HOT CAR SEAT SAFETY ALARM

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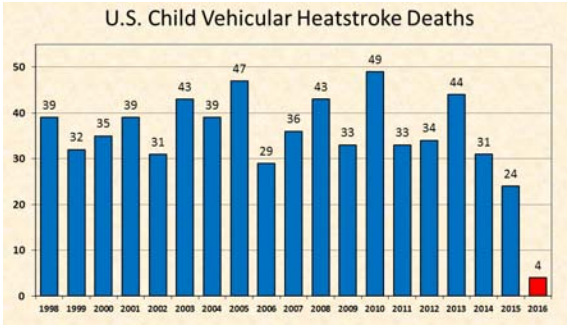
Presentation Outline

- Executive Summary
- Introduction with Problem statement/Solution
- System Requirements
- System Analysis
- Design
- Integration
- Validation
- Conclusion
- Demonstration

Executive Summary

- What?
  - Overview
  - Deliverables
- When?
  - Schedule
- How?
  - Cost

Introduction with Problem Statement



Date Range:1998-Now
Causes: “Forgotten” (54%)
Child Playing unattended (29%)
Intentionally left (17%)
Unknown (1%)
*(Null, 2016)

Problem Statement Continued

- Current items on the market
  - Alarms when car ignition turns off and child is buckled still
  - App that sends an alert each time you exit the vehicle
- Issues with the above designs
- A few other designs, but nothing put in place that is ideal that not only notifies the users but also people in the area if there is danger

Problem Solution

- A device that notifies the user after their vehicle is too hot with an occupant in the seat.
- If the text notification doesn't work then a strobe will go off to notify individuals outside of the vehicle
- Reasons this is better than the other options on the market
  - Cost effective
  - Scenarios the other options are more of a nuisance
  - Interchangeable

Some Original System Requirements

- The SHALLS:
  - Fit in a car seat with Cloth padding
  - Weight detector smaller than 4 square inches
  - Temp ranges of 0-150 degrees
  - Turn on when occupancy is detected
  - Send transmission after danger zone temperature is reached
  - Turn on strobe after 3 minutes has passed
  - Read temperature every 4 seconds
- The SHOULDS:
  - Store data in excel format
  - Text alert contain time for when strobe will occur
  - Text alert contain current Relative Humidity

System Requirements Continued

- Shalls not met:
  - None
- Shoulds not met:
  - Keeping track of Data
  - Text alert when strobe will occur
  - Text alert showing times

The items that weren't met were not met due to time constraints mostly. The main functionality of the device was achieved without those items included.

System Analysis

- During analysis of the system, the code for the device was modified from what would be in the final device.
  - Temperature
    - 75 degrees vs 85 degrees
  - Timer/Counter
    - Test temperature every 4 seconds VS 5-10 seconds
    - Changed the count for the strobe from 3 minutes (36 counts at 5 seconds each temperature reading) to 3 counts
      - Reasons
      - Why not less than 4 seconds?

System Analysis

- The code followed IF/THEN and AND statements
  - If the device is powered (occupancy) AND the temperature is above 85 degrees Fahrenheit, THEN send text
  - If the device is powered AND temperature is above 85 degrees Fahrenheit AND there have been 3 minutes worth of cycles in these states, THEN turn on strobe
  - Since these were AND statements, if any of the items were false then the device stopped the alarm loops

Design

- Some parts necessary
  - Arduino Uno
  - Arduino Transmitter/Receiver
  - DHT 22
  - Relay
  - Strobe
  - Mini Boards

Design Continued

- The functionality and easy to understanding code of the Arduino UNO was ideal for this project
  - Easy to power
  - User friendly
  - Fairly inexpensive
  - Well known
- Transmitter/Receiver
  - Not the best when it comes to reliability
  - I/O pins easy to understand similar to the Arduino

Design Continued

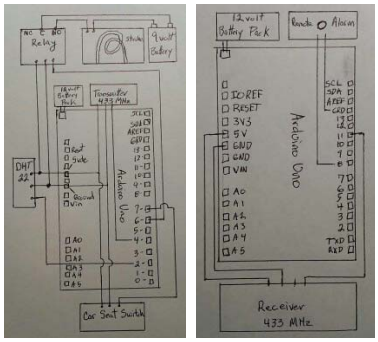
- Temperature/Humidity Sensor
- Why the DHT 22 vs DHT 11
  - More accurate
  - Larger Range for relative humidity and Temperature
  - Longer life span
- DHT 22
  - Fairly inexpensive
  - Reads Temperature, Humidity, and Heat Index

Parts

Product Name	SKU	QTY	Subtotal
DIY DHT22 2302 Digital Temperature and Humidity Sensor Module with DC 3.3 to 5.5V Working Voltage	NZ0038301	1	$9.04
ProtoShield Prototype Expansion Board 2 LED + Mini Breadboard Work with Arduino Duemilanove Color:BLUE AND WHITE	143348301	2	$6.90
433MHz RF Transmitter Module and Receiver Link Kit for Arduino ARM MCU WL DIY	NZ0024401	1	$3.08
KT003 Arduino UNO Starter Kit with Bread Plate / Sensor / LED Light for DIY Parts	137013401	1	$23.55
2013 Version Arduino UNO R3 ATmega328P Development Module 2013 Version with Free USB Cable	NZ0032101	1	$4.96
0.5A 125V / 250V 3Pin Power Control Micro Switches for DIY - 10PCS Color:BLACK	121962901	1	$2.47
Subtotal	$50.00		
Insurance	$2.00		
Shipping & Handling	$10.81		
Grand Total	**$62.81**		

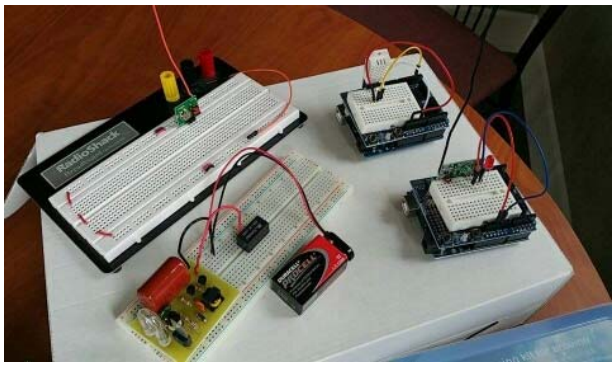
Design Continued

- These designs are the original sketches for the circuit.
- Similar to final design
  - Difference is that the switch powers board so it is in between the battery and the board



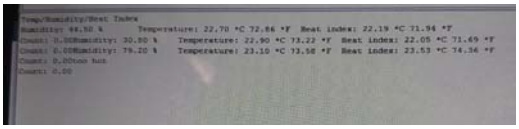
Mid Point Design

- The design was fairly basic at this point and mostly just to figure out how it works and also to experiment with programming

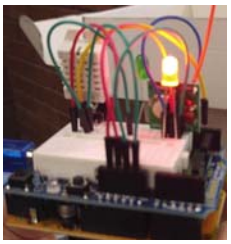


First test of Functioning Device

- No LED lit when temp is below 75 degrees (testing temperature)

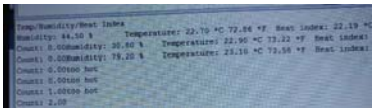


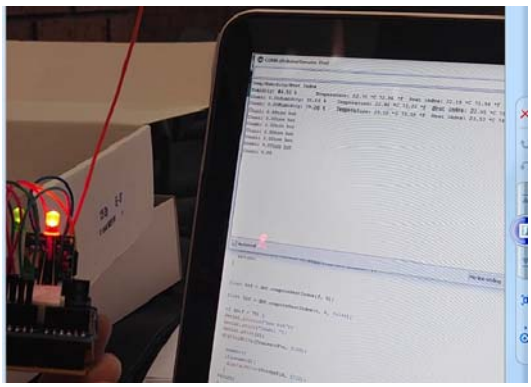
- After above 75 degree the red light indicates that it is communicating to receiver.



First test of Functioning Device Continued

- When in danger zone the device starts a counter from 0 and with this design, it lit the strobe LED (Green) after 2 counts.





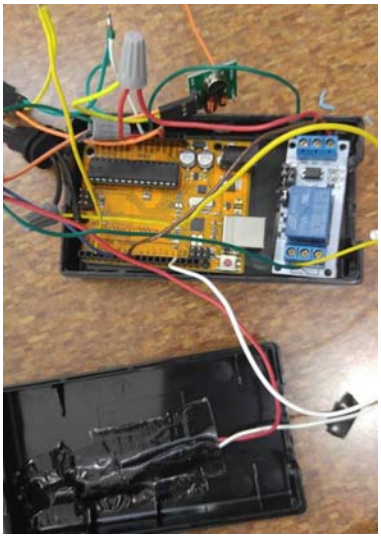
Reading the data

- This is what the monitor looks like when the Arduino is plugged in and functioning.
  - Reads Temp
  - Senses temp is too hot
  - Begins Count
  - Safe zone
    - Clears count and stops alarmt

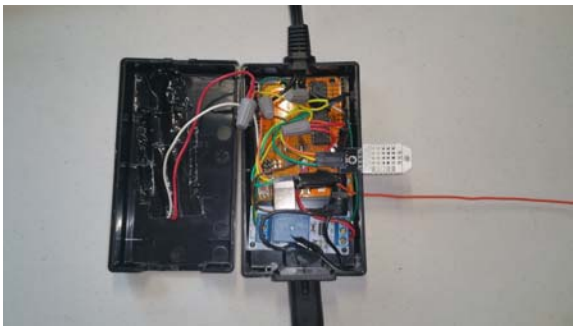
Building the Prototype

- Arduino
- Relay
- Transmitter
- LEDs

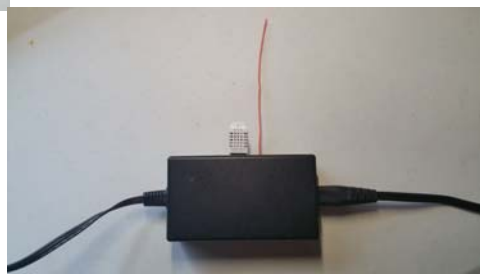
- Cords Connect to
  - Power
  - Strobe



End Design



End Design Continued



Final Setup

Integration

- Designing the device to work outside of the car seat was the “easy” part
- The main issue was the switch
  - Too sensitive
  - Too hard to develop a design that worked in multiple car seats

Validation

- The device functioned as the device was designed
- The code worked as needed when adjustments were made
- This code is with the testing parameters
  - 75 degrees F vs 85 degrees F
  - Count set to 2 vs 3 minutes worth

```
#include <DHT.h> //Library for the Humidity Sensor
#define DHTTYPE DHT22   // DHT 22  (AM2302), AM2321
#define DHTPIN 2    //Humidity sensor pin assignment
#define TransmitPin 5 // Transmitter trigger
#define StrobePin 7  // Turns on relay for strobe
DHT dht(DHTPIN, DHTTYPE);
int count = 0;
int counter=0;
void setup() {
  Serial.begin(9600);
  Serial.println("Temp/Humidity/Heat Index");
   pinMode(TransmitPin, OUTPUT);
   pinMode(StrobePin, OUTPUT);
  dht.begin();
}
void loop() {
  delay(4000);
  float h = dht.readHumidity();
  float t = dht.readTemperature();
  float f = dht.readTemperature(true);
  float c = count;
  if (isnan(h) || isnan(t) || isnan(f)) {
    Serial.println("\n Failed to read from DHT sensor!");
    return;
  }
  float hif = dht.computeHeatIndex(f, h);
  float hic = dht.computeHeatIndex(t, h, false);
  if (hif > 75) {
Serial.println("\n too hot.  It feels like");
Serial.print(hif);
Serial.print("degrees Farenheit!!!");
Serial.print("Count:");
Serial.print(c);
digitalWrite(TransmitPin, HIGH);
   count++;
    if(count>2){
     digitalWrite(StrobePin, HIGH);
    }
return;
  }
  digitalWrite(TransmitPin, LOW);
  digitalWrite(StrobePin, LOW);
  count = 0;
  Serial.print("\n\n Humidity: ");
  Serial.print(h);
  Serial.print(" %");
  Serial.print("\nTemperature: ");
  Serial.print(t);
  Serial.print("°C ");
  Serial.print(f);
  Serial.print("°F ");
  Serial.print("\nHeat Index: ");
  Serial.print(hic);
  Serial.print(" °C ");
  Serial.print(hif);
  Serial.println(" °F");
  Serial.print("\ncount:");
  Serial.print(c );
}
```

Conclusion

- After a few minor issues with the development of the device, it functions as designed
- Although the switch/occupancy sensor isn't transferrable as it stands, it would be fairly simple for someone who specializes in that sort of thing to design the trigger
- The transmitter/receiver system isn't the strongest, but it does it's job for the purpose of this prototype

Conclusion: Next Steps

- Reach out to Cell Phone providers to see if someone would want such a device sponsored
- Contact car seat companies to get their backing as well
- Develop a more solid, multi-use design so it could go from one car seat to the next without much work.

Questions?

References

- Lawrence, M. G. (2004, July 22). *Rutgers.edu*. Retrieved March 2016, from The Relationship between Relative Humidity and the Dewpoint Temperature in Moist Air: http://climate.envsci.rutgers.edu/pdf/LawrenceRHdewpointBAMS.pdf
- Null, J. (2016, 04 21). *Heatstroke Deaths of Children in Vehicles*. Retrieved 04 22, 2016, from No Heat Stroke: http://noheatstroke.org/
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Demonstration