APPLICATION OF RSSI ON INDOOR SECURITY WIRELESS NETWORK

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ABSTRACT
A smart security system in indoor environment using the Received Signal Strength Index (RSSI) is proposed in this paper. RSSI shows irregular wave pattern with low variance in common closed field. If dramatic RSSI signals happen in a closed environment, it means that someone may have entered the field or something has moved its position. Furthermore, this new technology can simply be used as a wireless security system without the necessity of preparing any special experiment equipment, all that is required is a normal labtop and wireless LAN cards.

KEY WORDS
Wireless security system, RSSI, wireless LAN card

1. Introduction

In wireless communication systems, the most important consideration is the multipath fading effect [1] between the transmitter and the receiver. Due to multiple reflections from various objects, the electromagnetic waves travel along different paths of various lengths. The interaction between these waves causes multipath fading at a specific location, and the strengths of the waves decrease as the distance between the transmitter and receiver increases. The mechanisms behined electromagnetic wave propagation are diverse, but can generally be attributed to reflection, diffraction, and scattering. Fading is often studied by separating the variation into two separate effects of long-term fading [2] and short-term fading [3]. Long-term fading is typically caused by relatively small-scale variations in topography along the propagation path. Short-term fading is typically caused by the reflectivity of various types of signal scatterers, both stationary and moving. The Doppler effect [4] and various man-made noises [5] also affects the multipath fading. Moreover, the multiple signal paths that arrive at the receiving end, displaced with respect to each other in time, is referred to as delay spread [6]. The arrival of two closely spaced frequencies with different time-delay spreads, having a strong potential for correlation, is referred as the coherence bandwidth [7-8], and RSSI signals are usually used to represent the multifading effect sensored.

From previous explanation, the sigals from RSSI can be unbalanced due to environment changes or multipath fading. If we offer a simple and stable environment, we will find the variation of RSSI is unclear, and the link quality values are centralized at some values. Knowing its unique characteristics, we can use RSSI as a motion detector under closed or stable environment. When violent changes occur, RSSI will create greater amplitudes and high variances. So if great changes of RSSI signals arise, it is positive that there are unusual movements around the surrounding, achieving the goal of wireless security system.

2. Changes of RSSI Signals due to Interference

The interference of environment variation of RSSI signal in a closed field is studied in this section. The scheme of RSSI measurement is shown in Fig. 1, and the measurement strengths of RSSI is shown in Fig. 2(a) and Fig. 2(b). At the beginning, the RSSI has huge unstable variations caused by humans operation inside the room, and later opening the door to leave. Between 670 ~ 700 seconds, we have another huge unstable variation of RSSI,

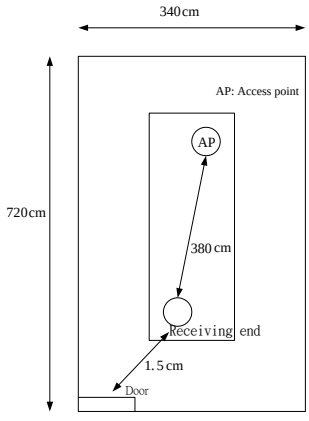

Figure 1: The scheme of RSSI measurement.

this time caused by suddenly opening and closing of the door from outside of the room. Soon, it will return to its original stable status. Also we take successive 5 points of RSSI signal to calculate the standard deviation of RSSI as shown in Fig. 3(a) and Fig. 3(b). We can see that the locations of huge RSSI variation in Fig. 3(a) and Fig. 3(b) corresponds with that of Fig. 2(a) and Fig. 2(b). Therefore, it indicates that there are environment changes when the standard of RSSI is between 2 and 5.

3. Distant of Detection

This section describes the variation of RSSI in relations to the distance between the source of interference (door) and the receiver (labtop). If the distance between the receivor and the source of intereferece is too great, it is possible that the changes in the surrounding cannot be detected. This idea is shown in Fig. 4, and the computations of interference reaction between distance and access points (AP) are shown in Table 1, where the distance refers to the length between the receiving end (labtop) and the interference end (the door) From Table 1, we can see that the ideal reaction range is within a radius of two meters.

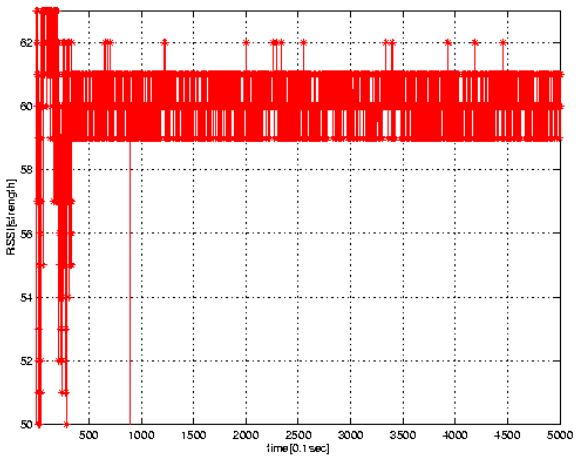

Figure 2(a): The strength of RSSI signal (0-500sec).

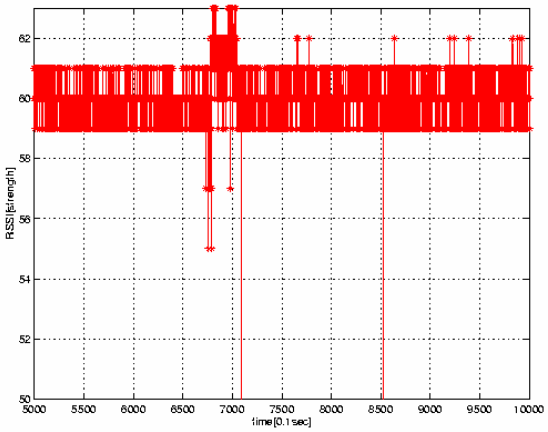

Figure 2(b): The strength of RSSI signal (500-1000sec).

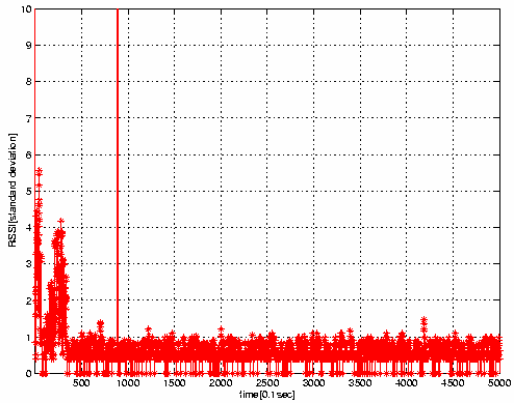

Figure 3(a): The standard deviation of RSSI signal (0-500sec).

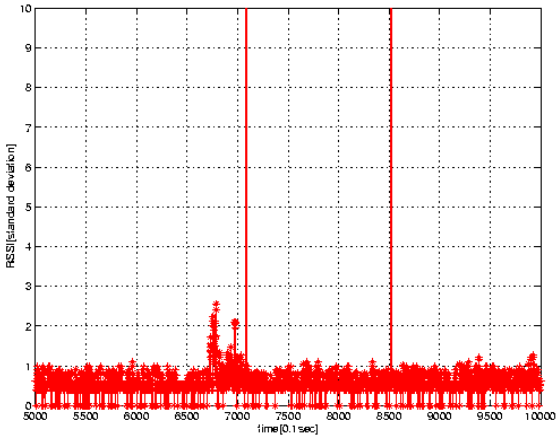

Figure 3(b): The standard deviation of RSSI signal (500-1000sec).

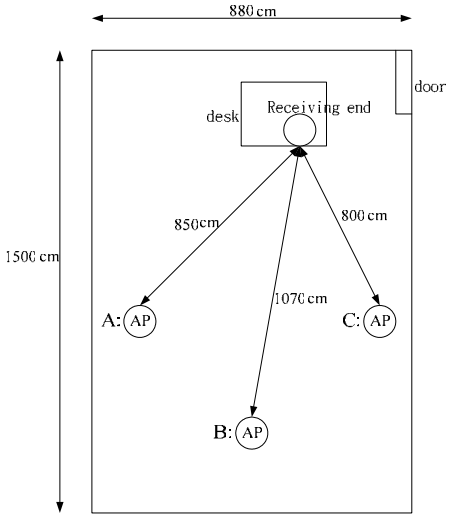

Figure 4: The scheme of distance reaction meansurement.

Table 1: The interfence reaction between distance and access points.

Distance(cm) / location	80	160	200	240	320	480
A	O	O	O	X	X	X
B	O	X	X	X	X	X
C	O	O	O	O	X	X

O: The reveiving end can detect interference variation.
X : The reveiving end cannot detect interference variation.

4. Similation Result

We use VC++ 5.0 software to create a program for detecting the RSSI signal, as shown in Fig. 5. Its function is to show the "***Time***" when unstable RSSI variation occurs.

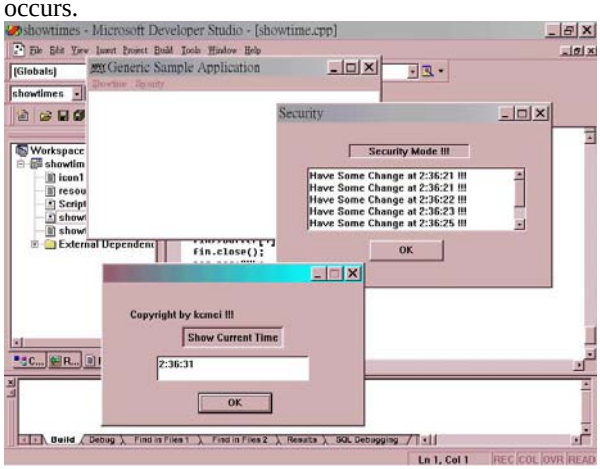

Figure 5: The detection time results of RSSI variation.

5. Conclusion

The equipment needed for this wireless security system using RSSI is very simple. It is so straightforward; even ordinary individuals or families can achieve this. Therefore, this method is being called the "simple and easy" wireless security system. The only drawback is the interference source has to be within the ideal "two-meter" radius in order for this technology to work properly.

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