

A
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FEATURE PROJECTION SYSTEM USING UNITY

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CERTIFICATE

This is to certify that the Project Stage I Report entitled

FEATURE PROJECTION SYSTEM USING UNITY

Has been successfully completed by

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Is a bona fide work carried out by them towards the partial fulfillment of the requirement of the Savitribai Phule Pune University, Pune for the award of the degree of the Bachelor of Engineering in Electronics and Telecommunication Engineering.

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Abstract

As we all are aware that Augmented Reality is soon going to flourish. It is used in almost every field and it is important for an Engineer to know more about Augmented Reality. We can see that the children's can learn more and try to remember more if there are images and videos shown to them in the same way if we want to remember anything we can just scan the application read all the details check the picture displayed and apply that knowledge physically in the real world.

Our mirror neuron system suggests that we can connect with each other and with our work much better if we can see each other faces and hands in 3d. Like Iron man we will be surrounded by data in 3d models that we can actually grab and interact with it. Soon Augmented Reality will surpass the current 2.6 billion smartphone users in the world.

List of Acronyms & Symbols

OS	Operating System
AR	Augmented Reality
VR	Virtual Reality
AI	Artificial Intelligence
UI	User Interface
HMD	head Mounted Display

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CHAPTER 1

Introduction

The project phase 2 is completely based on Augmented Reality. So the question arises what is Augmented Reality? It will completely change the way we learn, the way we think and the way we work. Other promise hold by Augmented reality is that instead of isolating us even more it will free us from the tiny addictive screen in our hands. It will take the data and will place around us. When we will start this application several things will pop up on the screen such as scan Interior, scan Exterior, Car Engine. In short this application will help you to scan the whole car in a single application. The application will also help in understanding the importance of Air bag, seat belts, parking light, etc. If we scan the car Engine and we want to know the information of a certain component we can click on it and a screen will appear with detailed description of that component as well as it can also consider link to short videos as well as pictures and variations in it.

1.1 Background

The basic idea behind developing this application is that the user will not need to read the whole car manual. He can just scan the car whether it can be interior, exterior or the car engine. The required information will be developed on the screen and the user can interact zoom into it, read the details provided and also he can see the animation associated with it. He can show the same data to the other family members instead of actually driving them all over to the car showroom. We have played many games and we can observe that if we read we will forget but if we see it we interact with it and we can remember it for a longer time. In the same way the user can also remember the car information for a long time. The car seller is beneficial over here it will be an easy task for him to sell his car and which will help a lot of people.

1.2 Relevance

The Three aspect of Augmented Reality are-

1. You are the OS.
2. Touch to see.
3. The Holographic campfire.

As I mentioned earlier we all had played games in our childhood so I can say this was my motivation towards developing my own game according to my choice and according to my requirements and needs. I have interest in playing games as well as people around me wanted to develop a game for them. In Life everyone is motivated with some or the other person or a film maker or elder brother/sister. We have our role models in Life. They are the only reason which help us to keep going no matter what all the odds we face. The motivation behind doing this project is to create something of my own after which I can proudly say that this is something which I have developed with all my efforts and hard work.

1.3 Literature Survey

I have gained most of the information from Internet as well as from one of my friend who have helped me in this project. Most of the information is available on the software itself once we download the Unity Engine and Vuforia software the whole SDK as well as the manual is available. With practice of creating small 2D games I started to create my own VR/AR game in Unity [14-20].

As I mentioned earlier we all had played games in our childhood so I can say this was my motivation towards developing my own game according to my choice and according to my requirements and needs. I have interest in playing games as well as people around me wanted to develop a game for them. In Life everyone is motivated with some or the other person or a film maker or elder brother/sister. We have our role models in Life. They are the only reason which help us to keep going no matter what all the odds we face. The motivation behind doing this project is to create something of my own after which I can proudly say that this is something which I have developed with all my efforts and hard work [20-25].

1.4 Motivation

The bright idea behind this application is since our childhood whenever we see anything we try touching it and since then this is how the idea was developed the information of car would be more interactive rather than reading it from a book or any online website. Touching the screen will make it more interactive and memorable. It will take less time to grasp all the information about the new car. A new driver can easily learn all the features and accessories of the car. The music system can tell us more information we can play a video and we can also start the route on the GPS which will help the driver to reach his destination. The software used to develop this application is Unity. This is a game development software wherein we can design all our games the way we want. There will be a time where everything can be developed based on Augmented Reality. We can also add other features to the application it can be like it can display information while the car is moving. It can display all the things which are there on the road on the screen which can be much more informative.

1.5 Aim of the Project

The aim of this project is to meet everyone's requirement and to develop an AR based system which can be used by a single person and also can be used by a group of people. As we all are aware that soon we will be interacting with Metaverse so this is the basic step towards it. The main reason is that the electric car is been seen much in the market but the people are not aware of how the functionality is so with the help of this application they can get all the information required to get to know the car in detail. We will be able to see the computer generated information in the real world. With the help of this application the user can travel alone also because all the information will be presented to him on his screen. If there is a mechanical failure and if the person don't know how to deal with it he/she can simply scan it and the solution will appear and then he can cure it accordingly which will be very much helpful.

1.6 Scope and Objectives

The future scope of this project is vast as it is said that in few years we will be introduced to Meta verse in which we will meet people virtually without even leaving our home. In future we can bring many changes in the application we can update it with animation as well as short videos. Hyundai has developed such an application. In future this technology will boom with many more featured added to it.

CHAPTER 2

Theoretical Description of Project

2.1 Theoretical Background



Fig.2.1 Unity Structure

The project report is been divided into different point and parameters. The project report covers all the description, Details, Implementation, Programming, Diagrams, Flowcharts related to the project. Starting from the scratch I have learned this Software called Unity with the help of an online Platform which is Udemy. So it consisted of different topics related to development of Game using Unity Software. I have used Unity Engine to develop this game because it's powerful and free. The First chapter taught us how to download and Install Unity on your Computer. Then after that I got Familiar with the User Interface. Then there was a basic lecture of how to place a 3d object in Unity and then how we can change its size and shape. Then I saw different lighting effects on the placed 3d shape and side by side I kept on checking the camera angle so that the game can look fantastic once it is implemented and completed fully. Finally in this lecture I studied the physics and material so to actually get a clear idea of how the game will look in the real world. This was all learned in the First Chapter and can be considered as background for developing a game.

The topics that were all covered are:-

1. Basic Platform
2. Top Down Shooter
3. Top Down Shooter with AI
4. Main Menu, Localization & Game Loading
5. Third Person Shooter
6. 2D Action Game
7. Vuforia Engine.
8. AR Kit.
9. AR Core.
10. Canvas
11. Event System.
12. Rendering.
13. Adding Image to the scene

2.2 Block diagram

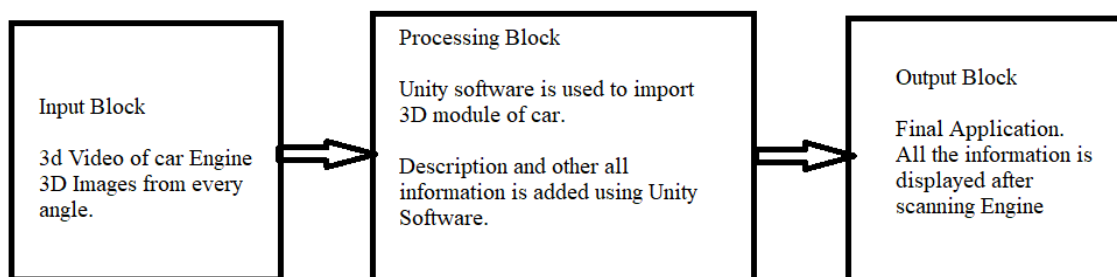


Fig.2.2.1. Block Diagram Basic

The above block diagram shows the interfacing between input, processing block and output. In the block diagram the input block contains of the 3D images and video of car engine. The 3D scan is done with the help of an application named polycam. The input processing block is the main backbone of this application all the operations are performed in this block which is Unity Software SDK. After all the changes as well as after adding all the images and description to the application a build is generated which is in the form of apk. Then with that link the application is downloaded and installed in android phone. And then the scanning is done.



Fig2.2.2 Car Engine

The above diagram is the car engine of Swift Dzire using this we have developed our application and we have arranged all the components that are present in the Engine and the description of the same is displayed on the application as well. The 3D image and videos of the engine were used to develop the following application which was beneficial.

- Unity User Interface
- Creating 3D Objects
- Moving, Rotating & Scaling Objects
- Unity Inspector Window & Scene Hierarchy
- Adding components to Game Objects
- Creating Materials
- Using lighting to create atmosphere (Omni light, Directional Light)
- Collisions & Triggers
- Physics using Rigid body & Add Force
- Using a Character Controller to control and move a character
- Creating & adding scripts to GameObjects
- Start, Update (+ Awake, Fixed Update, ...

2.3 Flow chart /Algorithm

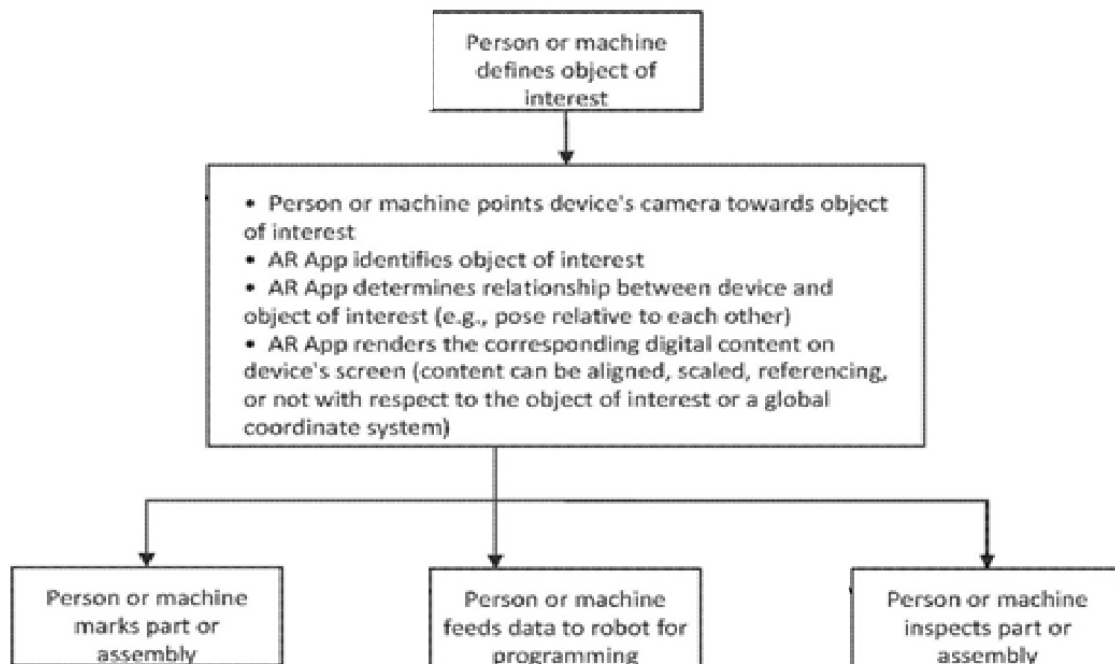


Fig.2.3.1 Flow Chart

CHAPTER 3

System Design

3.1 Block wise Design

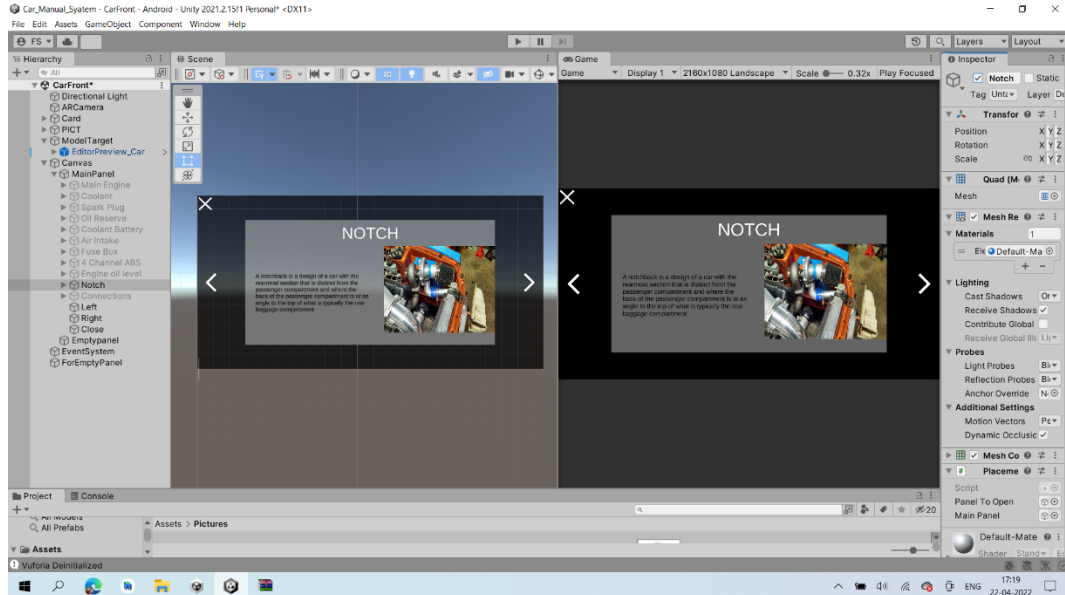


Fig 3.1.1 Notch Description

This is how it will look when we will click on the component after scanning. The picture and description will be displayed on the screen.

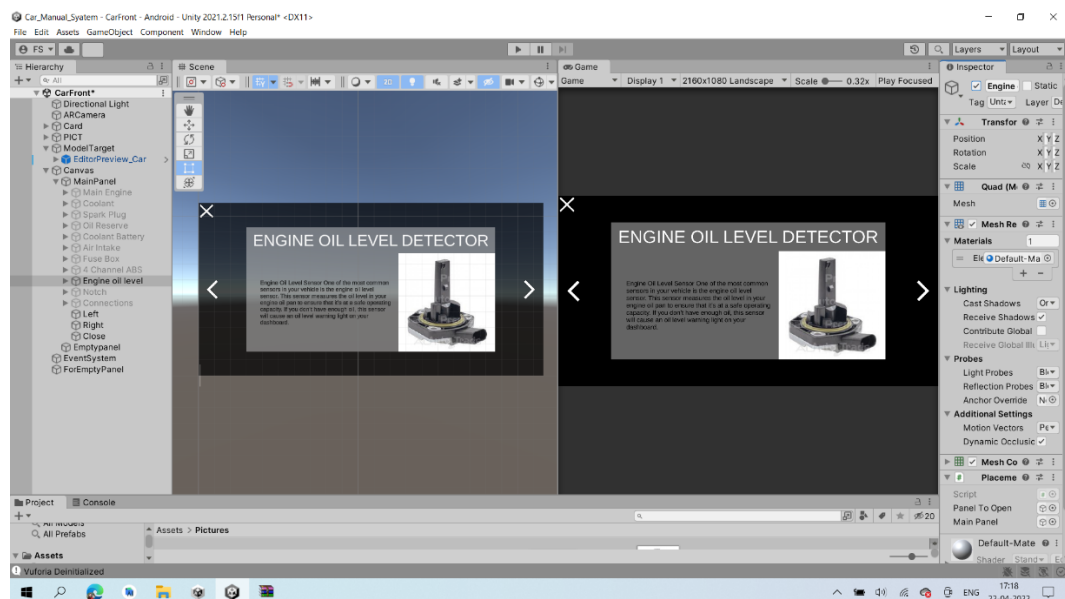


Fig 3.1.2 Engine Oil level Detector

This is how it will look when we will click on the component after scanning. The picture and description will be displayed on the screen.

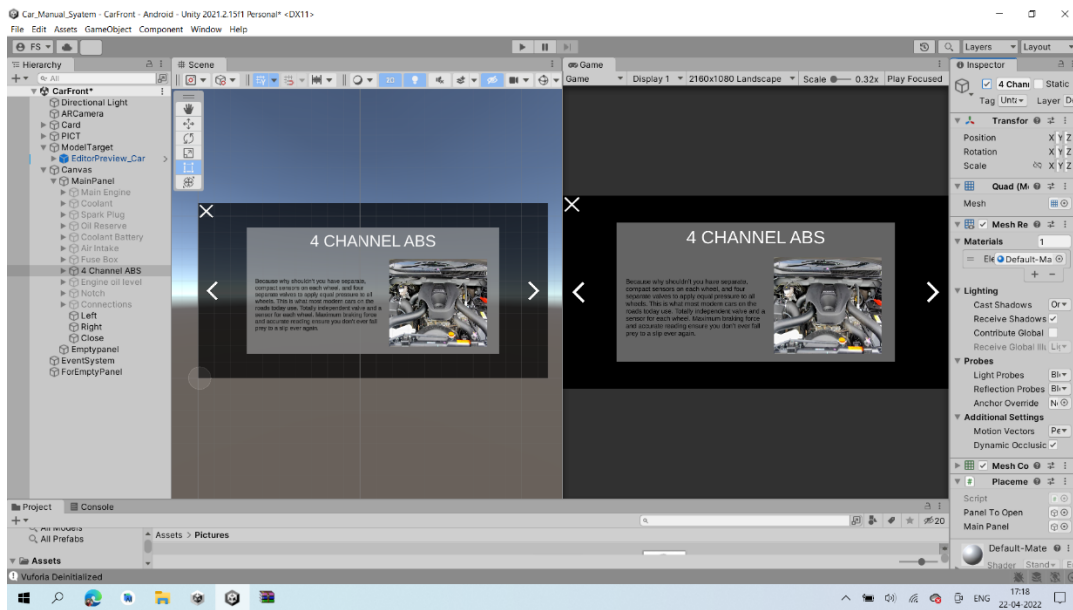


Fig.3.1.3 4 Channel ABS

This is how it will look when we will click on the component after scanning. The picture and description will be displayed on the screen.

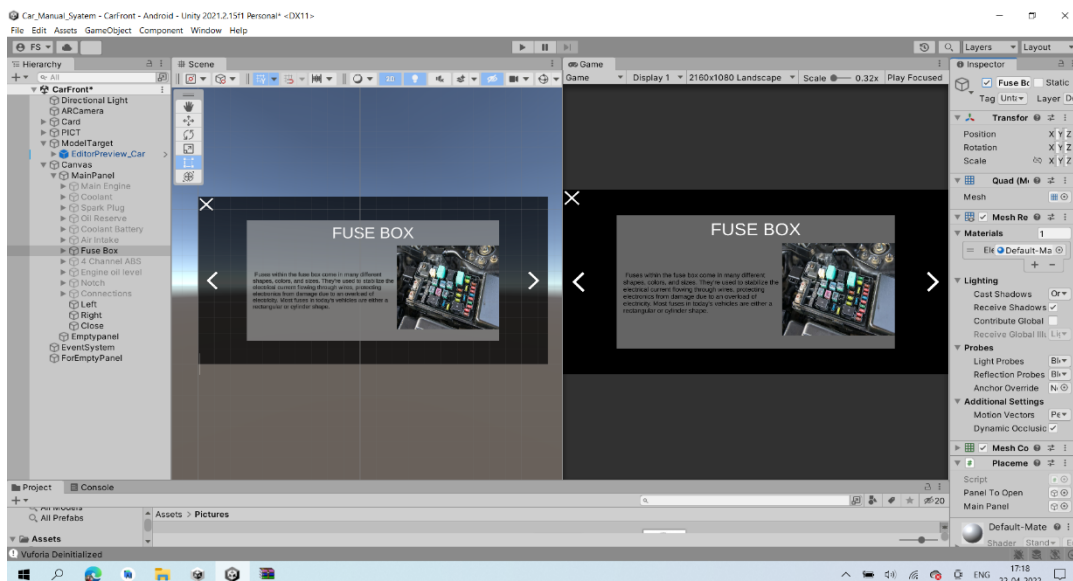


Fig.3.1.4 Fuse Box

This is how it will look when we will click on the component after scanning. The picture and description will be displayed on the screen.

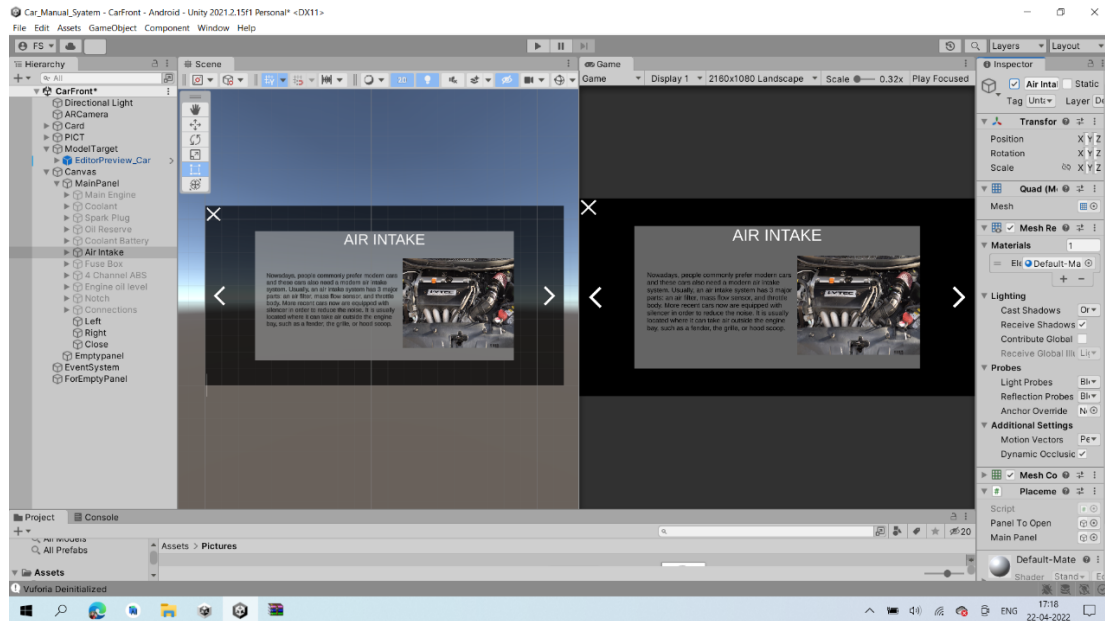


Fig 3.1.5 Air Intake

This is how it will look when we will click on the component after scanning. The picture and description will be displayed on the screen.

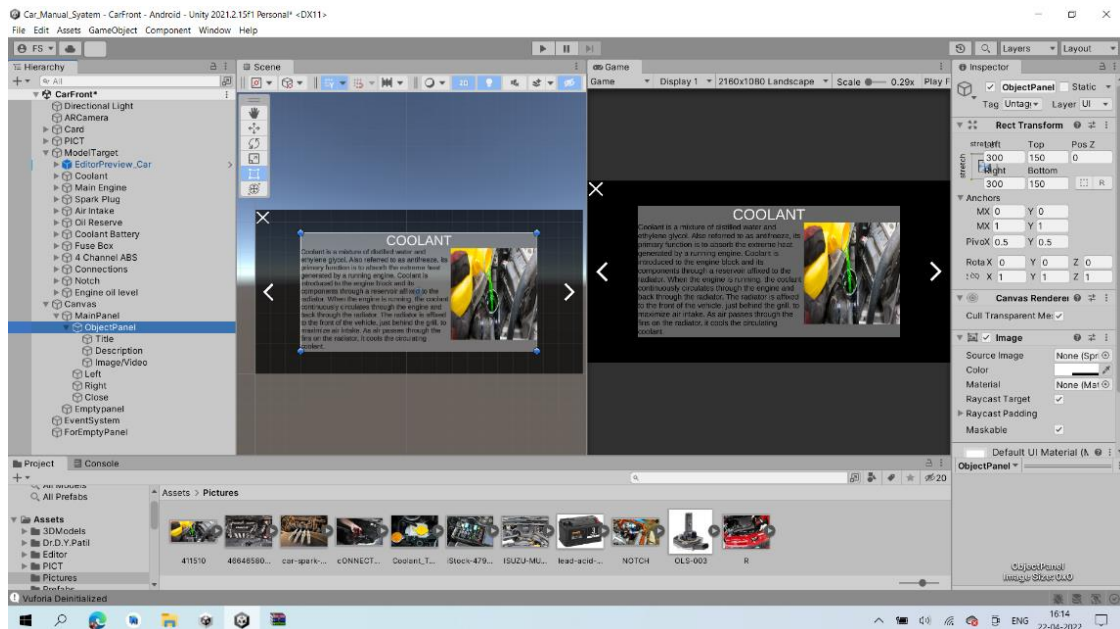


Fig 3.1.6 Coolant

This is how it will look when we will click on the component after scanning. The picture and description will be displayed on the screen.

3.2 Types, Components and Objects

- AR Devices
 1. Optical See Through.
 2. Virtual Retinal Systems.
 3. Video See-Through.
 4. Monitor Based AR.
 5. Projector Based AR



Fig 3.2.1 Optical See Through HMD



Fig 3.2.2 Virtual Retinal System HMD



Fig3.2.3 Video See Through HMD

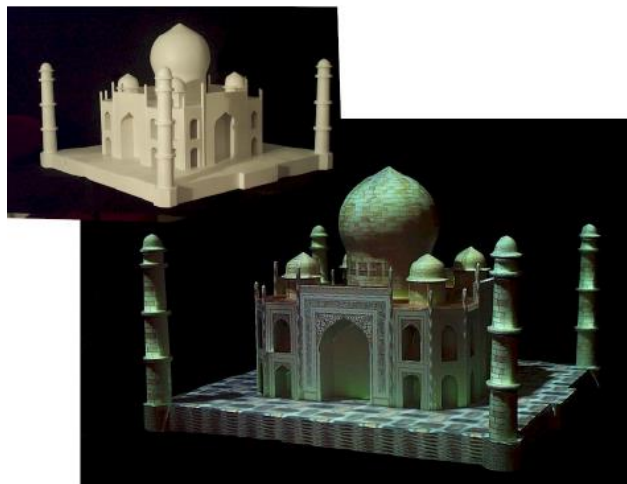


Fig 3.2.4 Projector Based AR

CHAPTER 4

Implementation, Testing and Debugging

Model Target

Model Targets is a thing provided by Vuforia to enable apps built using Vuforia Engine to recognize & track particular objects in the scene in the real world based on the shape of the object and maybe the color of the object.

To make a Model Target for a particular object you need to have access to 3D model data for the object, such as a 3D CAD model or a 3D scan of the object that you created or obtained from a 3rd party source or application.

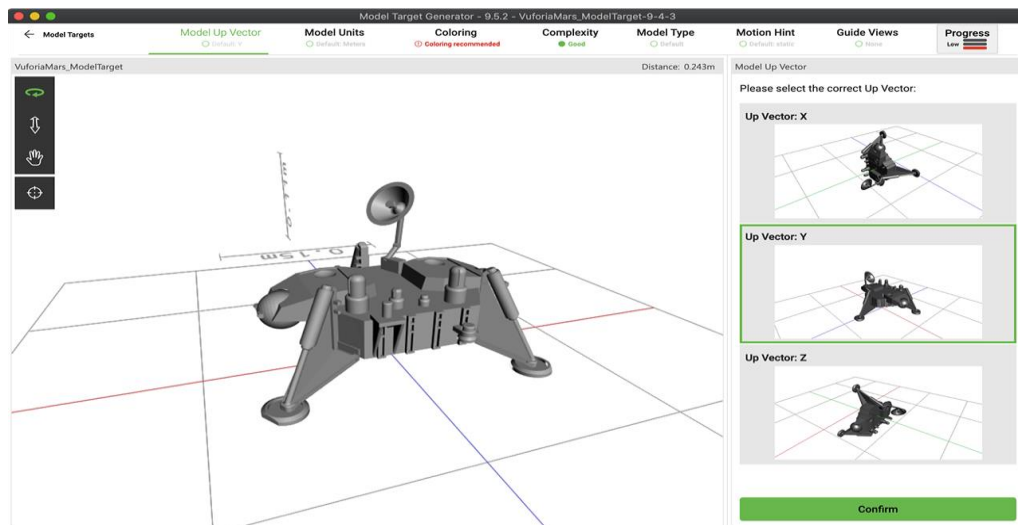


Fig 4.1 Design Tool A

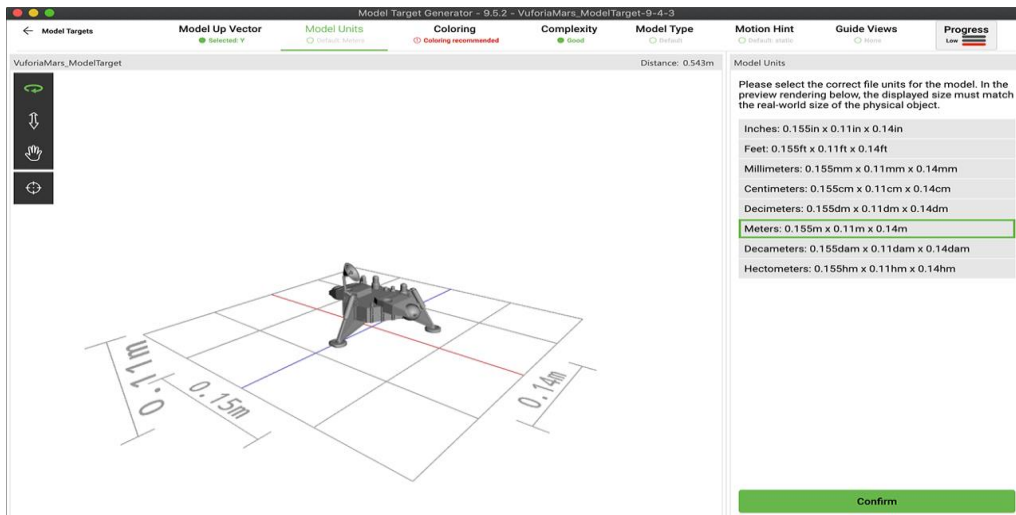


Fig 4.2 Design Tool B

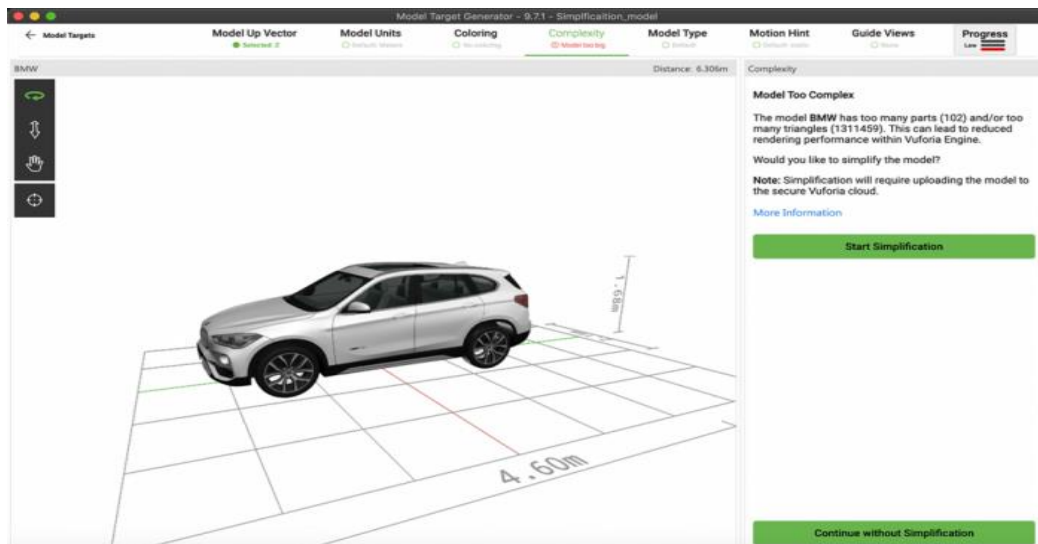


Fig 4.3 Design Tool C

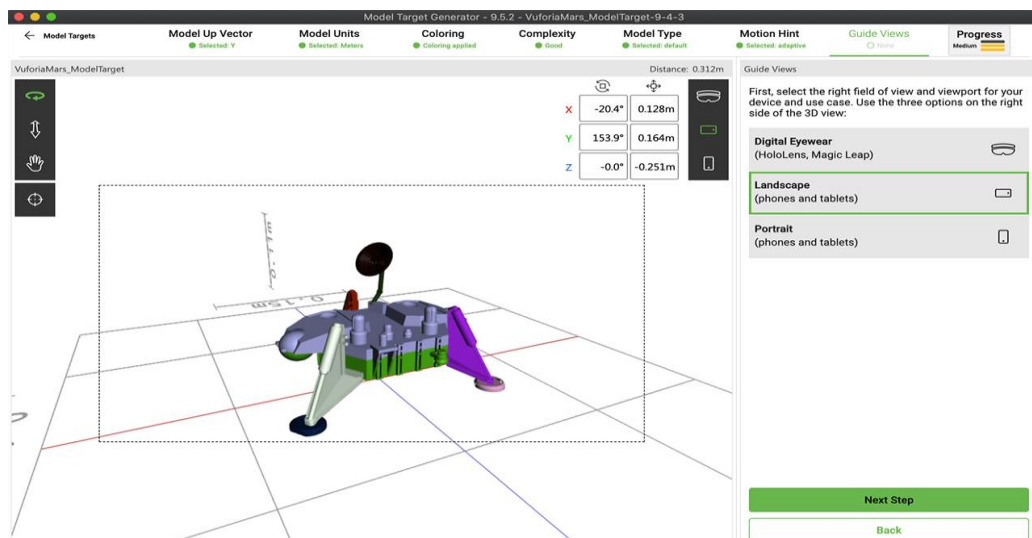


Fig 4.4 Design Tool

CHAPTER 5

Progress of project and discussion



Fig 5.1 Actual Implementation

The project is completed successfully. Following are the steps and procedure that were followed while creating this application.

AR is a technology to superimpose digital information into real scene viewed by user.

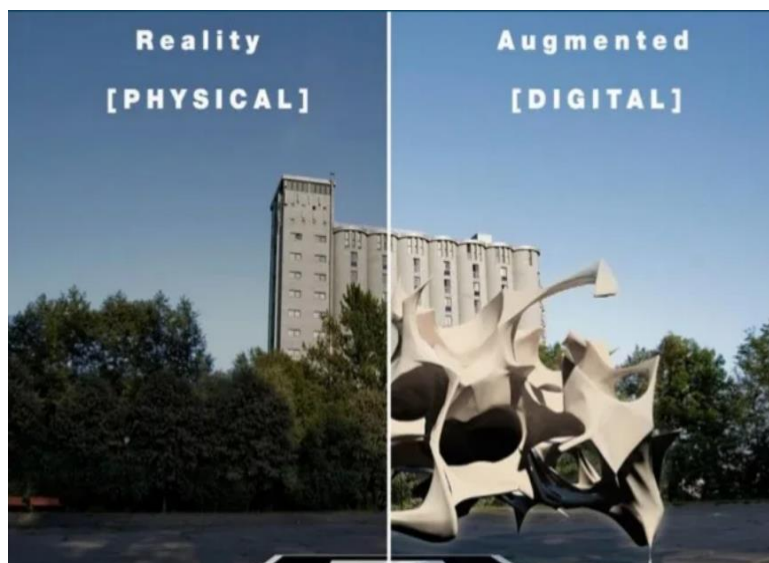


Fig 5.2 Difference

To complete this project the basic idea is to use Unity software for Game development. Unity is a platform wherein we can develop our own games based on different concepts. Unity provides a game development engine for Augmented Reality project named AR foundation and Vuforia Engine.

The Unity Editor is a popular and useful authoring platform to create cutting edge augmented reality experiences for both handheld devices and digital eyewear.

Vuforia Engine is a software development kit (SDK) for creating Augmented Reality apps. Developers can easily add advanced computer vision functionality to any application, allowing it to recognize images and objects, and interact with spaces in the real world.

It is possible to add Vuforia Engine targets to an existing AR Foundation project, and similarly, adding AR Foundation capabilities to Unity project already using Vuforia Engine.

Simple Example of Model Target

So in the below image we can see that it is a car Engine wherein we can see that there are stands with boards on it so this is what we can see that if we scan the car engine this output is displayed with the help of unity software we have imported the 3D model in unity and then with the help of Raycast and with the help of Canvas feature in Unity we were able to add description as well as the picture for that description and we can check for the image description and also we can add animation to the same.



Fig 5.3 Example

Following are the scripts used for the project:

Placement Object:-

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;
using UnityEngine.SceneManagement;
using TMPro;

public class PlacementObject : MonoBehaviour
{
    public GameObject PanelToOpen;

    public GameObject MainPanel;

    public bool Selected { get; set; }
}
```

Open Panel when touched:-

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;

public class OpenPanelWhenTouched : MonoBehaviour
{
    [SerializeField]
    private PlacementObject[] placedObjects;

    [SerializeField]
    private Camera arCamera;

    private Vector2 touchPosition = default;

    private void Start()
    {
        ChangeSelectedObject(placedObjects[0]);
    }

    void Update()
    {
        // do not capture events unless the welcome panel is hidden
        if (Input.touchCount > 0)
        {
            Touch touch = Input.GetTouch(0);

            touchPosition = touch.position;

            if (touch.phase == TouchPhase.Began)
            {
                Ray ray = arCamera.ScreenPointToRay(touch.position);
                RaycastHit hitObject;
                if (Physics.Raycast(ray, out hitObject))
                {
                    PlacementObject placementObject =
                    hitObject.transform.GetComponent<PlacementObject>();
                }
            }
        }
    }
}
```

```

        if (placementObject != null)
        {
            ChangeSelectedObject(placementObject);
        }
    }
}

void ChangeSelectedObject(PlacementObject selected)
{
    foreach (PlacementObject current in placedObjects)
    {
        MeshRenderer meshRenderer = current.GetComponent<MeshRenderer>();
        if (selected != current)
        {
            current.Selected = false;
        }
        else
        {
            current.Selected = true;
            current.MainPanel.SetActive(true);
            current.PanelToOpen.SetActive(true);
        }
    }
}
}

```

Complete Application details:-

The application developed will look like this. The following picture shows the car scan of Engine. After generating an apk file with the help of Unity software we can open it in the Android Mobile and then we can download it and install it. So after everything is done we can open the application the first thing that will be displayed on the screen is shown below:-

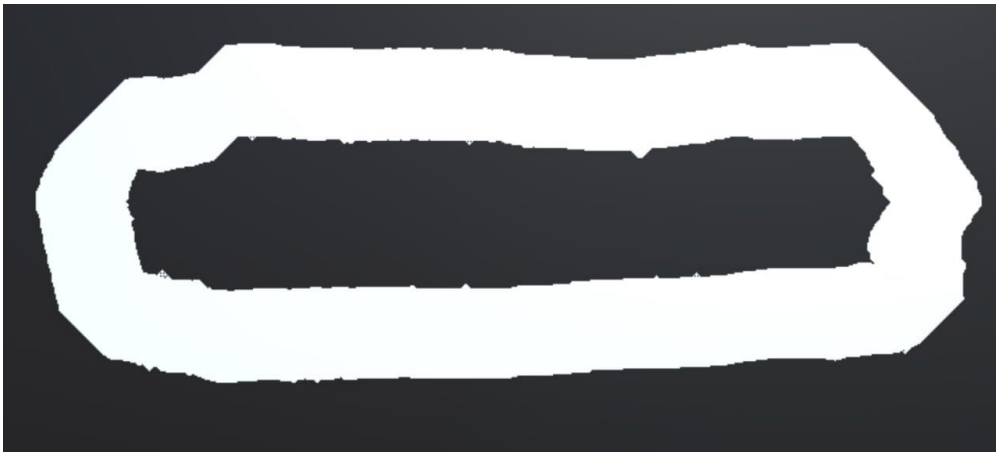


Fig.6.1. Car Engine Scan

This particular image shows the shape of the Engine after scanning the engine we can click on this and the second screen which will be displayed is shown below:-

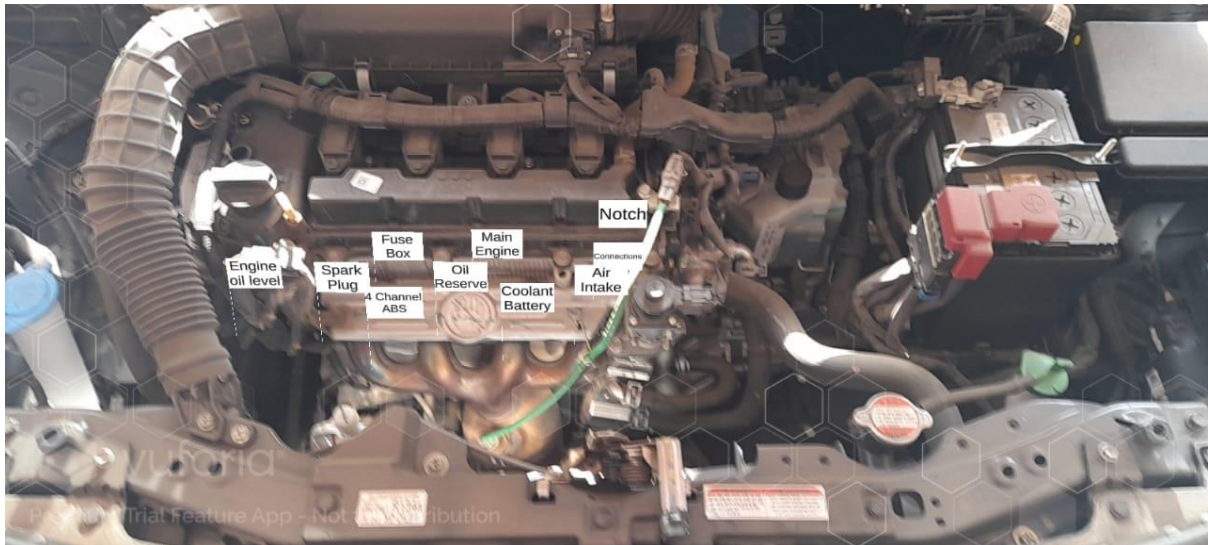


Fig.6.2. Car Engine scan display

This image shows the objects or the components that are present in a Car Engine. So if we click on any of these flag we can see the information of that particular component on the screen. The image after clicking say Fuse box is attached below:-

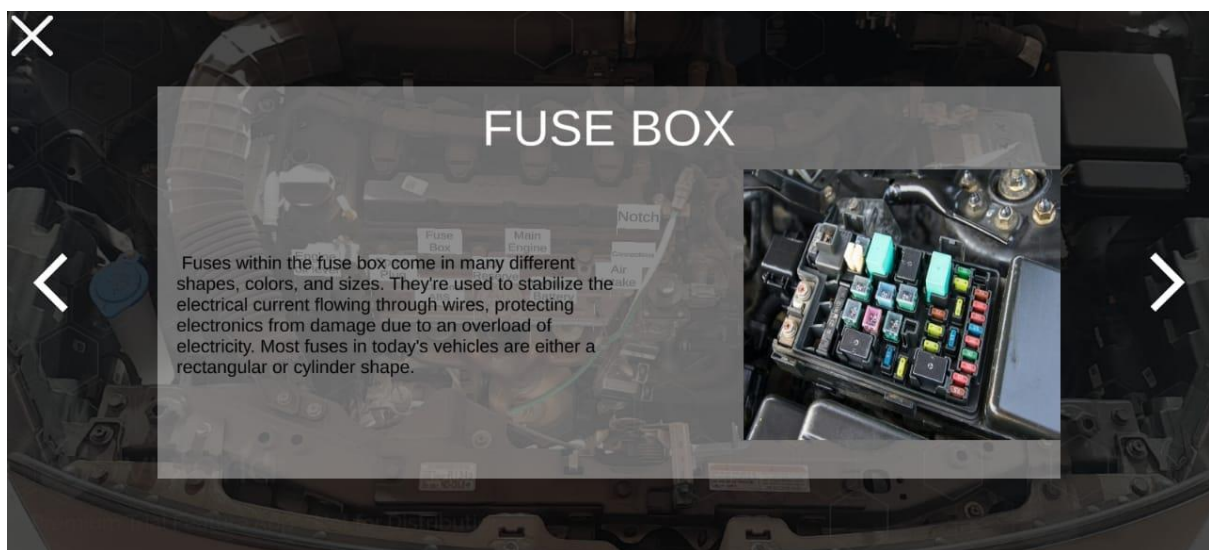


Fig.6.3.Fuse Box Description

In the same way if we click on coolant battery then the description of coolant battery is displayed on the screen. The below image shows the same:-



Fig.6.4.Coolant Battery Description

In the same way if we click on any of the flags the information will be displayed on the screen. Following are few images of the applications and component description:-

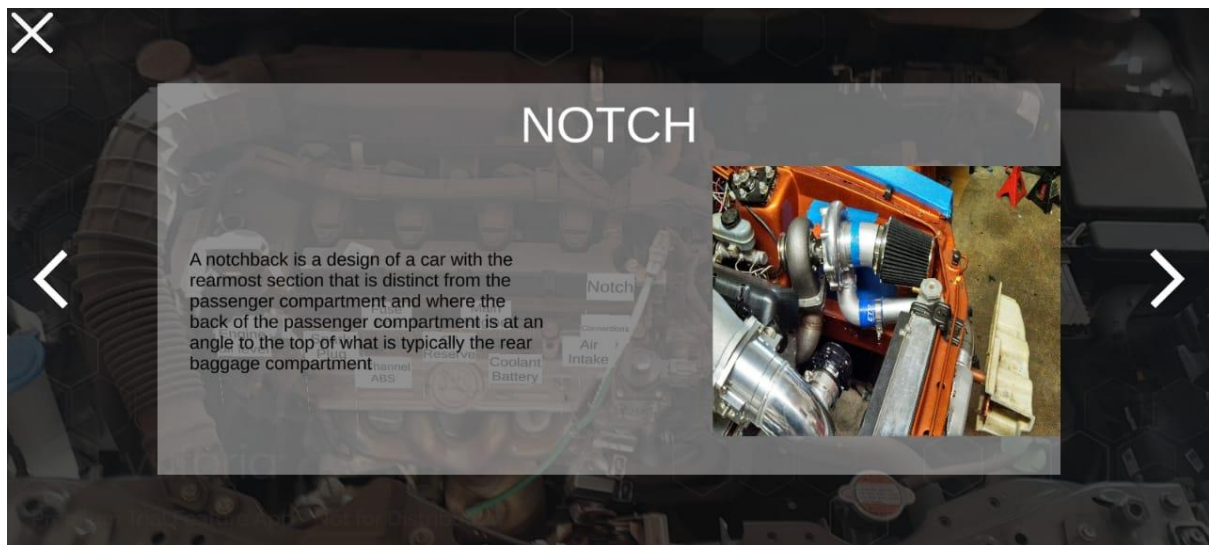


Fig.6.5. Notch Description

CHAPTER 6

Conclusion

- AR is already available technology with smartphone, pc, etc...
- Many kinds of Application is published.
- AR has potential for use of learning.-Medical Operation- Drawing Picture
- Creating AR content has become easy.
- Accuracy is 98%
- Response time is fast.
- Scanning is more Accurate.
- The output is displayed clearly.

CHAPTER 7

Future Scope

Following are the future of cars using Augmented Reality:-

1. Directions and Road Awareness- The car driver will be able to see the road map on his music system screen and can drive more carefully.
2. Live points of Interest- The person sitting in the car will be able to see the symbols and information prior on the screen hotel, hospital, petrol pump, etc.
3. An extra set of eyes- The user will be able to see the extra information prior.
4. Surrounding awareness- Surrounding Information can be displayed on the screen which will be more beneficial to the user.
5. Protect Pedestrians- The pedestrians crossing the road will be more attractive to the driver.

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