Final Project Review

Child Alert and Rescue System (CARS)

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Who We Are

Amer Becirovic (EE)

George Bayides (EE)

Sean Danielson (EE)

Kevin Ford (CSE)

Problem

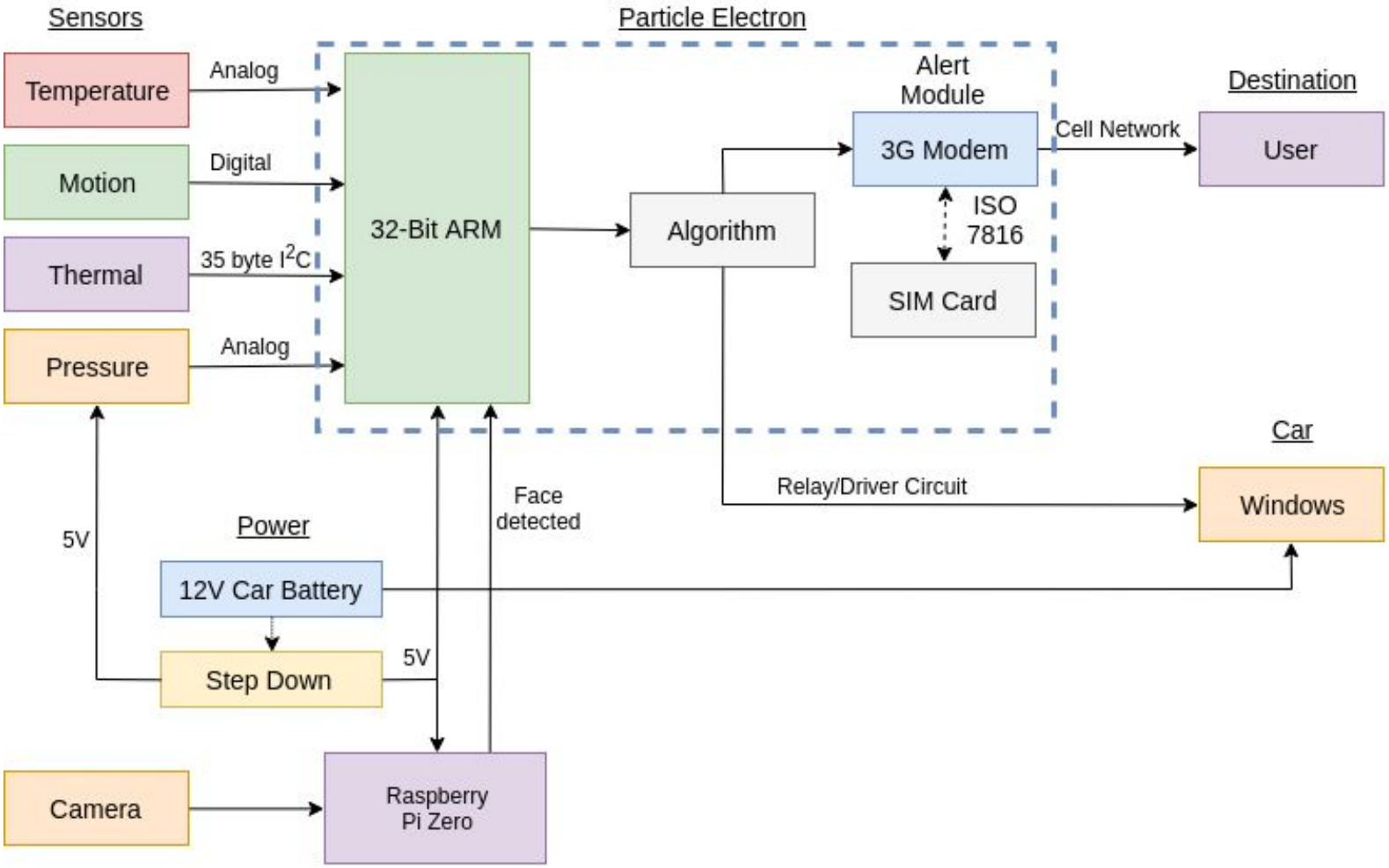
- Every year, people all over the world forget their children or pets inside of a hot vehicle
- These children and pets die because they undergo heat stroke without any relief
- Our team is creating a system to prevent hot car deaths

System Specifications

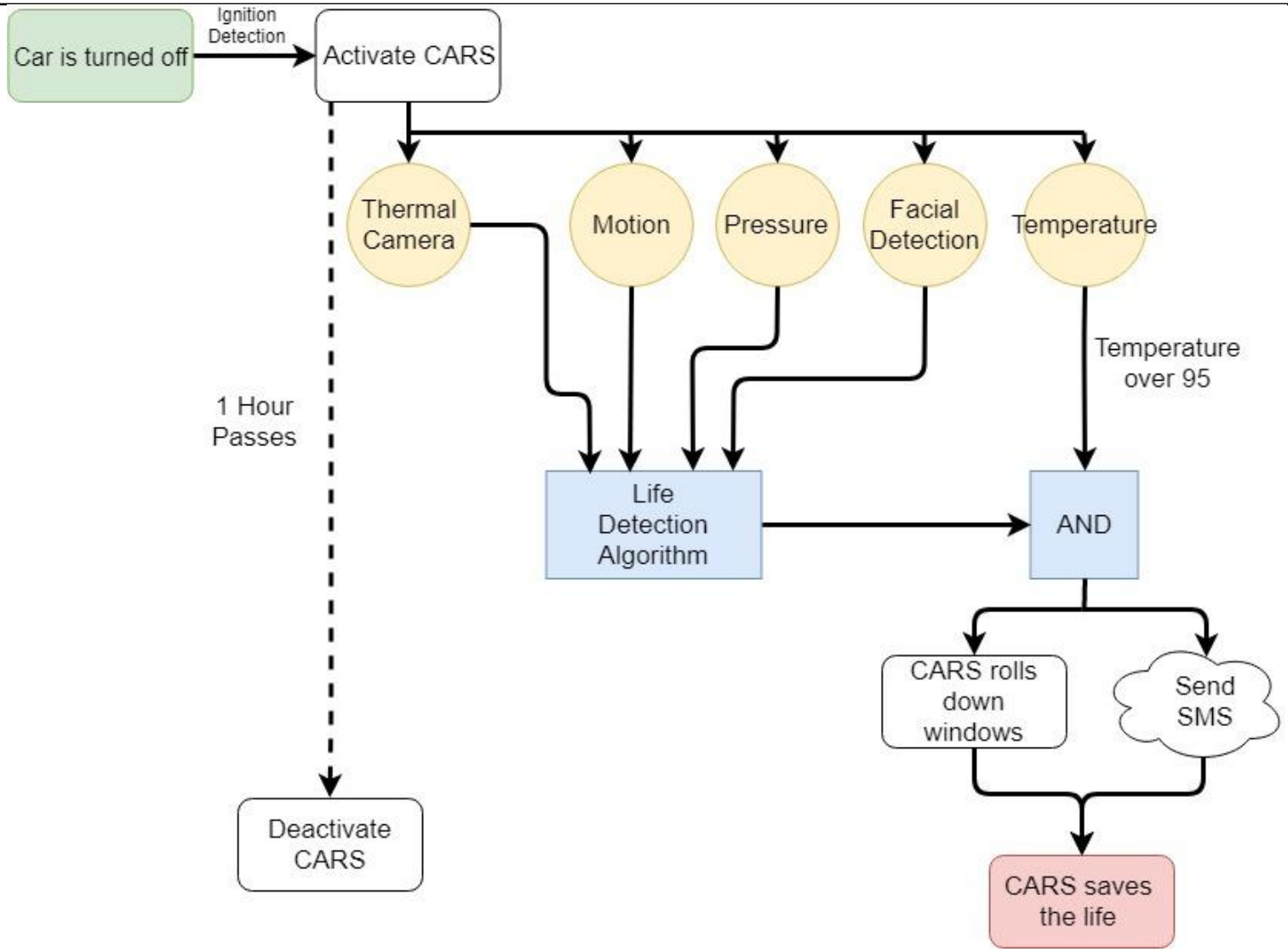
1. Measure temperature in a car
2. Detect if child is in the car
3. Integrate alert system with cellphone
4. System should be compatible with most sedans (target manufacturer level)
5. Easy installation for a mechanic/auto electronics expert
6. Must take action to cool car at or below 95ºF*
7. Keep car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

*demonstrated at 70ºF due to weather conditions

Block Diagram: Overview



Logic Flow Diagram



Sensor Analysis

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%

- Issue: Facial detection restricted by camera viewing angle
- Average Success Percentage: 87.5 %

Life Detection

- Sensor combinations dictate what action is taken
- Which action to take is informed by individual sensor reliability

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

Thermal Camera Algorithm

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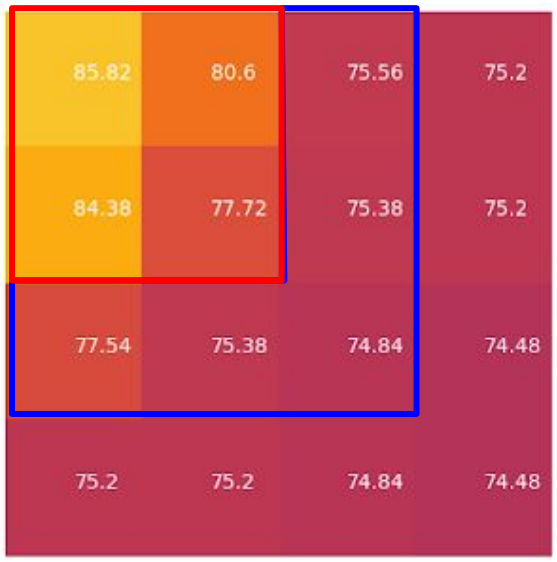
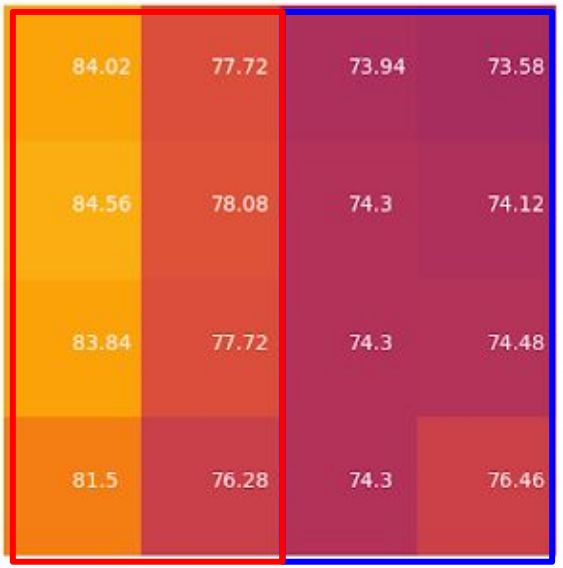
temp”



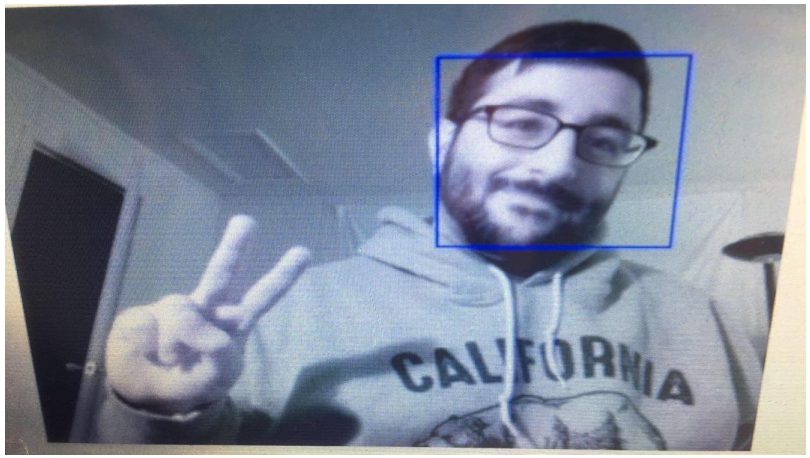


Facial Detection - Update

- New Wide Angle Camera
- No image transfer - too long delay, not very useful
- Binary signal sent to Particle
- Bash script to shutdown automatically

Specification:

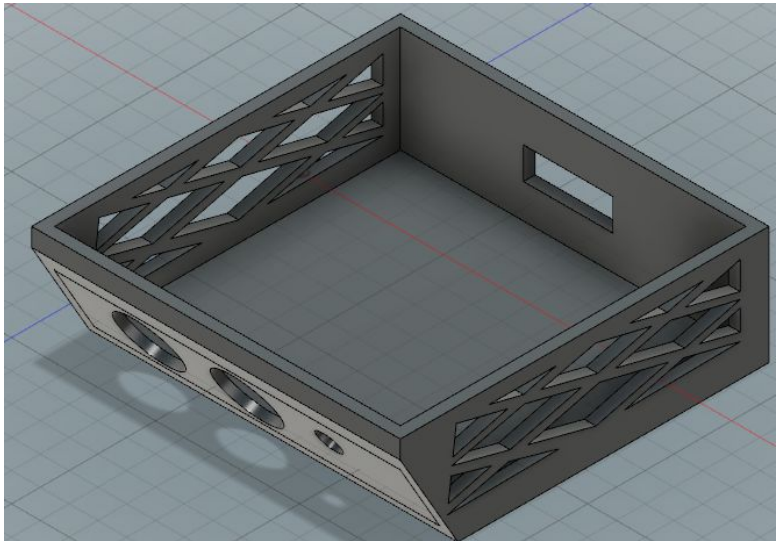
- Fully Compatible with Both the Model A and Model B Raspberry Pi
- 5 MP Omnivision 5647 Camera Module
- Still Picture Resolution: 2592 x 1944
- Viewing angle: 160 degrees
- Camera angle: Size can be replaced
- Video: Supports 1080 p @ 30 fps, 720 p @ 60 fps and 640 x480 p 60/90 Recording 15-pin MIPI Camera Serial Interface
- Size: Approx. 25 x 24 x 9 mm /0.99 x 0.95 x 0.36 inch

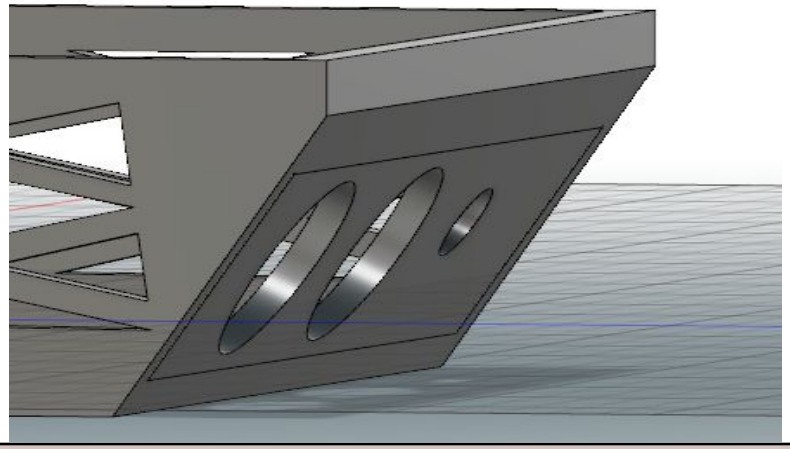


Component Placement

- Roof Box
  - Motion sensor
  - Thermal camera
  - Temperature sensor
  - Pi + Pi camera
  - Particle Electron
- Seat
  - Pressure pad
- Driver's side door
  - Relays

Roof-Mounted Box - Updated





- New Additions
  - 60° viewing angle for optimal sensor vision
  - Side venting to dissipate component heat
  - Rear connector port

Power Calculations - Real System Measurements

- Car battery power: 70 Ah * 12 V => 840 Wh
- Current delivered while system is active (controller+sensors+all windows rolled down): 12.450 A
  - Tells us the car battery can provide this power for about 5 hours and 45 minutes
  - However, we will only be pulling this much current for about 5 seconds
- Most of the time, our system will be in a passive mode, (microcontroller in sleep mode) drawing: 0.03 A * 12 V => 0.36 W
  - So, really the system can stay in sleep for about 97 days

Design Challenges

- Raspberry Pi
  - Has no power management hardware - must be managed in software
  - Camera range not wide enough
- Heat Dissipation
  - Heatsink too hot - made new heatsink
  - Heatsink began affecting temperature - insulation needed

FPR Deliverables

- Fabricate PCB and implement in roof box ✓
  - Amer & Sean
- Testing and refinement of life detection algorithm ✓
  - George & Kevin
- Clean up and hide car wiring as much as possible ✓
  - Amer
- Power Optimization ✓
  - All members
- Optional: Install 4 additional relays to roll windows back up ☒
  - All members

Cost Analysis - Updated

Device	Cost
Thermal Sensor	$50
Pressure Sensor	$10
Harness	$14
Power Feed Cable	$15
Microcontroller	$70
Relays	$12
Motor	$8
Motion Sensor	$10
Sonar Sensor	$8
Velcro	$11
Circuit Breaker	$11

Device	Cost
Pi + Camera	$48
Fuses (5)	$12
Better Camera	$20
Power Feed Cable	$15
Replacement Thermal	$53
PCB	$78
New Pi Camera	$37
Total	**$466**

*All values are rounded up

Thank You

Questions before demo?

Demo

Let’s go outside!