06/4/2018-08/04/2018

* Component Testing
* Breadboard testing
* Initial Communications
  + Transmitting and receiving data
* Error testing
* 7-seg display
* Accelerometer Test

09/04/2018

Prototype was capable of transmitting a series of numbers to its receiver. Objective was to work out how to determine the distance between transmitter and receiver.

Started by looking into using the system clock, if the system clocks between the transmitter and receiver were synchronised, then all the transmitter has to do is transmit its on-board time, the difference between the received time and the value at the receiver would give the time delay and ultimately the distance. Unfortunately, the arduino chips don’t possess a built in system clock, so synchronising the clocks was close to impossible.

Still attempting to utilise time delay for distance calculation, since the calculation is simple and less susceptible to noise, we looked into pulsed communication (each device is capable of transmitting and receiving). This would necessitate the adaption of the design, so we did some basic calculations:

* Radio waves travel at 300,000,000 m/s
* Oil rigs are approximately 150m x 100m (<http://theweek.com/articles/494480/oil-rigs-cities-sea>)
* If the base station was located at the centre of the rig, and the tag at the extremity, a pulse would have to travel 150m
* This would take 0.5 microseconds
* Even if the rig was 1km in diameter and the signal had to travel 1km, it would only take 3.3 microseconds
* Arduino chips only have a maximum resolution of 4 microseconds (<https://www.arduino.cc/reference/en/language/functions/time/micros/>)

Ultimately, while it would be possible to use time delay if we had sophisticated radio equipment with extremely accurate time keeping functionality, it is beyond the budget and feasibility of this prototype.

Still attempting to adapt the current prototype, we investigated using packet loss to determine the distance between the transmitter and the receiver. Since the stream of numbers that was being transmitted followed a defined order, if any numbers were missed, the amount of data lost could be determined and then the distance between transmitter and receiver could be estimated. The transmitter and receiver code were modified and testing began. It was discovered that the amount of information lost in a short period of time had a lot of random variation. Increasing the distance between the transmitter and receiver didn’t reveal much information, there was little consistency in the randomized loss second to second over short distances. Over slightly longer distances ~20m away, the signal from the transmitter was almost completely lost and not picked up by the receiver.

This property could be used as an asset tracking system, used to establish a safe zone which could set off an alarm when one of the tags drifts outside of the zone, but would not provide that much value for the client. We eventually decided that we would have to modify the design to make use of received signal strength (RSS). The receiver module we had purchased for the prototype does not provide RSS information, and the schematic is not detailed enough to understand where we could read the value from. In order to incorporate this functionality into the prototype, so that the distance between receiver and transmitter could be determined, research into a RSS Arduino receiver antenna was done, and the part was ordered.