Deliverable F: Prototype 1 and Customer Feedback

GNG 1103B

Group 3

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Introduction:

In this deliverable, a prototyping test plan for the first prototype will detail test criteria and the parts tested, followed by an analysis of these tests and final results. This is paired with the updated target specifications, bill of materials, and detailed design. Expanding upon the first prototype's analysis and results, the prototype test plan for the second prototype was developed, as seen below.

Prototyping Test Plan-1:

Table 1: Expectations of the first prototype

	Parts	Testing	Stop Criteria
Prototype 1, Test 1	- Temperature sensor - Fan - Arduino - PIR sensor - Motor - Misc wires - LED light - Bread board	For the first prototype, we are testing virtually to see whether all of our sub-systems will work when put together.	Test code to get inputs and outputs.
Prototype 1, Test 2	As Above	Simulate conditions virtually, i.e. temperature above 35 degrees (°C), movement every few minutes, etc.	Motor labeled "Fan" will toggle on, motor labeled "Window Opener" will toggle on for a few seconds then shut off.
Prototype 1, Test 3	As Above	Directly after test 2, remove one or both conditions.	After reset button is pressed, the motor labeled "Fan" will shut off.

Analysis:

(LINK TO PROTOTYPE)

The virtual prototype is a microcontroller (specifically an arduino) hooked up to a PIR sensor, a temperature sensor, and two motors (representing the fan and window control respectively). The code in the prototype is meant to turn on the fan and window control motor when the specified test conditions are met.

While the components are not identical to the ones we will be using in our second physical prototype, their quantity, wiring, and code will likely remain the same. The only exception is a battery pack that will replace the USB power connection that the controller uses in the simulation.

Results:

After testing the virtual version of the prototype, it can be noted as a reasonable success. The code allows our prototype to turn the fan and 'window opener' at the appropriate times. The system also resets when the button is pressed. The prototype passed all of our stopping criteria in the first test plan. We saw that the coding had a few trial and errors as well as the construction due to lack of parts, but we know that we have the coding for our final prototype complete after this testing stage.

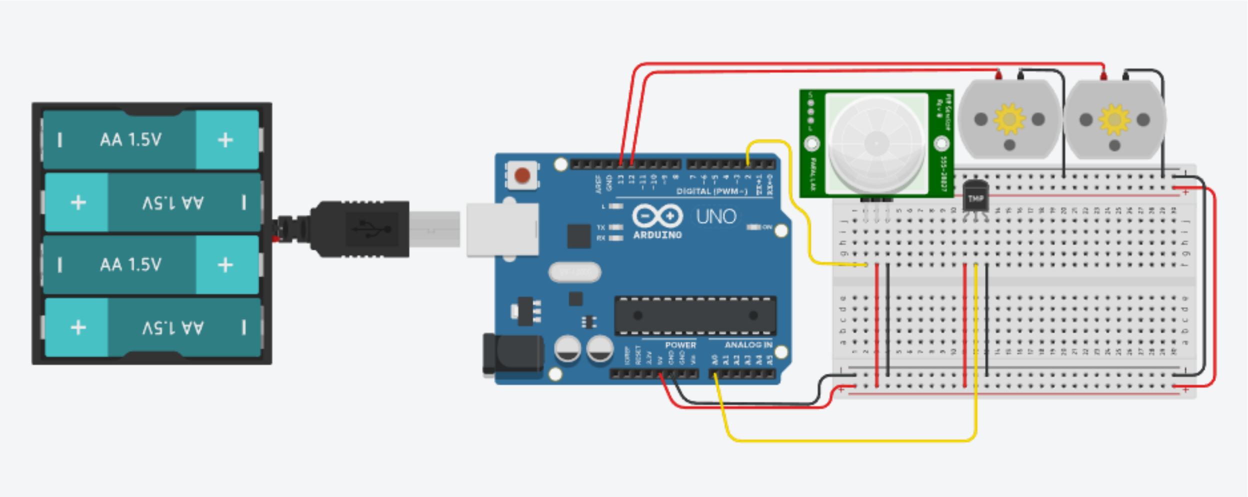
Updated Target Specifications:

Table 2: The Best Specifications for Functional, Non-Functional, and Constraint groups

Necessary Specification	Required Value(s)	Verification
Child Alive and Unharmed	Mostly	Test
Stable Temp and Exiting Car	< 60 min	Test
Not integrated	Yes	Analysis
Identifies child through motion	Yes	Test
Compatible with all vehicles	Yes	Test
Triggers without formal interaction	Yes	Test
Constraints	Required Value(s)	Verification
Cost	50$	Feedback from Project Manager
Size	Fits in car (relatively small)	Estimate
No/Lack of premade communication infrastructure	Still functions	Test/Analysis
Non-Functional Requirements	Required Value(s)	Verification
Aesthetics	Positive client feedback	Direct feedback from client
Reliability	75-99% efficiency	Test
Ease of installation	Positive client/customer feedback	Direct feedback/Test

Compared to our target specifications from Deliverable C, these are the target specifications that coincide with our chosen prototype. These specifications are those that the prototype is capable of meeting, within the given constraints of our project.

Updated Detailed Design:



```
int sensorPin = 0;
int pirPin = 2;
int pirStat = LOW;
int val=0;
int motor1pin=12;
int motor2pin=13;
int x;



void setup()
{
  Serial.begin(9600);
 pinMode(pirPin, INPUT);
 pinMode(motor1pin, OUTPUT);
 pinMode(motor2pin, OUTPUT);
}

void loop()
{
 int reading = analogRead(sensorPin);
 float voltage = reading * 5.0;
 voltage /= 1024.0;
 float temperatureC = (voltage - 0.5) * 100 ;
 Serial.print(temperatureC); Serial.println(" degrees C");
 val=digitalRead(pirPin);
  if(val==HIGH)
{
  Serial.println("PIR sensor activated");
    if(pirStat==LOW)
    {
          pirStat=HIGH;
    }
}
else
{
   Serial.println("PIR sensor not active");
     if(pirStat==HIGH)
     {
           pirStat=LOW;
     }
}
  if(val==HIGH&&temperatureC>=25)
  {
    digitalWrite(motor1pin, HIGH);
    delay(30000);
    digitalWrite(motor1pin, LOW);
    digitalWrite(motor2pin, HIGH);
    delay(18000000);
  }

 delay(1000);
}
```

Updated Bill of Materials:

Updated BOM

Prototyping Test Plan-2:

Table 3: Expectations of the second prototype

	Parts	Testing	Stop Criteria
Prototype 2, Test 1	- Temperature sensor - Fan - Arduino - PIR sensor - Motor	This will test the overall function of the prototype in real life. This will assess whether or not the	When the temperature is above 35°C, the fan will turn on. The ‘window opener’ will open the

	- Misc wires - Bread board	construction of our prototype allows all the subsystems to function properly together.	window.
Prototype 2, Test 2	As above	This will test how many times our prototype can be used.	After pressing the reset button, the process will begin again once reaching the specific temperature that it is triggered by.
Prototype 2, Test 3	As above	This test will show us, structurally, what is needed for our 3rd prototype in terms of stability.	A location in a vehicle is chosen so that our prototype can rest there without the risk of being damaged, but still able to function properly.

Conclusion:

In conclusion, a first virtual prototype was developed and tested using three sets of criteria. These results were analyzed and adjustments were made based on the conditions used. Updated target specifications for functional, non-functional and constraint groups were recorded and compared to previous reports. Additionally, the detailed design and bill of materials were both updated. A test plan for the second prototype was mapped out based on the results of the first prototyping test, to be further developed.