Preliminary Design Review

Child Alert and Rescue System (CARS)
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Who We Are

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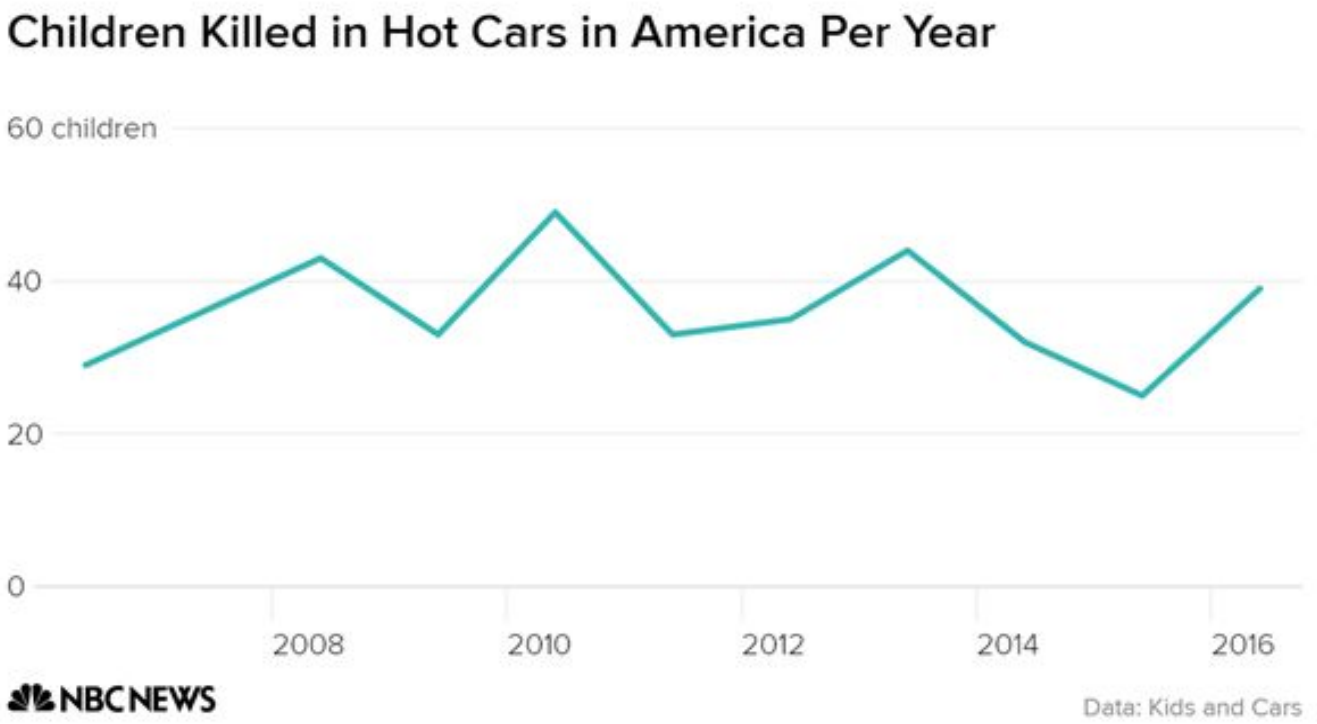
Problem

- 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

Significance and Impact



- On average, 37 children per year die in a hot car
- Hundreds of pets also die

Research

- Heat stroke occurs at a body temperature of 104 ºF (40.0 ºC)[1]
- Even on a 70 ºF day, the inside temperature of a car can exceed 120 ºF[2]
- It is generally not good for babies and dogs to be active in temperatures of 101+ ºF[3]

Existing Solutions

- Sense a Life
  - Pressure sensor sits in baby's car seat, thermometer simultaneously measures temperature
  - If temperature is high, and weight sensor is tripped, user is alerted along with 2 emergency contacts
- ChildMinder
  - Same as above, but comes with a beeping keyring device instead
- What do these systems have in common?
  - Both systems alert, but do not take any real action

Our Proposed Solution

- Design a system that not only alerts, but also takes a physical action in prevention
- Cool the car down automatically by taking advantage of systems already built into the car
- What happens without a system that takes action:

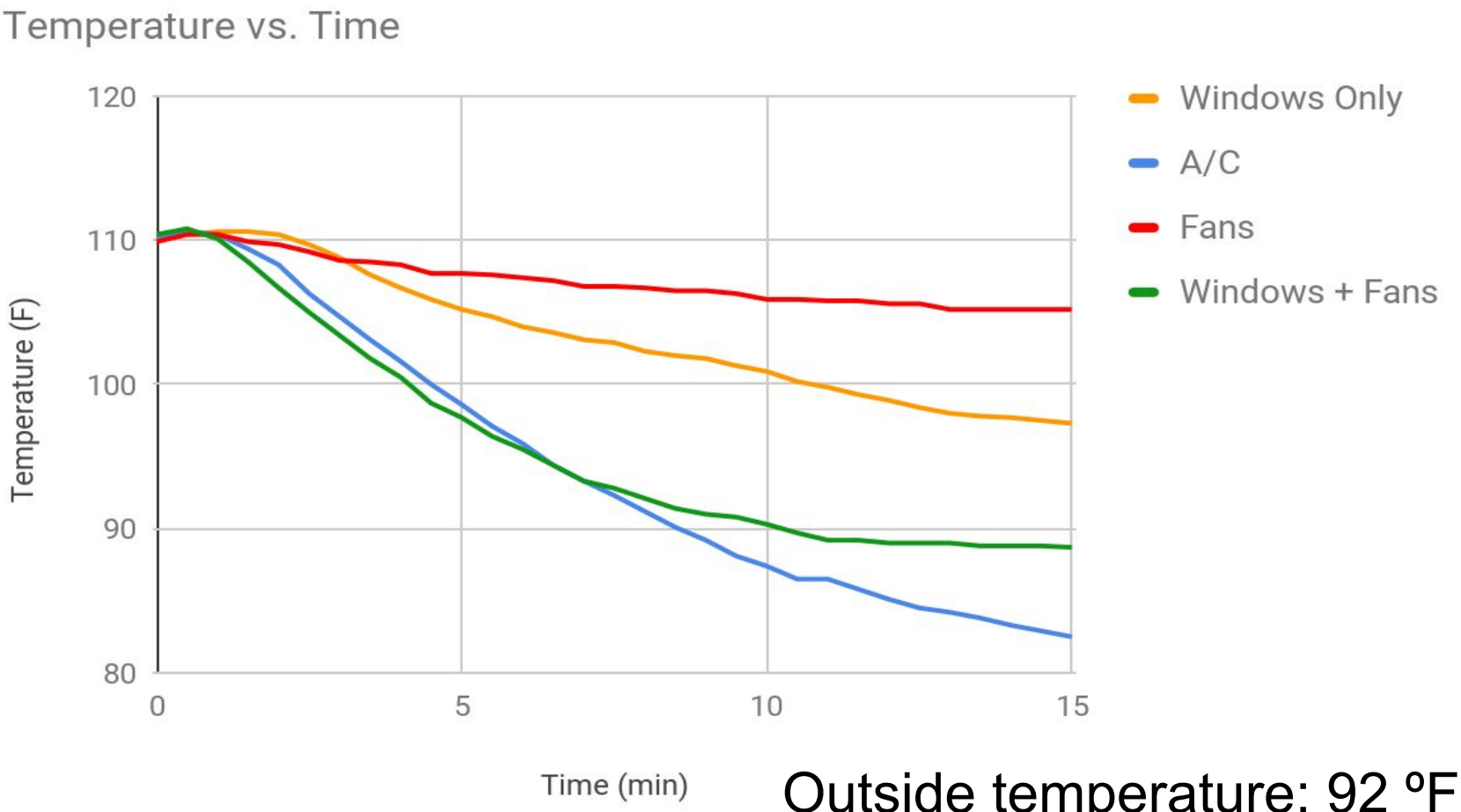
Testing Method

- Left car outside on 92ºF day
- Had car heat to 110ºF before activating cooling method
- Measured temperature over 15 minute span

Car Used

- Red Mazda 3 2006
- Black leather seats
- Electronic fan control
- No remote starter

Results



Outside temperature: 92 ºF

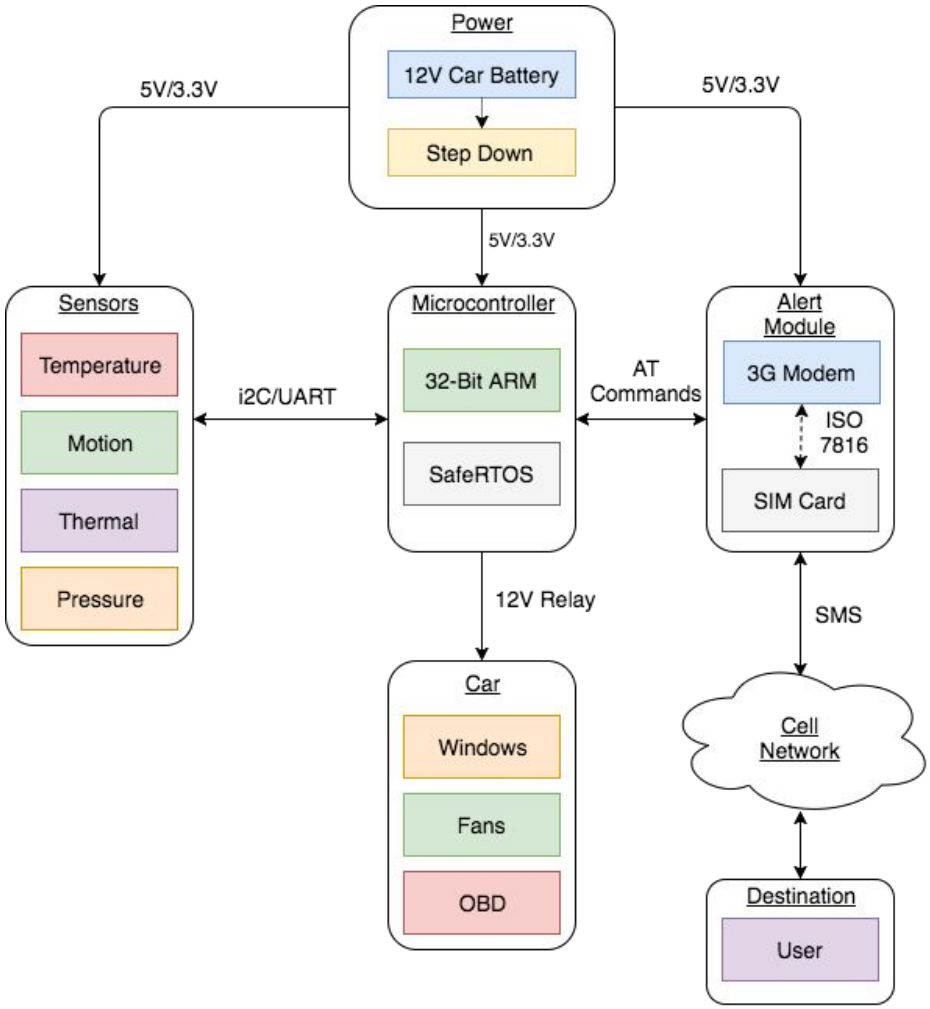
Analysis

A/C	Windows and Fans
+ Cools Fastest	+ Cools Almost As Well As A/C
+ Reaches Lowest Temperatures	+ No Remote Start Needed
- Requires Remote Start	+ Easier to Implement
- Cannot Remote Turn Off	- Does not cool as much as A/C

System Specifications

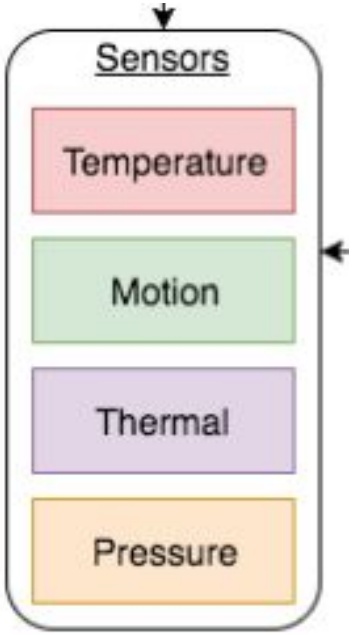
1. Measure temperature in a car
2. Detect if child is in the car
3. Integrate alert system with cellphone
4. System should be compatible with most sedans
5. Easy installation for a mechanic/auto electronics expert
6. Must take action to cool car at or below 95ºF
7. Keep car under 95ºF
8. Do not deplete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

Block Diagram: Overview



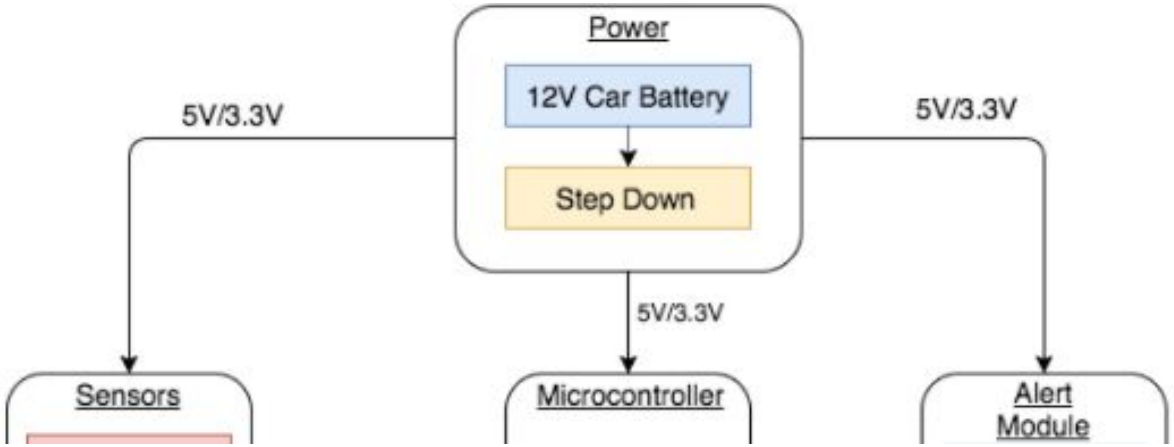
Block Diagram: Sensing

- Requirements
  - Detect the presence of life in the car
    - Baby in front or rear facing car seat
  - Detect car temperature over 95ºF
  - Communicate to controller
    - Controller enable sensors to be on/off
    - Send sensors data to controller
    - Send temperature to controller



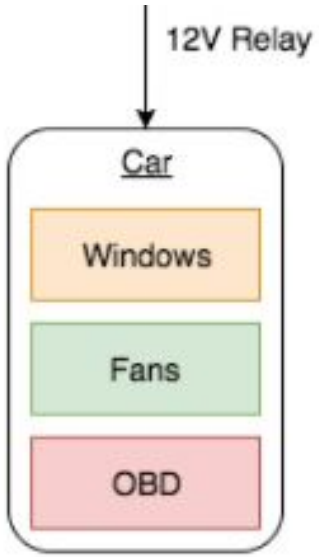
Block Diagram: Power

- Requirements:
  - Input power from car battery 12V
  - Step down voltage required for
    - Sensors
    - Controller
    - Alert Subsystem
  - Up to an hour of runtime without draining battery



Block Diagram: Car Interface

- Requirements:
  - Controller communicates to car interface
    - Roll up/down windows
    - Turn on/off fans
    - Turn on/off car and AC together
  - OBD Port
    - Status of car on/off and in park



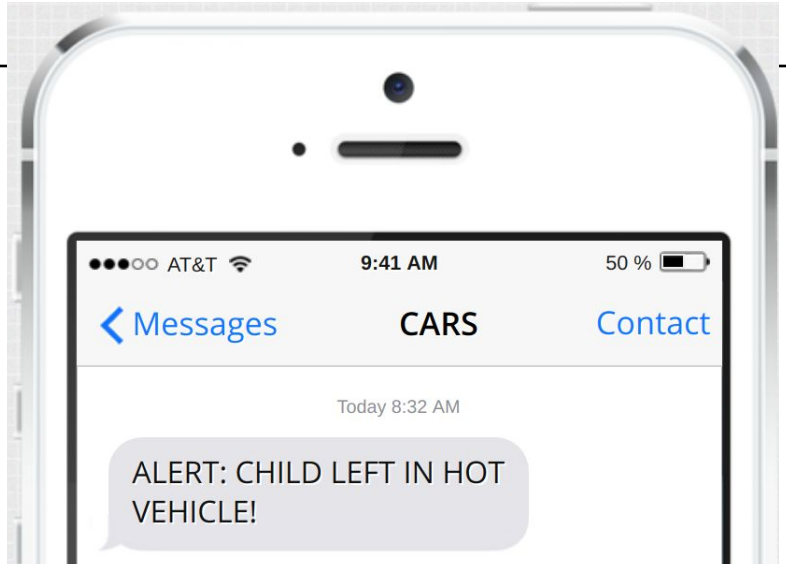
Block Diagram: Microcontroller

Requirements:

- Low power (sleep mode)
- Reliability
- Sufficient interfaces


```
if(car_is_off)
    read_sensors()
    if(temp > threshold && infant_present)
        roll_down_windows()
        activate_fans()
        alert_owner()
```

Block Diagram: Alert



- Requirements:
  - Reliability
  - Easy to integrate
- SIM card
  - Data plan ($)
  - Carrier (maximize service area coverage)
- ublox SARA U260
  - 3G modem with 2G fallback
  - 850/1900 MHz bands
  - TCP/IP stack
  - UART interface to main microcontroller

Cost Analysis (Estimated)

Microcontroller	$80
OBD Reader	$25
Ublox SARA U260	$30
Phone plan	$30
Pressure sensor	$50
Motion Sensor	$15
Thermal Sensor/Camera	$50-200
Temperature Sensor	$20
Total	$300-450

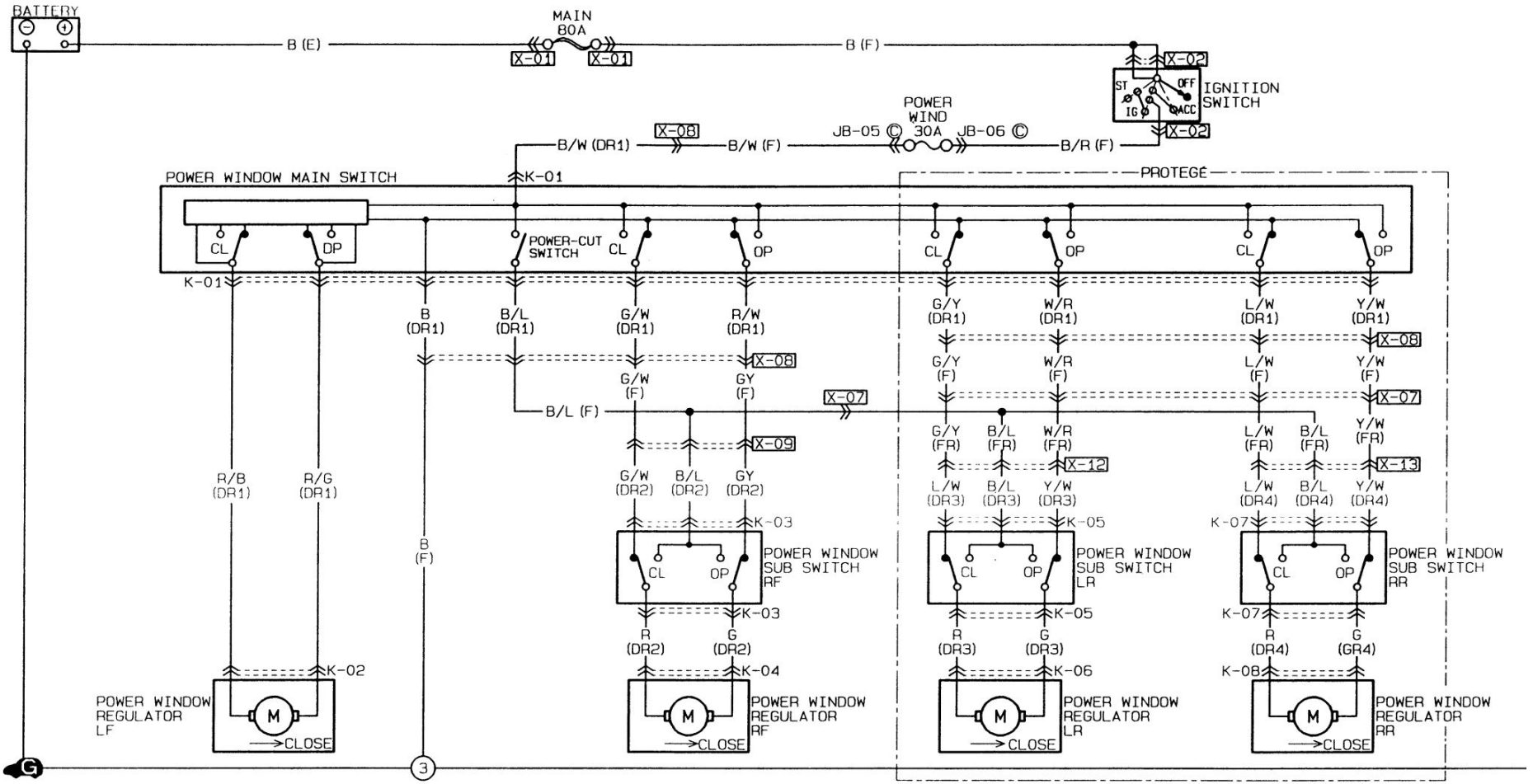
Proposed MDR Deliverables

- Sean+Kevin+George: Demonstrate reading of sensors using microcontroller development board
  - Temperature, motion, pressure(weight)
    - Optional: Thermal imaging, A/C output
- 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

Thank You

Questions?

Power Windows: Wiring



Works Cited

1. http://www.mayoclinic.org/diseases-conditions/heat-stroke/symptoms-causes/syc-20353581
2. https://www.accuweather.com/en/weather-news/heat-heightens-car-temperature/15305637
3. https://www.thespruce.com/what-is-too-hot-for-dogs-3975543