ECE 490/491 Capstone Design Project

Vehicle Immobilizing Device

Design Group Members	Client & Technical Advisor	Year
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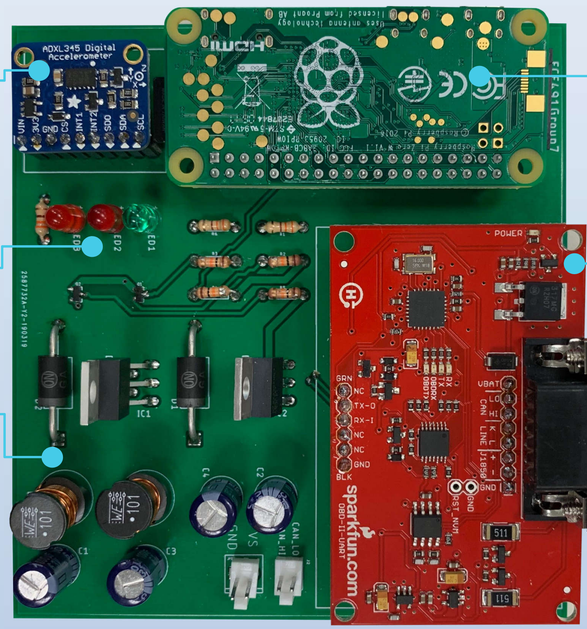
Project Overview

Vehicle accidents can cause injuries and fatalities to all involved parties. Insurance claims are often complex, due to a lack of information about the incident. This device aims to “freeze-the-scene”, to aid authorities in the investigation process. The primary target market for this product are fleet management organizations, i.e. rental car agencies.

Prototype Design

This prototype is designed to detect front-end collisions and divided into three modules:

1. Accident detection is done through monitoring vehicle speed via queries to the On-Board Diagnostics (OBD-II) port and monitoring of changes in acceleration (3G over 0.5 seconds) through a Digital Accelerometer
2. Upon detection, the vehicle is immobilized via injection of packets to the Controller Area Network (CAN) via the OBD-II port. These data packets can be implemented based on the vehicle to trigger braking, changing transmission to park, or execution of a Denial-of-Service (DoS) attack
3. Once authorities investigate, they are able to revert vehicle to its normal operation using an App, via Bluetooth Low Energy (BLE). The device performs secure authentication to prevent tampering



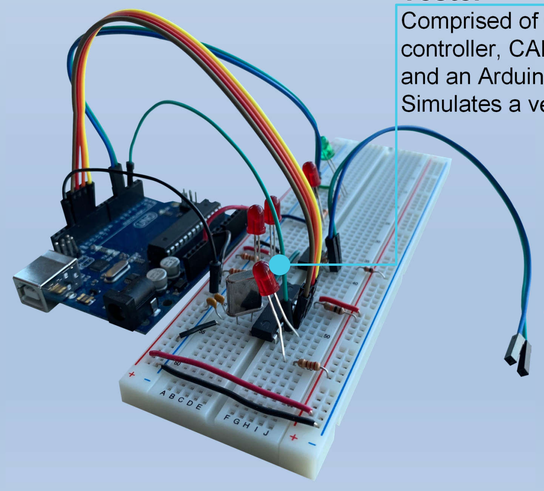
Detection
Accelerometer set to ±8G range, sampling rate @ 100 Hz

Computer
The Raspberry Pi Zero W serves as central microcontroller (MCU) of the device

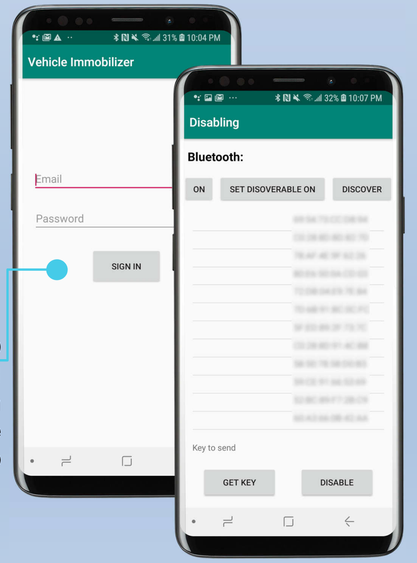
Status LEDs
Device and car status is visible to the driver

Power Module
Steps down the 12V input from the OBD-II port (vehicle battery) to 5V and 3.3V, for Pi Zero, and accelerometer respectively

CAN Bus Communication
OBD-II to DB9 to UART communication with CAN bus of the vehicle for accident detection, and immobilization



Tester
Comprised of CAN controller, CAN transceiver, and an Arduino Uno. Simulates a vehicle ECU



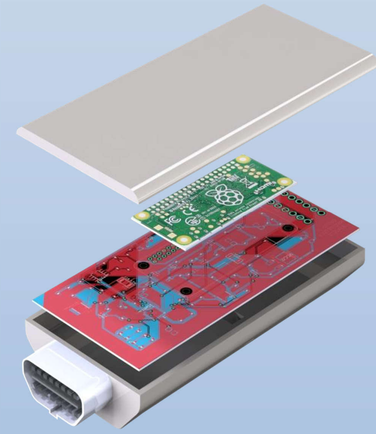
Mobile App
The vehicle is restored to normal operation through the use of the app

Testing

The device’s functionality is verified using the testing module. The testing module imitates an electronic-control-unit (ECU), complete with a CAN network (Transceiver & Controller). All standard OBD-II queries can be performed using this tester.

Product Design

The future device’s form factor is to be a dongle for the OBD-II port, to improve ease of installation, and for commercialization



Acknowledgements

We would like to thank Dr. Lipsett, Alan Lim, Ben Flanders, Jesse Tham, Eric Der, Graham Hornig, Simarjeet Dhanoa, and Bianca Angotti for making this project a success