

Indoor Mobile Robot Localization and Mapping

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1 Introduction

2 Project So Far

- Network Diagram
- Previously Done
- Current Progress
- Current Progress

3 Future Directions

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

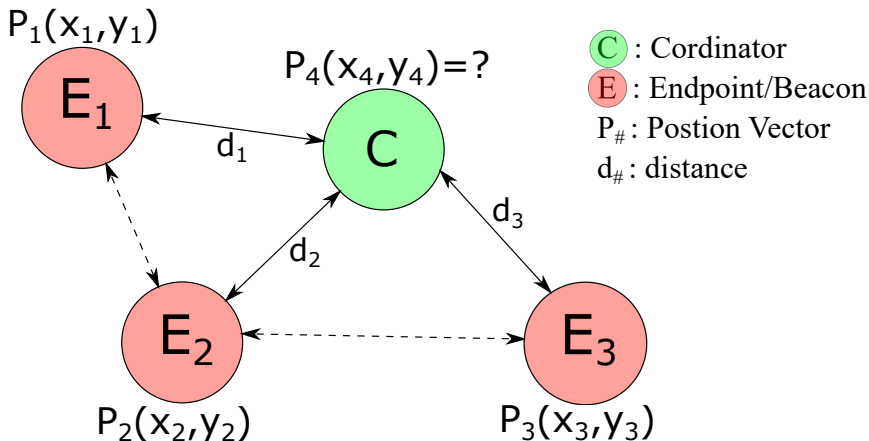


Figure: ZigBee network diagram

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

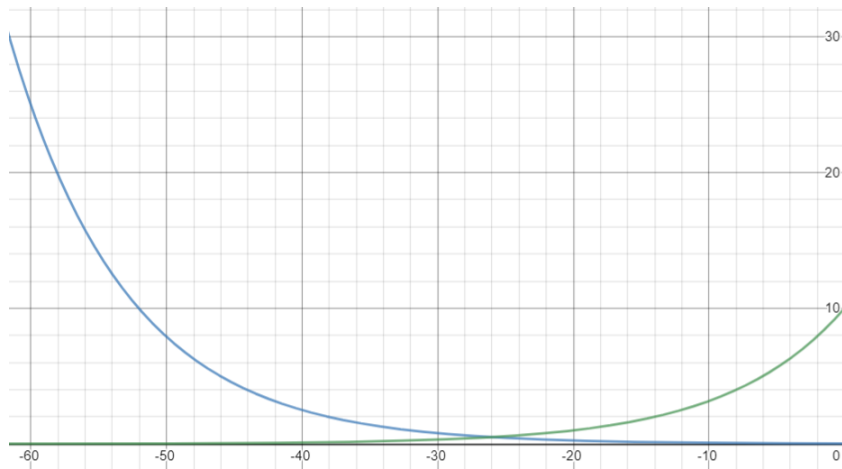


Figure: Current Distance Test Outputs

Current Progress

```
debian@beaglebone:~/localization/Darrah$ ./TestProg.a
900.000000,540.000000,360.000000,8100.000000
Coordinator 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
Coordinator Position: (-0.371920, 0.067119, -0.642178)
```

Figure: Current Distance Test Outputs

Future Directions

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