Virtual and Real World in Mobile Reality

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ABSTRACT

Technology in education has impacted many ways in student's life to learn enthusiastically by giving better and more than expected results. Some research stated that technology will create a passive process if it doesn't promote critical thinking. To support the statement Augmented Reality (AR) has shown the best potential to make learning more interactive and easy. It's because of the feature of AR that lets us interact with things in virtual and real-time. Therefore this paper represents the idea of using AR in education.

Keywords— Technology, Education, Augmented Reality, Virtual Reality, OpenCV, OpenGL

I. INTRODUCTION

From the tie technology embedded in education provides many effective results in learning and teaching styles. By Shapley et al. 2011 lessons with technology will lead to more informative types of teaching and learning. As technology allows to have real-world scenarios /issues and the respected data and connects with the professionals of fields/areas.

Not Only Students but teachers also need to spend more time understanding and collecting more information. Technology enrolled in education makes everyone enroll and expand their rooms for improvement.

Existing active research focuses on implementation by teachers to teach the phenomena of the real world, and for students to learn through immersion.

AR is a new technology that provides many potentials in interaction with the real world and virtually. The number of studies increasing on AR due to its effectiveness. AR can sufficiently provide visualization for models. Most field AR research is conducted are medical, chemistry, Mathematics, Physics, Geography, etc.

AR has proven the result accuracy of a task, especially in the surgery and airplane manufacturing field. It accelerates the audio-visual method of learning in classrooms.

A major challenge in the field of Augmented Reality (AR) is the way in which augmented the information is presented under a wide array of uncontrollable environmental conditions.

Virtual pictures have been integrated into real-world scenes in recent years using optically transparent augmented reality (AR) screens.

They got a lot of attention because they are able to quickly and accurately inform the user by projecting AR information directly on the object of interest.

The interaction between learners and a 3D virtual object is intuitive as it reflects their natural perception of objects.

II. RELATED WORK

Augmented has made significant advances in the education sector, both theoretical and practical by analyzing its surrounding environments and fetching informative details. With AR many kinds of 3D objects can be shown in the real world.

Generally AR, has the following three properties:

- Mixed the Real and virtual objects in real environment
- Runs interactively and in real time
- Aligns the

Head-mounted displays and goggles are some examples of AR. As they are costly so they are used in limited fields. Due to the rapid growth and ubiquity of smartphone technology, AR is now available to all.

Recently, there have been trials using LCD screens to produce a transparent screen for smart window applications.

With the explosive growth of powerful, less expensive mobile devices, and the emergence of sophisticated communication infrastructure, Mobile Augmented Reality (MAR) applications are gaining increased popularity.

MAR allows users to run AR applications on mobile devices with greater mobility and at a lower cost.

In order to realize the proclaimed five senses, the system has two main modules:

- Mobile application which deals mainly with the senses of sight and hearing, using for that the mobile device camera to recognize and track on-

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the objects and give related information about them; and

- Portable device capable of enhancing the augmented reality (AR) experience by associating itself to the users' smartphone or tablet.

Mobile augmented reality (Mobile AR) is gaining increasing attention from both academia and industry with two dominant platforms:

1. App-based Mobile AR.
2. WEB-based Mobile AR

A. Mobile AR

Simply put, it is the AR that we can transport anywhere with no difficulty and no heavy load.

MAR are AR applications which operate on mobile devices and allow users to obtain services via the interfaces of mobile devices.

Understanding the differentiation between AR and Virtual Reality (VR) and their place n the spectrum, from real to the virtual environment defined within [4].

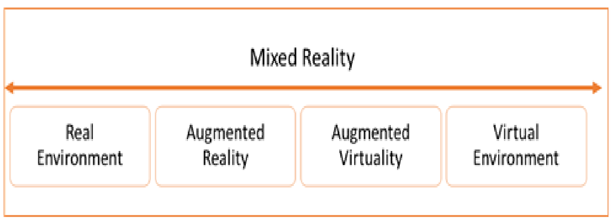

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Figure 1: Miligram and Kishino's Reality-Vituality Continuum [4]

Conversely, in both augmented virtuality and virtual environment/VR, the surrounding is virtual. Figure 1 presents the real to virtual continuum

In general, a MAR has following structure as depicted in fig2:

- **Inputs:** Add various sensors of the device or any other companion device.
- **Processing:** The collection of functions that generates the output to be displayed on the mobile device's screen.
- **Outputs:** The action of augmenting, which projects the virtual content on the present view of the real environment.

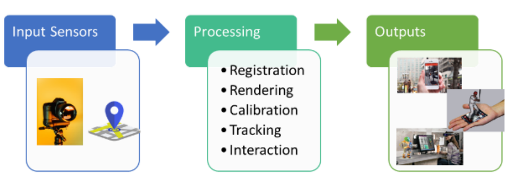

Figure 2: Generic AR work Flow

Different AR architectures exist based on the deployment of the processing function. Several processing techniques called tracking, rendering, interaction, calibration and registration contribute for useful AR experience.

Tracking identifies current posture information in order to align virtual content with physical objects and divide in sensor-based, vision-based, hybrid tracking [7]

Sensor-based tracking systems rely on optical, acoustic, mechanical and magnetic sensors [8], whereas vision-based tracking systems use camera feed and image processing techniques to determine the current pose relative to the real world objects [9].

Vision-based tracking is further divided into marker-based [10] and markerless [11] (also called as natural feature tracking), in which marker is an image or view of a real world object that provides a unique pattern.

AR software and AR camera responsible to find MARKERs.

When recognizing a particular object, the rendering the function produces the content corresponding to the display output.

Rendering is an intensive computing process because of the demands of today's applications of augmented reality in real time. Hence, it is best to offload the rendering to powerful computing platforms like the cloud.

Calibration and recording technologies precisely align the vision of the real world with virtual objects while the user view is still, and interaction techniques specify how the user should handle AR virtual content [7]. Interaction uses various interfaces such as acoustic, tangible and text-based to interact with virtual objects [9].

B. Recent advancement of AR and MAR

Property	Augmented Reality	Mobile AR
Mobility aspect [10]	Not necessarily attached in a place. Portability is possible, however, by utilizing the complete AR functionality during movement is unrealistic.	Users are capable of experiencing the full AR functionality while moving.
Task processing [11]	Devices can be equipped with GPUs to perform heavyweight computer vision on-device	Mobile devices may not have sufficient computational capability to perform suitable computer vision for immersive MAR. May require computational offloading
Device from factor [12]	Not necessarily a major design concern.	Should be less bulky easy to handle while delivering the required functionality

Figure 3: AR vs MAR

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The envisaged future of MAR puts strictness on wireless connectivity, which can be achievable using sophisticated communication systems such as 5G systems.

Future MAR systems will be noticeably different characteristics compared to current MAR devices, especially with the introduction of 5G systems and on-board computing.

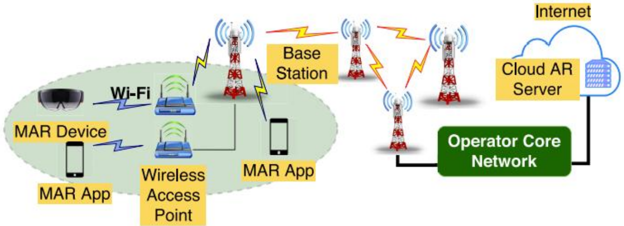

Figure 4: Cloud based System Architecture for a MAR System

III. METHODOLOGY

The proposed system aims at creating 3D models for scanned body parts and providing the relative knowledge and functionality of parts. Markers (Image Targets) are tracked by using camera and 3D models mapped to the marker and models will be represented on screen. Users can interact with these models and understand the functionality and details of the model.

C. Vuforia

Vuforia is the SDK that helps AR applications to work smoother by handling the detection and tracking of image targets or markers. It uses the computer vision technology to recognize and track planer images and 3d objects in real time. This image registration capability enables developers to position and orient virtual objects, such as 3D models and other media, in relation to real world objects when they are viewed through the camera of a mobile device. The Vuforia SDK supports a variety of 2D and 3D target types including 'markerless' Image Targets, 3D Model Target, and a form of addressable Fiducial Marker, known as a VuMark. Developers can easily add advanced computer vision functionality to Android, iOS, and UWP apps, to create AR experiences that realistically interact with objects and the environment.

D. Unity

Unity is cross-platform game engine used to develop the three dimensional and two dimensional games, as well as interactive situations and other experiences.

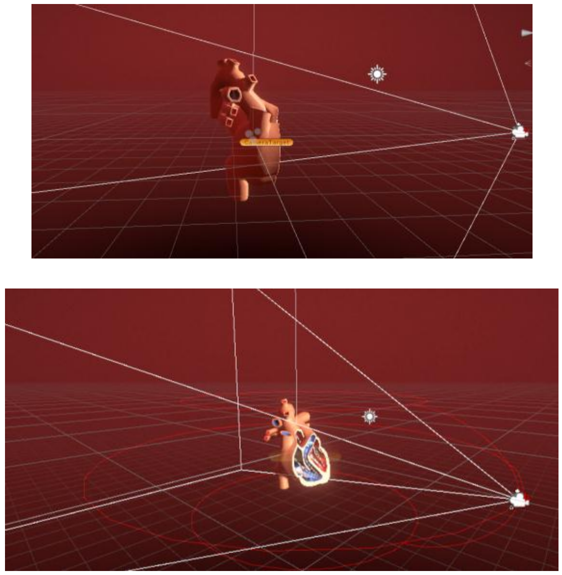

Figure 5: Adjusting the view

E. Dividing the Axis

To make sure that object will get at the center and user will get perfect view from every angle. The proposed solution consider the x_{axis} and Y_{axis} and pixels from center of screen by suing the functionality of Unity.

F. POP up Messages

To provide the details of every scanned part and provide the audio and to get the perfect from every angle. The paper proposed the camera stacking way.

Camera stacking a term to give perfect view from every angle.

IV. TECHNICAL ASPECTS AND DIFFICULTIES WITH MAR

This section discusses different technical aspects, which play an essential role in realizing future MAR systems.

A. Security

It is an essential component of MAR ensuring the required service levels of the application are delivered. By adopting suitable security measures in MAR, the adverse effects caused by illegal access, data alterations, and data non-availability can be avoided. System problems may result from sensory overload attacks, such as playing loud music and flashing lights on the display.

B. Mobility Management

Wearable MAR glasses are one example of an AR device which has significantly progressed from the initial designs that supported portability and enabled users to carry backpacks filled with computing gear.

The whole potential of MAR can be realised with devices directly connected to 5G networks due to the exponential development of user mobility and the anticipated future MAR applications.

As the user wanders around, a network's mobility support ensures service continuation. Mobility support, however, is made more challenging by MAR applications' high throughput and ultralow latency needs.

C. Energy Management

To allow new user experiences with MAR features, they should be equipped with additional sensors, powerful onboard cameras and increased treatment power .The energy the usage of a mobile device depends on a number of factors including display size, amount of up linking and downlink data traffic, and energy consumption profile of internal components.

MAR demands a complex process that quickly consumes the device's battery. One way to handle these issue to write the algorithms and handle the novel hardware architectures.

V. LESSONS LEARNED AND FUTURE WORK

The study highlights the research difficulties that still need to be solved, related potential solutions, and future research directions for the technical components in this section.

The topic focuses on how the research issues for 5G MAR can be solved by developing the current working solutions and by using fresh ideas.

A. Communication

Future MAR applications' high throughput requirements are met by a communication infrastructure that combines revolutionary 5G technologies including mmWave, tiny cell UDN, massive MIMO, and beamforming.

To achieve extremely low latencies, design adjustments are suggested for symbol periods and transmission time intervals.

MEC-enabled 5G moves the processing power closer to the consumer, significantly cutting down on transit time.

B. Mobility Management

The critical service levels and obligatory mobility support are required due to the projected growth of the MAR application sector enabled by 5G services.

Wearable MAR devices are anticipated to connect to 5G directly in addition to the apps hosted on regular mobile smartphones.

Wearable devices may be application-specific with enhanced hardware and software, in contrast to the MAR apps hosted on standard mobile handsets.

Future MAR systems must take sufficient mobility assistance into account while designing their small cells because 5G small cells have a decreased cell radius, which will result in a high handover frequency.

C. Service Migration

The specific application of MAR in relation to service migration is a field that has received little research. To solve the performance deterioration issue with user mobility, few research projects examine service migrations in mobile edge clouds. The 5G UDN's enhanced mobility means that service migration will be essential to maintaining service continuity.

The potential for improvements in service migration is significant given the anticipated changes in network topologies in the 5G era, improved with SDN and NFV technologies.

D. Privacy

Due to the distributed nature of the systems and their large attack surface, the future 5G networked MAR systems must contain measures for privacy protection.

In the interim, more advanced privacy protection methods for MAR systems can be implemented by efficiently utilising the advantages of SDN, NFV, and network slicing in 5G networks.

Using the SDN, the privacy protection strategies can be adjusted based on various MAR application requirements. Along with data privacy, location privacy will also be trivial because location data is essential to the provision of MAR services for the majority of outdoor MAR applications. There are few talks currently on privacy protection for MAR, but in the future dynamic and distributed 5G MAR systems, a redesign of the techniques is required. Emerging MAR systems may want to concentrate on offloading privacy protection methods to MEC-enabled 5G UDN.

VI. CONCLUSIONS

We will develop an application that will be using AR technology to help in learning the desired part with MAR. Our learning system will explain the functionality of the scanned part to help the learner get an effective and easy understanding of the 3D model.

Future MAR solutions will give value by improving user experience and fostering the welfare of the advanced next generation society. Different network formulations, such as cloud-based, edge-based, localised, and hybrid architectures, should be able to accommodate the extreme versatility requirements of such applications. Future 5G systems' extremely high bandwidth, extremely low latency, and huge connection foresee a bright future for MAR applications and the supporting technology MEC and AI collaboration.

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