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AUGMENTED REALITY IN MILITARY TRAINING AND EDUCATION

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Abstract:
In recent years Augmented Reality (AR) has become widespread throughout the world and is used to make world easier. It is the combination of the real world and the virtual world. Augmented reality (AR) is a live, direct or indirect, view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data. It enhances one's perception of the world by giving him/her valuable information. In this article we will discuss the applications of AR and its military applications and its advantages in military training and education by using it in military brochures, manuals and in the field.

Key words: Augmented Reality, education, military, training, virtuality.

1. Introduction

In military, it is very hard to simulate military subjects to the people who haven't seen them before. However with help of AR it is very easy, cheap, and quick to explain it all. For example how one can explain mechanized and armor units' movements or tactics to someone who has never seen them before? Likewise some topics can't be easily described. There are two ways. One is to take personnel to the field and take out all units which will carry out the duty and make them to do the job each time. This will be very costly on some occasions. And the other way is to explain it with help of Augmented Reality, which is easier, cheaper and quicker. Then what is Augmented Reality?

2. Definition

Augmented Reality (AR) is a live, direct or indirect, view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data[1][2]. As a result, the technology functions by enhancing one's current perception of reality. By contrast, virtual reality replaces the real world with a simulated one[1].

3. Applications of Augmented Reality

AR is widely used by a number of fields in daily life. For an instance a mobile AR application guides you on your touristic travel by showing on the screen of your smart phone when you turn it up, down, leftwards, or rightwards the places to see, eat, entertain,

and spend the night by determining your location by Global Positioning System(GPS) or Inertial Navigation System (INS).

In movies, special effects or real-animation composed films are created by help of AR, but the difference in movies is that AR applications are made beforehand. Likewise, in news business changing screens in weather maps is a typical product of AR. Reporter stands in front of a blank screen and it is augmented with computer generated maps seen by us[3].

In engineering and architecture AR is being used to see the product in real field before it is constructed. With AR, an architect will be able to see the building he designed if it is suitable for that area, line of sights of each apartment; or even he can show the building and the apartment rooms to the customers who can walk around in an apartment beforehand.

In publishing, the feeling of the reader about a book may be enhanced by putting in it an AR. The application can be effectively used in lessons. Some newspapers use AR in order to communicate more visually with their readers by putting a marker which is percepted by the application is placed on the page, and as it is seen, the application starts automatically and visual and audio related to the news is serviced. Likewise, a reader may able to see the characters and even some scenes of a book in 3-D while reading an novel.

In medical, AR helps the surgeon to compare the imaging such as MRI and CT by showing necessary internal anatomy. In a continuing operation, AR can show where to look, cut, and suture. Neurosurgery is at the forefront when it comes to surgical applications of augmented reality. Since the brain is more complicated than the other parts of the body, the registration of exact coordinates can be achieved by help of AR[4].

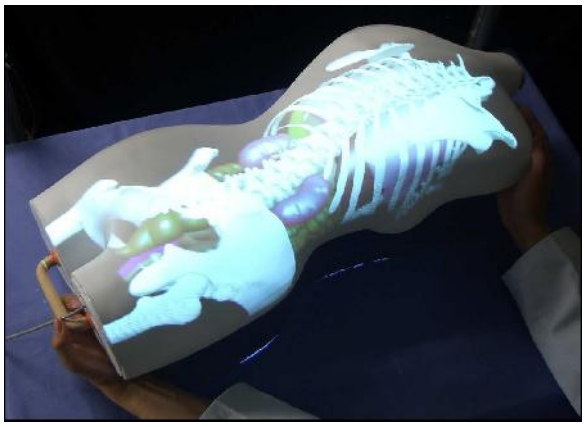

Fig.1 The Virtual Anatomical Model uses real-time adjusted projection of internal organs onto human-shaped surface. Both the viewer’s head and the manikin object are tracked in real time, which allows students to handle the display and examine if from different angles [5].

In maintenance and repair, a mechanic can learn how to repair, break and reunite a device or machine without looking up its manual. It is achieved via tablet PCs, smart phones, AR glasses, or by an AR application installed computer [6].

Fig.2 Augmented Reality in Maintenance and Repair [6].

In museums there are Near Field Communication (NFC) systems which send signal to the mobile device carried by the guests in its vicinity and the device starts an audio application. This system can be applied with AR. In this system NFC system device is to be placed on for example in an area taken place great wars. When an AR application installed tablet PCs, smart phones or AR glasses are gets near to NFC system, the user will be able to the war in 3-D on the real scene. This method will help the guests to comprehend the war thoroughly.

4. Military Applications of Augmented Reality

AR is being widely used in military in order to make the soldier's life in the field easier, to train him, and to get advantage against his current or potential enemies. An AR system mixes computer-generated graphics (or annotations) with the real world. The annotations can provide information aimed at establishing situational awareness or to provide realistic training for such scenarios. The design of the user interface of a mobile AR system presents a unique set of technical challenges. An AR display must be capable of automatically deciding what annotations need to be shown. Or, in the training applications, the virtual opposing forces (OPFOR) must appear and behave realistically[7].

The important thing is to filter the data which will be delivered to the personnel in the field. Filtering must be done by an automatic program which determines the level of the personnel and sends critical data for his/her level.

4.1 AR Applications in Military

4.1.1 Augmented Maps

The most important issue for the headquarters personnel during an ongoing operation is to pursue the intelligence outputs which determine friend and foe units' position on the scene. This subject is important for the commander to visualize the war scene and to decide. 3-D programming is used to produce an augmented map[8]. In order to enhance the situational awareness of the commander, on an AR map, the personnel wearing AR glasses are able to watch the map and the friend and foe units' position in 3-D. It is essential to make a mediator program that sends the updated information immediately. Likewise, it becomes easier to plan an operation with augmented map. Land characteristics, the effect of the seasonal weather on the units' movements can be shown in the augmented map. Thus a realistic vision of the region can be possessed.

4.1.2 Training

An application in military is trainings, in which soldiers wear AR glasses, and a vest with sensor devices, and takes his training rifle. In a real world and real scene come virtual enemies which he tries to extricate himself from and tries to kill. An INS (Inertial Navigation System) or GPS (Global Positioning System) device is to be installed on the AR glasses in order to determine the position of the soldier. It is essential to determine the exact position of the soldier is when he is standing, crouching, or lying.

Another training method is done as a team or squad. Team/Squad members are being trained as a group member and learn to play his role in his group. This method may be assisted with paintball.

Fig.3 Two Simulated Forces in an Office Environment[9]

4.1.3 Real Operations

In real operations a soldier wears AR glasses will be able to get information of the formation of his team or squad, and position of friend and foe units even if he cannot see them with his own eye. Required information will be delivered by headquarters to the soldier in the field. The soldier will be able to see the images of UAVs (Unmanned Aerial Vehicle) and UGVs (Unmanned Ground Vehicle) as well. It is crucially important for the headquarters to deliver the right information to the right unit on the right time. Here are some assumptions may be useful to overcome this difficulty by Simon Julier and others:

1. Any object of any type can, at any time become sufficiently "important" that it must be highlighted by the system.
2. Certain types of objects (such as the location of enemy forces) are extremely important and should be known by all users all the time.
3. Some objects (such as way points or objectives) are only critical to the mission profile of a particular individual.
4. If an object has no "special properties", it should exhibit the following default behavior. The environment surrounding the user is known in the highest detail possible. As distance increases, the user might want to know progressively less and less information. At a significant distance, might only have the critical landmarks as well as the locations of known friendly and enemy forces [10].

4.1.4 Fighter Planes and Military Vehicles

In fighter planes and military vehicles AR is an excellent aide. The information is shown on the windshield of modern fighter planes or visor of the pilot’s helmet[4]. In

military vehicles the information is shown on the windshield of the vehicle. This information includes the mechanical data of the vehicle and the friend and foe units' positions as well as directions to move.

4.1.5 Military Field Manuals and Brochures

In military, it is not easy for personnel to understand several subjects about operations, logistics, weapons, military vehicles, or services. For an instance, they cannot clearly visualize the tactics unless they see or exercise it. Repetition of all the tactics just for teaching personnel each time requires time, money and labor.

Instead, with an AR application installed on a computer, it will be simple to comprehend the subjects explained in military field manuals and brochures. For example, personnel will be able to watch in 3-D the settlement, tactics, and logistics of the units when they are reading the related page. So, these subjects will be understood thoroughly in a short time in comparison with exercising it in a real scene.

In order to start the application when reading these methods can be used:

1. It is possible to place tags which can be recognized by the application on the related page. In this way, whenever the application sees, it recognizes the tag, will show and tell the explanation written in the manual.
2. Page DNAs can be determined, and each page or a part of a page can be defined as a tag to start the application. It is nearly impossible to face a confusion problem.
3. Page numbers of each manual can be defined as a tag to start the application. A possible problem is that each manual or brochure has the same page number. In order to solve this problem, different applications may be started for each manual or brochure.

In order to put AR applications into practice these methods can be applied:

1. An AR application program may be installed on intranet computers used in military. By this way, with a camera plugged in computer, the program will be able to recognize the tag on the page and display the explanation in 3-D.
2. In headquarters of military units, there can be rooms for computers installed AR applications. Personnel, individually, or in teams and squads, can learn, watch, and listen the subjects written on the manual. Furthermore, he will even plan operations in these rooms on operation maps seen in 3-D.
3. Applications can be installed on smart phones, tablet PCs, and PDAs. With this way personnel will turn the camera of the device to the page and see the AR explanation.
4. With AR glasses, the subjects explained in manuals can be seen even in real scene. GPS (Global Positioning System) and INS (Inertial Navigation System) will detect the position of the personnel and use the real scene to show the explanation.
5. Bionic lenses are being developed. If produced and used widespread, they will be able to wear by the personnel and help them to see the world through AR.

5. Contribution of Augmented Reality to Military Life

In this essay, military applications, especially in military field manuals and brochures, of AR, which has many fields of usage, and its advantages are assessed. Augmented Reality applications have made an innovation in military as they have made in many fields. As the technology improves and AR applications are widely used, a concept is

going to be constituted and it will made opportunity to the countries which have AR in military effectively in the battlefield.

Surveys show the learning methods of human beings revealed that 79% of learning is via perceiving. With AR, written expressions will be supported by visual objects, and thus understanding level of the personnel of a specific subject will go up. Consequently, personnel will learn and grasp the subjects in shorter time in lower price and lower labor.

But it must be clearly understood that the AR applications are all means to help people to ease their daily life, but cannot solve all the problems of it. For an instance, AR applications help a soldier in the field to train and realize his whereabouts, but do not kill his enemies instead. Likewise it shows the parts of a weapon and how to aim; but doesn't show the feelings when it is grabbed, pulled the trigger; or whether shot exactly in correct way. So, as an aide for life, AR applications are became more widely used.

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