

Conceptual Design Descriptions

As a major part of the pre-proposal, many different designs of this project have been discussed and various paths were suggested to follow in order to build a prototype for this project however, to maximize the proficiency of the project and the easiness of troubleshooting, the project designs were divided to three separated designs that will be built individually and then put together, and they are: Load Cells Design, Battery Charging Design, and Cart Weighting Mechanism Design.

Load Cells Design

Load cell Design 1

The first suggested design for the load cells consists of four major parts:

- 1) Load Cells
- 2) Amplifier
- 3) Analog to Digital Converter
- 4) Microcontroller

After the item is scanned by the customer's phone and sent to the load cells, the amplifier will amplify the signal, and then it will be converted to digital signal and sent to the Wi-Fi network through a microcontroller, and finally the server will receive the data and communicate with the cart and check if that item was placed or not. (See figure 1)

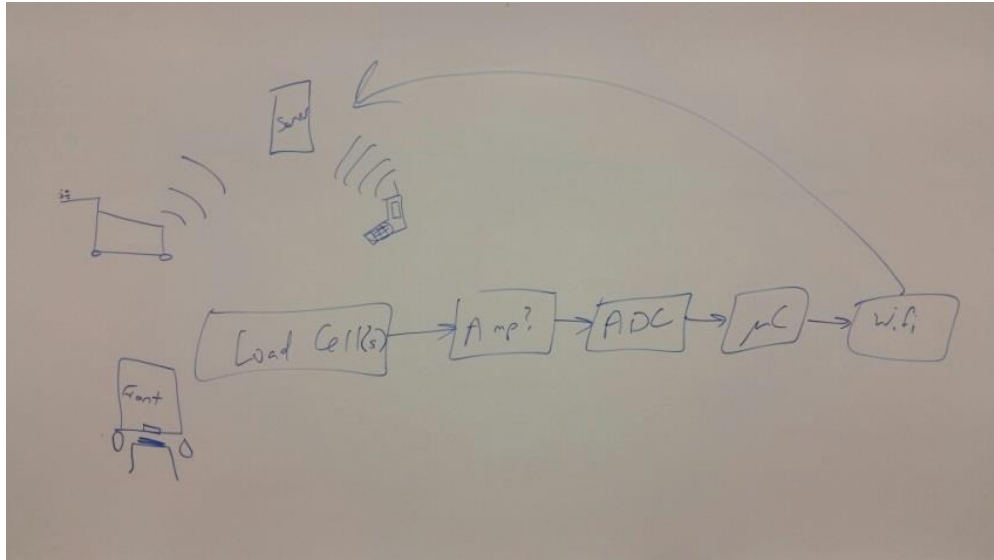


Figure 1

Load Cell Design 2

The second proposed design for the load cells will have the previous parts except that this design will have an Arduino board that will have built-in Analog-to-Digital converter device and a microcontroller, and it will be responsible to send the data to the server through the Wi-Fi network. (See figure 2)

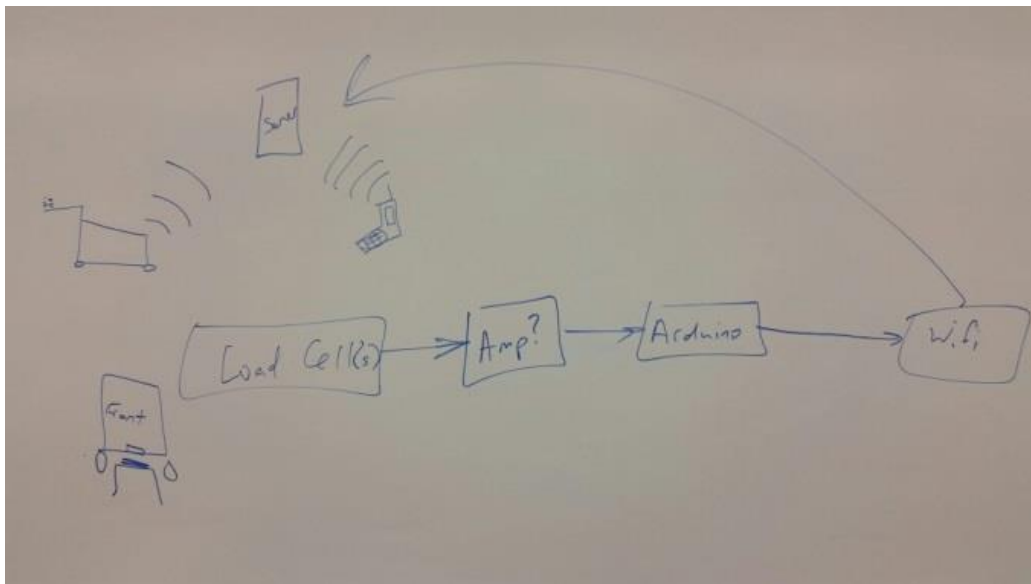


Figure 2

Battery Charging Design

All of the designs will have a stationary battery at the bottom of the shopping cart however, the charging procedure is different.

Battery Charging Design 1

This design consists of a wireless charging mat that will be placed at the front doors. The customer will basically push the cart into the backside of the mat where that mat will take position between the tires of the cart. The mat will have a queue of carts where new customers will take new carts from the front side; in that case there will be enough time for the carts to recharge. (See figure 3)

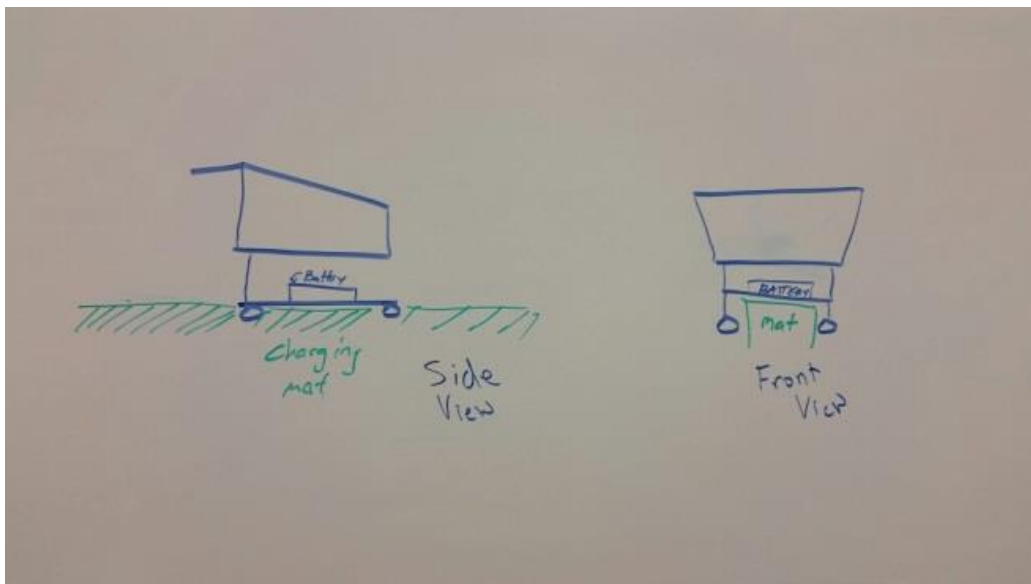


Figure 3

Battery Charging Design 2

The concept of this design is similar to Design 1, except that the battery will be placed on the side of the cart, and the charging mat will be connected to the wall; in that case when the customers are done they will place their cart next to the mat with side of the battery facing the mat. (See figure 4)

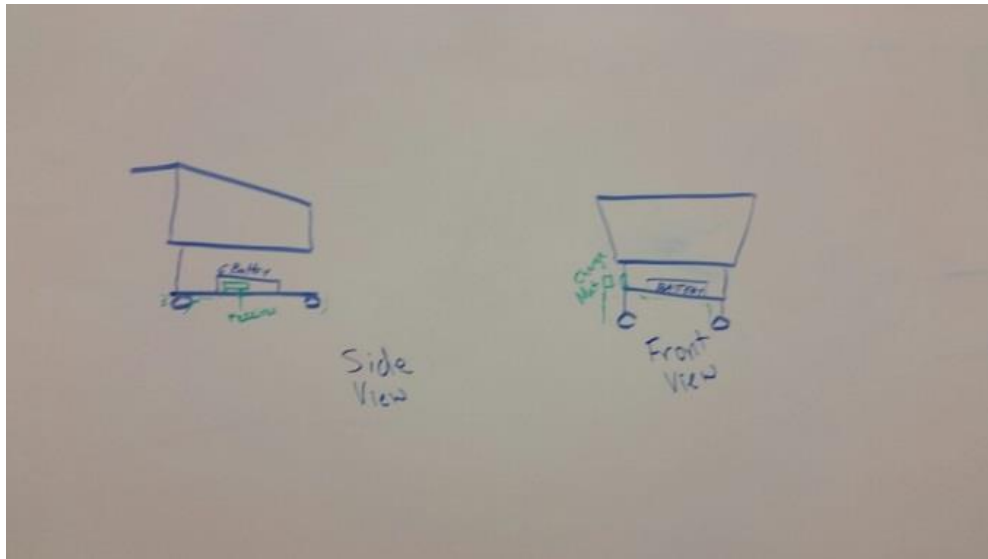


Figure 4

Battery Charging Design 3

This design follows a different concept. In this design, each cart will have a battery that will be connected to a wall outlet and thus recharge. (See figure 5)

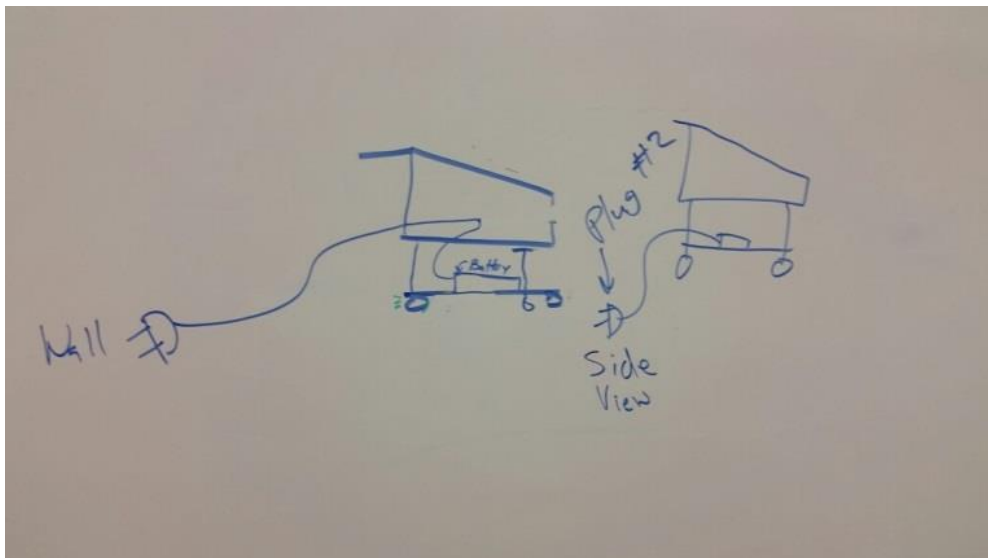


Figure 5

Battery Charging Design 4

Instead of having multiple outlets that connect to the carts, one outlet could be used to charge all carts. The first cart will be connected to the outlet, and then customers will place their carts at the front of the cart queue and connect the wire to the cart at the front, having carts charging in series. (See figure 6)

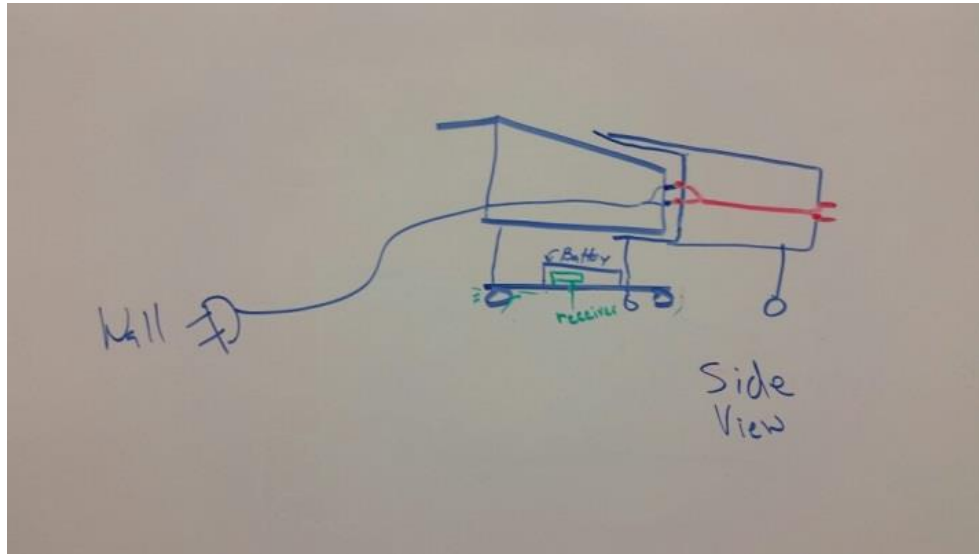


Figure 6

Cart Weighting Mechanism Design

Cart Design 1

In this design, four sensors will be connected to the weighting basket, one sensor in each corner. Each sensor will calculate portion of the weight of the item depending on the position the item was placed on, that is the closer the item to a sensor the more portion that sensor will measure. (See figure 7A)

Cart Design 2

This design follows the same concept of Design 1, the only difference is that one more sensor will be added to the center of the basket giving more accurate results. (See figure 8A)

Cart Design 3

This design will consist of one heavy-duty sensor that will be placed at the center of the weighting basket, and two metal bracings will be connected in diagonal to prevent any chance of basket bending on any side in case one side was oversized with items. (See figure 7B)

Cart Design 4

The final proposed design of the cart consists of two sensors that will be placed at the center of two sides facing each other, and three metal bracings will connected to the basket in H-shape to prevent any possible bending. (See figure 8B)

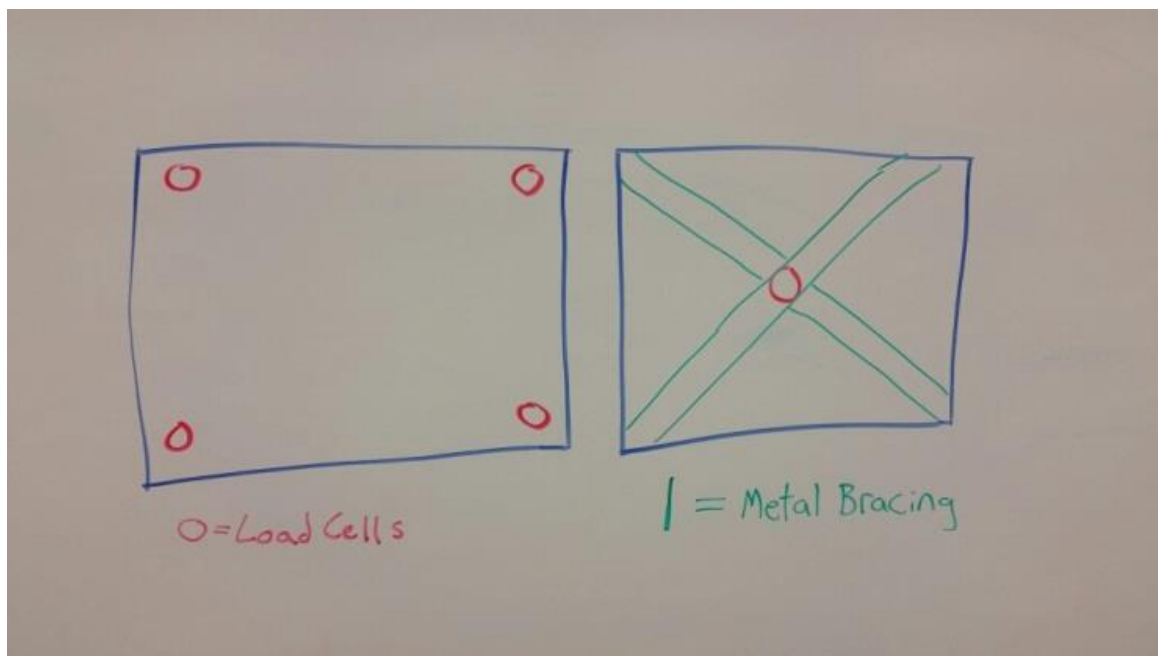


Figure 7:

A

B

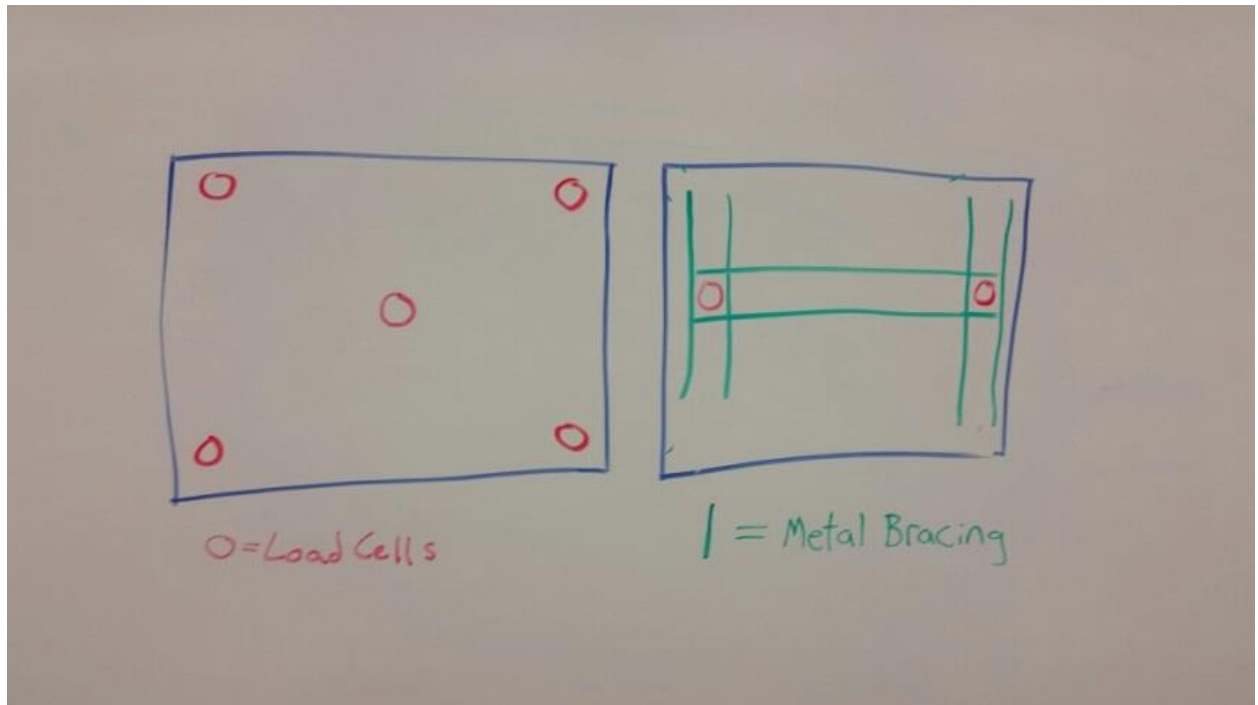


Figure 8 :

A

B