CARS

Child Alert and Rescue System

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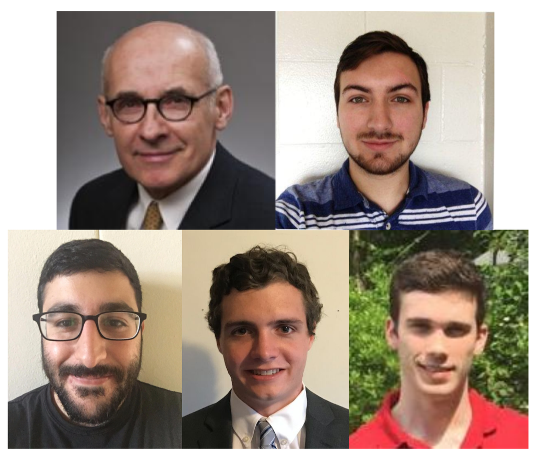


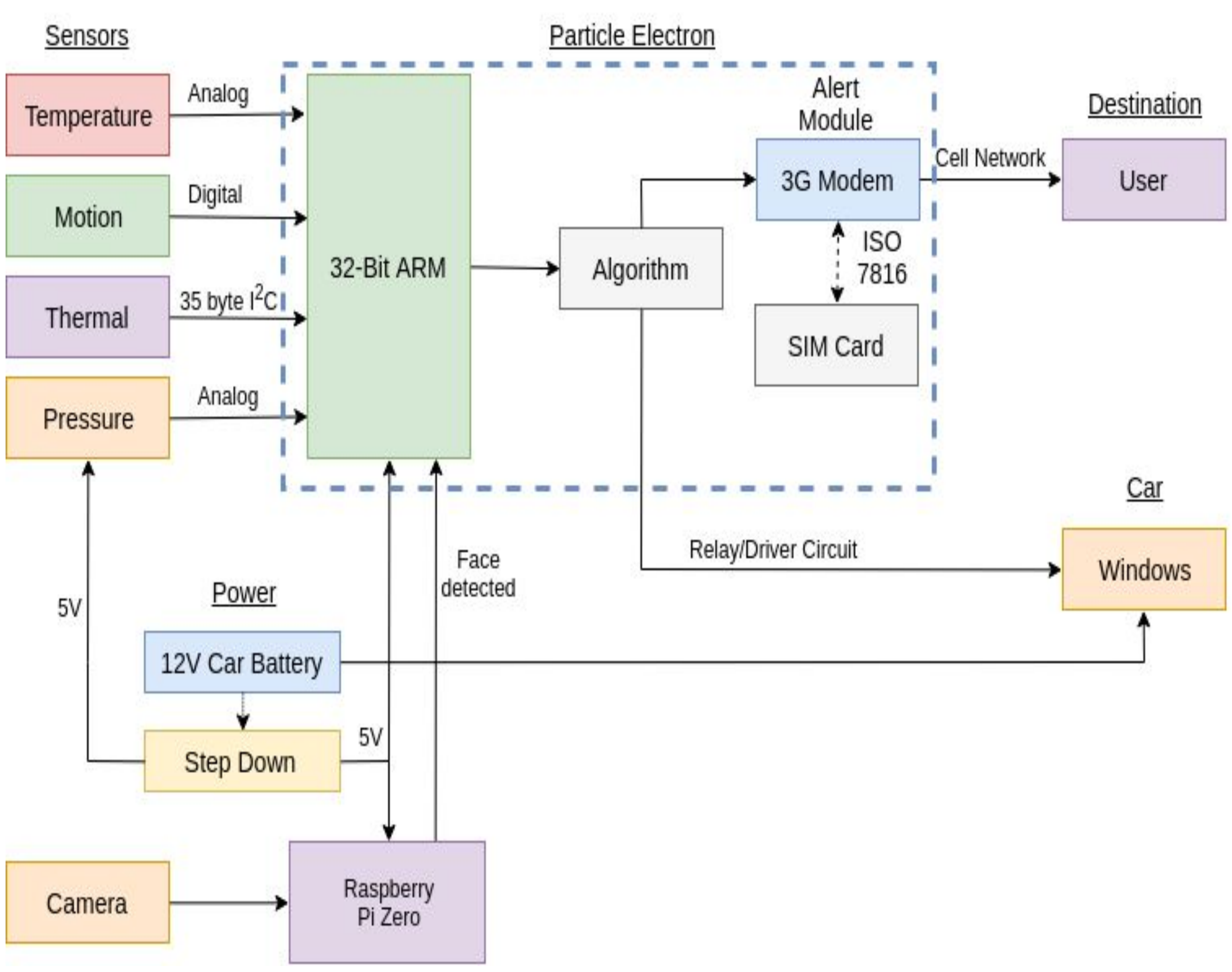
Abstract

Every year, a number of people forget their children and pets in their hot cars; leaving them defenseless in a fight for their life against heat stroke. The solution for these individuals is the Child Alert and Rescue System. CARS seeks to provide relief and save lives in the event that a pet or child is forgotten in a hot car. Our system has been designed to integrate with most existing vehicles with little effort.

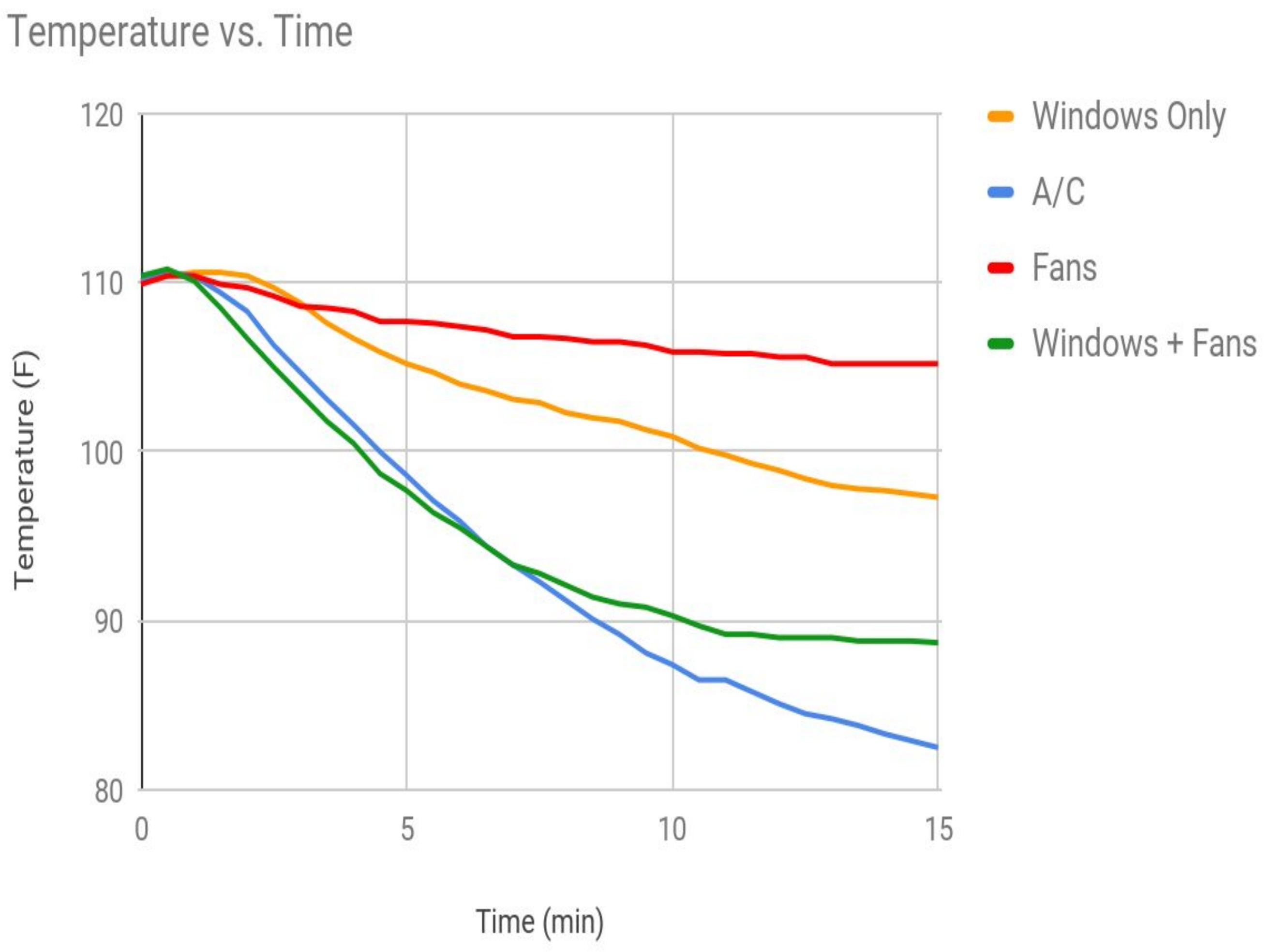
System Overview

Our system makes use of proprietary automobile electronics, in addition to a few processing and sensing tools to detect life in the backseat of a car. By simply adding on to what already exists in the car, our team is able to create an overall robust system that can provide relief to a living being facing potential heat stroke conditions by rolling down the windows and therefore, lowering the interior ambient temperature.

Block Diagram



Results



After completing the design process, our team was able to fabricate a system that is capable of not only detecting life in the backseat of a car, but is also capable of rolling down the windows. As the graph above shows, rolling down the windows in high temperature situations helps create relief for any living being.

Specifications

1. Measure temperature in a car
2. Detect for life in back seat
3. Integrate alert system with cellphone
4. System should be compatible with most sedans (target manufacturer level)
5. Easy installation for a mechanic/auto electronics expert
6. Must take action to cool car at or below 95º F
7. Keep car under 95º F
8. Do not deplete power of batter beyond ignition start

Acknowledgement

We would like to thank our advisor, Professor Ciesielski, as well as our evaluators, Professors Anderson and Irwin for their thoughtful feedback. Additionally, we would like to thank Zbylut Motor Works of Amherst, MA for their generosity in providing to us wiring diagrams and schematics for the car we will be installing our system into.

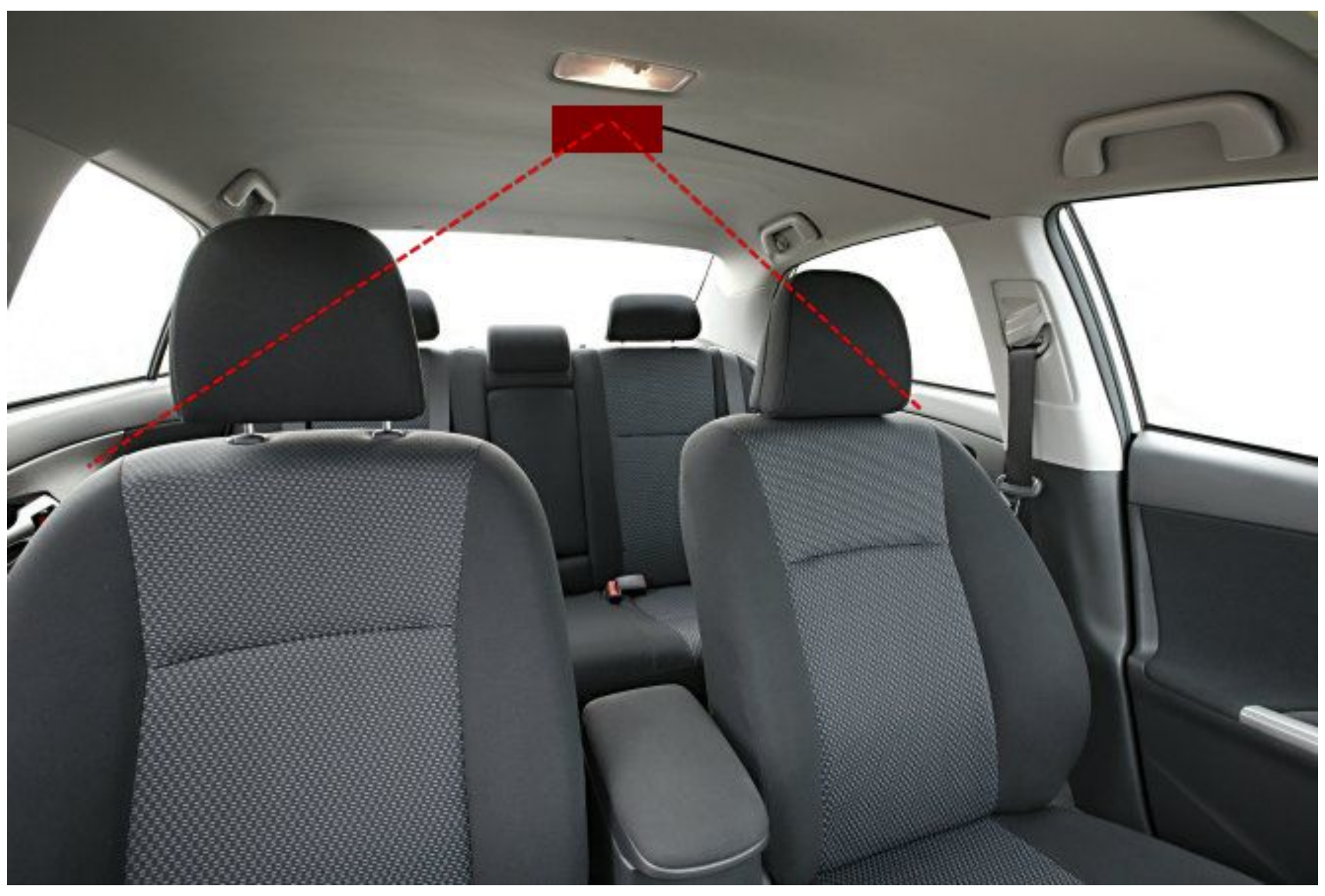
Algorithm

Based on the combination of individual sensors, our system decides the appropriate action (if any) to take.

Thermal	Pressure	Face	Motion	Action
0	0	0	0	x
0	0	0	1	Text User
0	0	1	0	x
0	0	1	1	Roll Windows & Text
0	1	0	0	x
0	1	0	1	Roll Windows & Text
0	1	1	0	Text User
0	1	1	1	Roll Windows & Text
1	0	0	0	x
1	0	0	1	Text User
1	0	1	0	Text User
1	0	1	1	Roll Windows & Text
1	1	0	0	x
1	1	0	1	Roll Windows & Text
1	1	1	0	Roll Windows & Text
1	1	1	1	Roll Windows & Text

Sensing

Our system consists of 5 sensors. The first is a temperature sensor to measure ambient temperature within the car. Once the temperature reaches 95 degrees we will then use our other 4 sensors to detect for life in the back seat. These sensors include a PIR motion sensor, thermal camera, pressure sensor and facial detection camera. All except the pressure sensor will be located on the ceiling of the car looking down across the entire back seat. As for the pressure sensor, it will be up to the car owner to place it directly in the child car seat to help improve our system.



Cost

Development

Part	Price
Microcontroller	70
Thermal Camera	50
Motion Sensor	10
Pressure Sensor	10
Raspberry Pi Zero	25
Pi Cameras	60
Relays	12
PCB	78
Other	151
Total	466

Production

Part	Price
Microcontroller	70
Thermal Camera	50
Motion Sensor	10
Pressure Sensor	10
Raspberry Pi Zero	25
Pi Camera	37
Relays	12
PCB	26
Total	240

Proprietary Systems

One main focus of this project is the utilization of proprietary systems in vehicles. What this really implies is that we use what is already existing in the car and extend its function to serve the purpose of our system. In this case, the existing system in question is the window control located in the driver side door. We alter the function of the main window control connector by adding in four electromagnetic relays. These relays are triggered by our microcontroller, and in turn a 12V input is applied to the existing controls, causing the windows to promptly roll down at the same speed as they normally would with the press of the driver control switches.

Power Use

A key thing we wanted to be cautious of in the design of our system is the amount of power dissipated. We wanted to be able to fully integrate our system and have it fully functional without draining the car battery beyond ignition capabilities. To achieve this, we chose a low power microcontroller, the Particle Electron. Along with being very low power, the Electron is also capable of going into a conservative sleep mode. By our calculations, the system can actively sense for life and roll down the windows repeatedly for 5 hours and 45 minutes straight. However, since the windows only need to be rolled down for 5 seconds, the power consumption is negligible. Most of the time, the system will be in sleep mode, which it can remain in for 97 days straight.

Reliability of Sensors

We ran 10 separate trials for each one of our sensors. For each trial we experimented with the range of our sensors along with how well they were able to detect a human being. We sat in different areas of the back seat of the car and observed each sensor's output. There were only a few cases that our sensors gave a false reading (shown as x's in the table below). We noticed that the facial detection camera had the lowest accuracy due to its limited field of view. Overall, our sensors had an average 87 percent success identifying someone sitting in the back seat.

Sensor	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10	Success Percentage
Motion	✓	✓	✘	✓	✓	✓	✓	✓	✓	✓	90%
Pressure	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100%
Thermal	✓	✓	✓	✘	✓	✓	✓	✓	✓	✓	90%
Face	✘	✘	✓	✓	✘	✓	✓	✓	✓	✓	70%