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Research Article

FULLY AUTOMATIC PARKING GUIDENCE SYSTEM USING RASPBERRY PI-3

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Abstract

The purpose of this project is to solve the parking problems in large gathering areas such as shopping malls, apartments, function halls, stadiums, etc. This system presents an automatic parking guidance system using Raspberry pi and RFID system. It also uses a mobile application connected to raspberry pi using internet to display the information of slot availability.

***Keywords*—** RFID, IR Sensor, Android, SBC, Raspbian, IoT, GPIO.

I.INTRODUCTION

The population of this world is increasing day by day and because of which the count of number of vehicles is also increasing. Whenever a new vehicle model is launched in the market, people desire to own it and huge booking requests are made without any concern about parking or traffic or other problems. With the increase in vehicle numbers the problem of parking is also increasing because of the inadequate space availability. This problem is mainly for private vehicles in places of huge population such as movie theatre, award functions, shopping malls, etc. Vehicles are equipped with latest technologies but the parking system works on the old model of collection of manual payment and make the vehicle park in a congested space which is difficult to get out of there. Several other issues are less space, change cash problem, fuel and time wastage. As per the data in every year nearly 3.1 billion gallons of fuel gets wasted. To get rid of this parking problem with the help of technology we have proposed the parking model which consists of parking guidance for cars. wasted while parking of vehicle.

The model involves the use of several electronic components including Raspberry Pi-3, LCD Screen, IR sensors, RFID reader, servo motor and other accessories. The detailed working of this project is explained in the next section. In our system an LCD is placed at the entry gate which shows the updated information of parking slots every second. When there is any empty slot the vehicle is charged a fixed entry fee which is deducted using RFID reader and tags. This will also update the balance after deducting the balance and new balance also gets updated on the LCD screen and vehicle is allowed to pass. The vehicle will not be allowed if balance is not more than minimum entry fees. The entered vehicle is parked at the slot available and this information is updated on the LCD and mobile application. During the exit time the IR sensor will detect the

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vehicle and open the barrier using servo motor. This process is completely automatic with no human involved. We will discuss more about this in coming sections in detail.

II.RELATED WORK

A lot of work and research have been done in the past to make the parking management less complex and user friendly. The intelligent parking system for parking slots for efficiently utilizing the available parking space using IoT technology by guiding the users to nearest parking slot [1]. The accessibility for the driver to find the nearest slot and directly reach there which reduces the parking time [2]. The use of robotic technology to arrange a combined set of the parking path, advance resource allocation and elevator scheduling to reduce waiting time and enhance space utilization[3]. An approach based on UHF waves used in RFID technology is applied into parking system for vehicle identification and for good parking management [4]. Some of the Scholars have also contributes a model based on driver's location and time to find best path considering the road and traffic conditions [5]. Abu Dhabi's indoor mobile application based parking system which helps in reducing the parking time by informing the available parking slot to the driver [6]. The scholars have also tried to solve this problem using the display and microchip technology to get better view of parking slot availability in residential parking area [7].

III. METHODOLOGY

OVERALL DESIGN

The parking slot guidance is based on mainly 3 modules, the information management using raspberry pi, displaying the information and performing operations using servo motor and IR sensors.

- The complete controlling of the parking guidence model is done using a single board computer i.e. Raspberry pi-3 which is no less than a mini computer. This have the properties of microcontroller as well as microprocessor. Process involving the authorization, transactions and slot management is done using this board. It is linked to hardware devices including Servo Motor, LCD screen, RFID reader and IR sensor.
- An LCD is placed at the gate which displays the information about the number of parking slots available or booked. There should be atleast one parking slot empty for the next vehicle to get parked. As the vehicle reach the entery gate of parking the RFID card is scanned by the RFID reader installed in the gate. This RFID reader is connected to the database. It can read , write, update the balance amount on the RFID tag with the help of Ultra High frequency (UHF) rays so that no human involvement takes place. A mobile application is used for getting the slot information which is same as displayed on LCD. This task is completed using SQL for sending and accessing data stored on cloud server.
- After deducting the balance from the card, signal is sent to the servo motor for opening the barrier. Simultaneously, a buzzer will beep as an indicator for the driver to get access to parking. The barrier will remain open for a fraction of second and closes as the vehicles gets entered. The driver can get the information about the empty slot using his android application as well as LCD on entry gate and park his vehicle there. As the vehicle occupies a slot in parking, the information about parking slots gets updated on the mobile application as well as on LCD. The same process is followed up for the exit process. But during exit time the IR sensor is placed in the exit gate which detect the presence of vehicle and opens the exit barrier. The information

will then again get updated into the application as well as LCD.

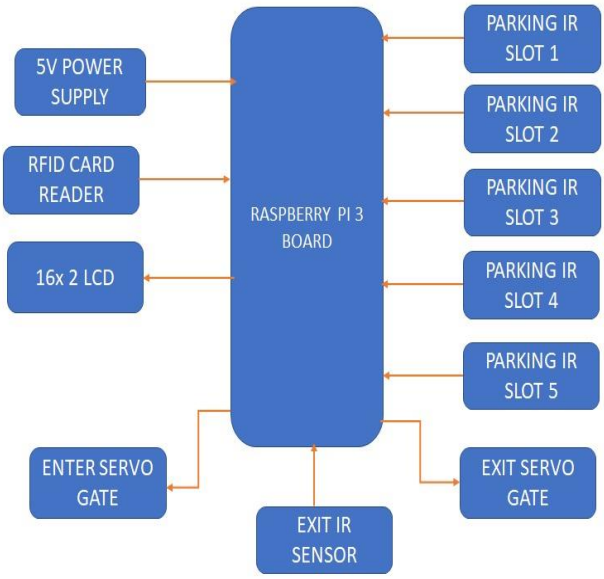


Fig.1. Block Diagram of model

SOFTWARE

The software part of the model is divided into two separate parts. One includes the programming of raspberry pi board and other is the making of android application.

- Raspberry pi has its own OS which is called Raspbian. Raspbian is an LINUX based OS which is installed within the board using memory card. We have programmed raspberry pi using C++ and python programming language while SQL is used for performing database operations using server. The code can be written on it by connecting board to any digital monitor using HDMI cable and also connecting mouse and keyboard to the USB ports available on it. Now this setup will behave like a mini computer which is ready to be programmed.
- Android application used in our model can be easily build using a website “appinventor.mit.edu/”. The main advantage here is that you don’t have to perform any programming to build the logics. The application is easily built by dragging logic blocks.There are two interfaces available in this platform. One for external look of application while another for internal performance which involve simple logical statements like if, while, or, end, etc. This application is linked to the server and can be exported easily. It is a basic version of android app which is good for performing minor applications. We are just using it to get information of slots. The color of slots will get changed from green to red when any card gets parked and a text “occupied” will be displayed on the interface. The screenshot of the application interface is displayed in the below figure.

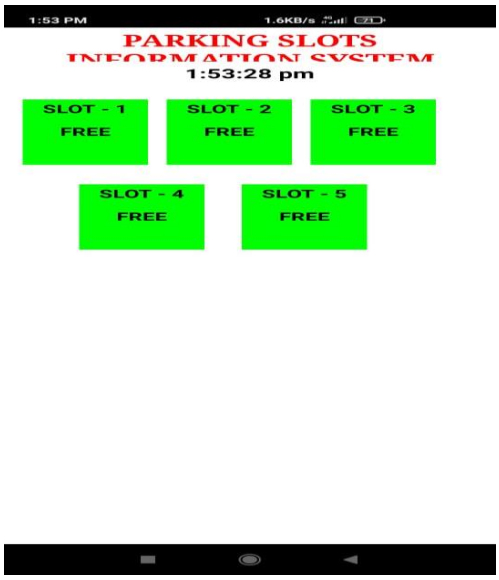


Fig.2. Android Application interface

Detailed Design Implementation

The paper introduces the step by step implementation of hardware and debugging the program into the board. User use an android based mobile application for getting information about the available slots in the parking area. The information received from each IR sensor term of '0' and '1' is sent to the server to analyze and provide the available slots to the user if available. The data from server is received by the raspberry pi and mobile application.

- The user will look at either the LCD screen or the android mobile application for knowing the parking slot availability. If the answer is yes then RFID reader will detect the identity of the user and display on LCD screen. The next step is to make sure if the balance is greater than the minimum parking amount.
- If the balance is more than minimum balance needed for parking then the fixed amount is deducted from the card balance which is also displayed on the LCD screen to increase the transparency of transactions. Further the barrier is opened using raspberry pi and vehicle is allowed to enter the space provided and directly goes to the free slot available. The access is denied access if the balance is not sufficient or the parking slot is full and the same is displayed on the LCD screen.
- The IR sensor placed in every respective slots changes their output signal from '0' to '1' whenever any vehicle is parked there. The information is sent to server which displays it on the LCD screen as well as android mobile application.

Fig.2. explains about the sequence of operation of the circuit in a proper order.

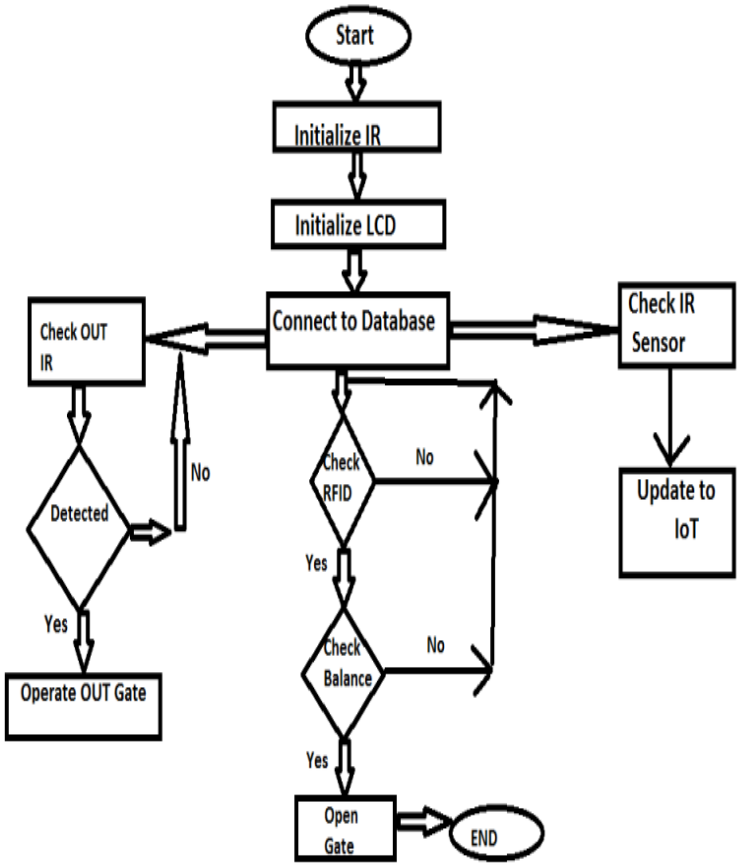


Fig. 2. Flow chart of parking spaces reservation algorithm

Schematic Diagram

The connections of all the components are well shown in the given schematic diagram. One thing which is to be noted is that the physical pin numbers of raspberry pi are different to those assigned while programming. To reduce the circuit complexity we have avoided the Vcc and ground connections. These connections are given using power extension. Data pins of the components are directly connected to the raspberry pi using jumpers. We are utilizing only 4 data pins of LCD.

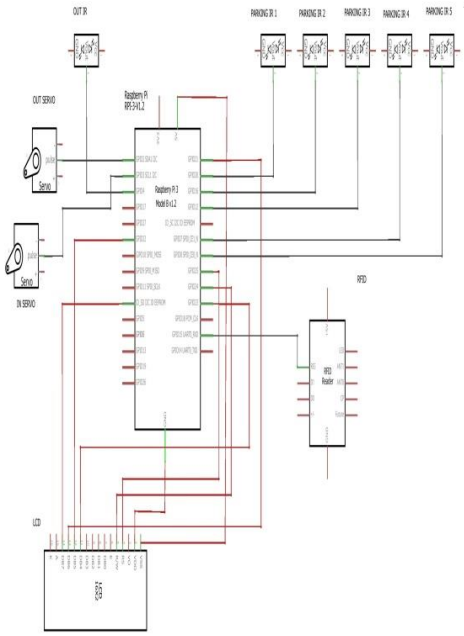
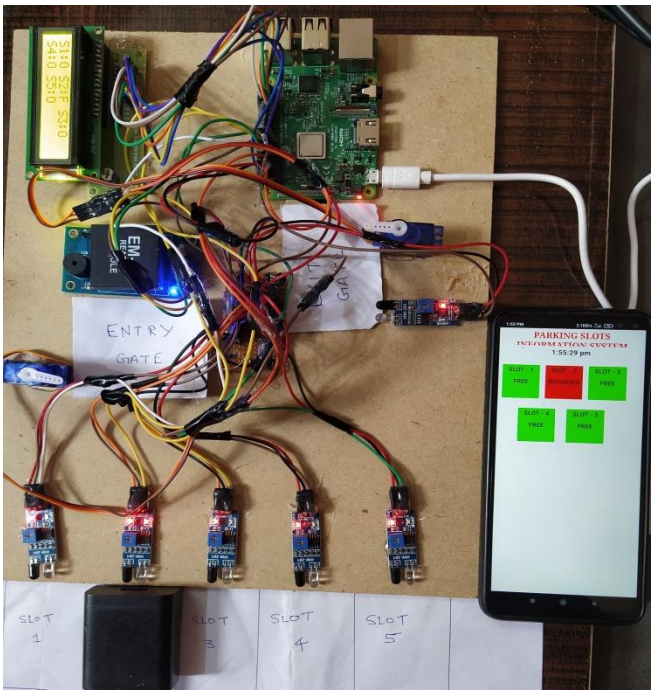


Fig. 3. Schematic Diagram of Circuit

IV. TEST AND RESULTS

This model proposed a prototype for the car parking guidance system which some advantages over traditional parking system. IR sensor is used in this project for detecting the availability of the vehicle on the slot. This information will be displayed in the LCD screen placed at the entry as well as it is sent to the database through internet. These data base gets updated in every 5 second. The results get automatically displayed on the mobile app. As the slot is booked by a vehicle, the background color of app gets changed from green to red. When the vehicle leaves the parking, the IR sensor at the exit gate detect the car and again update the slot information and empty and sent this data to the database and LCD display.

(a)



(b)

Fig.4. (a) LED when no vehicle is parked (b)Working model showing 1 vehicle parked at slot

V. CONCLUSION

Automation is a step in the right direction for a future fulfilled in the world of revolution. The smart car parking guidance system was designed, fabricated and tested which provided accurate results. The design is flexible and can be altered based on the space available and can be installed even in tight and constrained space. Based on the number of green colored slots and red colored slots we can easily get the information about parking slot availability. The payment system is much satisfying
than others. So this system provides a well organized technical solution to parking problem.

FUTURE SCOPE OF IMPROVEMENT

The camera can be installed in each parking slot and get the user an updated information about his/her car and thus enhancing security. With the use of parking tray system we can reduce the effort and time of driver in parking the car. The collaboration of electronics and mechanical can give a much advance parking system

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