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# Marker Based Application in Augmented Reality Using Android

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**ABSTRACT:** This paper that enables Marker Based Application in Augmented Reality (AR) on the Android platform. Augment Reality combines the real world with virtual reality, 3D objects in real time. In which real world is enhanced by superimposing computer-generated sensory input such as audio content, activities, textual, GPS or graphical, as well as objects onto display to the screen. The proposed application is an android smart phones based application which will be compatible with all the existing and upcoming versions of the operating system. The idea is to allow the user to view the virtual object in the real world using a marker based Augment Reality system. The user could provide images of the object which would be the front, back, top, bottom, left and right side pictures of the object. They will be placed onto a three dimensional cube which will make up complete the virtual object. This application is capable of displaying 3D models on augment reality markers. One of the challenges of augment reality is to align virtual data with the environment. A marker-based approach solves the problem using visual markers. Ultimate goal is a mobile solution, even though the demonstration may run on a PC environment and the advantages of this application as compared to the already existing Two-Dimensional application are that it would display object in Three-Dimensional and enable the user to rotate it virtually.

**KEYWORDS:** Augmented Reality, Android, Marker, Virtual Reality;

### I. INTRODUCTION

Augmented Reality (AR) a new technology that blends virtual objects into the real world. Augmented reality (AR) is a live direct or indirect view of a physical and real-world environment One of the best overviews of the technology is that defined the field, described many problems, and summarized the developments up to that point. That paper provides a starting point for anyone interested in researching or using Augmented Reality. The Main types of augmented reality included are recognition, location, sensor, outline and projection.

**Recognition:** Recognition is a common type of augmented reality that uses the shapes of recognition, faces or other real world items to provide supplementary virtual information to the user in real-time. A handheld device such as a smart phone with the proper software could use recognition to read product bar codes and provide relevant information such as reviews and prices or to read faces and then provide links to a person's social networking profiles.

**Location:** Location uses GPS technology to instantaneously provide you with relevant directional information. For example, one can use a smart phone with GPS to determine his location, and then have onscreen arrows superimposed over a live image of what's in front of the user and point him in the direction of where you need to go. This technology can also be used to locate nearby public transportation stations.

**Sensor:** A sensor is an object whose purpose is to detect events or changes in its environment. The position and orientation are determined by fusing information from a camera and an (IMU) Inertial Measurement Unit .

**Outline:** Outline is a type of augmented reality that merges the outline of the human body or a part of the body with virtual materials, allowing the user to pick up and otherwise manipulate objects that do not exist in reality. One



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example of this can be found at some museums and science centers in the form of virtual volleyball. Although the player can stand and move on an actual court, the ball is projected on a wall behind him, and he can control it with an outline of himself, which is also projected on the wall using the concept of augmented reality our project focuses on creating a very useful android mobile based application. The idea is to allow the user to view the virtual object in the real world. The user could provide images of the object which would be the front, back, top, bottom, and left and right side pictures of the object. They will be placed onto a Three-Dimensional cube which will make up the complete virtual object. Thus an extended environment will be created through the amalgamation of real world and generated object and it will appear as though the real-world object and virtual object coexist within the environment. In order to use this application, the user will first need to acquire a marker. A marker is a piece of paper with black and white markings. This is used to display the augmented object on your mobile phone's screen. Marker-based augmented reality uses a camera and a visual marker which determines the center, orientation, and range of its spherical coordinate system. Once the marker is present one can view augmented objects. Virtual object interaction is another added feature wherein the user can rotate or change the orientation of the object according to his requirements.

**Projection:** It is the main type of augmented reality, projection uses the virtual imagery to augment what you see live. Some mobile devices can track movements and sounds with a camera and then respond. Projection or virtual, keyboards, which one can project onto to almost any flat surface and use, are examples of augmented reality devices that use interactive projection. Spatially augmented reality renders virtual objects directly within or on the user's physical space. A key benefit of SAR is that the user does not need to wear a head-mounted display. Instead, with the use of spatial displays, wide field of view and possibly high-resolution images of virtual objects can be integrated directly into the environment. For example, the virtual objects can be realized by using digital light projectors to paint 2D/3D imagery onto real surfaces, or by using built-in flat panel displays.

## II. RELATED WORK AND WHY ANDROID USE

- Augment reality in Toolkit is a open source library it is distributed under GPL. The main feature included in toolkit like single camera position, The ability to use any square market patterns.
- Augmented Reality n toolkitPlus is a library based on augmented reality Toolkit. Andorid supports both c and c++ it lacks support for the Standard template library. Because of the augmented realityPlus can currently not be used on Android device.Though this might change in future android versions, making this toolkit an alternative to the Augmented Reality Toolkit.
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- Studiers tube Tracker is a rewrite from scratch not based on Augmented Reality Toolkit.It is not released as open source and also not publicly available. Studiers tube Tracker was designed not only for PC's but also for android Mobile devices. According to processing is about twice as fast compared to Augmented Reality ToolkitPlus on Android Mobile Device.
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- Since the advent of 2010 more and more stress has been given on the usage of Free and Open Source Software (FOSS). Android is leading the current O.S market as shown in figure 5, because it is open source and developed by a consortium of more than 86 leading M.N.C's called Open Handset Allowance (O.H.A). Android also is stated as one the most rapidly growing technologies. More and more applications have been developed and modified by third party user.

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Fig 1:Related works in Augmented Reality Using Android

### III. MARKER BASED

Different types of Augmented Reality (AR) markers are images that can be detected by a camera and used with software as the location for virtual assets placed in a scene. Most are black and white, though colours can be used as long as the contrast between them can be properly recognized by a camera. Simple augmented reality markers can consist of one or more basic shapes made up of black squares against a white background. More elaborate markers can be created using simple images that are still read properly by a camera, and these codes can even take the form of tattoos.

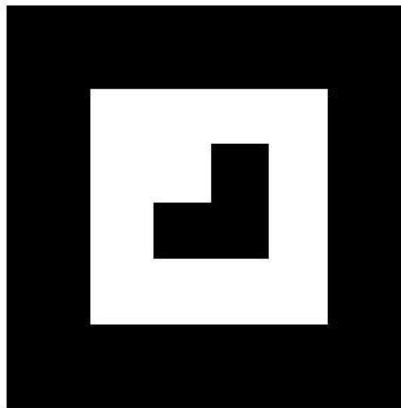


Fig 2: A simple marker

A camera is used with Augmented Reality software to detect the augmented reality markers as the location for virtual objects. The result is that an image can be even live, viewed, on a screen and digital assets are placed into the scene at the location of the markers. Limitations on the types of augmented reality markers that can be used are based on the software that recognizes them. While they need to remain fairly simple for error correction, they can include a wide range of different images. The simplest types of augmented reality markers are black and white images that consist of two-dimensional barcodes.

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## IV. 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 separate 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.4.



Fig 3: Procedure of unwrapping marker image to find ID

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

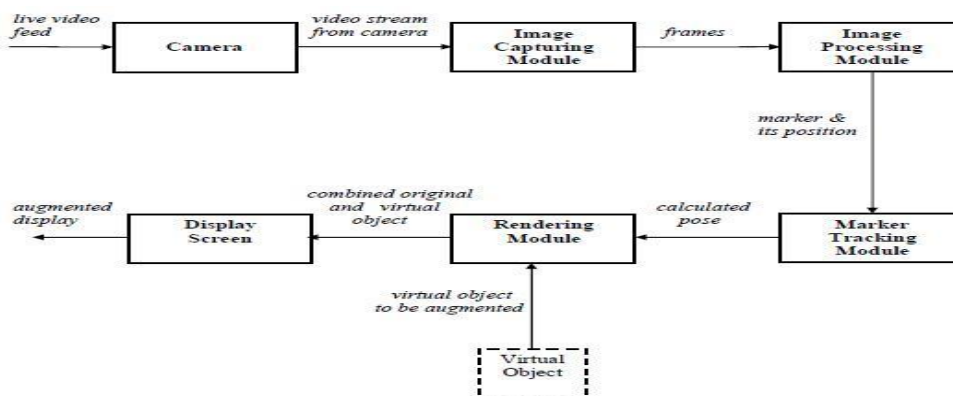
$$\begin{bmatrix} hx_c \\ hy_c \\ 1 \end{bmatrix} = H \begin{bmatrix} x_m \\ y_m \\ 1 \end{bmatrix} = \begin{bmatrix} N_{11} & N_{12} & N_{13} \\ N_{21} & N_{22} & N_{23} \\ N_{31} & N_{32} & 1 \end{bmatrix} \begin{bmatrix} x_m \\ y_m \\ 1 \end{bmatrix} \quad (1)$$

After that, unwrapping image are used to match templates in matching method or decode in code-decoding method respectively.

### Problem Statement:

- The proposed system aims to provide an environment that will help the users to place artificial 2D as well as 3D objects into real world through the use of AR Markers.
- The proposed system also allows the user to decide, where to place the object in real world. Once the object has been placed in the scene, it will be displayed accurately according to the perspective in the original scene, which is especially challenging in the case of 3D virtual objects.
- The proposed system solves the problem of viewpoint tracking and virtual object interaction.

## V. PROPOSED SYSTEM ARCHITECTURE IN AUGMENTED REALITY USING ANDROID



FFig 4: Block diagram



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

- Camera Module
- Capturing Image Module
- Processing Image Module
- Rendering Module
- Tracking Marker Module
- Display the screen

## 1 Camera Module:

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 Capturing Image Module.

## 2 Capturing Image Module:

The input to Capturing Image Module is the live video feed from the camera of a mobile device. This module analyses the camera feed, by analyzing 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 colors used for a binary image are black and white. These binary images are provided as an input to Processing Image Module.

## 3 Processing Image Module:

Inputs to Processing Image Module are the binary image from Capturing Image Module. These binary images are processed using an image processing technique to detect the Augmented Reality Marker. Detection of Augmented Reality 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.

## VI. PROJECT CONSTRAINTS

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. The application will be built for mobile phones which usually have low screen dimensions and resolution. It also adds additional stress on the O.S because it requires high processing power to augment. Developers of the application are supposed to have a thorough knowledge of Android O.S (Applications developed for) and Windows O.S (Application developed in). Developers are also supposed to be familiar with ADK (Android Development Kit) and Eclipse.

## VII. APPLICATION AREAS

A figure is worth thousand words. The applications of this paper are well understood from below snaps which shows

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virtual objects in real world environment.

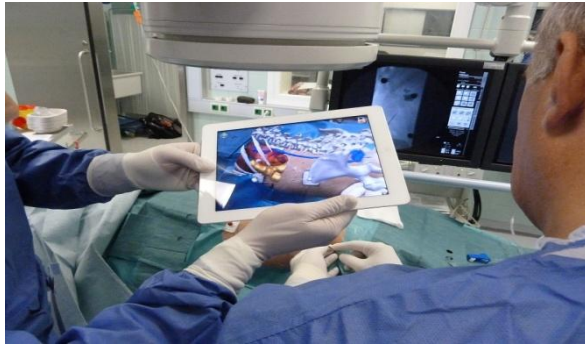


Fig 5:Medical Science



Fig 6:Fashion World

## VIII. CONCLUSION AND FUTURE WORK

This paper proposes a marker based application in augmented reality using Android which will help to combine virtual objects with the real time environment facilitating various applications as mentioned in this paper. The main advantage is use of low cost devices as compared to the costly head mounted display devices. Secondly with the help of this project you need not buy product and then see how it will suit your environment. In future images of objects from various views can be fetched directly from vendor's websites; same could be modelled into a 3D objects and augmented. Also multiple objects will be augmented which is currently a major challenge.

## REFERENCES

1. <http://mobile.tutsplus.com/tutorials/augmented-reality>
2. <http://mashable.com/follow/topics/augmented-reality>
3. <http://www.se.rit.edu/~jrv/research/ar/>
4. Rencheng Sun , YiSui , RanLi , Fengjing Shao, *The Design of a New Marker in Augmented Reality*, 2011 International Conference on Economics and Finance Research , IPEDR vol.4 (2011) © (2011)IACSIT Press, Singapore/
5. Ronald T. Azuma, *A Survey of Augmented Reality*, In Presence: Teleoperators and Virtual Environments 6, 4 (August 1997), 355-385
6. Si Jung Jun Kim, *A User Study Trends in Augmented Reality and Virtual Reality Research*, 2012 International Symposium on Ubiquitous Virtual Reality
7. [http://www.pcworld.com/article/253530/top\\_15\\_augmented\\_reality\\_apps\\_for\\_iphone\\_and\\_ipad.html](http://www.pcworld.com/article/253530/top_15_augmented_reality_apps_for_iphone_and_ipad.html)
8. <http://en.wikipedia.org/wiki/OpenGL>
9. <https://code.google.com/p/andar/>
10. <https://code.google.com/p/andar/wiki/HowToBuildApplicationsBasedOnAndAR>
11. <http://technocult.net/archives/2010/01/11/augmented-reality-medical-app/>
12. <http://www.studio4d.lt/en/augmented-reality>
13. <http://www.iphonesty.com/iphone-apps/best-augmented-reality-iphone-applications/>
14. <http://blog.t-immersion.com/2010/09/08/germaine-et-les-martiens-first-augmented-reality-apps-on-iphone-for-pos-advertising-and-augmented-packaging/>