INTRODUCTION
There are many products and technologies that have been developed to assist the blind and the visually impaired for everyday tasks by using methods to deliver information to the user through senses other than vision. Such devices developed in the past assist the visually impaired through auditory, tactile, and haptic feedback yet, many have failed to make a big difference in the world of the visually impaired because of drawbacks like high cost, low environmental resistance, slim usability scenarios and portability. This research. This research explores a combination of various inexpensive existing technologies driven by advances in open-source machine-learning tools for visual analysis. Our goal is to develop a scaled down model using machine learning on edge devices like raspberry pi and the Arduino microcontroller.

RESEARCH QUESTION
What are the drawbacks of current commercially available (and other proposed technologies) to assist the visually impaired and how can these technologies be made better?

RESEARCH FOCUS
- CURRENT SOLUTIONS
- DISTANCE ESTIMATION
- TEXT TO SPEECH
- FEEDBACK
- INTEGRATION AND FUTURE WORK

CURRENT SOLUTIONS
- OrCam Devices [9]: Very Portable, suited to read written text, only Text-to-Speech functionality, very pricy ($1500)
- WeWalk Smart Cane [8]: Portable, only obstacle avoidance functionality through haptic and auditory feedback, very prices ($500)
- eSight: [9]: Provides an AR (augmented reality) experience, several functions (magnification, contrast and brightness adjust), very pricy ($5500)

TEXT TO SPEECH
The pyttsx3 module is an easy module to implement in code. It is a text to speech conversion library that can work offline and can also run with both Python 2 and Python 3. Another option is the gTTS library or Google Text To Speech. This library is also very easy to implement however it cannot run offline and requires to save the results to an MP3 file instead of directly playing it. Playing a MP3 file repeatedly through code can add some extra unnecessary lines to the code and can be slow due to repeated opening and deletion of a separate file. Although gTTS has a more natural voice, pyttsx3 is better suited for this implementation.

DISTANCE ESTIMATION
Distances can be estimated to an accuracy of 5mm for a range of 30cm to 12m using a TF Mini Lidar Module with an Arduino. The result from this sensor can be very reliable due to very high accuracy and low-light functionality. It is relatively expensive compared to other sensors, however its pros outweigh the cons. It has been used to generate a 2-D point cloud of its surroundings for a visual look. This technology can be expensive for better versions and does not work well in extreme weather.

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