

WiFi Environment Mapping with Arduino - Initial Plan

The main goal of this project is to undergo research into the feasibility of constructing an indoor localised positioning system. Similar to that of GPS whereby an entities location can be calculated using a global navigation satellite system, I wish to use the surrounding access points of a building to locate an entity within a localised environment. This is under the assumption that there are many wireless access points located throughout the building so more accurate results may be achieved.

For this project I wish to construct an autonomous robot controlled by an Arduino board with the ability to collect data that could to be used to determine the location of an entity within a building. The idea is to place this robot into an unknown environment, such as the COMSC corridors and have it collect data from the wireless signals radiating throughout the building; including signal strengths and MAC addresses of the access points within the corridors at various points. I will also need to collect the current position of the robot, say from a relative, fixed point. From this data I wish investigate how accurately the location of a person can be determined within the same environment, having given them an application that uses the collected data to locate them.

The application will likely be in the form of a tablet or smart phone application that is also capable of detecting the MAC addresses and signal strengths of the surrounding access points, and can match this up with the previously recorded data from the robot to determine users' locations.

The practicality of this project is to demonstrate how robots can be used to survey and map out the environments that they are put in, and have this mapped out environment reused by other applications.

Aims and Deliverables

- Design and build an autonomous robotic system capable of knowing it's location,
 - Collision detection,
 - Collision resolution,
 - Motorised means of movement,
- Data collection,
 - Use a WiFi enabled Arduino shield to pickup surrounding WiFi signals,
- Determine and implement an appropriate solution to store the collected data,
- Analyse the data to determine how accurately a user's location can be determined,
- Build a mobile application that makes use of the data to determine a user's location,
- Investigate how accurately a user can be located within the environment.

Inclusion within the Reports

Interim Report

- Detailed description and analysis of the problem and what I intend to address,
- Background study relating to the project and any other related literature,
- Some initial research into a solution to the problem,
- An initial design of the autonomous robot including the specification of the design,
 - Hardware,
 - Software.

Final Report

- Full description of my findings from research
- Difficulties and limitations
- The final design and implementation of the entire project including the specification of the final design
 - Hardware
 - Software
 - Robot
 - User application
- Data storage backend
- Test plan and results
- Evaluation
- Future work
- Conclude on whether the aims of the project have been met

Work Plan

The plan in which I intend to take to complete this project will follow a weekly timescale and details the tasks I wish to accomplish within the year. Milestones are highlighted in bold and denote when a large part of the project is completed. These are likely to be in the form of physical deliverables.

- Background research (10th October - 21st November),
 - Has it already been done,
 - What systems are currently available,
 - Available technologies,
 - Investigate platforms that I may need to learn,
 - Investigate topics that I may have to learn.
- Initial design for the autonomous robot and storage backend (14th November - 21st November),
 - Circuit diagram for the robot,
 - Perhaps a database model for storage,
- **Build a prototype capable of collecting and storing data (28th November - 16th December),**
- **Produce the interim report (28th November - 16th December),**
- Examination period (17th December - 28th January),
- Investigate suitable methods of using the data to represent a position on a map (29th January - 5th February),
- Investigate to what extent I can accurately calculate a users location (6th February - 13th February),
- **Build an application that tries to locate a user and construct a final version of the robot (14th February - 5th March),**
- Perform a series of tests across the entire system (6th March - 12th March),
- Analyse the results and determine a set of improvements for possible future work and a conclusion to describe my findings (13th March - 19th March),
- **Produce the final report (20th March - 4th May),**
- **Viva (14th May - 15th June).**