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Wifi Positioning System Using WLAN Signal Strengths by Block

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Abstract- Recently indoor WLAN positioning system has been given priority by utilizing the location-based information service. A positioning method, conventional triangulation techniques often rely on measuring the position of the user terminal but due to the interior walls and other obstacles accurate positioning is a difficult problem and the positioning error is large. In this paper, an indoor location system based on WLAN room (room), such as block (block) units of measure of the location of the user is presented. As a result, the proposed method compared to a conventional method in positioning error can be reduced by 50% or more was confirmed by the experiment results..

Keywords— Mobile Computing, Wifi, mobile networks, WLAN Signal, Block computing

I. INTRODUCTION

GPS (Global Positioning System) are dead spots and WPS (WiFi Positioning System) based LBS (Location Based Services) service is drawing attention [1]. In addition, smartphones are widely spread and proliferation of spread of wireless LAN coverage of WPS is also rapidly increasing. As a result, the WPS-based user positioning technology is actively being researched.

Typical techniques proposed so far are the positioning of the terminal that are recognized by the Access Point information in real-time position estimation utilizing a triangulation (Triangulation Method), and the position recognition to utilize a signal for the target space to pre-built information DB recognized by the real time signal information to indicate a location of the most similar fingerprinting (finger-printing) technique [2].

However, in the case of conventional indoor positioning technique presented in WPS interior walls if there is an obstacle such as a precise positioning is a difficult problem. In this paper, we propose how to increase the accuracy of the positioning WPS in indoor structures room such as block (block), separated by a unit measuring the user's location to offer, through experiments to analyze the performance of the proposed method.

The paper is organized as follows. First, in Section 2 with respect to existing methods related to recognize the WPS, Section 3 "block-based positioning techniques which WPS 'proposed. Experiments in Section 4 analyse the performance of the proposed method and Section 5 concludes the paper.

II. LITERATURE REVIEW

Representative of the existing technology of WPS technology fingerprint techniques, there is triangulation. Fingerprint technique is to unit size, positioning target area is divided into a reference point to this point (RP, Reference Point) is called [3] and a point of reference for the signal strength of the AP listed by gathering nearby, save it. As shown in Figure 1 since that is recognized by the user's device and the signal strength of the AP list, the signal strength is collected similarly to the user terminal in the location area represented by the technique.

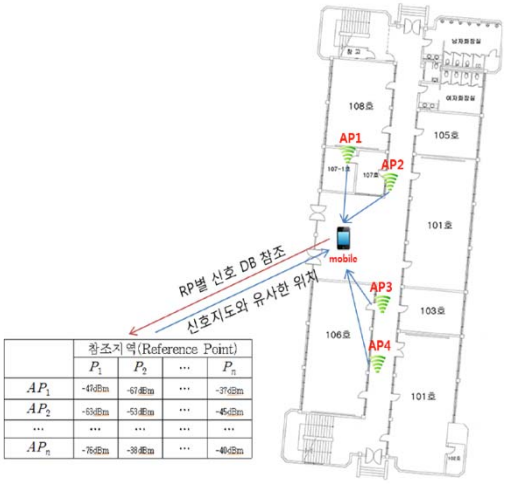

Fig 1 The behaviour of fingerprint technique

The advantage of the fingerprint technique is that it has an error range of 1 ~ 3m [4]. Once they have accumulated database techniques they may derive more accurate results. But the downside of fingerprint technique is that it is difficult in pre-investigation stage. A reference point by the process of collecting all the information must be done manually and it requires a lot of time and efforts. In addition, if the AP is extended or deleted, the topography of the target area has to be remodelled that hassles us to collect new data.

Triangulation of the user terminal that is recognized by the signal strength of the AP list near the terminal is recognized by using the AP and the terminal, the three terminals using the distance in a straight line out of the position estimation method. Prior knowledge of the location and positioning of the AP of the target area map is a must.

There is very small difference compared to the fingerprint technique, which requires a prior investigation. But it is subject to extreme variations in the signal strength of the AP, the influence of the surrounding environment is easy to obtain because the error is increased. The average actual room space triangulation errors appear to be 4.5m [5]. The main cause of errors a loss due to co-channel interference signal is due to wall or an obstacle.

The proposed method is a mixture of the two approaches in a typical room (Block) by the AP to establish the value of the signal loss of the fingerprint technique, which reduces the hassle of pre-triangulation surveys and the major cause of the error signal by obstacles could compensate for the loss of the line.

III. DB BLOCK UNIT USING WPS AP RSSI LOSS

The proposed system is basically for indoors, the position estimation by the blocks when dividing the blocks used in the AP signal loss due to the wall or the obstacle to the building, the room is recognized by the signal loss and the location estimate to be read from DB used

A. AP by the obstacle in consideration of the loss of signal triangulation

Access Point in order to discriminate a block in consideration of the loss of triangulation uses the RSSI. First official fleece (Friis Equation) using user terminal measures the distance between AP and recognition. The formula is as follows fleece:

$$P_R = G_T G_R P_T \left(\frac{\lambda}{4\pi d}\right)^2$$

- P_R = Terminal power, P_T = AP power,
- G_R = Device power gain, G_T = AP power gain,
- λ = Wavelength, d = the distance between devices

The formula using RSSI according to the reception terminal device and the AP can calculate the distance between the straight lines. Triangulation of the three (or multiple) of the fleece against AP can be obtained by the formula using the following straight-line distance between the calculated positions of the terminal.

$$d_1 = \sqrt{(x_1 - x)^2 + (y_1 - y)^2}$$

$$d_2 = \sqrt{(x_2 - x)^2 + (y_2 - y)^2}$$

$$d_3 = \sqrt{(x_3 - x)^2 + (y_3 - y)^2}$$

- d_1, d_2, d_3 straight-line distances from the AP and the terminal,
- (x_n, y_n) The coordinates of the AP, (x, y) the terminal 's coordinates.

Expressions have been shown in the figure, due to the obstacles in open space assuming that there is no loss of signal, such as the shape shown in Figure 2.

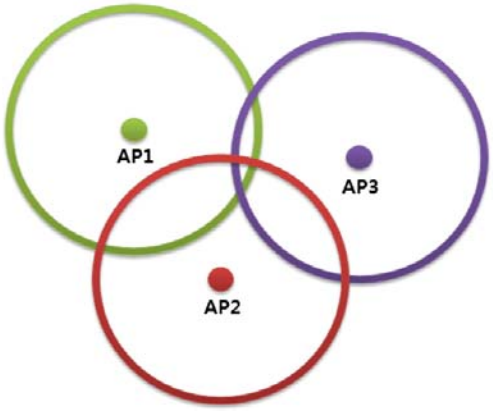

Fig 2 An example of triangulation

Location using triangulation to estimate the time, the three values (distance in a straight line with the terminal), the intersection of two radius, is the location of the terminal. However, considering the environment in the room at the time of positioning the obstacle by the AP's RSSI signal is largely lost and that case is shown in Figure 3, which may frequently happen.

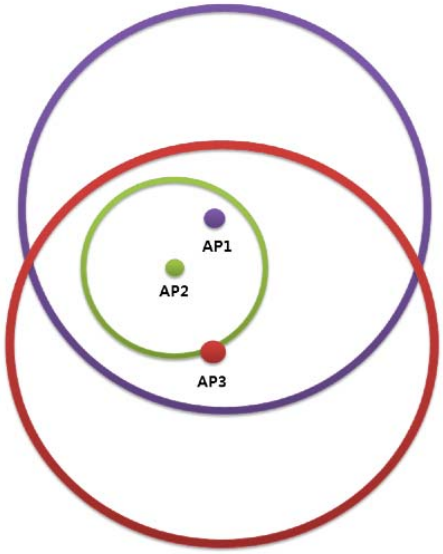

Fig 3 When the signal is lost by obstacles Examples

Some of the AP signals are lost, but there are various cases depending on whether, AP1 and AP3 in the case of Figure 4, the signal is lost and the linear distance larger than the actual case can be seen as measured. If this does not occur because of the intersection of the three values, it results in errors greater than 5m. For this reason, in conventional triangulation when recognizing through Block, user terminal belongs to an accuracy of less than 50% that is confirmed. Block must be properly recognized by known Access Point if the signal is lost because of which these errors should be reduced.

So the three intersections of the circle made of AP is not to artificially enhance the intersection but it is made in consideration of the loss of RSSI is a triangulation. The AP List is to be sorted in order of signal strength when signal

strength is strongest AP [0] is the smallest and the signal loss is high, so the probability of the nearest signal terminal of the signal is recognized by the AP list. Also, both the measured signal is too strongly and does not meet these two sources of AP to attenuate the signal to create an intersection point of the circle.

Thus, the signal strength, reinforcement/ attenuation results can be obtained which is in the case of Figure 3, Figure 4.

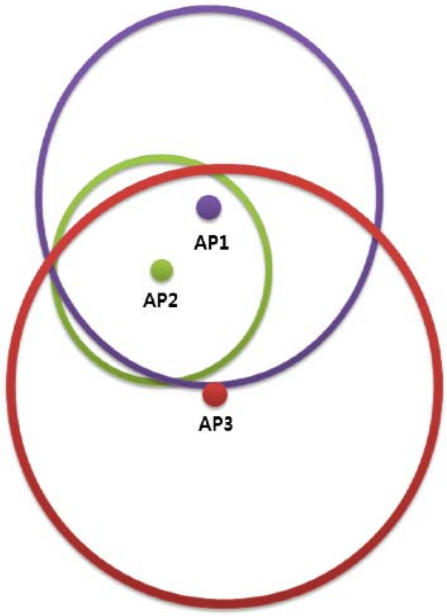

Fig 4 Reinforcing the obstacles by the loss of one example of the RSSI

Using this method, when measuring the room on the basis of AP terminals, an accuracy of 95% could be correctly recognized.

B. Block loss by using a re-measurement of the AP

While considering the signal loss in Section 3.A using a triangulation method, terminal has been introduced to recognizes the Block. After recognizing Block, pre-pointing Block database reads by loss of AP. This signal loss is shown in Fig.6. Block terminal scans the AP's RSSI in a closed and the same distance in open space to find out the difference between the two.

Measured in the same manner as in Figure 5, the Block AP-specific DB loss values are stored, as shown in Figure 6.

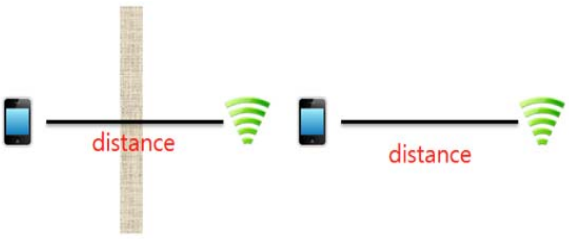

Fig 5 Block signal loss values collected by the AP

ROOM_N	FLOOR_N	BLDGN_N	AP_N	WEIGHT	CON
1	4	0	d8:c7:c8:3d:49:60	0	
2	4	0	d8:c7:c8:3d:49:60	0	
3	4	0	d8:c7:c8:3d:49:60	0	
4	4	0	d8:c7:c8:3d:49:60	56	7
5	4	0	d8:c7:c8:3d:49:60	212	35
6	4	0	d8:c7:c8:3d:49:60	0	
7	4	0	d8:c7:c8:3d:49:60	0	
8	4	0	d8:c7:c8:3d:49:60	0	
9	4	0	d8:c7:c8:3d:49:60	0	
10	4	0	d8:c7:c8:3d:49:60	0	
11	4	0	d8:c7:c8:3d:49:60	0	
12	4	0	d8:c7:c8:3d:49:60	0	
13	4	0	d8:c7:c8:3d:49:60	0	
14	4	0	d8:c7:c8:3d:49:60	0	1

Fig 6 DB stored in the RSSI value of the loss

At the tine of initial scan of AP with respect to RSSI value there is a loss of signal due to obstacle. Using the triangulation, final position is determined.

IV. EXPERIMENT AND RESULTS

The positioning accuracy of the algorithm for testing, prior to loss AP RSSI values are stored in a DB using conventional triangulation, and the AP of the RSSI by the obstacle in consideration of loss is improved with the help of triangulation, which allows us to compare the error in positioning with the help of algorithm,

The AP IPtime, Uplus was used a variety of devices, such as, the measurement of the size of the Block. Test equipment was used for the Samsung Galaxy 3.

Experiments are shown in Figure 7. Block selected using Android apps from multiple locations within a certain position error is measured in meters, and the average value is obtained, respectively.

Fig 7 Demo application screen positioning

By measuring the AP position, the error of measurement, which is the number of times the circuit 200 was less than 10m from the positioning point AP and the number of applications of the inherent error in the positioning algorithm, was confirmed.

According to the positioning error of the algorithm, when using the database unit, the signal loss compared to other algorithms can be seen how accurate it is. When using this algorithm, the particular AP Block shows the loss of signal because it can know whether the fleece according to the signal strength is using the formula or not. The distance between the AP and the terminal when estimating, the error is reduced. Note the signal loss due to the DB after climbing to the accuracy of the triangulation could be confirmed.

The performance of the proposed method when compared to traditional methods and look, traditional triangulation techniques [2] and improved triangulation method [5], the actual position error of the measured position appears higher as compared to 2.7m ~ 4.63m, the proposed block- side up to 1.8m offense has been made to reduce the positioning error. Overall, the conventional techniques can reduce the error up to 50%.

Number of Access Points, the positioning at the point of less than 10m, the AP count is increased as compared to where the error of the position measurements did not differ significantly. That is, the position of the terminal block within the AP may estimate the loss in signal value is not lost because of the obstacle. By the use of a positioning algorithm the process becomes easy and reliable signal value can be obtained.

V. CONCLUSIONS

In this study, the fingerprint technique reduces the hassle of preliminary research; triangulation-positioning algorithm can reduce the error with respect to the proposed. Subsequent challenge with a variety of location-based services to be utilized in a wide variety of terrain and tests, by minimizing the pre- irradiation area , whether any services can proceed within a short time to seek , and the algorithm to minimize the error of collateral AP error factor in issues such as inter- channel interference for the study.

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