Augmented Reality

Integrating the Real and Virtual World

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ABSTRACT: Augmeneted Reality is a revolution in technology in which nthe User is immersed not only into a Virtual world but is present in the physical world itself with objects augmented into it. The difference is that these objects also provide a link into a computer network. Doctors can examine patients while viewing superimposed medical images; children can program their own LEGO constructions; construction engineers can use ordinary paper engineering drawings to communicate with distant colleagues. Rather than immersing people in an artificially created virtual world, the goal is to augment objects in the physical world by enhancing them with a wealth of digital information and communication capabilities.

KEY WORDS: virtual world, physical world, augmeneted reality, virtual reality, mediated reality

1. Introduction

Augmented Reality is a type of virtual reality that aims to duplicate the world's environment in a computer. Virtual reality (VR) is a virtual space in which players immerse themselves into that space and exceed the bounds of physical reality [2]. It adds information and meaning to a real object or place. Augmented reality is characterized by the incorporation of artificial or virtual elements into the physical world as shown by the live feed of the camera, in real-time. Common types of augmented reality include projection, recognition, location and outline [3].

2. Goals

The basic goal of an AR system is to enhance the userís perception of and interaction with the real world through supplementing the real world with 3D virtual objects that appear to coexist in the same space as the real world. Many recent papers broaden the definition of AR beyond this vision, but in the spirit of the original survey we define AR systems to share the following properties: 1) Blends real and virtual, in a real environment 2) Real-time interactive 3) Registered in 3D Registration refers to the accurate alignment of real and virtual objects. Without accurate registration, the illusion that the virtual objects exist in the real environment is severely compromised. Registration is a difficult problem and a topic of continuing research.

Fig. 1. Augmentation with help of a Mobile

3. HOW TO "AUGMENT REALITY"

3.1. Augment the user

The user wears or carries a device, usually on the head or hands, to obtain information about physical objects. Some applications are designed to let people get information by "seeing through" them. For example, an obstetrician can look simultaneously at a pregnant woman and the ultrasound image of her baby inside

3.2. Augment the physical object

The physical object is changed by embedding input, output or computational devices on or within it. Toy car to the alternately start or stop at any loud noise. Children (and their teachers) have created a variety of whimsical and useful constructions, ranging from an "alarm clock bed" that detects the light in the morning and rattles a toy bed to a "smart" cage that tracks the behavior of the hamster inside.

3.3 Augment the environment surrounding the user and the object

Neither the user nor the object is affected directly.Instead, independent devices provide & collect information from the surrounding environment, displaying information onto objects & capturing information about the user's interactions. The Digital Desk uses a video camera to detect where a user is pointing and a close-up camera to capture images of numbers, which are then interpreted via optical character recognition. A projector overhead projects changes made by the user back onto the surface of the desk. For example, the user may have a column of numbers printed on a particularpage. The user points to numbers, the digital desk reads and interprets them, and then places them into an electronic spreadsheet.

Augment:	Approach	Technology	Application
Users	Wear devices on the body	VR helmets Goggles Data gloves	Medicine Field service Presentations
Physical objects	Imbed devices within objects	Intelligent bricks Sensors, receptors GPS, electronic paper	Education Office facilities Positioning
Environment surrounding objects and users	Project images and record remotely	Video cameras, Scanners Graphics tablets Bar code readers Video Projectors	Office work Film-making Construction Architecture

Table 1 Examples of augmented reality approaches, with relevant technologies and applications

Each approach has advantages and disadvantages; the choice depends upon the application and the needs of the users. The key is to clearly specify how people interact with physical objects in the real world, identify the problems that additional computational support would address, and then develop the technology to meet the needs of the application.

4. Applications

4.1. Medical

AR might be helpful for general medical visualization tasks in the surgical room. Surgeons can detect some features with the naked eye that they cannot see in MRI or CT scans, and vice-versa. AR would give surgeons access to both types of data simultaneously. This might also guide precision tasks, such as displaying where to drill a hole into the skull for brain surgery or where to perform a needle biopsy of a tiny tumor. The information from the non-invasive sensors would be directly displayed on the patient, showing exactly where to perform the operation. AR might also be useful for training purposes. Virtual instructions could remind a novice surgeon of the required steps, without the need to look away from a patient to consult a manual. Virtual objects could also identify organs and specify locations to avoid disturbing

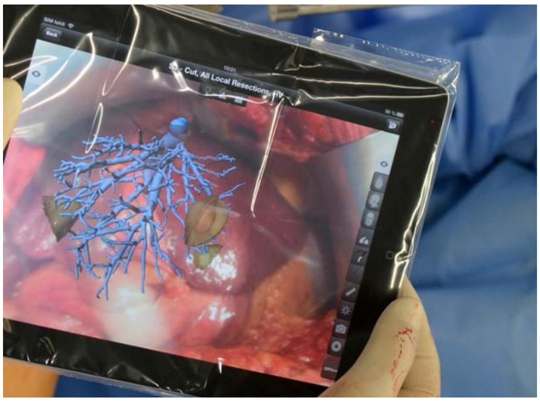


Fig. 2. Doctors Perform Surgery with Augmented Reality Technology

4.2 Entertainment and Games

Augmented reality works by using your smartphone to react to a trigger image, which turns your phone into an advertising platform displaying video, pictures, articles and maps. Just imagine scanning a picture of your local bar from a leaflet, and the AR app guides you to the front door using GPS and mapping systems, describing key points along the way. One company who has got it right is IKEA, whose new AR friendly catalogue allows its user to scan the image of a sofa or chair that they are interested in buying, and by using their smartphone can see what furniture looks like live in their living room. The revolution for the print media industry is that published articles that have some sort of visual or audible media attached can be accessed by the reader. An article that had to rely on images to show the royal baby leaving hospital for the first time could now be just one image, which once scanned brings up a video of a podcast of NEWS.

Fig. 3 Augmented Reality Growth to Save Newspaper Industry

4.3 Military aircraft

For many years, military aircraft and helicopters have used Head-Up Displays (HUDs) and Helmet-Mounted Sights (HMS) to superimpose vector graphics upon the pilot's view of the real world. Besides providing basic navigation and flight information, these graphics are sometimes registered with targets in the environment, providing a way to aim the aircraft's weapons. For example, the chin turret in a helicopter gunship can be slaved to the pilot's HMS, so the pilot can aim the chin turret simply by looking at the target. Future generations of combat aircraft will be developed with an HMD built into the pilot's helmet

5. TYPES OF AUGMENTED REALITY

There are 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. (Johnson et al, 2010)

5.1. Marker based

The images (or the corresponding image descriptors) are provided beforehand. In this case you know exactly what the application should recognize while acquiring camera data. Most of the nowadays AR apps dealing with image recognition are marker-based It's much more simple to detect things that are hard-coded in your app. There is no need of accelerometer or compass in a marker-based app. The recognition library may be able to compute the pose matrix (rotation & translation) of the detected image relative to the camera of the device.pppppppp

Fig. 4 A Simple Marker for Marker based AR Systems

5.2. Marker less

A marker-less AR application recognizes images that were not provided to the application beforehand. This scenario is much more difficult to implement because the recognition algorithm running in your AR application should identify patterns, colors or some other "features" that may exist in camera frames. For example if you algorithm is able to identify dogs, it means that the AR application will be able to trigger AR actions whenever a dog is detected, without providing images with all the dogs in the world (training a database for example) when developing the application.

Fig. 5 Markerless Image Recgnition AR Systems

6. MARKER DESIGN , DETECTION AND RECOGNITION METHOD

Markers are square and constituting of black thick border and black graphics within its white internal region. The advantage of using black and white colour is to eparate marker from background in grabbed frame easily. Internal region of a marker marks identifier of it. In term of projective geometry, square markers in real world could not be square after projecting onto image plane, in other words, internal graphics in markers often display in distortion. When recognizing them, image unwrapping is necessary.[4] The procedure of unwrapping image is shown in Fig.6

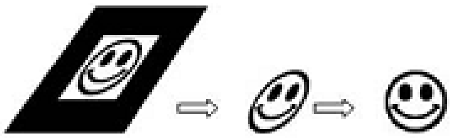


Fig. 6. Procedure of unwrapping marker image to find ID

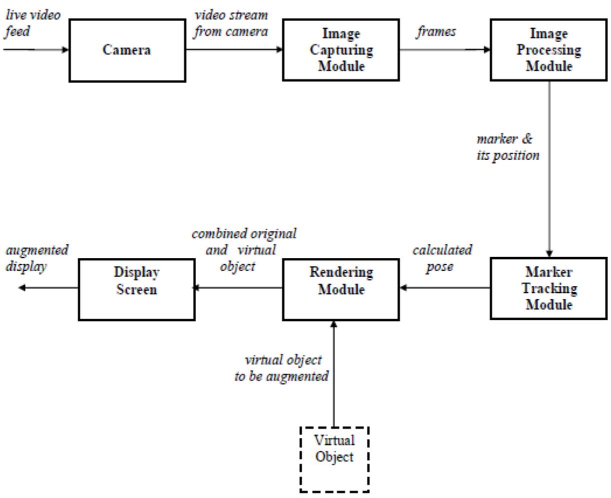
The calculation of marker unwrapping could be described as follows: (xc,yc) i=1,2,3,4 as four corners of a marker are acquired after detecting grabbed frame. Positions of four corners are known in the real world as (xm,ym) i=1,2,3,4. Homography matrix H could be calculated in . By H points in internal region of marker could be unwrapped to formal one.

$$\begin{bmatrix} hx_c \\ hy_c \\ 1 \end{bmatrix} = H \begin{bmatrix} x_m \\ y_m \\ 1 \end{bmatrix} = \begin{bmatrix} N_{11} & N_{12} & N_{13} \\ N_{21} & N_{22} & N_{23} \\ N_{31} & N_{32} & 1 \end{bmatrix} \begin{bmatrix} x_m \\ y_m \\ 1 \end{bmatrix} \qquad (1)$$

7. PROBLEM STATEMENT

Communication with people is a basic need for everyone, but some people are not able to communicate well due to some disabilities. A group of these people is deaf people, and communication is the main problem among them. Deaf people communicate visually and physically rather than audibly. Therefore, they have some problems in their relationship with people. Usually, deaf people use sign-language to communicate with each other, but people have no desire to learn sign-language. For this reason, many people feel awkward or become frustrated trying to communicate with deaf people, especially when no interpreter is available. Besides this problem, most deaf people are unable to make meaningful sounds and also have problems in visual literacy, such as participate in university classes or scientific meetings. Therefore, we tried to find a way to solve the communication problem among deaf and hard-of-hearing people, using new technologies Helping deaf people to communicate with ordinary people is the main goal. Our proposed system uses the narrator's speech to make the speech visible to deaf people on AR display. This system helps deaf people to see what the narrator says, and also the narrator does not need to learn sign-language to communicate with deaf people. Furthermore, deaf people can talk to the narrator, using a computer.pppppp

8. PROPOSED SYSTEM ARCHITECTURE



The proposed system is a marker based system and its architecture as shown in figure 6 contains following modules.

1. Camera
2. Image Capturing Module
3. Image Processing Module
4. Rendering Module
5. Display Screen

1 Camera: A real-world live video is feed as an input from the Android cell phone camera to the Camera module. Displaying this live feed from the Android cell phone camera is the reality in augmented reality. This live video stream is given as an input to the Image Capturing Module.

2 Image Capturing Module:

The input to Image Capturing Module is the live video feed from the camera of a mobile device. This module analyses the camera feed, by analysing each frame in the video. This module generates binary images i.e. a digital image that has only two possible values for each pixel. Typically the two colours used for a binary image are black and white. These binary images are provided as an input to Image Processing Module.

3 Image Processing Module: Inputs to Image Processing Module are the binary images from Image Capturing Module. These binary images are processed using an image processing technique to detect the AR Marker. Detection of AR Marker is essential to determine the position, where to place the virtual object. Once the AR Marker is detected, its location is provided as an input to the Tracking Module.

4 Marker Tracking Module: The tracking module is “the heart” of the augmented reality system; it calculates the relative pose of the camera in real time. The term pose means the six degrees of freedom (DOF) position, i.e. the 3D location and 3D orientation of an object. The calculated pose is provided as an input to Rendering Module.

5 Rendering Module: There are 2 inputs to Rendering Module. First is the calculate pose from the Tracking Module and other is the Virtual Object to be augmented. The Rendering Module combines the original image and the virtual components using the calculated pose and renders the augmented image on the display screen of the mobile device.

9. CONCLUSIONS

This paper proposes a marker based augmented reality application using Android operating system which makes the speech visible to deaf people on AR display. as mentioned in this paper. The main advantage is use of low cost devices as compared to the costly head mounted display devices. Augmented reality still has some challenges to overcome. Augmented Reality systems are expected to run in real-time so that a user will be able to move freely within the scene and see a properly rendered augmented image. Therefore, these technologies are in a position to grow and offer new possibilities to the world of technology. Hopefully, our proposed system will be an alternative tool for deaf people to improve their communication skills.

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