Awareness +1

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BACKROUND

The Awareness +1 bike helmet accessory was designed to make cycling a safer experience. In 2020, it's estimated there were over 450,000 bicycle related injuries(See *CPSC)*, and as that number will only increase as bike popularity continues to grow. As biking lanes are becoming more prominent in cities, vehicles pose a far larger threat than previous years. To minimize that threat, we decided to make an early detection system that would provide a cyclist with additional time to react when a car approaches from their rear.

We wanted our design to help cyclists in any skill range and people who may have a physical disability that would inhibit them from look behind them. We also wanted the project to remain more affordable than other products on the market. Doing so would improve the safety all cycling and appeal to a larger demographic that would want to take up cycling.

To summarize, riding a bike on a public road poses several risks for cyclists, from passing cars to inconsistent pavement, but one problem we can alleviate is the danger of a car approaching from behind by creating a helmet to increase the cyclist's awareness via visual cues.

PROSPOSED SOLUTION

This system is comprised of a Raspberry Pi Zero W, Garmin LiDAR Lite, Blue LEDs, and a 3.7v Lithium-Ion Battery. The decision was made to use a LiDAR(Light-Detection-And-Ranging) due to its ability to constantly measure distances at a high frequency and remain safe to the human eyes. Unlike other laser sensors, the LiDAR uses infrared LED technology, which is a less focused beam light allowing to be used in the general public.

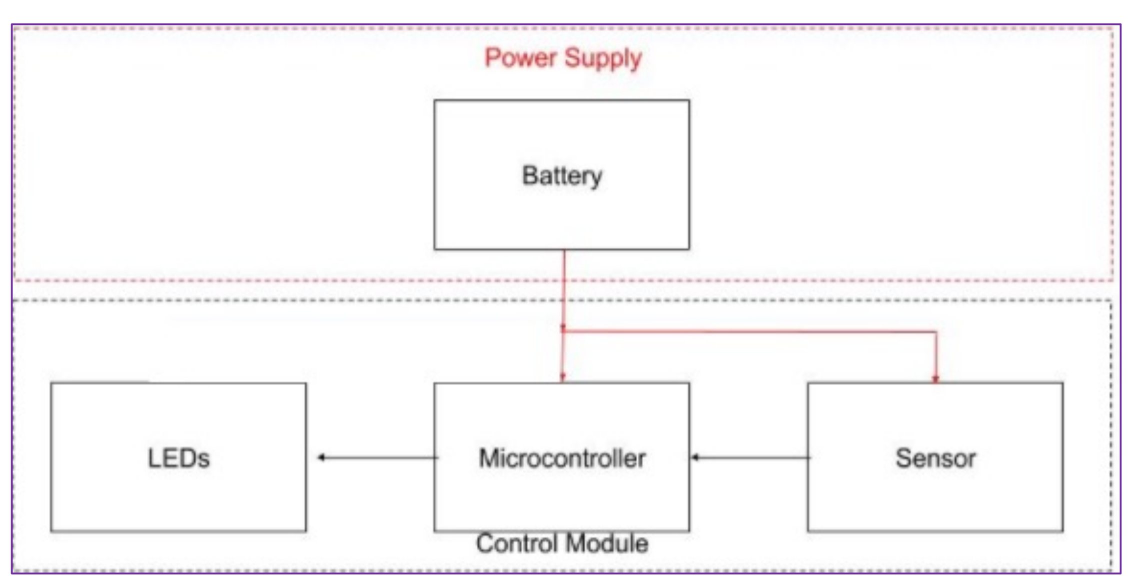

Figure 1: Block Diagram

SYSTEM DESIGN

RASBERRY PI ZERO W

The Raspberry Pi Zero W is a microcontroller designed for IOT projects. The ease of use of this microcontroller is what landed it for this project. The GPIO and I2C functions were used to relay information from the Garmin LIDAR LITE v4 and to the LEDs.

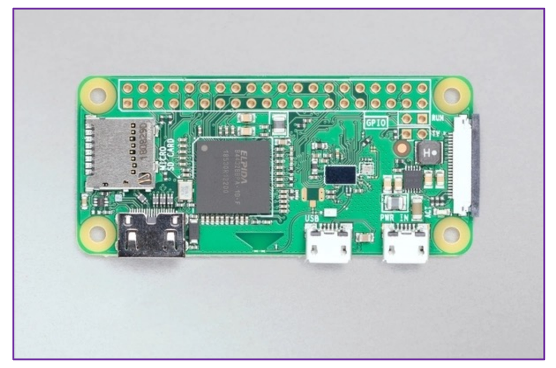

Figure 2: Raspberry Pi Zero W

SOFTWARE

The software portion of this project was written with Geany on the board itself and PyCharm was used for writing code on the computer

GARMIN LIDAR LITE V4

The Garmin LiDAR-Lite v4 utilizes infrared LEDs to gauge distance of an object. The LEDs operate with a divergence angle of roughly 4.7 degrees giving an area of operation that resembles a cone allowing for a wider field-of-view.

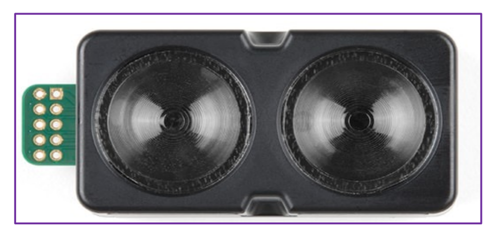

Figure 3: Garmin LIDAR-Lite v4

MOUNTING

Since the group did not have a functional mount that could pass the durability tests, the system was zip-tied to the back of the helmet so we could properly test the helmet without having to worry about it falling off. The zip-ties do not comply with 16 CFR § 1203 and as such this would not be the final design for the mounts.

Figure 4: Side View of Helmet

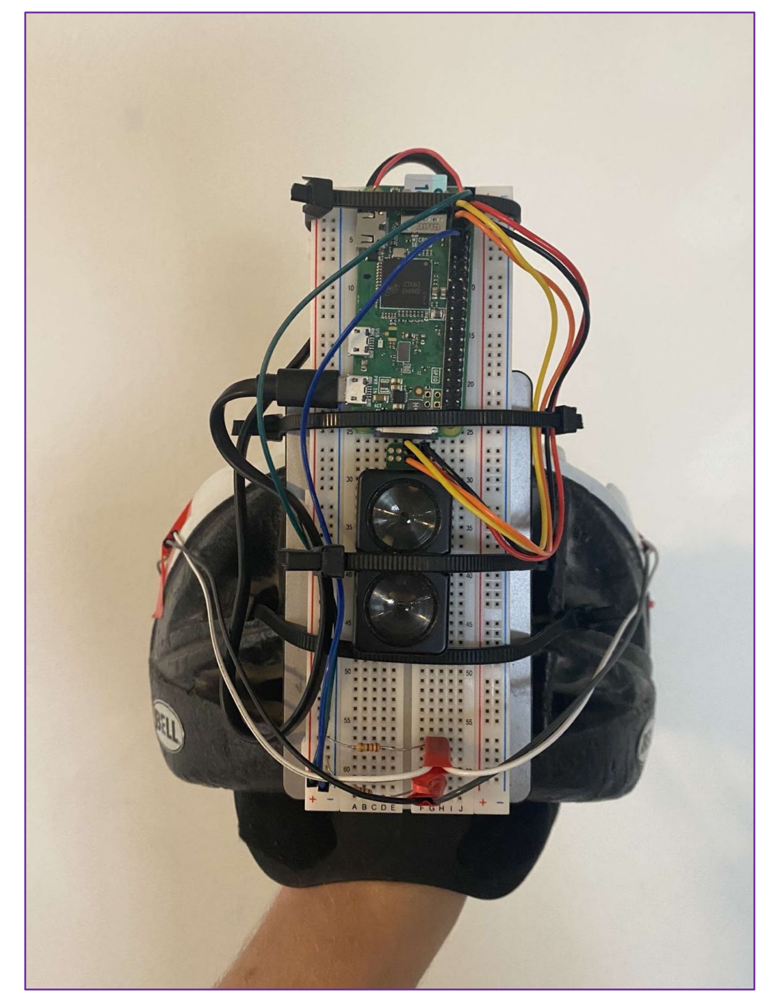

Figure 5: Rear View of Helmet

LEDS

The Blue LEDs are used as the only feedback system on the helmet. They will simply light up when given the signal from the microcontroller. They work on a simple voltage divider to remain under 0.25W at each resistor and the LEDs stay at their required values of 20mA and 2.8V-3V.

Figure 6: Blue LED

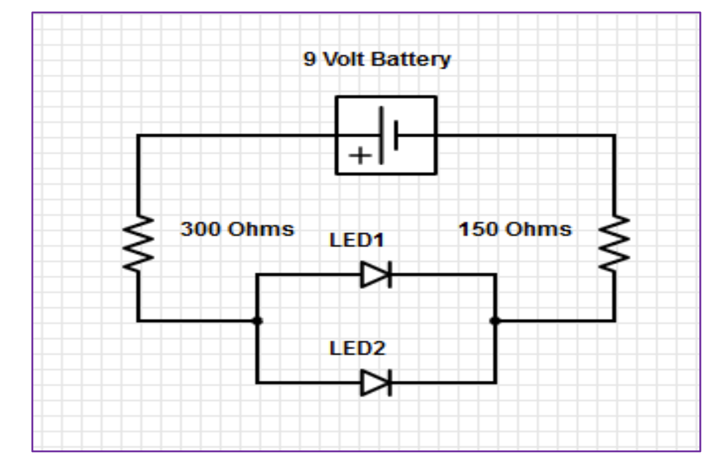

Figure 7: Voltage Divider

Battery

The battery that we decided to use is called PRT-13845. The battery's description is specified as lithium 3.7V 850mAh. We calculated that the battery would last just under two hours on a full charge. The dimensions and weight are as follows, 43.0mm x 34.0mm x 6.2mm and 20 g. The standard charge current and the discharge rate are the same at 170 mA. The voltage rating is the same as in the description for the product, 3.7 V.

FUTURE DIRECTION

Future direction of this project is to move towards decreasing the size of the system to help improve the look of the finished product and move towards using camera technology instead of the LiDAR sensor to help improve accuracy and reliability.

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CONTACT INFORMATION

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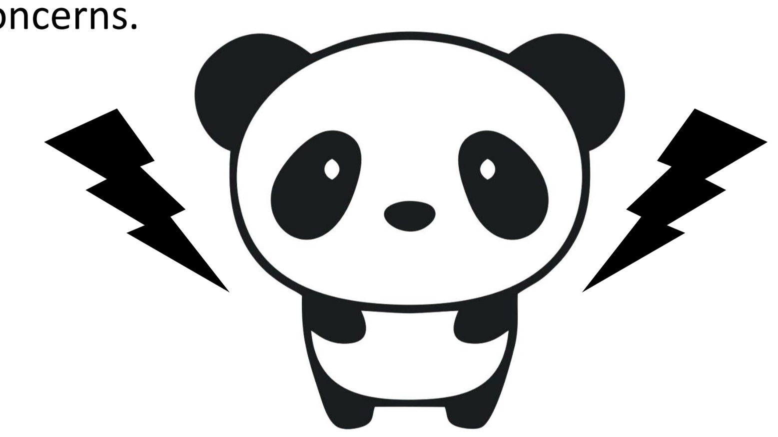

Figure 8: The Power Panda