Software Requirement Specifications

For

Virtual Tour of
 Department of Computer Science and Engineering

Version 1.0.1

Prepared by

Group 27

Abhinav Hinger-160101004

Apurva N. Saraogi-160101013

Daman Tekchandani-160101024

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1 Introduction

This SRS document aims at developing Mobile App that gives users the Virtual Tour of the CSE Department.This aims at familiarising new students and visitors with our Department.

1.1 Purpose

The purpose of this document is to give a detailed description of the requirements for this Virtual Reality App.It will give a comprehensive scope of it's working and also explain system constraints, interface and interactions with other external applications.

1.2 Scope

Project- Virtual Department
Features:

      1.Comprehensive 3D map of the CSE Department
      2.Control the first person character with your head movements only.
      3.Immersive Environment

The VR App when completed can be used by all users who know how to operate an Android application and a VR headset to get an immersive tour of the Department. Most of the gestures to roam around in the virtual world are kept intuitive which makes it easy to operate.

1.3 Definitions, Acronyms, and Abbreviations

SDK : Software Development Kit
VR: Virtual Reality
AR:live direct or indirect view of a physical, real-world environment
Unity: cross-platform game development engine

1.4 References

IEEE. IEEE Std 830-1998 IEEE Recommended Practice for Software Requirements Specifications. IEEE Computer Society, 1998.

1.5 Overview

Other parts of the SRS :-
 1. Functional Analysis : contains the modular structure of the whole software
 2. Softwares/Resources Requirements:Function required to construct the product
3. Interface Description
4. Contextual Inquiry

2.The Overall Description

This section presents the overall view of specific requirement which will form the background of section 3.

2.1 Product Perspective

Apart from giving the virtual tour of our department,this Android app has the potential of motivating all the country's bright students.When they see themselves standing in one of the best colleges in the country,they will be motivated to opt for it.This app will also form the base for AR/VR tour of entire IIT.

2.1.1 System Interfaces

The software can be directly launched on Mobile supporting Android without the need for installing external APIs.

2.1.2 Interfaces

This software uses the following Software-User interfaces :

    1.This app is based completely on Android Platform using Unity engine and can be used by any device supporting Android 4.0+.

    2.The software will be GUI accessible and will use Accelerometer of the device to move around.

    3.User will be immerse himself and be able to control his movements using his head positioning.

2.1.3 Hardware Interface

1. The final version of the software can be used by any smartphone with at least:

- Android 4.4+ (KitKat)
- Processing Power: Dual Core 1.2GHz
- Accelerometer Sensor

2.VR headset compatible with Google Cardboard SDK

2.1.4 Communications Interface

Map will be Offline without the need for a Server side application.Environmental sensor data will be sent by the Android as sensor information packages through Java's ObjectOutputStream.

Authentication and data encryption should be considered to disallow unauthorized users from logging in to the App, but is outside the scope of this project.

2.1.5 Memory Constraints

Minimum Memory Space:500 MB (due to extensive detailing of the map)

2.2 Product Functions

1. Immersive tour of the Dept. of CSE
2. Extensively detailed to match the Real Department
3. Movement in Virtual Space is decided by head movements -forward,backward,left,right,look up/down/right/left

2.3 User Characteristics

The intended users for the product will have the following characteristics :-
1. Able to afford and use an Android device (Version 4.4+)
2. Able to understand the functioning and operation of the software on a basic level.
3.Able to move the head without any restriction

4.Should know how to control a VR headset and how to move in the virtual Space.

2.4 Assumptions and Dependencies

1. OS used on the device :- Android 4.4 (KitKat) or higher
2. Device must have a minimum of 500 MB storage space for storing the application and also some minimal data generated whilst operation.
3. Device must have a minimum 2GB RAM and 1.2GHz Processing Power.
4. Device must have support for Virtual Reality Apps
5. Must have ARM architecture based hardware design

3.Specific Requirements

The inputs and outputs of the Application related to External Environment. We conducted Contextual Inquiry of around 50 people belonging to our target audience about various functional and non-functional requirements. Results of this are attached at the end of this document.

3.1 External Interfaces

Inputs

1.Head Movements of User detected via Accelerometer of Smartphone
2.Map of the Department through Memory of Device.

Outputs

1.Movement in Virtual Space:
   - I.   Forward
   - II. Backward
   - III. Left
   - IV. Right
2.Rotation of Character in Virtual Space:
   - I.   Look Up/Down
   - II. Turn Left/Right

3.2 Functional Requirements

Following functions have been included using the results of the Contextual Inquiry:

   I.   Display 2D minimap for guidance during the tour.
   II.   Audio Description of the Different sections of the Department

1)   Navigation

1.1)   Directional movement:

   ·   Input: User interaction with the Device(Accelerometer)
   ·   Function: Calling one of the below four functions accordingly.
   ·   Output: Process completed.

1.1.1)   Move front.

   ·   Input: Call from directional movement function.
   ·   Output: Change the location inside the virtual world.

The below functions have similar input/output specifications.
   1.1.2) Move back.
   1.1.3) Move left.
   1.1.4) Move right.

Rotational movement function is defined similar to the directional movement function.

1.2) Rotational movement:

   1.2.1) Up rotation by W degrees.

   ·   Input: Call from directional movement function.
   ·   Output: Change the orientation inside the virtual world.

Similarly defined are:

      1.2.2) Down rotation by X degrees.
      1.2.3) Right rotation by Y degrees.
      1.2.4) Left rotation by Z degrees.

2)   Boundaries:

2.1)   Fetch from database and retrieve data of the map.
2.2)   Boundary specification:
A function used to specify the boundary limits for the Department

- Input: Data retrieved from function 2.1.
- Output: Boundaries of the given map.

2.3)   Boundary restriction:
Restriction function is used to restrict the user movement so that he/she does not go off the limit.

- Input: Current location and Output from Boundary Specification function.
- Output: Error display if coordinates go outside boundary.

3)   Map of the Department:

3.1)   A function which calls retrieves from the database. The database stores the specification of the map and positions of the entities.

- Input: Call from the initialization module when App is Launched
- Output: Call the function to generate 3D map of the Department.

3.2)   Function to generate 2-D minimap. This mini-map is useful for the user to navigate through the premises of the Department.

- Input: Call from function 3.1
- Output: 2D map of the Dept. Section-wise

3.3)   Function to monitor Gaze of User constantly with the 3D visualization module.The position of the user is also constantly monitored.

- Input: Global coordinate variables and View Area of the User(Gaze)
- Output: Call 3.4 upon the Gaze of User to 3-D visualization module.

3.4)   Function to play Audio describing the details of the Current Section of the Department.

- Input : Call from 3.3
- Output: Audio Description of the Current Section

4) Initialisation Module

- Input : Start of the App
- Output: Call the 3D visualisation to create the 3D world from the Map

5) 3D Visualisation Module

5.1) Function which sets up the 3-D visualization.

- Input: Call from Initialisation Module(4)
- Output: Create the 3D Virtual World and also Call 5.2 whenever the position of user changes.

5.2) Since the surroundings change whenever the user moves, this function is needed to constantly calculate the 3D surrounding setup for each and every position and orientation of the user's view.

- Input: Current user position.
- Output: Changes surroundings according to the position of the augmented user.

3.3 Non Functional Requirement

1. Usability

This application is Easy to Use

I.   The app is simple with respect to functionalities and does not require any specific prior knowledge to operate it.
II. The Movements are Intuitive to a great Extent.Eg. Turn Left to make the character look towards left.

2. Apportioning of Requirements

I.   Construction of a 2D minimap(for guidance) and Audio Description of Department may be avoided in the first version of the design.Since these requirements are secondary they can be avoided without affecting overall functioning of the application
II. The 3-D visualization module and the Boundaries module will be given top priority while the app is implemented.
III. Description of each Professor and Designing of the Rooms may be reserved for future version of the app.

3.4 Software System Attributes

3.4.1 Reliability

MTBF (Mean Time Between Failures) : Minimum value - 30 Seconds The software is supposed to work properly while running any applications while providing user with probable suggestions to change their operation method whenever required.

3.4.2 Availability

The system will be available for use whenever the user deems necessary 24/7. The system shall allow users to restart the application with User starting the Tour from the Entrance of the CSE Department.

3.4.3 Security

Being a tour app it would not need any type of Authentication.The Map files will be DRM encrypted by Unity itself to prevent unauthorized changes .

3.3.4 Maintainability

The system will be updatable from software patches available through the Google Play Store. Any discrepancies will be addressable by any developer as the coding will be done according to the coding standards of IEEE.

3.3.4 Portability

The software will be easily transferable to any Android device satisfying the minimum software dependency requirements as specified in this SRS Document. The software can be installed on an Android using the same method as any other Android App via the Android App Manager.

4. Contextual Inquiry

4.1 Procedure

A set of questions were asked to an impartial and diverse group of people.These questions catered to both functional,non-functional requirements and usability of the application.They were also asked whether they had the required prerequisites to operate the app efficiently.The users were constantly monitored to prevent influence while answering the questions.After compiling the results,decisions were taken for functions and the design of the application.
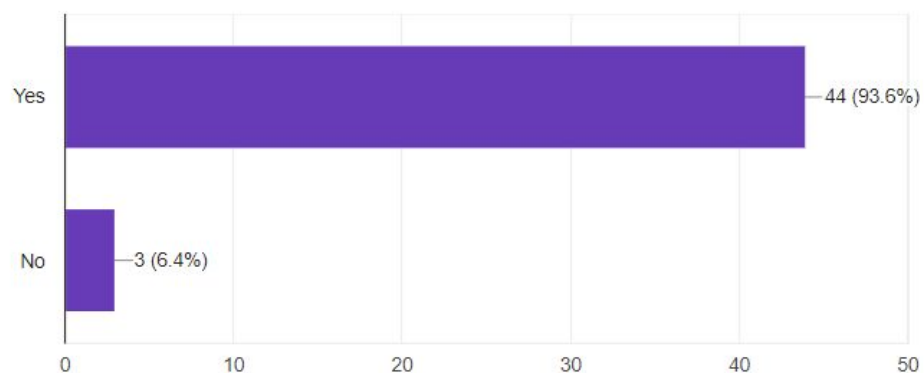
4.2 Results

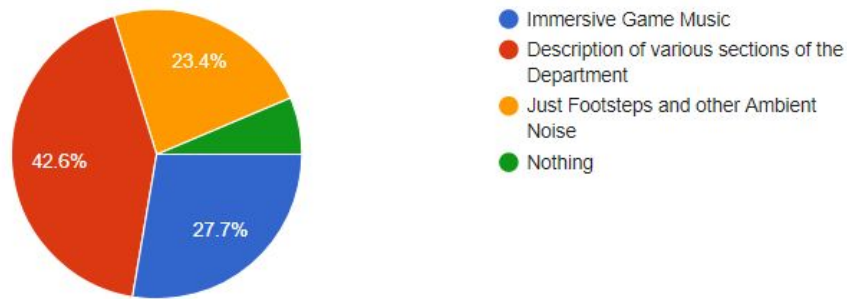Pictographic representation of some of the questions asked are shown below:

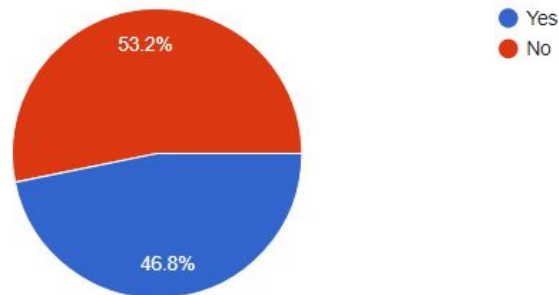Question : How often do you face difficulty in finding Faculty rooms or Labs in your Department ?
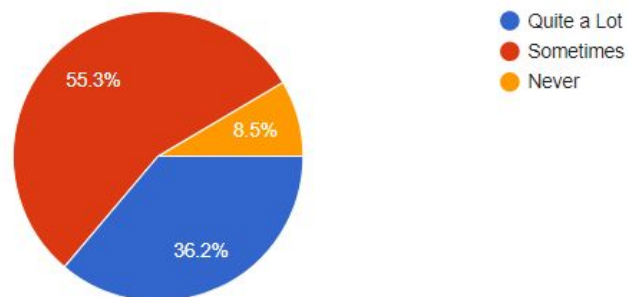
Question : Would you like a 2D Mini Map to guide you in the tour ?

Question : What do you want as Background Audio?

- Immersive Game Music
- Description of various sections of the Department
- Just Footsteps and other Ambient Noise
- Nothing

23.4%

42.6%

27.7%

Question : Have you ever used a VR headset before ?

- Yes
- No

53.2%

46.8%

Question : Lastly do you think that Tours like these can help motivate students who pursue JEE ?

- Yes
- No
- Can't say

36.2%

17%

46.8%
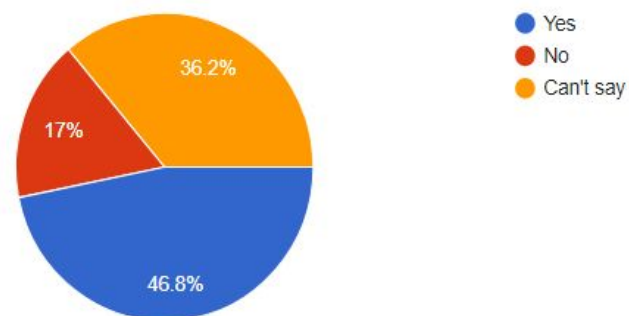
4.3 Conclusion

Following functions have been included using the results of the Contextual Inquiry:

  I.   Display 2D minimap for guidance during the tour.
 II.   Audio Description of the Different sections of the Department
III.   Since many of users suggest that these type of tours can motivate students,this app has broad scope of expanding to rest of the campus and even other IITs.

We will be keeping this app Open-Source and free to use so that others can also contribute to its expansion.