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Applications of Augmented Reality: A Review of Studies

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ABSTRACT: Augmented reality is one of the most advanced technologies in today's world and isthe virtual experience in the real world which is capable to show tremendous amount of information in a sensational way. Its advantages are used in different applications. In this review, we lookinto some AR applications and analyze the significance of this technology. The main things focused inthis review are about things with more social relevance. So some important topics for review is aboutdisaster management, Geo visualization, Urban planning etc. By doing this work we were able toidentify and improvise the impact of AR on those applications.

KEYWORDS: Augmented Reality, Marker Image, Computer Vision.

I. INTRODUCTION

Over the last few years, Augmented Reality (AR) has developed into a cutting edge technology that lets people superimpose digital content over real-life scenes. The technology provides an experience based on the users actual environment, amplified by computer generated sensory input, such as sound, video, graphics or location data. It is a novel technology that is gaining preponderance, and there are various ways of integrating it in different contexts.

The aim of this work is to review applications of Augmented Reality techniques in different context such as disaster management (Johannes Leebmann, 2004), building evacuation (Sharad Sharma and ShanmukhaJerripothula, 2015; James Stigall and Sharad Sharma, 2017), emergency response (Alexandre Campos, Nuno Correia,TeresaRomao,2019),geo-visualisation (Nicholas R. Hedley, Richard May,2002;Fotis Liarokapis, Ian Greatbatch,2005) and urban modelling (Jin-Tsong Hwang and Ting-Chen Chu, 2016).

This paper also reviews about the technologies like Virtual Reality, Augmented Reality and Mixed Reality that integrate virtual and real-world componentsand the computer vision technology. Also this work includesdiscussionson two types of simple augmented reality: marker-based which uses cameras and visual cues, and marker less which use positional data such as a mobile's GPS and compass.

II. RESEARCH ELABORATION

A work by Jin-Tsong Hwang and Ting-Chen Chu discusses the application of Augmented Reality in urban modelling. Traditional way of using 3D building model in urban planning and designing involves an operator who has to control unilaterally the location and view angle on the scene of the display. This paper describes a potential solution to this problem, augmented reality. To generate vectors from point clouds, using AutoCAD 2016, the 3D models were reconstructed from the photographs taken by using photogrammetry techniques .The mobile application is designed and implemented using Unity3D[1].

The paper by Johannes Leebmann proposes an AR system for disaster management. This paper lay a hand of help to the rescuers who are finding people trapped inside the collapsedbuilding. The main agenda of the paper is to provide training for the members of the rescueteam. The system uses the camera of the phone and creates a virtual environment andoverlaps it with reality using the camera. The system can be used an rescue operation System[6].

The paper "mobile augmented reality techniques for emergency response", authors discussabout mobile application that can be used as a task and decisions assistant for the quick responders. This technique visualizes the geo-

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referenced data where the incident happened.The application is developed with user centered design. The application concentrates onsharing information between the rescue team and the augmented reality (AR) display views the commands given to the team. The system uses an AR option that allows the user tointeract and visualize with the content [2].

Figure 1: AR View

In the paper "An Indoor Augmented Reality Mobile Application for Simulation of Building Evacuation" come up with an emergency evacuation system with safe evacuation of building in case of an emergency situation. the mobile AR application is made with Unity software and is able to display a 3D model of the building and animation of people evacuation using markers and web camera. The system representing a building in 3D space, allowing people to acknowledge where are the exits in the building through smartphone or tablets. Vuforia AR library is a fast and robust marker detecting technique. And proposed system includes putting the markers at key spots in the building, which allows smartphones to view the 3D representation of the building and exits [9].

In the work "Mobile Augmented Reality Application for Building Evacuation Using Intelligent Signs", JamesStigall and Sharad Sharma developed Android-based Mobile Augmented Reality Application (MARA) using Unity3D and Vuforia to show users how to evacuate a building. The system uses four different intelligent signs (blinking exit signs, floor arrows, photo references, and moving doors) acting as visual aids which helps to users to determine and to visualise the best path to the exits.The buttons on the GUI (graphical user interface) were implemented in C#. They allow the user to toggle the intelligent signs on and off[5].

In the paper "Mobile Augmented Reality Techniques for Geo-Visualization", the authors discuss the first prototype system for representing the geographical information with ESRI (Environmental Systems Research Institute) shapefiles as the input that represents 3D building geometry and landuse attributes by using GIS, 3D modeling, AR and VR technologies. The system allows the users to visualise the same information in a two types of mobile environments including: a mobile VR interface which is operational on PDA and 3G phones and a tangible AR interface for laptop computers[3].

In the paper "Explorations in the use of Augmented Reality for Geographic visualization" discussing about the user interfaces of geographic data visualization. In the AR interface with the help of wearable display unit with an attached camera, users can interact with the 3D virtual geographic model on the map. And through the AR Prism interface multiple users can interact and manipulate the geographical visuals which is super imposed on the map and the manipulation is through various interaction techniques and physical markers. The important thing to be noticed is the precise calculation of user's view and alignment of real world objects. So with an AR software and with the techniques of computer vision we can set the orientation and camera view with respect to marker image. And if we know the position of real camera then we can easily set the virtual camera view[4].

In the paper "Virtual Object Manipulation on a Table-Top AR Environment" discussing about the virtual object manipulation techniques and the user interaction. Tangible augmented reality is one of the virtual manipulation techniques. The main objective of tangible user interface is to turn real objects into input and output devices for computer vision. The physical properties of the tangible interface recommend which is devoted to virtual objects might interact and enhance the virtual interaction. Physical interface aspects are particularly important in interfaces formulated to support face-to-face collaboration. Also the coupling of tangible user interface with AR imaginary improved the user interaction to the AR environment[7].

Snehakasettysudarshan in here thesis paper "augmented reality in mobile devices" has cited the importance and application of mobile augmented reality. Mobile augmented realityenhances the user experience by expanding the digital world into the real time world. Manyapplications uses GPS to navigate the system. In military application the fighter pilots aregiven with a Heads-up display (HUD), it shows the details like altitude, airspeed and otherimportant data. And all these revolve around the mobile AR [8].

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III. TERMINOLOGIES

3.1 AUGMENTED REALITY

Augmented reality (AR) is a rising up technology that overlaps the real time world with the virtual world. In simple the virtual objects are placed onto the real world and is projected through a camera. Now a days all the mobile phones are supporting the augmented reality technology leading it to be one the most popular technology. There are a wide application of AR in the field of education, military, navigation, etc.

Figure 1: Augmented Reality

3.2 MARKER-BASED AR

Simply, Marker-based AR has to use a marker image as a triggering source inorder to integrate the virtual 3D images on the real environment. Markers are defined as the images that were detected by the camera and used with software as a location for the virtual content placed in a scene. Most of them are black and white though colors are also used as long as the contrast between them can be properly identified by a camera. The main advantages of marker-based AR are that it can give meaningful content for a small region. However, drawback is that identification is only possible after viewing the entire card.

Figure 2: A Simple Marker

3.3 MARKER LESS AR

In marker less AR 3D content is gathered through the internet and displayed on any location (GPS can be used). The system does not require any markers to integrate the virtual 3D content on the real environment. It is more interactive than marker-based AR. To accurately detect the real-world environment, marker less AR uses sensors in devices**.**

Figure 3: Marker Less AR

3.4 VIRTUAL REALITY

Virtual reality is a simulated experience created completely different from the real world. In VR generating an environment with scenes and objects that appear to be real and making the user immersive in their surroundings. The interaction to VR is only through a specific headset. The user experiences a telepresence in and through motion sensors.

3.5 COMPUTER VISION

Computer vision is an interdisciplinary scientific field that deals with how computers can gain high-level understanding from digital images or videos. Computer vision provides the appropriate augmentation inducement and addresses the sensing in the correct place. For AR,a successfully added virtual world to them, accurately discern and identify the surrounding requires computer vision. So computer vision helps augmented reality with robust vision, mapping and marker detection etc.

3.6 MIXED REALITY

It is a combined form of reality and virtual reality. The virtual objects are projected into the reality and the user will be able to interact with the virtual objects. It is similar to augmentedreality. The projection does not entirely takes place in virtual or reality but a combination ofboth.

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Figure 4: Mixed Reality

IV. CONCLUSION

In this paper various augmented reality applications was discussed. The application of AR system in the field of disaster management was also discussed. 3D building projections, computer vision, mixed reality, virtual reality, these key terms are discussed. The paper discusses about research works and experiment done by various authors and conclusion made by them. The paper mainly focuses on the application of AR content along with other technology in the field of disaster management.

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