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Team: Survivors

Project: Sight By Touch

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# Document Revision History

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| --- | --- | --- | --- |
| Revision Number | Revision Date | Description | Rationale |
| 1.0 | 10/9/2013 | First SRS Draft | Team’s initial draft |
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# 1. Product Concept

This section describes the purpose, use and intended audience for the Sight By Touch system. The Sight By Touch system is made to aid visually impaired users through the use of vibrations. Users of the Sight By Touch system will be able to move around and gauge where they are. When a user walks near an object, the system will vibrate in the direction where the object is closest. This warns the user that there is an object nearby and thus prevents a collision. With the use of these vibrations created by the system, a user will be able to avoid obstacles since the use of sight will not be available or limited.

## Purpose and Use

The purpose of the Sight By Touch system is to aid visually impaired individuals since they are unable to rely on their sight. With this system, a user should be able to traverse and avoid collision with any obstacles that are found in the environment. The system should lead the user to a safe direction by warning the user when an object is within the radius of the sensors through the use of vibrations from the vibrators on the system. The vibrators on the system will vibrate near the location where the object is located when the sensors sense the object nearby. This system is used solely for the purpose of helping users navigate in unknown surroundings or in common areas. It is advisable that this product not be used in a crowed place because there will be too much interference.

## Intended Audience

The intended audience for the Sight By Touch system are individuals who are visually impaired. The system will come in one standard size and the target group will be ages 14 through 25. Since this is the intended range, accommodations for other target groups is currently not a priority.

# 2. Product Description and Functional Overview

This section provides the reader with an overview of the Sight By Touch system. The primary operational aspects of the system, from the perspective of the end users to the implementers of the back end, are defined here. The key features and functions found in the system, as well as critical user interactions and user interfaces, are described in detail.

## 2.1 Features and Functions

The Sight By Touch system shall consist of a pouch that holds the main battery which connects to the sensors and vibrators. The battery will have a cord that can connect to any outlet for charging when the user is not using the product.

The sensors will be detachable to allow for flexibility and cleanliness. The sensors will be attached to straps at the front and their wires will be connected to the main battery and to the vibrators. The area that the system will cover will be in front of the user (180 degrees, a 5 feet radius horizontally, and from head to toe vertically). When a sensor detects an object in its range, the sensor will send a signal to the microcontroller and will then forward the message to the vibration motor. How close the object is will determine the intensity of the vibrations. The system will not be able to detect the absence of flooring such as a hole or a stair case.

There will be multiple vibration motors distributed along the body of the user. When the sensor connected to those vibration motors senses an object within the range, the sensor will send a signal to the microcontroller, which will then forward the message to the vibration motor. There can be multiple vibration motors vibrating at the same time and at different intensities depending on where the object is located. The closer the object is the more intense the vibration will be.

The system will also have a belt in the front that will give the user a simple interface. The interface will have an on/off button to turn the sensors on/off. In addition, there will be a knob that allows the user to adjust the range that the sensors will detect. There will be no external elements for all the functions and data manipulation will be done internally.

## 2.2 External Inputs and Outputs

The system will have a belt that contains a button which receives input from the user to turn the sensors on/off. Also the user will use a knob that will adjust the range of the sensor’s detection depending on what the user finds appropriate for the user's environment. The sensors on the straps will receive input which notifies the sensors that there is an object close by. With this data, the sensors will then communicate with the microcontroller, which then forwards the message to the vibration motors through signals. The vibration motors will take this input and intensify its vibration depending on the distance between the object and the sensors.

**Table 2-1: External Inputs and Outputs**

|  |  |  |
| --- | --- | --- |
| **Name** | **Description** | **Use** |
| **Power Button** | A button located on the belt part of the product. Turns the sensors on/off. | This will be input, initiated by the user when they are ready to use the product. |
| **Range Adjustor** | A knob located on the belt part of the product. Adjusts the range of the sensors. | This will be input from the user when they wish to adjust the range of their sensors. |
| **Proximity Sensor** | Used to detect objects nearby. | Sensors will receive input to determine the general direction of an object. |
| **Vibration Motors** | Increases vibration as the distance of an object becomes closer. | The microcontrollers will send input to the vibration motors and signal them to vibrate. |

## 2.3 Product Interfaces

The system will have an interface that will be designated on a belt, in the front of the user. The belt will have a button that turns the sensors on/off. The belt will also have a knob that is capable of adjusting the range of the sensor’s detection.

The straps, which are the main part of the system, will have small sensors lined up and will face the front. On the front, there will be vibration motors distributed along the body of the user.

# 3. Customer Requirements

This section consists of the requirements created by the team Survivors and the sponsor Jennifer Svelan. Each requirement will have a description, a source, constraints, standards, and a priority.

## 3.1 On and Off

3.1.1 Description: The system shall be able to be turned on/off with one button.

### 3.1.2 Source: Jennifer Svelan and Survivors

### 3.1.3 Constraints: None

### 3.1.4 Standards: None

### 3.1.5 Priority: 1- Critical

## 3.2 Object Detection

3.2.1 Description: The system shall be able to detect and warn the user of nearby objects in front of them.

### 3.2.2 Source: Jennifer Svelan and Survivors

### 3.2.3 Constraints: Will not be able to detect unleveled floors.

### 3.2.4 Standards: The system shall have a 5 foot radius, 180 degrees horizontally, and head to toe vertical detecting standard.

### 3.2.5 Priority: 1 - Critical

## 3.3 Battery Powered

3.3.1 Description: The system shall be powered by a battery.

### 3.3.2 Source: Jennifer Svelan and Survivors

### 3.3.3 Constraints: None

### 3.3.4 Standards: Must last between 6 and 10 hours on a full charge.

### 3.3.5 Priority: 1 - Critical

## 3.4 Common Physical Appearance

3.4.1 Description: The system shall be an appropriate level of discreteness.

### 3.4.2 Source: Jennifer Svelan

### 3.4.3 Constraints: Finding material that is imperceptible, washable, and lightweight.

### 3.4.4 Standards: None

### 3.4.5 Priority: 2 - High

## 3.5 Low Battery Notification

3.5.1 Description: The system shall be able to notify the user when the battery has less than an hour left of charge and again when the battery has less than thirty minutes left of charge.

### 3.5.2 Source: Jennifer Svelan and Survivors

### 3.5.3 Constraints: None

### 3.5.4 Standards: None

**3.5.5 Priority:** 1 -Critical

## 3.6 User Friendly

3.6.1 Description: The system shall be able to be operated by inexperienced users.

### 3.6.2 Source: Jennifer Svelan and Survivors

### 3.6.3 Constraints: The operating difficulty of the sensors and vibration motors.

### 3.6.4 Standards: None

### 3.6.5 Priority: 2 – High

## 3.7 Safe

3.7.1 Description: The system shall be safe and shall cause no harm to the person wearing it.

### 3.7.2 Source: Jennifer Svelan and Survivors

### 3.7.3 Constraints: The wiring and battery must not harm the user.

### 3.7.4 Standards: Must use insulated wires (more research required)

### 3.7.5 Priority: 1 - Critical

## 3.8 Replaceable Components

3.8.1 Description: The system shall have replaceable components.

### 3.8.2 Source: Jennifer Svelan and Survivors

### 3.8.3 Constraints: Component compatibility

### 3.8.4 Standards: None

### 3.8.5 Priority: 2 - High

## 3.9 Floor Depth Detection

3.9.1 Description: The system shall be able to detect the depth of the floor.

### 3.9.2 Source: Jennifer Svelan

### 3.9.3 Constraints: None

### 3.9.4 Standards: None

### 3.9.5 Priority: 5 – Future

## 3.10 Global Positioning System

3.10.1 Description: The system shall have GPS to guide the user from the current location to another.

**3.10.2 Source:** Jennifer Svelan

**3.10.3 Constraints:** None

**3.10.4 Standards:** None

**3.10.5 Priority:** 5 - Future

# 4. Packaging Requirements

This section will list and describe each major component of the system. These components include hardware, software and documentation that will be delivered to the user. The system will be packaged with a “Plug-and-Play” type setup.

## 4.1 Interface Device

4.1.1 Description: The system shall include a device that will allow the user to control and activate the system.

**4.1.2 Source:** Survivors

### 4.1.3 Constraints: The device will require a power source.

### 4.1.4 Standards: None

### 4.1.5 Priority: 2 - High

## 4.2 Sight By Touch System

4.2.1 Description: The system shall include distance sensors that can detect objects from a distance, vibration motors to alert the user, and microcontrollers to compute/process the data. The microcontroller will be attached to the interface device. This system will come pre-assembled.

### 4.2.2 Source: Survivors

### 4.2.3 Constraints: The system will require a power source.

### 4.2.4 Standards: None

### 4.2.5 Priority: 1 – Critical

## 4.3 Battery

4.3.1 Description: The system shall come with its own power source that is rechargeable.

### 4.2.2 Source: Survivors

### 4.3.3 Constraints: Power source must last between 6-10 hours.

### 4.3.4 Standards: None

### 4.3.5 Priority: 1 – Critical

## 4.4 Charger

4.4.1 Description: The system shall come with its own charger to charge the battery.

### 4.4.2 Source: Survivors

### 4.4.3 Constraints: Power source must last between 6-10 hours.

### 4.4.4 Standards: None

### 4.4.5 Priority: 1 - Critical

## 4.5 Software

4.5.1 Description: The system shall come with the software pre-installed.

### 4.5.2 Source: Survivors

### 4.5.3 Constraints: None

### 4.5.4 Standards: None

### 4.5.5 Priority: 1 – Critical

## 4.6 User Manual

4.6.1 Description: The system shall include a user manual with instructions on how to assemble and use the system.

### 4.6.2 Source: Survivors

### 4.6.3 Constraints: None

### 4.6.4 Standards: None

### 4.6.5 Priority: 3 - Moderate

# 5. Performance Requirements

This section covers the performance requirements the system must fulfill. Performance requirements include detection range, real-time response, independent detection, independent response, parallel processing capabilities, detection quality, simultaneous active states, response strength, and battery life.

## 5.1 Detection Range

5.1.1 Description: The system shall be able to detect objects within a 5-foot radius in front of user and from head to toe.

### 5.1.2 Source: Survivors

### 5.1.3 Constraints: Performance of the system’s sensors

### 5.1.4 Standards: None

### 5.1.5 Priority: 1 - Critical

## 5.2 Real-Time Response

5.2.1 Description: The system shall be able to detect objects and notify the user through vibrations in real-time (preferably on the order of milliseconds, but at most a tenth of a second).

### 5.2.2 Source: Survivors

### 5.2.3 Constraints: Quality of microcontroller(s), the processing algorithm, and the environment.

### 5.2.4 Standards: None

### 5.2.5 Priority: 1 – Critical

## 5.3 Detection Quality

5.3.1 Description: The system shall be able to detect solid objects such as walls, tables, chairs, doors, and even moving objects.

### 5.3.2 Source: Survivors

### 5.3.3 Constraints: None

### 5.3.4 Standards: None

### 5.3.5 Priority: 1 - Critical

## 5.4 Response Strength

5.4.1 Description: The system shall have enough vibration intensity to be noticed by the user (0.04 vibration amplitude is the minimum).

### 5.4.2 Source: Survivors

### 5.4.3 Constraints: Quality of the vibration motors

### 5.4.4 Standards: None

### 5.4.5 Priority: 1- Critical

## 5.5 Battery Life

5.5.1 Description: The system shall be able to last 6-10 hours on a full charge.

### 5.5.2 Source: Survivors

### 5.5.3 Constraints: Power source, distance sensors, vibration motors, and microcontroller

### 5.5.4 Standards: None

### 5.5.5 Priority: 1- Critical

# 6. Safety Requirements

This section covers the safety requirements the system must fulfill. Safety requirements include wearable system material, exposed components, exposed circuitry, and power supply.

## 6.1 Wearable Material

6.1.1 Description: The system shall not contain materials that could jeopardize the user’s health including, but not limited to: conductive material, allergic material, sharp objects, rusted material, etc.

### 6.1.2 Source: Survivors

### 6.1.3 Constraints: None

### 6.1.4 Standards: None

### 6.1.5 Priority: 1- Critical

## 6.2 Exposed Circuitry Protection

6.2.1 Description: The system shall be properly insulated to prevent any potential harm to the user.

### 6.2.2 Source: Survivors

### 6.2.3 Constraints: None

### 6.2.4 Standards: None

### 6.2.5 Priority: 1- Critical

## 6.3 Power Supply Protection

6.3.1 Description: The system shall keep the power supply covered by a surface that provides protection from any possible power leaks (ex. chemical, electrical, battery meltdown, etc.)

### 6.3.2 Source: Survivors

### 6.3.3 Constraints: None

### 6.3.4 Standards: None

### 6.3.5 Priority: 1- Critical

# 7. Maintenance and Support Requirements

This section will list and describe the maintenance and support that will be provided for the delivered system. This includes documentation and maintenance.

## 7.1 Troubleshooting

7.1.1 Description: The system shall include a troubleshooting guide to assist in fixing small technical difficulties.

### 7.1.2 Source: Survivors

### 7.1.3 Constraints: None

### 7.1.4 Standards: None

### 7.1.5 Priority: 3 - Moderate

## 7.2 Future Upgrades and Maintenance

7.2.1 Description: The team shall provide documentation and details to aid future development teams and allow them to extend our product.

### 7.2.2 Source: Survivors

### 7.2.3 Constraints: None

### 7.2.4 Standards: None

### 7.2.5 Priority: 3 - Moderate

# 8. Other Requirements

This section includes requirements not previously mentioned in other sections of the document. The addition of these requirements will be needed in order for the product to be deemed complete.

## 8.1 Weight

8.1.1 Description: The system shall be lightweight (under 10 pounds).

### 8.1.2 Source: Survivors

### 8.1.3 Constraints: The size of the battery, wires, sensors, vibrators, and interface device

### 8.1.4 Standards: None

### 8.1.5 Priority: 3 - Moderate

## 8.2 Voltage of Battery

8.2.1 Description: The system shall have a battery with the minimum amount of power required.

### 8.2.2 Source: Survivors

### 8.2.3 Constraints: Battery type

### 8.2.4 Standards: None

### 8.2.5 Priority: 2 - High

# 9. Acceptance Criteria

This section includes every requirement that will be verified by the sponsor. Each feature and function must be demonstrated to the sponsor until the sponsor is satisfied. After the sponsor is satisfied, the sponsor will be able to accept or reject the system.

## 9.1 Verify That the System Turns On and Off

9.1.1 Requirement(s) addressed: 3.1 On and Off: The system shall be able to be turned on/off with one button.

9.1.2 Verification Procedure: The team shall demonstrate how the system can turn on/off by pressing a button to turn the system “On” followed by a strong and quick vibration. Pressing the button again to turn the system “Off” followed by two strong and quick vibrations.

## 9.2 Verify That the System Detects Objects

9.2.1 Requirement(s) addressed: 3.2 Object Detection: The system shall be able to detect and warn the user of nearby objects in front of them.

9.2.2 Verification Procedure: The team shall demonstrate how the system can detect objects by having a volunteer wear the system. The volunteer will be blindfolded and asked if he/she can tell in which direction the objects are through vibrations.

## 9.3 Verify That the System is Battery Powered

9.3.1 Requirement(s) addressed: 3.3 Battery Powered: The system shall be powered by a battery.

9.3.2 Verification Procedure: The team shall demonstrate how the system turns on/off without the need of it being plugged in to an external source. Additionally, the team will show how the system's sensors and vibrators operate using only the battery. Also, the team will show how the battery is rechargeable by connecting the battery to a wall outlet. Finally, to demonstrate how the battery is replaceable, the team will switch out the battery with another one and turn on/off the system to show that it still works.

## 9.4 Verify That the System Has a Common Physical Appearance

9.4.1 Requirement(s) addressed: 3.4 Common Physical Appearance: The system shall be an appropriate level of discreteness.

9.4.2 Verification Procedure: The team shall walk outside and have people look at the user and then take a survey to see if people think the system is discrete or if it stands out.

## 9.5 Verify That the System Notifies the User That the Battery Is Low

9.5.1 Requirement(s) addressed: 3.5 Low Battery Notification: The system shall be able to notify the user when the battery has less than an hour left of charge and again when the battery has less than thirty minutes left of charge.

9.5.2 Verification Procedure: The team shall demonstrate how the system notifies the user that the battery is low by installing a very low charged battery into the system and then feel the “Low Battery Vibrations”.

## 9.6 Verify That the System is User Friendly

9.6.1 Requirement(s) addressed: 3.6 User Friendly: The system shall be able to be operated by inexperienced users.

9.6.2 Verification Procedure: The team shall demonstrate how the system is user friendly by allowing a volunteer to put on the system and turn it on. In addition, the volunteer will be able to feel the different vibration intensities by moving towards an object and then moving away from the object.

## 9.7 Verify That the System is Safe

9.7.1 Requirement(s) addressed: 3.7 Safe: The system shall be safe and shall cause no harm to the person wearing it.

9.7.2 Verification Procedure: The team shall demonstrate how the system is safe by personally wearing the system in front of the sponsor and by not being harmed or shocked in any way.

## 9.8 Verify That the System Has Some Replaceable Components

9.8.1 Requirement(s) addressed: 3.8 Replaceable Components: The system shall have replaceable components.

9.8.2 Verification Procedure: The team shall demonstrate how the system has some replaceable components by physically detaching some component from the system and replacing them in front of the sponsor.

# 10. Use Cases

This section includes the identified Use Cases and Use Case Diagram. The Use Cases are Turn the System ON, Turn the System OFF, and Change Range. These Use Cases belong to one system, which is the Sight By Touch system. Below are the high level uses cases for the project. Note TUCBW stands for “This Use Case Begins With” and TUCEW stands for “This Use Case Ends With”.

## 10.1 Turn System ON

10.1.1 Precondition: The System is OFF, and battery is connected

10.1.2 Scenario: The User turns ON the system

10.1.3 Actor: User

10.1.4 System: Sight By Touch

10.1.5 TUCBW: The user presses the power button

10.1.6 TUCEW: The user feels the initial vibration of the system

## 10.2 Turn System OFF

10.2.1 Precondition: The System is ON

10.2.2 Scenario: The User turns OFF the system

10.2.3 Actor: User

10.2.4 System: Sight By Touch

10.2.5 TUCBW: The user presses the power button

10.2.6 TUCEW: The user will feel two strong vibrations

## 10.3 Change Sensing Range

10.3.1 Precondition: The System is ON

10.3.2 Scenario: User wants to extend or shorten the sensing range by turning the knob

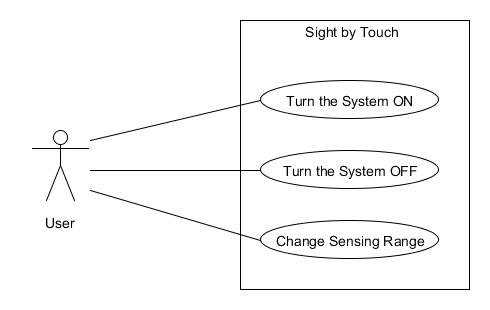
10.3.3 Actor: User

10.3.4 System: Sight By Touch

10.3.5 TUCBW: The user turns the knob

10.2.6 TUCEW: The user hears the knob click

## 10.4 Use Case Diagram



**Figure 10-1 Use Case: Belt Operations**

# 11. Feasibility Assessment

This section includes the six components (scope analysis, research completed/remaining, technical analysis, cost analysis, resource analysis, and schedule analysis) that we used to determine if the project can be implemented by the team.

## 11.1 Scope Analysis

After analyzing the scope and multiple discussions about our individual and team skills, we have concluded that the prototyping of the critical requirements by the deadline date appears feasible. The critical requirements for the system are as follow:

* Turn on/off
* Detect objects in the front of user
* Notify user of the presence of an object in real time
* Adjustable sensing range
* User friendly

## 11.2 Research

The team has been looking at a past graduate project called the “SpiderSense Suit” from the University of Illinois. Another area the team has done research on has been on the backup systems that vehicles currently use. The team discovered that these systems do much of the processing and detection that our system needs. The Sight By Touch system could mimic what a backup car system does, which could mean that a good portion of our hardware could be assembled without having to modify the original component. In terms of cost, many of these systems can be purchased for less than $100.

However, we still need to research the individual components such as sensors, vibrators, batteries, and microcontrollers. We feel that knowing more details about the limitations of each component could give us a better idea of the limitations of some of these systems. Another area that we also need to research is how the system could be worn so that the user can easily use the system without having the system intrude in their daily activities.

## 11.3 Technical Analysis

Technical aspects of our project will include compact design, algorithm implementation, and embedded system.

For our project, we recognize that the team does not have a strong set of hardware skills, which is why we have identified that retrieving the signal of the hardware will be the hardest part of the project. Our system will require us to convert between analog and digital signals very quickly with a limited computational environment, since we also need to keep the system at a compact and wearable level. We understand that the system will be portable, so we have to make sure that the overall design is as compact as possible.

Overall the team has weak hardware skills. However, we have discovered that similar systems currently exist and that we may be able to use their hardware design and components to fulfill the requirements. We have found that many of the components can be bought prebuilt and even have similar interfaces that will help the team during the development phase. In terms of programming, the team understands that the system will mostly use a low level language, but the team will try to find a microcontroller that can be programmed in C.

## 11.4 Cost Analysis

Based on the team’s judgment and current research, we predict that we will be able to complete this project with an $800 budget. Most of the hardware components are available to buy from several vendors. This gives us a lot of flexibility in terms of choosing between the accuracy and cost of the overall system. Overall, our budget will determine the effective range and the performance of the system. Below is a summary of what the cost will be for some of the components.

**Table 11-1: Low and High End Cost of Components**

|  |  |  |
| --- | --- | --- |
| **Items** | **Low End Price** | **High End Price** |
| **Backup car systems** | $20 | $200 |
| **Vibration Motors** | $1 | $15 |
| **Battery** | $5 | $50 |
| **Proximity Sensors** | $2 | $250 |
| **Microcontroller** | $2 | $300 |
| **Total** | $30 | $815 |

## 11.5 Resource Analysis

The team has 2 software engineers (Victor, Gerardo), 2 computer science members (Kevin, Margaret), and 1 computer engineer (Henry). Henry will be in charge of the hardware implementation and physical communication between the components. Victor and Margaret will be in charge of developing the software for the system. Gerardo and Kevin will be in charge of the integration between the software and hardware.

## 11.6 Schedule Analysis

To estimate the schedule, the team has used multiple estimation techniques. We chose to use function points, Jones First Order Estimation, and COCOMO II to provide an initial estimate. Other techniques may be used in the future for additional estimates that will give us a better idea of the schedule.

**Table 11-2: Function Points**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Function Type** | **Low Complexity** | **Medium Complexity** | **High Complexity** | **Functional Point Total** |
| **inputs** | 2\*3 | 1\*4 | 0\*6 | 10 |
| **outputs** | 0\*4 | 1\*5 | 2\*7 | 19 |
| **Inquiries** | 2\*3 | 1\*4 | 0\*6 | 10 |
| **Logical internal files** | 2\*7 | 1\*10 | 2\*15 | 44 |
| **External interface files** | 0\*5 | 0\*7 | 0\*10 | 0 |
|  | | | | |
| **Unadjusted Total** | | | | 83 |
| **Adjustment Factor** | | | | .91 |
| **Adjusted Total** | | | | 75.53 |

**Table 11-3: Influence Multipliers**

|  |  |
| --- | --- |
| **Influence Multipliers** | |
| **Characteristics** | **Effort (0-5)** |
| **Data Communications** | 4 |
| **Distributed Data Processing** | 3 |
| **Performance** | 1 |
| **Heavily Used Configuration** | 0 |
| **Transaction Rate** | 5 |
| **Online Data Entry** | 0 |
| **End User Efficiency** | 5 |
| **Online Update** | 0 |
| **Complex Processing** | 5 |
| **Reusability** | 1 |
| **Installation Ease** | 0 |
| **Operation Ease** | 0 |
| **Multiple Sites** | 0 |
| **Facilitate Change** | 2 |
| **Total** | 26 |
| **Value Adjustment Factor** | .91 |

Value Adjustment Factor = (Total \*.01) + .65

**Table 11-4: Jones’ First Order Estimation**

|  |  |  |
| --- | --- | --- |
| Best Case | Average Case | Worst Case |
| 75.53.43 | 75.53.45 | 75.53.48 |
| 6.42 Calendar Months | 7.00 Calendar Months | 7.97 Calendar Months |

**Table 11-5: COCOMO II Model Estimation Tool**

|  |  |  |
| --- | --- | --- |
| Optimistic | Most Likely | Pessimistic |
| 6.7 Months | 7.6 Months | 8.6 Months |

# 12. Future Items

This section reiterates requirements that were listed as priority 5 in previous requirement sections that were intended for the future. These requirements were suggested by the sponsor and, if more time is allowed, may be considered in future enhancements.

## 12. 1 Requirement 3.9: Floor Depth Detection

### 12.1.1 Requirement Description: Unleveled areas, such as stairs or holes made in the ground, specified in Customer Requirement 3.9: The system shall be able to detect the depth of the floor.

### 12.1.2 Constraint: Schedule: The main focus is to implement sensors that sense objects in front of a user. If time allows, we will work to make the sensors detect objects in unleveled environments to avoid injury to the user.

## 12. 2 Requirement 3.10: Global Positioning System

### 12.2.1 Requirement Description: A GPS system specified in Customer Requirement 3.10: The system shall have GPS to guide the user from the current location to another.

### 12.2.2 Constraint: Schedule: Implementing a GPS system would involve Wi-Fi and, given the time allotted, involving Wi-Fi will create a whole new set of requirements that our schedule may not be able to fit.