EFFECTIVE UTILIZATION OF PARKING SPACE BY USING PR ROUTING ALGORITHM WITH ZIGBEE TECHNOLOGY

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Abstract

To recognize the investigation of a routing algorithm for ZigBee technology, a kind of intelligent parking system based on wireless sensor network with ZigBee is designed. The parking place is administered either offline or online interaction. In present day vehicle parking is very problem in urban areas. Hence the proper utilization of parking place can solve some problem in this concern; an intelligent and effective parking guidance technology is required. For effective utilization of space, use shortest path routing algorithm. For intelligent, sensor signal system is used. One of such system is ZigBee technology. By using a routing algorithm with ZigBee technology can solve parking problems in urban areas up to some extent.

Keywords: routing algothm, ZigBee Technology, parking system, sensor signal.

1 Introduction

From last ten years national economy has been greatly increased by urbanization and increased population. Consequences of this leads to series of urban problems, among them most important problem is traffic problem. On other side peoples living standards are increased thus the number of individual vehicles is increased. As a result it improves the traffic and parking problems. In this paper focussed on effective utilization of parking place with sensor i.e ZigBee technology along with a routing algorithm. Finally our system improves the convenience of peoples life and easy to park and more effective utilization of space. Here we developed a system for automatic intelligent parking management combined with wireless technology and computer networks.

2 Literature review

In olden days compass is used to estimate the location. Due to rapid development of electronic communication technology, many large -scale wireless location systems have been developed. The GPS (global positioning system) is a new generation of space satellite navigation and positioning system. So far, GPS system has gradually entered people's daily life, and GPS navigation mobile phone and vehicle GPS navigator can be seen everywhere, which is convenient for people to know their position whenever and anywhere when they are travelling.

Choe et al. (2017) designed a real-time and dynamic parking guidance system to monitor the main parking area, collect the data through the computer controlling the underlying system. The owner of the vehicle chooses the parking lot based on the electronic indicator. Vlahogianni et al. (2016) used the operator's parking guidance and information system, adopted three levels of guidance and display in the district, the intersection and the parking lot to locate the parking lot and the driving direction of the parking vehicle, and update the number of remaining parking space of the parking lot to facilitate the user to choose the parking. Liu et al. (2017) proposed a city intelligent parking system based on Client/Server mode based on Android system. On the basis of location based service, unified management is conducted for the system, which has intelligent parking, intelligent charging, and log records functions. Song et al. (2017) proposed an intelligent parking lot lot navigation scheme based on the ZigBee technology of the Internet of things. It uses ZigBee and ultrasonic to deal with the vehicle location detection function, and improves the parking efficiency by modifying the shortest path algorithm. Khan et al. (2016) studied wireless remote monitoring based on wireless sensor network (WSN). The WSN composed of ZigBee technology has the characteristics of simple structure, small size, and low cost. It can realize close range wireless connection, which can ensure the real-time and reliability of data transmission. Khan et al. (2016), through the analysis of the new and open wireless interconnection technology ZigBee technology, combined with sensor technology, ZigBee technology and routing protocol, constructed a WSN. Moridi et al. (2018) proposed a CC2431 chip and ZigBee WSN coal mine monitoring system based on received signal strength indication (RSSI) wireless location algorithm. It was pro-moted by the TI Company, which has positioning and tracking engine and has good reliability and real-time performance. Han et al. (2016), aiming at the diversity of the WSN application environment and irregularity effects on the deployment of sensor nodes, a kind of indoor 3D scene reconstruction and 3D ray tracking method is proposed. It can improve the efficiency and accuracy of ZigBee transmission modelling and simulation in indoor environment and can be well used in different indoor environments [8].

Based on above, the paper mainly focussed on routing based ZigBee technology for parking management through either offline or online.

3 Proposed PR routing algorithm

The PR is the best routing algorithm with constraints; it is used to find the shortest path from a particular point to another point two-dimensional grid.

1. Simplify the area in two dimensional mesh
2. Starting point is 1 and ending point is 2
3. Look all accessible grids around staring point 1 and store it is as activation list. Point 1 act as root point for activation list.
4. Check the nearest point in activation list from root point.

   Use D=X+Y, X- cost matrix up to root point , Y- cost matrix from root point to point in activation list

Distance between two points (x_1, y_1) and (x_2, y_2) in the plane coordinate system is $|x_1-x_2|+|y_1-y_2|$. This method is suitable for planning the path of only horizontal or vertical. In the parking guidance, the vehicle can move along the slant, that is, in the grid, it can walk along diagonal lines.

$\Delta X = I(X_2 - X_1)I$, $\Delta Y = I(Y_2 - Y_1)I$

$H(n) = \min(\Delta X, \Delta Y) * SQRT[\Delta X^2 + \Delta Y^2)$

5. Select the nearest point is as new root point
6. Repeat the steps 4 and 5 until endpoint to reach.
7. Select all root point and make a path, it gives shortest path between starting point and ending point.

4 Parking detection and control

The parking position detection and control module is responsible for the data collection and the hardware control. The data collected by the sensor is the data source of the whole system, and the effective data can drive the system to work properly. The module mainly consists of ultrasonic sensor, Arduino controller, ZigBee module and buzzer, which together make up the vehicle position detection device and hardware control device, and build a typical sensing network. In this sensor network, the sensor is responsible for detecting data, and the ZigBee network is responsible for communicating with the upper layer, and the buzzer is used to respond to the user's operation of booking a vehicle position. In practical applications, in extreme cases, a number of mandatory protection measures can be triggered to prevent other users from entering the booked parking space if the user books the parking space. In the parking detection and control module, Arduino is responsible for coordinating each hardware work, and its data interaction is shown in Figure 1.

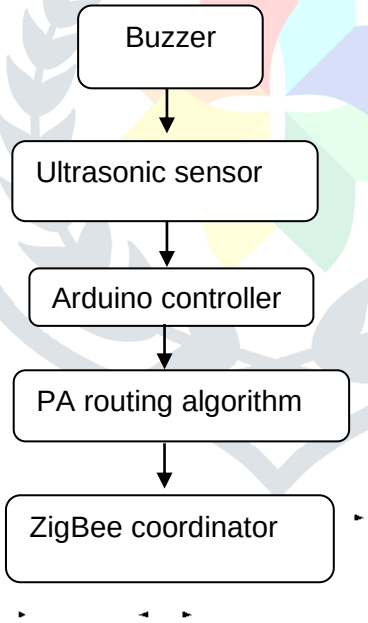

Fig. 1. Parking area detection and control

5 System design

A. Data monitoring

In the parking system, the sensor network ultimately needs to communicate with the Internet. There are two communication schemes at present: one is to install Internet module directly on the hardware system, and the sensor data can be directly submitted to the server. Each sensor node has the ability to communicate with the Internet server, and the structure is clear and simple, easy to implement. The host computer module monitors the running state of the sensor network, pre-processes the sensor data, submits data to the server,

avoids the direct access of the lower machine to the server, reduces the pressure of the server, and receives message push according to the communication protocol of the IoT.

B. Sever module

The cloud server must be able to meet high concurrency and high real-time performance because of the requirement of massive data request and real-time control in the IoT. Traditional server development uses reverse proxy, multithreading or server cluster to improve the service performance, but the corresponding technology is also complex and is not suitable for the development of intelligent parking system prototype.

C. Client module

The intelligent parking system will eventually show user client in front of users. In practical applications, in order to facilitate the user's use of intelligent parking system, the client needs to be provided on the mobile device.The client provides the basic functions of the intelligent parking system for the user, including the functions of the user registration and login, the statistics of total number of parking spaces, the status of parking space, the book of parking space, and the planning path. The registration and login function is used to save user information, accept user feedback, and restrict users to repeat multiple scheduled parking spaces. After entering the system, users can use parking booking, parking path planning, parking guidance, parking evaluation and other functions

6 Analysis of test Results

First, the parking lot detection module can effectively monitor the status of the ve-hicle by ZigBee WSN, and the data are basically stable and correctly displayed in the host computer interface.

Second, the server side runs HTTP services, MQTT services and WebSocket ser-vices simultaneously. They are monitored in ports 3000, 1883, and 8081, and the ser-vices run normally.

Third, the identification generation policy is running normally, the initialization data can be stored in the database, and the unique identifier generated by the database will be returned to the host computer.

Fourth, when the distance value measured by the ultrasonic sensor is less than the set threshold, the status of the parking lot becomes occupied, and the change of the parking lot state can also be seen in real time, even if the message is uploaded to the server and the message is pushed to the user client.

Fifth, it can effectively locate the user's current position, plan the path from the user's current position to the specific parking lot, and complete the parking path planning function.

7. Conclusion

The demand of the user's parking is analyzed first, the basic function of the intelli-gent parking system is determined according to the user's demand, and the overall scheme of the system is put forward. The key technology used in it is compared, the technical route of solving the system problem is made, and the overall structure of the system is designed. Under the guidance of the overall structure, each function module is realized, including the parking lot detection module, the host computer data pro-cessing module, the cloud server module and the Web client module. Finally, the sys-tem is analyzed and tested from three aspects, including the data acquisition module of the lower computer (parking lot detection and control module), and the forward flow test of the system data, which verifies the feasibility of the basic function of the whole system

prototype. The test and analysis results show that the intelligent parking system based on ZigBee can provide the functions of online parking field search, parking status view, path planning and online parking space reservation for users with parking de-mand, which can help to solve the problem of parking difficulty.

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