EE 491 Senior Design May 2018 Group Meeting

September 2017~May 2018
Client: Vishal Mahulkar
Advisor: Dr. Hegdey Chinmay

Safe Communication Between Lead and Following Vehicle

Week 5~6 Bi-Weekly 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

Past Week Accomplishments:

This week, we have been testing extensively with the XBees and also looking at alternative hardware models that had longer transmission range. For the first time, we did extensive testing by applying the Xbees to a following and lead car. We used MatLab code as a simulation to send mock data between the remote Xbees as we drove throughout ISU campus. We were able to graph data at different areas.

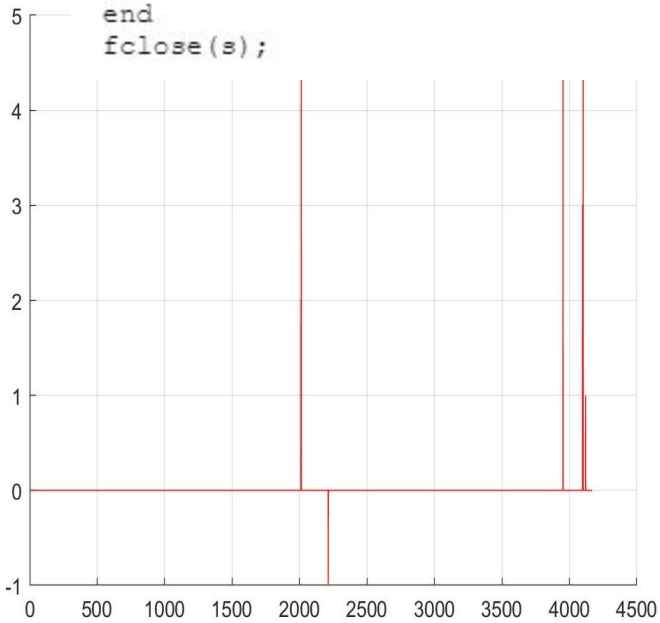
The code below shows the receiving loop and the sending loop respectively. For a period of approximately 10 seconds, we would transmit mock data to the receiving Xbee. Our objective for sending the mock data was to observe the range and efficiency in which the devices can send and receive data.

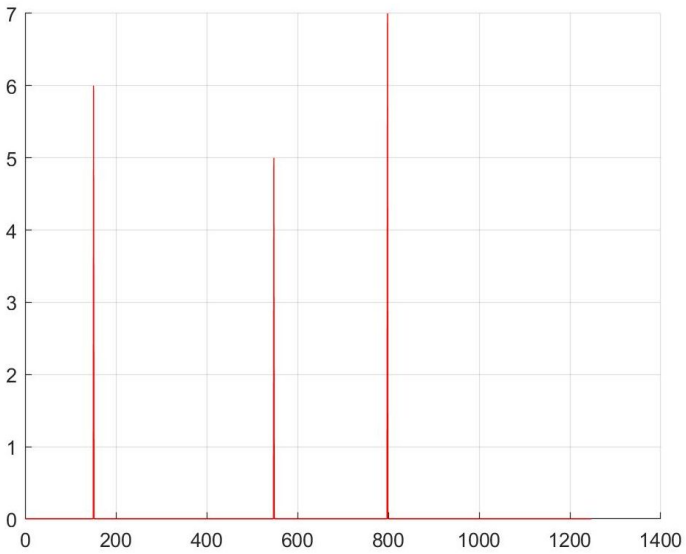
```
tic;
s = serial('COM4','BaudRate',9600,'DataBits',8);
fopen(s);
f = fopen('output.csv','w');
for i = 1:10000
j = fscanf(s);
fprintf(f,j);
end
fclose(s);
toc;
```

Receiving Loop

```
s=serial('COM6','BaudRate',9600,'DataBits',8);
fopen(s);
for i = 1:6

   fprintf(s,'0');
      fprintf(s,'1');

         fprintf(s,'2');

            fprintf(s,'3');

               fprintf(s,'4');

                  fprintf(s,'5');

                     fprintf(s,'6');
   fprintf(s,'7');

      fprintf(s,'8');

         fprintf(s,'9');

end
fclose(s);
```

Sending Loop





We created multiple graphs that displayed failed tests where the receiving Xbee was not able to receive all of the data in each timeframe. The axis for the graph is the following:

- The X axis is the amount of values transmitted
- The Y axis is the number of failed messages that we estimate went missing in between at the moment it shows on the x axis

The graphs above display two different scenarios in which the full data packet failed to receive. The graph on the left failed when there was a car between the lead and the following. This means that the following car had exceeded the maximum range in which it can receive data. The second case which is the case on the right, was in a similar scenario, but involved taking a sharp turn on the road which resulted in buildings being between the lead and following car. The obstacles would result in a reduced receiving range which caused multiple loss of received data until the following car finally was in close proximity to the lead.

Overall, our extensive tests with the transceivers showed us that it is adequate, yet would not hurt to have insurance by looking at more reliable devices. This week, our group met with our senior design advisor, Dr. Hegde, to show him the results of our testing. He stated that we should not worry too much about our range limits since the actual golf carts we will be using will be moving at much slower speeds.

Even with this remarks we felt the need to make changes. Even though we only lost data for a few seconds we knew that too much data could be lost in larger distances since data is lost in chunks not small bits hence our test might have been inaccurate since we also took the time that it took the XBees to finish transmitting and it was not very consistent. This could only mean that data was being lost in chunks not how the graph alone would suggest. Since the XBees we were using transfer data at 2.4GHz which does not do too well with buildings in between and have an optimal range of about 300 feet we started looking into the lower range XBees around the 800MHz.

Individual Contributions (2/11~2/23)

Team Member	**Contribution**	**Weekly Hours**	**Total Hours**
Brad Stiff	Set up the testing of the transmission of the GPS between the end and coordinator Xbees. Worked on learning python by using tutorials online in preparation for possible work with Anuj. This work will include cameras and deep learning algorithms.	8	58

Jose Candelario	Set up the testing method for the PX2 and overall planned how to test the Xbee range with the cars. Functioned as the receiving tester.	8	72
Junho Chun	Tested the Xbee range and acted as the lead car at reasonable speeds. Tested with the powering method for the PX2	6	49
Justin Wheeler	Went to Vermeer and tested the transmission of GPS data between the lead and following vehicles.	4	52
Sang Uk Park	Tested the Xbee range and functioned as the transmitter Xbee through connected laptop.	6	59
Yifan Lu	Tested the Xbee range and acted as the following car at reasonable speeds. Tested with the powering method for the PX2	6	52
Zhize Ma	Tested the Xbee range and acted as the lead car at reasonable speeds. Tested with the powering method for the PX2	7	54

Plans for the Next Two Weeks

Our group plan on accomplishing the following by the upcoming two weeks:

- Start to slowly implement the transmission code into the Robot Operating system and if everything is converted successfully, try to test out the efficiency through the ROS
- Regather all of the output data using the modified wires and start to create a way to efficiently distribute all the power needed in powering the sensors.
- Look into other XBee models that might give an even better result for our project. There are some models in mind around the 800 MHz range.