Augmented Reality to help Public Safety Workers

[1]Santhra K Joy, [2]Dr. Vijayalakshmi M N

[1]Student, [2]Associative Professor
[1,2]Department of Computer Application,
[1,2]RV College of Engineering, Bangalore, India

Abstract: Augmented Reality (AR) gives an interactive experience of real-world where the objects that are present in the real world gets superimposed by computer-generated perceptual information. One great advantage of AR is that it provides a great enhanced sense of reality than any other technology in use and it reduces the difference between which is real in physical world and what is digitally generated, and with such advantages of AR, Emergency workers can utilize the technology to respond to any deadly scenarios like car accidents, terrorist attacks and natural disasters.

AR can help Public Safety workers in training them to do Complex activities like mid-air refuelling and flying formations, that could get extremely difficult to do in real life without any such training. Another way on how AR can help these safety officials is by providing efficient maintenance of vehicles, aircrafts, gadgets and equipment's used by them. This technology can also be used to help First responders who arrive in a scene of fire or earthquake trying to figure out who needs help, and the best way to get people living in a that area to safety, and to show them real-time individuals that would need their assistance just by wearing AR glasses. This Paper mainly focusses to propose how an AR mobile application can be created which will help military personnel to get a full picture of the areas which can be viewed in three dimensions and can be manipulated. This can help in the development of plans and strategies and any changes could be marked and relayed to the AR glasses of military personnel in real-time.

Index Terms – Augmented Reality(AR), Public Safety workers, Military personnel, AR Glasses.

I. INTRODUCTION

AR is a method of using technology to superimpose information - sounds, images and text. AR is often presented as a kind of futuristic technology, but a form of it has been around for years. Applications on AR includes navigation, marketing, entertainment, tourism, construction, industrial training and maintenance, medical training, interactive teaching and learning and many more.

When it comes to Public Safety Workers like law-enforcement officers, lifeguards, firefighters, rescue personnel's, emergency service providers, AR has mostly helped them during their Training. As Public Safety Workers perform really Complex activities that can get extremely difficult to do in real life, without any help of simulated training. With the help of AR, it is possible to train Public safety officials in advanced manoeuvre techniques in order to increase their efficiency and operability. AR has also helped them by providing efficient maintenance of vehicles, aircrafts, gadgets and equipment's used by them. As AR allows users to enhance their field of view with real-time super imposed digital information, this can allow them to gain any/all information on an equipment or step by step instructions on how to repair an equipment.

The proposed AR application will mainly help Public Safety Workers like law-enforcement officers, firefighters and rescue personnel's by helping them get a clear view of their battlefield or target area before they actually go there, and help them strategically plan their work accordingly. It will allow them to interact with the 3D target field by adding anchors and other text over it. The user can then save the session so that they can view modified 3D target fields later. This proposed AR application is a marker-based application; thus, the 3D target field will only be augmented if the marker is detected. For multiple users to view the 3D target field simultaneously, Photon Unity Networking can be used to make this a Collaborative application. This will allow a host to create a room and share the room ID to other users who then can join the room and then they all can view their battlefield or target area at the same time from their own device. Thus, this will help them to work together even if all the users are far away. All they would require is a Smart phone with the Application installed and with the right marker.

II. LITERATURE SURVEY

AR gives a real-time direct or indirect view of a physical real-world environment that is enhanced by adding virtually computer-generated information to it. It enhances user's perception and interaction with the real-world. The purpose of AR is to bring virtual information not just to immediate surroundings, but also to any indirect view of the real-world environment. With such benefits we can now find this technology applied in almost every field. Though AR was discovered back in 1990, it started gaining more popularity after the game Pokemon Go was released in the year 2016. The application was really simple where Pokemons are pinpointed on real world map, and when you get to that location, you use your camera to see them in the real world through your phone and catch them. Yet another popular example of AR through smartphone is Snapchat filters. Both Pokemon Go and Snapchat are example of how AR is applied in the Entertainment field. Apart from this now we can find different applications of AR in Medical Training, Retail, Repair and maintenance, Design & Modeling, Business Logistics, Tourism Industry, Classroom Education, Field Service and Public Safety [1].

Public safety workers like Law enforcement officers and emergency responders go through crucial training that requires significant investment in terms of time, financial resources, logistics, organization, and personnel reallocation. Every year, these officers must accomplish a required minimum number of hours of training for specific tasks (e.g., use of force, conflict resolution), scenarios (e.g., hazardous materials contamination), procedures , and equipment (e.g. non-lethal Tasers, lethal firearms,). Most common forms of training are realistic simulations, which usually occur in physical places such as abandoned buildings or "disaster cities" where the environment is designed in such a way that it matches the purpose of the simulation. But this is a very expensive activity that poses logistical challenges. So Considering all these Limitations, when training does occur, it often takes place in classrooms where poor student engagement and lack of opportunity for simulation can lead to failure in the field. In Recent years, virtual reality (VR) and Augmented Reality (AR) simulations have been introduced to offer convenient, affordable, and reusable training programs. But using them also has some disadvantages, they lack physically engaging experiences and introduce habituation to what is perceived as nothing more than a video game. VR can remove most psychological and nearly any physical stress, which are crucial aspects of coaching. It usually supports a limited number of users at one time that can prevent much needed experience working with teams and with multiple stakeholders [2].

AR based see-through system to solve the visibility problem while driving a car in overtaking situations by overcoming the occlusion caused by the front car. To achieve this goal, they developed a specific setup where the front vehicle is equipped with a stereo vision system while the rear car requires a single camera only. The information transfer between the vehicles by a wireless Vehicle to Vehicle (V2V) communication system. Then, the pose of the rear car in 3D map is estimated using a novel 2D-3D feature tracking [3].

The Naval Research Laboratory has developed Battlefield Augmented Reality System (BARS). The BARS is a wearable device that is incorporated into a soldier's personal equipment for enhancing his or her combat capability by gathering and displaying real-time intelligence, overlaying surrounding geographic information such as floorplans or maps , providing better optical capabilities, and maintaining constant communications with team members and higher headquarters [4].

The tool called "virtual reality cave" is used to interact with a virtual victim, honing skills to identify controlling and coercive behavior. The Cave Automatic Virtual Environment has three screens to offer a virtual experience for a growing number of exercises, including vital training to extend rape convictions and a virtual custody suite complete with detention officers, detainees, nurses, and lawyers etc. And another tool called CSI is used to digitize the crime scene. At the crime scene, all the traces of evidence must be identified and captured as quickly as possible. So the project used AR that would create virtual version of the crime scene that would always remain same so forensic investigators could revisit it again and again. To create the crime scene, a first investigator at the actual crime scene would wear a head-mounted display that would receive 3D videos from the cameras attached to it. In this way, he or she could see the environment, but also overlay and virtually tag objects using hand gestures [5].

AR and VR can present challenging issues for the law. Many such issues will require adapting existing doctrines to new circumstances or modifying legal rules to take account of new facts. As we don't have definitive answers to questions like "How might the law treat "street crimes" in VR and AR, behavior such as disturbing the peace, indecent exposure, deliberately harmful visuals and "virtual groping"?". The existence of VR and AR poses existing legal questions in new ways, ways that can illumine the assumptions the law makes about freedom in the physical world as well as the virtual world. For that reason alone, it is worth paying attention to the developing law of virtual and augmented reality [6].

Augmented reality can help the Police by Providing biometric recognition data of known criminals, such as facial and voice-print identifiers, to allow for real-time identification and can Create safer, better efficient driving environments during any situation that would need rapid response by putting patrol car operator data and regional traffic management information to their display. It can also be used to Notify officers of any local chemical, biological or explosive contamination through sensors and recommend appropriate protective measures for officers and the public [7].

As smart phones are becoming more and more technology efficient it is becoming easier for developers to create immersive, rich augmented reality experiences through mobile apps. By using the smart phones, the AR application can be experienced at the location where they are present geographically. Mobile-AR technology are low cost as compared to permanent or special-purpose AR technology. Many people can own their own necessary hardware to experience mobile AR technology as current smartphones contain necessary hardware components to implement mobile-AR applications [8].

There are still many Limitations in using AR like HMDs (Head Mounted Display) are still too clumsy and have limited field of vision, contrast and resolution. HMDs and other wearable equipment's, such as data-gloves and data suits, can be a limitation for the user. All wearable equipment's need be developed to be lighter, smaller and easier to work with the user. Also, the AR system researchers need to consider challenges like response time delays, hardware or software failures in the AR systems [9].

III. PROBLEM STATEMENT AND OBJECTIVE

Having an Idea about the Battle field or the targeted area without actually visiting the place is difficult. And it gets even more difficult for the Public safety workers to create their work plan. Augmented Reality will permit military personnel to get a full picture of the areas which can be viewed in three dimensions and can be manipulated [10]. And deciding their plan using a 2D map will cause issues as everyone in the team won't have a map and it is difficult to lay anchors or markers over the 2D map.

Fig 1: The Australian Air Force using the Microsoft HoloLens [10]

The Objectives to create this application will involve two parts one is using Vuforia to Augment the 3D target area which can be created using 3D modelling tools like Maya or Blender where each individual part of the map will be created and will be placed together.

Second is using Photon Unity 3D Networking (PUN) to allow Multiple users to view the same map at same time through their devices[11]. This will allow a host to create a room where other valid users can join and then they all can collaboratively look at the map and plan their strategy.
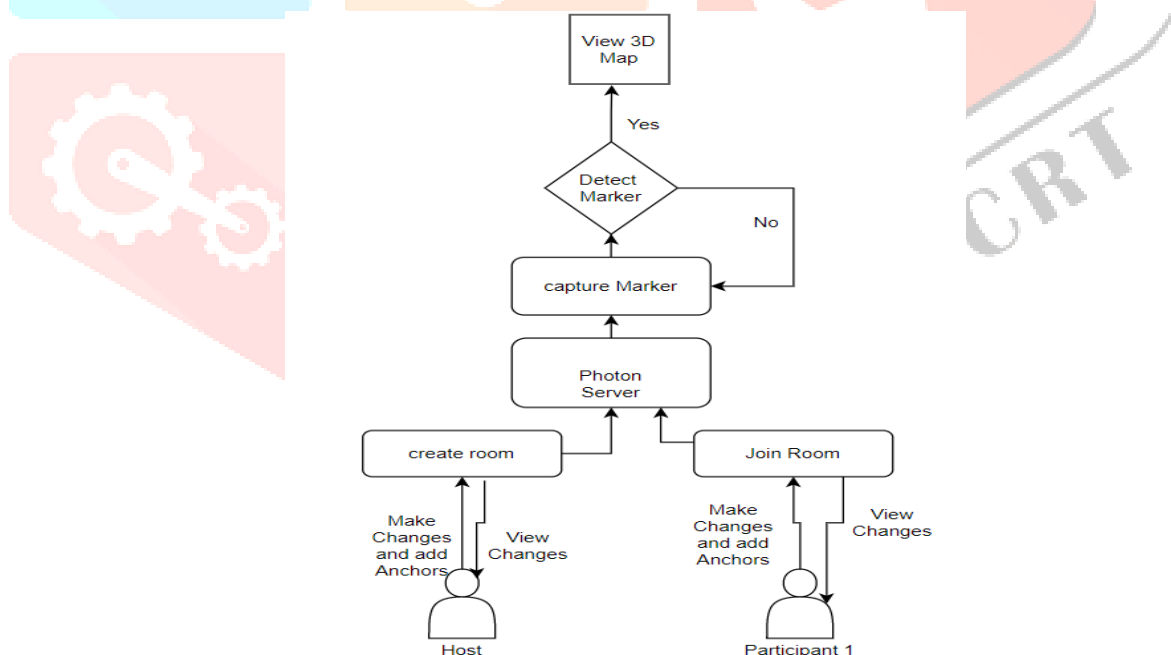
IV. METHODOLOGY

Fig 2: Block Diagram

The proposed AR application will be build using the Unity Game Engine. Here the first step is to upload marker image into Vuforia database. This project works on marker based augmented realty method. Marker-based augmented reality require a static image that a person can scan using their mobile device via an augmented reality app. The mobile scan will then trigger the additional content (video, animation, 3D objects) prepared in advance to appear on top of the marker. The triggered 3D model for this project will be 3D Area of the Battlefield[12]. The database will be then downloaded from the Vuforia portal for its deployment in development of augmented reality app. User Interface for creating the room and joining the room can be done by creating different scene in Unity Editor. Then a Photon Account has to be created and the Photon ID generated has to be set in the PUN Wizard in the Unity Editor. Then we can write the necessary code to create the Lobby and to integrate the entire Scene that will help in Augmenting the 3D models with Photon. Also, Serialization technique can be used to save the state of the Map to local System. So that user can view the Map any time later. Serialization is the conversion of an object into a stream of bytes which will be then stored as. json or .txt file and can be loaded back later [13].

V. RESULT

The proposed AR application can help Multiple military personnel view the 3D Map simultaneously. And they can add anchors and text over the 3D map and decide their strategy. This app is also secure as the user with Room ID or Room name can only join the Room and access the Map. And even if they have Room ID they need the Image Marker to view the Map, thus making it more secure.

Also using features like Serialization will help the user save the Map state to local system and view it Offline. This application can not just help Military personnel but can also help Fire Fighters and Rescue operators.

VI. CONCLUSION

In this paper we saw how AR technology can be efficiently used in the policing profession. Its different applications to help public safety workers by providing Simulated training, Maintenance of their equipment's, Geo Enabled AR applications etc. This paper then discussed various existing application like BARS and CSI that helps the policing profession. The paper also proposed an AR application that can help the Military personnel to view 3D map of their Battle field before the Battle Begins. The battlefield is a place of chaos, violence and ruled by uncertainty. Viewing their battle ground before the real battle can help them to come up with strategies to survive in the Battle Better. We can further enhance this application by allowing the user to communicate with each other, and this can be Implemented in unity with help of Unity plugins like Agora voice SDK. And also by implementing it using any AR smart glasses like Oculus Quest or Microsoft Hololens[14].

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