Project Deliverable G: Prototype II and Customer Feedback

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Introduction

The previous deliverable concerned prototype I—its nature, related test and analysis—as well as exhibited client feedback for our final design and the prototyping test plan for our second prototype. In this deliverable, we will address feedback received for prototype I, create and test our second prototype, analyse the results of these new tests, and come up with our third and final prototyping test plan ahead of prototype III. Prototype II will be developed based on results yielded by our previous tests and using features implemented in prototype I, as well as newer features. As our product becomes better rounded, we'll be able to test more of its expected functionalities.Prototyping Test Plan I

Prototype II

The second prototype is made up of three components, two of which are connected. The first component of the prototype is the physical wiring, sensors, and the microcontroller. This component is to be calibrated and tested using the second component, that being the code. The code is used to calibrate the sensors of the device. Then the code and prototype device are to be tested and troubleshooted to create an early working model of the code. The final component of the prototype is a complete CAD drawing of the device case. This is to be printed and tested by fitting the hardware inside and securing the case.

Analysis

For this second prototype, we were able to complete three separate prototype components. These were a partial working prototype of the hardware, a functioning code to allow the hardware to function as desired, and a complete CAD drawing of the final case design.

In testing, the hardware troubleshooting was the first thing that needed to be done. We needed to make sure each and every component was functioning properly before we started to run and test code. We found that the arduino microcontroller we were given was faulty, so it was replaced. The temperature sensor also worked in accordance with our code, and the 9V battery proved to be sufficient to provide the necessary voltage to power the system built thus far. The PIR sensor was also tested, and successfully detected movement. Once the hardware was tested for functionality, the code was then used to test the inputs of the sensors. This was done by printing the sensor inputs into the Arduino IDE terminal. The last test using these first two components was testing the full code for the sensors that were present, (some had still not shipped yet). This was done by running and analyzing the results of the code to fix any errors or unwanted behavior.

The other component of this prototype was the physical casing of the device. For the first section of completing this component was creating a CAD drawing of the case based off of the dimensions that were found in the previous prototype's test. This was then improved during this process based on observations. The second part of this component was to 3D print the casing and fit the hardware inside. This task, however, will be delayed, as it could only be done physically at a specific time, and the group member responsible for this task was unable to carry through due to unforeseen personal complications.

Globally, this prototype was successful in the most part for testing what we had previously planned to do; we were unfortunately unable to complete the test fitting of the hardware. This prototype was made for the purpose of creating the base, as shown in the image below, for our

final prototype. This goal for prototype II was accomplished as all the components are now ready to be assembled and tested for the last prototype.

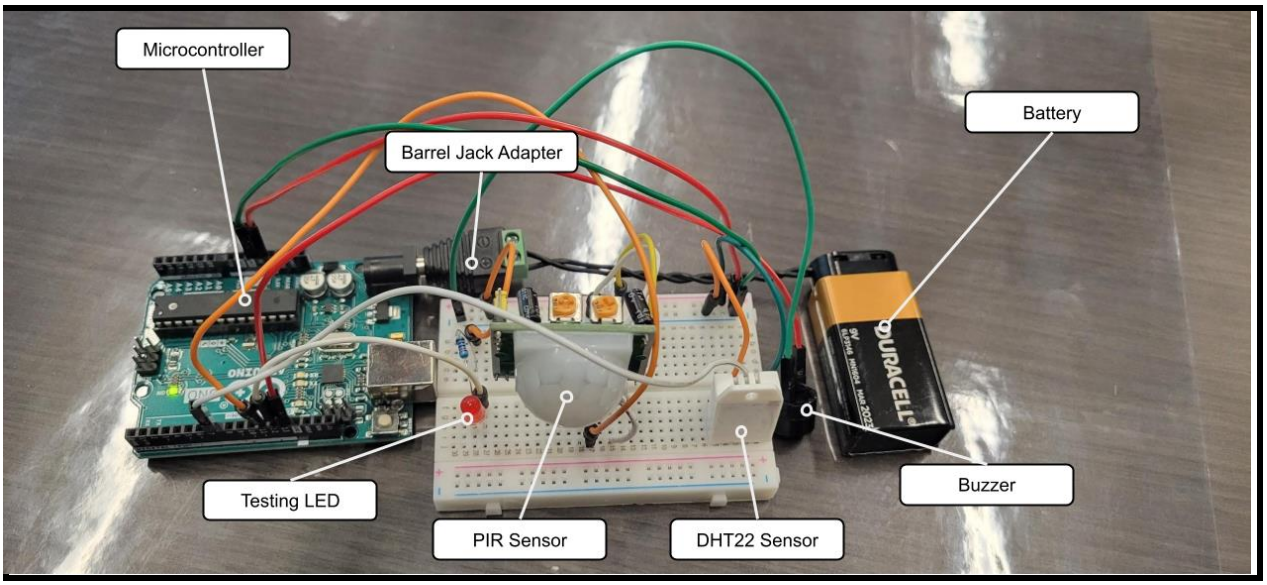

Figure 1: Hardware setup including all physically available components

Prototype III Test Plan

Test ID	Description of Prototype used and of Basic Test Method (What)	Description of Results to be Recorded and how these results will be used (How)	Estimated Test duration and planned start date (When)
1	The coding prototype will be tested using the arduino IDE to ensure that the sensors work based on the functions of the code.	All the sensors must work in the same fashion as the written code: if motion and a current stoppage between the car USB and the Arduino is detected or temperature/CO levels are detected to the set values, then the arduino will output values to the buzzer and GSM shield to send notifications to the user, and to the LED	11/18/21 Afternoon 30mins-1hr

		to flash, accordingly with our design outline. For motion: Place your hand in front of the sensor and see if the buzzer activates. For temperature, we will place the device in a heated area (e.g., using a hair dryer) and record the data on the serial monitor. The current sensor will first be tested by being plugged into a separate computer's USB slot, then into a car USB. The GSM Shield will first be prescribed to send a single SMS and a call, and later to send them as part of the completed system.	
2	The shell prototype will be tested for aesthetic and fitability in the car and the internal components fitted inside the secured casing.	The straps will be attached to the headrest bars in the car to ensure the device is safely secured and is able to perform all detection functions. Feedback will be received from individuals having little to no knowledge of this project for aesthetics and related concerns.	11/17/21 Afternoon 15 mins
3	The entire system will be tested using a	All the components will be attached and	11/24/21 Afternoon

	team member's car, which will briefly be driven around in a parking lot. This will mainly constitute a test for the PIR sensor, but also for the entirety of the alert system.	left alone to calibrate. The PIR's range of detection will be set at 1-2 meters. The first part will be accomplished with nothing on the backseat; the second will include some objects which would move when the car is stopped, and the third part will include a human presence in the backseat. We will verify if the system is triggered at the right time and activated in accordance with our code.	30 mins

Prototype I Feedback

As client feedback for our previous prototype could not be acquired in time, we simply reached out to an individual not involved in this project for his input, showing him our design and first prototype. While he thought our design globally seems adequate, he pointed out that the immediate alert system might be triggered too early and bewilder the child or pet. We will adjust this functionality when testing our third prototype, as it will necessarily become more comprehensive and customizable. He also expressed some concern about the efficiency of the LED light and sticker combination to alert the passerby, as it could easily be ignored by him/her. Thus, for our last prototype, it will be important to gauge for led visibility and to create a sticker which will be efficient and durable. Since the interviewed individual does not possess much technical knowledge related to our product, our design remains unchanged; for prototype II (and prototype III, depending on whether client feedback is received for prototype I), we will continue to use it as a base.

Conclusion

While little technical feedback was received from our impromptu source, it is clear we will need to address user experience as part of our third prototype by physically arranging our components in a manner which will optimize their performance. Additionally, our second prototype showed that the Arduino could run simple code on battery without restriction and that the sensors physically available to us at the time could work properly and in accordance with our Arduino sketch. Our final prototype will be the most comprehensive, which consequently means that substantial testing will have to be done to verify if the system functions properly as a whole and provides the user with a pleasant experience.