Cumulative Design Review

Child Alert and Rescue System (CARS)
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Who We Are

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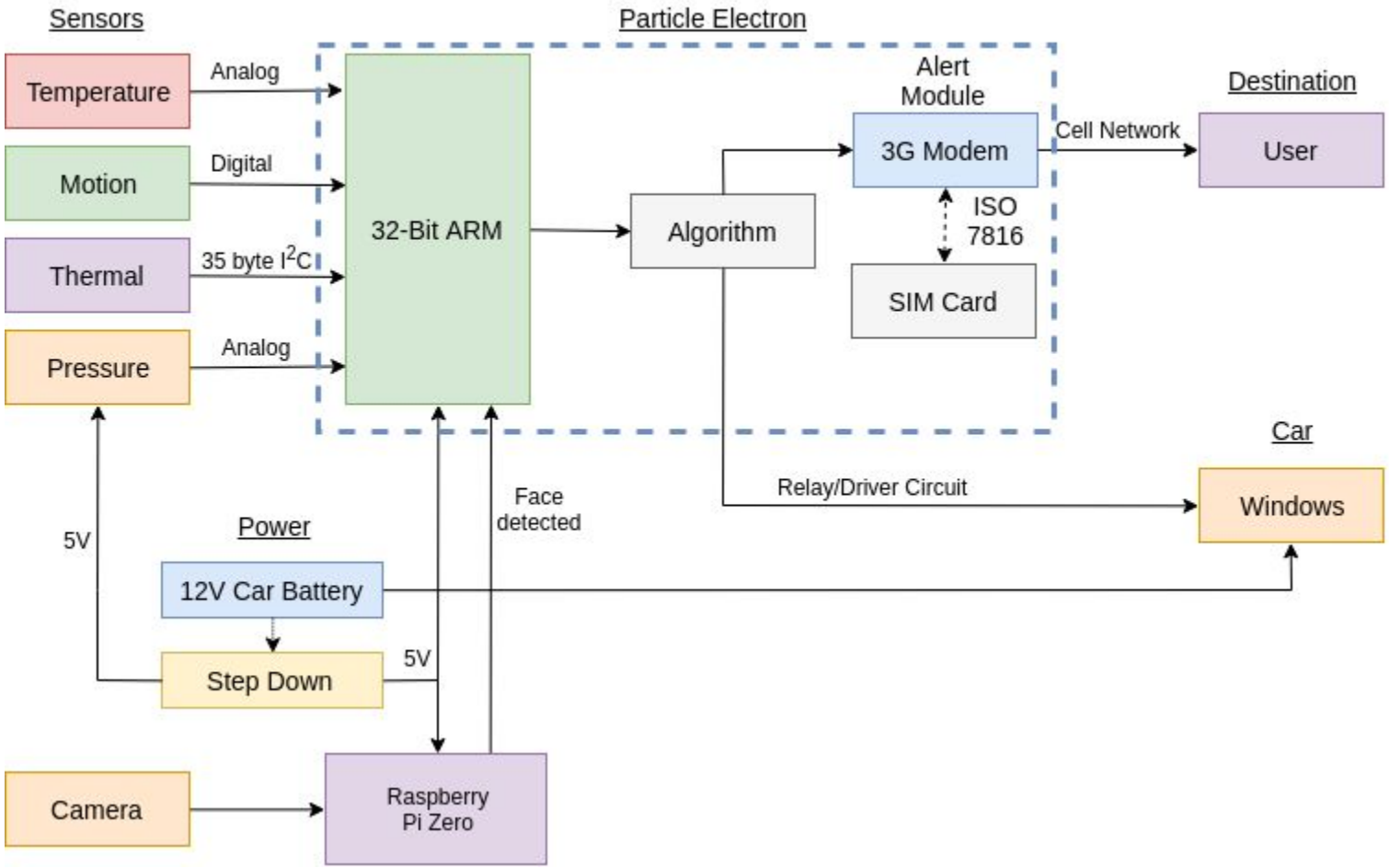
Problem

- 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

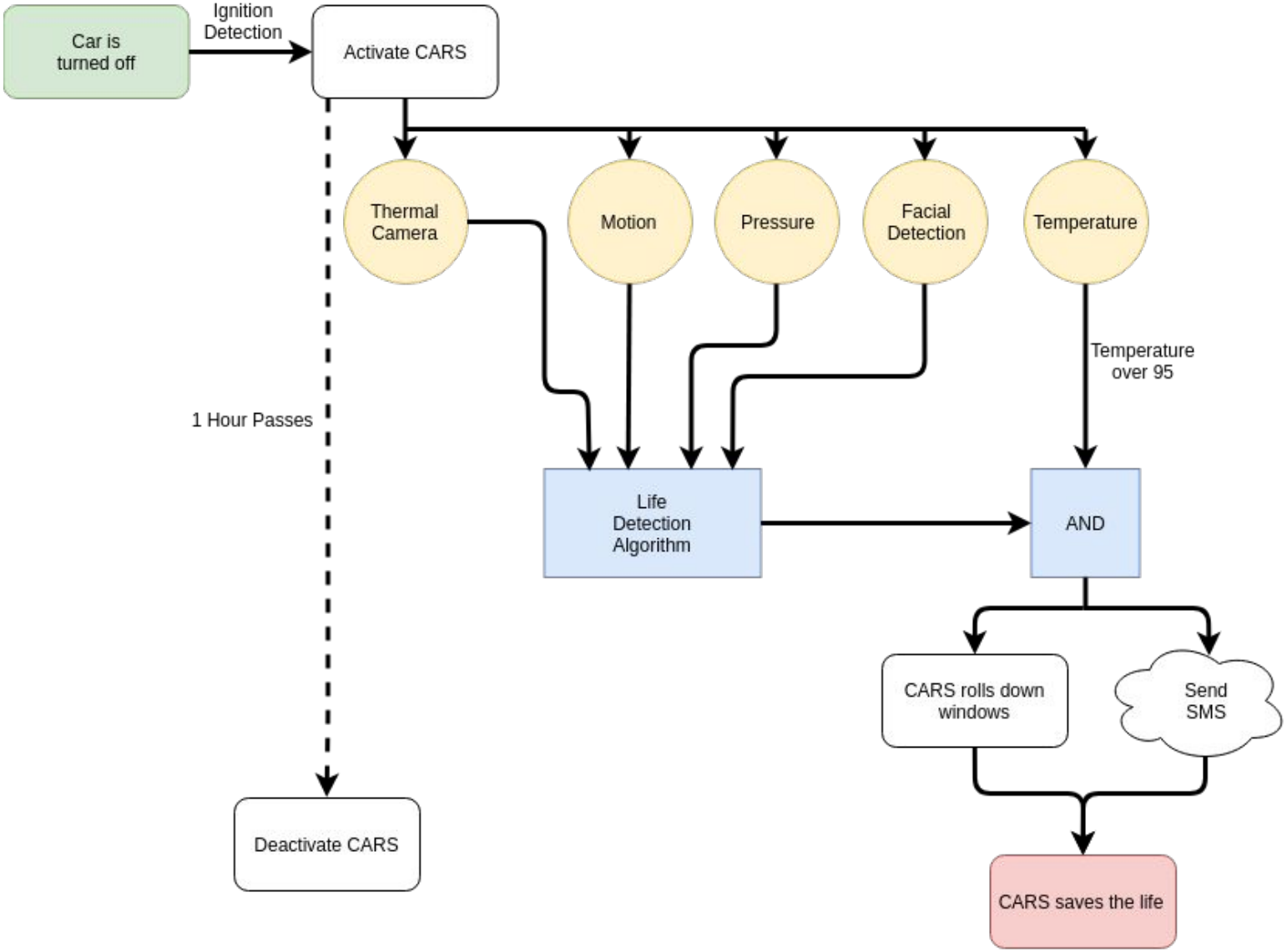
System Specifications

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

Block Diagram: Overview



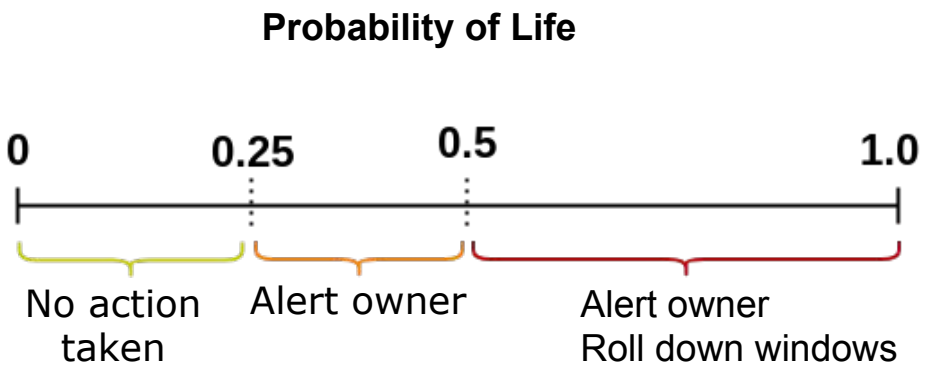
Logic Flow Diagram



Life Detection Algorithm

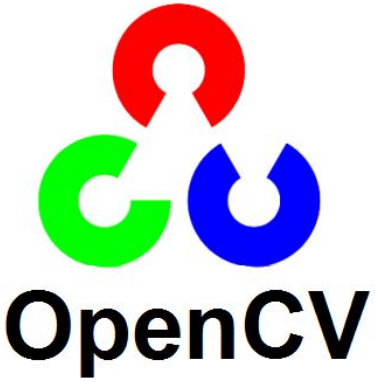
- No single detection method is perfect
  - Some more reliable than others
- Weighted sum of probabilities
- Resulting "probability of life" decides the action the system takes

Detection Method	Weight
Motion	0.5
Pressure	0.25
Facial detection	0.15
Thermal camera	0.1



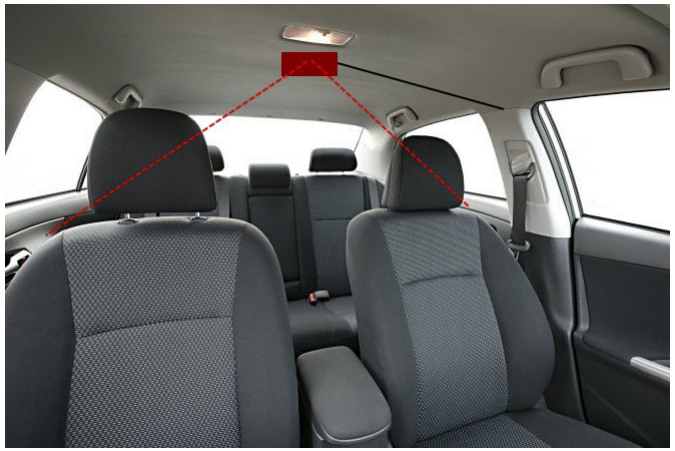
Facial Detection

- Raspberry Pi Zero - 512MB RAM
- Pi Zero Spy Camera - 8 Mpixel resolution, up to 1080p video resolution
- Used OpenCV library in Python
- Over 90% facial detection accuracy
- Ability to train own Haar classifier

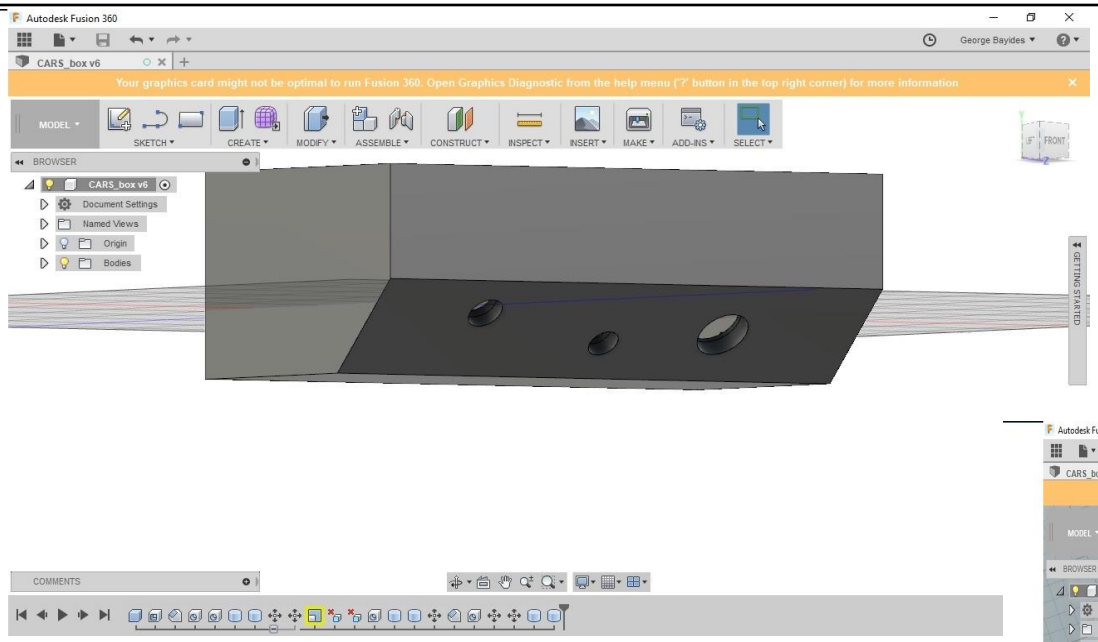


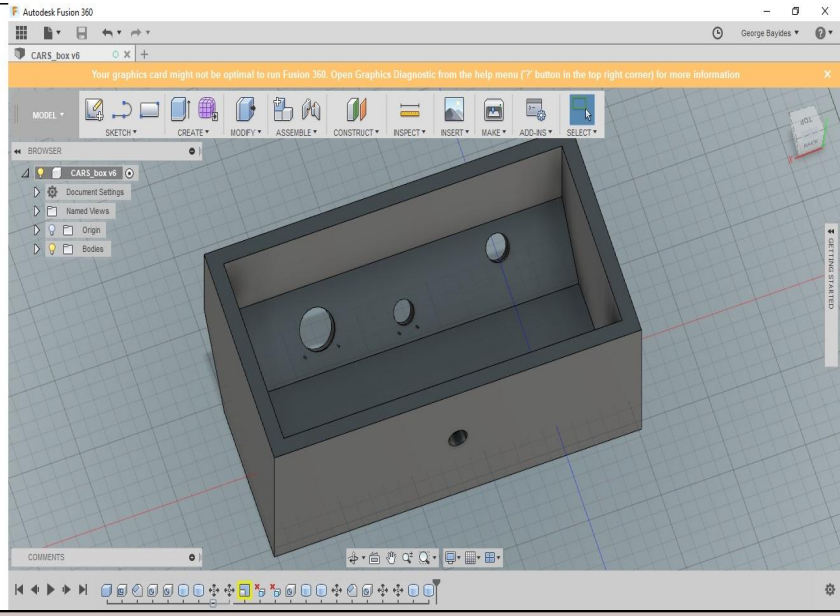
Component Placement

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

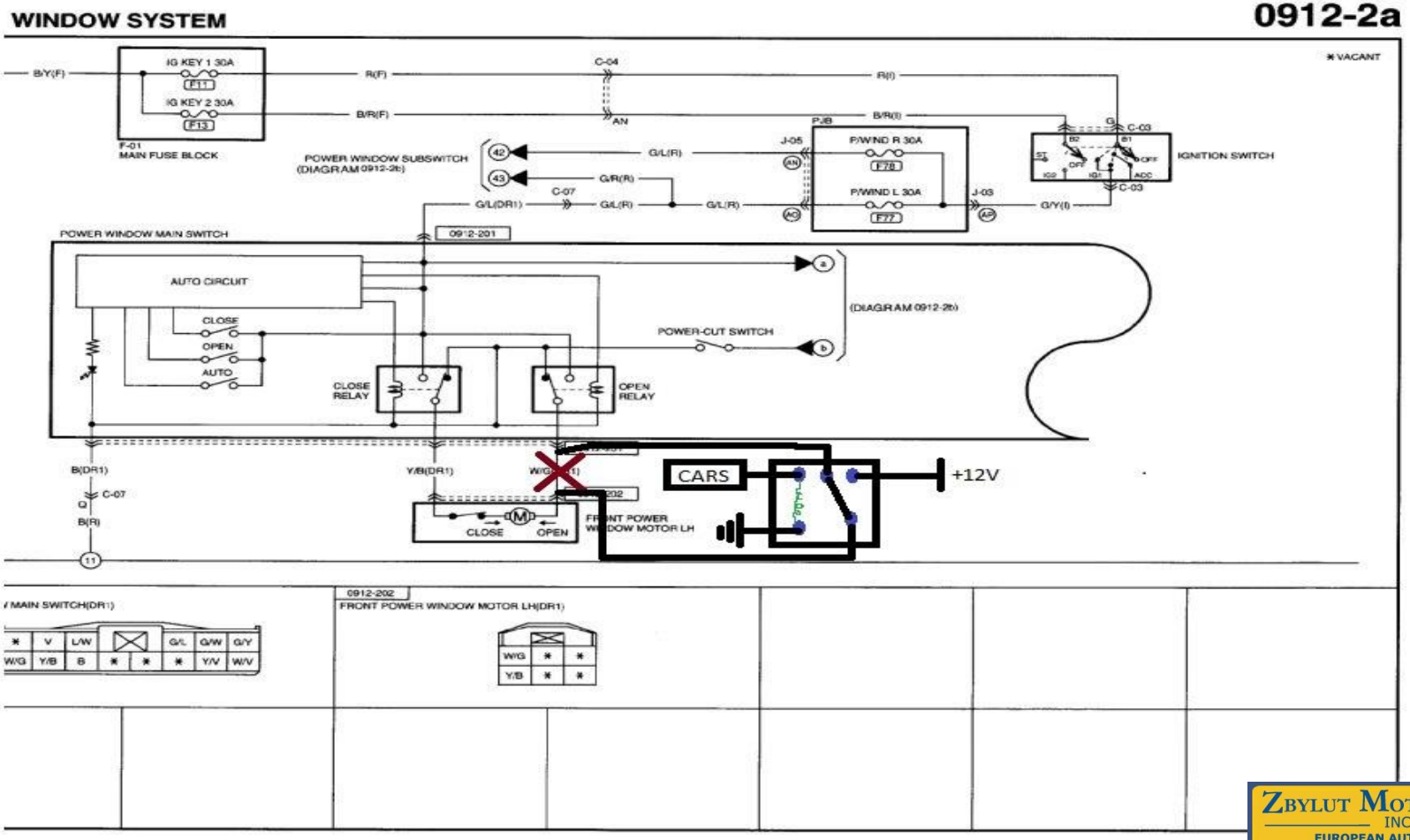


Roof-Mounted Box

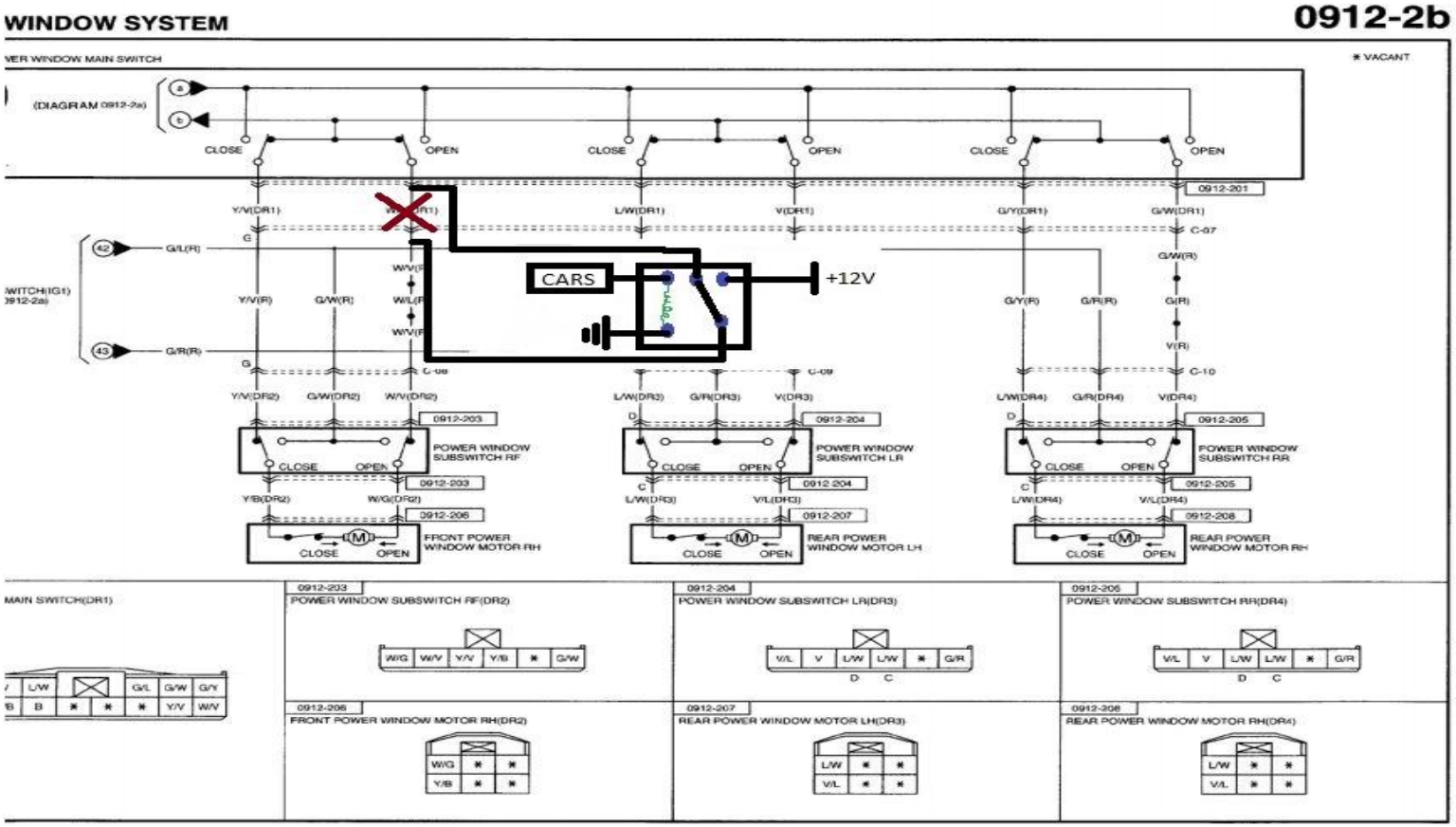




Mazda Wiring Diagrams: Our Modifications



Mazda Wiring Diagrams: Our Modifications - Cont.



Wiring into Car - Pictures

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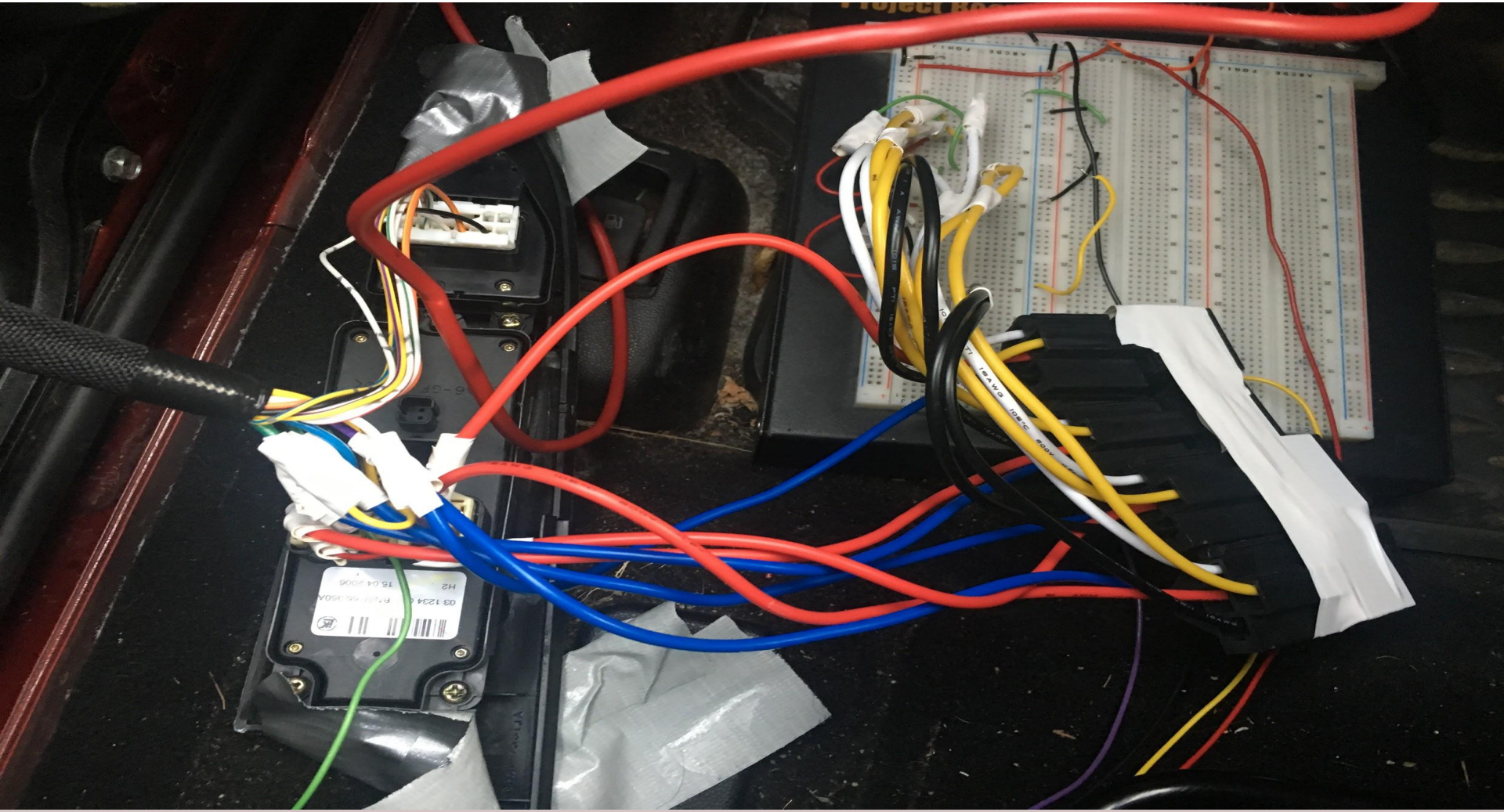


Power Calculations

- Average car battery current: 70 Ah
- Current delivered while system is active(controller+sensors+all windows rolled down): 12.188 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: 110 μA
  - So, really the system can stay in sleep for about 72.6 years

CDR Deliverables

- Successfully wire design into Mazda interface ✓
  - Amer and Sean
- Position sensors within car and detect life in back seat ✓
  - All Members
- Ignition detection ✓
  - Amer and Kevin
- Facial Detection (Optional) ✓
  - Kevin and George
- Website ✓
  - George and Kevin

Proposed 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

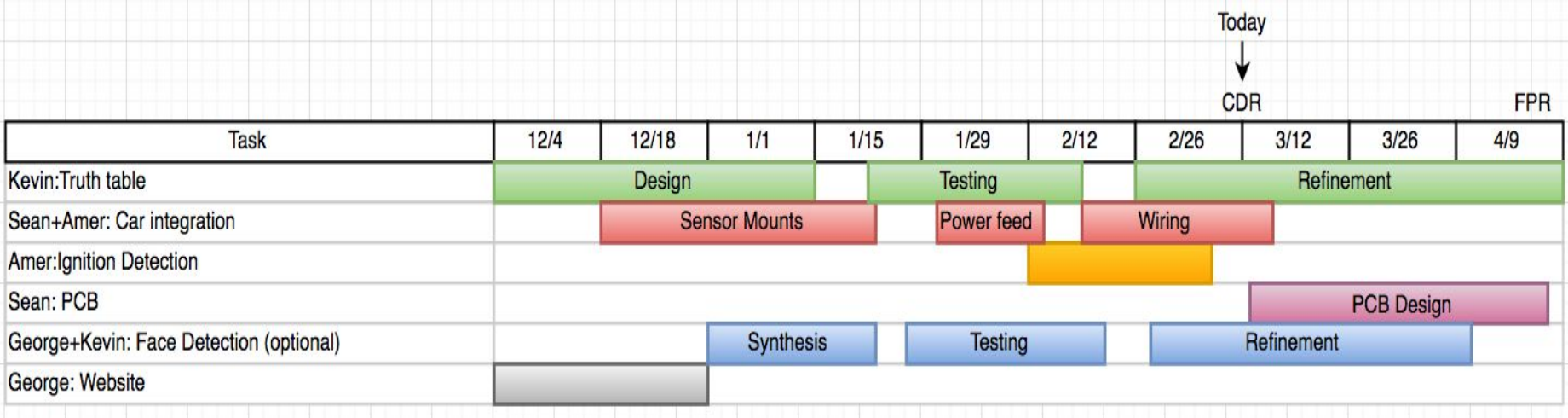
Cost Analysis - Updated

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
Total	**$351**

*All values are rounded up

Gantt Chart: Up to FPR



Thank You

Questions?

Ignition Detection Video

Full Demo

Alert Only Demo