A Direction Conducting based on RFID Multi-Blocks Tag for Indoor Guidance System

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Abstract **—The GPS (Global Positioning System) associated with GIS (Geographic Information System) has been broadly applied to many navigation applications but this system is insufficient under an indoor environment for its signal obstructed. The indoor environment is simple; therefore it is not necessary to use a complicated or high-cost device for positioning. This study proposed to utilize an RFID (Radio Frequency IDentification) as a positioning device to build an indoor guidance system. Once the RFID reader receives a signal from an RFID tag, this system will determine the current location immediately and then the user will be conducted through a speech from this system when the user intends to get to somewhere beneath the system service. This system will render a corrected direction for any entry direction.**

I. Introduction

People might be a blind in the place where without a definite indication or they were unfamiliar with the indoor environment even if the indoor environment is simple and pure [2]. Recently, the indoor service has been more important, e.g. Museum guiding system [1,3,4], WiFi indoor position [5] and so on.

Chou et al. (2004) ever developed a guidance system with IR (Infrared) [3]. General speaking, the infrared is insufficient in sensing distance, transmitting velocity and line of sight, although it is high accuracy. Föckler et al. ever developed an enhanced museum guidance system — PhoneGuide [4]. This system based on a mobile phone is utilizing a camera for recognizing, so as to introduce the exhibit. The camera will take a picture and recognize what the exhibit is, then present the content of the exhibit. Most guidance systems only present what this exhibit is, but there are not many systems to provide a dynamic conducting function, e.g. way finding for this service.

RFID (Radio Frequency IDentification) is wireless sensing, easy to use, lower cost, high tag capacity and reliability, hence this paper thinks about that the RFID will be more efficient than IR or other devices in the indoor positioning.

II. System Architecture

The system consists of 4 Units (figure 1): RFID, Positioning Unit, Control Unit and Speech Unit. The users are able to know where they are via Positioning Unit; the system renders a recommendatory route from current location to the destination, and both functions are providing speech guiding function. The geographic information (serial number or coordinate) is embedded in an RFID tag. The system is allowed to position or to find the shortest path for conducting the user.

2.1 RFID

This system proposes to utilize the RFID as a positioning device, and the Philips Mifare RC500 RFID reader is selected to position in this system since RC500 is lower cost, high tag capacity, multiple blocks and easy to use. The tag not only provides 64 blocks for storage data but also provides encryption for improve secure reason. Each block capacity is 16 bytes hexadecimal. The value of blocks (figure 2) is defined in this paper.

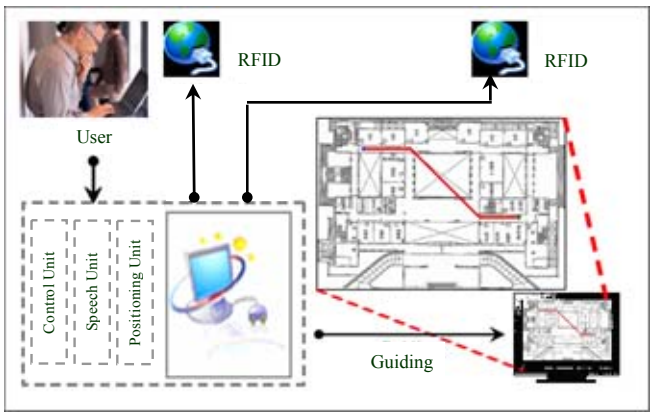

Figure 1 - Indoor Guidance System Construction

	A	B	C	D
0	Manufact. ID	Expand	Expand	
1	Coordinate	Coordinate	Node Name	
2				
3				
4				
5				
6	Relationship			Key Value
7				
8				
9				
10	Area			
11				
12				
13				
14				
15				

Figure 2 - Block Value Definition

The value of block A0 is used to store manufacturer code and it is read only. The value of block B0 and C0 are undefined so as to the other function expanding. The coordinates are stored in block A1 and B1 respectively, and node name is stored in block C1. Key value is used to control the access bit and the relationship area is used to describe the relation of current node among other node.

2.2 Route guidance

It is necessary to pre-measure the relation from every node and convert to a prescribed format, for instance as below:

TABLE 1 - EXAMPLE OF TAG BLOCK

Char.	1	2	3	4	5	6	7	8
Val.	4	0	0	0	0	1	1	2
Val.	5	0	0	0	0	1	1	5

The user sets the destination, room 114, and there are 2 blocks relating to the destination is shown in table 1. The first block value is 40000112, and another is 50000115. The control unit will determine the direction by first character and the relation is shown in Table 2.

TABLE 2 - TABLE OF DIRECTIONAL RELATION

Direction	Sequence	Intermittent
Keep Going	0	1
Right Front	2	3
Right	4	5
Right Rear	6	7
Make U-turn	8	9
Left Rear	A	B
Left	C	D
Left Front	E	F

The preceding first character is 4 which represent "right, sequence," and the rear is 5 which represent "right, Intermittent." Those 2 directions both are "right" and preceding relation is "sequence," it is mentioned room 112 to room 115 are all on the same route sequentially, so that if the user want to go to the room 114 and then should turn right. This tag format method is in order to save the waste on tag capacity.

2.3 Rotation Modification

Due to the direction in tag block is measured by system administrator, and this direction only describes the direction of administrator in measurement, therefore the current direction of user will effect the direction of tag block and a wrong direction guide will happen. According to this problem, the system has to modify the rotation as below:

1. Rotation = 16 – (Current Direction – Tag Rotation)
2. If Rotation ≥ 16 then Rotation = Rotation mod 16

Using above method and then the correctional direction (Rotation) will be determined instantly.

III. INDOOR GUIDANCE SYSTEM

The System interface is shown in the figure 3 and when the users want to find the shortest path and they should assign the start and destination before the user clicks the "Wayfinding" button, then the system will draw the route on the screen immediately. The blue line is used to represent the shortest path from the start to the destination.

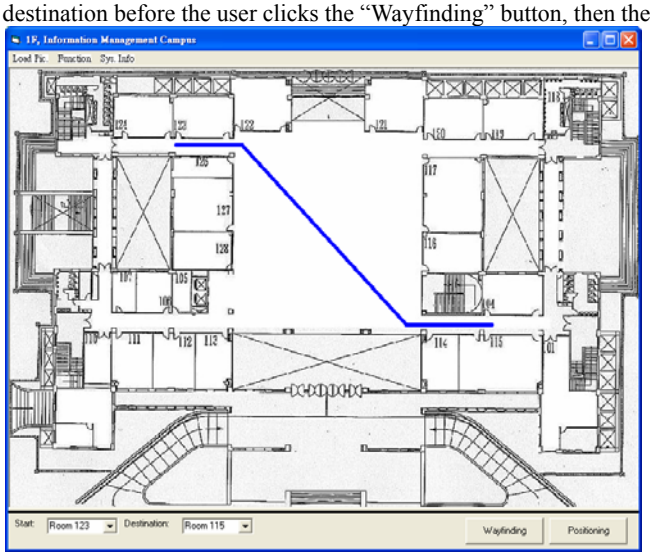

FIGURE 3 - WAY FINDING FROM ROOM 123 TO ROOM 115

When the user utilizes this system to conduct him to the destination and the red line is used to represent the past route. The system will notify the user "here we are" (figure 4) through the Speech SDK when the user arrives at the destination. The green line is used to represent that here is the destination.

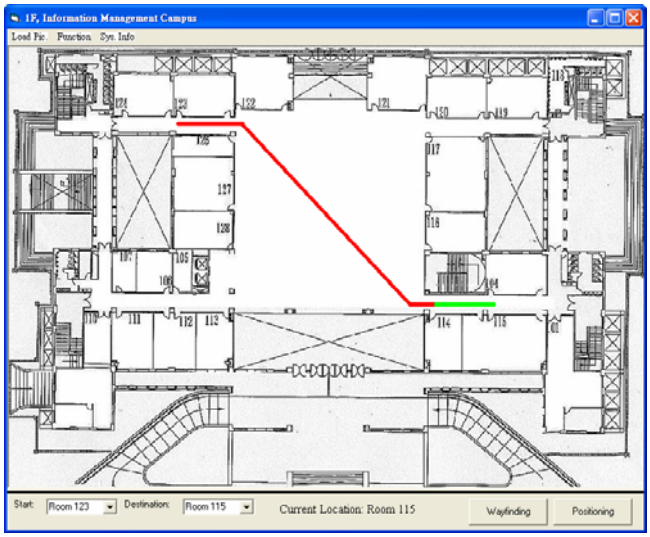

FIGURE 4 – ARRIVING AT THE DESTINATION

IV. CONCLUSION

There are many people probably feel like a blind in an unfamiliar indoor building, therefore they can not reach their destination successfully. Nowadays, the indoor guidance system is not only to be utilized to guide in museum; but also broadly applied to every kind of place. In the past, most of people focus on outdoor guidance and there is not many research focuses on indoor environment.

According to the above problem, this paper tries to find a solution for it and implements an indoor guidance system to conduct the users for getting their destination. It can be expected that this system will be extensively utilized to various place and provided an indoor guiding service.

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