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Augmented Reality in Computer Education using Android

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Abstract — *Augmented Reality is a concept wherein one's perception of environment is improved by superimposing digital information like graphical, textual, or audio content, as well as objects onto a display screen. It is in between real and virtual reality, wherein virtual objects are seen in real world. The application will be mobile based.*

The idea is to allow the user to view the virtual object in education in the real world using a marker based AR system. We propose that the system should be used in computer education by augmented animations of various parts of computer. It is not expensive as the user does not actually need to open parts of a computer, but instead just needs to view the animation.

The Android Application will scan the marker and the animation will be seen on the display screen of the mobile device along with the real environment.

Keywords-*virtual reality, real, marker, augmented, android*

I. INTRODUCTION

Augmented Reality known as Mixed Reality combines virtual and real scenes to achieve that virtual ones are belong to the real world. Because of this integration it is being used in various applications like medical, education, and entertainment.

There are 2 ways in which this can be implemented:

Marker Based:

There are different types of AR markers which can be detected by a camera and used with software as the location for virtual objects placed in a scene. They are image descriptors or black and white images (features + key points)..Simple augmented reality markers can consist basic shapes made up of black squares on a white background. Different 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.

The simplest types of AR markers are black and white images that consist of two dimensional (2D) barcodes.

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Marker less:

A marker less AR application recognizes images which were not provided to the application beforehand. This is more difficult to implement because the recognition algorithm running in the AR application should identify patterns, colors or some other "features" that may exist in camera frames

II. MARKER DETECTION,DESIGN AND REGONITION METHOD

Markers are square and have a black thick border and black graphics within its white internal region. The advantage of using black and white color is to separate the marker from the background easily. In terms of projective geometry, the square markers in real world could not be a square after projecting it onto an image plane, in other words, the graphics which are internal in the markers often display in distortion. So it is necessary to unwrap these markers when we recognize them

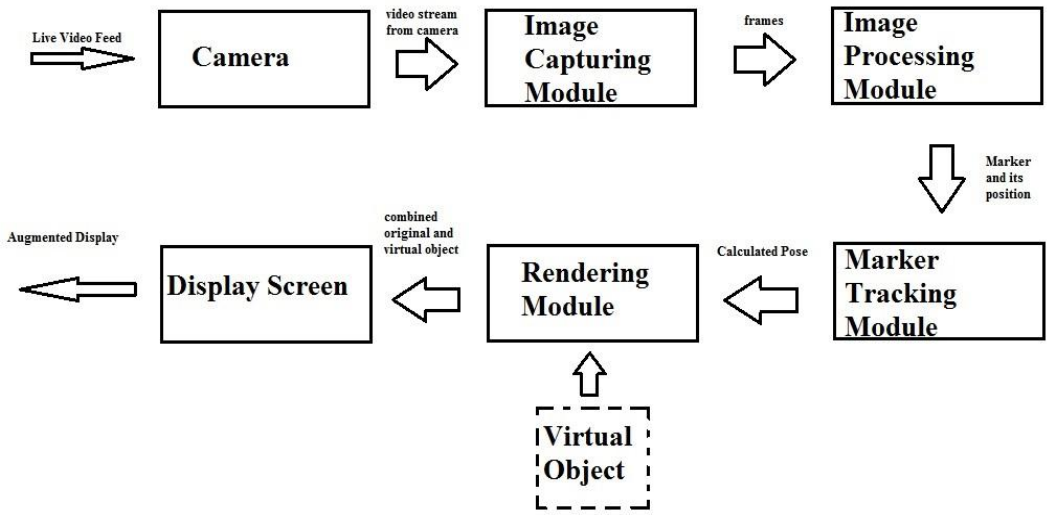
The procedure of unwrapping these image is shown in the figure

After detecting the grabbed frame the calculation of the marker unwrapping can be described as follows: (xc, yc), i = 1,2,3,4 as the four corners of a marker which are acquired. These positions in the real world of the four corners are given by (xm, ym), i = 1,2,3,4. Homography matrix H is calculated as shown in figure:

$$\begin{bmatrix} hx_c \\ hy_c \\ 1 \end{bmatrix} = H \begin{bmatrix} x_w \\ y_w \\ 1 \end{bmatrix} = \begin{bmatrix} N_{11} & N_{12} & N_{13} \\ N_{21} & N_{22} & N_{23} \\ N_{31} & N_{32} & 1 \end{bmatrix} \begin{bmatrix} x_w \\ y_w \\ 1 \end{bmatrix}$$

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

III. SYSTEM ARCHITECTURE



The proposed system's architecture is shown in figure which contains following modules.

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

1. Camera: A live video is fed from the Android device camera to the Camera module. Displaying this live feed from the Android device camera is the reality in augmented reality. It 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. It 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. Generally the two colors 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 images are processed using an image processing technique to detect the AR Marker. Detection of AR Marker is important to determine the position as to where to place the virtual object. After the AR Marker is detected, its location is provided as an input to the Tracking Module.

4 Marker Tracking Module: The most important module of the augmented reality system which 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.

IV. WHY ANDROID OS

Since the advent of 2010 more stress has been given on the usage of Free and Open Source Software (FOSS). Android is leading the current O.S market because it is open source and developed by a consortium of around 86 leading M.N.C's called Open Handset Alliance (O.H.A). Android also is one the most rapidly growing technologies. More and more applications have been developed and modified by third party user.

Moreover, the Android O.S is user friendly. It has a great performance and processing power. Thus, the proposed system is being developed for the most rapidly emerging and flexible O.S- "ANDROID"

V. CONCLUSION AND FUTURE WORK

This paper proposes a marker based augmented reality application in Android operating system which will help to integrate virtual objects with the real environment helping people in the field of Computer education. Advantage of this project is that you need not open any parts of the computer to study rather just watch the augmented animation. Also multiple objects will be augmented which is currently a major challenge.

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