Navigational Aid for the Visually Impaired

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ABSTRACT

The estimated number of visually impaired people in the world is 285 million, where 39 million are blind [1]. They often face discrimination and are not included in the Millennium Development Goals, resulting in exclusion from many development initiatives and funding systems. Technologies can be powerful tools of integration for visually impaired people, it can be used to help achieve their independence. Self-navigation in an urban landscape or an unfamiliar environment is a problem for the visually impaired, even the simple task of using public transportation. The aim is to develop a solution for blind people to achieve autonomous mobility without feeling marginalized. Hence, creating a device that identifies signs & changing street lights, detect bus numbers and improves the ease of using public transport is necessary. Enabling them to navigate safely and independently will give them the freedom to go to work, undertake their own projects and be financially stable.

I. Proposal

A. Problem Statement

In modern cities, travelling is vital to members of society. In fact, the average commute lasts 57.1 minutes daily in the United Kingdom according to the Office for National Statistic [2]. The predicament visually impaired people face is being unable to commute autonomously due to challenges such as the inability to read signs and difficulty using public transport. Existing assistive systems for the visually impaired are unsatisfactory and has limitations. For instance, the lack of a readable timetable formatted for the blind and lack of acoustic information about arriving vehicles [3]. Finding the right stop, the right bus and getting off at the correct destination is another example. Research reveals 70% of visually impaired people have missed their bus stop at some point. [4] A survey by the Royal National Institute for the Blind found that of 800 blind and partially sighted people, 40% relied on others to drive them. [5] Autonomous mobility for the blind can be made possible - allowing them to navigate independently -with the help of modern technology.

B. Market Research/Business Case

The project is worth doing as blind people represent 0.58% of the worldwide population and low vision people 3.65 % [1]. This represent more than 285 million worldwide. In the UK, there are 350,000 people registered as blind or partially sighted in 2014 [6]. It is estimated that by 2050, the number of people with sight loss and blindness in the UK will rise to 4 million [7] and so the demand for such a device is high and justified. In the UK Members of the Youth Forum of the Royal London Society for Blind People (RLSB) said they wanted to navigate the tube system independently [8].

C. Competitor Analysis

There are a range of products which helps the blind identify items and read texts, but few that specializes in navigation. Various prototypes and concepts exist – however most of them have not gone to market. Hence, assistive navigational technology for the visually impaired is limited. The products that are available in the market requires a human agent to assist in the usage of the product, thereby not giving full independence to the user. Traditional passive technology such as the white cane or a guide dog, albeit largely used, has its limitation. The white cane restricts obstacle detection to only the lower part of the environment. A guide dog needs to be looked after and comes with additional responsibilities.

Company	Price	Functionality
Sunu Band [9]	£230	Uses echolocation to sense proximity
Airo [10]	£89 - £329	human assistance (limited to paid time)
eSight[11]	£3000-£7,600	Gives sight to *low vision* people

II. Project Development

A. Objectives

The project objective is to develop an assistive technology that would aid the visually impaired to navigate - allowing them to be more confident in taking public transportation and feel secure navigating a new environment. The preliminary objectives are as followed for the development of a solution:

- That can read signs, detect stairs and navigate footpaths & pedestrian crossings.
- That has a GPS tracker, allowing the user to be aware of their location
- That is autonomous, light-weight and small which makes it ideal for travelling and moving
- Able to detect the correct incoming public transportation vehicle (whether their desired bus or tube has arrived)

B. Resources/Expertise

The development and design of a solution to this problem will require a multidisciplinary approach. The skills and expertise necessary can be found through a channel of resources and expertise.

- Data Science/Machine Learning Society – provides tutorials to advanced machine learning techniques. Necessary for programming the machine learning to read signs, bus numbers, etc..
- IEEExplore – gives online access to documents of research papers on wearable navigational tool for the blind
- EE Laboratory – Has the resources necessary to build a prototype for the circuit and conducting tests. Supervisors are available if there are questions.

C. Technical mapping

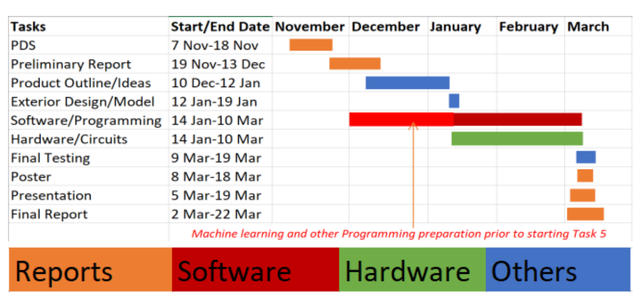
The main engineering skills that will be utilized to develop the product will be a range of familiar ones and new ones that would require additional learning. The product will require working sensors that would be able to detect proximity, measure distance and motion. Materials learnt from Circuit Analysis, Analogue Electronics and EE Lab will aid in design of the circuit for the sensors. Computing skills will be necessary to program the interface of the device. Machine learning & data processing will be vital for the device to be able to 'learn' to read signs, detect changing pedestrian signs and to process the imaging coming through from the camera. The integration between the hardware and software part of the device will need to be connected seamlessly.

D. Project Planning

Each member of the group has been assigned a role and is aware of their duties. Technical roles had also been assigned according to the individual's strength and skills. Selena, Terry, William and Charles will be working on software related tasks. Alan, AJ and Elliott will be working on the hardware. Charles will also be doing the exterior design for prototype. The group has a weekly meeting every Wednesday – to keep everyone updated on the activities of each sub-group. A chat and Google Drive for the group had also been established for effective communication.

E. Timelines

The Gantt Chart below outlines the timeline.



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