Aftermarket Blind Spot Detection System

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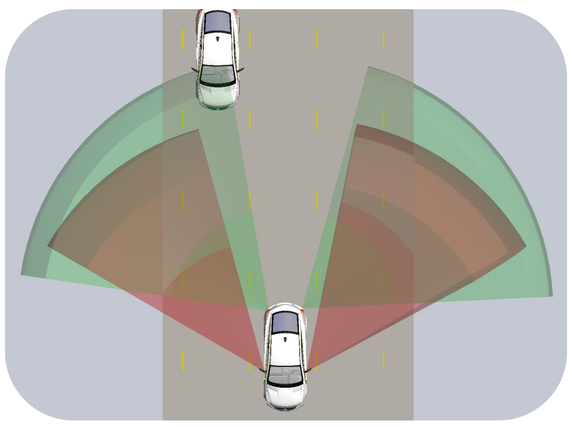
Project Description

An aftermarket blind spot detection system monitors a car's flanks, meaning that this system checks if there is a car on either side of the vehicle that the driver cannot see in their mirrors. If a car is in this spot, the system informs the driver though an LED attached to the A-pillars that lights up. The word aftermarket means that this detection system is bought separately from the vehicle and added by either the owner or a professional. Our purpose is to create our own system that is reliable and more affordable than all the current systems on the market today.



Red: Blind Spot Zone

Green: Sensor Coverage

Project Justification

In the U.S. nearly 840,000 accidents occur each year solely due to failure of observing one's blind spot. From such, 300 accidents result in a fatality. These types of accidents correspond to 14% of the U.S. total automobile accidents (GCU, 2019). The aftermarket blind spot detection system intends to decrease this percentage by highly increasing driver safety, providing individuals an affordable way to electronically monitor their automobiles blind spots. To provide visibility to the blind spot area of a vehicle and to simultaneously improve driver safety, the system has been designed to sense approaching vehicles and alert the driver of their presence.

Functional Requirements

Functional requirements are an essential factor in determining the success of the project. The requirements either had a numeric to be met or just had to be implemented to be met (Binary).

Functional Requirement	Numeric	Result (Pass/Fail)
Detect Vehicles Remaining in Blind Spot for Extended Period of Time	Binary	PASS
No Alterations to Vehicle	Binary	PASS
Functions in Low Light Conditions	Binary	PASS
LED Indicators to Warn Driver	Binary	PASS
Avoid False Positives	Vehicles moving in opposing direction and stationary objects	PASS
Able to Detect Vehicles in Motion	Detect Vehicles Between 5 and 75 MPH	PASS
Not Obstructed by Common Weather Conditions	Binary	IN PROGRESS
Flexibility to Function with Any Vehicle	Binary	IN PROGRESS
Power Switch Located Per Driver Preference	Binary	IN PROGRESS
Detect Objects in Blindspot for Extended Period of Time	Binary	IN PROGRESS
Low Cost	Under $350	IN PROGRESS
Water and Dust Resistant	IP66 Dust and Water Resistant	IN PROGRESS
Withstand Extreme Temperatures	Functional between -40°F to 200°F	IN PROGRESS
Operate When Vehicle is in Forward Gear	Minimum speed of 60 km/hr (37.7 mph)	IN PROGRESS

Engineering Standards

Blind spot detection systems are part of a relatively new category of products and in our research, we were only able to find one standard that was applicable to our product: SAE J2802.

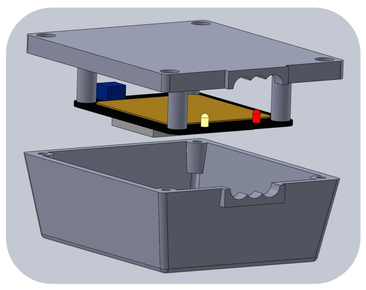
- Operational at a minimum of 60 km/hr
- Visual indication that the system is active
- Indication of a system fault
- Indicators located on or in close proximity to side mirrors
- Use of ISO Side Object Detection symbols
- Amber-colored LEDs
- Indicator LEDs illuminate at a minimum of 6000 cs/m^2
- Ability to dim luminance at night

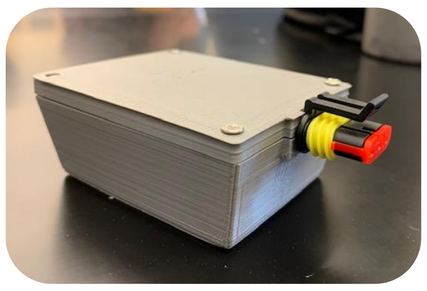
Indicator Housing Icon Above; Printed Indicator Housing

Layout of System Concept

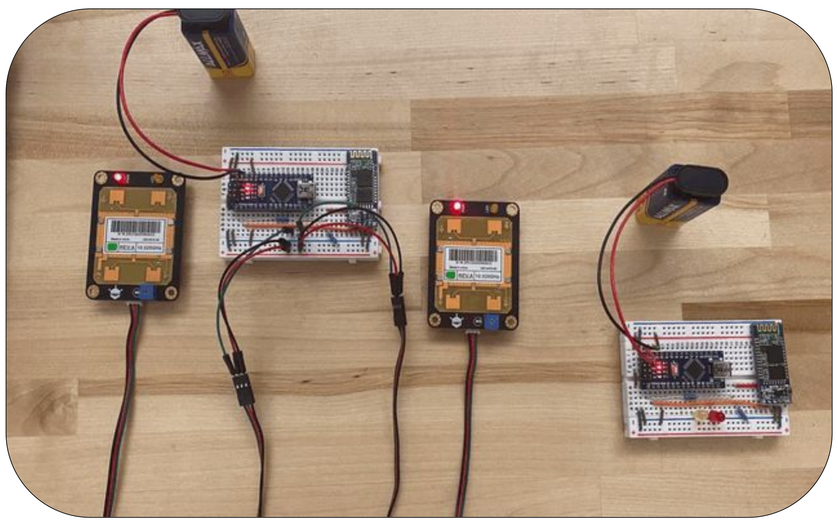
Design Process

- Purchase and test multiple sensor types
  - Discard those unsuitable for project needs
  - Select microwave sensor
- Code Arduinos
  - Communicate over Bluetooth
  - Accept and process sensor signals
  - Relay signals between Arduinos
- Create sensor, Arduino and indicator housings
  - Model housings in SolidWorks
  - 3D print housings
  - Test size and fitting of printed housings
  - Reprint if needed
- Design sensor shielding
  - Dimension based on sensor housing
  - Cut and bend from sheet metal
- Assemble system
  - Mount sensors, Arduinos and indicator LEDs in their respective housings
  - Connect sensors and LEDs to Arduinos using modular, waterproof cable connectors





From Left: Sensor Housing Model; Printed Sensor Housing



Complete System at Final Stage of Development

Data Summary

- Testing goals help determine successful blind spot detection
- Tables (such as above) outline tests, data and results
- System is installed on Chevy Sonic for road test
- Car is driven onto Camelback Ave., joining road traffic
- Sensors search for cars that either approach or breach the automobiles blind spots
- LED's activate upon vehicular obstruction, indicating the driver of the hazard.
- Test continues for consistency at speeds of 10-40 MPH
- Testing continues on different vehicles at a variety of speeds