

**Wireless Communication Final Report**  
**—Indoor Localization**

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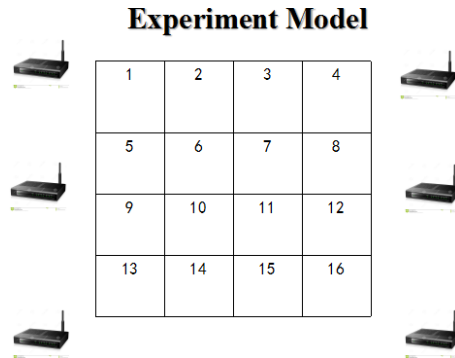


Figure 1: Experiment model

## Section 1 Introduction

In this semester, I mainly worked with Senior Li Yang, and my main work was to study the algorithm of indoor localization and helped deal with the experiment data. In this report, I will introduce the detail of indoor localization in Section 2 and introduce my contribution in Section 3. Finally, I will give a brief summary.

## Section 2 Indoor Localization

### 2.1 Introduction

Indoor localization is of great importance for a range of pervasive applications, attracting many research efforts in the past decades. In this section, I will give an introduction to an algorithm based on fingerprint database.

### 2.2 Experiment Model & Fingerprint Database

The experiment model is as shown in Figure.1. We can consider the boxes in this figure as a room, and this room is separated into several regions. (In this figure, 16.) In this room, we have several WiFi APs. The purpose of this WiFi localization algorithm is to use these WiFi APs to locate which region we are in.

The key tool of this algorithm is fingerprint database. In this data base, we would store the average strength of each WiFi AP in each region. The average strength in each region is called fingerprint, so that the database is called fingerprint database.

### 2.3 Indoor Localization Algorithm

This algorithm has 4 steps. The first step is building the fingerprint database. The second is selecting WiFi APs. The third is calculating the minimum Euclid Distance and the last is examining the adjoined regions.

The first two steps was introduced as before. In this subsection, we will mainly talked about the last two steps.

After we select several WiFi APs, we will use the current strength of these APs to locate our location. We calculate the Euclide distance between these current strength and the fingerprint database of each region and choose the region which has the minimum Euclid distance as the target region.

Because only use the minimum Euclid distance may cause some error, we will next examine the adjoined regions. Take Figure 1 for example, after some calculation, we choose region 1 as the target region and now we will examine region 1, 2, 5, 6.

For these region, we calculate

$$P = \prod_{r=1}^N \left[ \frac{1}{M} \sum_{k=1}^M \frac{1}{\sqrt{2\pi}\sigma} \exp - \frac{(\hat{o}_r - o_k)^2}{2\sigma^2} \right]$$

In this equation, N is the number of APs, M means in this experiment, we measure the strength M times.  $\hat{o}_r$  is the average strength of region r which is stored in the database,  $o_k$  is the strength measured in the kth time.

For these selected regions, we calculate this P and find the maximum one as the target region.

## Chapter 3 My work

In this experiment, my main contribution is measuring the strength of each WiFi APs and deal with the data. The code which I use to deal with the data and the Java code which realize the algorithm can be found in the packet.

I also take part in the experiment at a factory of Foxconn.

## Chapter 4 Summary

In this semester, I read several papers and do some experiments in Dr.Tian's Lab. I learn a lot in the domain of indoor localization. Thanks to the teach of Dr.Tian and Senior Li.