# Indoor Mobile Robot Localization and Mapping

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# Outline



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# Introduction

Goal of project is to implement XBee modules to to localize a mobile robot using Cayley-Menger determinant's based on signal strength.

# Network Diagram

## Diagram of ZigBee network

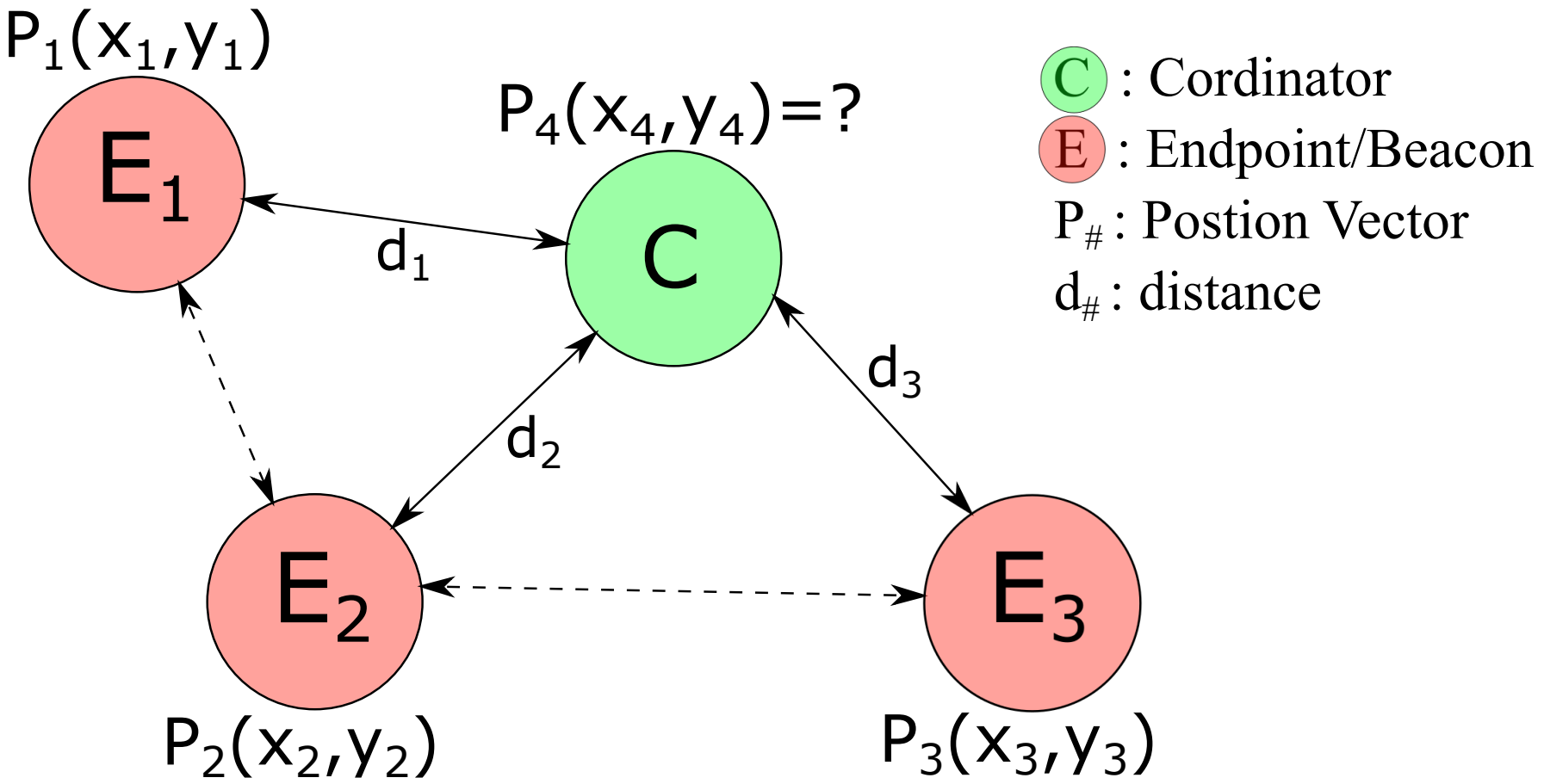


Figure: ZigBee network diagram

# Previously Done

- XCTU
- Powershell
- Backbone to XBee (linux c code)
- Calculate Distance - Ongoing
- Matrix Determinants Added - Ongoing
- File loading for beacon positions
- Trilateration equation implemented and Tested

# Previously Done

```
debian@beaglebone:~/localization/Darrah$ ./TestTableProg
| Beacon # |    RSSI     | Distance |
|----------|-------------|----------|
| Beacon 1 | -0x0C dBm | 0.039573m |
| Beacon 2 | -0x24 dBm | 0.627185m |
| Beacon 3 | -0x2D dBm | 1.767649m |
```

Figure: RSSI+Distance(FreeSpace) Output Table

```
debian@beaglebone:~/localization/Darrah$ ./TestTableProg
| Beacon # |    RSSI     | Distance |
|----------|-------------|----------|
| Beacon 1 | -0x0C dBm | 7.079458m |
| Beacon 2 | -0x26 dBm | 0.354813m |
| Beacon 3 | -0x2F dBm | 0.125893m |
```

Figure: RSSI+Distance(Miah Paper) Output Table

Note: Need to finish checking sources for "Miah Paper" solution

# Current Progress

- Calculate Distance - Ongoing
- Fixed localization Program - Ongoing

```
debian@beaglebone:~/localization/Darrah$ ./Test.sh Tests/TestProg4_2.c
Compiling Tests/TestProg4_2.c ...Done.
| Beacon # |    RSSI     | Distance |
|----------|-------------|----------|
| Beacon 1 | -0x25 dBm | 0.141254m |
| Beacon 2 | -0x24 dBm | 0.158489m |
| Beacon 3 | -0x20 dBm | 0.251189m |
debian@beaglebone:~/localization/Darrah$ ./Test.sh Tests/TestProg4.c
Compiling Tests/TestProg4.c ...Done.
| Beacon # |    RSSI     | Distance |
|----------|-------------|----------|
| Beacon 1 | -0x25 dBm | 1.767649m |
| Beacon 2 | -0x24 dBm | 1.575419m |
| Beacon 3 | -0x21 dBm | 1.115311m |
```

Figure: Current Distance Test Outputs

# Current Progress

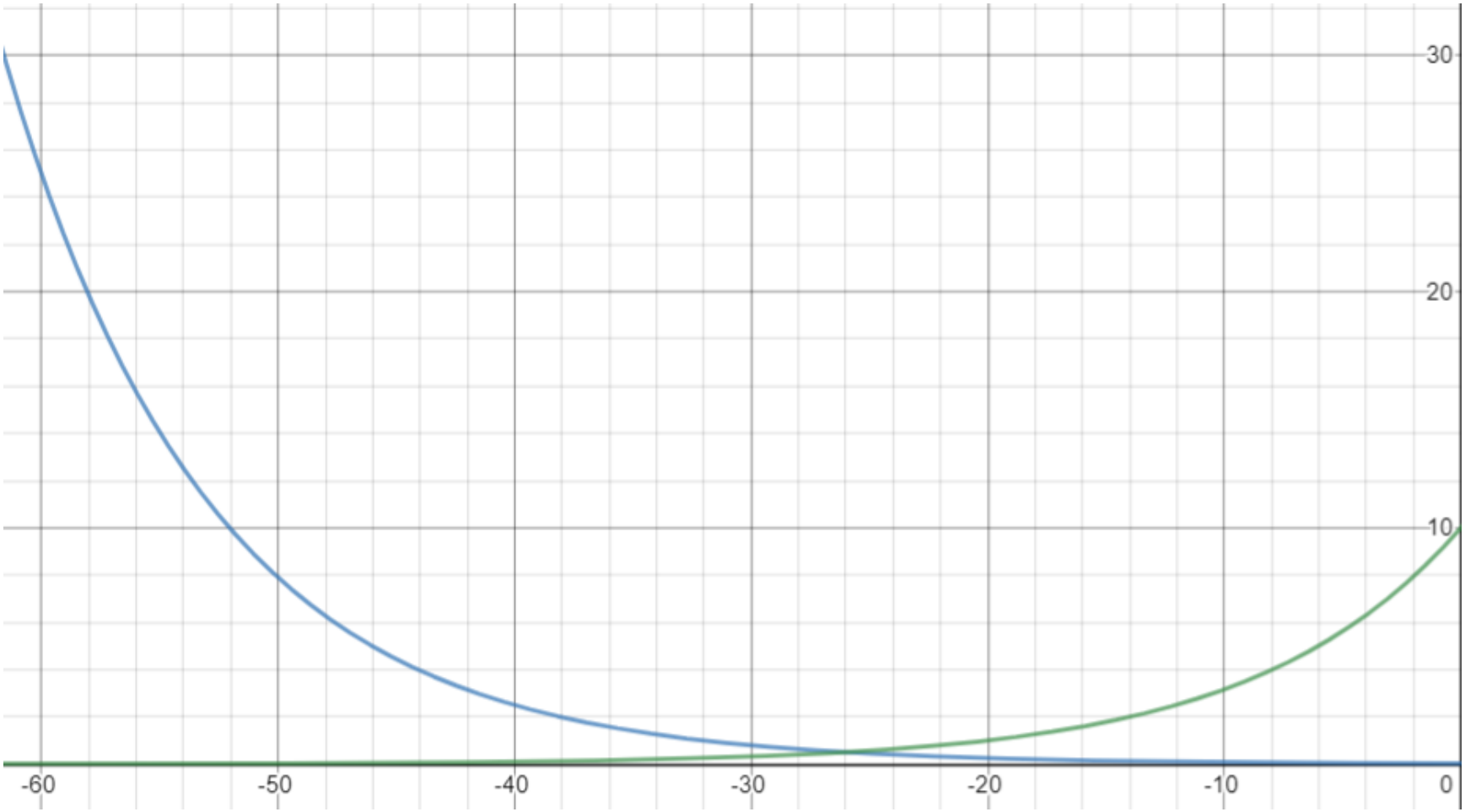


Figure: Current Distance Test Outputs

# Current Progress

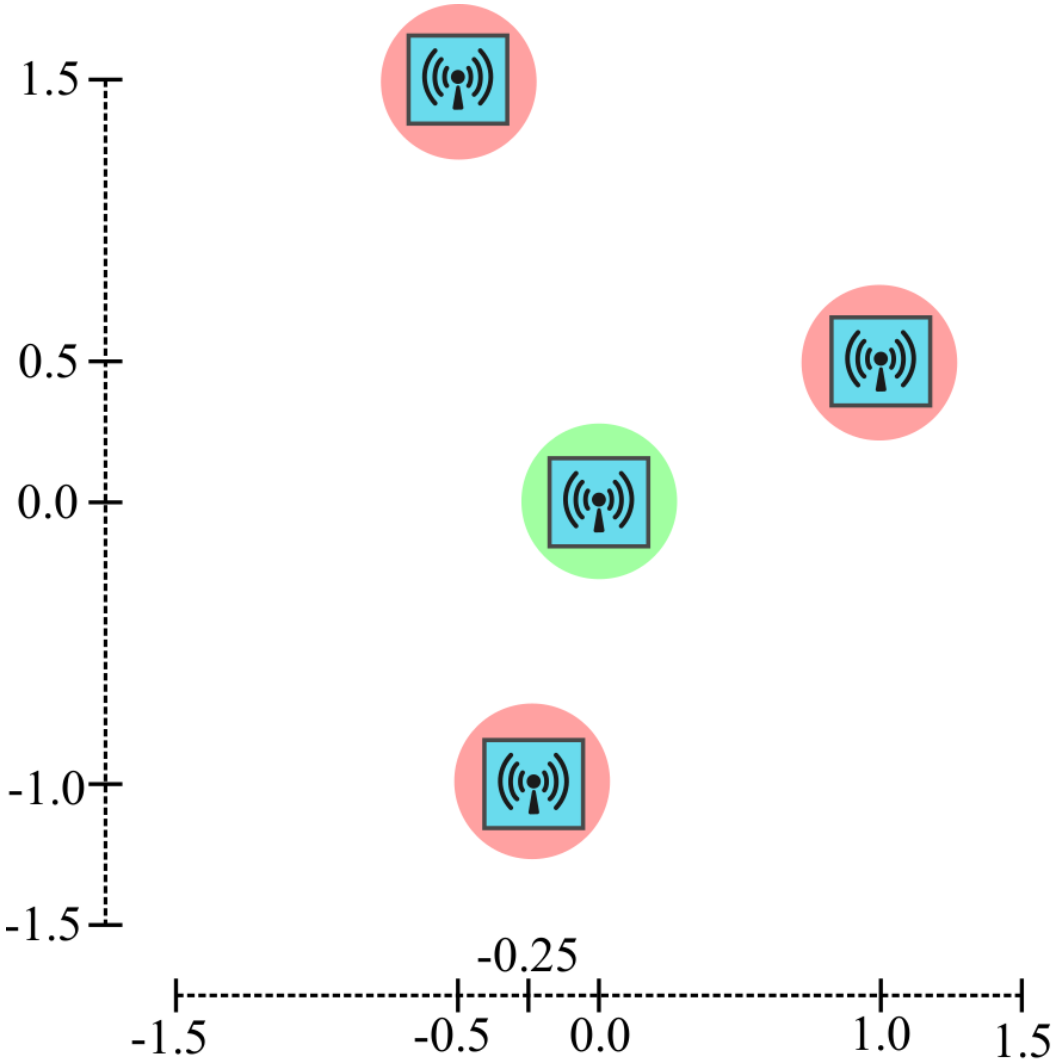


Figure: Test Setup

# Current Progress

```
debian@beaglebone:~/localization/Darrah$ ./TestProg.a
900.000000,540.000000,360.000000,8100.000000
Cordinator Position: (3.000000, 2.000000, 0.000000)
```

Figure: Old Distance Test Outputs

```
debian@beaglebone:~/localization/Darrah$ ./Test.sh Trilateration.c
Compiling Trilateration.c ...Done.
P1: (1.000000, 0.500000, 0.000000)
P2: (-0.500000, 1.500000, 0.000000)
P3: (-0.250000, -1.000000, 0.000000)
D1:1.575419, D2:1.575419, D3:1.251399
[DEBUG-RSSI] Step By Step
(-7.963094, 5.308729, 0.000000)
(0.000000, 0.000000, 3.500000)
(-8.842934, -10.611521, 0.000000)
sqrt(cmDet1234): 2.247622
(0.000000, 0.000000, 7.866679)
(-8.842934, -10.611521, -7.866679)
(-16.806026, -5.302792, -7.866679)
Point 4:(-0.371920, 0.067119, -0.642178)
[DEBUG-RSSI] 12.250000,-5.308729,7.074347,5.051807
Cordinator Position: (-0.371920, 0.067119, -0.642178)
```

Figure: Current Distance Test Outputs

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# Current Progress

- File Transfer Batch script
- Bit of extra cleanup/comments

# Future Directions

- Optimization/Consistency of localization program
- Putting together some API documentation
- Wiki Page