

Augmented Reality: The Future Ahead

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Abstract- *Augmented reality is a groundbreaking technology which has led to a new way of experiencing things and interacting with the real world. The field of Augmented Reality (AR) has existed for just over one decade, but the growth and progress in the past few years have been notable. Augmented reality, in which virtual content is seamlessly combined with displays of real-world scenes by using Scene Analysis, is a growing area of interactive design. With the escalation of personal mobile devices that are capable of producing interesting augmented reality environments, the vast potential of AR has begun to be explored. This paper surveys the current state-of-the-art in augmented reality. It describes work performed in different application domains and describes the existing issues encountered when building augmented reality applications considering the technical limitations of mobile devices. Moreover, we discuss the future direction and areas requiring further research.*

Keywords- Augmented Reality, Virtual Environments, Mobile Technology, Scene Analysis, Mixed Reality

I. INTRODUCTION

Introduction

The Augmented Reality (AR) is a combination of technologies that empower real-time mixing of computer-generated content with live video display. It is also known as the next generation Virtual Reality (VR) technology. [1] And interacts not only with a virtual world but has a degree of independence with the real world. In the late 1990's, several conferences specializing in this area were started, including the International Workshop and Symposium on Augmented Reality [2], the International Symposium on Mixed Reality [3], and the Designing Augmented Reality Environment workshop. A freely-available software toolkit (**the ARToolkit**) for rapidly building AR applications is available [4]. Because of this wealth of new development, an updated survey is needed to guide and encourage future expansion in the exciting area.

The objective of this new survey is to cover the recent advances in Augmented Reality that are not covered by

the original survey in the past. This survey provides an overview of recent technologies, potential applications, limitations and future trends of AR systems.

The rest of the paper is organized as follows: Section 2, focus on the application of AR in different domains such as medical, military, entertainment etc. Section 3, discuss about how to get started in the AR industry. Section 4, concludes with a number of directions that we believe AR research might take.

II. AUGMENTED REALITY

The basic goal of Augmented Reality is to enhance the user's perception 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 spirit of the original survey we define AR system to share the following properties:

- 1) Mixtures real and virtual, in real environment
- 2) Real-time interactive
- 3) Registered in 3D

Registration refers to the precise alignment of real and virtual objects. Registration is a difficult problem and topic continuing research.

The term "augmented reality" was first coined by Tom Caudell, at Boeing in 1990, who was asked to improve the expensive diagrams and making devices used to guide workers on factory floor [5]. He suggested to replacing the plywood board. Which contained individually designed wiring instruction for each plane, with a head-mounted apparatus that displays a plane's specific schematics through high-tech eye ware and project them onto multipurpose, reusable boards.

Augmented Reality and Virtual Reality

The word virtual reality is usually used by the popular media to describe imaginary worlds that only exist in computer and our minds. Reality is defined to be something that constitutes a real or actual thing as distinguished from

something that is merely apparent; something that exists self-reliantly of ideas conceiving it. A good virtual reality system will allow users to physically walk around objects and touch those object as if they were real. The creator of one of the world's first virtual reality systems specified "The ultimate display would, of course, be a room within which the computer can control the existence of matter. A chair displayed in such a room would be enough to sit in. handcuffs displayed in such a room would be confining, and a bullet displayed in such a room would be fatal".

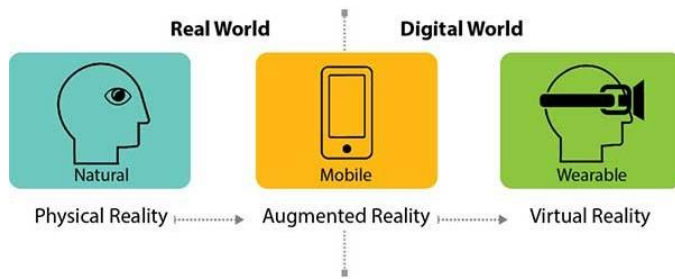


Figure 1: Picture Depicting Physical, Augmented, and Virtual Reality [6].

Although both the technologies seek to indulge the user in an unreal, artificial setup, these are inverse reflections of each other. While VR isolate the user and take him/her to another world, AR user continue to dwell in real worlds during their interaction with the virtual objects. The purpose of VR is to create its own computer generated, digital world without using the actual real-life setup. On the other hand, AR adds virtual components like graphics and images as a layer onto the real objects.

Types of Augmented Reality

Augmented Reality(AR) is divided into 2 sub categories:

A) **Markerless AR** which is based on a technology called slam(simultaneous location and mapping). Slam uses a camera and it figure out the unique spots, surfaces and planes within the environment. Once it has figure out the points in real-time the camera can move around/ pan around the objects keeping the objects fixed.

B) **Marker Based AR**- The application using this type of AR, the uses of the applications are known beforehand. This means that in the marker based AR applications the images to be recognized are provided beforehand.

Some Examples of Augmented Reality:

- a) QR codes on steroid(company named *Vuforia* is using this technology)
- b) Snapchat filters
- c) Pokemon Go and many others
- d) ARIS(an open source interactive storytelling application)
- e) Aurasma
- f) Layar(an app that let you create augmented materials)
- g) Google Tango(an upcoming platform which can scan your surrounding and can create a virtual environment on your smartphone)
- h) ScanLife(an application made by Microsoft)
- i) Popcode
- j) Google Goggles

Augmented reality Components

- Scene Generator

The scene generator is a software responsible for rendering the scene.

- Tracking System

Tracking system help the virtual objects to be aligned in the real world, so that they can behave in a certain manner.

- HMD(head mounted display)

Most of the displays for AR are head mounted displays, and this field has limit the development of augmented reality. Researchers are looking for a cheap and viable display source so that consumers have no problem in wearing them.

III. HISTORY

Given below is the brief History about AR:

- In 1901, L Frank Baum first mentioned about the display/spectacles that can overlay a frame or data on to real life.
- From 1957-62, Morton Heilig created a simulator called Sensorama. The simulator can provide a cinematic experience to the user where user can even smell the environment.
- In 1968, Ivan Sutherland created head mounted display.
- In 1980, Steve Mann created the first wearable computer named EyeTap.
- In 1990, Thomas P. Caudell gave the term 'Augmented Reality'.

- In 1992, one of the first functioning AR systems called Virtual Fixtures was developed by Louis Rosenberg
- In 1999, us Naval Research Laboratory engages on a research program called Battlefield Augmented Reality System. This program was to prototype wearable systems for dismounted soldier operating in urban environment.
- In 2001, Bruce H. Thomas developed AR Quake. Gaming industry was blow away by this fusion of games and AR as it was the first AR game.
- In 2009, Adobe flash became the first company to bring AR to web browsers.

IV. APPLICATIONS OF AUGMENTED REALITY

Augment reality is no more associated with sci-fi movies. While some experts think augment reality is still in its infancy, we can already see real applications that may change our everyday lives. The AR can be used in well-established domains like medical, military, manufacturing, entertainment, visualization and robotics. They may be use in domains such as education, marketing, geospatial, navigation and path planning, tourism, urban planning and civil engineering, etc.

4.1. Medicine

Lack of interactive materials in medical education has been a struggle for decades. While it's not possible to allow fresh medical student to perform operation on real patient, the partial solution was to create a lab simulator where students can train to perform treatments. However, these simulators were overly simplistic and didn't take into account all complexities of real therapy. Augmented reality can finally provide necessary solution where a scope of real emergency situations can be modeled and student can navigate and get feedback through AR glasses that project augmented reality into the real world

Another application for augmented reality in medical domain is ultrasound imaging. Using an optical see-through display the ultrasound technician can view a volumetric render image of the fetus overlaid on the abdomen of pregnant women. The image appears as if it were inside of the abdomen and is correctly rendered.

4.2 Entertainment

We all watch news, don't we? In the news room where the recording takes place the reporter stands in front of a blue screen, image is augmented with computer generated maps using a technique called chroma-keying. Games are a part of all age groups, games are now being augmented. For

example-pokemon go was the first successful augmented game.

Princeton Electronic Billboard developed a augmented system where we can place objects in a live environment when broadcasting a match or a live show. This uses point detection techniques and mapping to place objects in the live environment.

4.3 Military Training

Augmented reality has been an asset for our military. By using such technology they give training to the new emerging candidates. The military has been using displays in cockpits that present information to the pilot on the windshield of the cockpit or the visor of the flight helmet. This is a form of augmented reality display.

4.4 Photorealistic Rendering

Most common use of augmented reality, companies like snapchat, Facebook, Microsoft, google and some others have applications that uses the concept of Photorealistic rendering. This concept captures the surroundings with the help of a camera then analyzes the objects in that scene making it easier to project virtual objects, lastly it optimizes the virtual objects so it is easier to render during the live capturing of a video. Encryption is basically a process of converting confidential data and information in a form of code, which prevent from unauthorized access [7]

V. HOW TO GET STARTED WITH AUGMENTED REALITY

This question is a complex one as there are few options, in this example we will be taking about HoloLens sdk created by Microsoft supported by Unity3D. We are assuming that you have some kind of programming experience and you have worked on Unity. If not then please refer to some tutorials on C# language as it is the most preferred language for unity development. As you will be using Unity3d you should also have some prior experience with asset creation. Blender is a great choice if you need a free software to learn asset creation. In a future to come, some facilities can be provided to the user itself at basic level itself. With higher and advanced technologies we are putting an effort to make people life at ease [8]

VI. CONCLUSION

Although some work has been done on augmented reality and has benefited a wide range of audience but we still have a long way to go. There are many areas where this kind of technology can help, some of them are listed below:

- a) Architectural work – Making 3d models that can be manipulated real time can help the builders and the architects.
- b) Ubiquitous tracking and system probability- We are using these AR system in a restricted environment which are being created specially by professional, but the end goal is to make a system which is unambiguous, reliable and meticulous in nature.

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