# Innovative Learning and Entertainment tool for Kids using Augmented Reality and Virtual Reality

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**ABSTRACT** *In today's world, kids are very much familiar with the use of smart phones and use it majorly for playing games. The aim of this project is to develop an application which is fun and help them to learn new things as well. User will draw an object which will act as a marker and will be tracked by the camera. This object will be matched with the dataset and will augment the corresponding 3D model. It will also give 360⁰ view of the theme and corresponding relative information to increase their knowledge. The application will also consists VR mode, which when selected will create a complete virtual environment where the user can interact with the object using VR Headgear.*

***Key words:*** *Augmented Reality, Virtual Reality, Image targets, Data sets, VR Head Gear, Multiple Markers.*

## I. INTRODUCTION

Augmented Reality (AR) is a technology that layers computer-generated enhancements on top of an existing reality in order to make it more meaningful through the ability to interact with it.Augmented reality is a concept of supplementing the real worldwith the virtual world. Augmented reality system made possible in innovative way of information acquisition by providingadditional information of the virtual world to the real world.

AR apps are developed and used on mobile devices to blend the digital world into the real world in such a way that they enhance one another, but can also be told apart easily.

Augmented Reality is the technology to recognize an object visually and overlay the information about that object on the display screen over the picture of the object. The information in overlaying the object can be any digital information such as videos, photos, sounds etc. thereby connecting us with more meaningful content of our daily life. Such an applicationof AR is identified in indoor location identification. Here, the information is rendered over the image[1].Another application of AR is ABC3D, smart phone application to enhance literacy in preschool–aged children [2].

Virtual Reality (VR) is an artificial, computer - generated simulation or recreation of a real life environment or situation. It immerses the user by making them feel like they are experiencing the simulated reality firsthand, primarily by simulating their vision and hearing. VR is used to create and enhance an imaginary reality for gaming, entertainment and playing video or computer games, or 3D movies, head mounted displays. AR and VR are inverse reflections of eachother, VR offers a digital recreation of a real life setting, while AR delivers virtual elements as an overlay to real world.

The popularity of video games [3]suggests that video game are a way to tap into children's interests and promote reading. Augmented reality (AR) is on the brink to be an interesting and powerful tool for education. In this paper, we present an educational, mobile application that utilizes AR to encourage young children to practice drawing.

## II. BACKGROUND

The idea of incorporating virtual information into objects has been used for more than 20 years in fields, such as defense, medicine and aeronautics, gaming. Augmented reality is a term that was coined by Thomas Caudellin 1992. However, from mid-2008 with the appearance of smart phones, like HTC, Samsung or Apple it has reached the mainstream, taking advantage of all the functionalities that these devices provide. Augmented Reality (AR), for first time is accessible and all set to change the way people will interact with the world though it cannot really be called a 'new technology'. The history of mobile based augmented reality dates back all the way to the early 50's. In 1957, a gentlemen,

Morton Heligstarted building a machine called the Sensorama. It was designed as a cinematic experience to take in all your senses and, shaped, rather like arcade machine from the 80s, vibrated the seat you sat on, it blew wind at you, played sounds to your eyes and projected a form of a stereoscopic 3D environment to the sides of your head and in front. It was supposed to be moving and extraordinary with its sample film of a cycle ride through the streets of Brooklyn but it never sold commercially.At that time it was not easy to make films because of They were much expensive. The problem of cost arisedbecause it involved the camera man having two to three cameras strapped to him. But considering full virtual reality, it was really more an adventure, both the devices which are between environment and user were elements of ARand it is a fact that the environment created was, the real world itself which is viewed in a real time situation - even if it is recorded.

The first computer based application of the technology was Videoplace which allowed people to interact physically with a virtual environment. Many other applications have been developed using augmented reality and virtual reality, which has come to define as having three main components as,

1. Mixed Reality is a combination of the real world and virtual world so that the actions which happen in real world have virtual world significance.
2. It provides real time interactivity because of which the virtual world adjusts pretty much instantly to the actions that happen in real world.
3. The responses that happen in virtual world are provided in 3D which is the one standard generally not implemented in mobile augmented reality.
4. Complete virtual world where user can interact with the components of the virtual environment.

In today's world where AR and VR are trending technologies, many applications exist with solely AR or VR functionalities. But there are very few (less than 10) applications on playstore that has both AR and VR functionalities included under one roof.

## III. RELATED WORK

Augmented reality can be defined as “a situation in which a real worldcontext is dynamically overlaid with coherent location orcontext sensitive virtual information”. Wu et. al’s review of the AR literature [5] established that AR possessesaffordances useful for education like to be able to viewcontent in 3D format and experience it.

AR is a way to provide students with a situatedlearning experience rather than “skill and drill”experiences that abstract the learning away from its usage according to Klopfer squire’s study.Their work developing the game Environmental Detectivesoffered support for AR allowing situated experiences thatmight otherwise be dangerous, expensive or impractical.

Children andtheir interaction with AR in class using a “virtual mirror” interface [6] of the earth and sun’s rotation is studied by Kerwalla, Luckin, Seljeflot and Wollard. This interfaceconsists of monitor who is equipped with acamera and users are standing in front of it holding a special card. When the AR system recognizes this card then the 3Dimage is drawn on screen on top of it(card).Thestudents showed positive interactionusing this and enjoyed this technology but the AR implementation wasfairly limited and thechildren were regulated to a passiverole. The above-mentioned studies were conducted with upperelementary students. Our project proposes an extension tostudy AR interactions in early childhood. The rise of video games as a real and popular form of entertainment has provoked analogousacademic interest. Games as an area of interest for researchers has been championed by scholars such as James Gee [7] and Jonathan Alexander, who emphasize that gaming involves a “intricate use of multiple modes of writing” and a “variety of complex literacy skills”[8]. A study showed that video games trace on the important element of interest and can be used to catalyzelearning practices that often emerge surrounding games [9]. While this study was conducted with older and only male students (the above-mentioned study shows a clear gender difference in reading performance), we believe it gives priority to the idea of interest generated by games and the potential for games to act as literacy facilitators. Augmented Reality and Virtual Reality in combination with smartphones is not something new. There are many applications available that implement either AR or VR for smartphones. But there are very few applications with a combination of both. A lot of work is still going on and it has become a field of interest for the developers. There are very few applications on play store that has both AR and VR functionalities included in the same application. AR VR Dinosaur is one such application. In this application the 3D model corresponding to the selected dinosaur is

displayed in AR mode whereas in VR mode, the dinosaur is shown in virtual environment. This application is limited only to dinosaurs.

Our paper will be a considerable work in this field, with a combination of both Augmented Reality (AR) and Virtual Reality (VR) under same roof.

## IV. PROJECT DESIGN

In order to enhance the imagination and learning capability of children of age 3-8 years, we propose to design a smartphone application to attract children to interactive learning.

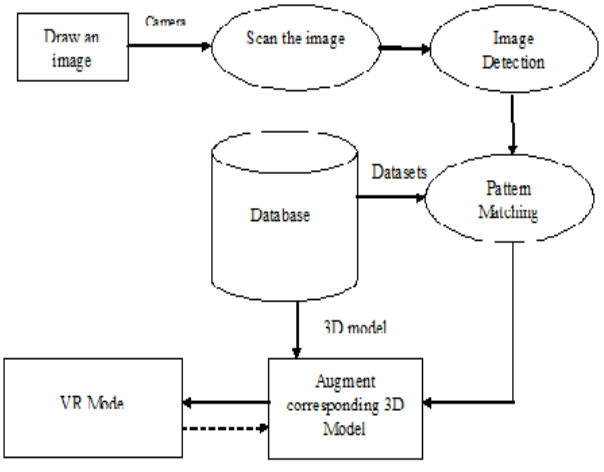


Fig. 1

Application consists of 3 basic modules:
1. Marker Identification - It identifies whether the scanned image is a valid marker or not.
2. Marker Detection(Pattern matching)-In this module, pattern i.e marker is checked whether it is present in the database or not.

The marker detection process is comprised by two main steps:

1. Detection of marker candidates. In this step the image is analyzed in order to find square shapes that are candidates to be markers. It begins with an adaptive thresholding to segment the markers, then contours are extracted from the thresholded image and those that are not convex or do not approximate to a square shape are discarded. Some extra filtering are also applied (removing too small or too big contours, removing contours too close to each other, etc).

2. After the candidate detection, it is necessary to determine if they are actually markers by analyzing their inner codification. This step starts by extracting the marker bits of each marker. To do so, first, perspective transformation is applied to obtain the marker in its canonical form. Then, the canonical image is thresholded using Otsu to separate white and black bits. The image is divided in different cells according to the marker size and the border size and the amount of black or white pixels on each cell is counted to determine if it is a white or a black bit. Finally, the bits are analyzed to determine if the marker belongs to the specific dictionary and error correction techniques are employed when necessary.

3. VR mode- In this mode, total virtual environment will be displayed.

### DYNAMIC COLORING ALGORITHM

In this algorithm, the image behaves as a marker. When this image is scanned by the application, corresponding 3D model gets augmented. But these models are in grey-scale. Dynamic coloring is nothing but the recognition of the color of the drawing dynamically and apply same color to the augmented model. This is done by means of texture mapping. A suitable color is picked from the texture map of the image scanned and applied accordingly to the 3D model.

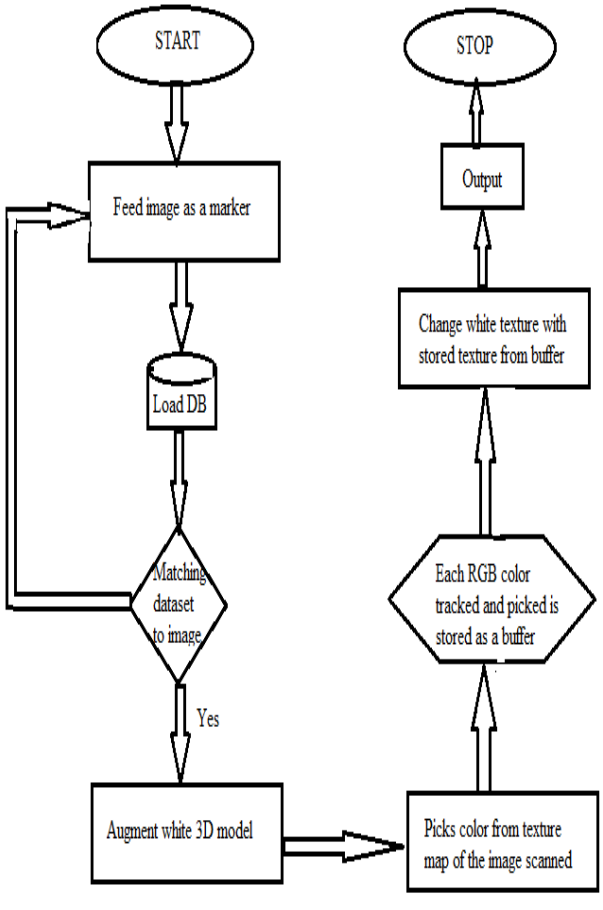


Fig.2

## V. EXPERIMENTAL RESULT

**INPUT:**

The input to the application will be an image or a picture sketched by the user (kid) which will act as a marker for the application to identify the object. The picture may or may not be filled with colors. Also the user need to give an input as to which mode he wants the application to operate in, i.e., AR or VR mode. Initially, the application, by default, will be in AR mode.

**OUTPUT:**

When the picture is scanned by the user using the application camera, it works as a marker. The marker on scanning is identified using the AR camera and the corresponding 3D-model gets augmented on the screen enhancing the user's view of object. If the object is colored, the model gets rendered with the colors in the picture (Dynamic Coloring) and if the object is not filled with any colors, 3D model is viewed in grey-scale format. User can also interact with the object and can view the object from different angles and positions.

In addition to the AR mode, user can also switch to the VR mode where he can actually interact with the object and its environment. On switching to VR mode, a complete virtual world is generated around the user which is totally different from the actual world of the user. To experience the VR mode user must have a Google VR headset. Now the user can actually get the feel of being in an environment which is completely isolated from the real world.

## VI. CONCLUSION

Mobile Based Augmented Reality is a rapidly growing field which shows a lot of promise for supporting both fun and useful tools. Its major challenge at the moment is to provide its users with as much functionality as possible without overloading the still relatively small computational power of most mobile devices.

Hence, the basic idea of building an android application which is based on learning as well as entertainment of the users will be implemented. An application will have combination of both AR and VR that will enhance the user's experience. It can also be used for educational purpose for better understanding of real world objects and learning with the additional information about the objects. 3D models will make learning fun for the kids.

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