Sri Lanka Institute of Information Technology

Marker-less Augmented Reality Interactive Furniture Layouting

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Project Proposal

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Declaration

We the project group hereby declare that the project work entitled “Marker-less Augmented Reality Interactive Furniture layouting” submitted to the Sri Lanka Institute of Information Technology, is a record of original work done by our group under the guidance of Mr. Udara Samaratunge (Supervisor) and Mr. Tharindu Perera (Co- Supervisor), and this project work is submitted in the fulfillment for the award of the Bachelor of Science (Special Honors) in Information technology Specialization in Software Engineering. The results embodied in this project proposal have not been submitted to any other University or Institute for the award of any degree or diploma. The diagrams, research results and all other documented components were developed by our group and we have cited clearly any references we have made.

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Abstract

Designing and marketing of furniture according to the exact requirements of the customer has always been a pending problem in the furniture industry. Customers end up making do with what they get even though that product may not meet their expectation. As of yet no system has been implemented to overcome this problem. The proposed System will comprise of a mobile application which will utilize Augment Reality technology to produce 3d models of the furniture to the customer beforehand and a web-portal for dealer to upload detail related to their product. The mobile application can be used to retrieve 3d models of furniture which can be placed and view through the mobile camera in the location where users wished the real furniture to be place. Allowing them to customize furniture and identify if the furniture they are going to purchase, has the right scale, colour or design to match their home. This new system will drastically reduce the issues that customer face when purchasing, and is more profitable for dealer who will be using this system.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1. Background

Furniture manufacture is a vast industry with count-less variations implementation methods and designs. This variations of designs make the marketing of products very complex and cumbersome. Furniture manufacture is a large sub sector within the industries in Sri Lanka. Household furniture is made to look strikingly elegant and comfortable to use; this includes furniture for the bedroom and living room, kitchen furniture as well as any other relevant household or company space.

The marketing aspect of the furniture industry continuously faces a strenuous task of satisfying the customers' demand. Designing furniture according to the exact requirements of the customer has always been a pending problem in the furniture manufacturing industry. Customers who also request ready-made furniture will not know if the selected furniture actually suit them till it has been bought and placed in their home. If they are not satisfied with the furniture they will either refund it or if it cannot be refunded, will have to make do with it. This results customer dissatisfaction as well as the decline of marketability for products.

The Proposed system utilizes a technology call Augmented Reality (henceforth referred to as "AR") which uses a mobile device's camera to superimpose a computer-generated image or 3 dimensional (henceforth referred to as "3D") model on to a user's view of the real world. The traditional Augmented Reality tools which were used until now relied upon a pre-defied marker (A image or pattern in the real world) on to which the computer-generated object can be placed. The proposed system will be utilizing the AR technology but will move a step forward in the direct marker-less tracking. This as the name in itself defines will not use pre-defied marker for tracking, instead this technology analyzes the user's surrounding and define track points which can then be used to lock 3D models into place. This method will provide user with greater mobility and allow him/her to view and customize the placed object in any direction and distance without always having to focus on a marker.

The Proposed mobile application will be utilizing Marker-less AR for furniture placement, customization and interaction.

1.1.1. Existing Products

- Augment

Figure 1 : Augment Vendor Logo

This is an application for sellers to showcase their product catalog in augmented format to customers. After downloading the free Augment app, customers can scan a specific brochure (Marker) to try out all the products offered by the seller in scale in augmented reality before buying.

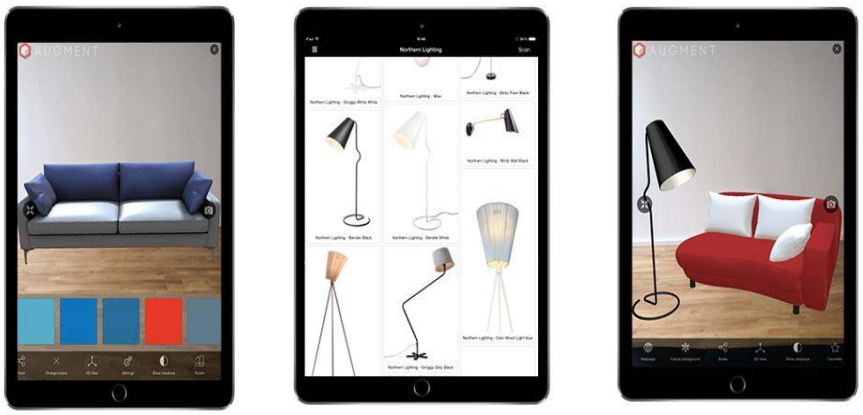


Figure 2 : Augment Application Screenshots

- VIUTEK-uDecore

uDecore is our customisable 3D Room Planner utilising a patent pending Augmented Reality technology for iOS devices. It can visualize multiple photorealistic 3D items to create stunning room planning configurations for kitchens, bathrooms and living rooms.

uDecore can support hundreds of furniture models that can be customised and placed in a virtual 3D room planner. Users can take snapshots of their designs and share them with family and friends. The furniture models can be permanently stored in iOS devices or downloaded from a server.

Figure 3 : uDecore application screenshots

- Sayduck

  Using Vuforia, Sayduck developed a series of product visualization apps enabling consumers to see all kinds of products - from sofas to sinks - within their homes or offices, thereby helping them to make better-informed purchasing decisions, as well as allowing products to be purchased directly from within the app.

  High-end furniture manufacturers and retailers immediately grasped the value of having such virtual showroom apps. Not only would they alleviate the burden of stocking large, expensive items in every color and material, they would make shopping more personal and productive.

Figure 4 : Sayduck application screenshots

- Augmented furniture

The Augmented Reality tool allows you to visualize your selection of objects inside your own room and to make a better evaluation of how it will fit in your own living room.

Once you have found the furniture that fits better in your room you can start configure it choosing your favorite setup, color, material or texture or you can combine it with other objects to complete the décor of the interior.You can then save your configured object in your wishlist and share it with your friends.

Take a screenshot of your furnished interior and send it off via Email, Pinterest, Twitter or Facebook and collect comments and reviews from your friends. They will help you choose the right product for your needs.

Figure 5 : Augmented furniture application screenshots

1.1.2. Existing products against features comparison

	Augment	VIUTEK uDecore	Sayduck	Augmented furniture	Proposed solution
Marker-less AR	✓	✓	✗	✗	✓
Support multiple objects	✓	✓	✗	✓	✓
Support customization of objects	✓	✓	✓	✓	✓
in-app user Feedback	✗	✗	✗	✗	✓
Suggestion features	✗	✗	✗	✗	✓
Voice recognition	✗	✗	✗	✗	✓
in-app purchasing	✗	✗	✓	✓	✓
Augmented Object Details	✗	✗	✗	✗	✓
Support Android	✓	✗	✗	✗	✓
Scale detection	✗	✗	✗	✗	✓

Table 1 : Existing product comparison

By using our proposed kind of system users can gain more benefits.

- Less burden on furniture transporter
  As 3D furniture models are provided for the customer prior to purchasing the actual product the customers will have ample time to decide whether furniture they selected actually suit them.

- Increase of customer satisfaction
  As the mobile application will be easily operable, and the system will provide suitable suggestions, the customer satisfaction will increase.

- Increase of Profitability
  The dealers who will utilize this system will get the opportunity to further identify the customers exact likes and dislikes while increasing the sale of product as well as reducing the cost accumulated due to transport or decrease of quality due to return of item.

- Retain Customers and Improve customer service
  Improve dealer efficiency and customer service by ensuring to provide all necessary details (customization options, price, and details of making) to customers beforehand.

- Motivation and improve of customer feedbacks
  As customer are allowed to customize the product to meet their needs, each customers' opinions and ideas can also be obtain.

- Improvement to quality of products
  Customer feedback results in improvement of quality of product.

1.2. Literature Survey

The present Augmented Reality Technology can be divided into two distinct field of study as; Marker-based Augmented Reality and Marker-less Augmented Reality. The field of marker-based Augmented Reality relies upon a predefined target "Markers" (A real-world image or Pattern) onto which digital images are augmented. The Marker-less Augmented Reality as the name itself states deviates from the prior mention field wherein this does not use "Markers". Marker-less Augmented Reality relies on tracking features [1] (distinctly identifiable location such as shapes, edges and point) of the area of the real-world retrieved on run time and data from device sensors to identify the position onto which digital images are augmented. Several techniques have been research in Marker-less AR [2], [3], [4] regarding how to effectively map and retrieve features for real-world.

Simultaneous Localization and Mapping (SLAM) is an approach which was originally used in environment mapping for robotics [5], which was latter improved for computer-vision based applications such as AR. since then several methods have been used for achieving SLAM some of which are [2], [3], [4]. Parallel tracking and mapping (PTAM) [2] used a key-frame based Mapping framework which is PC-based, due to this factor PTAM can be used for mobile implementation but with a certain amount of limitations as stated in [3]. Fast-SLAM is another algorithm [4] used to tackle the issue of concurrent mapping and localization. This method has been proven to be operation with small number of features making this a more favorable method to be used in mobile applications.

Therefore we concluded on utilizing Fast-SLAM based software development Kit (SDK) "KudanAR" as the base for implementation of the 3d scanning and mapping for our solution and combining with other techniques such as extended Image tracking and indoor location tracking (explained further in methodology), to overcome drawback which were not addressed in the Fast-SLAM algorithm and the SDK itself.

Another Research area in proposed system is Indoor location tracking. The key part of this system is mapping the indoor environment as it will be the input for all other subpart of the system. Sisi Zlatanovaa, George Sitholeb, Masafumi Nakagawac, Qing Zhud[1] considered existing and emerging problems in indoor mapping. Tough the system based on augmented reality they concluded that in order to transfer more information to user system must use new visualizing techniques.

C. Holzmann and M. Hochgatterer[2] found a way to measure dimensions of objects using mobile camera by determining the distance between the camera positions. They observed that lighting conditions and unintentional device rotations influenced the results. A “baseline” is used to estimate which is based on the accelerometer reading in combination with the gyroscope data and increasing the baseline leads to high accurate results. The device must contain both gyroscope and accelerometer in order to perform.

Mahdi Momeni-K., Sotirios Ch. Diamantas, Fabio Ruggiero and Bruno Siciliano[3] estimated the height of an object by getting use of height , pitch angle of the camera(respect to the ground) and the focal length of the camera (using a single camera).

Another research area in the proposed system is the image processing; which is utilized in the furniture suggestion feature (Explained further in methodology). The color model plays a prominent role during the image processing whereas according to Gonzalez, R.C. and R.E. Woods [6] there are three main models used in modern day computer vision applications. Namely RGB, HIS and CMYK. Each and every model has a different impact on efficiency of image processing. Throughout our project we are using RGB color model which will be an advantage in separating red, green, blue color channels.

During image processing each and every pixel need to be analyzed for its intensity values. Previous research has been conducted by Chhaya S.V., Khera S., Kumar P., [7] revealing how image can be analyzed to capture the intensity values is conducted only for similar single colored image. During this methodology we are supposed to analyze images with different color combinations.

Number of researches has conducted for efficient image processing with use of the Graphical Process Unit (GPU) [8] which need super performance in processing. But since we are aiming for mobile devices, the required performance for such methodology could not be achieved in our project.

The next research area include voice recognition and augmented audio. The android voice recognition system, according to Yu Zhong, T.V. Raman, Casey Burkhardt, Fadi Biadsy and Jeffrey P. Bigham [15] has an android universal voice control assistance running on devices by synthesizing set of command from on-screen context, and it supports chaining of multiple

command in same utterance. It is utilized for commonly used mobile applications .i.e. Sending emails, calling, opening applications, but what our solution utilizes is voice recognition for customization. The voice commands that will be applied in our application to do tasks, within the application's environment and not in global environment.

Augmented Audio is a wide area to research, in our project we are focusing on how to apply in augmented audio to Imaginary 3-D model that exists in augmented world for android mobile devices. Augmented reality audio can be used in two main ways one is as a part of aural augmentation, and the other as part of User Interface. As an assembly demo [16] the system will give feedback with beeps. According to LookTel [17], the visually impaired better understand the augmented environment which is smart phone applicable. There taking into account these factors and combining in this application we will be using augmented audio as a means to narrate the details of 3D furniture.

1.3. Research Gap

Sri Lanka is lacking behind providing a better customer satisfactory solution for prior mentioned problem. Several researches have been carried out in fields related to similar problem but no practical solution was proposed as of yet. When considering Augmented Reality, solution propose were based on predefined markers (A image or pattern of the real world pre-stored in a database) when compared and detected in the real world on which augmented 3D objects are displayed. The current solutions which are offered for marker-less AR lack the reliability and support necessary to be use in mobile applications.

Also present days finding a suitable furniture that matches with the surrounding of the area that someone supposed to keep the furniture is problematic. It may be because of non-matching colors, furniture shape or because of the space limitations in furniture placement. Among those issues the color of the furniture plays a prominent role where the issues can be minimized by selecting a matching furniture at first place.

Another Research area Gap is though we use mobile camera for capturing scenes taking dimensions of each object that present in the scene is bit of troublesome because taking those dimensions depend on many factors like focal length of camera height of the camera view etc. Deriving dimensions like height width and length form a camera feedback is another key point of this application.

Also many augmented reality applications shows a way to purchase a product, meaning augmented reality is used to simulate the experience of that object so that customer can make the purchase later. So that making this two way process into one by including the purchasing part while getting the experience is effective way to sell product.

Moving on, Today, society is more familiar with voice command and voice recognition systems. When it comes augmented reality field it is more suitable to use voice command. In Android Environment does not provide a direct means to recognize voice inputs. Therefore the device cannot recognize the speech to overcome this we need to use a different approach.

“Marker-less Augmented Reality Interactive Furniture layouting” will be offering solution taking into account all the prior mentions research gap to over-come the issues customers face when purchasing furniture.

1.4. Research Problem

Designing furniture according to the exact requirements of the customer has always been a pending problem in the furniture manufacturing industry. Customers who also request ready-made furniture will not know if the selected furniture actually suit them till it has been bought and placed in their home. If they are not satisfied with the furniture they will either refund it or if it cannot be refunded, will have to make do with it. This results customer dissatisfaction as well as the decline of marketability for products.

The main area of research is to find an augmented reality solution for placing 3D furniture in runtime defined real world environments. The solution needs to be mark-less, stable, supportive wide-range of devices, user-friendly, secure and consistent. The current augmented reality solutions does not provide means in which to properly utilize marker-less augmentation. This research based project tries to identify methodologies to provide marker-less augmented reality on a mobile platform and provide a solution where customers can view and customize 3D furniture on their desired location and identify whether the relevant real furniture might actually suit the location.

2. OBJECTIVES

2.1. General Objectives

- Provide customers with a mobile application that provide 3D models of furniture which can be placed in their home to identify where it suit them before purchasing actual product.
- Provide a means to customize the furniture with the respective customizations provided by the dealer.
- Voice recognition feature to allow customer the ease of customizing 3D models placed in the scene.
- Provide a suggestions feature that identify the real world location's main colour and provide furniture suggestion to suit it.

2.2. Specific Objectives

- Scan the real world environment and provide data necessary for marker-less AR.
- Identification of position and scale of object with respect to the surrounding.
- Provide means to add multiple object onto the environment.
- Identify and record colour histogram to be used in suggestion for furniture.
- Suggestions feature which identify prominent colours and recommend most suitable furniture for the environment.
- Track the object and apply the voice commands for tracked object by identifying customer's voice.
- Provide customizing options via Voice command system.
- Provide details in augmented voice format. (Text to Voice)
- Provide a web portal for dealer to upload the furniture and their respective customization features.
- Provide details of furniture (Prices, Measurements, and any relevant details) next to the respective 3D furniture in the augmented environment.
- Provide services that allow filter furniture search based on budget and other space specifications.

3. RESEARCH METHODOLOGY

3.1. System Diagrams

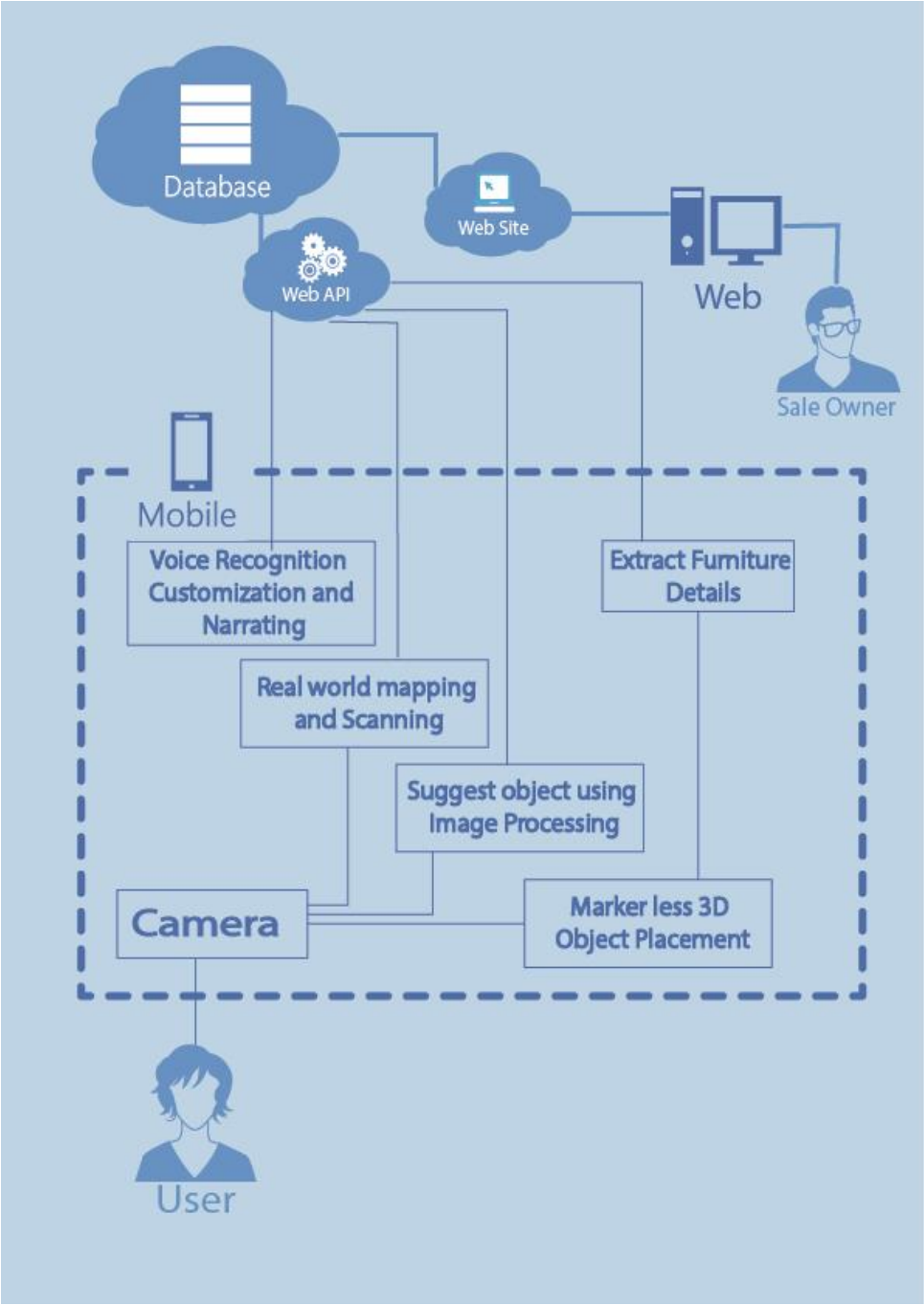


Figure 6 : System Diagram and Mobile Application System Diagram

3.2. Overview

The Final outcome of this research project will produce a mobile system that can be used to augment 3D furniture at real scale onto real world without predefined markers and be able customize those said furniture through an augmented interface or voice commands with the options provided by the dealer. Main development areas and their sub sections are as follows.

SLAM based mapping of room

- Obtaining tracking features of the location that is to be augmented
- Store the data obtained in a database
- Identify the scale of the location
- Handling multiple 3D objects at the same instance
- Match the scale of furniture to the real-world environment
- Provide augmented interfaces with information relevant to the furniture

Scale identification of Real-world objects

- Retrieve the camera properties in the mobile
- Identify the distance between camera and the real world object
- Calculate and match the 3D object's scale to the real world

Furniture Suggestions

- Identify the prominent colours present when scanning the environment
- Upload the colours onto a web-service and analyze the colours against the furniture
- Provide recommendation of furniture with respect to the analysis done

Voice Recognition

- Identify specific voice commands and provide relevant output
- Identify the users proximity to each 3D object
- Isolate the voice commands to the 3D model the user is currently focusing on
- Text to speech to dictate the information of furniture

Web Portal

- Provide location for registering dealer's company
- Provide location for uploading 3D model of furniture
- Provide location to insert details with respect to customization of furniture
- Identify and Handle each furniture and their respective customizations

3.3. Software Development Life Cycle

The software development methodology which is going to be used as the process of development of the system is Agile Scrum. Agile Scrum methodology facilitate more flexibility to software development as it allows for requirement change to be handled with ease throughout the process of development. Since research projects are associated with a lot of changes it is hard to follow a set sequence of development such as the waterfall model. Scrum concentrates on task management within a team based environment. As this project is done by a group of four members this methodology will help to team to perform all the formal and informal activities and to solve problems faces by individual members as well as facilitate common understanding of each area of the project by conducting regular meetings.

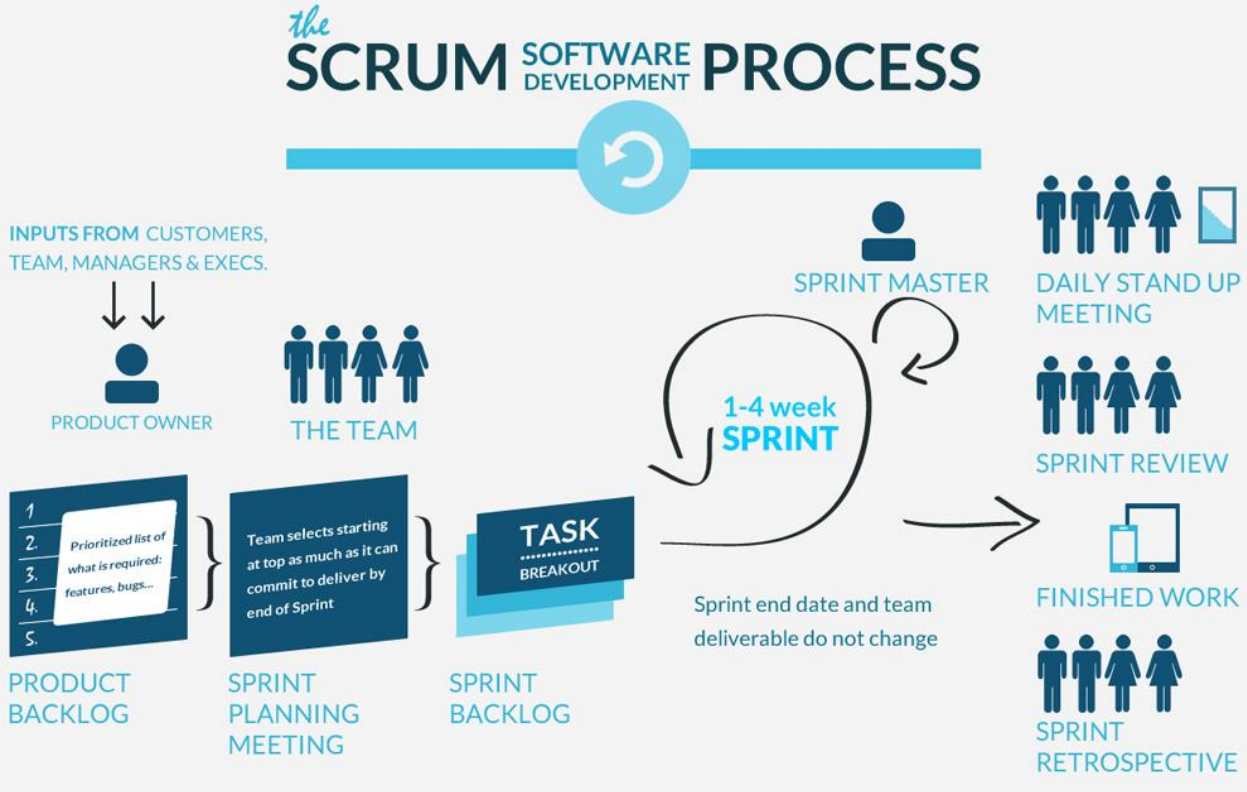


Figure 7 : Agile Scrum Development Life Cycle

3.4. System Description

3.4.1. SLAM based mapping of room

Simultaneous Localization and Mapping (SLAM) is a technique which was originally used in environment mapping for robotics [5], which was latter improved for computer-vision based applications such as AR. since then several methods have been used for achieving SLAM some of which are [2], [3], [4]. Parallel tracking and mapping (PTAM) used a key-frame based Mapping framework which is PC-based, due to this factor PTAM can be used for mobile implementation but with a certain amount of limitations as stated in [3]. Fast-SLAM is another algorithm [4] used to tackle the issue of concurrent mapping and localization. This method has been proven to be operation with small number of features making this a more favorable method to be used in mobile applications.

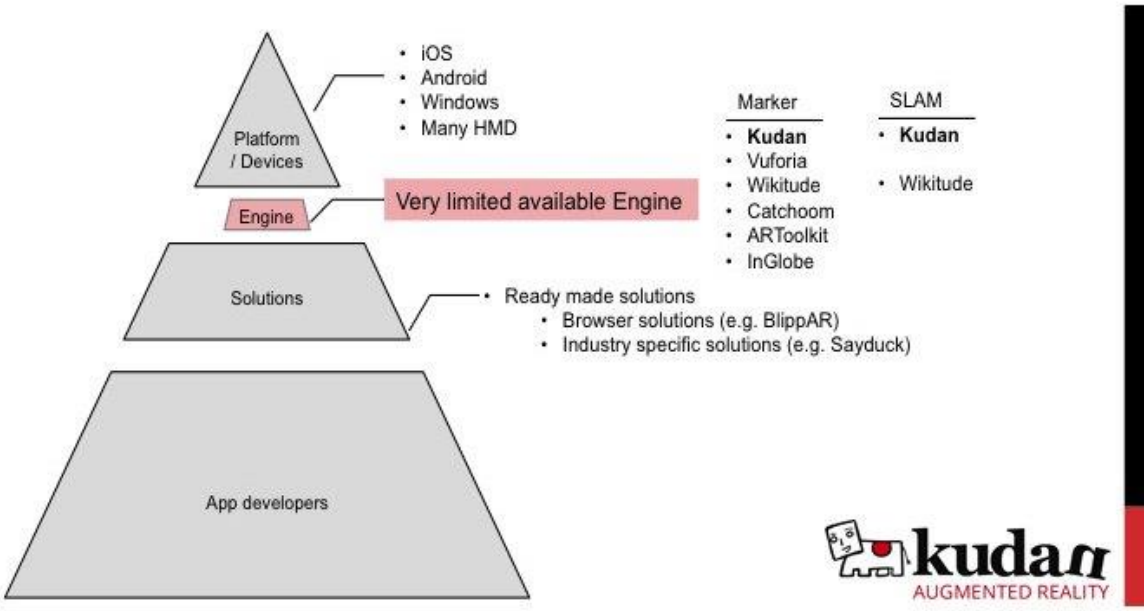


Figure 8 : Augmented Reality Technology Provider Pyramid

Of all the technologies which offer Augmented Reality solution very few had offered solution for SLAM technology. Wikitude and Kudan are at present the only leading SDK provider to have

offer Solutions for SLAM marker-less AR. Wikitude has achieved SLAM with an approach know only to them while Kudan has achieved SLAM through a Fast-SLAM approach (A recently introduce and developing technology).

In this project we will be using utilizing Kudan SDK paired with Unity 3D for developing and mapping real-world environment.

In order for the Simulate a realistic augmentation we have to access the mobile device sensors. Latest device in the market now consist of Magnetometer (used in applications such as compass), Accelerometer (used in applications to identify the orientation by rate of acceleration) and gyroscope (used in applications to identify the orientation through rate of rotation). By utilizing each of these sensors we can improve on the basic foundation laid by marker-less Tracking.

We start off by aim the camera at a specific location in the real world where we would like to project the 3D object on to. When the user clicks on a button (command) to place the object the system should immediately retrieve and analyze several factors of data. These are:

- Identifying distinct feature in the environment to be marked are tracking features
- Identify the direction the user is facing (utilizing magnetometer)
- Identify the floor orientation (utilizing a combination of accelerometer and gyroscope)
- Identify Scale of the environment

These factors need to be processed and assigned/linked with the 3D object which been placed in the environment.

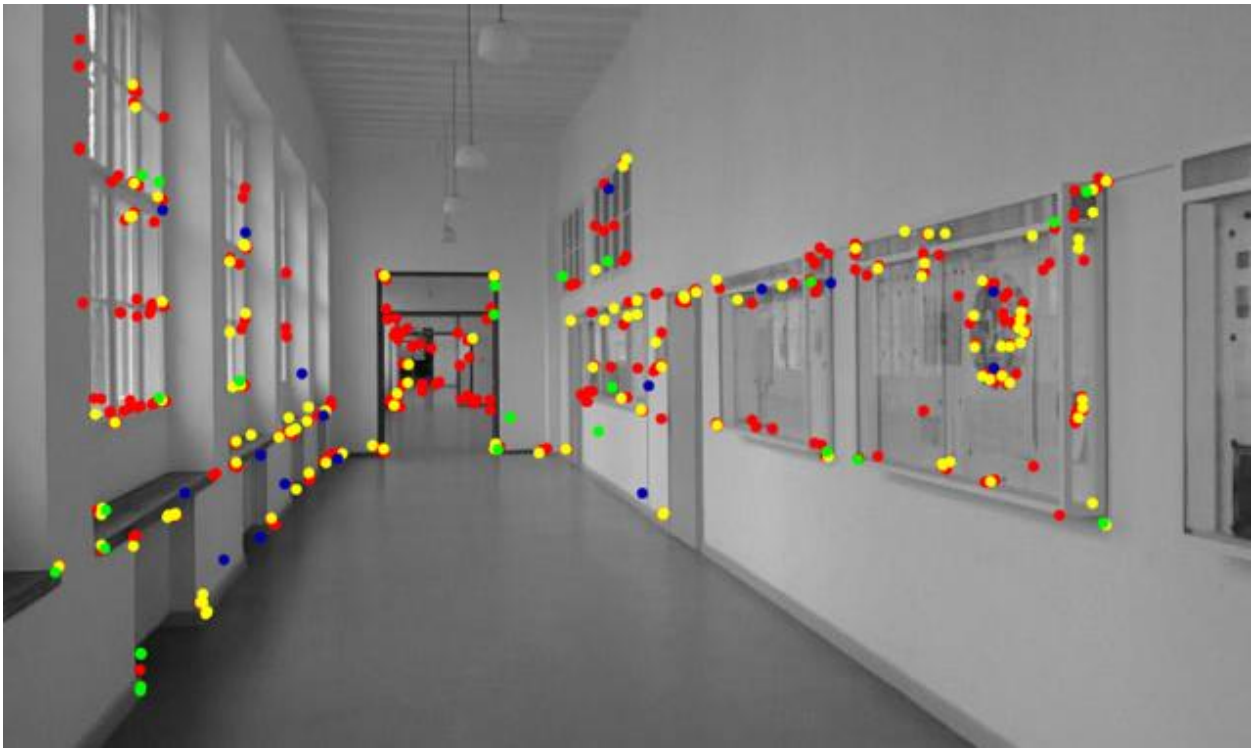


Figure 9 : Tracker-able feature detection example

Figure 10 : Kudan's Marker-less object placement example

The Next step is to continuously identify tracker-able feature in the environment. Kudan's SDK offers an Arbitrary Tracking method which initializes instantly without having to move the device to different viewpoints. The advantage of this been the user does not have to scan the whole environment begin start in order to place the 3D object. But the disadvantage of using arbitrary tracking is that it only track features which it has initial recognized. This result in limiting the number of view point the user can use to view the 3D object without the tracking been lost.

The solution to overcome this would be to identify the point at which the tracking might get lost and to compensate for it till a new tracking location is found. For example if we were to say the number of features detect from the view point is at present is less than 10%, then scan the present view point to location new track features which were not already recorded. By this method we can iteratively increase the tracker-able feature identified by the camera and at the same time avoid tracking loss. This method will also help in managing the maximum number of features we can use by allow to remove any features further away from the camera location, which in turn helps to avoid any performance impact that might occur.

3.4.2. Scale identification of Real-world objects

This component plays an effective role in the system to map the indoor environment to the actual scale because the customer must get the real experience of the real object through the 3D object which is projected. According to the Sisi Zlatanovaa, George Sitholeb, Masafumi Nakagawac and Qing Zhud[9] considering new methods of augmentation; new visualizing technologies can be made in order to transfer more information to user.

As this application is a mobile application limited resources are available. According to Holzmann and M. Hochgatterer[10] We can use mobile phones which are equipped with just one camera by determining the distance between the camera positions, from where the two pictures are taken and the lighting conditions and unintentional device rotations influenced the results.

Without going for two camera positions Mahdi Momeni-K., Sotirios Ch. Diamantas, Fabio Ruggiero and Bruno Siciliano[11] found a technique for the estimating the height of an object

using a single camera view by getting use of height and pitch angle of the camera with respect to the ground and the focal length of the camera.

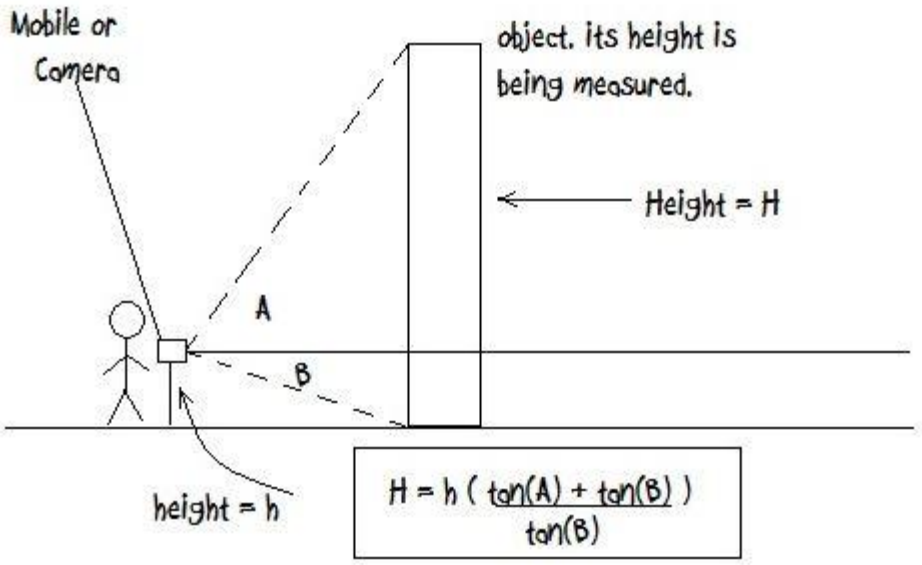


Figure 11 : Identification of object height with respect to person's height

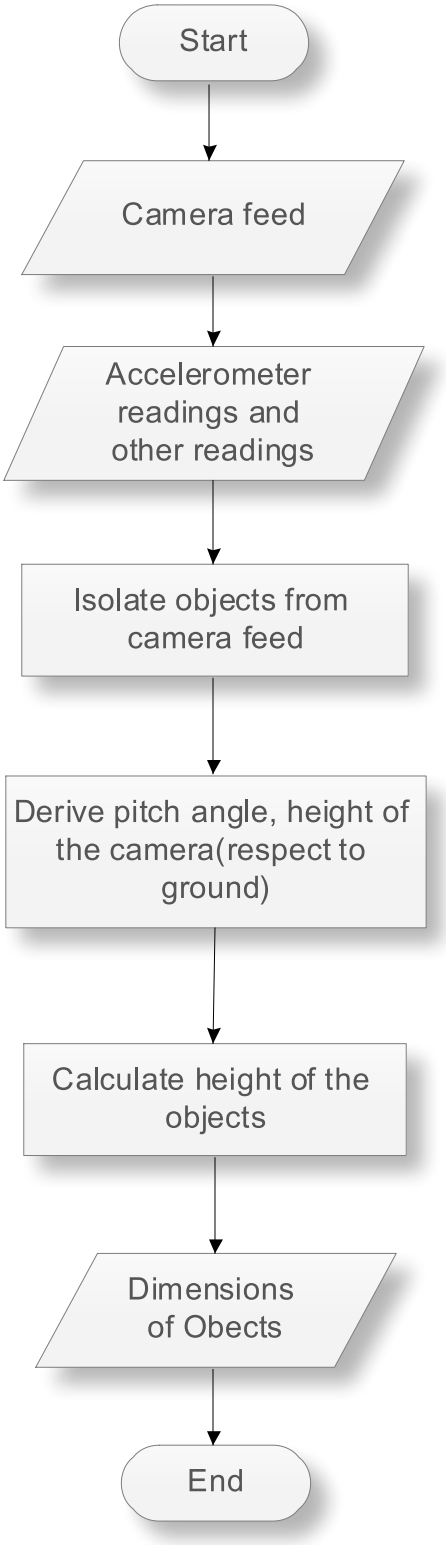


Figure 12 : Flow chart for scale identification

3.4.3. Furniture Suggestions

This component will act as a user aiding component or helping system in finding a suitable furniture that matches their desires. The component will automatically suggest furniture based on the color patterns in the area and based on the previous user ratings.

An image can be of one of different color models. According to Gonzalez, R.C. and R.E. Woods [6] there are main three color model types used mainly on modern day image representation, analysis and interpretations. The RGB model is used for monitors and video cameras while CMYK used for printing purposes. The HSI model is closely similar to human interpretation of colors. We use BITMAP image format which uses RGB model for represent an image where we can separate red, green and blue color channels in order to identify the colors used in each pixel.

Once the image captured by the imaging sensor it will be converted in to a binary string and pushed into the main server where the primary image processing carried out.During image processing each pixel in the 2D finite image matrix will be analyzed and the overall color of the image will we saved. According to Chhaya S.V., Khera S., Kumar P., [7] in their research three matrices are created for red, green and blue from the image and all the pixels are compared with each other pixel. If a particular image have a large value for red and zero values for green, blue it is treated as red image. Similarly for the other two colors green and blue. In their methodology they have used plain single colored images during image recognition where in our method we have to analyze different RGB color patterns in a single image. This process involves analyzing each RGB intensity values and generating an output taking most prominent colors used in the image.

According to Bhavneet Kaur and Sonika Jindal [8] Content based image analysis can be implemented using CRIB method. That method analysis the content of the image where in our method we analyze image metadata such as color, textures. The main drawback of this CRIB method is that it needs higher Graphical Processing Unit (GPU) power to perform the calculations. As we are designing the application for mobile devices we can’t afford that much hardware performance for CRIB methodology. Because of that we analyze metadata of the image which will be able to perform with the performance of a mobile device.

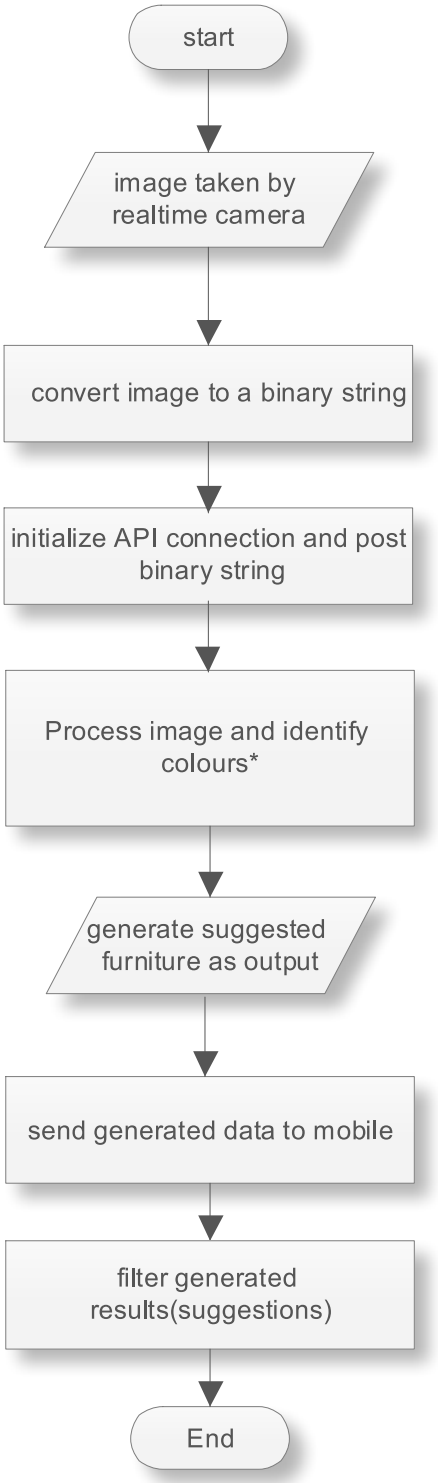


Figure 13 : Furniture suggestion Flow Chart

3.4.4. Voice Recognition

This component helps the user to customize the items according to their voice recognition and help the user with narrating detail of furniture through augmented Audio. Augmented audio; similar to augment reality are created on virtual reality or another augmented environment. Augmented reality audio needs to mix real and augmented audio both to perceive as an extension of the natural ones. In such a situation according to Aki Ha Rma, Julia jakka, Miikka Tikander, Matti Karjalainen And Jarmo Hiipakka, Aes Member, And Gae Tan Lorho,[12] the system should pass a test that is closely related to the classical Turing test. [13] that is the user will be unable to identify whether the sound is created in the augmented world is real or virtual, it means the sound should be produced perfectly clearly as to mimic for the user as a natural voice.

when the mobile camera point to a 3D object and is in close proximity to it the detail of the relevant object is given in audio (Narrative) format, as described by Andrew I. Comport, Eric Marchand, Muriel Pressigout, and Franc¸ois Chaumette,(Members of IEEE) [14] we can use the bundles adjustment technique, in this approach consisting of joint estimation of camera localization and scene structure using nonlinear minimization technique. With this technique the model can identify the camera location and we can track that for rendering the voice description of only the object which is been focused.

Automatic Speech Recognition System (ASR), also known as “Speech to Text”. The Recognition of natural spoken speech is a very complex problem because vocalizations vary in terms of accent, pronunciation, pitch, volume, speed, as well as any other relevant factors. we have to consider those terms when use the ASR on our system, the performance measures at this stage are accuracy and speed of processing the output. As in Google “Justspeak” Research [15] the methodology of speak recognition is transcribe the spoken speech in to text format. Then we pass those plain text to process with those command with formalize command system. What we are trying to do here is to get those text file and execute command one by one, regarding our project and then manipulate the proceed output with the best matching command available in the previously defined methods. If there are no matches, we are planning on checking for the most probable commands and producing a suggestion list regarding the speech, or allow user to say again.

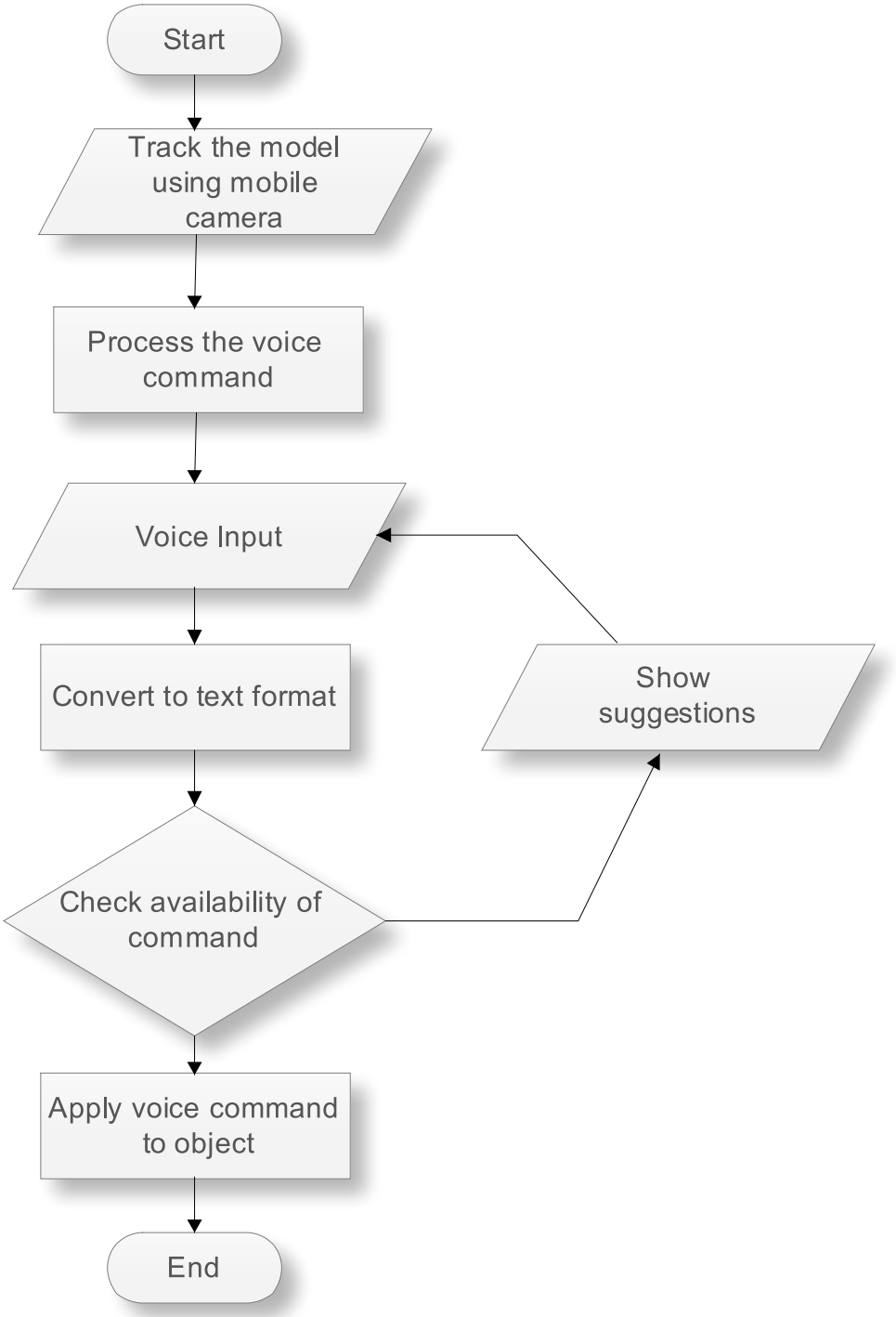
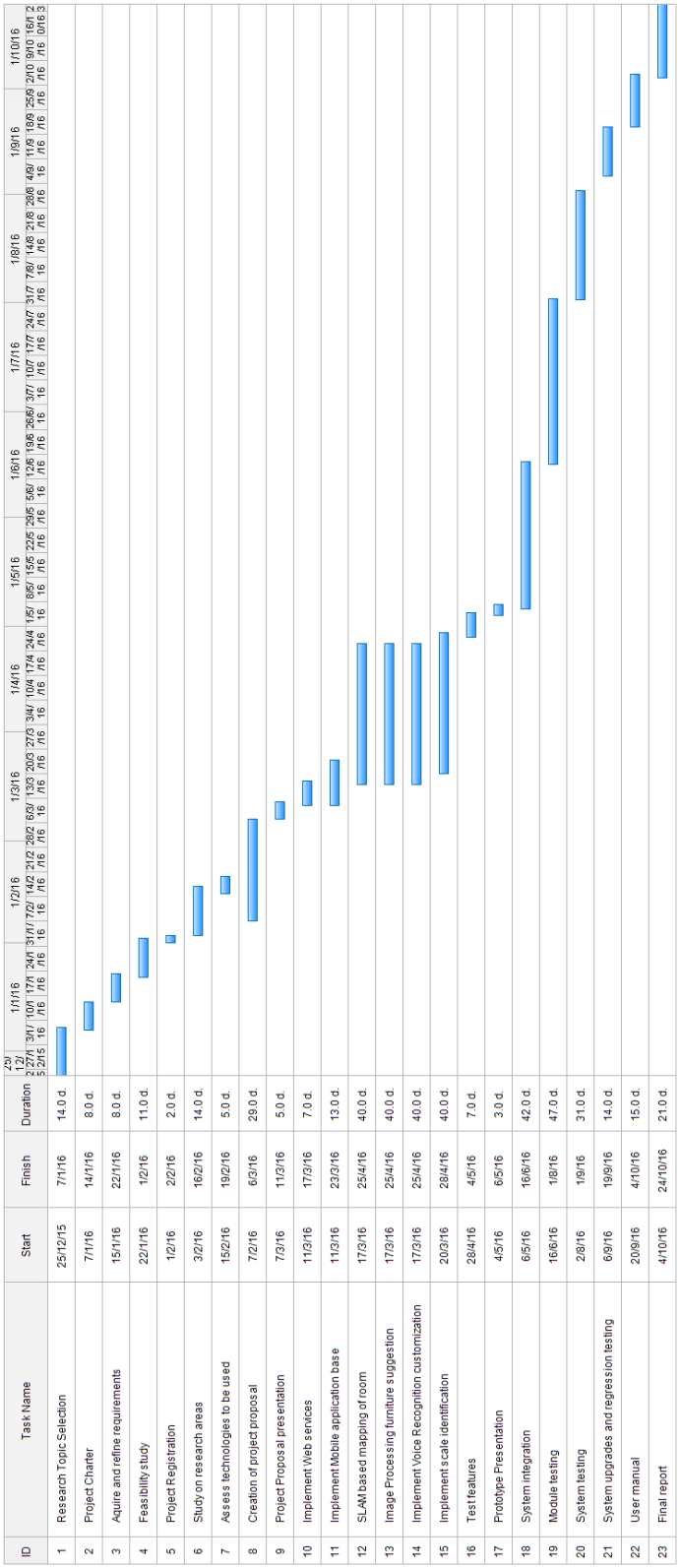


Figure 14 : Voice Recognition flow Chart

3.5. Gantt Chart



ID	Task Name	Start	Finish	Duration
1	Research Topic Selection	25/12/15	7/1/16	14.0 d.
2	Project Charter	7/1/16	14/1/16	8.0 d.
3	Aquire and refine requirements	15/1/16	22/1/16	8.0 d.
4	Feasibility study	22/1/16	1/2/16	11.0 d.
5	Project Registration	1/2/16	2/2/16	2.0 d.
6	Study on research areas	3/2/16	16/2/16	14.0 d.
7	Assess technologies to be used	15/2/16	19/2/16	5.0 d.
8	Creation of project proposal	7/2/16	6/3/16	29.0 d.
9	Project Proposal presentation	7/3/16	11/3/16	5.0 d.
10	Implement Web services	11/3/16	17/3/16	7.0 d.
11	Implement Mobile application base	11/3/16	23/3/16	13.0 d.
12	SLAM based mapping of room	17/3/16	25/4/16	40.0 d.
13	Image Processing furniture suggestion	17/3/16	25/4/16	40.0 d.
14	Implement Voice Recognition customization	17/3/16	25/4/16	40.0 d.
15	Implement scale identification	20/3/16	28/4/16	40.0 d.
16	Test features	28/4/16	4/5/16	7.0 d.
17	Prototype Presentation	4/5/16	6/5/16	3.0 d.
18	System integration	6/5/16	16/6/16	42.0 d.
19	Module testing	16/6/16	1/8/16	47.0 d.
20	System testing	2/8/16	1/9/16	31.0 d.
21	System upgrades and regression testing	6/9/16	19/9/16	14.0 d.
22	User manual	20/9/16	4/10/16	15.0 d.
23	Final report	4/10/16	24/10/16	21.0 d.

Figure 15 : Gantt Chart

3.6. Material, resources needed

3.6.1. Hardware requirements

- Android tablet or Android smart phone (consisting of gyro)
- A logical Cloud Server (Eg: Microsoft Azure)

3.6.2. Software requirements

- Android SDK
- Unity 3D
- Microsoft SQL Server
- Visual studio 2015
- OpenCV

4. DESCRIPTION OF PERSONAL AND FACILITIES

Member	Task	Description
IT13014964 – N. J. De Silva	• Build an environment scanning section in the mobile applications.	• This section is concerned about obtaining tracking feature of the real-world environment to allow 3D object placement.
	• Assign and display details of 3D object next to them in the augmented environment.	• This section is concerned on augmenting the furniture details to the 3d object with virtual buttons for the user to interact with.
	• Customize the 3D furniture with textures and colours provided by dealer	• This section is concerned on retrieving customization data relevant to each furniture and assigning them on user selection
IT13030254 - A. K. S. Y. Alawatta	• Implement method of identifying users voice	• This section is concerned with identifying users voice and translate it into text format to be compared with command.
	• Identify the object which is been focused on	• This section is concerned on identify the closest 3D object in the view of the camera.
	• Narration of details of the furniture	• This section concerned on converting the text description to speech.

IT13013660 - R. K. A. D. C. Ranaweera	• Implement method to identify the real scale of the indoor environment. • Implement a method to do an online purchase if customer is satisfied trough the app.	• This section is concerned on the get the real scale of the mapped real world environment in order to place the 3D object. • This section concerned on giving a customer an online payment method to do a purchase.
IT13016630 - D. G. T. K. Jayathilaka	• Implement method of obtaining colour found in abundance environment. • Implement an Algorithm for suggesting furniture • Implement of Web portal, Web API	• This section is concerned on retrieving prominent colours found in the environment and export those information to suggestions section. • This section is concerned on implementing an effective algorithm for suggesting furniture with respect to prominent colour and user feedback • This section is concerned with implemented the Web portal for dealer and Web Api for pairing with mobile application and user feedback

Table 2 : Description of Personal and facilities

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