Project Deliverable F: Prototype I and Customer Feedback

GNG 1103 – Engineering Design

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GNG1103, Section # ____C01___ Team # ___4___

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Introduction

The purpose of this deliverable is to create the first prototype of the project. This prototype is a simple model that we will use as a proof of concept. With this prototype, we are able to gain a good visual on whether this is what we want our final product to look like. This prototype will allow the team to test the physical functionality of the device and also help to better notice any potential flaws that may affect our final product. The feedback and test results received from this prototype will then be used to improve Prototype 2.

Hardware Subsystem

The hardware casing for the device was 3D Printed and was modeled using SOLIDWORKS. It is used as a visual gauge and a proof of concept. Prototype 1's focus will revolve around this casing.

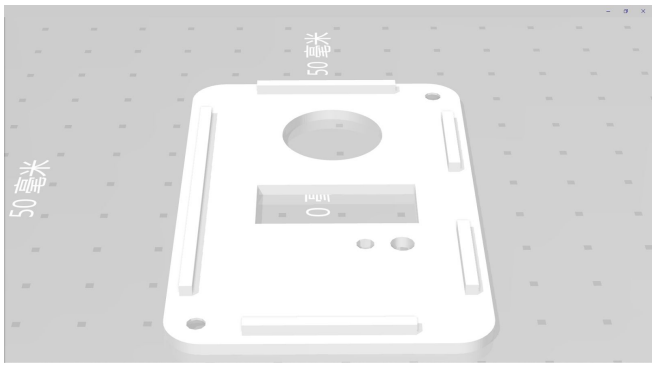

Figure 1. 3D model of the casing

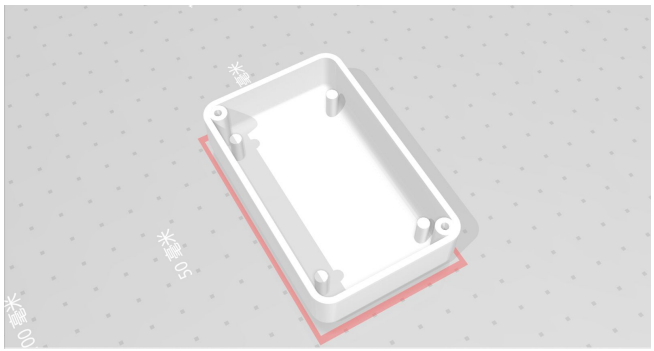

Figure 2. 3D model of the casing

The main objective of this model is to see if the device's components will fit the casing. The team wants to see if the prototype will be able to both sustain the device's needs as well as provide comfort and appealability to the users. As our product requires users to wear it in order to function, we have to balance the functionality as well as the overall size of the product. Hence, to make it more appealing to the user, our device cannot be too big, giving this product a major size constraint.

During the prototyping of the model, we used the following criteria:

- Will the components of the device fit the casing?
- Will it be appealing for our users to wear? (E.g. Will it be comfortable? Is it inconspicuous?)
- Is the device too big/ too small?

The measurements of the casing will be recorded as quantitative data. This will assist us in making improvements to future prototypes.

Measurement of Case	Value (mm)
Length	80
Width	50
Height	20
Thickness	2

Table 1: Measurement obtained from Prototype 1

The things that the team will measure are:

1. Overall dimensions of our current model.
2. The amount of space left in our casing after adding all the components.
3. Any new dimensions for our future models.
4. Any difference between the old and new dimensions

The materials being used for the casing will be obtained from the 3D printing in Makerspace. The only dependency for this prototype would be the time taken for the ordered components to arrive before the team can begin testing the model.

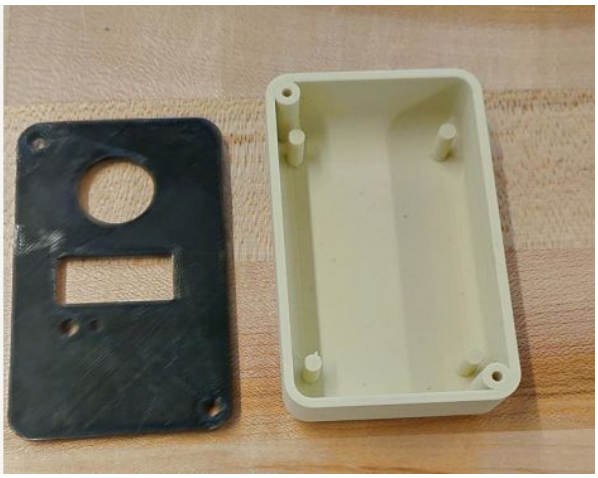

Figure 1. The first prototype of our casing

Discussion

After printing out and collecting the 3D model, the team conducted the first test on the prototype. The team tried various ways to arrange the electrical components(including wires) into the model. The test concluded that the casing would be big enough to fit all the components. However, it was discovered that the current dimensions for the casing would be too big for the components all put together.

The reason for this was due to the fact that when the model was designed in Solidworks, the team was still unsure on whether to use the Arduino Uno/ the Arduino nano. As of current, the team has decided to use the Arduino nano, therefore making the casing for the model far too large for the size for the internal component components put together. Despite the results for this first test, we are still unable to determine an exact size as our GSM module component has yet to arrive. Hence the team will have to develop a new model dimensions based on estimates of the components. It is also currently unknown on the exact amount space the wiring of the components will take as the team has not fully assembled electrical hardware due to the missing components not arriving on time.

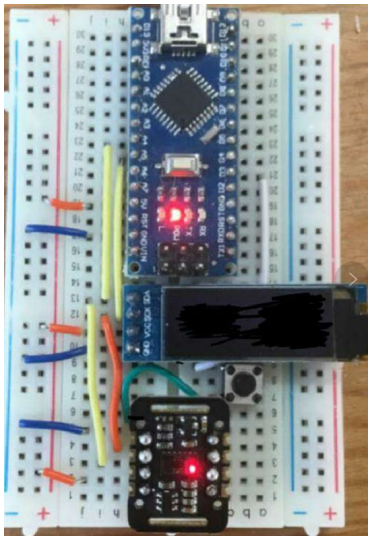

Figure 4. A preview of our components on a breadboard

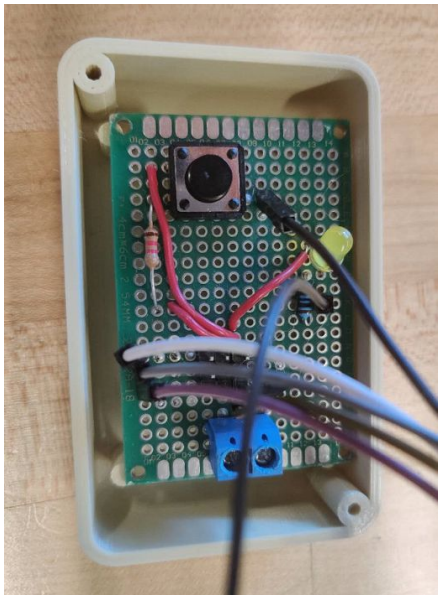

Figure 5. Fitting an example of the electric board into our prototype

It was also discovered that the cut-outs for our model had to be redesigned because of the blood oximeter. The blood oximeter was much smaller than what the team anticipated as the measurements for the size of oximeter could not be found online. Therefore the team had to estimate the size of the cut-outs which led to yet another overestimation. This led to the cut-out slot for the oximeter to be larger than the oximeter itself, which may affect the reading of blood oxygen levels of the user.

Overall, the team felt that the model is a nice size. However, as it is larger than most standard watches, it may lose its appeal for some users. Hence, we aim to make our next design more compact and akin to conventional watches.

Next steps

The team needs to make major adjustments to the design of the casing, mainly adjusting the dimensions of the device to fully optimize the size to suit the client's needs as much as possible. This means given the excess space in Prototype 1, our team has to develop a new design that is more compact than Prototype 1; The new design will be tested in Prototype 2.

The team would also need to assemble the electrical components, as well as prepare the codes for Prototype 2. The team will aim to test the functionality aspect of the device in Prototype 2 and experiment with the software and hardware of Prototype 2. The missing components are expected to arrive before the commencement of Prototype 2.

Conclusion

Overall, we had a very successful Prototype 1. Through this prototype we were able to gain a good grasp on how our device will look visually and whether it will have a good appeal factor to our users. We were also able to catch some major flaws, mainly the model's overly large size as well as the errors of the cut-outs due to previous over-estimations. The prototyping results will help us in developing a better design for Prototype 2.

Our main setback for this prototype was the tardy arrival of the components which limited the team to only being able to experiment the outer casing of the device rather than including tests on the electrical hardware as well. As such, it is important to monitor and accurately estimate the duration taken when we purchase any required components as it limits the productivity of each prototyping session.

Moving forward, the team will focus on the internal components of the device and the software. As mentioned in Deliverable E, Prototype 2 will focus on the electrical hardware and coding of the device, it will include experimenting on the prototype's response to the user's blood oxygen level, the speed of the its response and the integrating the GSM module into the device to enable it to send signals to a target using SMS.

The team will likely increase the frequencies of meetings in order to increase the productivity of the second prototype, this would greatly benefit the final product as a whole.