UCF Senior Design Project

SPOT
(Searching Parking On Time)

Presented by Group Nine.

Them Le	Electrical Engineer
Carlos Pereda	Computer Engineer
Danny Russell	Computer Engineer
Roddey Smith	Computer Engineer

Sponsored by:

The project is currently self-funded.

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I. Project description:

The problem: Due to increased enrollment at UCF as well as the elimination of existing parking areas, the number of available parking spots has decreased while the demand for such spots has increased. Finding a parking spot has become a task that consumes time, gas, and elevates the level of stress in the person looking for the spot.

The solution: Although a possible solution would be to increase the number of parking spots in order to make a more efficient supply to demand ratio, this would have a large cost to the University. If students were better informed of the location of open spots, the problem could be fixed with a smaller investment. This alternate solution consists of an information system that provides up to the minute updates to people seeking a spot. In this way, a person who needs to park can determine not only how many spots are available in a particular parking building, but also know with certainty how many spots are available on a particular floor. With this information in hand, a driver can drive to the available spot directly. Avoiding the 'go around' or the 'waiting for someone to leave' tactic. Thus saving time, gas, and frustration.

The implementation: In order to achieve this solution, a parking sensor would be allocated to each parking spot (see figure 1). The sensor would be responsible for determining if the spot is in use or not. This information would then be transmitted from the sensor to a micro controller unit. Four sensors would be used per MCU, which in turn will send the information wirelessly to a server that contains and updates a database with the relevant parking information.

The client (a driver looking for parking) may obtain parking availability through the use of a web application accessed through a cell phone, PC, laptop, tablet, or any similar device.

Figure 1

(Sensors, cabling and MCU are not to scale, they are shown for information purposes)

At this time, the team is evaluating both Hall Effect sensors as well as Ultrasonic sensors. The ideal candidate would be a cost, efficiency, low maintenance, and reliable sensor. The location of each sensor will depend on the surroundings (walls, line of view, ceilings, etc.) of the spot to be monitored.

The microcontroller is to be designed, assembled, programmed, tested, and operated by team nine. Initial requirements for the MCU are:

- Low cost.
- Low power consumption.
- Capability to connect at least four sensors.
- Wireless communication with server.

As a group project, this would this be an exciting challenge from a hardware point of view, and it would also test the software prowess of the group through designing a user friendly

application interface. All with the purpose of fixing a daily real-world problem. This is why Team Nine believes it to be an excellent senior design project.

Possible Problems and Limitations: The most important aspect of our design is to accurately detect the individual cars that are parked. Implementing this can present a few problems that must be overcome. For each possible sensor, there are different issues that can arise. Some sensors require line of sight, and almost all of them are susceptible to noise. Many sensors will need to be tested in order to determine which can most accurately sense that a parking spot is occupied.

The viability of this as a product also relies on the price of the components used. Every part of the system has a cost associated with it. A perfect sensor could easily be built in small scale with a relatively low cost. Our current design calls for a large number of these sensors for each parking garage. If the cost is too high, it will not be an economically viable system. These constraints must be taken into account when designing each component of the system.

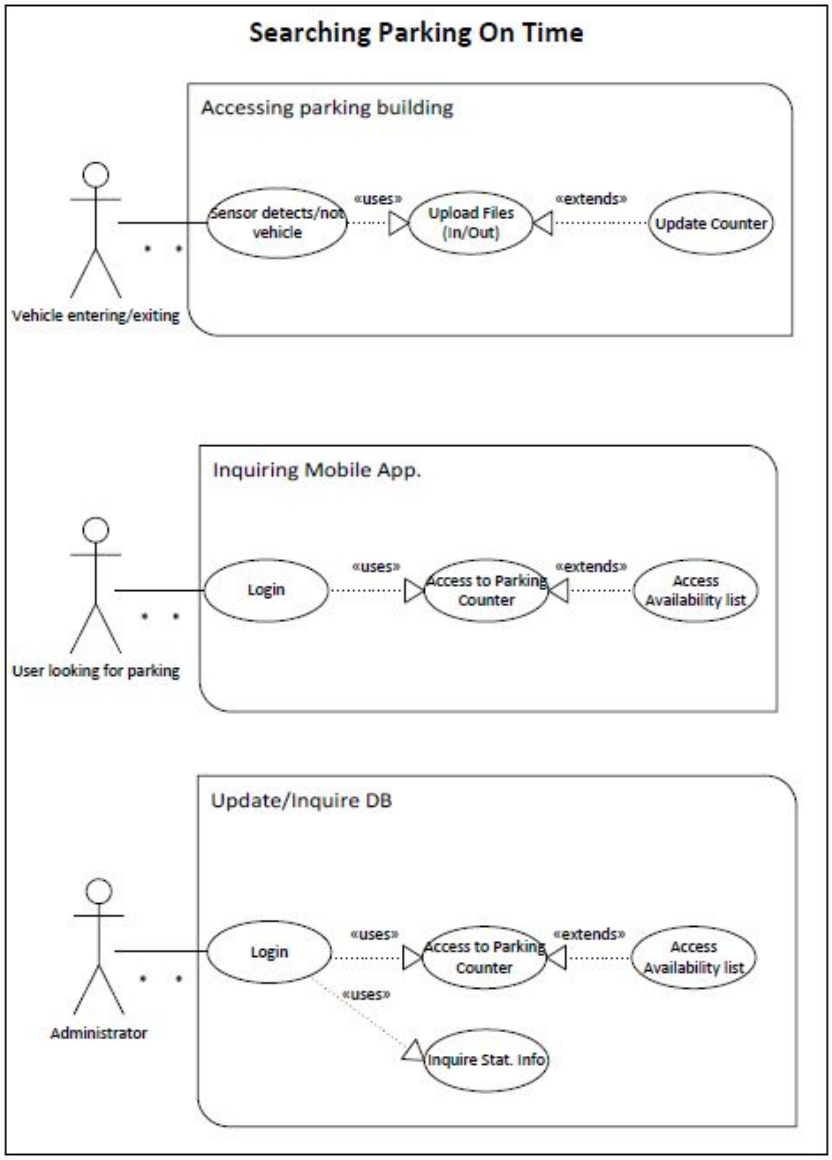


Figure 2 - Use Case Diagram

II. Requirements:

The board (to be designed and built):

(This is a preliminary list)

- Wireless capabilities (Ethernet 802.11ng, or Bluetooth to be determined).
- Input/Output capabilities (for sensor communication).
- A power supply source (voltage to be determined).
- Internal clock.
- CPU (# of bits to be determined).
- ROM memory (capacity to be determined).
- Other electrical components (capacitors, resistors, to be determined).

Sensors:

- Proximity sensor (type to be determined) with desire capabilities of:
  - ➢ Temperature range from -40 C to 125 C.
  - ➢ Reverse-voltage protection at VDD-pin.
  - ➢ Short-circuit protected open-drain output by thermal.

Hardware/Software:

- A DBMS system (such as MySQL, DB2, Microsoft SQL Server, etc.)
- Software for app developing:
  - On the client (Student) side: PHP, HTML, Javascript.
  - On the server (UCF Staff) side: A language with a good GUI (Visual Studio, or web based such as PHP, HTML, Javascript. etc.)
- Server hosting paid.
- Bootstrap CSS for mobile and full-size viewing functionality.
- A server hosting the database; in communication with MCU's, and server hosting.

III. Block Diagrams:

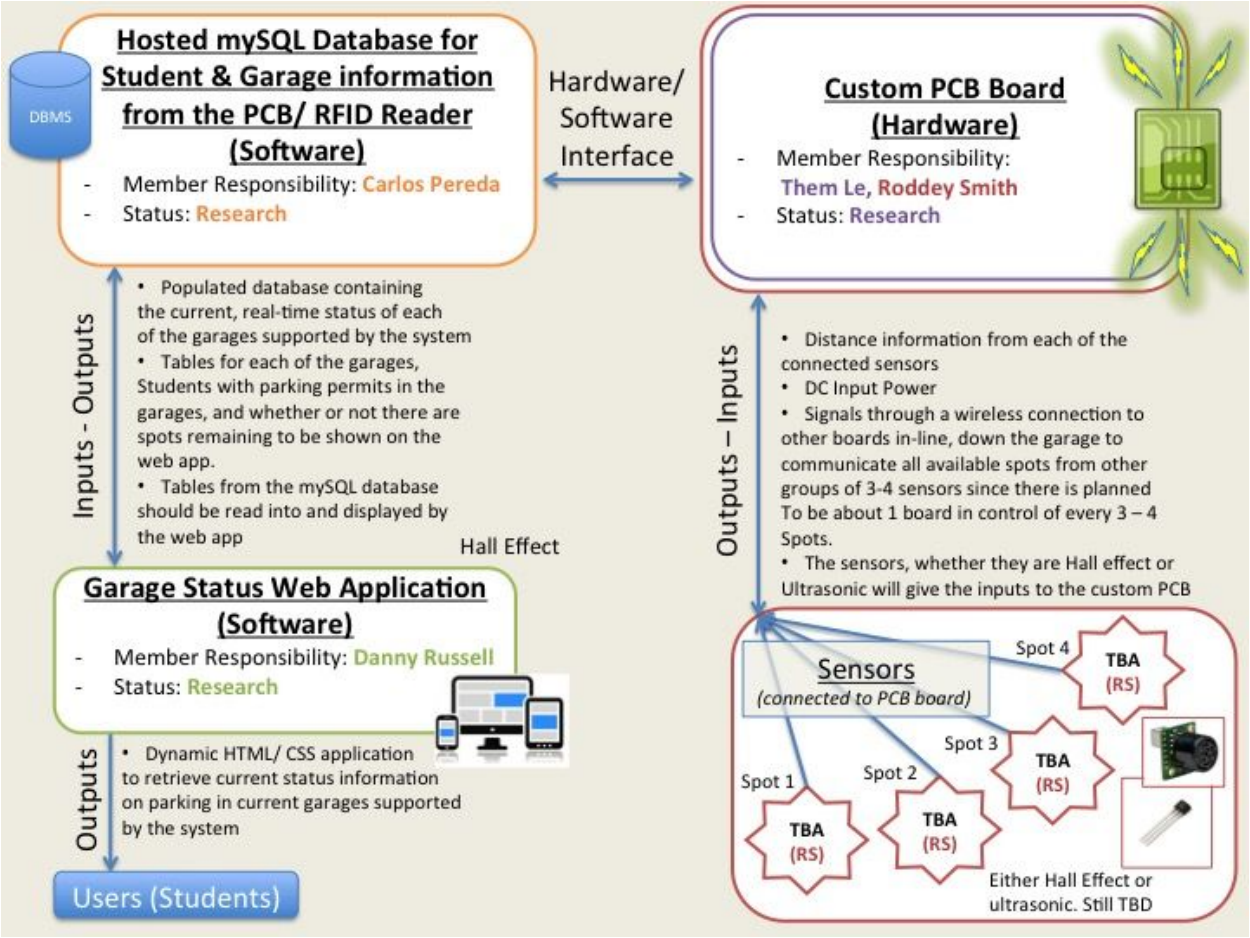


Figure 3 - Primary Block Diagram

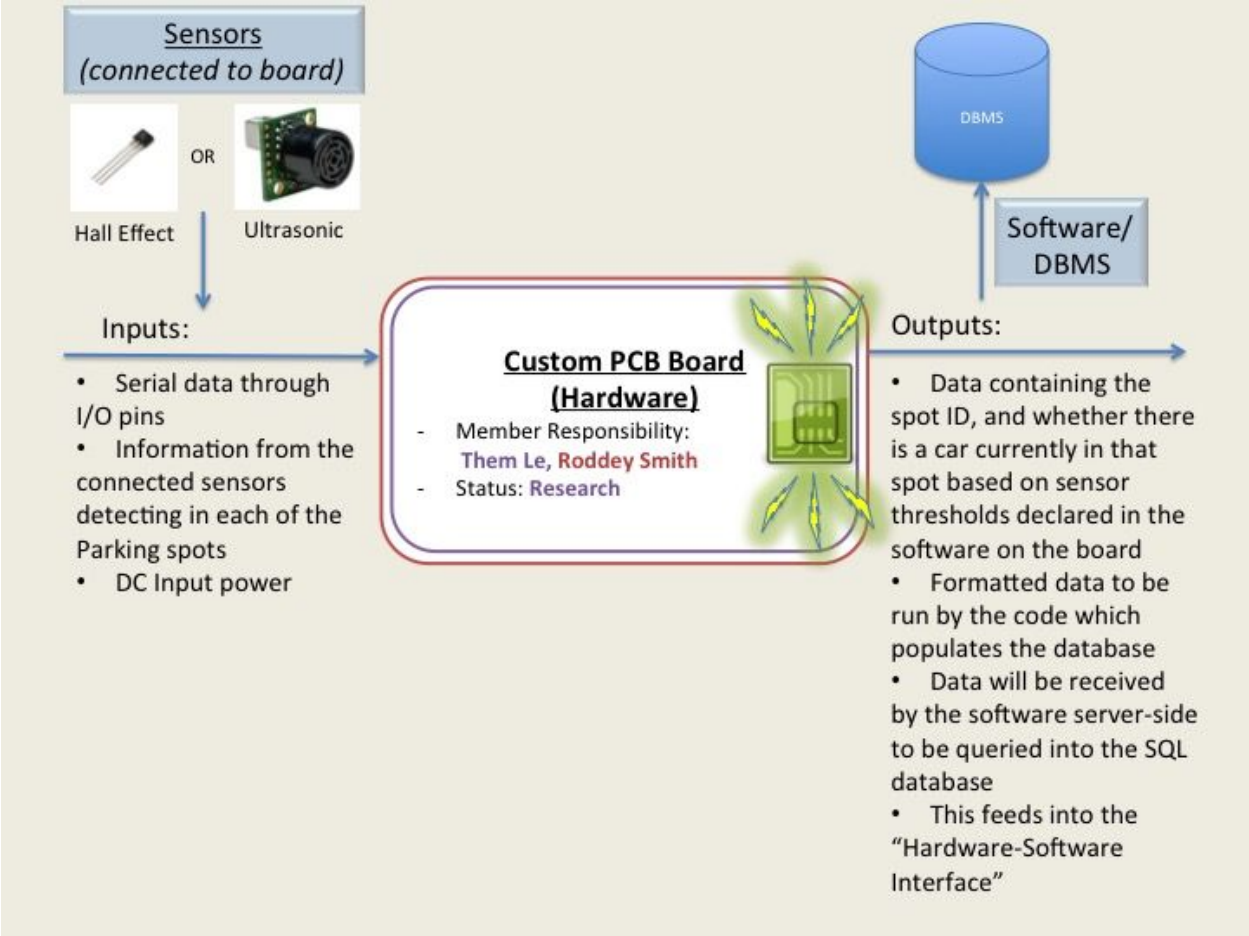
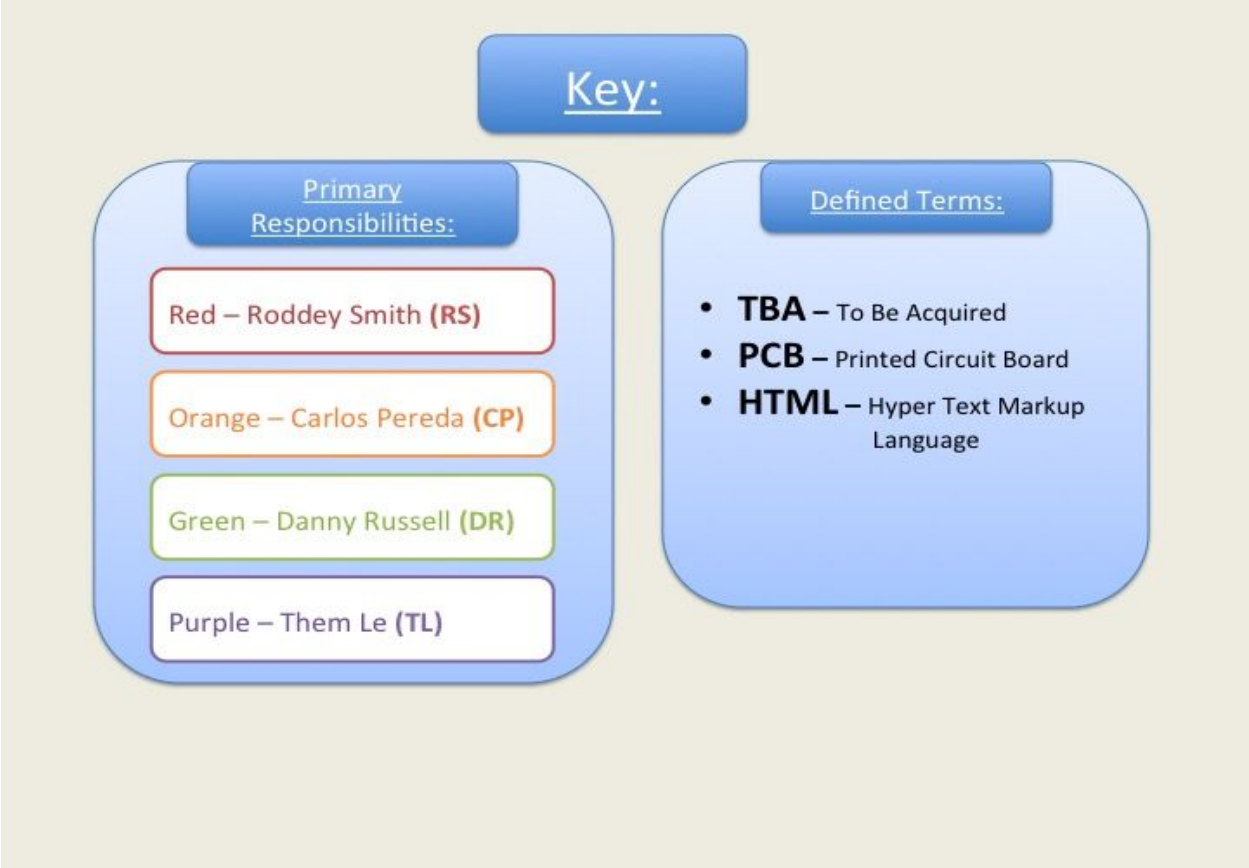


Figure 4 - Input/Output for the Custom PCB with Connected Sensors



IV. Project Budget and Financing - Preliminary Estimations:

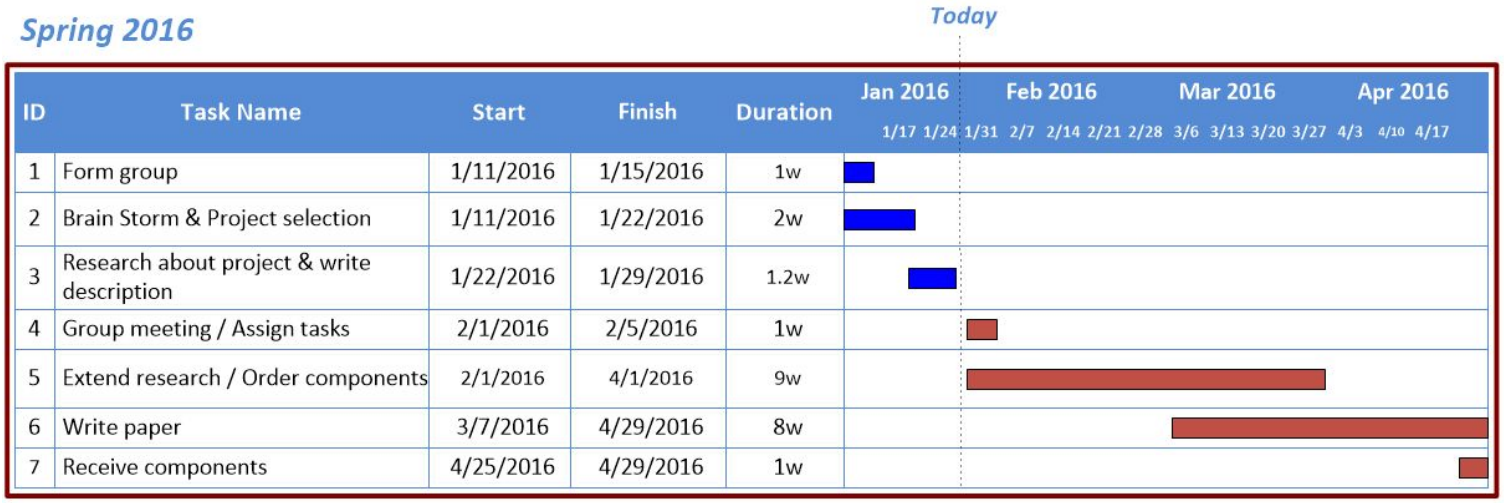
Component	Number of component	Cost
AT mega 328	1	$2.00
Hall Effect sensor	4	$1.00 (each)
Ultrasonic sensor	4	$5.00 (each)
12v AC transformer	1	$20.00

5V voltage regulator	1	$2.00
Diodes	4	$0.50 (each)
Microcontroller	1	$20.00
Other components		$100.00

Total: $170.00

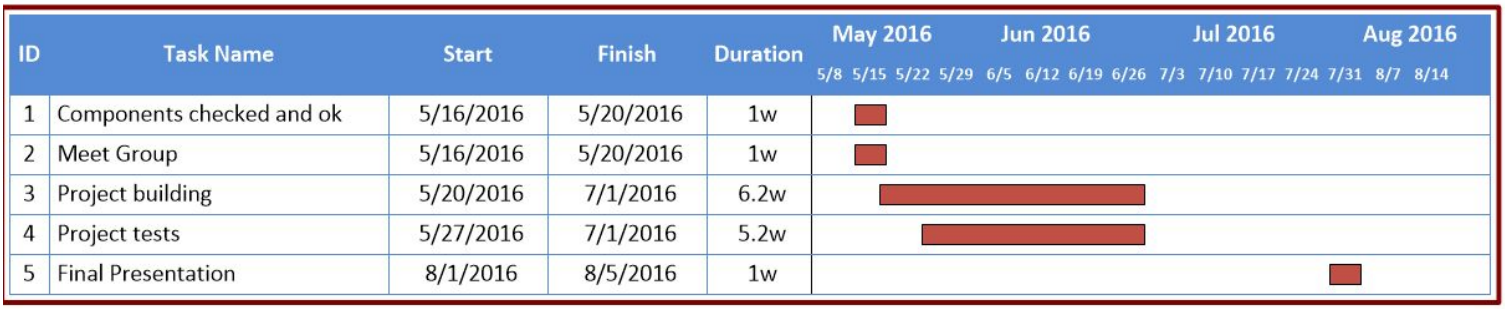
V. Project Milestones (Represented as Gantt Charts):

Spring 2016



ID	Task Name	Start	Finish	Duration
1	Form group	1/11/2016	1/15/2016	1w
2	Brain Storm & Project selection	1/11/2016	1/22/2016	2w
3	Research about project & write description	1/22/2016	1/29/2016	1.2w
4	Group meeting / Assign tasks	2/1/2016	2/5/2016	1w
5	Extend research / Order components	2/1/2016	4/1/2016	9w
6	Write paper	3/7/2016	4/29/2016	8w
7	Receive components	4/25/2016	4/29/2016	1w

Summer 2016



ID	Task Name	Start	Finish	Duration
1	Components checked and ok	5/16/2016	5/20/2016	1w
2	Meet Group	5/16/2016	5/20/2016	1w
3	Project building	5/20/2016	7/1/2016	6.2w
4	Project tests	5/27/2016	7/1/2016	5.2w
5	Final Presentation	8/1/2016	8/5/2016	1w