

Room-Level Indoor Localization

Fan Wai Hang, Tsang Siu Lung, Yam Yin Lung

Advised by
Professor ZHANG, Qian

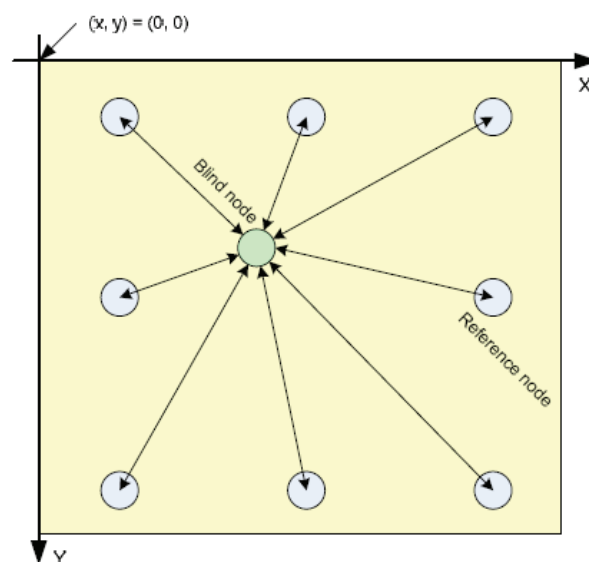
INTRODUCTION

Room-level localization is indoor localization taken to a higher level of precision: specific areas within a particular room in a building. This poses even further problems for the development of wireless technology. Nevertheless, it is crucial for the advancement of ubiquitous computing.

In our project, we propose a new methodology for room-level localization. We are going to achieve our target by studying others' work on this subject and trying to make improvements.

NETWORK OVERVIEW

Below is a diagram of an indoor location estimation network.



Location Estimation Network

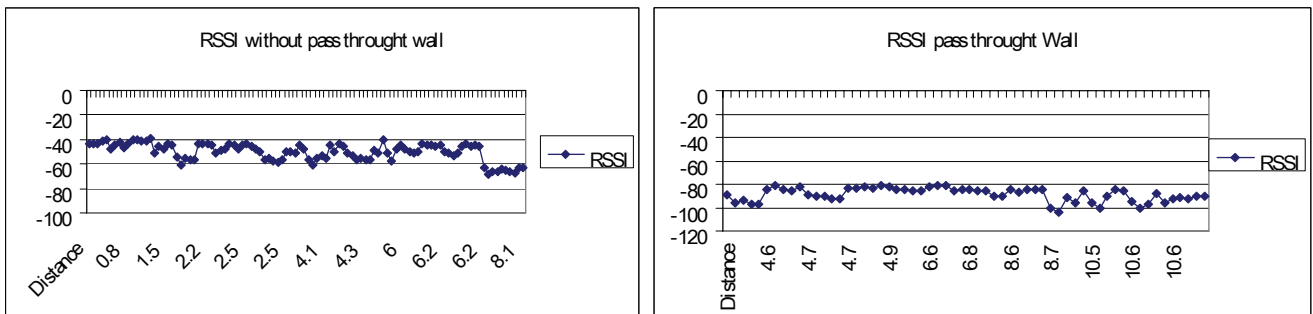
Reference nodes must be configured with X and Y values that correspond to the physical location. The main task for a reference node is to provide “reference” packets to the blind node. Reference packets contain X and Y coordinates of the reference node. A blind node communicates with its nearest reference nodes, collecting X, Y and received signal strength indicator (RSSI) values for each of these nodes. Then it uses location engine hardware to calculate its position based on the collected parameters from several reference nodes.

RSSI

The formula for calculating RSSI is:

$$RSSI = -(10n \log_{10} d + A)$$

- n: signal propagation constant, also named propagation exponent.
- d: distance from sender.
- A: received signal strength at a distance of one meter.



OUR ROOM-LEVEL LOCALIZATION ALGORITHM

The following is the data flow of our system:

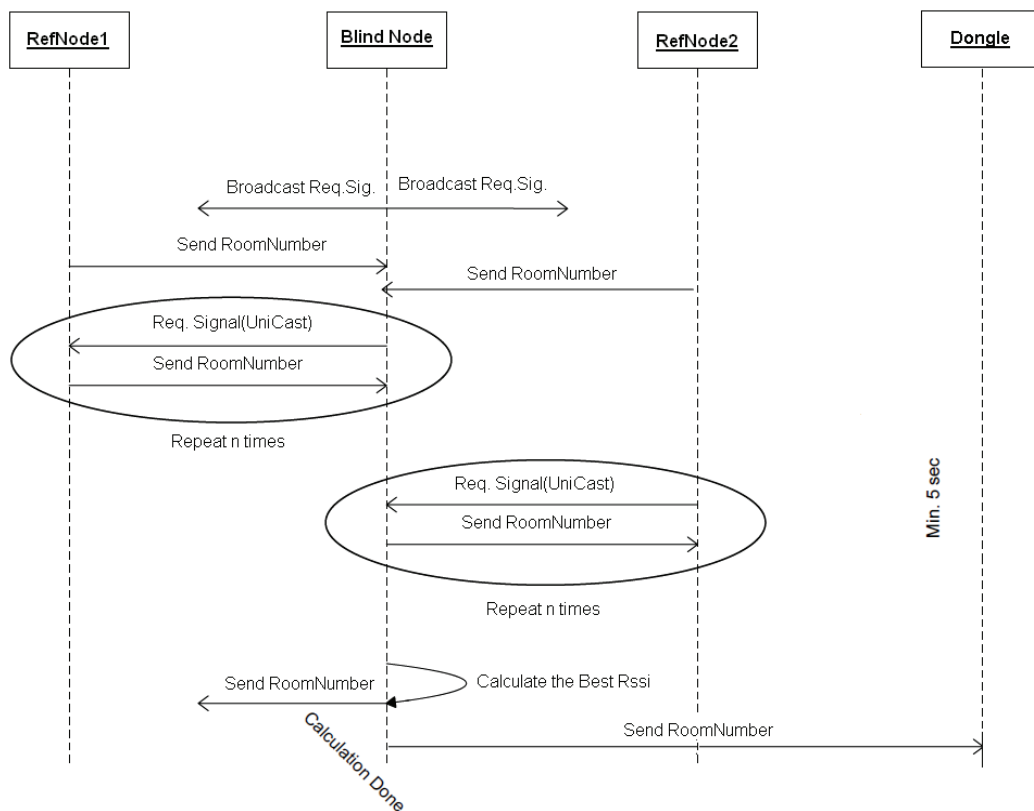


Figure: Blind node collecting data and performing location estimate

The blind node listens to several reference node packets and uses RSSI to compare their signal strengths and find out the nearest reference node. If the signal strength of this reference node is very large, then the blind node will trace the nearest reference node's room information directly and consider itself to be inside the room of this reference node.

RESULT

In indoor localization, the methodologies using room area as result rather than specific X, Y coordinate, the accuracy increase. The methodologies can perform 99% accuracy if there's enough time for enough for every environment.

A room level algorithm is the major accomplish that perform better than TI algorithm in room level environment. FYP Group 176's room-level localization methodology can provide 99% accuracy if there is enough time for collecting environment information.

CONCLUSIONS

Inside an environment, there are several critical point affect the accuracy. The size, the open or close of window, and the thickness of the window affect the signal strength. The structure and material to construct the wall affect the signal strength most. (Thickness, steel bar inside the wall, etc) The status of the door, open or close provides a totally difficult result. Every indoor environment is different, every environment had a unique constrain and environment information. The Methodology try to summarize constrain and environment information into few parameter for algorithm calculation.