# Software for Nextgen 3d Visualization in Augmented Reality

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*Abstract*— Augmented reality is a way of fusing the real and the virtual world by overlaying digital data on to real-world analog views. Augmented reality applications are appearing in diverse products like fashion and education. And what's more, anyone with a mobile phone or laptop with built-in video capability can augment and extend their reality with easy-to-use applications. There is a huge difference between reality and imagination. For example, buying a car includes looking at different models of different brands. Hence travelling to various showrooms for test drives has become outdated. Moreover, the retailer will be unsure about the customers' choice. The existing system requires time, energy and patience which nowadays are too precious to be wasted. In this project we are developing an interactive augmented catalogue to bring solutions for the above mentioned problems and to improve the seller-buyer relationship.

***Key words:*** Augmented Reality, Catalogue, 3D Visualization, Virtual Model

## I. INTRODUCTION

Augmented reality is an area of research that aims to enhance the real world by overlaying computer generated data on top of it. It is the ability to render 3D objects that do not exist or are difficult to create in the real world. The various characteristics of AR are mixing virtual images with the real world, 3D registration of digital data and interactivity in real time. The primary need of AR is due to its ability to add virtual components as part of the real scene and facilitates real time interaction between user, real objects and virtual objects. AR has the potential to improve human performance in the real world by adding pertinent information where and when it is needed. Applications generally use either marker-based approach or location-based approach. Information can be added in three primary ways. The first involves adding information that is not an integral part of the natural scene, as occurs. The second method adds information that is to be fused spatially, indistinguishable, and integral with the natural scene such as inserting a model into a scene. The third method consists of portraying information that is already in the natural environment, but is not immediately viewable without augmentation. Some of the applications of AR are Floor Map, Shopping, Gaming, Education, Defense, Interior Designing, Advertising, etc .

## II. RELATED WORKS

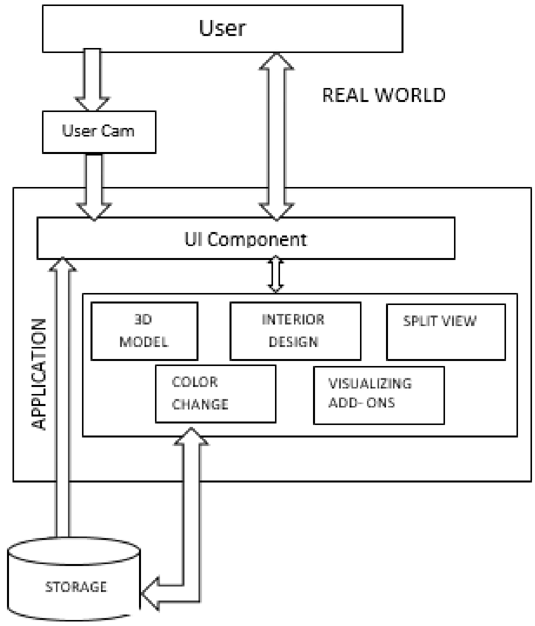
Rishabh et al [1] presented a new headphones configuration with two pairs of binaural microphones attached to headphones which focuses on enabling natural listening using open headphones the headset such that virtual sources are perceived as close as possible to sounds emanating from the physical sources. Zollman et al [2] showed how AR can support the flight management process for aerial vehicles and proposed FlyAR, an AR interface that superimposes the user's view with flight specific information for flight path planning as well as for the supervision of flight sessions. Sutherland et al [3] have presented an AR Haptic Simulation System with potential for spinal needle insertion training with the use of torso mannequin, a micron tracker optical tracking system which is a phantom haptic device. Granier et al [4] have put forth the concept of image based approach for outdoor illumination variations from videos captured with moving cameras. The algorithm used to detect and track feature points is KLT algorithm. Henderson et al [5] experimented with two HWDs and tracking was provided by NaturalPoint OptiTrack system, that uses passive retroreflective markers illuminated by IR sources in each camera. The participants' comments suggested that more objecteful work is needed to prevent occlusion during localization. Keshav et al [6] conducted within-participant and between-groups experiments where, by providing augmented coordinates as a cue for robot end effector guidance, path distance and reversal errors were reduced. Guan et al [7] suggested that instead of considering a global map, the map is to be subdivided into several sub maps and focus only on local areas. Registration is done based on super imposing virtual objects into the real world. Jong et al [8] proposes a system which will automatically recognize a location from image sequences taken of indoor environments, which is obtained from an already pre-constructed image database and location model. Brian et al [9] used AR to improve way finding performance in situations where users are unfamiliar with a particular space by providing facility to find the way. Dasgupta et al [10] attempted to build an economic PC-based panoramic vision system that renders in real time while maintaining high-resolution color imagery. The real-time constraint for the experimental setup requires that the stitched frames be presented faster than the retentivity of the human eye (1/12 s)

| Reference | Existing Technique | Possibility (in %) |
|---|---|---|
| [5]Henderson | Repair instructions in object | 90 |
| [7] T. Guan | Outdoor Tracking | 70 |
| [8]Kim | Adaptive Threshold | 10 |
| [4] Yanli Liu | Online Processing | 98 |
| [9] Hancock | Head mounted device (HMD) | 98 |

Table 1:

## III. SYSTEM OVERVIEW

### A. *Architecture:*




Implementation of AR based system encompasses four levels: user level, interface, application level and storage. User level corresponds to real world entities that include input- target images, scenes, text and voice forms. User Interface serves as a bridge between the user and the system. UI for AR applications can be designed using one of the many tools available. In general there are two types of user interface: Command Line Interface (CLI) and Graphical User Interface (GUI). In augmented reality, GUI is preferred over CLI. Application level is the one where the important operations of the system are objectried out. The primary module of the system is augmenting virtual 3D models upon the real world 2D scenes captured from the camera. Other modules might vary according to the needs of the user such as changing the colour of the model, changing background scenes and other functions. Storage is used for matching the target media with the desired functionality by storing all the 3D models, scenes and the required pattern matching criteria in order to overlay the object on the specific scene. The entities in the system are

- Admin - Designs the 3D models of real world objects and updates them in the database.
- User – Accesses the application by giving input, observes the changes made by objects that not physically present in the real world by placing their 3D models upon them.
- Database – Contains the target media and 3D models that are to be augmented in the real world.

### B. *Design And Concepts:*

#### 1) *3d Model:*

The 3D modelling module displays the 3D image of the scanned target augmented on the mobile screen. The target image of the object taken as the input and the appropriate 3D model is retrieved from the database and displayed to the user. This enables the user to get a feel of how exactly the object looks without having to see it physically.

Input: Catalogue

Algorithm:

1) Choose the target media.
2) Scan the target via user camera.
3) Recognize the target and augment the corresponding 3D virtual model over the real world

Output: Interactive Augmented model of objects listed in the catalogue

#### 2) *Color Change:*

This module furnishes the user with an option of viewing the various color options available for a particular model. On selecting a color out of those displayed on the screen, the user will be able to see the color of the 3D model change. This option allows the user to picture the object in the color of their choice.

Input: 3D model, Color Choice

Algorithm:

1) Perceive and project the model in default colour
2) Display the available colours and get the user's choice.
3) Change the colour of the model accordingly.

Output: Color Change of the 3D model

#### 3) *Interior Design:*

The interior of a object holds a number of variations. This module presents the user with the various alternatives available. On choosing a particular interior type, an image of how it would look will be rendered on the mobile screen.

Input: 3D

Algorithm:

1) Obtain the user choice.
2) Switch camera view and coordinates to the model's hollow interior with parts attached to it.
3) Project 3D arrows pointing to each part with tiny labels.
4) Perform translation, scaling and rotation of nthe pasrts to get the feeling of an actual object.

Output: Visualizing the selected interior type of the 3D model

#### 4) *Visualizing Add-Ons:*

A number of exterior accessories are available for objects like bumpers, mud guards, door and bumper guards, handle covers etc. The users can customize and decide on the appearance of their objects by virtually viewing how the add-ons would look. After selecting the required components, the user will be provided with a 3D model of the object along with all the attachments.

Input: 3D model, Add-ons

Algorithm:

1) Display the augmented model and the available attachments.
2) Get the input from the user.
3) Append the choice to the 3D model.
4) Repeat step 2 and step 3 if required.
5) Display or capture the final image.

Output: Augmenting the model with the selected add-ons

#### 5) *Splitview:*

The split view allows the user to view and compare two models on the screen by splitting the screen view. Each of which is capable of implementing the other 4 modules independent of each other. These enhancements are a direct result of the excellent feedback.

Input: Two 3D Models

Algorithm:

1) Highlight the two models selected by the user for comparison
2) Split the screen vertically into two parts and import the models into each part.

3) Provide the functionality available in the remaining modules to each model.
4) Perform comparison by changing camera view and saving screenshots.

Output: Split screen displaying both models in its own spaces

## IV. RESULTS AND DISCUSSIONS

### A. *Test Setup:*

Experiments on the proposed system are performed using graphical catalogue. Images were captured at the rate of a number of frames. The images are converted into digital forms of minimum size 320x240 pixels upon which the augmentation takes place. The experiment was performed on mobile phones with platforms like Android, iOS and Windows (making the application to be cross platform). The basic requirements that the phone is expected to have in order to conduct the experiments are a touch display screen with a minimum size of 5 inches and a camera with a minimum of 5 Mega Pixel. Also the same can be performed with Personal Computers and Laptops with optimum camera quality and Graphics Card. The simulation needs the basic version of OS or above.

### B. *Screenshots:*

Fig. (a):

Fig (b)

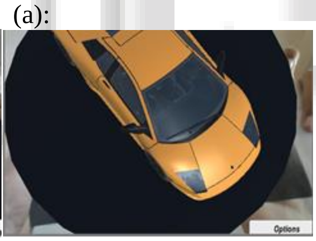


fig (c)

The 3D model is visualized. The catalogue may contain real world objects like cars, furniture, buildings etc. fig (b) displays the 3D model that is projected over the real world catalogue. Fig (c) is the enlarged view of the virtual object

| Cases | Input | Process | Output |
|---|---|---|---|
| 3D Model | Catalogue (Image) | Scan the image, get the coordinates and convert into 3D model | 3D Virtual Object |
| Color Change | 3D Virtual Object | Change the color of the object based on the user choice | Color variation |
| Translation | Virtual Object | Change the position of the object. | Relocated object |
| Resize | Virtual Object | Get the position of the object and change the size according to user choice | Enlarged or diminished 3D Object |

Table 2: Test Cases

## V. CONCLUSION AND FUTURE WORK

The system is designed to input predefined images or text by scanning them and presenting with an augmented showroom of the catalogue. It only works for predefined targets and models. In case the system is to be expanded the models need to be entered into the database and the functions for the features required of the model are fed to the system by the admin. This system is mainly based on "Offline" application which consumes a lot of system's memory. In future this memory can be released by making use of cloud, by storing the application and also making it possible to get updated about latest models when released, by the manufacturer.

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