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Marker Based Augmented Reality Techniques: Review

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Abstract : *Augmented Reality is a technology that has changed the face of smartphone apps and gaming.But recently,it also has been emerging in the education fields.With a motive of improving the quality of teaching and learning experiences ,there has been a rapid increase in mobile apps development in education.Therefore, this paper reviews several literatures concerning the information about mobile augmented reality and exemplify the potentials for education*

Keywords – *Augmented Reality, Marker Based Augmented Reality, Marker detection, Image targeting, Vuforia platform.*

I. Introduction

Augmented Reality (AR) employs computer vision, image processing and computer graphics techniques to merge digital content into the real world. It enables real time interaction between the user, real objects and virtual objects. AR can, for example, be used to embed 3D graphics into a video in such a way as if the virtual elements were part of the real environment [1]. In marker based Augmented Reality, black and white

2-D images scanned by camera that connects with appropriate 3D object after pattern recognition [2]. In previous marker based augmented reality systems where mostly used for gaming, mobile applications or in field of architecture or home decoration applications but use of this system were never used in application like teaching and training and development in colleges (engineering, medical… etc.) and industries. With help of marker based augmented reality we can build more professional in many fields including technologies

In this paper various techniques for marker based augmented reality system has been addressed and how they are used in modern day education system as this can help many School, colleges and Industries with limited budget and manpower to improve their teaching and training methods making it more interactive and productive

II. General Concepts

Over the last few month, we have done research over" Marker Based Augmented Reality" and its use in teaching for the better understanding of the students and making their learning experience more and more interactive towards their studies. We have often noticed that Due to low budgets and manpower, most schools and colleges do not plan or provide to give perfect industrial or laboratory experience to the students, due to which students are bound learn from whatever outdated knowledge is there from textbooks. Our goal is to guide all of the research presented in this work. However, we do give an overview of the state-of-the-art in augmented reality and refer to other possible solutions throughout the work.

2.1 Marker Based Augmented Reality

A marker is a formation of black and white squares, using a computer application random marker are created by
the system. Data in form of image sound video even 3D models can be augmented on these markers by marker-based application, a marker based Augmented Reality uses the camera and fiducial which is a virtual marker to determine the centre and range of its spherical coordinates of the system. In other word the marker is detected and scanned and 3D image is overlaid on the place off the marker [3]

2.2 Few techniques Prior to Augmented Realities

2.2.1 Binarization Technique

Mostly for marker based augmented reality markers are in form of black and white random patterns to detect this marker the patterns are subdivided into rectangular blocks this technique is also used for edge detection of markers providing us smother augmented image.

2.2.2 Colour Segmentation Techniques

R,G & B are primary values for each pixel is different and hence operation for every pixel is performed altering its value.

2.2.3 Division of images in to region

Image is divided in small regions of 40x40 pixels and each region is divided into horizontal and vertical scan lines 5 pixels apart. These regions which boosts the performance dramatically

2.2.4 Detection of Markers

1) Template matching

This technique is used to identify a marker. The final binarized image from the previous stage is matched with a circular template of radius 9.5. After this, the cross correlation pseudo-image is thresholded to a binary image by considering gray scale values above 15% of the maximum value obtained by cross-correlation. This ensures that the entire marker region is highlighted, and also that the marker does not merge with surrounding regions. This technique does not eliminate noise and irrelevant detail (false positives) from the image.

2) False positive removal

This technique is used for eliminating false positives. False positive regions are the one which satisfy any of the following condition:

a) Skewed aspect ratio is beyond 1.4 or 1/1.4 b) Area is greater than 10K pixels [5]

2.2.5 Selecting region of interest

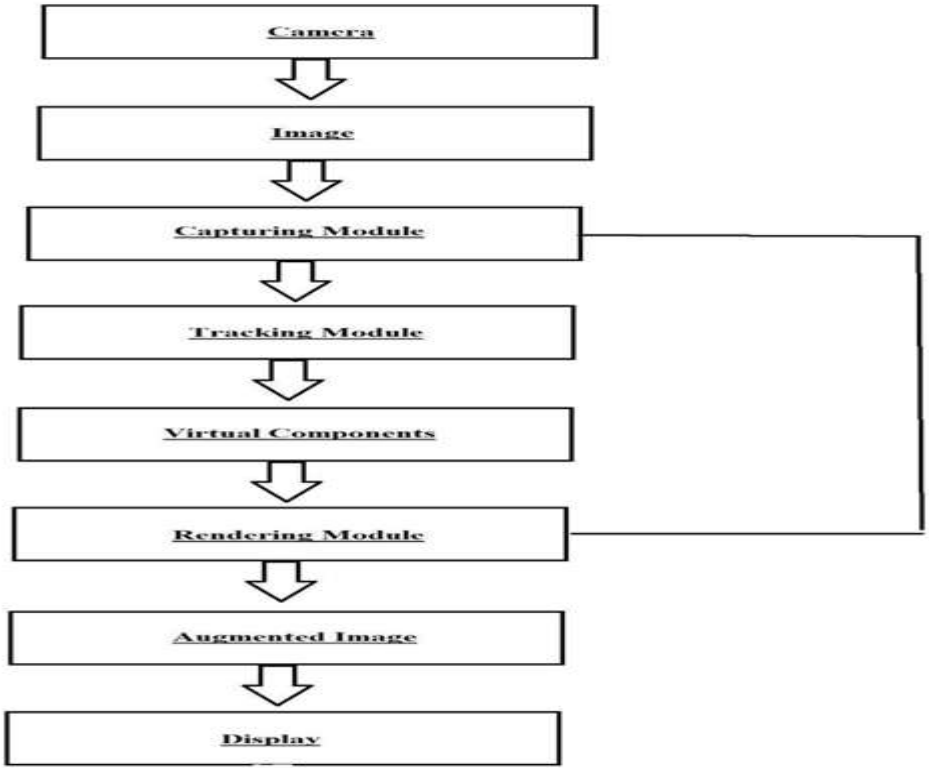
The approximate rotation of the marker is determined by taking a bounding box about the marker and calculating its area. This area is calculated for every rotation (the angle of rotation is incremented by 10o in the range of 0o-90o).The minimum area corresponds to the approximate angle of rotation. The result of this step is creation of a bounding box corresponding to the actual size of the marker. It can be further rotated by the approximate rotation angle so that only the marker elements are detected for reading the data, and in identifying the origin of the marker. Bounding boxes are used as masks for extracting the relevant marker areas from the adaptively binarized image [6]

2.3 System Design

1) Camera: The marker is placed in front of the camera and it captures video and sends it to the computer. Marker based Application system software on the computer searches through each video frame from camera feed.

2) Capturing Module: This module captures the marker with its four edges by differentiation black and white colour.

3) Image Processing Module: Image processing is process where image is scanned by the camera and it uses computer algorithm in order to avoid noise signal distortion etc.



4) Tracking Module: It is one of the fundamental components of augmented reality. In visual tracking, the system reduces the pose of the camera based on observations of what it sees. In an unknown environment, this is challenging; it takes some time to collect enough data to be able to deduce the pose and then the calculated pose estimation easily drifts over time. As the environment is unknown to the system, the system selects the orientation of the coordinate axis at random, which may be inconvenient for the user. In addition, it is impossible to deduce the correct scale solely based on visual observations. One solution to overcome these challenges is to add an easily detectable predefined sign in the environment and use computer vision techniques to detect it. A marker is such a sign or image that a computer system can detect from a video image using image processing. This approach is called marker-based tracking, and it is widely used in AR The tracking module is "the heart" of the augmented reality system; it calculates the relative pose of the camera in real time.

5) Rendering Module: The Rendering Module merges the original image and the virtual components and fetches the augmented image on the display screen of the mobile device.

2.4 Software Development Kit Process

Research and development team for an Augmented reality has created an augmented reality tool known as SDK, this Marker Based Augmented Reality Application SDK facilitates many components within the AR application such as AR recognition, AR tracking and AR content rendering. The identification component of the SDK works as the brain for the AR apps.

2.4.1 Developed Tech

Vuforia is a best example Augmented Reality software development kit (SDK) for mobile devices that enables the creation of Augmented Reality applications. It uses Computer Vision technology to recognize and track images and simple 3D objects, such as boxes, in real-time. This image Identification capability enables developers to position and orient virtual objects, such as 3D models and other media, in relation to real world images when these are viewed through the camera of a mobile device.

III. Conclusion

As discussed above this paper clears all doubt regarding the new "TeachEra-Marker Based Augmented Reality" and how beneficial and easy it will be for students, trainees as well as teachers including the new developed technology and techniques that can be acquired in doing so with this new Technology we can even help student who are Dyslexic or kinesthetic learners and giving them the new hope and vision in there

studies by making them virtually experience there studies as its often found that students with such difficulties often lose their interest in studies as books are not convenient option for them in studying.

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