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| **Software Requirement Specifications**  Indoor Navigation For Blind  Version: [1.0]   |  |  | | --- | --- | | Project Code |  | | Supervisor | Engr. Abdul Rahman | | Co Supervisor |  | |  |  | | Project Team | Rehan Arif (16K-3993)  Huzaifa Mughal (16K-3981)  Muhammad Sohail (16K-3987) | | Submission Date | 18 Nov 2019 | |

Document History

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| **Version** | **Name of Person** | **Date** | **Description of change** |
| 1.0 | Rehan Arif | 18/11/2019 | Document Created |
|  |  |  | [Added Non-functional requirements] |
|  |  |  | [Added UseCase x.x.xx] |
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Distribution List

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| **Name** | **Role** | |
| Sir Abdul Rahman | | Supervisor |
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Document Sign-Off

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1. Introduction

* 1. Purpose of Document

The purpose of this document is to present a detailed analysis of the software specifications required for the proposed project.

* 1. Intended Audience

Teachers

Fellow Students

Researchers

**1.3 Abbreviations**

NA

* 1. Document Convention

Main headings – Arial Sze. 16

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1. Overall System Description
   1. Project Background

Gadgets assisting blind/visually impaired have flooded the market in the recent times, offering myriads of services ranging from facial recognizing spectacles to obstacle avoiding walking sticks. There exist mobile applications that enable users to detect objects, quantity of currency and even colors of entities.

But numerous significant problems endure within these gadgets that discourage the potential users from utilizing them. The most prominent among these problems is the cost. Majority of the blind assisting products are excessively exorbitant to such an extent that they have become inaccessible for the bourgeoisie. Other problem that arises from these gadgets is that the features they offer are not bundled in a single device, rather these features are distributed among various devices. And last, but not the least, a feature that most of these appliances fail to deliver is ‘Indoor navigation’.

An app that allows blind/visually impaired to navigate indoors with just a camera seems to be a crucial system that is absent from the current market.

* 1. Project Scope

We propose an app that incorporates real-time obstacle avoidance and indoor navigation capabilities with an interface easy enough that a blind/visually impaired can interact with, without encountering difficulties.

* 1. Not in Scope

The proposed system is not autonomous.

* 1. Project Objectives

**The app will allow the users to reach their desired destination in an indoor environment through audio commands. The system will not only provide navigation, but also obstacle avoidance as the potential users are supposed to be blind and cannot avoid any hindrance in path of the destination.**

* 1. Stakeholders

**Potential Users:** Blind/Visually Impaired

* 1. Operating Environment

The system primarily consists of four components:

* An app installed in an android-supported cell phone
* An IP Sterio Camera
* A server
* A router

The camera (mounted on user) will transmit the footage to the server that will use it generate commands that will transmitted to the user, in form of audio, through the mobile application.

* 1. System Constraints
* Software constraints
* Hardware constraints
* Cultural constraints: English (en-US) will be compatible with the app.
* Legal constraints
* User constraints: The potential users are blind; thus, the app interface needs to be as simple as possible. Furthermore, vocal instructions for the app navigation are to be provided.
* Off the shelf components that might be used in the project may have their constraints that are consequently transferred to the project.]
  1. Assumptions & Dependencies
* The users are assumed to be blind only. Facilities to the people suffering from hearing-impairment are not provided.
* The users of the current system need to be approximately as tall as the technician capturing footage for the training of the model.

1. External Interface Requirements
   1. Hardware Interfaces

The hardware that we are currently using is a laptop that will serve as server. A mobile app that will host an android app, and an IP Stereo Camera that will be used to capture the footage for training and testing purposes. All three of these components will be connected to a router for communication.

* 1. Software Interfaces

N/A

* 1. Communications Interfaces

N/A

1. Functional Requirements
   1. Functional Hierarchy

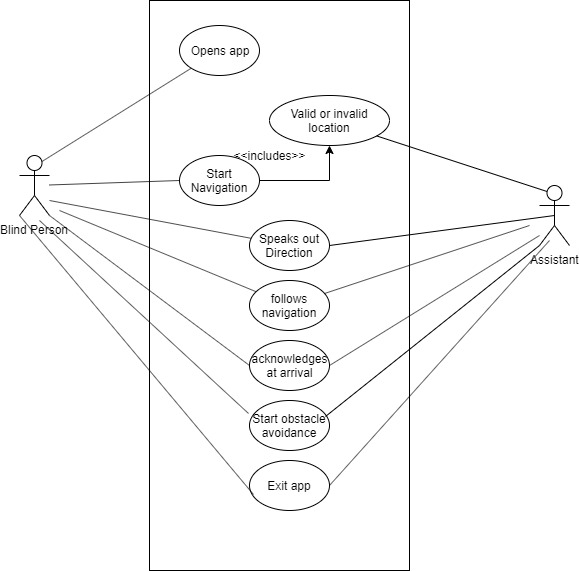
* Indoor Navigation

A model of the desired premise will be trained on a system. The system then will act as the server for our app. Once the model is trained, an IP stereo camera hoisted on the user, will start taking footage of the premise. The footage will be fed to the server that will in turn prompt the app to provide commands to the user to navigate, through audio signals.

* **Obstacle Avoidance**

Obstacle avoidance is an essential feature for blind assisting devices. The Stereo camera will provide obstacle avoidance feature by perceiving depth, the same way a human does. Depth perception is achieved when the brain processes different pictures from each eye and combines them to form a single 3-D image. Using the same mechanism, a method called ‘Obstacle Avoidance Using Stereo Camera’ [2] will estimate the distance of the objects present within 1- meter range of the user, through different images captured from each camera. Upon detection, the user will instantly be notified to change direction through vocal commands.

* 1. Use Cases



* + 1. Destination Selection

The user will be hoisted with an IP Stereo Camera that will be connected to the server through the router. An app will be hosted on the mobile phone that user will be using for communication with the system. The user will set the destination in the app.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| * + - 1. **Destination Selection** | | | | |
| **Use case Id:** | | 1 | | |
| **Actors:** User | | | | |
| **Feature:** NA | | | | |
| **Pre-condition:** | | Open app | | |
| **Scenarios** | | | | |
| **Step#** | **Action** | | | **Software Reaction** |
| **1.** | Opens the app. Touches the destination button once. The app will read the button’s content. Touching it again will select it. | | | The destination for navigation is selected. |
|  |  | | |  |
| **Alternate Scenarios:** NA | | | | |
| **1a: NA**    **2a: NA** | | | | |
| **Post Conditions** | | | | |
| **Step#** | **Description** | | | |
|  | 1. Directions will be prompted to the user. | | | |
|  |  | | | |
|  |  | | | |
| **Use Case Cross referenced** | | | Speaks Directions | |

* + 1. Speaks Directions

The footage captured through the camera will be sent to server, which in turn will prompt the app to transfer correct responses to the user through audio signals.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| * + - 1. **Speaks Directions** | | | | |
| **Use case Id:** | | 3 | | |
| **Actors:** App | | | | |
| **Feature:** NA | | | | |
| **Pre-condition:** | | The user has selected the destination | | |
| **Scenarios** | | | | |
| **Step#** | **Action** | | | **Software Reaction** |
| **1.** | NA | | | NA |
|  |  | | |  |
| **Alternate Scenarios:** NA | | | | |
| **1a:**    **2a:** | | | | |
| **Post Conditions** | | | | |
| **Step#** | **Description** | | | |
|  | The user will be acknowledged upon the destination arrival. | | | |
|  |  | | | |
|  |  | | | |
| **Use Case Cross referenced** | | | NA | |

* + 1. Obstacle Avoidance

The stereo camera will measure the distance of the objects in the path of the user and destination. If an object’s distance is less than a specified amount, the trajectory of the user will be altered so that the collision could be avoided.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| * + - 1. **Destination Selection** | | | | |
| **Use case Id:** | | 3 | | |
| **Actors:** User, IP Stereo Camera | | | | |
| **Feature:** NA | | | | |
| **Pre-condition:** | | The user has selected the destination | | |
| **Scenarios** | | | | |
| **Step#** | **Action** | | | **Software Reaction** |
| **1.** | NA | | | NA |
|  |  | | |  |
| **Alternate Scenarios:**  NA | | | | |
| **1a:**    **2a:** | | | | |
| **Post Conditions** | | | | |
| **Step#** | **Description** | | | |
|  | NA | | | |
|  |  | | | |
|  |  | | | |
| **Use Case Cross referenced** | | | NA | |

1. Non-functional Requirements
   1. Performance Requirements

The system will be needed to be responsive as the user using could incur serious injury if valid commands are not transmitted in time.

* 1. Safety Requirements

The premise needs to be as ‘childproof’ as possible, since the user might get seriously injured incase the app malfunctions.

* 1. Security Requirements

NA

* 1. User Documentation

SRS

SDS

1. References

[1] A.B. Smith, C.D. Jones, and E.F. Roberts, “Article Title”, *Journal*, Publisher, Location, Date, pp. 1-10.

[2] Jones, C.D., A.B. Smith, and E.F. Roberts, *Book Title*, Publisher, Location, Date.

1. Appendices

[This section should include supporting detail that would be too distracting to include in the main body of the document.]