A Study of Hummingbirds, Brains, and Bike Locks: Insert Descriptive Project Title That Is Concise But Descriptive

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ABSTRACT

Write a short description that summarizes your report, including the purpose of your system or product and a qualitative summary of the most important results from your project. The abstract should not be longer than half a page and should not contain any figures.

1. PROJECT DESCRIPTION

You will need to have a clear idea for what you are making, why you are making it, and where it fits in with the current state of the art. In the project description section cover:

- What is the purpose of your device? Who will use the system. What are the challenges in developing the device. This is a good time for coherent rambling and brainstorming.
- Talk about the current state of your development area. What has been done similarly, what will you be doing better. How will you utilize the power of BLE and the sensors to advance the state of the art.

This section needs to be two paragraphs at minimum. Search google scholar while on campus (all papers are free) and see if you can find related work.

2. SENSORS

Here you will take each sensor one at a time and do an in depth analysis of the sensor specifications, communication protocols, power requirements, dimensions, noise characteristics, accuracy/precision, frequency response, units of measurement and any other relevant information. This will vary per sensor. Use your judgment and dig deep.

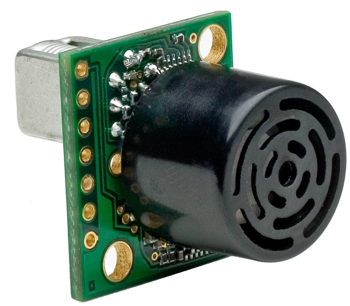

Figure 1: Memeographer sensor

2.1 Sensor 1: Awesomiter

Include part number, price, if relevant an image. Each sensor needs to be thoroughly discussed in terms of how it fits in and why you chose it.

2.2 Sensor 2: Memeographer

Include part number, price, if relevant an image. Each sensor needs to be thoroughly discussed in terms of how it fits in and why you chose it.

2.3 Sensor 3: Rhombascope

Include part number, price, if relevant an image. Each sensor needs to be thoroughly discussed in terms of how it fits in and why you chose it.

3. SYSTEM DESIGN

Here you will do all of your back of the envelope calculations for power, decide on communication protocols, and make educated size predictions.

3.1 Power Analysis

Include a power systems diagram like in the presentations. A sample table is added below. You should

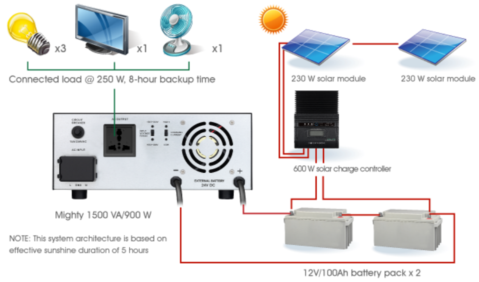

Figure 2: Power Diagram

be adding and removing columns as needed depending on your needs to summarize the power requirements of each sensor.

Sensor	I_{min}	V_{min}
Awesomiter	100mA	4.7V
Memographer	3mA	2.0V
Rhombascope	7A	3.3V

Add a paragraph talking about expected usage and how that relates to your power consumption and battery size. Put derivations for ALL calculations here as equations:

$$V = IR \tag{1}$$

Latex is a standard for publications, you can google how to write equations and symbols such as α, β etc.

3.2 Communications

Insert a communications diagram like in the presentations and figure 2. Add a discussion on what sampling frequencies each sensor will be using and relate it to your overall system analysis for power consumption etc. Talk about sleep cycling and how your sampling affects it.

3.3 Mechanical Design

Describe the mechanical specifications and goals for your device, such as maximum weight, maximum volume, shock and vibration tolerance, etc. Decide whether the device should be mounted within (e.g., in a vehicle) or attached to another object (e.g., shelving, pipes, ceiling), or if it is a portable or embedded device that needs its own enclosure. You have the opportunity to 3D print your enclosure if it makes sense for your project.

3.3.1 Mounting/Attachment

Create a neat mechanical drawing or 3D model of your device and the mounting or attachment system, including all dimensions. The drawing or model should include all large components such as PCBs, batteries, cables and harnesses, and connectors. Sensors that are not SMD

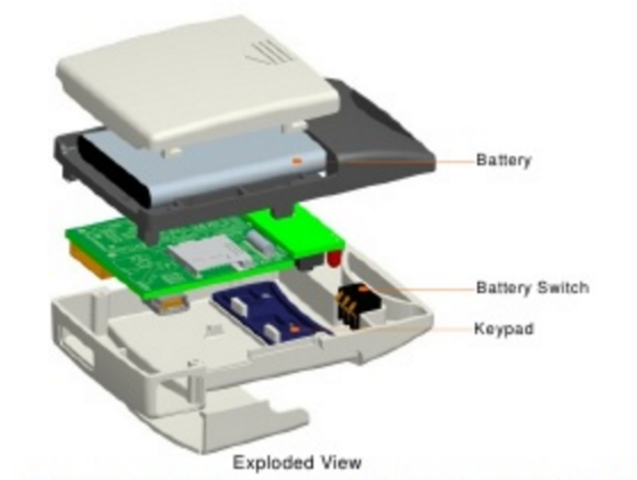

Figure 3: Enclosure and Internals

should also be included. Including small surface-mount components and chips is not necessary.

3.3.2 Enclosure

Create a 3D model of your device along with dimensions. This time around you should have selected your sensors and battery based on well thought out power requirement calculations. The 3D render should include all large components. Sensors that are not SMD should be included. Things like the PSoC chip and resistors are not necessary but larger things are. Battery is a must based on dimensions from the vendor. Add dimension markers in render. Remember you will be 3D printing your enclosure so the sky is the limit.

4. DEVICE FIRMWARE

Here you will put your PSoC firmware deliverables.

4.1 System Diagram

This is a general flow chart of how your system will work. It is meant to be a nice overview of how everything connects on a high level. The diagram will probably be wide so I put an example of how to put a two column image in your document using latex. Check out figure 4. There is no correct or wrong way to do this system diagram.

4.2 Signals Chart

You need a signals chart like in 5. Again, this was done in the presentations so should not come as a surprise.

4.3 State Machine

And you will also need a well designed state machine following the convention put forth over the past two

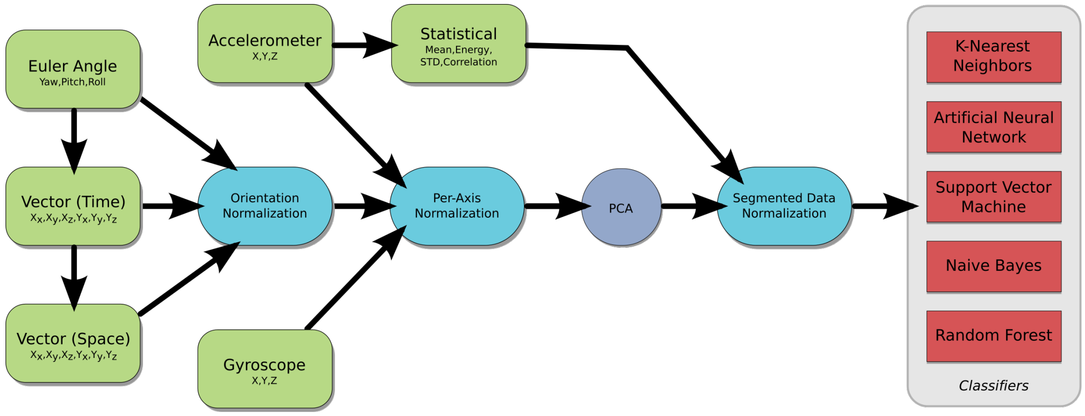

Figure 4: System Overview

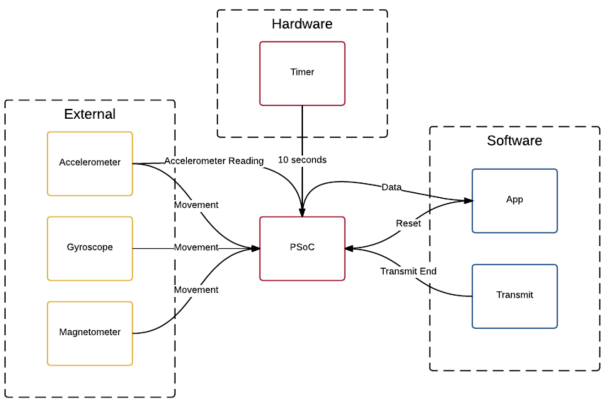

Figure 5: Signals Chart

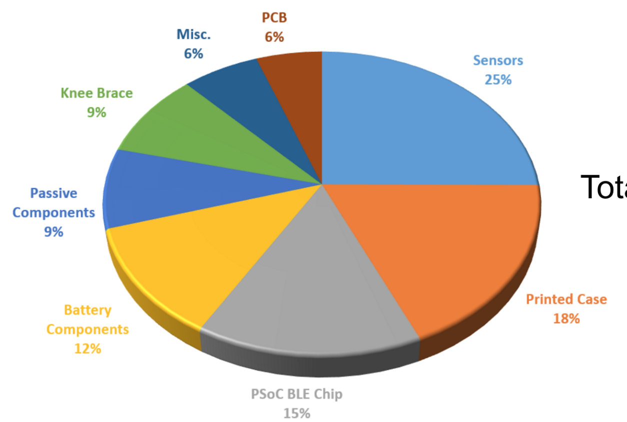

Figure 6: Cost Diagram

presentations.

5. MOBILE APPLICATION

Same as the presentation; add screenshots of a preliminary application. Include a list of features that will be available at the end of the quarter and two case studies outlining how a typical usage of your device will look like. Each of the two case studies should describe a particular scenario in which the app would be used together with the device to achieve something useful. For example: *Bob frequently loses his keys. Bob is smart and bought a Tile device to attach to his keys. Now, whenever Bob loses his keys, he uses the smartphone app to blink an LED on the Tile device, vibrate the device, and generate a chirping sound so Bob can locate his keys. Bob does not lose his keys anymore. Be like Bob, buy a Tile.*

6. PROJECT BUDGET

Here you should do a detailed cost analysis including pie charts for the cost breakdown for the bill of materials (BOM) per device or system. Check out Figure 6 for an example pie chart. The component costs should be calculated for two different scales of production, resulting in two different pie charts; one for an individual order and one for a bulk order (e.g., 1,000 devices). Also produce a table that shows cost estimates (broken down into different categories) for the entire quarter, resulting in the summed total for the quarterly cost estimate for the project. The non-recurring engineering (NRE) cost should be included in the quarterly cost estimates table, but it should not be part of the pie charts, since the NRE cost is not dependent upon the number of devices sold. For the NRE cost, choose a reasonable salary to pay yourselves as though you were working in a startup company. You can use your Gantt chart timeline to estimate the amount of time spent developing the product, and thus the amount of money you will need to pay each member of the team.

7. CONCLUSION

Briefly review the most important points from your report to reinforce them and provide a takeaway message for the reader of the report.