**Capstone Project Proposal**

Title:

Team members:

Supervisor: Dr.Nidal Nasser

1. **Background and Rationale**

Total blindness is affecting more than 39 million people worldwide, while people with severe visual impairment are in excess of 246 million[1]. New solutions to facilitate and improve the quality of life of those individuals are advancing. Engineers and developers contributed widely in creating solutions to improve the quality of life of visually impaired individuals (VII) [2]. There are many available devices that help the VII but these devices often help one purpose, the available devices are Trekker, it is a talking GPS, Kapten Plus Voice Activated GPS which is GPS unit for VIII and The WuFu is a proximity measuring device [3]. However, a full integrated system to help VII to navigate their surrounding is lacking. Our project is to design a system that integrates smart glasses, headphones, and a mobile application. These devices will work together to transform visual data into audible sounds. Our device will consist of motion sensor attached to glasses with a camera, that will detect obstacles and alert the users and direct them on how to avoid that obstacle by stopping or turning left or right. The system will help VII to walk around without the need of direct guidance, help them to be more independent by identifying objects without others help and also let them be more socialized by face recognizing system.

1. **Project Statement**

This project is of great importance because it offers us the opportunity to better the lives of the visually impaired by enabling them to be more independent and socially involved. At the end of this project, we hope to create a functional, reliable and easy to use product that will contribute to the technological community and inspire it. It is our ultimate goal to lead the advancement in technology, and working on a project such as this one will expose us to the recent trends of technology such as Machine Learning, Internet of Things and Artificial Intelligence.

1. **Project Objectives**

**Aim 1: Obstacle Detection to Ensure Safety**

Our product will be a replacement for the famous white cane. A Visually impaired person is usually identified by a white cane in his/her hand. Having a white cane helps in scanning the surroundings of the visually impaired people to detect any obstacles they may hit. Sensors will be attached to the glasses of the visually impaired and will be connected with a smart device using the concept of IOT. When a visually impaired person is near an obstacle, the sensors will send a notification to the smart device, and therefore the visually impaired person will be notified by a voice assistant.

**Aim 2: Promoting Independence and Social Engagement**

**Aim 2.1: Locating Lost Items**

Visually impaired people usually adapt to their surroundings by following a systematic approach to placing and organizing their belongings. But this is not always the case, visually impaired people sometimes forget where they placed their items and find it challenging to find them. To help with their independence, we intend to develop a smart phone application with voice activation that locates their misplaced items that has RFID stickers.

**Aim 2.2: Artificial Intelligence and Machine Learning as The Eyes**

It is said that to make up for the lack of sight, visually impaired people tend to have heightened sensitivity in the other 4 senses. While this may be true to some extent, the truth is that these senses are actually honed in time and not gifted all at once. Therefore, Artificial Intelligence and Machine Learning (AI/ML) can help the visually impaired identify various objects, and provide support in day-to-day activities, without the need to rely on others.

**Aim 2.2.1: Providing A Facial Recognition System**

Visually impaired people may not recognize a voice after one interaction; it may take a few conversations before they can identify a person with their voice. In such cases, an AI system that captures an image of the face to be remembered and matches the person in front of the visually impaired person with the correct, stored picture, if available, would be highly utilitarian. The details of the identified person are spoken out to the visually impaired person, thereby allowing them to be more socially able.

**Aim 2.2.2: Counting Money**

Money, an essential element of all human being’s daily activities, presents itself as another challenge to the visually impaired. It can be very difficult to distinguish between different monetary denominations unless helped by another person. Governments of some countries have devised ways to help the visually impaired distinguish between different denominations. However, not all countries have implemented such solutions. Once again, AI/ML can be used to identify the value of the currency and speak it out loud; a feat enabling them to be more independent.

This project will consist of sensors that can be attached to a person’s glasses, which detects any upcoming obstacles to help the visually impaired avoid accidents. In addition, these sensors will contain a facial recognition system that instantly recognizes the identity of people standing in front of the visually impaired to inform him or her of their identity. As well as a system that differentiates between various monetary denominations, and can guide the visually impaired to the location of his or her lost items within a specified range. However, one major question to be addressed would be if the project is feasible given its complexity and the specified timeframe. Another question would be if it is convenient and reliable to use for the visually impaired.

1. **Project Approach**

For the features involving AI/ML, we will use Python - based image processing and data mining libraries like OpenCV, TensorFlow, Keras, Theano, Scikit-learn, etc. These libraries are chosen because they are based on older, more fundamental libraries. Therefore, they include most of the major functionalities required to implement our AI/ML requirements, along with useful features of their own. Furthermore, they are open source and utilize Python, which is an easy to use, lightweight language that can be integrated with the glasses easily.

For locating lost items, we intend to use Radio-frequency identification (RFID) stickers given their lightweight, ease of use and cost effectiveness. Also, they are very practical to use as they do not require any charging. Furthermore, RFID stickers use the same frequency band used in Bluetooth and Wi-Fi. Therefore, it can be connected with smartphones through our app. This will remove the need to design and manufacture special gadgets.

In the app, a user registers an item by scanning the RFID sticker for it, then naming it using voice activation. Once the user loses the item and want to find it. The app will give the necessary directions.

1. **Proposed Timeline**

|  |  |  |
| --- | --- | --- |
| Activity | Start date | End date |
| Specify requirements | 4/11/2018 | 18/11/2018 |
| Design document | 19/11/2018 | 18/12/2018 |
| Implementation | 6/1/2019 | 4/4/2019 |
| aim 1 | 6/1/2019 | 7/2/2019 |
| aim 2 | 10/2/2019 | 28/3/2019 |
| aim 2.1 | 10/2/2019 | 21/2/2019 |
| aim 2.2 | 10/2/2019 | 28/4/2019 |
| aim 2.2.1 | 10/2/2019 | 14/3/2019 |
| aim 2.2.2 | 17/3/2019 | 28/4/2019 |
| Finalize report | 31/3/2019 | 11/4/2019 |

1. **Estimated Budget**

|  |  |
| --- | --- |
| Product | Price/piece |
| Obstacle sensor | 5 SR |
| RFID tags | 2 SR |
| Small camera | 105 SR |
| Glasses | 200 SR |

1. **References**
2. <https://www.disabilitywisdom.com/2017/12/01/blind-in-the-city-why-we-dont-touch-faces-and-what-we-do-instead/>
3. <http://evengrounds.com/blog/blind-people-identify-paper-currency>
4. N. Nasser, N. Khan, M. ElAttar, K. Saleh, A. Abujamous, “An Efficient Data Scheduling Scheme for Cloud- based Big Data Framework for Smart City,” *IEEE Global Telecommunications Conference (Globecom),* Waikoloa, HI, USA, Dec. 2019.