Project Deliverable D: Conceptual Design

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Abstract

The main objective for this project deliverable will be to address our primary design concepts, which will be our first sketched out ideas on how to organize each subsystem within our device. The purpose of this is to see three different concept ideas from each member so that we can by the end of this report come to a solution to which all group members agreed. This report will contain our final design concept which will be used for the rest of the project, with the three subsystems chosen by our team. Lastly, we will reflect on the different drawbacks and benefits from each subsystem chosen, and also an explanation on why other subsystems were not considered, these reasons could be prices, availability, complexity level, and such.

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Introduction

As seen in our lectures, coming up with the very first design concept is the basis of the entire prototype development, which is why much thought needs to be put into the pros and cons of each device and subsystem required for our prototype to have the desired outcome. After discussing the client's needs and the technical specifications needed to fulfill those needs, then we must proceed to choose the different components to satisfy all those. Since our project has been carried out through group work, now is a good point throughout the whole process to have each member bring out their design ideas to the table, and this can be done by having each group member choose a combination of subsystems to meet the required specifications, this is a great opportunity to understand different points of view and find different ways to try and solve the same problem. After each comes up with a solution, we can come to a general consensus on which subsystems would work better together, by taking into consideration their limitations, pricing, availability, and constraints. The goal is then, to have a set concept by the end of this report which will be used for our main prototype design.

Three design solutions

German Soublette's chosen subsystems:

- Passive Piezo-Buzzer (KY-006), buzzer device whose volume can be changed by setting different frequencies within our code.
- Temperature Sensor (KY-013), this analog sensor can be of great usage at critical temperatures.
- Strain Gauge Load Cell (Product ID: 4630), it has an electrical signal which can be programmed to trigger the buzzer which would be beneficial for our device.

William Hickey's chosen subsystems:

- LM35DZ temperature sensor. This temperature sensor has a large temperature range(-55°C to 150°C) and is very easily integratable with the arduino uno interface.
- YZC-133(20kg) load sensor. This load sensor is a transducer that converts force into an electrical signal.

- KY-006 passive piezo buzzer. This active piezo buzzer uses pulse width modulation to set a tone to be played

Defne Oguz's chosen subsystems:

- Temperature Sensor TMP36; this temperature sensor has a wide range of temperature(-50°C to 125°C) and is compatible with the Arduino uno; it is also low cost($2)
- Passive Piezo-Buzzer (KY-006), buzzer device whose volume can be changed by setting different frequencies within our code.(and it is the most effective buzzer).
- Load sensor: Micro load cell type S (10kg to 50kg): the weight range is useful with a child's/pet's weight.

Three design solutions

1) A device composed of the Temperature Sensor TMP36, the Passive Piezo-Buzzer, and the YZC-133 load sensor.
2) A device composed of the Passive Piezo-Buzzer, the Micro Load Cell type S and the temperature Sensor LM35DZ.
3) A device composed of the KY-013 temperature sensor, the KY-006 Passive piezo buzzer, and YCZ-133 load sensor

	Importance	Solution 1	Solution 2	Solution 3
Cost	3	$22.50	$72.00	$20.00
Weight	3	0.25 lbs	0.8 lbs	0.2 lbs
Temperature range	5	-50C to 125C	-55C to125C	-55 to 125C
Weight sensor range	5	10kg to 50kg	Up to 100kg	10kg to 50 kg
Size	4	12 in x 6 in x 1 in	14 in x 8 in x 2 in	12 in x 6 in x 1 in
Total	20	16	12	15

Final Design

For our final design we decided to go for the first one of the solutions described above, which includes the temperature sensor TMP36, the passive piezo buzzer, and the YZC-133 load sensor. After analyzing our options we came to choose this option since it satisfies every single minimum required we had set, except for the overall size of our device. On our last deliverable we set our approximate sizes to be 10 in x 5 in x 1 in, however, all design solutions would turn out to be larger than that. On the other hand, solution number 2 ended up being past our budget for this project, specifically because the load sensor that was picked for that design, has a rating of 100 kg and would cost around $60, therefore it had to be discarded. Finally, the last deciding factor was the weight, which ended up being lower for our solution 1, even though it came out to be only 2 dollars more expensive. All of this made us choose solution number 1 to move forward in our project.

Conclusion

Throughout this project deliverable we were able to narrow down our options for our prototype and overall device design. We could clearly see how in the design process, one of the major and most important steps is, during the conceptual design where all of the thoughts that have been developed since the first brainstorming session need to be put into action. Through rigorous thought and several discussions amongst our group we saw and understood the different trains of thought each of the members have and the different ways we can positively contribute to our project. We can also conclude that technical benchmarking is the key to come up with a final design solution, and through a matrix solution we can bring every important aspect into perspective which can help at the time of making a decision.

References

1. Temperature Sensor - TMP36 (SEN-10988). Retrieved October 17, 2021 from https://www.scribbr.com/apa-citation-generator/

2. KY-006 PASSIVE BUZZER MODULE. Retrieved October 17, 2021 from https://arduinomodules.info/ky-006-passive-buzzer-module/

3. Micro Load Cell, S type, 1kg/2kg/3kg/10kg to 50kg. Retrieved October 17, 2021 from https://www.ato.com/micro-load-cell-s-type-1kg-to-50kg

4. Electronic 1/2/5/10/20KG YZC-133 Aluminum Weighing Weight Scale Sensor Load Cell. Retrieved October 17, 2021 from https://www.aliexpress.com/item/32831470064.html

5. LM35 Temperature Sensor. Retrieved October 17, 2021 from https://components101.com/sensors/lm35-temperature-sensor

6. KY-013 ANALOG TEMPERATURE SENSOR MODULE. Retrieved October 17, 2021 from https://arduinomodules.info/ky-013-analog-temperature-sensor-module/

7. Strain Gauge Load Cell (Product ID: 4630). Retrieved October 17, 2021 from https://www.adafruit.com/product/4630