in medicine, entertainment, military training, engineering design, robotics, manufacturing and other industries. Augmented Reality systems have reached certain level of maturity in educational environments and its effectiveness has been widely proven. The paper describes applications in these areas.

Keywords : Augmented Reality, AR Toolkit, OpenCV, Vuforia, Wikitude

I. INTRODUCTION

Augmented Reality (AR) is a communication environment in real world. The objects that reside in the real world are improved by computer-generated digital information. The information may be audio, video, haptic, somatosensory and olfactory. Using this technique engineers can see instructions what can be done next when repairing an unknown piece of equipment, surgeons can monitor ultrasound scans of organs during surgery, fire fighters can watch building layouts to avoid invisible hazards, soldiers can see positions of enemy snipers spotted by unmanned inspection aircraft and we can read reviews for each restaurant in the street while walking [1]. AR is a technology to create a reality-based interface. The technology is moving from labs around the world into various corporate and consumer market places. AR augments the real world with virtual (computer-generated) objects that appear to together in the same environment as the real-world entities. AR was recognised as an out coming technology of 2007. It is now utilized as applications in smart phones and smart devices.

AR provides users to extract the information of an object using the surrounding environment. With a hand click or blink of the eye the information of the object associated can be extracted rather than the traditional approach of gathering the information. The world can develop and more sophisticated by

utilizing the technology. Thus, it has become essential to utilize AR studying the nature of the objects. The paper is structured as follows, Section II describes related works, section III illustrates the applications of AR in the areas of Medicare, manufacturing, navigation, reality systems, museums, education. Conclusion is depicted in section IV of the paper.

II. RELATED WORKS

The survey of AR is considered due to its growth in internet information technology. Information about AR was initially gathered from internet sources. To be aware about of th topic, initial survey was done in 1997 [2]. The article facilitated in understanding of area and comprehensive issues in AR. Later survey was published in 2010 on applications and limitations of augmented reality systems [3]. This survey provides an up-to-date survey of the field since 1997 to 2010. As the initial study was done to begin the process of systematic literature review queries were formulated. List of every possible paper related to AR application was needed.

III. APPLICATIONS

The study is based on the application needs. The following are the tools being used to are Vuforia SDK, MetaIO, AR Toolkit, OpenCV and Kinect. AR is used in various potential applications. The applications are used in Medical, Industry and Manufacturing, Navigation, Mobile Augmented Reality Systems, Augmented Reality Systems in Museums, Augmented Reality Systems in Education and learning. These are illustrated in this survey.

A. Medical Care

Medicinal care systems are rising most promising application regions for innovations of virtual objects and augmented reality [4]. Real time AR execution and improvement in clinical convenience of AR is utilized by surgeons for medical training systems and assessment of surgeries. MRI and CT scans collect patient's 3D data in real-time. They are then rendered and combined by the real view of patient. AR helps here to provide an internal view of body to the doctor. AR Systems are improving the area of health care in Life Support Training Systems. AR has supported training system's aim to upgrade the traditional training environment life support by delivery picture and sound resources into the real systems. Using technical approaches features such as facial expressions, changes in skin color and different types of skin injuries projection over the human body can be simulated. The use of machine resources for use in health training has recognized to be an incredible device for supporting new thoughts in connection to the change of the current instructive process. The nurse injects the injection into the patient's body' many a times until the right vein is found. AR has brought revolution this small medical patient issue in such a way that a nurse will be wearing AR glasses while injecting the injection so that the right vein is found in one go. There are no limitations of applying AR systems into medicine to ease doctors, patients, nurses and related medical stuff.

B. AR Systems in Industrial Manufacturing

One of the vital areas where AR can is used is Industrial manufacturing. The techniques enable in product development and manufacturing process. AR helps for humans who are not good at memory and need physical assistance in doing work. AR system improves human interaction. This is done by enhancing brain functionality by refining information available and simplifying the decisions. The augmented simulation of real time machines running in the industries can be checked on the digital i-pad. The required information of the machine temperatures can be extracted by knowing the duration how long machine is been running and how many products they have worked in a given time slice. The interesting part in manufacturing research is to design and implement AR assistance manufacturing

systems that will upgrade the manufacturing processes [5]. This in turn helps in product manufacturing and reduce development and rework. This is used in digital product designing and development. A knowledge-based AR system with an improved control approach and a set of rules was developed for maintenance and repair which helped to improve real world with extra data to support the execution of simple tasks and actions on certain equipment's by Feiner et al in 1993. Later Neumann and Anthony in 1998 gave information representation of caution and warning messages in object designing and the scheme of colour coding. Molineros in 2002 worked on assembly of augmentation in AR assisted assembly system with the help of this system information was transmitted between assembly planning and AR system and lastly in 2005 Marcus et al. developed visualization schemes of 2D and 3D driver's field of view. AR applications in manufacturing and industry are still in a descriptive stage. Augmented Reality (AR) comprehensive assembly system for the multi-interactive creation of assembly processes. The special multimodal interface allows the presentation of not only new types of visual display but also interestingly designed voice instructions and material flow management. The system simulates many-sided and complicated assembly tasks in various areas of manufacturing. [6]

C. AR Systems in Navigation

AR systems help in navigation. The navigation systems were introduced in vehicle navigation systems. The driver sitting in a car would be supported by knowing the navigational directions, maps to destination without the fear of being lost and less accidents would be caused due to systems occlusion detection techniques. The AR apparatus is difficult to carry around hence it should be built into the user environment. A car itself is presented as an AR apparatus because it's the environment in which driver will remain during its journey. It presents an innovative visualization paradigm for navigation

systems that is anticipated in enhancing the user interaction and experience as this environment is itself an AR apparatus user interaction will be carried out naturally because the user will not feel locked up in a cage and chained to wearable equipment. Further at the point when drivers turn away from the street to view a personal navigation device, driving execution is influenced. To keep visual consideration out and about, an AR Personal Navigation Device utilizing a heads-up presentation could overlay a route course. Most of the unconventional virtual programming used for the Visual Trace Way [7]. For visual tracking, digital tagging and digital information should be provided while the Non- visual Trace Way requires the use of Hardware (G.P.S, sensors etc.). Most navigation requests can only show the path from the user's current location to its destination The AR Personal Navigation Device is an innovation that doesn't right now exists yet can be simulated, with two Personal Navigation Device technologies that are popular, an egocentric street view Personal Navigation Device and the Standard map-based Personal Navigation Device. According to simulated AR Personal Navigation Device results, driver participants spent about 5.7 sec and 4.2 sec more each minute looking at the road ahead which increased driver's visual attention span.

D. Mobile AR Systems

Advances in mobile application development and AR introduce new ways to perceive things we see around us and to interact with the world around us. The recent AR applications are designed for personal use while people are on-the-going. This is one of the applications of AR which did not exist until a decade back. Effective and usable AR applications for mobile devices pose challenges in designing such applications. Smart phone user can simply install a mobile application which supports augmented reality and use it on the go, the available selection of augmented reality apps is diverse, some of which are highlighted as follows based on apple app store and android

ratings and daily usage just to give and idea about augmented reality mobile applications market.

Wikitude: It is a mobile augmented reality browser. It uses the smartphone's camera in the given area along its virtual browser and shows just about any geographically relevant information a person will find valuable while traveling. · Yelp: It was one of the first AR application used on mobile in 2009, it uses the smartphone's GPS to display AR markers for nearby restaurants, bars, and other businesses and all on the go in real time.

SnapShop: SnapShop showroom lets users see the furniture they are buying online from a retail store like IKEA augmented and placed into their own living room or kitchen. · Groopic: A mobile app which lets the photographer itself also come in the picture which is being clicked using techniques from computer vision because people can't trust handing over their smart phones to strangers or taking a selfie which gives us back ill posed grope pictures. E. AR Systems in Education and Learning AR systems are being used in education sector to promote learning in various fields. Children are learning from Augmented Reality books while interacting with book in real time and learning from the story process. Such AR books look interesting to children and attract them towards learning the tool and stories they include but the navigation remains an issue. Researchers have found out that navigation in AR books is a potential issue and that learning with a predefined interactive story is better than the child creating their own.

Mobile devices are more constrained computational wise from traditional computers, they have a multitude of sensors that can be used to the development of more sophisticated mobile AR applications and can be assisted from remote servers for the execution of their intensive parts [8].

Automated tour guide is being introduced in museums so that it enhances the social aspects of museum visits, compared to taped tour guides. A prototype museum tour guide focused around Augmented Reality which demonstrates that more proper engineering can improve our encounters without interfering with our social cooperation's as much. This automated tour guide framework superimposes sound on the world focused around where a viewer is located. Virtual museum exhibitions are also being introduced; An Augmented Reality system allows museums to build and manage Virtual and Augmented Reality exhibitions based on 3D models of artifacts is presented. This done by creating dynamic content based on pre-designed visualization templates by the content designers to create virtual exhibitions very efficiently. Augmented Reality technologies allow museum visitors to interact with the objects and content artifacts in an intuitive and exciting manner. There are numerous circumstances in which physical cooperation with genuine items is impractical – for instance, galleries hold numerous articles or antiques which are excessively delicate or extravagant for general society to handle. Augmented Reality can possibly offer an option in these circumstances. User responses towards a prototype that allows users to physically orientate virtual objects so that they „snap" together in order to complete a "3D AR Puzzle", showed that they felt very positive about the way the virtual puzzle pieces interacted with each other naturally by „snapping" together. Responsive virtual objects in AR applications are a solid first step towards our goal of making interactions with AR feels more natural. A model consists of two types of activity experienced by the observer of a work of art: sensitive and analytical tour of museum. Called Mobile Augmented Reality Touring System [9].

E. AR Systems in Museums

F. AR Systems in Education

In a rapidly changing society where there is a great deal of available information and knowledge, adopting and applying information at the right time and right place is needed to main efficiency in both school and business settings. AR is one technology that dramatically shifts the location and timing of education [10]. Given the exciting developments and the manifest functionality of AR as an improved user interface technology, researchers believe that AR has vast potential implications and numerous benefits for the augmentation of teaching and learning environments. AR has potential to i) engage, stimulate, and motivate students to explore class materials from different angles. ii) It helps to teach subjects where students could not feasibly gain real-world first-hand experience iii) To enhance collaboration between students and instructors and among students (iv) To foster student creativity and imagination v) To help students take control of their learning at their own pace and on their own path (vi) To create an authentic learning environment suitable to various learning styles.

Researchers have explored the use of AR applications within a variety of fields and disciplines, many of which are already directly or indirectly related to education. have looked at the use of AR for medical training simulations. AR have examined the use of AR as a tool for engineering where Web3D and AR technologies allow students to explore mechanical engineering concepts. Kaufmann and his team have focused their AR research on applications in mathematics and geometry by creating an AR system to facilitate learning between instructors and students. Additionally, researchers have investigated the feasibility of various AR applications for use within the field of e-commerce

IV. CONCLUSION

Augmented Reality is a breakthrough technology but, at the present day, it is still affected by serious problems that jeopardize its implementation in industrial environments. We have presented some applications of augmented reality. AR could seriously improve human performances, and this can lead to great benefits not only from an economical perspective. Better materials, faster algorithms, smaller hardware are demanded and the research community must take charge of this need and offer valid solutions in augmented reality.

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