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# **Bahria University Virtual Guide**

## **Bachelor of Science in Computer Science**

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# Certificate

We accept the work contained in the report titled “Bahria University Virtual Guide”, written by Mr. Muhammad Zohaib Azam AND Mr. Muhammad Hassaan Sabri as a confirmation to the required standard for the partial fulfillment of the degree of Bachelor of Science in Computer Science.

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# **Abstract**

'Bahria University Virtual Guide' is an android based application which is designed and developed to help visitors and new students to tour University virtually. It's an interesting concept, a new way of visiting university virtually. The purpose of 'Bahria University Virtual Guide' is to help users to find their destination within the university and the realistic view of university helps users to locate their respective university block destination. It's an interactive application designed to enable users to experience and interact with the digital environment. It gives an immersive display to the user if the user is in the real world. The application caters new visitors/students wanting to tour university virtually.

# Acknowledgments

As a matter of great significance that Almighty has gave us these favours and learning to make this project productive. We need to record our gratefulness to our Sir Dr. Muhammad Muzammil for his supervision, guidance and course from the hidden to the last level that enabled us to develop this project, he gave us empowerment and support in various ways. We additionally owe a great deal to our friends for their help and for all the fun we had in these vital four years.

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# Acronyms and Abbreviations

VR	Virtual Reality
3D	3 Dimensional
HMD	Head Mounted Display
AR	Artificial Reality
2D	2 Dimensional
SRS	Software Requirement Specification
UI	User Interface
GUI	Graphical User Interface

# Chapter 1

## Introduction

Naturally the definition of the virtual reality come from both its own word. The meaning of virtual is near and reality is what human being experience. So the term means near reality. In technical manner the term Virtual reality is describe as “A Three-Dimensional Computer Generated Environment” in which person can interact with that environment and can also be explored by the person.[1] The reality come by the way of our sense. The entire experience of reality is simple combination of our brain and information which create that mechanism of virtual reality.[2]

### 1.1 Problem Description

Our application is basically providing service relating to the Bahria University in which we are providing a map of the entire university in an application which is accessible to the students and visitors around the world, the application helps visitors to realistically view university as if they are physically present within the university premises. A person seated at home can view the selected area of the university he/she wishes to visit virtually. He/she can view the department or block where he/she wants to visit

### 1.2 Objective

The main objective of our project is to provide a virtual (3D) map of Bahria University so that a visitor can easily tour University. This virtual guide map can also help the new students to see university while they are seated at their home. It gives visitors a real view of university as if they are actually present inside the university premises.

### **1.3 Project Scope**

It will be a mobile application. There are some features of this application which are Listed as follows

1. New students can take guide when they come on day one(orientation).
2. People can take a look at university while sitting at their home.
3. Experience realistic look of university.
4. Application will have a user-friendly interface.
5. Application will be covering outer University boundary and especially XC block territory.
6. We would not be covering rest of area.

### **1.4 Methodology**

We are using Agile Method for developing the application. First of all we are modeling and developing our assets on Sketch-Up and those assets are used for modeling. After that we import our assets on Unity 3D. Then we are applying C-Sharp scripts for character moving technique on Unity3D. We are also using 3d Studio Max and blender for 3D modeling.

### **1.5 Tool/Technology**

As our project is based on Virtual Reality so we will be using three to four tools which are listed as follows:

1. Unity 3D
2. Sketch Up
3. 3D studio Max
4. Blender

## Chapter 2

# Literature Review

Now a day's computer graphics is used in all dimensions and walks of life. In the last phase of 20th century it is hard to think that engineers, doctors, and tourists work without the graphics platforms. As technology is moving faster and faster it leads to faster computers and mobiles and the hardware of these devices are becoming more and more powerful with these advancements the graphic capabilities of these gadgets are also becoming better. The world of three-dimensional graphics has neither border nor constraints and whatever we want we can create but people always wanted more and they wanted to interact with the object in the virtual reality. So the research is made to enhance the virtual reality.

Let us have a short glimpse on the last few years of research and games made on VR.

### 2.0.1 Sensorama

Morton Heilig created a multi-sensory simulator. A prerecorded film in color and stereo, was augmented by binaural sound, scent, wind and vibration experiences. This was the first approach to create a virtual reality system and it had all the features of such an environment, but it was not interactive.

### 2.0.2 The Ultimate Display

Ivan Sutherland proposed a definitive arrangement of virtual reality: a manufactured world development idea that included interactive graphics, force feedback, sound, smell and taste. [3]

### 2.0.3 The Sword of Damocles

The primary virtual reality framework acknowledged in equipment, not in idea. Ivan Sutherland builds a gadget considered as the primary Head Mounted Display (HMD), with

fitting head following. It upheld a stereo view that was refreshed effectively as indicated by the client's head position and introduction.

#### **2.0.4 GROPE**

The first prototype of a force-feedback system realized at the University of North Carolina(UNC) in 2000. [4]

#### **2.0.5 Videoplace**

Artificial Reality made by Myron Krueger – "a conceptual environment, with no presence". In this system the outlines of the user snatched by the cameras were projected on a vast screen. The members were able to interact one with other thanks to image processing technique that determine their position in 2D screen space.

#### **2.0.6 VCASS**

Thomas Furness at the US Air Force's Armstrong Medical Research Laboratories created in the Visually Coupled Airborne Systems Simulator – an advance pilot test program. The military pilot wore a HMD that expanded the out-the window see by the graphics describing targeting or ideal flight way information.

#### **2.0.7 VIVED**

Virtual Visual Environment Display – constructed at the NASA Ames, with off-the-shelf technology a stereoscopic monochrome HMD.

#### **2.0.8 CAVE**

Introduced in 2001 CAVE (CAVE Automatic Virtual Environment) is a virtual reality and logical representation system. Rather than utilizing a HMD it project stereoscopic pictures on the wall of room (client must wear LCD shutter glasses). This approach guarantees super quality and resolution of view pictures, and more extensive field of view in contrast with HMD based system.

#### **2.0.9 Augmented Reality**

A technology that "exhibits a virtual world that enhances, as opposed to replaces this present reality". This is accomplished by mean of see through HMD that superimposes virtual three-dimensional objects on real ones. This innovation was previously used to improve military pilot's view with extra flight information (VCASS). Thanks to its

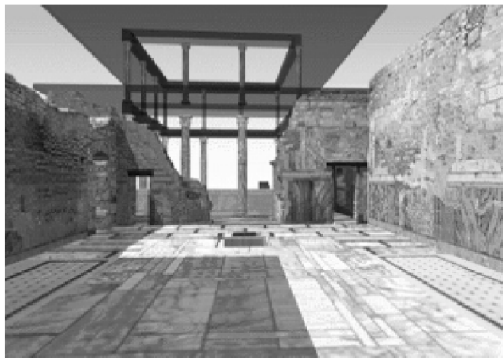
incredible potential – the upgrade of human vision – augmented reality turned into a concentration of many research extends in mid 1990s

## 2.1 Existing Applications

Virtual Reality has get the attention of many individuals in most recent couple of year. Being another face of UI which offer an extraordinary advantages in numerous applications. It gives a simple interaction between human and computers. The user can watch and explore the computer created condition with no compelling reason to figure out how it function. In this way numerous application like flight simulators, architectural walk through were developed fast.

### 2.1.1 Data and Architectural Visualization

The first attempts to apply VR as visualization tool was architectural walkthrough and guide. First virtual Kitchen was created in 1986. So what is fantastic about VR to make it superior to normal standard graphics. The feeling of presence and sense of space in virtual building which cannot be achieved in the most realistic still picture and animation.



(a) Visualization



(b) Modeling

Figure 2.1: Data and Architectural Visualization

### 2.1.2 Modeling and Designing

In modeling and designing virtual reality offers the possibility of watching in real time and in real space what the object of real model look like. This technology help the interior designer to easily look at their interior model. They can change color and texture and position of their object.

### **2.1.3 Cooperative Working**

Network based, shared virtual situations are probably going to facilitate the joint effort between remote clients. The higher data transfer capacity of data passing might be utilized for helpful working. The enormous capability of uses in this field, has been seen and multi-client VR turns into the core interest of many research programs like NPSNET. Some of these application, already do exist – just to mention a CO-CAD desktop system that benefits the co engineers to work together.

## Chapter 3

# Requirement Specifications

This application is designed for students which cannot reach university physically or they are living far from the university. This application include the visualization walk through of entire university. Our application provide following functionality.

1. New students can take guide when they come on day one (orientation).
2. People can take a look at university while sitting at their home
3. Experience realistic look of university.
4. Application will have a user-friendly interface.
5. Application will be covering outer University boundary and especially XC block territory.

### 3.1 Software Requirements Specification

Software Requirements Specification is the beginning stage of product development action. Less significance was provided to these stages in beginning of software advancement and improvement. The importance was first given to designing than afterwards moved towards coding. System became more and more complex, which end up plainly obvious that the objective of the whole system can't be effectively appreciated. Hence need of requirement analysis is emerged. Presently, for huge software system, analysis of requirement is maybe the great troublesome movement.

A portion of trouble is because of extent of this stage. Product is designed by the user requirements. At initial such necessities are in mind of different individuals in the customer company. The requirement examiner needs to distinguish the necessities and understanding their needs. In circumstances where the product is to mechanize at present manual process, a large portion of the necessities can be comprehended by watching the present practice. The SRS is a methods for interpreting the thoughts in the mind of the user into formal



archive (the output of requirement stage). Consequently, the output of the stage is an arrangement of formally determined requirement, which ideally are finished and predictable, while the input has none of these properties

### 3.1.1 Functional Requirements

Functional requirements are the set of inputs, outputs and behavior of any system. It tells about the main functions of a system and its components. Below are the functional requirement of our system that are discussed:

1. **3D Model:** Application provides a detailed 3D model of Bahria University Islamabad campus.
2. **Explore University:** User can explore the University virtually through the VR gadget.
3. **Movement of Character:** The user can head down and head up for the movement of character.
4. **Attaching Mobile in VR:** The user must properly attach mobile into VR gadget and must have a mobile which has a gyroscope sensor.

### 3.1.2 Non-Functional Requirements

The non-functional requirement are following

1. **Mobile Quality:** A mobile must have a gyroscope sensor.
2. **Availability:** This application will be accessible anywhere anytime.
3. **Maintainability:** This application will have user friendly interface which will make it easy to use and maintain.
4. **Portability:** This application will be portable easily as it will be accessible on any mobile phone having gyroscope sensor.
5. **Standards Compliance:** There will be consistency in variable names within the system. The graphical user interface will have a consistent look and feel.

## 3.2 Use Cases

### 1. Use Case:

Use case is a list of actions or event steps, typically defining the interactions between a role and a system, to achieve a goal. The actor can be a human or other external system.

### 2. Actor:

This application can be used by the new student which are willing to take admission in university. Or anybody to take a look at the Bahria university Islamabad campus. There can be multiple user all the task are done by the user.

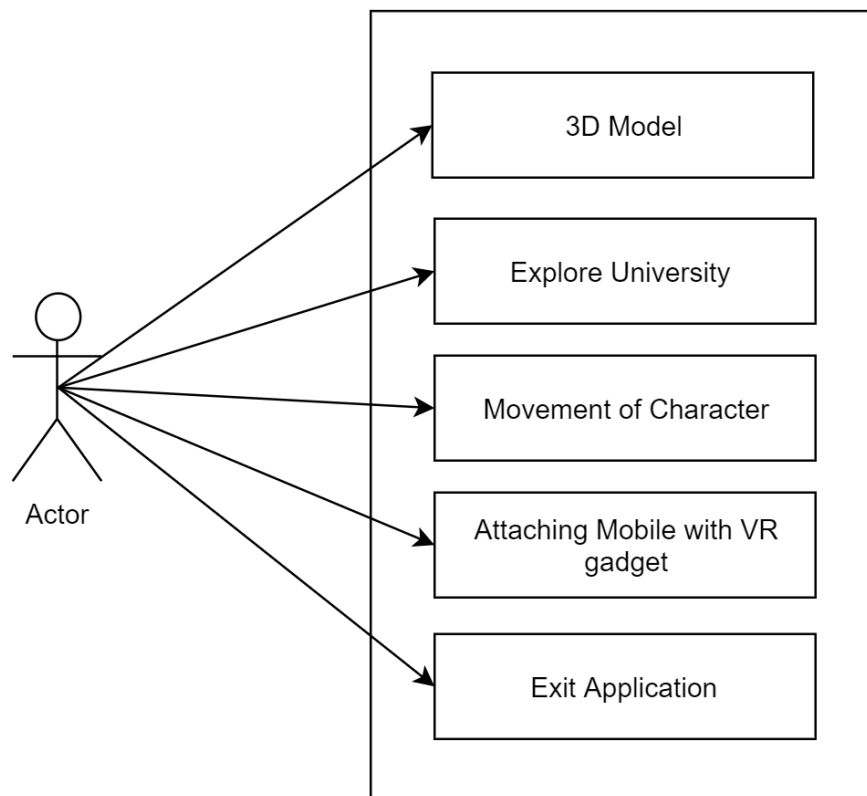


Figure 3.1: Use Case of Application

### 3.2.1 Putting mobile in VR gadget

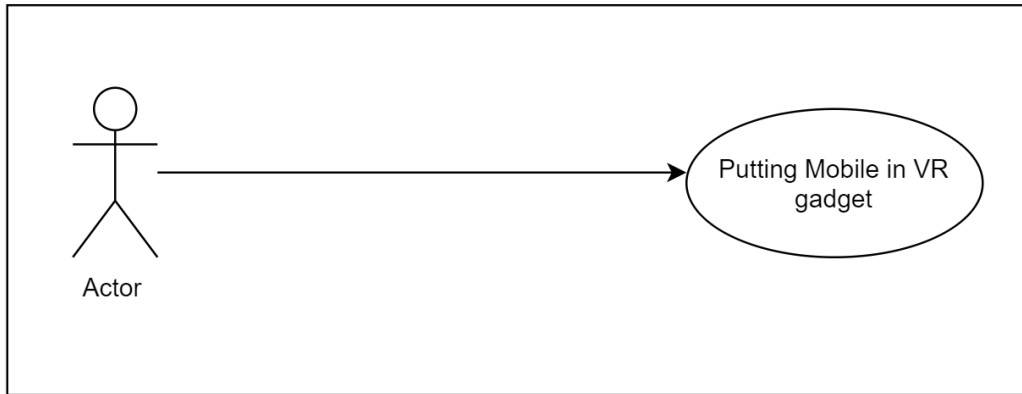


Figure 3.2: Putting mobile in VR gadget

### 3.2.2 Table : Putting mobile in VR gadget

Use Case ID	UC-1
Use Case name/Title	Putting Mobile in VR gadget
Actor	Student/Any Person
Brief Description	Attaching/Sliding mobile in VR gadget
Pre-Condition	Application must be installed on the mobile
Main Scenario	<ol style="list-style-type: none"> <li>1. Application must be install by user</li> <li>2. VR gadget should be available</li> </ol>
Post-conditions	Application menu will appear.

### 3.2.3 Pressing Start button

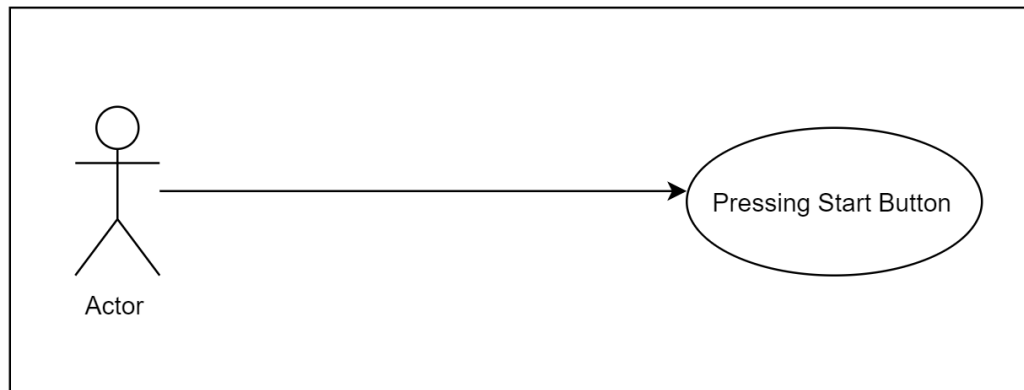


Figure 3.3: Pressing start button

### 3.2.4 Table : Pressing Start Button

Use Case ID	UC-2
Use Case name/Title	Pressing start button
Actor	Student / Any Person
Brief Description	Pressing start button in the start menu
Pre-Condition	UC-1/Application must be install on the mobile and should be in the VR gadget
Main Scenario	1. Clicking on the start button in menu
Post-conditions	The visualization walkthrough will be started and 3D model can be explored

### 3.2.5 3D Model

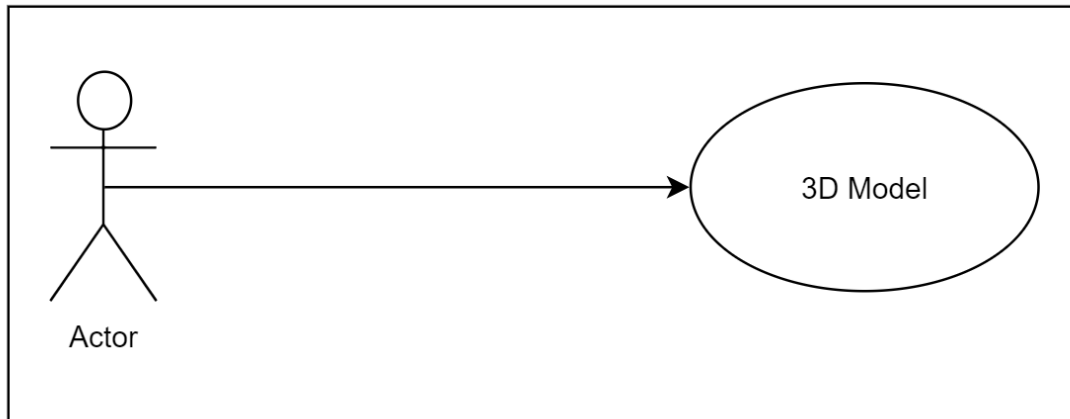


Figure 3.4: 3D Model

### 3.2.6 Table : 3D Model

Use Case ID	UC-3
Use Case name/Title	3D Model
Actor	Student/Any Person
Brief Description	User can view the 3D model of University
Pre-Condition	UC-2/Application must be install on the mobile and should be in the VR gadget and Start button must be pressed
Main Scenario	<ol style="list-style-type: none"> <li>1. Student Install Application</li> <li>2. 3D model must be displayed for user</li> </ol>
Post Condition	User can explore university virtually

### 3.2.7 Explore University

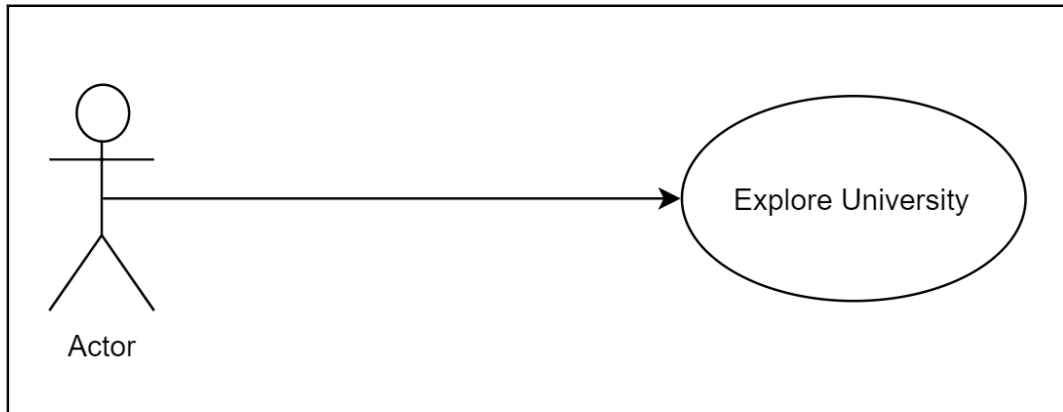


Figure 3.5: Explore University

### 3.2.8 Table : Explore University

Use Case ID	UC-4
Use Case name/Title	Explore University
Actor	Student/Any Person
Brief Description	User can explore university premises virtually
Pre-Condition	UC-3/Application must be install on the mobile and should be in the VR gadget and Start button must be pressed and 3D model must be displayed
Main Scenario	<ol style="list-style-type: none"> <li>1. User can explore University premises externally and internally</li> <li>2. User can identify university blocks with help of blocks names.</li> </ol>
Post-conditions	The visualization walkthrough will be started with the help of head movement

### 3.2.9 Movement with Head

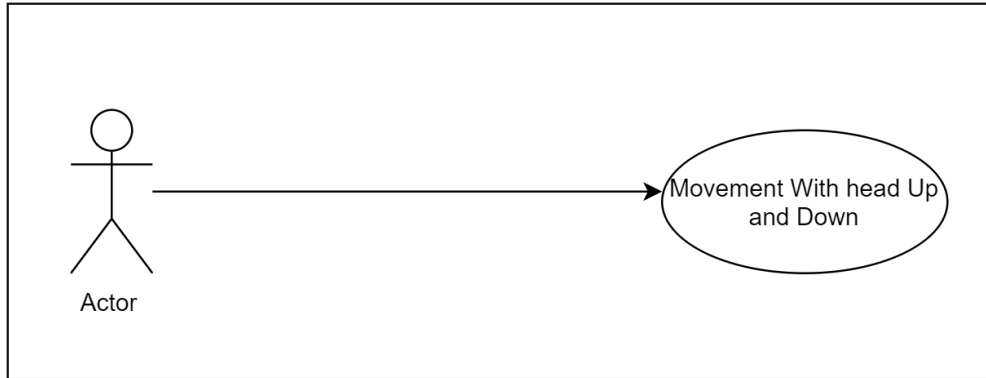


Figure 3.6: Movement with Head

### 3.2.10 Table : Movement with Head

Use Case ID	UC-5
Use Case name/Title	Movement with head
Actor	Student/Any Person
Brief Description	Character can be move by head down and and stop at head up
Pre-Condition	UC-4/Application must be install on the mobile and should be in VR gadget and must be in visualization walk through mode
Main Scenario	<ol style="list-style-type: none"> <li>1. Character can move with the help of head movement</li> <li>2. Head up will Stop the character</li> <li>3. Head down will move the character</li> </ol>
Post Condition	University can be explored in VR environment

# Chapter 4

## System Design

System design is the way toward characterizing the architecture, parts, modules, interfaces, and information for a system to fulfill specific prerequisites. System design could be viewed as the use of system theory to item development.[5]

### 4.1 System Architecture

System architecture is a model that defines the whole structure, behavior, and views of a system[6].The following diagram shows the general architecture of our system. It shows how the system will function. System architecture explain the basic idea of the system that how the application will work. The application has four module and they are as follow

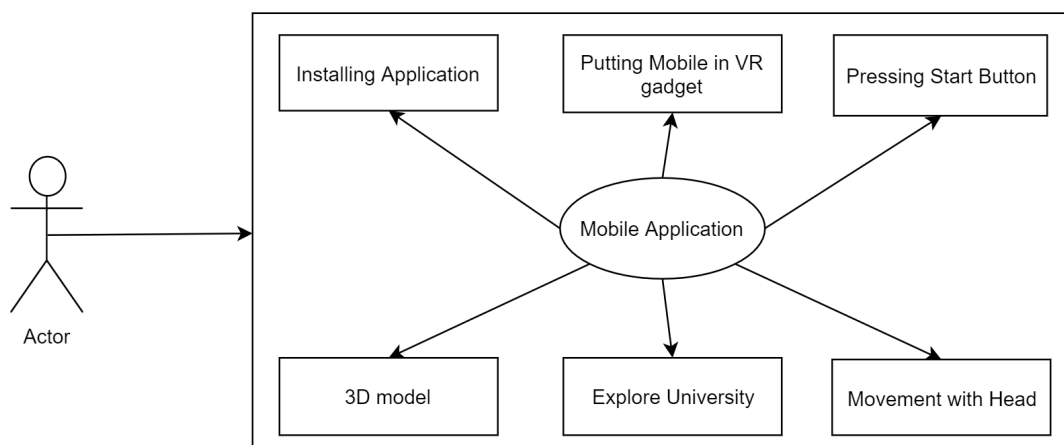


Figure 4.1: System Architecture



#### 4.1.1 Putting mobile in VR gadget

After installing application and checking gyroscope sensor we put the mobile in VR gadget.

#### 4.1.2 Pressing Start Button

By pressing the button we can successfully explore the university

#### 4.1.3 3D Model

Application provides a detailed 3D model of Bahria University Islamabad campus.

#### 4.1.4 Explore University

User can explore the University virtually through the VR gadget.

#### 4.1.5 Movement with Head

In visualization walkthrough we can move the character with the help of head motion. Head up mean we can stop the character where we want and head down mean that character is moving.

### 4.2 Design Methodology

We use agile model for the implementation of the project so that we have room for improvements since with the passage of time technology is advancing. At any point, when we realize we want new changes to take place! The opportunity which agile provides for change is very valuable. New changes can be executed at almost no cost in light of the recurrence of new increment that are created. To develop and execute a new element, the developer need to lose a couple of days work, or even just hours, to move back and execute it.[7]



Figure 4.2: Design Methodology

## 4.3 High Level Diagram

### 4.3.1 Package Diagram

Package diagram is UML structure diagram which shows packages and dependencies between the packages. It is a general purpose mechanism to organize elements into groups to provide better structure for system model[8]. The diagram shows the logical functional elements of the system. Each component represents alike grouping of functionality.

The application have four components i.e.(1) Installing Application (2) Putting Mobile in VR gadget (3) Clicking the start button from the menu in application (4) Exploring the university in Virtual reality

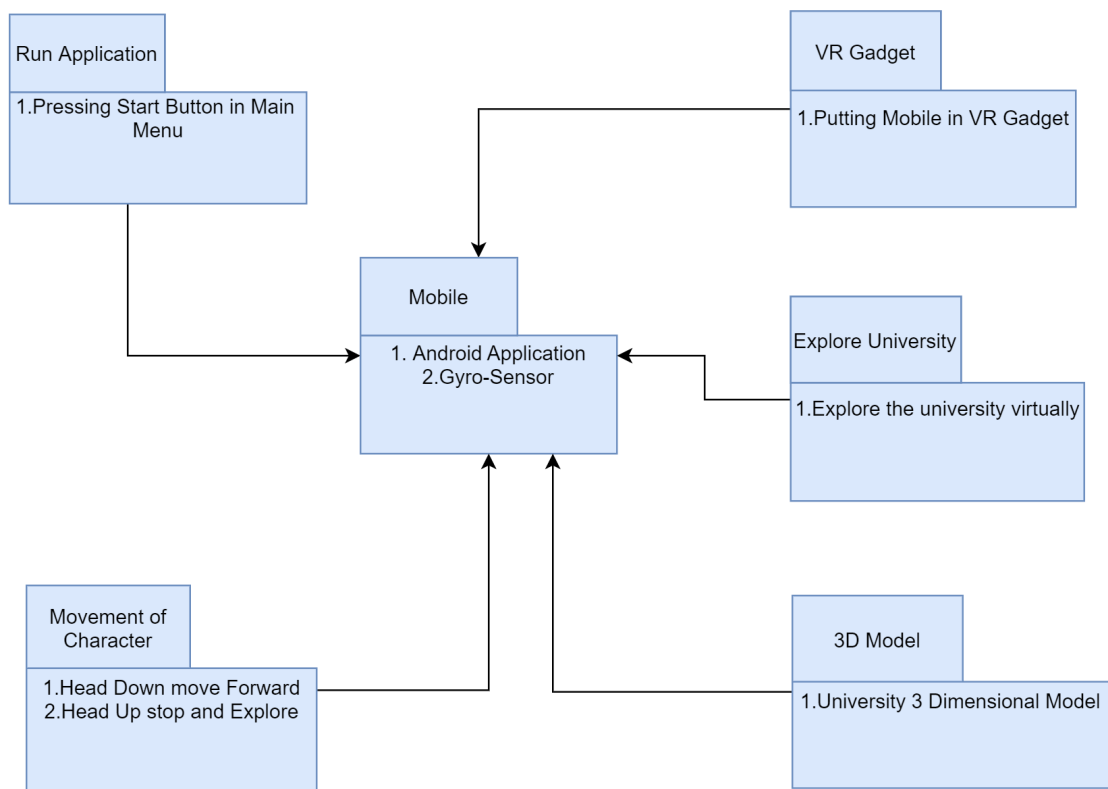


Figure 4.3: Package Diagram

### 4.3.2 Activity Diagram

Activity diagram is essentially a flow chart to represent the flow from one activity to another activity. The activity can be depicted as an operation of the system. So the control flow is drawn from one operation then onto the next. This flow can be successive, spread or simultaneous.[9]

The activity diagram of the application shows the activities of the application in which order it executes.

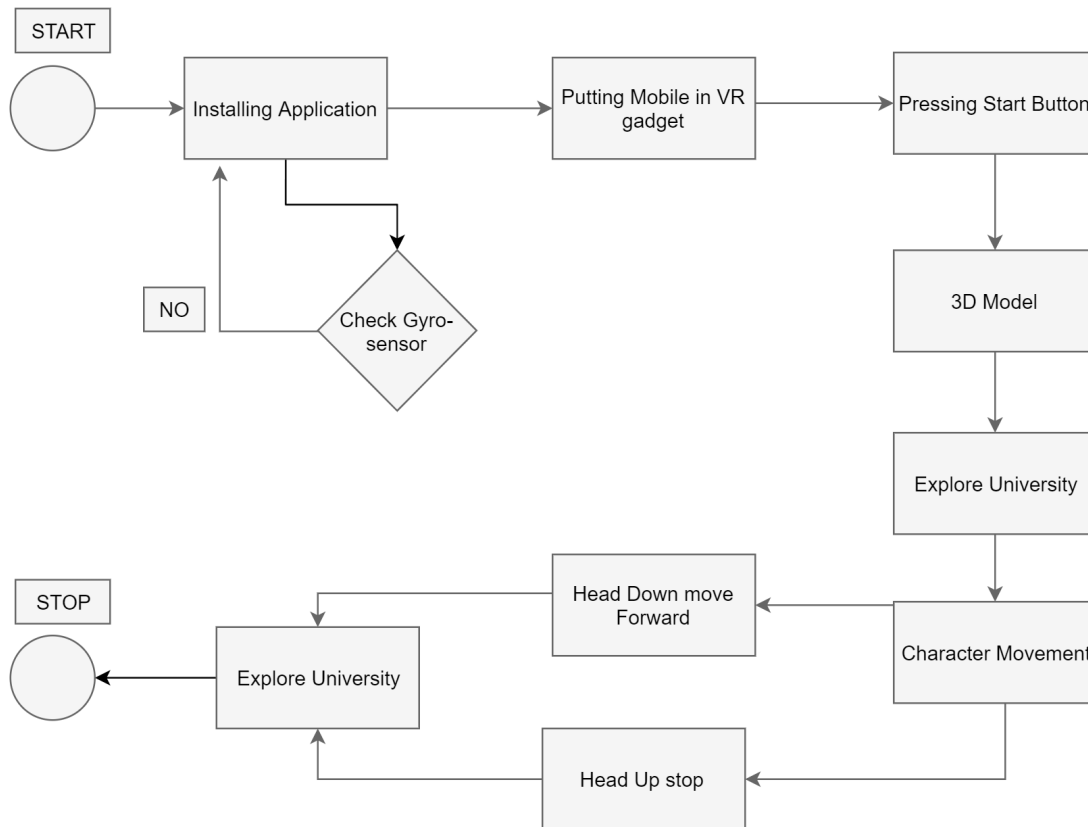


Figure 4.4: Activity Diagram

### 4.3.3 Sequence Diagram

The sequence diagram shows the run time view of the application. It shows the detailed process interaction between different threads or processes of the application. The diagram provides clear view how the user will interact with the processes of the application and how these processes will respond to each application trigger.

Sequence diagram of the application in as follows:

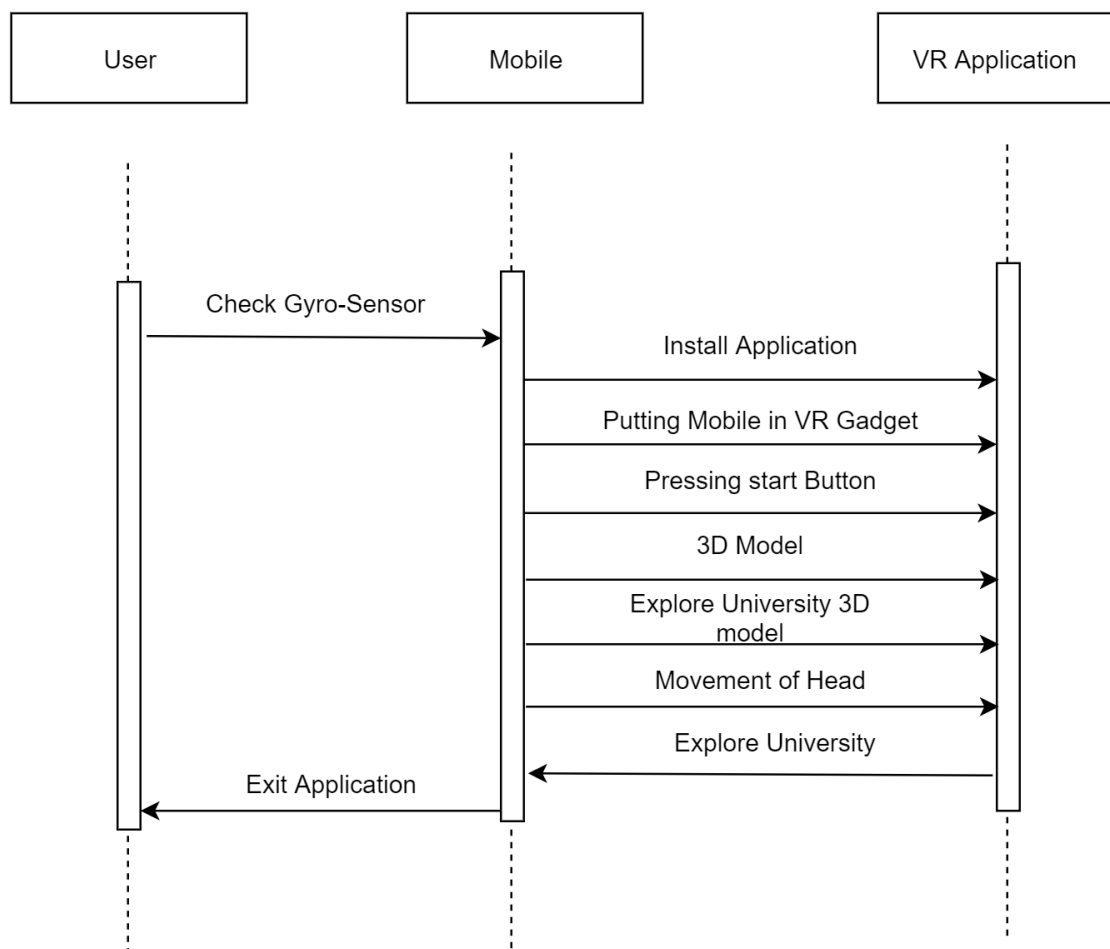


Figure 4.5: Sequence Diagram

## **Chapter 5**

# **System Implementation**

The system implementation is an understanding of a specialized determination or algorithm as a program, software component or the other computer system through programming and deployment. In this part system implementation is clarified in detail. This include an explanation about techniques and tool used to finish the project and also about the algorithm used in the project.

### **5.1 Tools and Technology Used**

The tools and technologies used in this system are as follows.

#### **5.1.1 Visual Studio**

Visual studio is an Integrated Development Environment(IDE) from Microsoft. which is used to develop computer programs, web applications, desktop application and computer games.It supports many languages like C++, C-sharp etc.So unity provide visual studio integration in C-sharp through which we can easily write the scripts for example movement of character and camera.

#### **5.1.2 Unity 3D**

Unity 3d is a cross platform 3D engine and user friendly development environment developed by Unity Technologies. Easy for beginner to use and powerful enough for the expert. Unity is used for mobile 3D games and application and also used for desktop application.

### 5.1.3 Sketch Up

Sketch up is also known as Google Sketch up. Sketch up is 3D modeling software and used for drawing application specifically used for architectural view, interior design, film and video game design.

## 5.2 Development Environment/Language Used

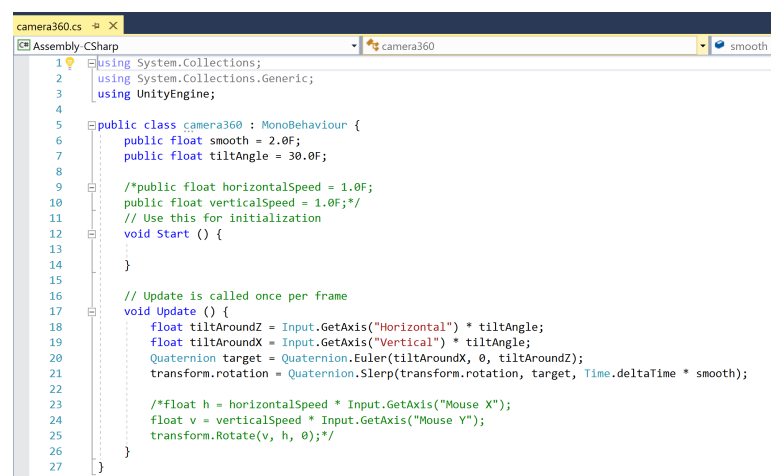
The main development tool used in this project is Unity 3d and for modeling SketchUp tool is used. The scripts are in C-Sharp language. Microsoft Visual Studio is used for scripting and for 3D modeling SketchUp tool and 3d Studio Max is used. E-draw is used for diagrams in the documentation.

## 5.3 Methodologies

As we've used agile model for the implementation so there is space for improvement with respect to time. When we want to apply changes we can easily change the project parts with very little cost. To implement a new feature the developer only losses the work of hours or days to roll back and implement it. Development of this project is completed in two phases.

### 5.3.1 Phase I (Modeling and Applying Scripting)

In first phase we've created the assets of our project which are university buildings and these assets are modeled by SketchUp tool and 3d studio max, then we've imported these assets in unity 3D tool. In Unity 3d tool we've applied and created the movement of our camera by this mean we can explore the university buildings.



```
camera360.cs
Assembly: CSharp
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class camera360 : MonoBehaviour {
    public float smooth = 2.0F;
    public float tiltAngle = 30.0F;

    /*public float horizontalSpeed = 1.0F;
    public float verticalSpeed = 1.0F;*/
    // Use this for initialization
    void Start () {
    }

    // Update is called once per frame
    void Update () {
        float tiltAroundZ = Input.GetAxis("Horizontal") * tiltAngle;
        float tiltAroundX = Input.GetAxis("Vertical") * tiltAngle;
        Quaternion target = Quaternion.Euler(tiltAroundX, 0, tiltAroundZ);
        transform.rotation = Quaternion.Slerp(transform.rotation, target, Time.deltaTime * smooth);

        /*float h = horizontalSpeed * Input.GetAxis("Mouse X");
        float v = verticalSpeed * Input.GetAxis("Mouse Y");
        transform.Rotate(v, h, 0);*/
    }
}
```

Figure 5.1: Camera Rotation Script



Figure 5.2: SketchUp Modeling

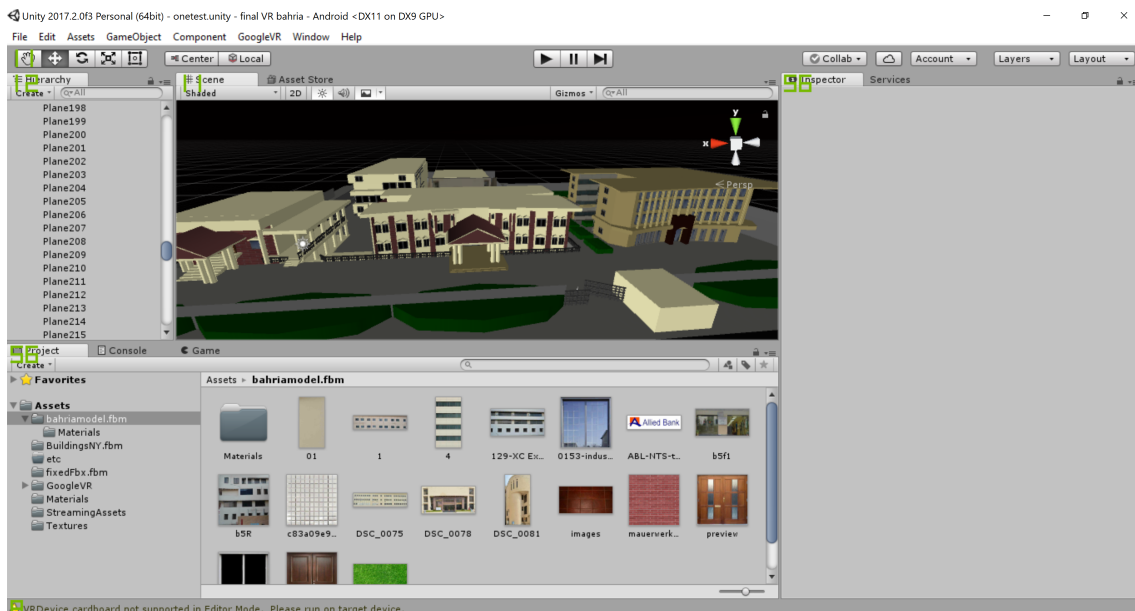


Figure 5.3: Unity Modeling

### 5.3.2 Phase II (Applying VR Technique)

For VR phase we used the plugin provided by Google for VR and apply them on our project.

## Chapter 6

# System Testing and Evaluation

This application was installed and tested on Samsung S6 which has gyro sensor and contain android version 6.0(Marshmallow).The mobile has 5.1 inches screen size and has 1440\*2560 screen resolution with 3GB ram and has Octa-core (4x2.1 GHz Cortex-A57 4x1.5 GHz Cortex-A53).

### 6.1 Installation Testing

This application was installed on different versions of android mobile. The first priority to run the application was that mobile must have a gyro sensor. Application will be installed on those mobile phones which have no gyro sensor but the movement will not be smooth and result will not be perfect. The android version of the mobile must be greater than 5.0(lollipop) or equal to 5.0(lollipop).Now a days no mobile phone company sells the previous version of the android, so application is only compatible with android version greater than 5.0 or equal to 5.0.

#### 6.1.1 Table Test Case 1(A)

Test Case 1	Installation
Description	Application will be installed and have no error.
Requirement	Mobile must have gyro sensor and android version must be greater than 5.0 or equal to 5.0

Table 6.1: Test Case 1(A)



### 6.1.2 Table Test Case 1(B)

Task	Expected result	Actual result
Run on Android(5.0 lollipop)	Pass/Fail	Pass
Run on Android(6.0 Marshmallow)	Pass/Fail	Pass
Run on Android(7.0 Nougat)	Pass/Fail	Pass

Table 6.2: Test Case 1(B)

## 6.2 Usability Testing

### 6.2.1 Table Test Case 1(A)

Test Case 1	Application Start-up
Description	The application display the Startup Screen when opened and has start button at the front of display screen
Requirements	Application must be installed on the android device.

Table 6.3: Test Case 1(A)

### 6.2.2 Table Test Case 1(B)

Task	Expected result	Actual result
Application Start	Pass/Fail	Pass
Start-up screen display	Pass/Fail	Pass

Table 6.4: Test Case 1(B)

### 6.2.3 Table Test Case 2(A)

Test Case 2	Rotation of camera in VR gadget
Description	After placing mobile in VR gadget check the rotation of camera 360 in VR gadget
Requirements	Application must be started and mobile must be placed in the VR gadget

Table 6.5: Test Case 2(A)

**6.2.4 Table Test Case 2(B)**

Task	Expected result	Actual result
Camera 360 rotation	Pass/Fail	Pass

Table 6.6: Test Case 2(B)

**6.2.5 Table Test Case 3(A)**

Test Case 3	Movement of character with head movement
Description	Character will move if head is down and will stop the movement if the head is up
Requirements	Mobile must be in VR gadget and must be in visualization mode

Table 6.7: Test Case 3(A)

**6.2.6 Table Test Case 3(B)**

Task	Expected result	Actual result
Head up character Stop	Pass/Fail	Pass
Head Down character movement	Pass/Fail	Pass

Table 6.8: Test Case 3(B)

**6.2.7 Table Test Case 4(A)**

Test Case 4	Move from one scene to another
Description	If character came to XC block then user will be entered in the XC building
Requirements	Mobile must be in VR gadget and must be in visualization mode and must be near to XC block

Table 6.9: Test Case 4(A)

### 6.2.8 Table Test Case 4(B)

Task	Expected result	Actual result
Move to the next scene(Inner XC building)	Pass/Fail	Pass

Table 6.10: Test Case 4(B)

## 6.3 Compatibility Testing

The application is compatible with mobile having gyro sensor and mobile which has 5.0(Lollipop) android version or greater android version.

### 6.3.1 Table Test Case 1(A)

Test Case 1	Compatibility Testing
Description	Running the application on different version of android
Requirements	Android version must be equal or greater than 5.0(Lollipop)

Table 6.11: Test Case 1(A)

### 6.3.2 Table Test Case 1(B)

Task	Expected result	Actual result
Android Version 4.0(Ice Cream Sandwich)	Pass/Fail	Fail
Android Version 4.1(Jelly Bean)	Pass/Fail	Fail
Android Version 4.4(KitKat)	Pass/Fail	Fail
Android Version 5.0(Lollipop)Tested	Pass/Fail	Pass
Android Version 6.0(Marshmallow) Tested	Pass/Fail	Pass
Android Version 7.0(Nougat)Tested	Pass/Fail	Pass

Table 6.12: Test Case 1(B)

## **Chapter 7**

### **Conclusions**

The project “Bahria University Virtual Guide” application will provide a complete guide tour to the user to explore the university by mean of using VR technology .This application was specifically design for new comer to the university or someone who is willing to take admission in the university and want to look at the university. The main objective of this project was to learn the emerging VR technology as well as provide a guide tour to the new students.

After developing this project, we understand that what Virtual Reality is and how it work. How the Virtual reality is implement on mobile application. We learn how to perform system testing on mobile application, especially application in which Virtual reality in involved.

#### **7.1 Future Enhancements**

In this project we only limited our guide tour design internally to the XC block .The future enhancement in this project will be by making the whole design of university internally. So user can explore all the other blocks of university internally.

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