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CPTS/EECS 555

Project Proposal

WiFi Localization of a Mobile Robot

Our purpose of this project is to investigate localization via WiFi signal strengths. We plan to build a mobile robot which can measure surrounding WiFi signals, and estimate its own location. Because the true locations of public access points are unknown or hard to measure, we will set up inexpensive routers at known locations relative to the robot. Next, we will implement the localization methods as found in various scholarly cited papers, as they provide a rich, in-depth insight of the requirements, and procedures used as part of the the localization process. Our major objectives are as follows:

* Objective 1: To build a robot controllable over wifi
* Objective 2: To analyze the surrounding routers’ signal strengths and estimate location
* Objective 3: To test the algorithms by driving the robot to an unknown location, and predicting its location using only WiFi signal strengths

Mechanically, the robot will consist of two motors mounted on either side of a plastic chassis. Running either motor independently will cause the robot to turn, and running the motors at the same time will cause it to follow a straight path. A camera will also be present in order to better control the robot. We believe this configuration will be easy enough to implement, while remaining useful for localization tests.

The robot will be driven by a Raspberry Pi Zero with onboard wifi. The robot’s control system will be written primarily in Python, and interfaced with over a wifi connection. An Arduino may be used to perform lower level motor speed regulation, in the event that simple on/off control is not sufficient.

WiFi localization will be determined using the algorithms and methods presented in the existing research. Most of the signal strength information is easily accessible from standard linux-based tools, and should prove straightforward to sample and perform analysis on. Once computed, the location data will be compared to the actual location of the robot, in order to evaluate the effectiveness of the methods implemented.

We plan to test the experiment in an open space with routers set up at known reference locations. The robot’s built in algorithm will allow it to move to a location unknown to us, then we will proceed and trace its coordinate through the combination of the three routers and signal strengths. The robot’s position will be measured directly relative to the routers, and compared to the robot’s computed position.

Results will be presented via video recording, as installing routers and performing a full localization demo will likely prove too involved. We are excited to purge our curiosities in this project as well as combine our knowledge of networks with that of physical hardware. This experiment will surely satisfy our thirst to learn and we are eager to gain new insight and make discoveries. The existing research appears interesting, and we look forward to completing the project.

<http://www.robesafe.es/personal/bergasa/papers/ISIEWifi2005.pdf>

<https://buleria.unileon.es/xmlui/bitstream/handle/10612/2013/Oscar.pdf?sequence=1>

Indoor Intelligent Vehicle localization using WiFi received signal strength indicator

<https://ieeexplore.ieee.org/document/7918849>

On the Performance Analysis of Wifi Based Localization

<https://ieeexplore.ieee.org/document/8461835>

An Indoor Localization Method Based on RSSI of Adjustable Power WiFi Router

<https://ieeexplore.ieee.org/document/7406094>