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IOT BASED VEHICLE PARKING PLACE DETECTION USING ARDUINO

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ABSTRACT

Vehicle parking place is one of the major problem in day to day life and it is indirectly leads to the traffic congestion. This paper presents the IOT based parking place detection using the mobile app. The user can able to check the nearest parking place availability and reserve the parking slot using mobile application. The mobile application will act as an interface between the end user and the system. Infrared sensor is placed at the parking slot along with the arduino. Infrared sensor is used to detect whether the slot is occupied or empty and it is updated to the cloud using the GSM. Arduino is used to track the number of vehicles parked in the parking area.

KEYWORDS: Arduino, Infrared Sensor, GSM.

INTRODUCTION

Internet of Things (IOT) is used to communicate with the devices. By using this devices could be controlled or monitored through the internet, IOT acts as a platform to store data from the remote locations. IOT consists of web enabled devices that collects the data from the surrounding environments using processors, sensors and other communication devices. The device could be monitored and tracked using computers connected through internet.

There are different types of car parking system available to reduce the time and the traffic congestion. The types used in day to day life are by using cameras, parking space is detected and the camera is fixed at the parking area pillars then another method is by using laser beams it detects the corner and target parking position. Then another method is by using Light Detection and Ranging sensors. Another method is based on the 3D reconstruction.

With the latest proliferation of the vehicle availability finding the parking place availability is more difficult. Car parking is a main problem because of increasing in the vehicle number. Searching of a parking place around the cities is the routine work. In the smart parking system the parking space information is available at the real time. It consists of real time data collection, low cost sensors and mobile phone enabled systems. The proposed smart parking system is implemented using mobile application and the system helps the user to know the parking space availability. The user can able to interact with the system by installing car parking application on their mobile phones.

In this paper Infrared sensor is used in every parking slot. The basic principle of Infrared sensor is the waves emitted by the transducer is reflected back from the object and received by the transducer. Therefore by using this sensor the user can able to understand whether the parking slot is occupied or not. The Infrared sensor is connected with the arduino board. The obtained details are send to the server using Global System For Mobile Communication (GSM) from the arduino board.

RELATED WORK

Many advances have been proposed to find out the parking space. In 2012, Zhou (18) searches for detection of parking space using laser line scanners. In this supervised learning technique is used to identify vehicle bumpers from laser range scans that the topological graph is created and then the parking space is identified. Franke in 2002 (14) proposed a 3D data based car parking place detection system. In this iterative closet algorithm is used. By using this algorithm the vehicle pose and the number of vehicle parked in that parking area will be easily analyzed.

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A different method for the parking system was planned by Ungerin 2014 (13) based on the image processing technique. In this video camera is used to find the vehicle and is updated to the server then the Infrared sensor is also attached to the parking area to detect the vehicle. Vestri in 2005(11).has proposed a vision based point tracker algorithm is used. By using this technology reference set of 3D points is tracked and then monitor the tracked points. The average value is used for the evaluation another process group 3D points to textured polygonal obstacles.

In 2013, Alois Knoll (9) proposed the parking space based on LIDAR Sensors. In this system RANSAC algorithm and kalman filter allows localization and tracking. LIDAR sensor is mounted on the moving object for tracking and detection of relevant object. LIDAR sensor measures distance between the sensor and its environment using laser rays. Another method for parking is planned by keppler in 2007 (22) uses 3D range camera for measuring spatial point. PMD sensor is used for detecting free space of a parking slot and also used to determine the optical clues about the distance of objects. A camera is used which scans the orthogonally scene to the lateral axis of the car.

PROPOSED SYSTEM

The main objective of the proposed system is to find the parking space and reserve the particular slot using modern technologies.

The figure 1 shows the block diagram of the proposed system. The system consists of arduino microcontroller unit for the controlling process which has been interfaced with the Infrared sensor, power supply, mobile application and a GSM module. Infrared sensor is used to detect the parking slot and determine whether the parking slot is vacant or not.

This Infrared sensor is connected to the arduino board. This sensor is connected to a 5V supply. This information is updated to the server using Global System for Mobile Communication. The mobile application act as an interface between the system and the end user. The purpose of mobile application is to provide information about the parking space availability and the user will book the slot accordingly. Once the user books the slot then the car is parked there that car details are sent to the owner mobile application along with the car number.

Then at the end the user have to pay the amount based on the parking time by using the mobile application. In the cloud database the user entry time and the exit time is recorded. Once the user will pay the amount then the owner will receive the notification about the amount paid and the number of cars still in the parking area along with the car number. By using the mobile application the owner can able to know the parking area information and the time the particular car using the particular parking slot based on that amount paid by the user. The merits of smart parking system is shorter waiting time at parking place, saves fuel, guided to nearest parking place, Carbon emission is reduced.

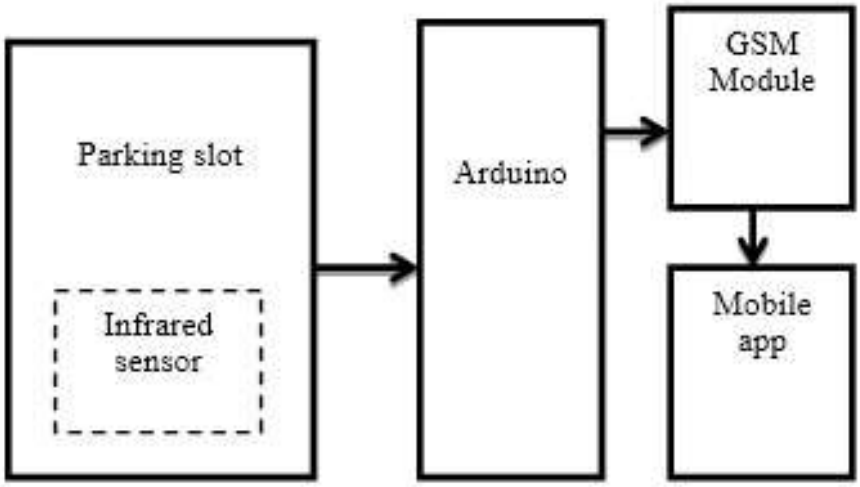

Fig.1: Block diagram of smart car parking system

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Arduino

Arduino Uno is a microcontroller based on the datasheet. It has 14 digital input or output pins of which 6 can be used as Pulse Width Modulation (PWM) as output, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, an ICSP header and a reset button. The Microcontroller simply connected to the computer with a USB cable or a power with an AC to DC adapter or battery to get started. Here the purpose of arduino is used to transmit the command through the signal. It can be powered using power supply or by using USB cable.The supply voltage is 6 to 20 volts either it is a AC or DC supply. The Arduino can be able to communicate with the other arduino or with other microcontroller or with other computer. It supports Inter Integrated circuit and SPI Communication.

Infrared Sensor

An Infrared sensor transmits Infrared waves into the air and detects the reflected waves from an object. The IR receiver can be a photodiode or phototransistor or any other module to decode the signal. It is a non-contact distance measurement module needs a power supply of 3.0V to 5.0V and current consumption is 23mA to 43mA, detection range is 2cm to 30cm. It has transmitter and the receiver module.

Infrared obstacle sensor is used in smart car parking system. It has three pins one pin is connected to5V power supply, then the second pin is connected to ground, and the third pin act as an output pin. It has on board potentiometer that lets the user to adjust detection range. The sensor has very good stable response even in complete darkness or in ambient light.
The Infrared sensor module automatically detects whether the signal is back and if the signal is back at high level then sending Infrared signal.

GSM Module

Global System For Mobile Communication provides wireless communication as well the authentication. The arduino is interfaced with the arduino board and allows GSM to communicate over the network. GSM allows the user to send and receive the messages. It consumes low power, high performance, small size and less weight. GSM SIM 900 operates at 4V to 4.5V.

It has configurable baud rate. For direct communication to the computer RS232 interface is used and it has inbuilt TCP/IP Protocol. The GSM module is controlled by AT commands and low power consumption is 1.5mA(sleep mode) then the operating temperature is -40°C to +85°C.There are eight pins in GSM module. First pin is the Rst it is used to Reset the module. The second pin is P it is the power switch pin of SIM900 module. Then the third pin is Tx it act as a UART data output then the fourth pin is the Rx it act as a UART data in. The fifth pin is DT it is used to debug data output then the sixth pin is DR it is used to debug UART data input. Then the seventh pin is ground and the eighth pin is connected to the power supply.

Work Flow

1. Install parking application on mobile device
2. with the help of the application search for parking area around user destination.
3. Select the particular parking area.
4. Browse through various parking slot available in that parking area.
5. Select the particular parking slot.
6. When the user leaves the parking area amount will be paid by using that mobile application.
7. The payment information will be notified to the owner using the mobile application.

RESULT AND DISCUSSION

The following images shows the result of the proposed system and also the slot status details and booking status details and the ticket details.

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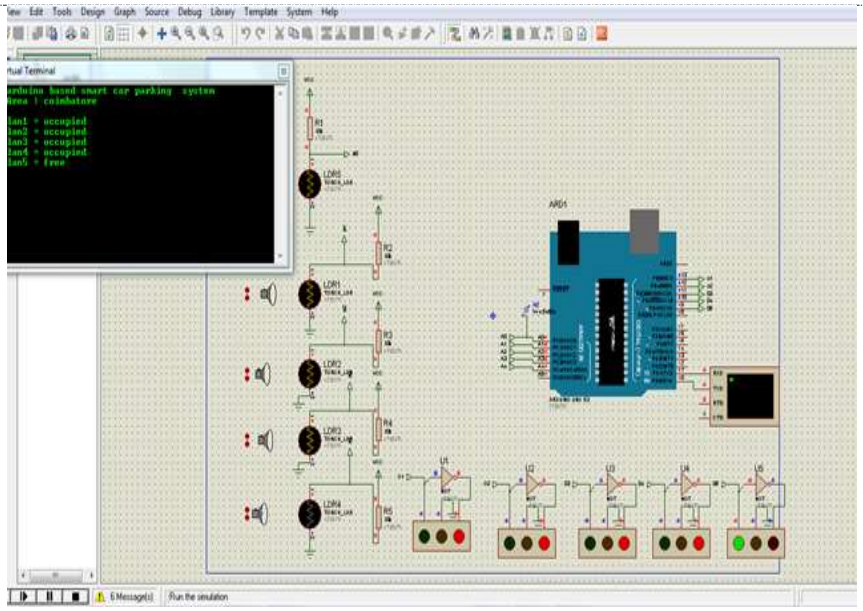

Fig.3 Simulation result of the proposed system

Fig 3 is the simulation result the parking place is detected by adjusting the potentiometer values. The output is viewed by using the virtual terminal.

The hardware setup Fig 4 consists of Arduino UNO, GSM Module, and the infrared sensor. The sensor detects the vacancy in the parking place then it is updated to the user by using the GSM Module. The LED is used to indicate the vacancy position.

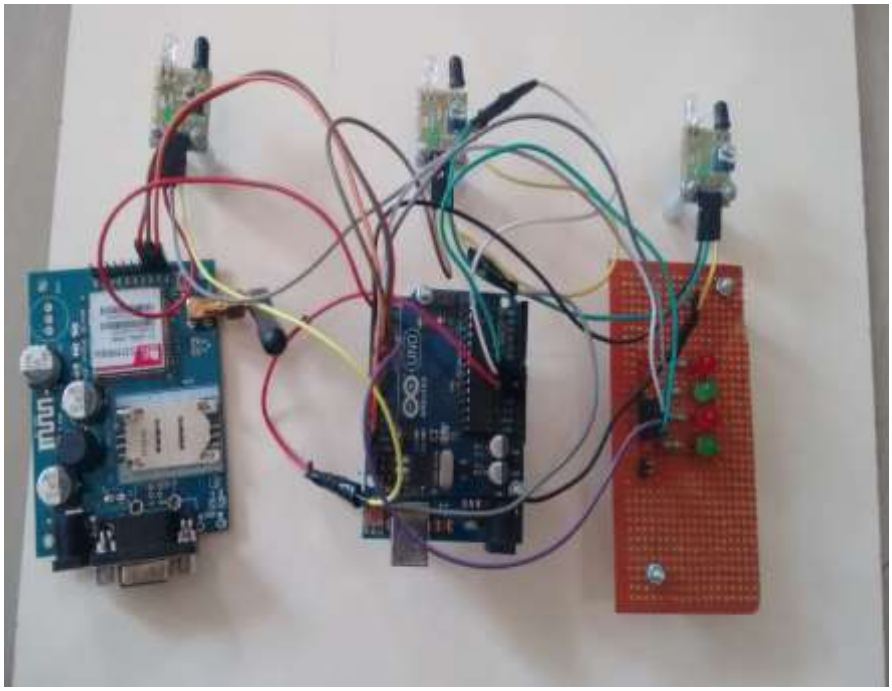

Fig.4 Hardware Setup

Fig 5 explains the car parking status it indicates whether the slot is empty or full. It is updated in the application by using the GSM Module.

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Fig.5 Parking Status

Fig. 6 explains the booking of particular slot. For booking the particular slot the user has to enter the vehicle number then the name of the user and the slot number with date and time. After entering all this details the user has to click the submit option.If the slot is available then it is booked for that user otherwise the booking is not confirmed. Then the user has to check the availability and then book some other vacant slot.

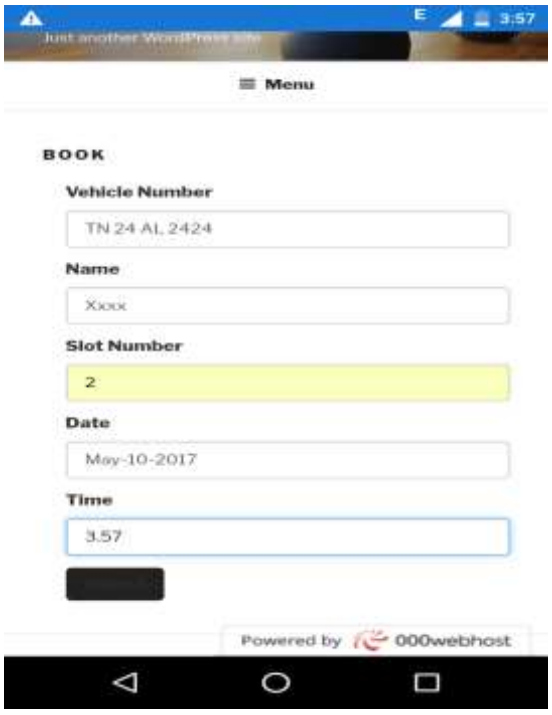

Fig.6 Booking Module

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Fig. 7 explains the booking confirmation to the user by the mobile application.

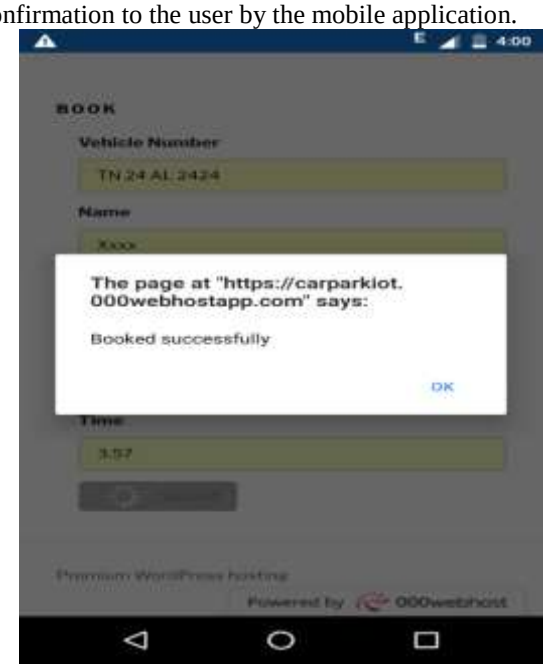

Fig.7 Booking status

Fig.8 explains the Ticket for the booking slot it has some details such as customer vehicle number, name, allotted slot number, date and time then the status whether confirmed or not.

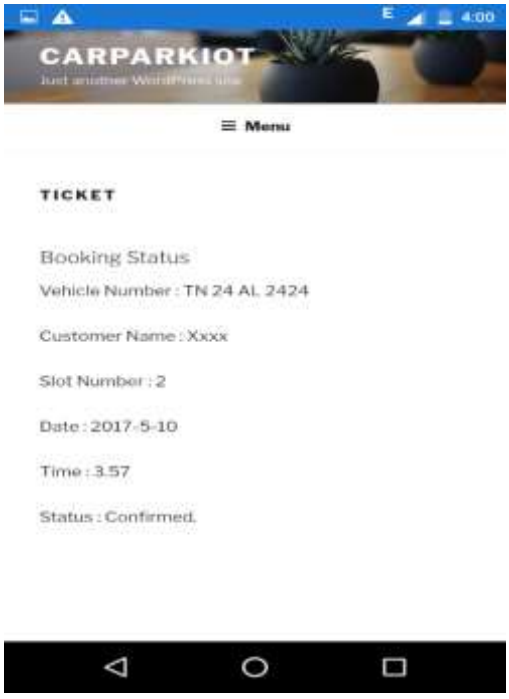

Fig.8 Ticket for the car parking

CONCLUSION

This project focuses on implementation of car parking place detection using Internet of Things technology. By using IR sensor the parking place vacancy is detected and it is updated to the user using the mobile application. By using this application the parking area can be easily identified so the traffic is reduced and also carbon emission is also reduced. This project is low cost, low power consumption, more accurate and well suited for real time implementation.

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