Deliverable G: Prototype 2 and Customer Feedback

GNG 1103B

Group 3

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Table of Contents:

Introduction:

In this deliverable, a prototyping test plan for the second 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 and detailed design. Expanding upon the second prototype's analysis and results, the prototype test plan for the third prototype was developed, as seen below.

Prototyping Test Plan-2:

Table 1: Expectations of the second prototype

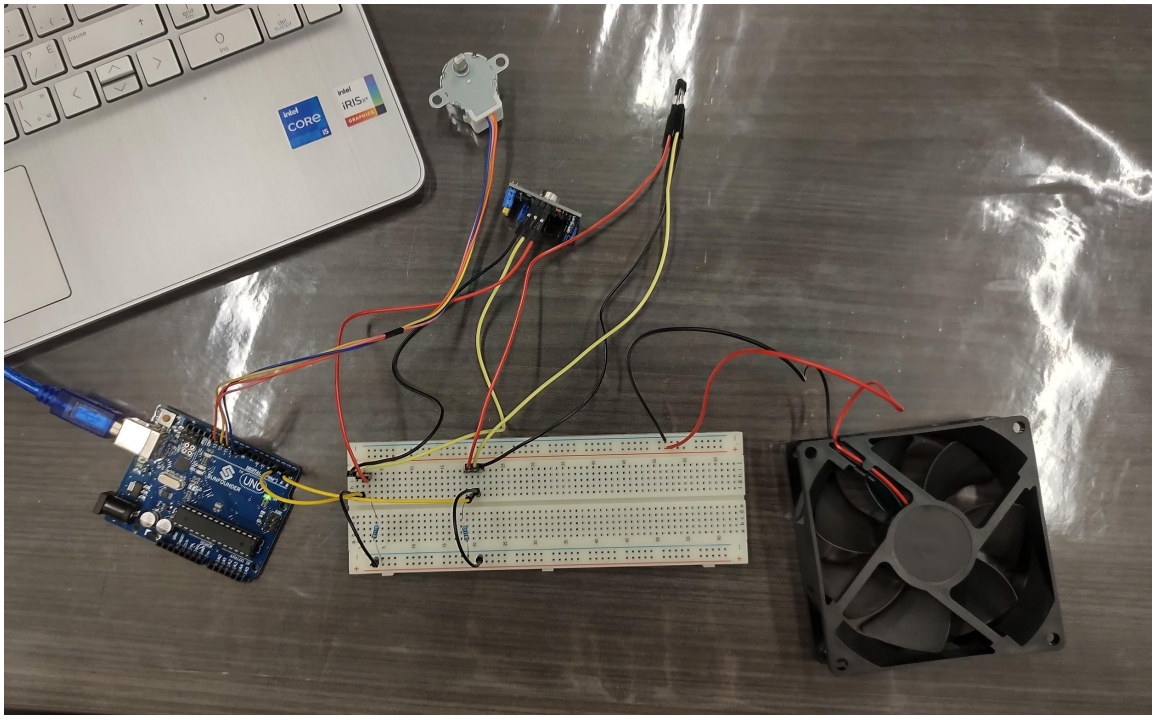
	Parts	Testing	Stop Criteria
Prototype 2, Test 1	- Temperature sensor - Fan - Arduino - PIR sensor - Motor - Misc wires - Bread board	This will test the overall function of the prototype in real life. This will assess whether or not the construction of our prototype allows all the subsystems to function properly together.	When the temperature is above 35°C, the fan will turn on. The 'window opener' will open the 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.

Analysis:

The major issue with the construction of the second prototype was the PIR sensor, Its reach was not considered great enough to cover an area of a car, and its expense compared to its useful-ness nessicates a replacement. The servo motors function is questionable, with damage allowed to the window and complexity of interacting with the built in controls being speculated to raise with each revision, however this cost is justified as without the motor the system may "Convection Bake" the child inside.

On the positive side however, the product appears to be easy to build structurally, and while a microcontroller appears to be excessive; its more advanced functions are exceptionally

useful, and as the complexity rises greatly without its addition. In total the device is shaping up a small electric/mechanical unit that can fit on the door of a car, its function is to cool the child inside down by winding down the window and moving cold air to the child through a fan.



Results:

Before the client presentation, we ran into some slight issues with malfunctioning components. These components will be replaced with others that are slightly different but don't change the overall function of our product. The product also had some overheating issues so we will look into the use of the fan to not only cool the child, but to draw the heat away from the product itself.

The size of the prototype was also a problem, which will be solved by replacing the temporary breadboard with the permanent soldered breadboard which is much smaller. The fan worked very well, and all the code was functioning as it should. Overall there are a few slight modifications that need to be made to have a complete prototype, but these will be fixed in the near future.

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

Client Feedback:

Table 3: Appropriate Solutions to Client Feedback

Subject	Client Feedback	Solution
Placement of the Device:	-Will the sensors damage the seats? -Will the sensors be easily damaged by the child? -Does anyone else use the seat? -What if the child is sleeping, or in a different seat? -Will this affect the thermal detection within the car?	We changed the placement of the device within the vehicle so that it is out of reach of the child, not attached to the seat the child is on, and able to detect the temperature and child within a larger area. Our previous design had the device in the headrest of the seat the child was on. Our current prototype places the device between the passenger headrest and the window at an angle to view the entire bench.
Powering the Device:	-Will the device always be on? -Will the device need to be	To eliminate the need for the user to remember to turn the device on, we've removed the

	turned off?	button and made sure the device is always on. To initiate the procedures to protect the child, 2 sensors need to be activated, so the device won't turn on if no help is needed. The system can always be reset if need be.
Response Time:	-The response should be immediate. -There is a priority on the temperature regulation and alarm.	We've lowered the temperature requirement for our device to turn on to eliminate the symptoms that the child can develop when left in extreme heat for long periods of time. Due to the budget, we prioritised temperature regulation so the child can be as comfortable as possible until the user returns.

Prototyping Test Plan-3:

Table 4: Expectations of the second prototype

	Parts	Testing	Stop Criteria
Prototype 3, Test 1	-CAD Onshape	This will test the overall shape and design to encapsulate the prototype appropriately. This will give us a virtual perspective of what our structure will look like and how it will work.	The testing can stop when the design is complete and matches the dimensions of our prototype.
Prototype 3, Test 2	-cardboard -plastic -adjustable straps -hot glue/gorilla glue -prototype 2	This will test the structural integrity, size, and placement of the second prototype within a vehicle.	This will stop when the prototype can be held structurally sound in the fabricated holding contraption.
Prototype 3, Test 3	As above	This will test whether or not the prototype can fit and work in multiple different	We can stop testing when the device can function properly, and fit into a car, van, and

		vehicles.	public transit bus.

Conclusion:

In conclusion, a second physical 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 was updated. A test plan for the third and final prototype was mapped out based on the results of the second prototyping test, to be further developed.