Mid-Year Design Review

Child Alert and Rescue System (CARS)
December 4, 2017

Supported by:

ZBYLUT MOTOR WORKS INC.
EUROPEAN AUTO CENTER

Who We Are

Amer Becirovic (EE)

George Bayides (EE)

Sean Danielson (EE)

Kevin Ford (CSE)

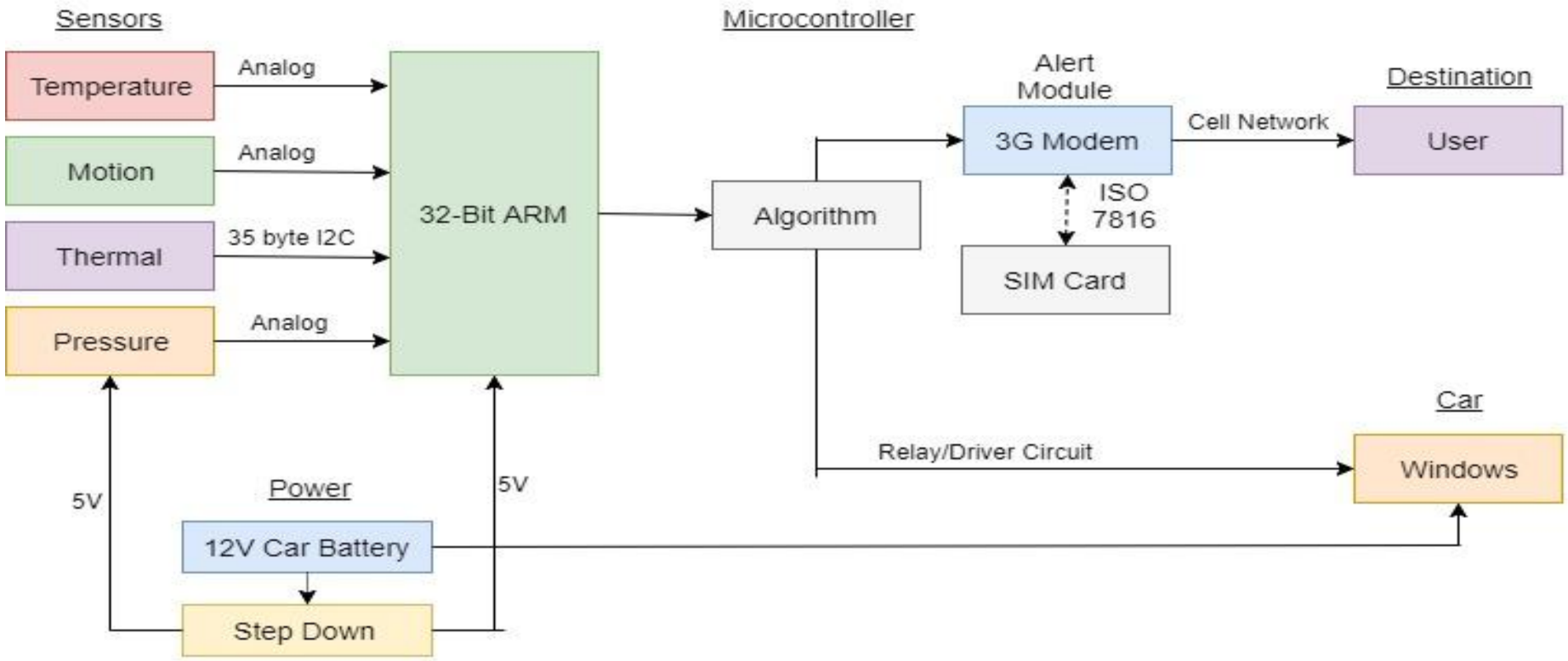
Problem

- 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

Block Diagram: Overview



Overview

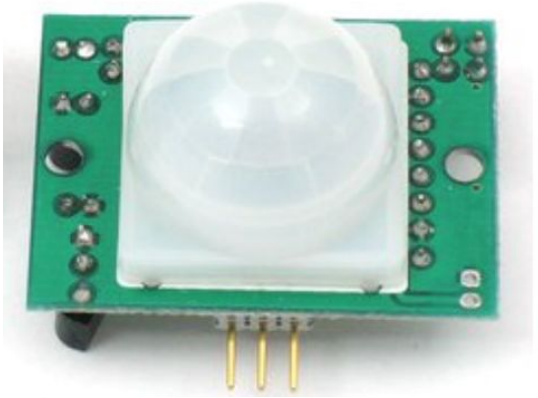
- Spec of Sensors
- Read Sensor Data
- SMS alert messaging
- GUI
- Driver/Relay Circuit

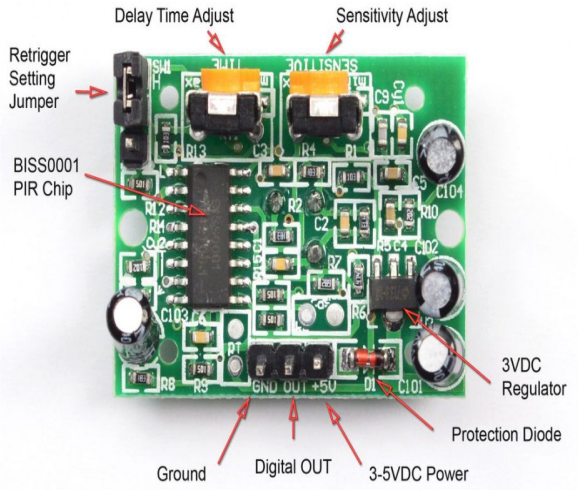
Sensors: Temperature

- TMP36
- -40 to +125 ℃ sensing range
- ±2℃ accuracy
- Linear 10 mV/℃ scaling

Sensors: PIR Motion

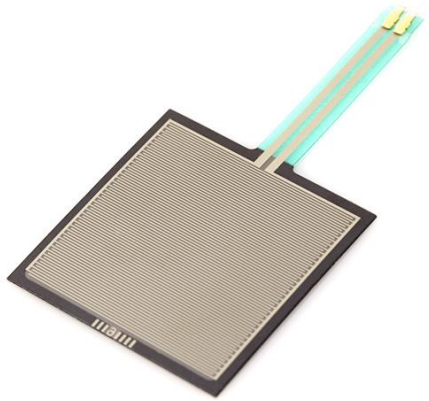
- Infrared
  - Heat+Movement
- Adjustable range
  - Up to 20 feet
- Adjustable reset delay
  - 2.5-250 seconds





Sensors: Force Sensitive Resistor

- Capable of detecting 100g-10kg
- Average baby weight: 3.5kg
  - 95% fall between 2.5 and 5kg
- Within child car seat



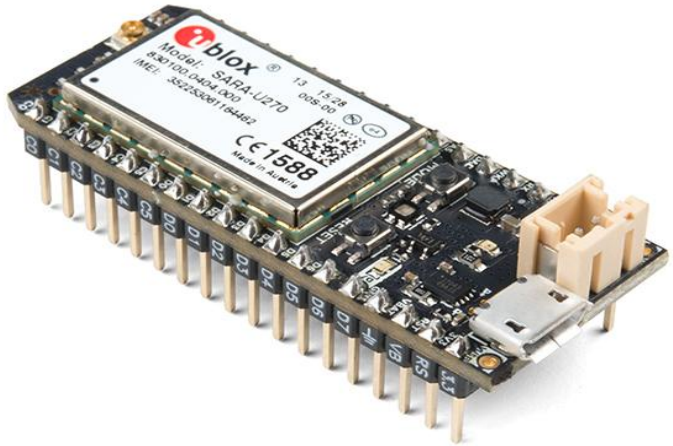
Sensors: Thermal Camera

- Omron D6T thermal camera sensor
- Senses from 5 to 50 ℃
- 44.2 degree range in x-direction
- 45.7 degree range in y-direction
- Outputs 16-block temperature map

74.3	74.48	75.02	72.14
73.58	78.8	89.78	75.02
73.94	79.52	89.42	74.66
74.66	80.96	87.08	77.36

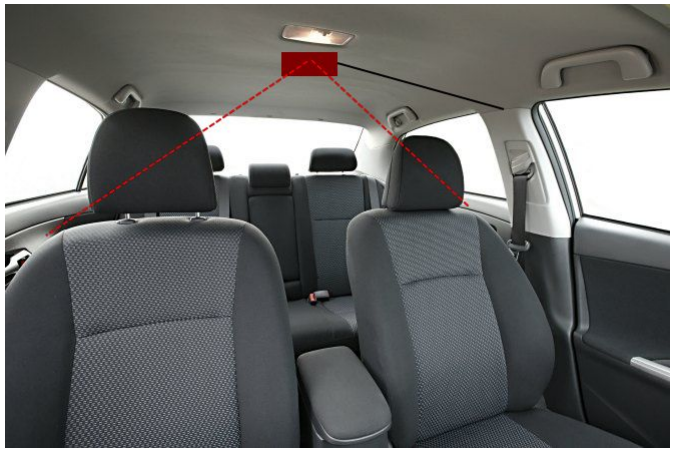
Processing: Microcontroller

- Particle Electron
- U-Blox 3G cellular modem (SARA U260)
- ARM Cortex M3 microcontroller
- 1MB Flash, 128 KB RAM
- Low power sleep mode
- Rich development ecosystem

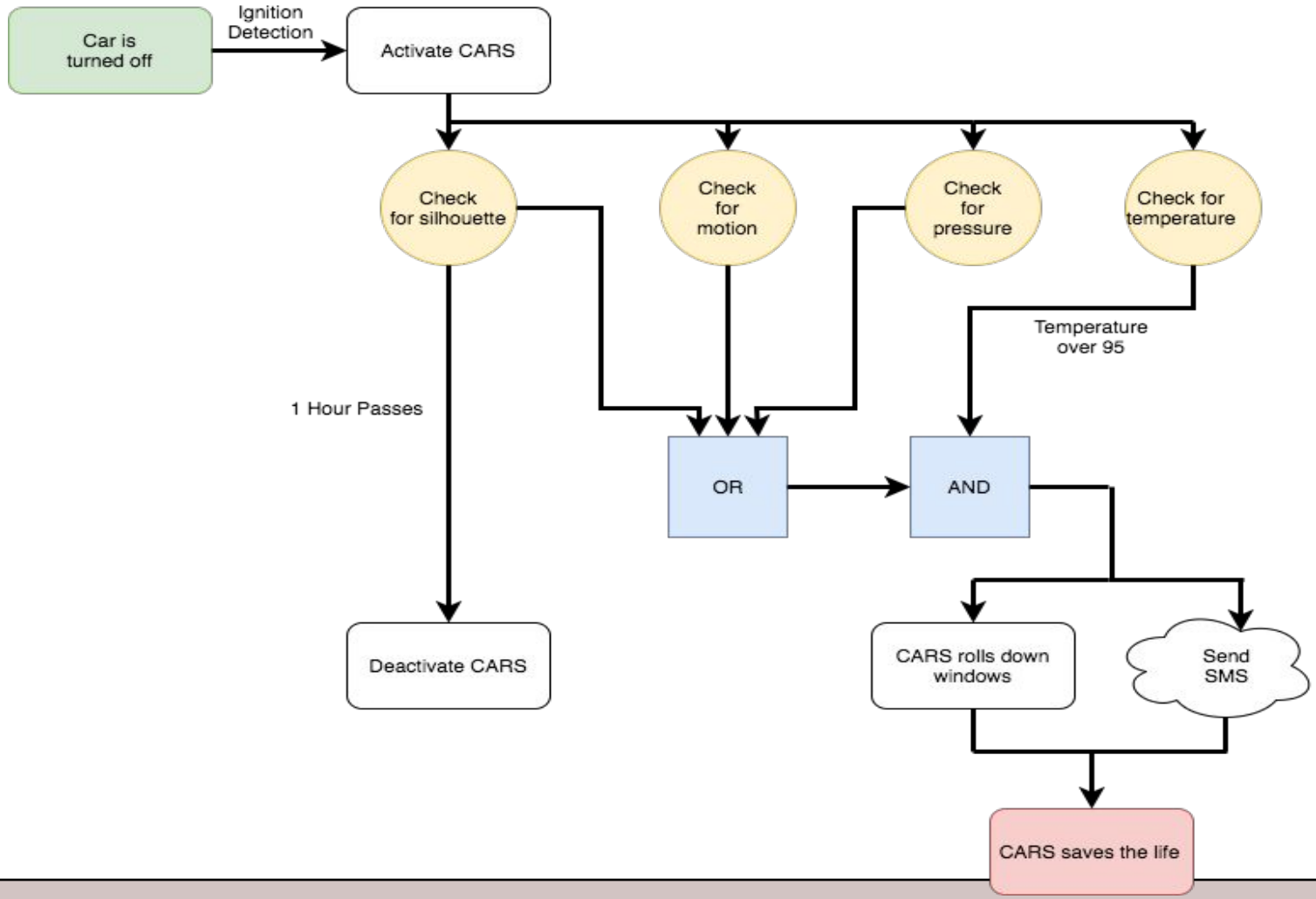


Sensor Placement

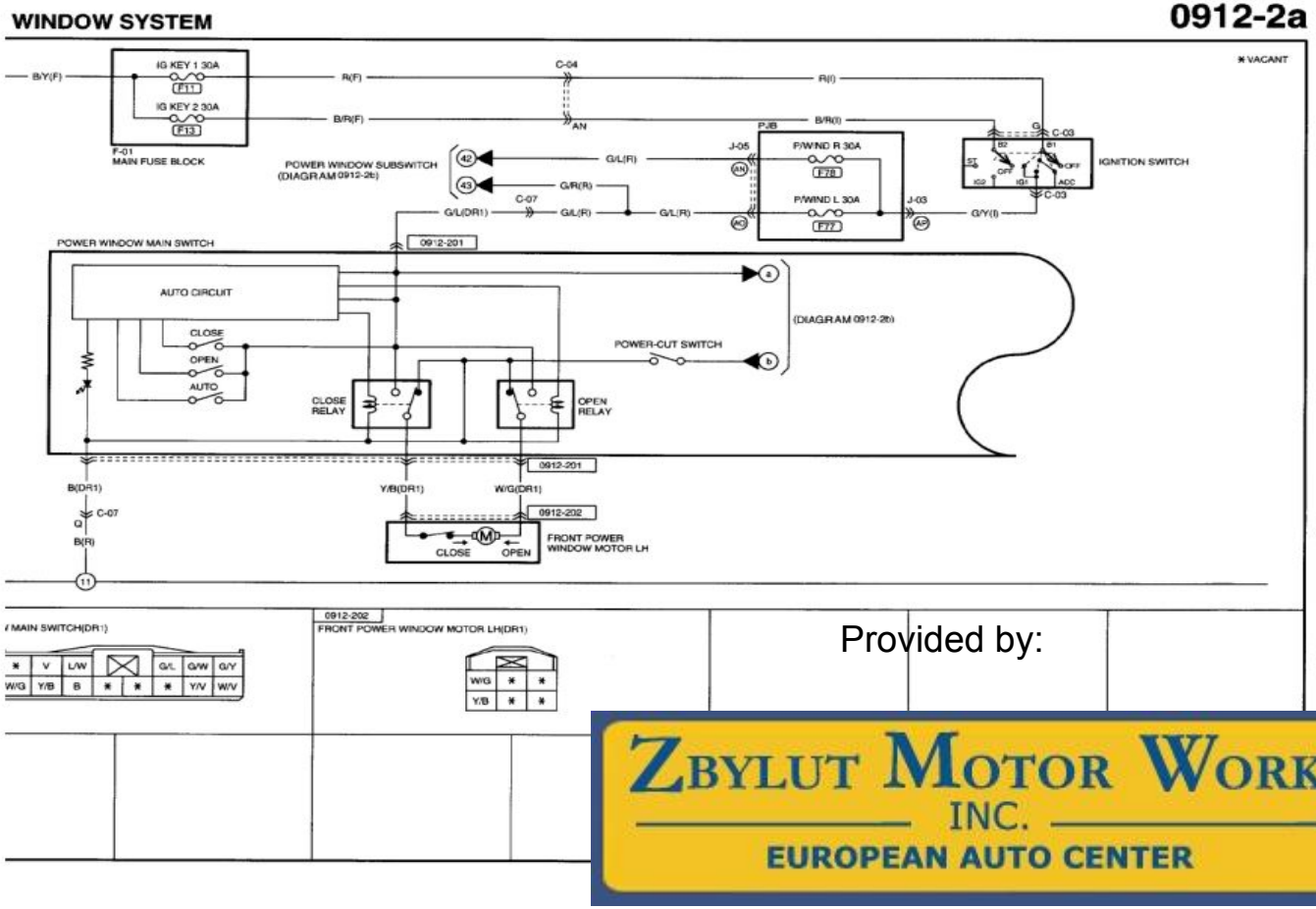
- Roof overlooking back seat
  - Motion sensor
  - Thermal camera
  - Temperature sensor
- Inside child car seat
  - Pressure pad
- Driver's side door
  - Relays
  - Microcontroller



Logic Flow Diagram



Mazda Wiring Diagrams: Existing



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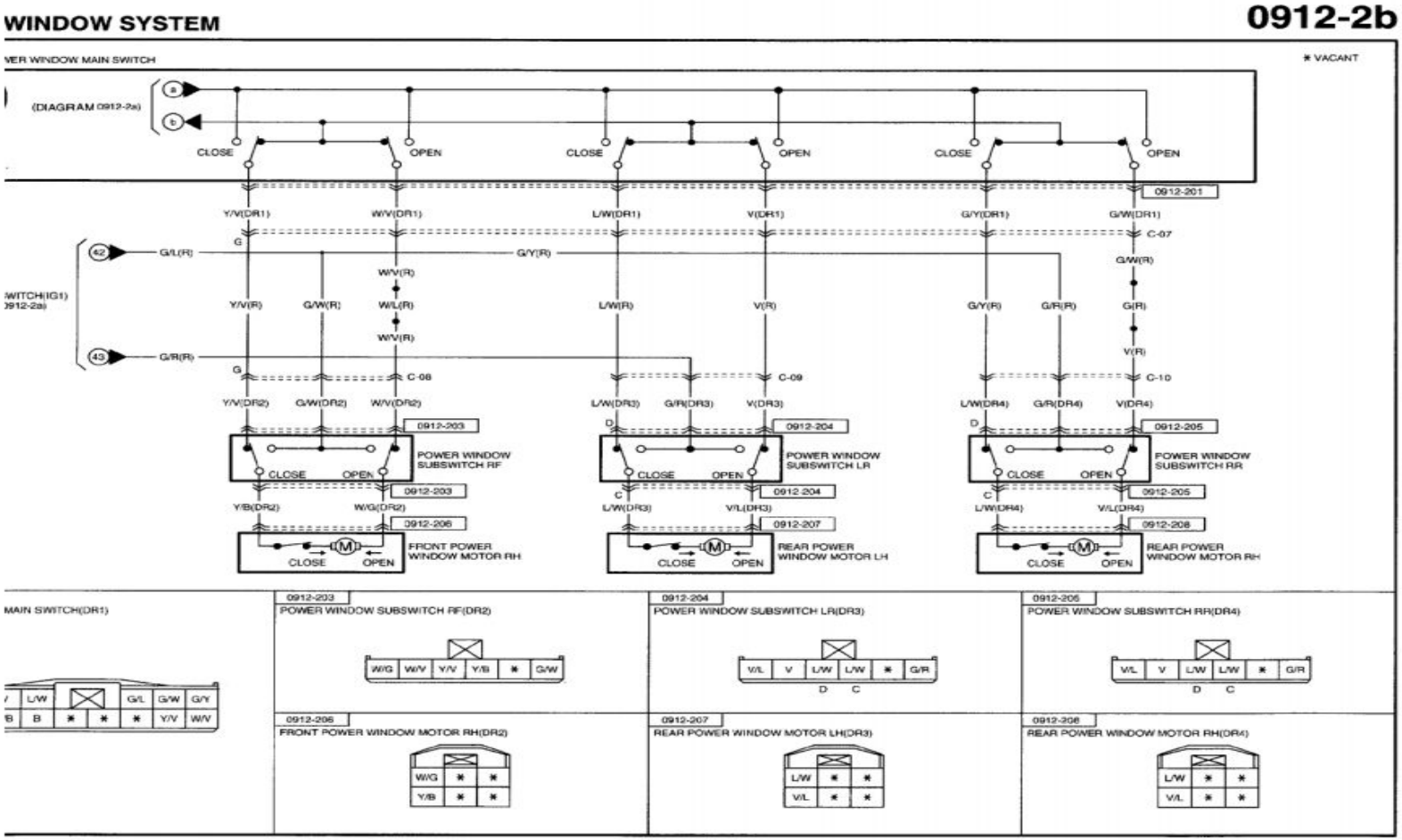
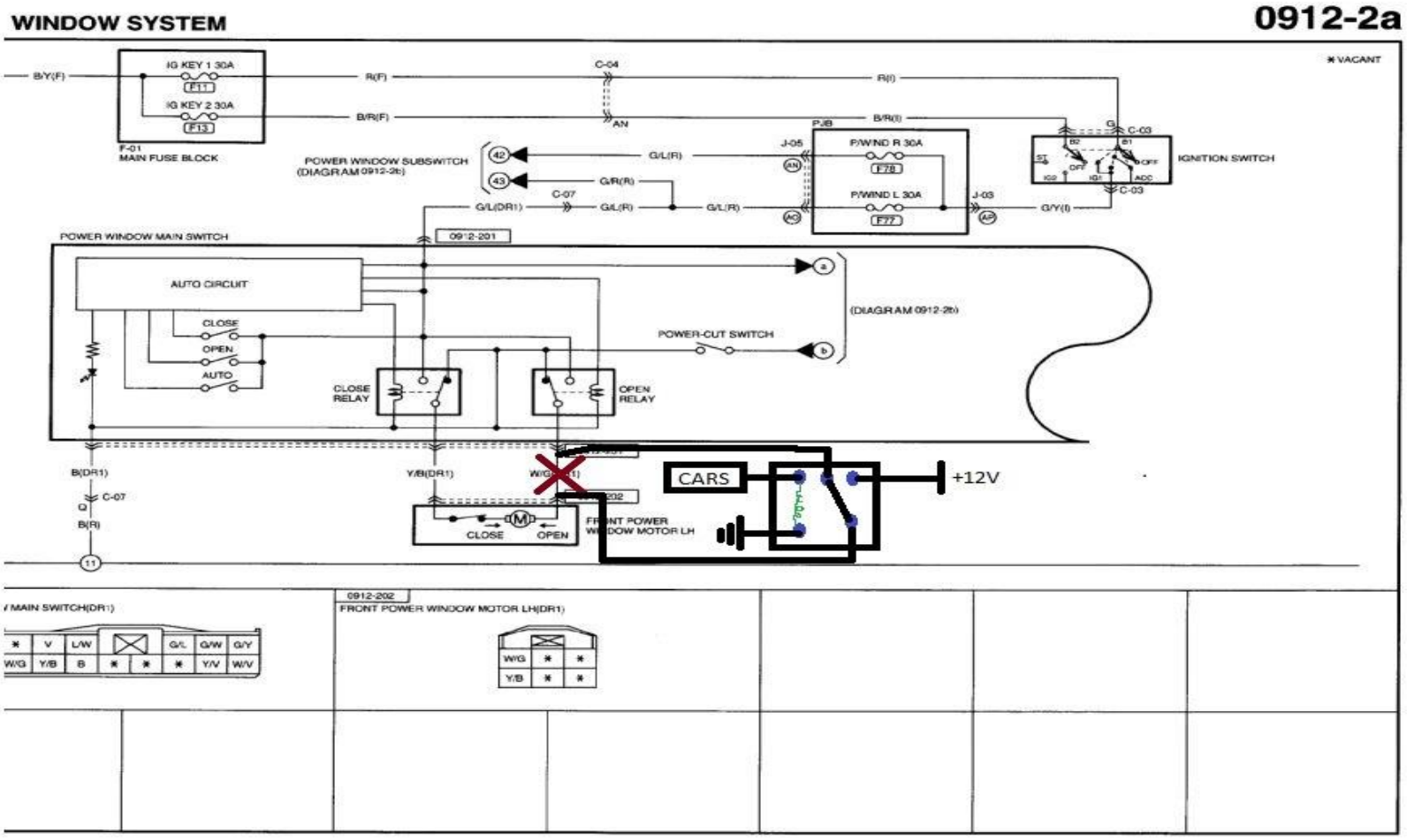
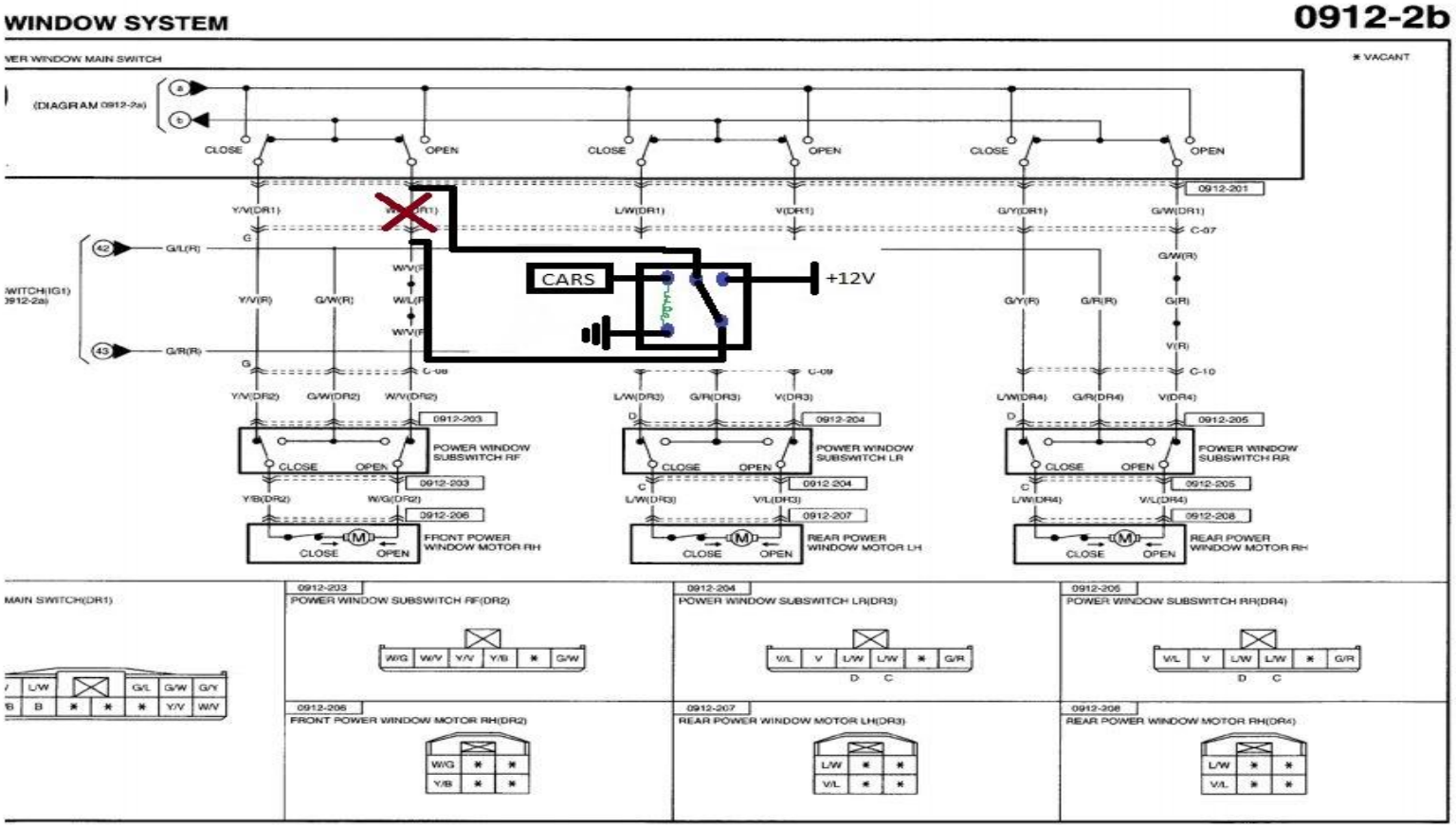
Mazda Wiring Diagrams: Existing - Continued



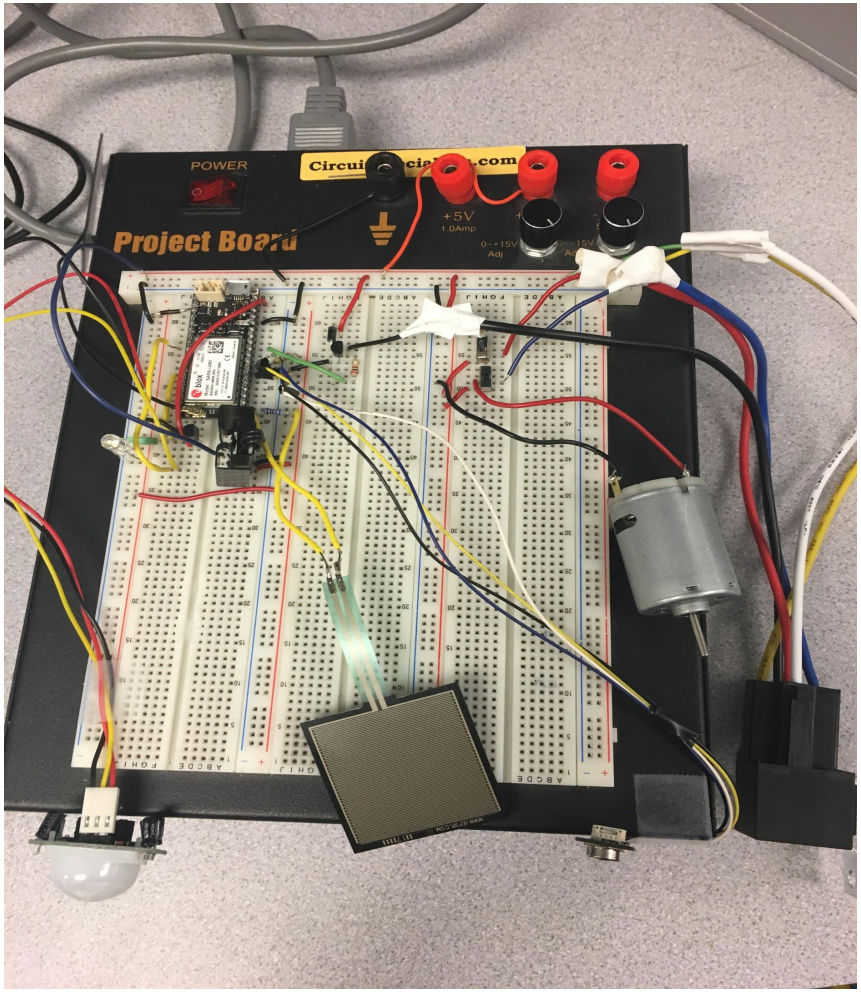
Mazda Wiring Diagrams: Our Modifications



Mazda Wiring Diagrams: Our Modifications - Cont.



Demo



Proof of Concept - Wiring Into Car

Proposed MDR Deliverables

- Sean+Kevin+George: Demonstrate reading of sensors using microcontroller development board ✓
  - Temperature, motion, pressure(weight)
    - Optional: Thermal imaging, A/C output
- All: Outline of data fusion strategy for life detection ✓
- Kevin: Demonstrate sending of SMS messages using 3G modem development board ✓
- George+Amer: Demonstrate 12V outputs to mock window/fan motor ✓
- Amer: Demonstrate that the system can be embedded in a real car ✓

Proposed CDR Deliverables

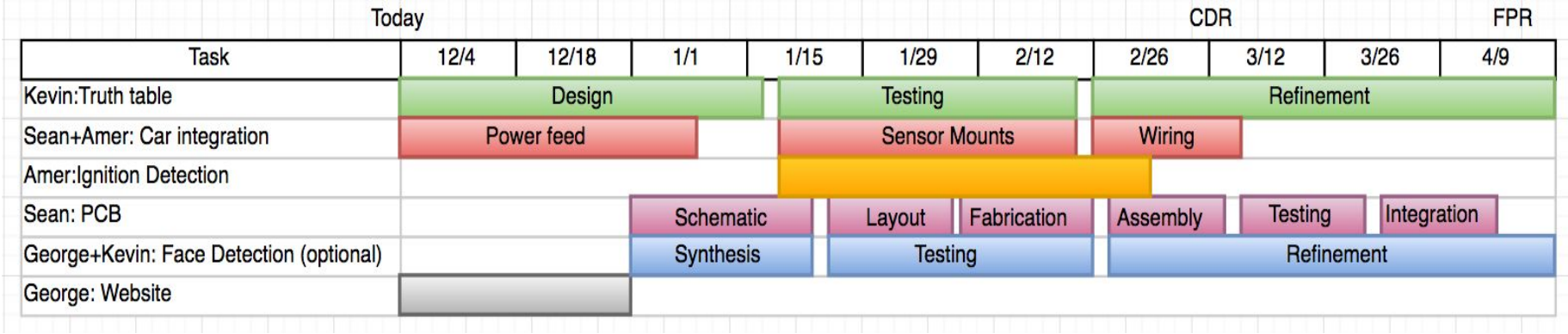
- Successfully wire design into Mazda interface
  - Amer and Sean
- Position sensors within car and detect life in back seat
  - All Members
- Ignition detection ✓
  - Amer and Kevin
- Facial Detection (Optional)
  - Kevin and George
- Website ✓
  - George and Kevin

Cost Analysis

*All values are rounded up

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
Total	**$196**

Gantt Chart: Up to FPR



Thank You

Questions?