College of Engineering and Computer Science

University of Central Florida

Charge Spot*

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* This is a running title. Actual Project Title may differ.

Project Narrative Description

Charge Spot is intended to demonstrate the feasibility of an autonomous electric vehicle charging system for residential use. The goal of Charge Spot is to have no user interaction and no physical connection between the car and the charging station.

Remembering to charge your electric vehicle every day is hard enough as it is. And if you forgot to charge it overnight you may not make it to work the next day. Also the task of undoing cables and precisely aiming and connecting charge connectors can be a bit of a hassle sometimes. Charge Spot is designed to eliminate these concerns and also include added features necessary for peace of mind. This is a hands-free, intelligent charging system, capable of fully charging your electric vehicle without human intervention. All you do is park your car as you would normally and the rest is taken care of.

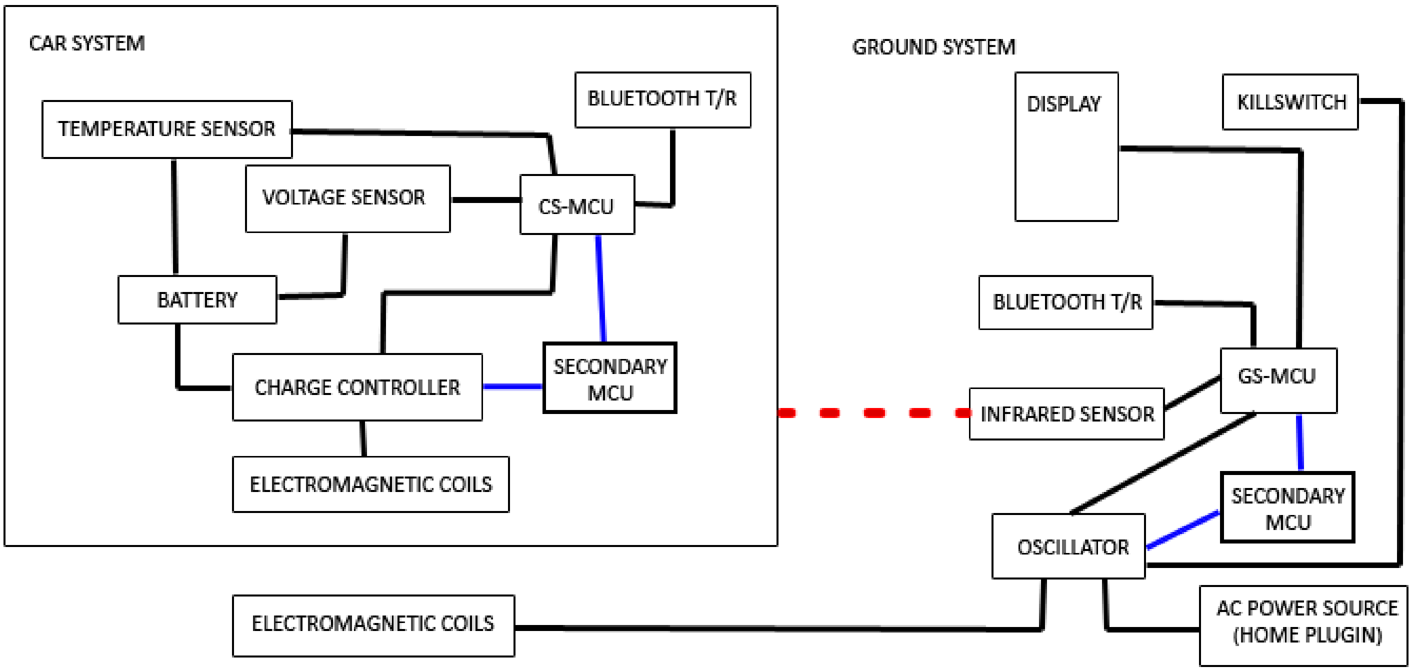
A proximity sensor detects the presence of a vehicle and immediately activates Bluetooth connectivity between the car and the charge panel. While Bluetooth pairing is underway, the car is being guided into place by the proximity sensor with a visual aid indicating proper alignment of both the car coil and the ground coil. Upon successful pairing, the battery status and temperature information is sent from the car to the panel via Bluetooth. After preset parameters for battery temperature is met, and battery status is determined to be less than 100%, the charging system is activated and the car battery will be charged with the high resonance frequency charging system.

Battery status is monitored and displayed on the panel along with battery temperature. When fully charged the charging system is designed to shut down automatically.

List of Specifications

1. Proximity sensor capable of detecting car within 5 feet of panel
2. Coil attached to car small and lightweight (approx. 2lbs)
3. A fail safe, shut down switch
4. Maximize charge time by adjusting charge current based on battery level
5. Battery status displayed on panel using 11-segment and LED bar displays
6. Proximity status for alignment displayed on panel
7. Battery temperature displayed on panel
8. No physical cable connectivity between car and charge system
9. Automatic shutdown when fully charged
10. Car should begin charging within 10 seconds of successful alignment
11. Eliminates trip hazard

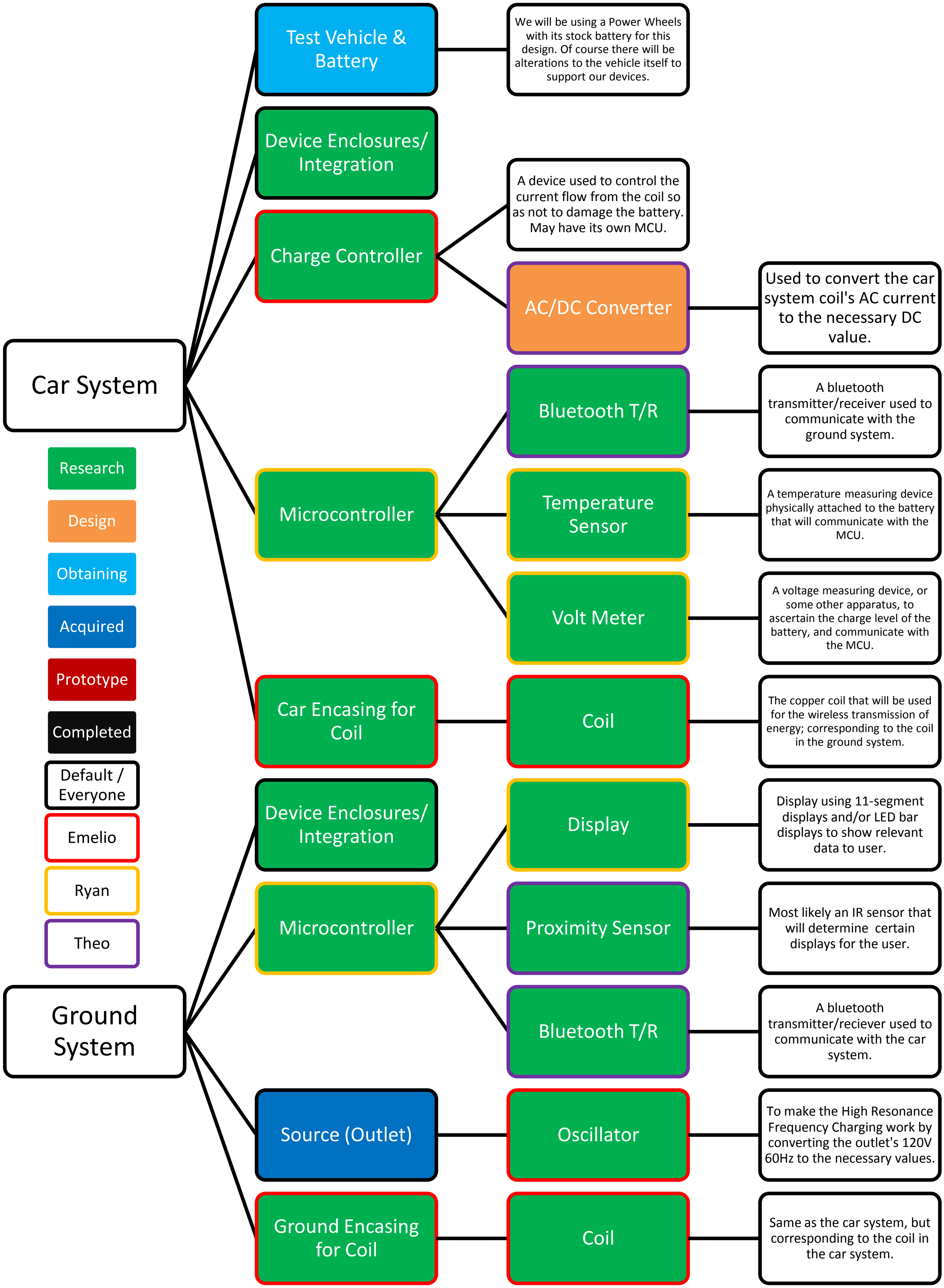
Block Diagram – Physical Connections



This is a very rough display of the prototype of our project. Each piece is explained in further detail below; this diagram just shows the physical connections of each component in the systems. If we opt for the two optional MCUs, instead of using one in each system, the blue line will represent the new connections, and the previously used black lines will become obsolete. Not shown is exactly how each component will be setup, or physically mounted. The entire ground system, except the electromagnetic coils and the power source, will be housed in a metal box, with a cutout for the LED display. The car system will be mounted for concealment. The two coils will be housed in a special encasing which we are still researching.

Block Diagram – Component Details

On the next page is the detail block diagram.


Car System
Test Vehicle & Battery
We will be using a Power Wheels with its stock battery for this design. Of course there will be alterations to the vehicle itself to support our devices.
Device Enclosures/ Integration
Charge Controller
A device used to control the current flow from the coil so as not to damage the battery. May have its own MCU.
AC/DC Converter
Used to convert the car system coil's AC current to the necessary DC value.
Microcontroller
Bluetooth T/R
A bluetooth transmitter/receiver used to communicate with the ground system.
Temperature Sensor
A temperature measuring device physically attached to the battery that will communicate with the MCU.
Volt Meter
A voltage measuring device, or some other apparatus, to ascertain the charge level of the battery, and communicate with the MCU.
Car Encasing for Coil
Coil
The copper coil that will be used for the wireless transmission of energy; corresponding to the coil in the ground system.
Research
Design
Obtaining
Acquired
Prototype
Completed
Default / Everyone
Emelio
Ryan
Theo
Ground System
Device Enclosures/ Integration
Microcontroller
Display
Display using 11-segment displays and/or LED bar displays to show relevant data to user.
Proximity Sensor
Most likely an IR sensor that will determine certain displays for the user.
Bluetooth T/R
A bluetooth transmitter/reciever used to communicate with the car system.
Source (Outlet)
Oscillator
To make the High Resonance Frequency Charging work by converting the outlet's 120V 60Hz to the necessary values.
Ground Encasing for Coil
Coil
Same as the car system, but corresponding to the coil in the car system.

Block Diagram – Data Flows

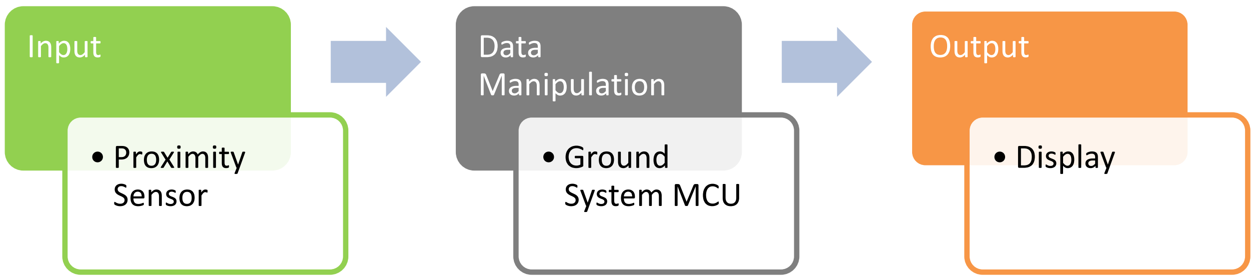


Figure 1: Data Flow 1

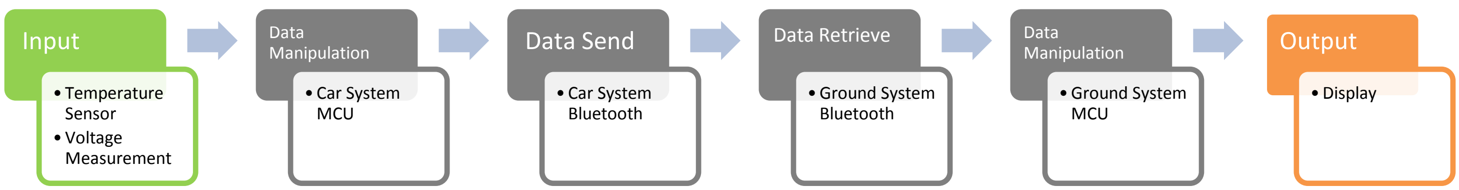


Figure 2: Data Flow 2

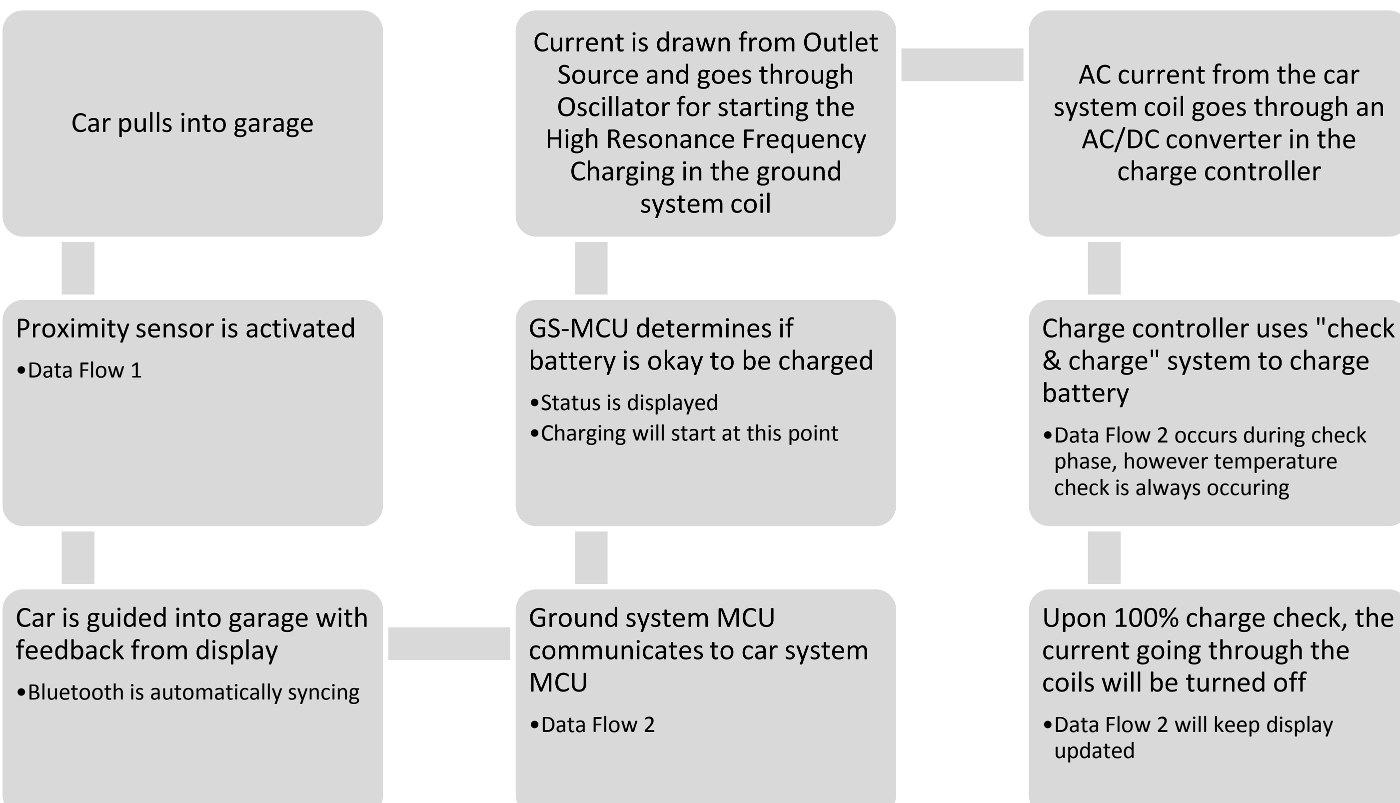
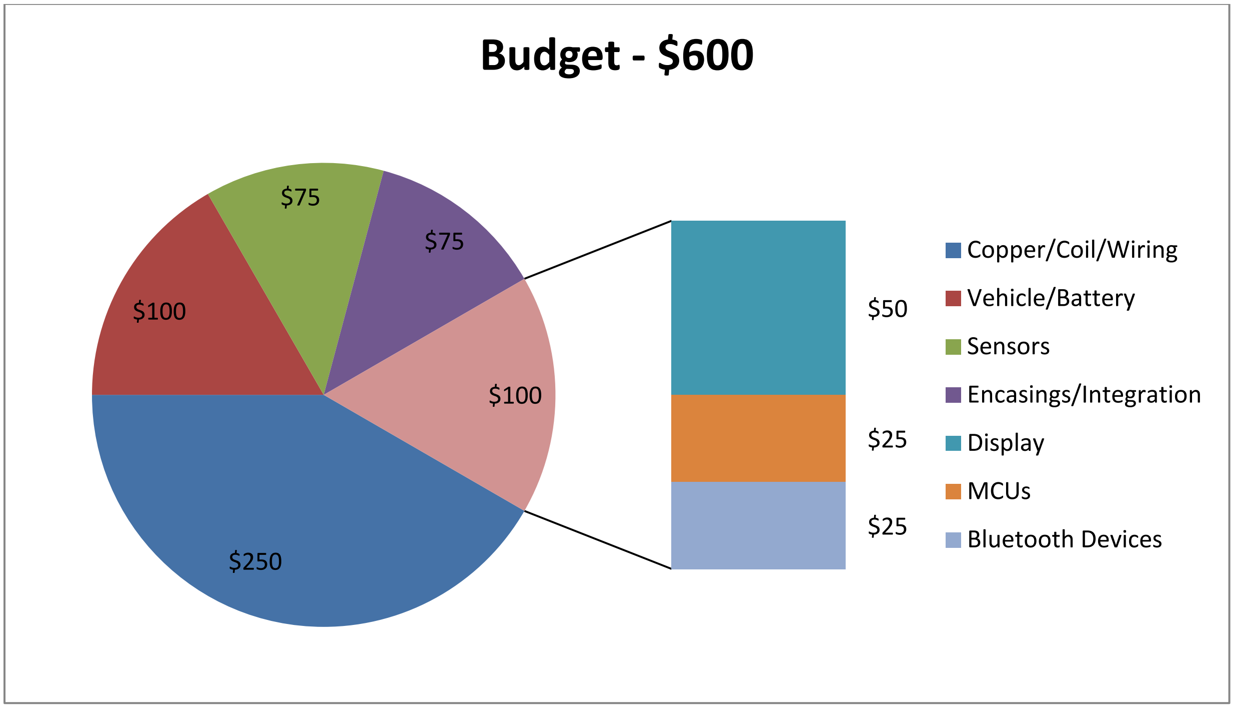


Figure 3: Sequence of events

Budget



The generous budget to the copper coil and wiring is due to the necessity of the amount we need. The coil itself with either be molded by us or bought that way, depending on cost and availability. The wires will also be a special wire used solely by the coils; this does not include the wiring for other devices. The vehicle we will be using will be a PowerWheels with its stock battery. We will be obtaining a used, working one preferably for a sound amount of money, which will be a challenge considering recent Craigslist postings.

The sensors, display, MCUs, and Bluetooth chips are given a bloated budget, just in case they don't work and we need to acquire another, or a different type. The sensor has a considerably larger budget because we're not sure of the type of proximity sensor to use – we can use either the more accurate and more expensive laser sensor, or the cheaper infrared sensor. As for the display, this includes all the LED Bar displays and the 11-segment displays. However, since we cannot find suitable LED bar displays, we may make our own.

The encasings/integration involves the encasing of the two coils and the encasing of the display. This slice basically involves the cost of putting everything together, soldering and wiring cost, the cost of physical parts used for encasing (wood frame, metal box), and possibly the cost of labor required, if applicable.

Project Milestones

Task Name	*Duration*	*Start*	*Finish*
1) Definition	**2 weeks**	**Tue Sept 3rd 2013**	**Mon Sept 9th 2013**
➢ Define project	2 weeks	Tue Sept 3rd 2013	Mon Sept 9th 2013
2) Research	**8 weeks**	**Mon Sept 16th 2013**	**Sun Nov 10th 2013**
➢ Type of Vehicle	2 weeks	Mon Sept 16th 2013	Sun Sept 29th 2013
➢ Blue Tooth T/R	3 weeks	Mon Sept 16th 2013	Sun Oct 6TH 2013
➢ Temperature Sensor	3 weeks	Mon Sept 16th 2013	Sun Oct 6TH 2013
➢ Charge Controller	2 weeks	Mon Oct 7th 2013	Sun Oct 20th 2013
➢ Volt Meter	3 weeks	Mon Oct 7th 2013	Sun Oct 28th 2013
➢ Type of Coil	3 weeks	Mon Oct 13th 2013	Sun Oct 3rd 2013
➢ Display	3 weeks	Mon Oct 13th 2013	Sun Oct 3rd 2013
➢ Proximity Sensor	3 weeks	Mon Oct 13th 2013	Sun Oct 3rd 2013
➢ MCU	3 weeks	Mon Oct 21st 2013	Sun Nov 10th 2013
3) Design	**6 weeks**	**Mon Nov 11th 2013**	**Sun Dec 22nd 2013**
➢ Hardware	6 weeks	Mon Nov 11th 2013	Sun Dec 22nd 2013
• Oscillator	6 weeks	Mon Nov 11th 2013	Sun Dec 22nd 2013
• Blue tooth	6 weeks	Mon Nov 11th 2013	Sun Dec 22nd 2013
• Charge Controller	6 weeks	Mon Nov 11th 2013	Sun Dec 22nd 2013
➢ Software	6 weeks	Mon Nov 11th 2013	Sun Dec 22nd 2013
• Microcontroller	6 weeks	Mon Nov 11th 2013	Sun Dec 22nd 2013
4) Prototype	**9 weeks**	**Mon Jan 6th 2014**	**Sun Mar 9TH 2014**
➢ Hardware	9 weeks	Mon Jan 6th 2014	Sun Mar 9TH 2014
• Oscillator	9 weeks	Mon Jan 6th 2014	Sun Mar 9TH 2014
• Blue tooth	9 weeks	Mon Jan 6th 2014	Sun Mar 9TH 2014
• Charge Controller	9 weeks	Mon Jan 6th 2014	Sun Mar 9TH 2014
➢ Software	9 weeks	Mon Jan 6th 2014	Sun Mar 9TH 2014
• Microcontroller	9 weeks	Mon Jan 6th 2014	Sun Mar 9TH 2014
5) Test	**3 weeks**	**Mon Mar 10th 2014**	**Sun Mar 30th 2014**
➢ Whole System	3 weeks	Mon Mar 10th 2014	Sun Mar 30th 2014
6) Final	**2 week**	**Mon Mar 31th 2014**	**Sun April 13TH 2014**
➢ Documentation	2 week	Mon Mar 31th 2014	Sun April 13TH 2014
➢ Presentation	2 week	Mon Mar 31th 2014	Sun April 13TH 2014