# EE 491 Senior Design Group Meeting

# Safe Communication Between Lead and Following Vehicle

# Week 8 Report

## Team Members:

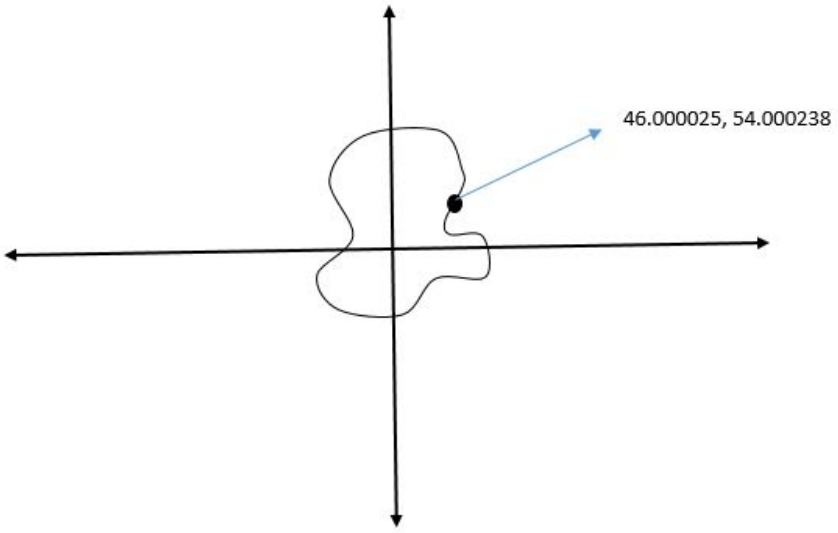
Bradley Stiff- Software Lead, Project Lead
Justin Wheeler- Software Lead
Sanguk Park- Scribe Lead, Communication Lead
Zhize Ma- Scribe Lead, Hardware Lead
Junho Chun- Hardware Lead
Yifan Lu- Hardware Lead
Jose Candelario- Project Lead, Communication Lead

## This Week Accomplishments:

This Sunday, we went to INTRANS to gather more information on the car and the certain ports it comes attached with. This is important because it gives us the data on which ports we can use to power the sensors and other devices that go along with the car. The car has the following:

- 2 USB ports
- HDMI input
- DB9 Female

We looked into the GPS as well and our software team, Justin and Brad, came to see if we could start gathering data from the GPS and see what the data format exactly looked like. The GPS model was the MTI G710 with a 115200 baud rate. This is important because we will have to match the baud rate with the transmitter and receiver we will be using which is the Xbee. The output of the GPS was indeed in NMEA format which we gathered with the default program, XSENS. The GPS format gave up to the 6th decimal place in longitude and latitude as shown below:




The dot marks the starting point of the GPS. The coordinates took some time to settle as the GPS had to auto calibrate itself and starting meandering over the grid. The NMEA grid format was in 16bits of data.

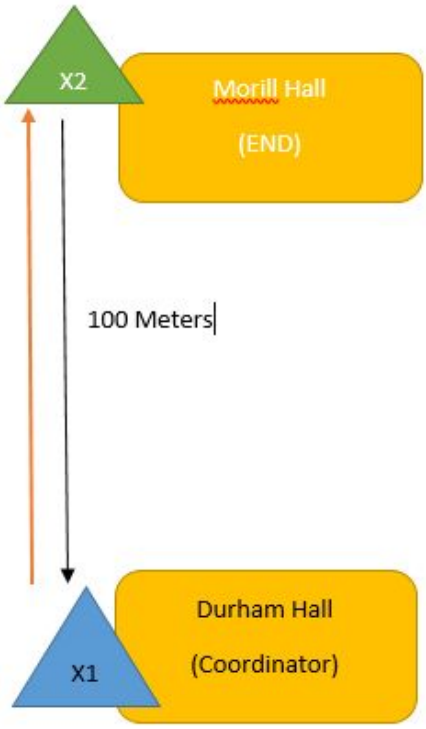
We also tested with the Xbee configurations. Having ordered two models, we downloaded the XCTU interface program to test the maximum range of the models.

| Specification | XBee | Xbee-PRO |
|---|---|---|
| Performance | | |
| Indoor/Urban | 100ft | 300ft |
| Line of sight range | 300ft | 1 mile |
| Data Rate | 250k bps | 250k bps |
| Serial Interface Data Rate | 1200bps-250kbps | 1200bps-250kbps |
| Receiver Sensitivity | -92 dBm | -100 dBm |
| Power Requirements | | |
| Supply Voltage | 2.8-3.4V | 2.8-3.4V |
| Transmit Current(@3.3V) | 45mA | 250mA |
| Idle Current | 50mA | 55mA |
| Power Down Current | <10uA | <10uA |

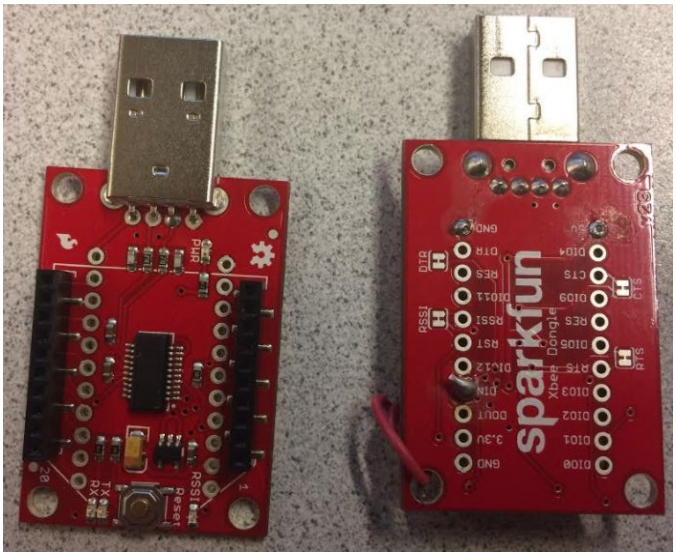
| | | |
|---|---|---|
| Our Choice | NO | YES |


The Xbee Pro S1 can operate in both a transmitter and receiving modes which allows both sides to exchange data. In the data sheet we tested the ranges of each Xbee to see if it matched the description. The Xbee has two modes: an API mode where both can transmit and receive data and then there is a transparent mode where one model operates as a Signal Antenna that transmits data while the other simply receives. We first tested the API mode to see if the range would be efficient in transmitting the GPS data from the lead car to the following one. In a more urban environment, we tested along Durham hall along the sidewalk that leads to Morrill Hall. We set both Xbees in API mode where X1 was the coordinator and X2 was the end. At approximately 130 meters, when sending messages along the Xbees, letters would get caught off and at anything less than the designated range, we got full communications.

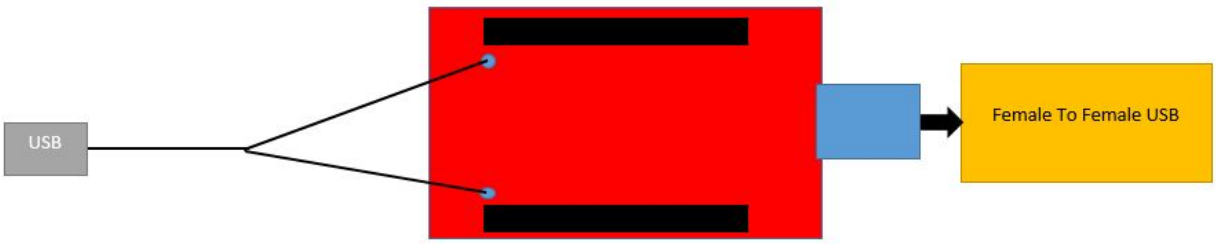
Our second test was in Coover Hall within walls. X2 was placed in the second floor near the 230 labs while X1 was located on the sofas of the 3rd floor. We had perfect communication in those settings, thus concluding the required range for communication. After these two tests we decided that the Xbee was sufficient in transmitting the GPS coordinates between the lead and following car.




Along with transmission of data, we are also responsible for powering the sensors and devices that go along with the car. The GPS unit uses a 4.5~33 V power supply, we we decided to use the Xbee USB dongle male input as a power source of the GPS. The GPS is normally powered through attaching it to a computer USB so we first had to see if the male port could output voltage as well.




The main function of the dongle is to configure the Xbee test for receiving and transmitting data by observing the data through a computer.
The dongle of the Xbee also has holes along the pins. These pins serve as extra configurations for the Xbee in which one of them is to hook it up to an external power source. We first tested if the male input gave voltage by giving it a power source of 5V through the holes and then hooking a voltmeter to the USB port. To our relief the USB did output the required 5V. This brought us to the design phase of the power source in the image below:




The Grey USB will be powered by hooking it to the laptop and the wires are connected to the +/- 5V holes of the dongle in which the Xbee Coordinator is attached. The female to female will connect to the usb port of the Xbee while the other end is attached to the USB port of the GPS. This way, both the GPS and the Xbee is powered.

# Individual Contributions (10/13~10/20)

| **Team Member** | **Contribution** | **Weekly Hours** | **Total Hours** |
|---|---|---|---|
| Brad Stiff | Researched alternatives for 16 bit to 8 bit conversion for our transmission format. | 4 | 31 |
| Jose Candelario | Prepared presentation for client and received some parts. Tested to make sure that the parts worked. | 6 | 43 |
| Junho Chun | Tested the range of the Xbee models. Visit Intrans to test transmission between GPS and Xbee. | 4 | 26 |
| Justin Wheeler | Research serial communication and wrote small programs to simulate the process of receiving GPS data over a serial communication. | 4 | 26 |
| Sang Uk Park | Wrote the weekly log. Tested the range of the Xbee models. Recorded the data format of the GPS from Intrans. | 4 | 32 |
| Yifan Lu | Making progress to figure out the actual max range that Xbee is able to handle comparing | 4 | 28 |

| | | | |
|---|---|---|---|
| | to the ones from datasheet. Preparing for lightning talk #3 | | |
| Zhize Ma | Went to Intrans to help test GPS, soldered on power supply for the sending Xbee. | 4 | 27 |

## Goals for Next Week

For next week, we will have to see if the Coordinator Xbee can receive the data from the GPS and transmit it to the END Xbee. We will also have to make sure that the Xbee configurations match the configurations of the GPS concerning bit rate and baud rate. This will decide if we will need to utilize a arduino in order to successfully transmit data from the GPS of the lead car and receive those coordinates to the following car.