

Leveraging artificial intelligence to assist the visually impaired

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I. Introduction

Various technologies have emerged within the past decade that possess immense potential to assist those with various disabilities. One area with massive room for improvement- visually impaired people. The massive field of user interface possibilities will be very interesting to explore with sight-based options being exceptionally limited.

II. Hardware

Raspberry pi's zero w board is capable of running a full blown linux operating system while remaining smaller than a credit card. This small form factor would be ideal for a wearable device, however some sacrifices of processing power are made. If the zero w is found to be insufficient in power a raspberry pi 4 will be used, with significantly more power. Both of these devices have directly integrated camera support as well as all of the other features of a modern desktop computer.

III. Software

While a number of object recognition technologies now exist, OpenCV makes the most sense for this project. With extensive documentation and widespread use, it will be both easy to implement and powerful for the application. Built upon the language python, it will be easy to leverage its power without too much focus on optimization during development.

IV. User Interface

There are numerous ways that interface with the user can be achieved, although this is somewhat limited compared to someone with full sight, meaning the other four

senses (primarily hearing and touch) must be more fully leveraged than in normal interface design. Some methods might include:

1. Voice feedback. An earpiece worn by the user could discreetly provide them with the information they require.
2. A tactile display. Like a normal display, a tactile display has pixels, although these pixels are physically actuated to give a tactile response. This could provide spatially oriented data to the user.
3. Vibration. Could be used to provide more urgent information to the user such as imminent danger, etc.

V. Form Factor

While a mobile application would make sense, the procession power of the device could be limiting. The device could be useful when using a mobile device as well, which would not be possible were the software running on it. For this reason, a pair of glasses will be used as the primary platform for the device, functioning as a standalone device. This will allow for more design flexibility as well as user interface options.

VI. Features

This software will have numerous features, including:

1. Object recognition and description to the user.
2. Facial Recognition and memory
3. Danger detection (cars, roads, cliffs, etc)
4. Reading assistance
5. Interaction via direct input on the frame (touch controls, buttons) and hand gestures

VII. Final Product

The end goal of the final project will be to create a device that leverages computer vision technology to assist the visually impaired in daily tasks such as travelling, reading and communicating.