RoboEye: Robotic Guide for the Sight-Impaired

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Goal Statement:

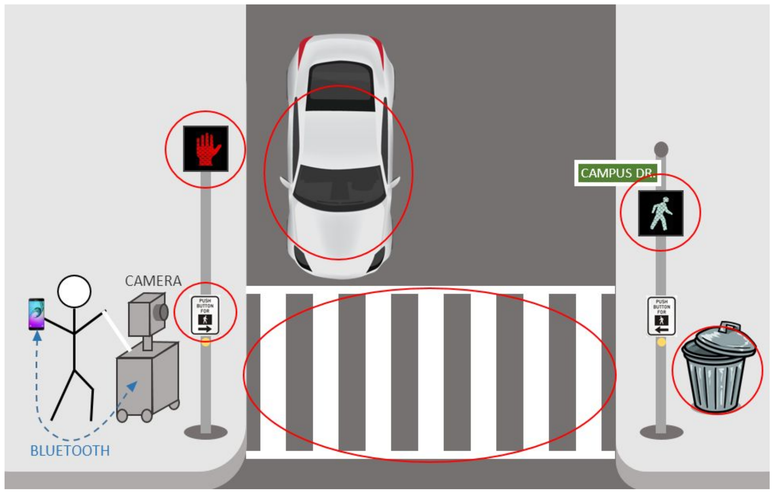
RoboEye will aid a sight impaired individual with crossing a street at a crosswalk safely and independently using an autonomous, moving device with sensors that is capable of navigation and obstacle detection.

Introduction:

The risks of blind pedestrians are on the rise, with several incidents reported at traffic intersections or stop signs. A major problem is that a blind individual does not always have terrain references for walking and can veer off course.

Our device will be an autonomously moving device capable of navigation and image recognition. The navigation feature will aid blind pedestrians in walking in a straight path and avoid obstacles. If RoboEye encounters an obstacle, it will automatically start to backup, veer around the obstacle by turning at an angle, and then proceed to a straight path again. This will prevent future car accidents and allow a blind person's transition between intersections to be easier, safer, and more efficient.

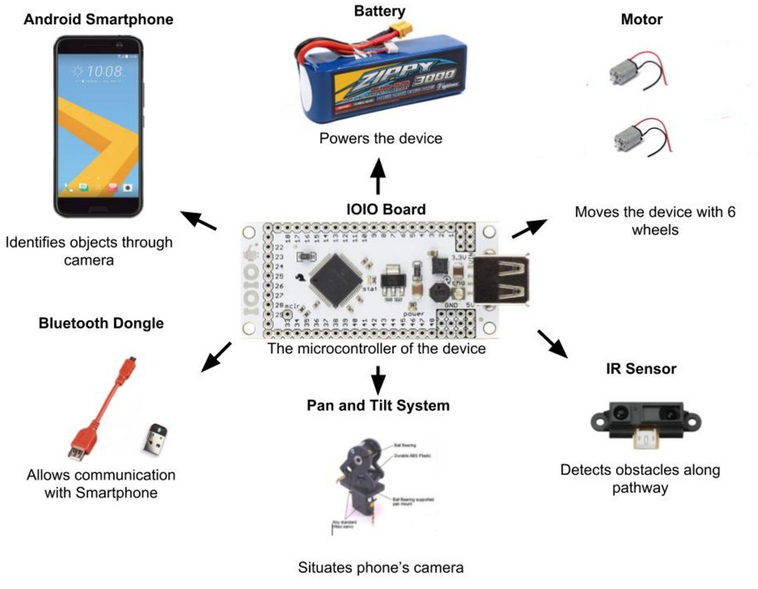
Crosswalk Scenario



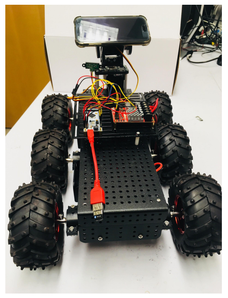
Objects circled red are detected by RoboEye. Some objects are detected and avoided, others send a signal to wait before crossing.

Approach:

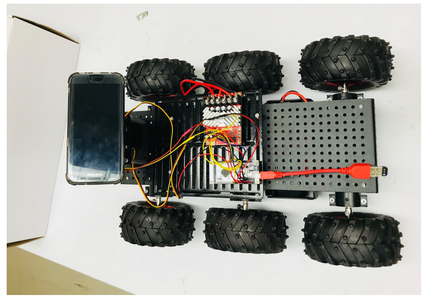
This project uses a IOIO board as the microcontroller and a RoboClaw 2x30A motor controller to control the robot's movement. The device essentially uses 2 motors to control the wheels and a 7.2 V battery pack for power. RoboEye's chassis consists of six rugged wheels designed to excel at traversing rough terrain and steep inclines. Hence, our robotic device is perfect for various weather conditions and rocky roads. Compatible with the IOIO board, a wide range of Android phones are available to run our phone application, developed on Android Studio. We use a bluetooth dongle to allow communication between the smartphone and the IOIO board. Our code uses Java to program the device and help recognize obstacles through the Android phone's camera. The pan and tilt system help support and angle the camera to detect the crosswalk sign. The openCV library is used to identify the sign and an IR sensor is used to detect any obstacle within a distance of approximately 8 inches along the crosswalk.



RoboEye



Front view



Top view

Responsibilities:

Team members learned how to integrate machine learning and IOIO board using Android Studio as well as code in Java to create a phone application. The specific individual tasks are shown below:

Tasks:

- Design and build the base of the robotic device
- Solder wires and components to IOIO board
- Setup and program Bluetooth communication between IOIO board and Android phone
- Program motor controller for robot motion
- Set up and program IR sensor for static and dynamic obstacle detection
- Build and program Pan and Tilt system to allow camera scanning within a range of view
- Program camera to use machine learning to identify crosswalk signals and guide a visually impaired person across a crosswalk

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