

Mobile Robot Target Localization Using Passive RFID Technology

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Overview

- To create a device that has the ability to locate stationary objects with passive RFID tags that require no power in an environment that has no signal or lack of
- Design an algorithm within Matlab that can localize the tag accurately and efficiently through the use of varying tags and antennas

Key Design Features

- UHF Antenna
 - Low gain (~5.5 dB)
 - Low front-to-back ratio (~10 dB)
- LF Antenna
- UHF and LF hard tags
 - High temperature and impact resistance
- RFID Reader
 - Dual antenna feature

Hardware Performance

- The project is about using tags that can be detected by antenna using radio waves, even if the tag isn't in visible range of the antenna. The antenna is placed on the robot, which then sweeps the room to find an approach the tagged object.

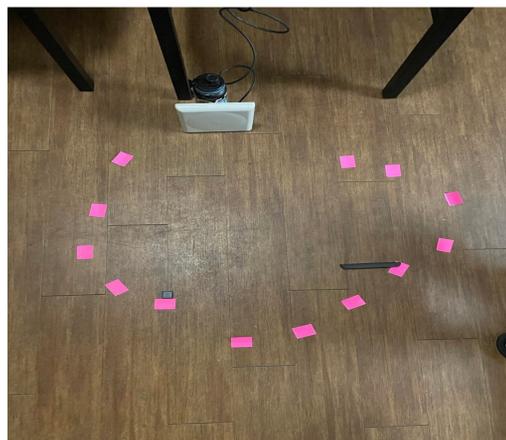


Figure 1. Post-Its were used to map out the range of the antenna using a UHF tag (right) and a LF tag (left).

Cost-Benefit Analysis

Components are too complex in design and easily purchasable. Cost-benefit analysis vital in component selection.

- High cost focus:
 - UHF Antenna - wider and longer read range to benefit sweeping algorithm
 - RFID Reader - easiest data acquisition for controller with both antennas



Figure 2. Our RFID Antenna attached to robot

Design Solution

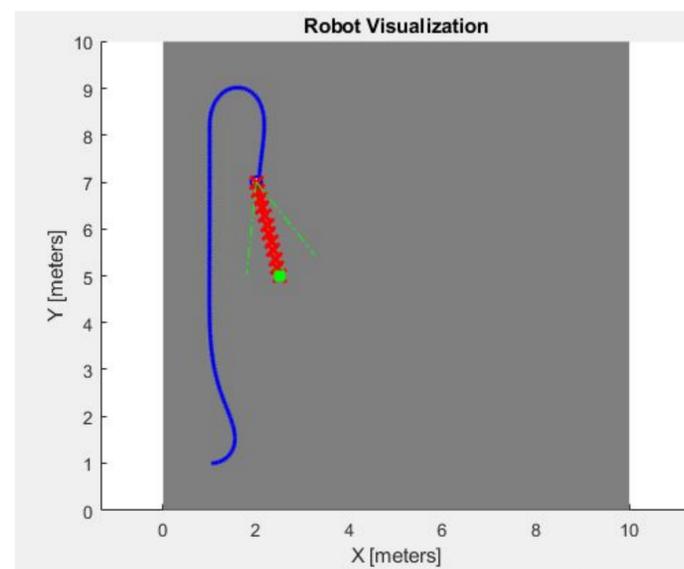
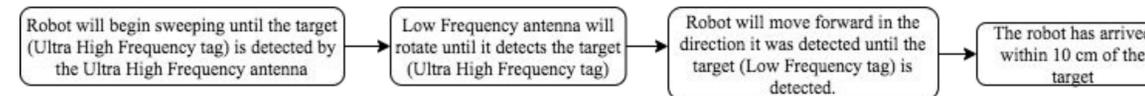


Figure 3. At this point of the simulation, the robot has swept the room, detected the tagged object, rotated to center itself with the tagged object, and is about to follow the red path to arrive at the object.

Future Improvements

- Changing the shape of the antenna range to be a more irregular, realistic shape
- Creating obstacles on the map to represent a more realistic environment



Figure 4. A robot using RFID tags on books to do the job of a librarian.

Societal/ Environmental Concerns

- There is some delay in the antenna, which can lead to there being slight inaccuracy in the robot, which can be a problem in biomedical applications of RFID.
- The robot takes a while to stop, can collide into people in search and rescue applications.

Acknowledgments/References

“How Does an RFID Asset Tracking System Work?” Lowry Solutions, 25 Nov. 2014, <https://lowrysolutions.com/blog/how-does-an-rfid-asset-tracking-system-work/>.

Owner, and Kelly Stark. “Understanding Passive RFID (Radio Frequency Identification) Technology |.” /, 22 Jan. 2019, <https://rfidworld.ca/understanding-passive-rfid-radio-frequency-identification-technology/1294>.