Project B7

Deliverable K-User and Product Manual

GNG 1103- Section B0

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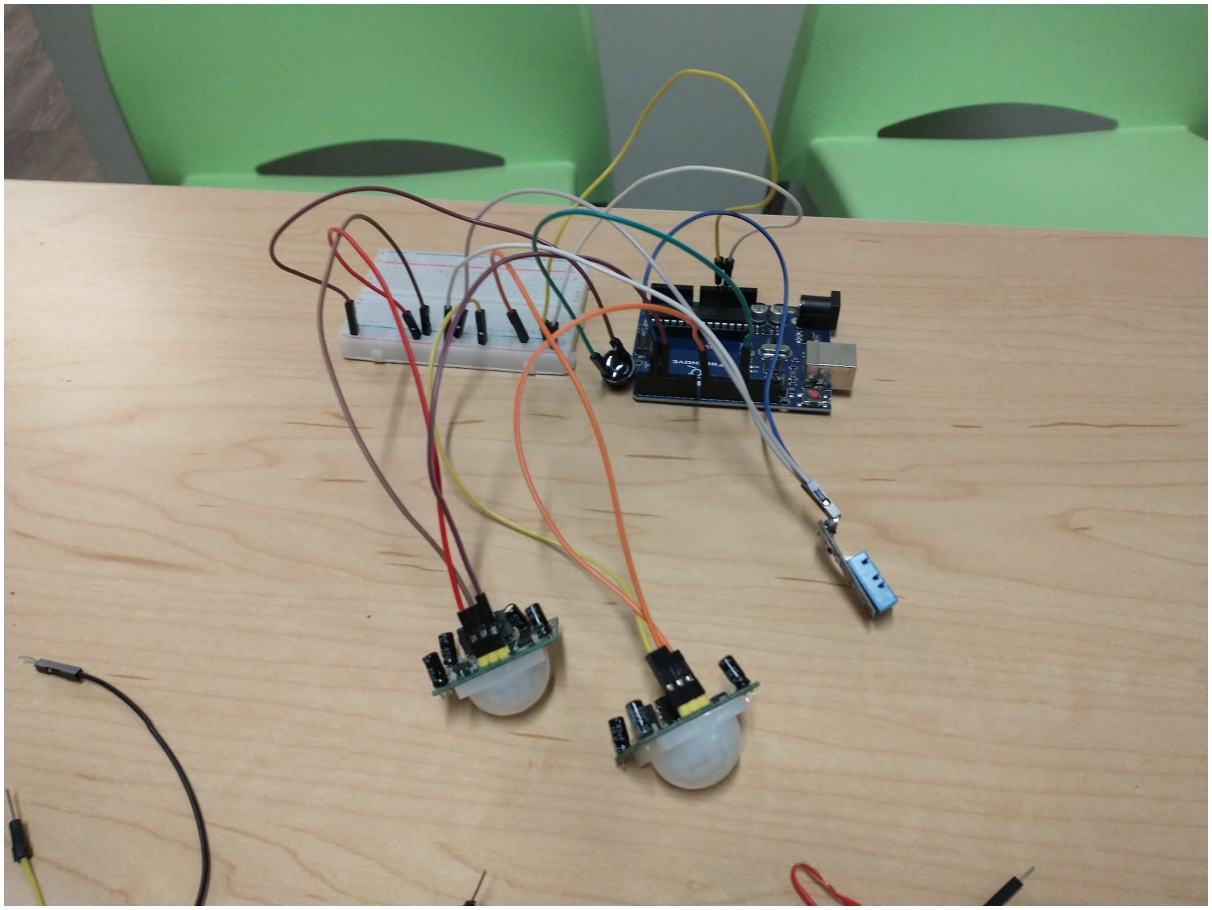
1.Introduction

In this report, we will summarize the design and production process for the project and highlight the focus on creating prototypes.Through the use of an arduino board and some sensors, we have achieved the goal of detecting whether the child is in a dangerous situation and issuing an alarm. If the temperature inside the car is too high, pedestrians passing by around the car will hear the sirens. Users can also connect to mobile phones by adding a Bluetooth module in the future.

2.Overview

Our group sets out to solve the problem of deaths by hot car. This problem is important due to the fact that at 40 degrees celsius it only takes 10 minutes to be fatal. There were 53 deaths over the years 2018 and 2019 by this method according to the National Safety Council. The user needs a simple and reliable way they can be notified of whether or not there is a child in the car and if the vehicle is approaching dangerously high temperatures therefore indicating if action must be taken. Our product is different as it is simple, reliable and completely universal, able to be connected to any vehicle with minimal difficulty. The simplicity of our product is achieved by using two PIR sensors with a wide field of view and a simple buzzer alert system to notify passerby in a code red emergency scenario where immediate action must be taken and the user is not close enough.



The key functions of our Heat Defeat Alarm System include the PIR and heat sensors and buzzer alert mechanism which sounds in dangerous conditions to notify passerby, the dangerous conditions are detected by the heat sensor at a temperature of 36 degrees and the PIR sensor detects whether or not the is a child or pet within the car. The architecture of the system is simple with a centralized box which houses the key parts with wiring that allows the user to attach the buzzer and sensors at their desired distance (above the door in front and back row is recommended). In order to set up the device all that is required is a few tests covered below, arranging the product in the ideal configuration and pressing the on button on the Arduino (blue circuit board looking device).

2.1 Warnings

The sensors may require calibration for a specific vehicle which is further elaborated upon below also cold weather may affect the battery life of the product and therefore the overall lifetime. The buzzer, while capable, is still small so it is important to configure its location so that it is closer to a window and less central within the car. The sensors should be configured to maximize their field of view while minimizing their appearance (above the door in front and back row is recommended). Prior to use it is important that the product is tested in the desired configuration.

3.Getting started

3.1 Purchasing components

The following table include the details about the components that will be used for the product:

#	Name	Description	Quantity	Cost	Link
1	Arduino Nano	The core where we do all the programming on	1	$14.33	https://www.digikey.ca/en/products/detail/arduino/ABX00028/10239971
2	DHT22 temperature-humidity sensor + extras	Temperature sensor that determine the temperature and humidity in the vehicle	1	$9.95	https://www.adafruit.com/product/385
3	PIR Sensor	PIR sensors that determine if the child is in the vehicle. The system is only active if the sensor detects a child is in the vehicle. Two sensor will be placed on different corner of the car to avoid blind point	2	$3.27*2=$6.54	https://www.robotshop.com/ca/en/sunfounder-pir-sensor-module-hc-sr501.html?gclid=Cj0KCQiAqbyNBhC2ARIsALDwAsCuaMrIzhmgLBE-HVw43ccRuyjZ1D4DmtSupKqMoD84eS8x8ZXiyn0aAuhSEALw_wcB
4	Breadboard	The breadboard which connects all the components.	1	$3.74	https://www.google.com/shopping/product/1?q=breadboard&prds=epd:13341622164520804467,eto:13341622164520804467_0,pid:13341622164520804467,prmr:1&sa=X&ved=0ahUKEwinktbJkdP0AhWIct8KHVRiDVkQ9pwGCAU
5	Buzzer	Speaker that warn people pass by that the kids is in the vehicle and apply rescue	1	$1.00	https://www.digikey.ca/en/products/detail/tdk-corporation/PS1440P02BT/2236832?utm_adgroup=General&utm_source=google&utm_medium=cpc&utm_campaign=Smart%20Shopping_Product_Zombie%20SKUS&utm_term=&productid=2236832&gclid=Cj0KCQiAqbyNBhC

					2ARIsALDwAsAyObRlDV4xAtVjWlsAnylyQrxlV0tqR2olV9kzrVhe144Czi9T50IaAghlEALw_wcB
6	Electrical Wire	Electrical wire that connects all components. (should have extra left)	1	$N/A	https://www.google.com/shopping/product/9571003807442386 76?q=electric+wire&prds=epd:7064696017660418035,eto:7064696017660418035_0,local:1,prmr:2&sa=X&ved=0ahUKEwin68qgkdP0AhVhn-AKHTtBAFkQ9pwGCBA
7	Tape	Tape that sticks all components onto the vehicle.	1	$1.29	https://www.google.com/shopping/product/1693237336000707 5354?q=electric+tape&prds=epd:13641895729356032355,eto:13641895729356032355_0,local:1,prmr:2&sa=X&ved=0ahUKEwiHvYSvkdP0AhUmnOAKHfmkDVkQ9pwGCAU
8	LED light	LED light that warn people pass by that the kids is in the vehicle and apply rescue	1	$0.84	https://www.digikey.ca/en/products/detail/rohm-semiconductor/SLR-56VR3F/636992

3.2 Assemble the product

First connect two wires from 5V and GND on arduino nano to +&- on breadboard.

3.2.1 Connecting PIR sensor

Connect VCC on PIR sensor to + on breadboard, GND to - on breadboard. Connect OUT to 4 and 5 on arduino nano. Mention that the one connected to 4 is for the front row while the one connected to 5 is the back row.

3.2.2 Connecting buzzer and LED light

Put the buzzer and LED light on the breadboard. The shorter pin is connected to -. The longer pin of the buzzer is connected to 8 on arduino nano and the longer pin of the LED light is connected to 10 on arduino nano.

3.2.3 Connecting temperature sensor

Connect the most left pin to + on the breadboard, connect most right pin to - on the breadboard. Connect the second pin from left to 12 on arduino nano. Keep in mind that the third pin from right will not be used.

3.3 Uploading code

Users will need to install Arduino IDE on computer and upload the following code to the arduino nano:

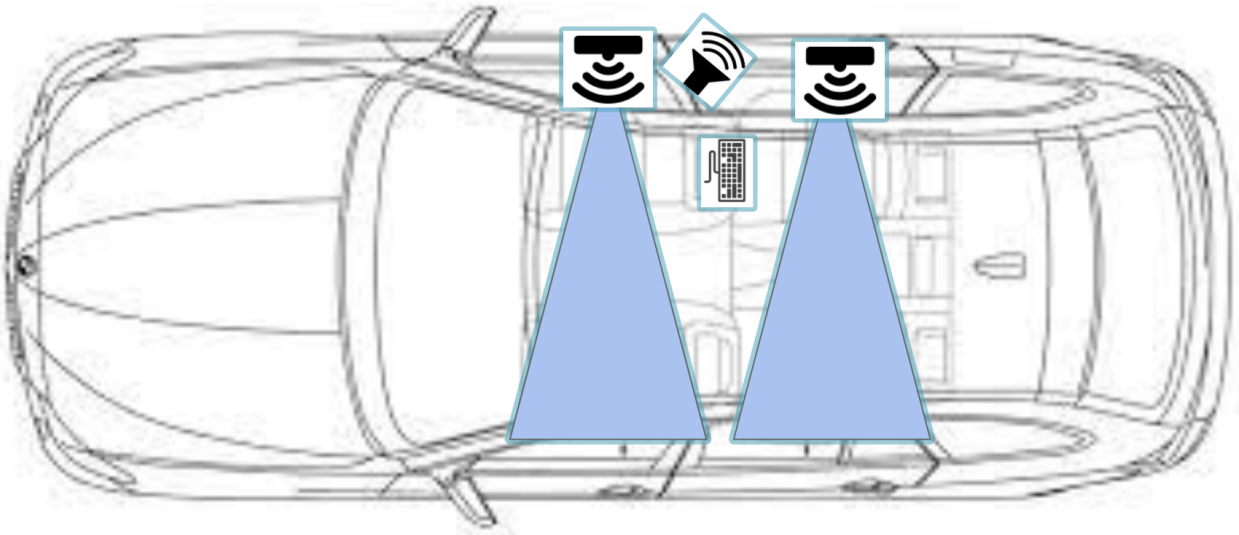
```
#include <DHT.h>
#define pirPin 4
#define pirPin2 5
#define buzzer 8
#define LED 10
#define DHTPIN 12
#define DHTTYPE DHT22
DHT dht(DHTPIN, DHTTYPE);

void setup() {
Serial.begin(9600);

pinMode(4, INPUT);
pinMode(5, INPUT);
pinMode(8, OUTPUT);
pinMode(LED,OUTPUT);

dht.begin();
}

void loop() {

   delay(1000);

  float h = dht.readHumidity();
  float t = dht.readTemperature();
  float f = dht.readTemperature(true);
```

```
if (isnan(h) || isnan(t) || isnan(f)) {
  Serial.println("Failed to read from DHT sensor!");
  return;
}

Serial.print("Humidity: ");
Serial.print(h);
Serial.print(" %\t");
Serial.print("Temperature: ");
Serial.print(t);
Serial.println(" *C ");

if (t<=34)
{
  Serial.println("Perfect temperature!");
  noTone(buzzer);
  digitalWrite(LED, LOW);
  delay (2000);
}
if (t > 34)

  {
    if(digitalRead(4)==HIGH){
      Serial.println("Too hot!");
      Serial.println("There is someone in the front row!");
      tone(buzzer, 500);
      digitalWrite(LED, HIGH);

   }else if (digitalRead(5)==HIGH){
      Serial.println("Too hot!");

      Serial.println("There is someone in the back row!");
      tone(buzzer, 500);
      digitalWrite(LED, HIGH);
```

```
    }else if ((digitalRead(4)==LOW) && (digitalRead(5)==LOW)){
      Serial.println("Safe");
      delay (1000);
      noTone(buzzer);
      digitalWrite(LED, LOW);
}
}
}
```

4.Using the product

After doing the basic setup, users will put the product onto their vehicle.



This will be a general look of how the product will be placed. Two PIR sensors will be each placed next to the door handle on the roof to be able to scan the whole vehicle. The breadboard with a buzzer and LED light on it will be placed on the top of the B pillar (the beam between two windows) of the car. The arduino nano will be next to the breadboard as well. Tape the components onto the car, make sure it will not fall due to the small shaking of the vehicle. Users can use any source with a USB port to power the system. Our recommendation is a low voltage power bank so that you can charge it with your vehicle when the engine is started.

The system starts working once the temperature reaches 34 degrees. If there's no one in the vehicle then the alarm system will not awaken. Once the PIR sensor detects someone is moving in the vehicle, the buzzer and the LED light will start to work and warn the people passing by and make them be able to rescue the kids in the vehicle. In fact, this system does not only work for saving kids but also works if pets are left onto the vehicle.

5.Troubleshooting & support

The PIR sensor may be too sensitive in some situations, in this case, upload the following code to the arduino nano and slowly adjust the right knob on the PIR sensor. Open the serial monitor, it will constantly print out 1 if there's a problem with the PIR sensor. But by slowly adjusting, until it appears 0 if there's no moving object in the front of the PIR sensor, it means the PIR sensor's setup is done and back to the right sensitivity.

```
#define pirPin 2
#define priPin2 3
void setup() {
Serial.begin(9600);
pinMode(2, INPUT);
pinMode(3, INPUT);
}
void loop() {
PIRSensor();
delay(200);
}
void PIRSensor() {
if(digitalRead(2) == HIGH) {
Serial.println(1);
}else if
(digitalRead(3) == HIGH) {
Serial.println(1);
}else{
Serial.println(0);
}
}
```

6.Product documentation

Our design was built from the ground up with a number one priority of simplicity for that reason the product is both affordable and user friendly. Specific design considerations made include the choice to omit a bluetooth communicator due to the elevated cost and software complications associated as well as the limited range of the device not being a necessary feature in most situations. Our product includes two PIR sensors which are an effective and reliable sensor that detects infrared signatures allowing for the detection of passengers and the driver. By using infrared and motion detecting sensors the heat signature of individuals within the car allows the

user to know reliably if they left a living entity within the vehicle and again confirms if that is in fact the case upon the detection of movement. The DHT 22 heat and humidity sensor is another system within the project that detects changes in heat and humidity within the vehicle notifying the user when the heat of the vehicle begins to reach unsafe levels. The buzzer system is the primary notification device which upon inputs from the PIR and DHT 22 sensors indicates via loud tone that there is a child within the vehicle, the buzzer will not sound if a child is not detected as to avoid unnecessary noise and annoyance. There is also an LED which functions as a pair with the buzzer system and is activated by the same sensor inputs. The central device housing will be plastic or cardboard as these materials have a lower specific heat capacity in order to avoid the classic hot seat belt buckle situation.

It is important to note that the primary form of notification (the buzzer) is only one of two forms of notifying the user of the situation the other of which is a powerful LED light which will blink upon detection of a child and excessive heat however it is best in dark situations so due to the device's limited capability with respect to the notification system. The omission of any personal device related notification system such as bluetooth or cellular the range of notification is extremely limited and relies heavily on “good samaritans” in order to ensure the safety of the child if the user is out of earshot of the device, or can not see the alert LED. Upon excessive testing of numerous bluetooth modules the effectiveness was deemed less valuable than the time and money saved by its omission.

6.1 Subsystem 1 (sensors)

6.1.1. BOM

	Name	Quantity	Cost
1	DHT22 temperature-humidity sensor + extras	1	$9.95
2	PIR sensors	2	$3.27*2=$6.54
3	Wire	1 (9 total)	$N/A

Links above.

6.1.2. Equipment list

What is required to build this subsystem is a soldering iron solder tape and a phillips head screwdriver the parts must be soldered to the correct pins for power and data and the phillips head is simply used to calibrate the PIR sensors. Mounting materials are also a required piece of equipment tape is suggested however this is up to user discretion. (All soldering will be done before reaching consumers)

6.1.3. Instructions

Open up the arduino software plug in the arduino microcontroller, choose the correct port and test whether readings appear when the PIR sensors should detect motion and when the heat detection system detects heat above 36 degrees celsius. Set up in vehicle.

6.2 Subsystem 2 (Notification systems)

6.2.1. BOM

	Name	Quantity	Price
1	LED light	1	$0.84
2	Buzzer	1	$1.00

Links above

6.2.2. Equipment list

The required equipment for the setup of the notification systems is simply enough wire to mount the buzzer and LED in the desired location and some sort of mounting medium which is up to the discretion of the user and of course the buzzer, LED and the arduino.

6.2.3. Instructions

First connect the wires to the LED and Buzzer then the appropriate pins on the breadboard and arduino with appropriate wire lengths. Next find the desired location within the vehicle for the devices to be mounted trim and reattach wires if necessary. Take the desired mounting method and attach the devices to the ideal location.

6.3. Subsystem 3 (Arduino and breadboard)

6.3.1. BOM

	Name	Quantity	Price
1	Arduino Microcontroller	1	$14.33

2	Breadboard	1	$3.74

Links above.

6.3.2. Equipment list

In order to set up the system it is important to have the Arduino and breadboard ready as well as the wires necessary to connect the two devices and then enough to connect the other components. If the reader will be soldering the components to the arduino a safe workspace as well as a soldering iron are all required. The reader should have a computer and the required connection cables to test the arduino or implement any desired changes to the code.

6.3.3. Instructions

Upon receiving the system specific lengths of wire should be measured out the connections on the breadboard, with the arduino and to the notification and sensor systems. The arduino should be connected to a computer to check if it is capable of functioning and to ensure the code is in fact effective. Connect the arduino and breadboard by matching up the pins and the components with the ones located within the code then connect the system to a computer. Use the power cable provided with the arduino to connect it to the computer and using the suggested software run the code with and without the sensors attached to determine the health of the device as you set up. After a few short sensor tests done by waving a hand for the PIR sensors and heating up the heat sensor the device should be ready to run simply press the on button and go.

7.Conclusion

From our project, we discovered that we have only scratched the surface of the arduino function. Potentials and functionalities that need further development are notification systems such as bluetooth connection. We failed to connect the bluetooth because our bluetooth was burned, however, we do not have enough time to get the bluetooth module on time. Also, to better maximize the potential of our product, we would reach out for skilled developers who are able to create products based on the arduino board.

After working through the entire project, we developed a better understanding for time management, project development and the importance of communication. Time management played a critical role in our project, especially when it comes to such a big project which required consistent group effort to push it forward. Our group member came up with their own time scheduling manners to allow sufficient time for getting their part done since the project takes a a lot of time.

In project development process, we discovered that we should keep the feature of the product

as simple as possible to better reduce the difficulty of use while optimize our product's functionality. Finally, as a group, communication is the foundation before any progress that has been made. We learned to listen to and respect all thoughts from team members. A successful group project can not be achieved without proper communication skills.

In conclusion, our group achieved the function of detecting and notifying. Each Wednesday and Sunday, we efficiently and allocated tasks to each member in the group meeting and completed each deliverable on a weekly basis. Generally, we encouraged team members to be responsible for the tasks they were familiar with or based on personal competence. That is the main reason why we can punctually submit deliverables with thorough editing.