

Slot Allocation and Reservation of Parking System Using IOT

Joyce. C.K. Mani, R. Anandan

Abstract--- Now days in many multiplex buildings, MNC companies and shopping malls have the severe problem in parking the car. Though the car users in the urban area have been dramatically increased over the last decade, there had been no smart facilities for parking their car in the respective areas. To overcome this drawback we have developed a smart parking system with slot reservation using IOT module, Bluetooth, Ultrasonic sensors and GSM. An android application is developed with the webpage accessibility for doing the same in reduced time.

Keywords--- Slot reservation; Internet Of Things IOT; Bluetooth technology; Mobile application; Global System for Mobile Communication GSM; Radio Frequency Identification RFID; Smart parking Management System SPARK; Wireless Sensor Network WSN; Speed Measurement Sub-system SMS; Weather information Providing Sub-system WPS; Peripheral Interface Controller PIC; Integrated Circuit IC; Liquid Crystal Display LCD

I. INTRODUCTION

As the era of human has evolved from walking to the transportation over the last decade which technologically paved way for many innovations especially in automobile industries. There are million people who reside in metropolitan cities and who prefer to operate four wheelers for their comfort. We have tremendous increase in the number of four wheelers (car) users. Thus it creates hectic job for the drivers to find the space for parking their car. It leads to the traffic congestion and fuel wastage in searching for the available space in shopping malls especially in festival seasons [1]. Different techniques to manage smart parking system have been developed, which includes Wireless Sensor Network, Bluetooth, Zigbee, RFID, GSM, Image processing and cloud based server [2]. The existing car parking system can be categorized based on two areas, they include wireless sensor network based system and camera based system [3]. This proposed system is centered on the Internet of Things. IOT is interrelationship via network of computing devices implanted (electronic, software, sensors, actuators, system connectivity) in day by day items that enables them to send and retrieve information.

II. LITERATURE SURVEY

[4] YusnitaRahya and Fariza N. Mustapa did researches and produced a paper "A Secure Parking Reservation System using GSM Technology"; this approach has the advantage of secure car parking and reservation using GSM.

The user needs to send the message for reservation of the preferred slots in addition practice the PIN provided to come into and going away from the car parks slot. However, some disadvantage, this system has not using suitable sensors to detect the slot is empty or filled. It requires some man power effects to park the car.

[5] Lambros Lambrinos and Aristotelis Dosis "Applying Mobile and IOT Technologies in Managing Parking Space for People with Disabilities"; is the project which describes an intelligent car parks system built on the IOT technology. Zigbee, wireless sensor network remained to be used in this manner by way of IOT technology is used to interface.

With this advantage there are some disadvantages such as they are not by means of appropriate application practice. There is no structure enactments per the measured models intended for the structure assessment.

[6] Satish V. Reve proposed "Management Of Car Parking System Using Wireless Sensor Network"; this structure has altogether the infrared radar nodes which intellects the rank of the vehicle gap besides transference of the facts to the AVR controller and it demonstrates the facts on the led display intended for the customer. Though this system does not have the reservation and the users do not get updated status of the parking area.

[7] S.V. Srikanth suggested "SPARK"; which offers innovative structures alike isolated car parks observing, automatic supervision & car parks booking mechanism. Never the less of the exemplar scheme they projected, the architecture gratifies the car parks super vision scheme necessities.

[8] Renuka R and S Dhanalakshmi focused on "Android Based Smart Parking System Using RFID"; this prototype of SPS that allows drivers to efficiently find the vacant space and perform automatic billing process. RFID request remains used for deduction of the price for car parks charges via the RFID tags. The foremost involvement of their projected system remains to discover the position of the car parks zone besides delivers a regarded car parks. An IR sensor remains used in every car parks space to sense the existence of an automobile and then a message is sent to the user. The main drawback is that it is not tested on an actual time atmosphere where the customers are able to consume the "Smart Parking" arrangement in their handled device.

[9] Seong-E-Yo proposed DGS; A Driving Guidance System based on WSN which guides a driver to drive a car in safety. Therefore the arrangement comprises of two subsystems SMS and WPS.

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SMS measures the rapidity of car and captures the picture of the rapid car by means of a high speed camera. WPS facilitates information about climatic circumstances as well as the road circumstances via VMS or a telemetric terminal.

[10] Thann Nam Pham and Der-Jiunn Deng are the authors of “A Cloud Based Smart Parking System on IOT Technologies”; IOT is functional to ease the communication as the authors indicated that the performance of the car is enhanced by dipping the quantity of users who fail to find a parking space thus minimizing the overheads to the drivers towards moving to the parking spaces. Irrespective of such merits, the system has also demerits since a security aspect of the system is not clarified; besides the system is implemented in short scales.

III. MOTIVATION OF THE PROPOSED SYSTEM

The main focus being, dipping the traffic jamming that occurs mostly in the metropolitan areas. The drivers are searching space to park their vehicles. In a latest investigation, researchers found that for one year car parking created the corresponding of 38 times trip around the globe, flaming 177914.8 liters of fuels and causing 730 tons of CO_2 [11]. To reduce this carbon foot prints in atmosphere and to let our emerging India into pollution free environment, we go for the smart parking system using “IOT” with various technologies.

IV. PROPOSED SYSTEM

The planned arrangement is the mixture of the slot allotment with reservation using the Bluetooth module for the non-internet users within the certain range available in the parking area and android mobile application for the internet users to reserve the slot in advance and it also has slot booking facility by an URL search of parking area which is available in the mobile application [12].

The ultrasonic sensor is used to sense the occurrence of the vehicles and to transmit the information to the IOT module.

V. PROCESS FLOW

The process flow of this project is broadly divided into two stages based on, Internet users.

A. Non Internet Users

For non Internet users there is a Bluetooth technology and its algorithm to find the status of the parking slot are given below:

Status Confirmation Algorithm

Step (1): Start the process by turning on the Bluetooth device.

Step (2): Check the Bluetooth module whether it is searching for any other device around.

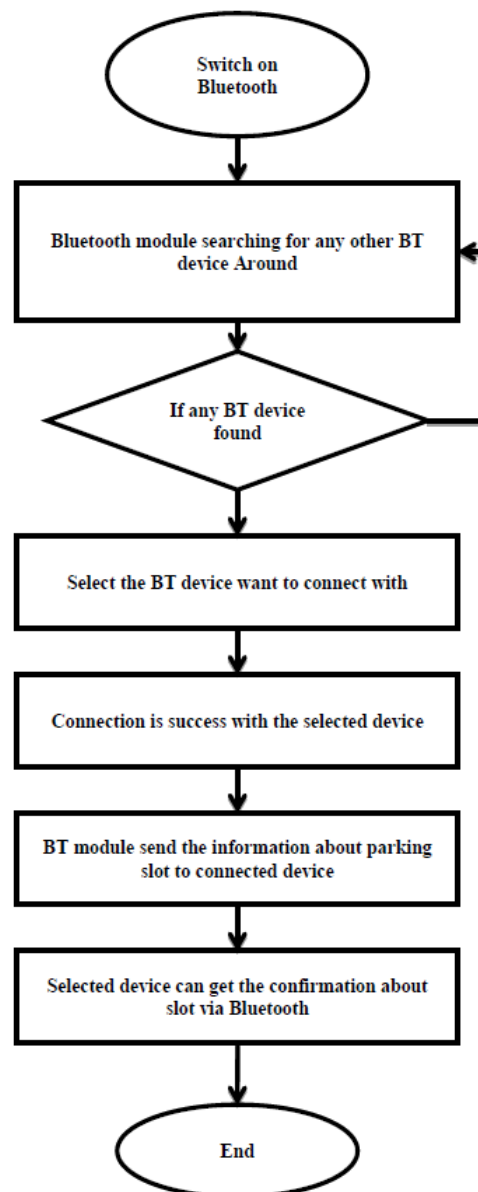
Step (3): connect with the preferred Bluetooth device.

Step (4): Parking slot information are send to the Bluetooth device by the module connected at the parking area.

Step (5): Now the client can view the position of the parking slot via the Bluetooth technology.

Step (6): Stop the process and go for the mobile application to reserve the slot.

Bluetooth Communication Flow Chart



B. Internet Users

For the internet users we designed the android mobile application using the development tool called android studio based on the java and xml language. The algorithm for the application is given below

Slot Reservation Algorithm

Step (1): Start the application.

Step (2): Check the user for the valid registration if not, go to the registration page and fill the needed requirements.

Step (3): With the use of valid user id and password check for the availability of slots using URL page provided by the application.

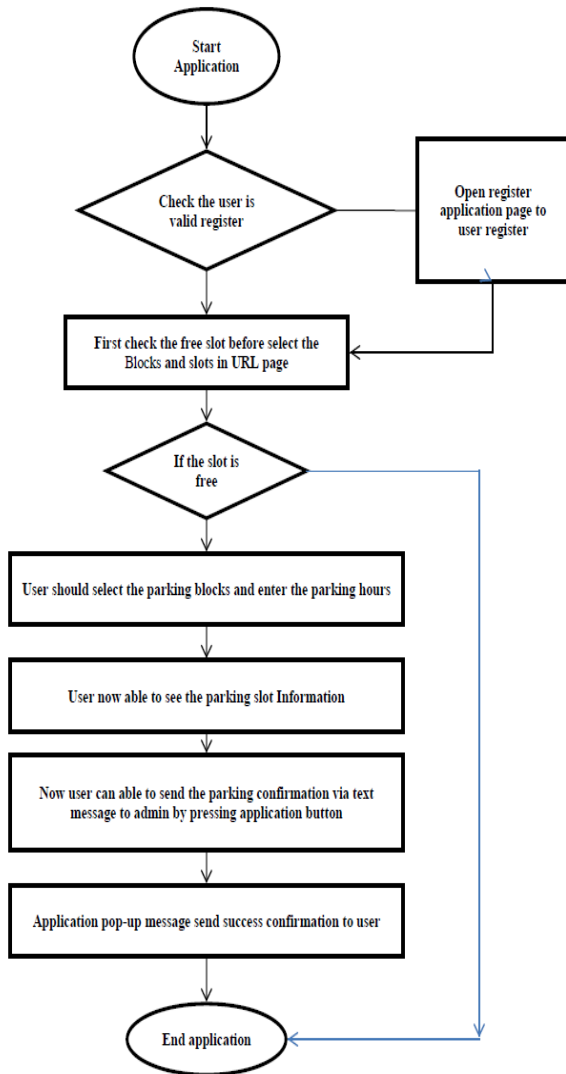
Step (4): Now the user must check for the list of available slots and know the status of the parking slot. Then the user may have the idea for booking required slot.

Step (5): With the information about the reservation of the preferred slot is directly available on the message and now the user must click the button to send the request of booking the slot.

Step (6): Application pop-up message send success confirmation to user.

Step (7): End the application.

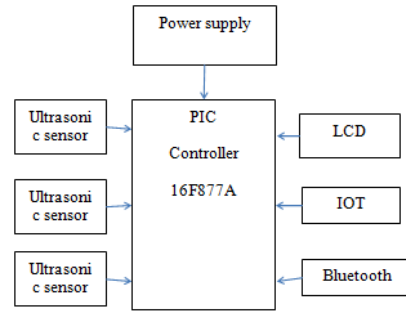
Android Application Flowchart



VI. SYSTEM DESIGN

IT consists of the LCD display for the status of the parking slots, Bluetooth module [13] is designed for the Non-Internet users also with the minimal distance of their parking area, Ultrasonic sensor acts as the transceiver, IOT is used for the Internet users plus for the transformation of data to the web server and the design process is done by the Peripheral Interface Controller (PIC) microcontroller. The design overview is divided into to two form, they are parking section and the Receiver section.

A. Parking Section



PIC Microcontroller

A PIC microcontroller is a single undersized IC which contains all the ICs such as CPU, EPROM program memory, RAM memory and an Input / Output interfaces. This PIC16F877A category can be used as a main regulator for this smart parking system. The PIC16F877A device has a 13-bit program counter able to address an 8K word x 14 bit program memory space. This memory is used to stock up the program once we flameit up to the microcontroller [14]. The PIC16F876A / 877A device encompassing of 8K words x 14 bits of Flash program memory can be electrically reprogrammed. Every instant we flameup the program hooked on the micro, we remove an older program and put in writing down a newer one.



Figure 1: PIC Microcontroller

LCD

The LCD is an electronic show module used for a broad variety of applications. A 16x2 LCD display is incredibly fundamental component and is generally used in a variety of gadgets and circuits. These components are preferred for more than seven segments and additional multiple segment LEDs. The cause being: LCDs are cost-effective; simply programmable; contain no restriction of displaying special and yet tradition lettering, animations and so on [15]. A 16x2 LCD way it is capable of displaying 16 lettering per line plus at hand are 2 such lines. Within this LCD, each lettering is displayed in 5x7 pixel matrix. This LCD has two registers, Explicitly Command and Data.

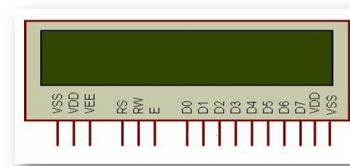


Figure 2: LCD Display

GSM

Global System for Mobile Communication (GSM) is an unbolt, digital cellular technology intended for transmitting portable voice plus information services. The communication medium sandwiched between the users and the hardware compartments is the GSM modem via SMS formats.

Ultrasonic Sensors

Ultrasonic sensors toil on a standard alike toward radar or sonar which evaluates characteristics of a goal through elucidating the reverberations from broadcasting or sound waves correspondingly [16]. Ultrasonic sensors produce elevated frequency resonance waves and estimate the reverberation which is expected back by the sensor. Sensors compute the moment in time period among distribution of the signal and getting the reverberation to find out the remoteness to an entity.

Systems typically employ a transducer which produces resonance waves in the ultrasonic range, higher than 20,000 hertz, by means of whirling electrical power into resonance, subsequently a head in receipt of the reverberation turn the sound effect into electrical power which can be calculated and displayed.



Figure 3: Ultrasonic sensor

IOT Module

IOT is a setting within which objects, flora and fauna or public are provided with sole identifiers and the capability to shift information across a network with no requiring human-to-human or human-to-computer communication. [17] IOT board is featured with SIM900 GPRS modem to activate internet connection also equipped with a controller to process all input UART data to GPRS based online data. Data may be updated en route intended for explicit location or a societal network through which customer be capable to access the data. [18] When IOT is enlarged with sensors and actuators, the equipment becomes an example of the further universal group of cyber-physical systems, which as well encompasses technologies such as elegant grids, stylish homes, clever moving and smart cities. Experts guesstimate that the IOT will subsist of approximately 50 billion objects by 2020.



Figure 4: IOT Module

Bluetooth Technology

Bluetooth is an existing standard and arrangement for small-form aspect, inexpensive, small range radio links amid portable PCs, mobile phones and additional portable devices. The technology allows users to form wireless connections between various communication devices, in order to transmit real-time voice and data communications. The Bluetooth is built into a small microchip and operates in the 2.4GHz band, a globally available frequency band ensuring communication compatibility worldwide [19]. It uses frequency hopping spread spectrum, which changes its signal 1600 times per second which helps to avoid interception by unauthorized parties. In addition software controls and identity coding built into each microchip ensure that only those units preset by their owners can communicate. It supports both point-to-point and point-to-multipoint connections and provides up to 720 Kbps data transfer within a range of 10 meters (up to 100 meters with a power boost).

Android Application

An android application is created using Android studio [20]. The android applications are developed using the JAVA code. Using the JAVA compiler the source files are converted to JAVA class files. The Android SDK contains a tool, which converts JAVA class into a .dex (Dalvik Executable) file.

The .dex file and the resources of an android application are packed in to a .apk(Android package) file. The resulting .apk file contains all data to run the android application and can be deployed to an Android device using adb tool. The Android system is more secured. The Android system installs each and every Android application with the unique user and group ID.

Android contains a permission system, declares required permission in the *AndriodManifest.xml* configuration file. Using the slot allocation method the Android application is urbanized for elegant parking. Slot reservation can be done using the slot allocation method. The demand is restructured in the server and forwarded to parking locale.

B. Receiver Section



Figure 5: Booking the Slot with the Help of Mobile Application

VII. RESULTS AND DISCUSSION

Slot allocation is implemented by using the smart android application, which are as follows:

The outlook of a mobile application for the internet users its starts with the registration page as shown in Figure 6, and proceeded with the login page with the correct user name and password ID as shown in Figure 7. Now the user can be able to see the status of the parking slots with the URL page as shown in Figure 8, and the user able to see the slots are in red color and after booking the slot it changed to red color as shown in Figure4. The slot confirmation message is sent to the admin as shown in Figure5 and the pop-up message is received that the booking of the slot is confirmed.

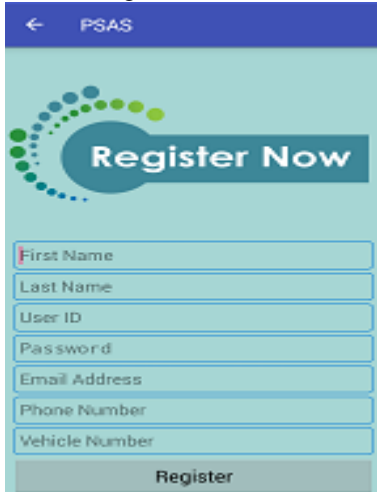


Figure 6: Outlook of a Registration page

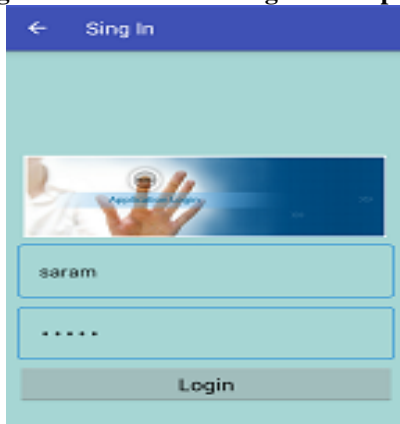


Figure 7: Login page

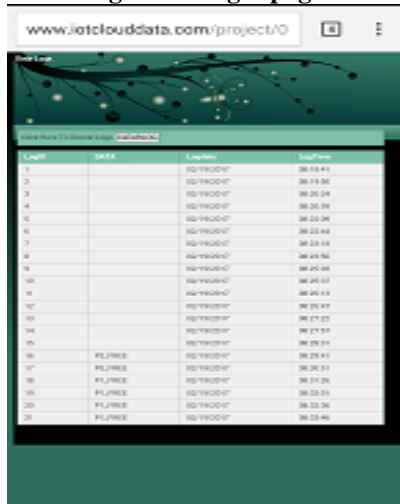


Figure 8: Status of the parking slot

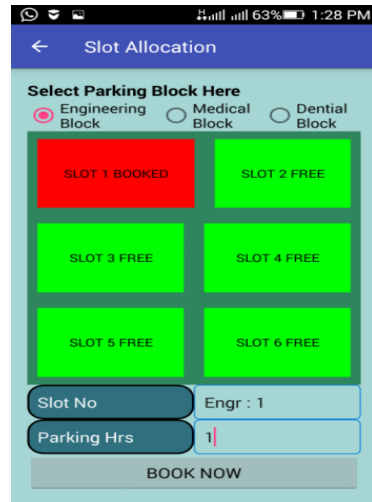


Figure 9: Booking the slot and Parking hour

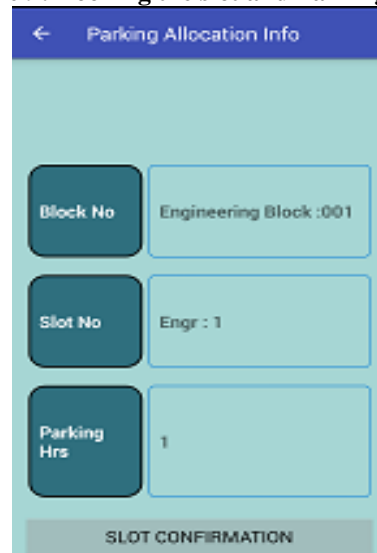


Figure 10: Slot confirmation message

The status of the parking slots can be known to the user with the help of the Bluetooth technology, in which the user should search for the paired device as shown in Figure 8. After the paired device they have to select the preferred device as shown in Figure9 and the status of the parking slot can be known to the user as shown in Figure10.

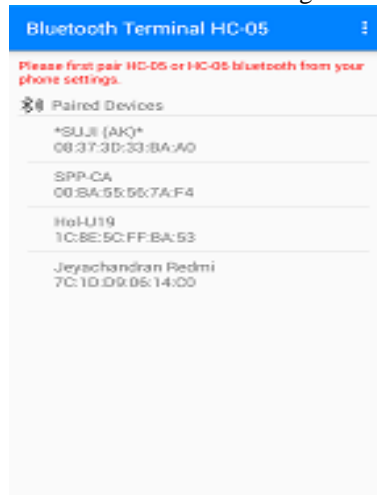


Figure 11: Searching for the preferred device



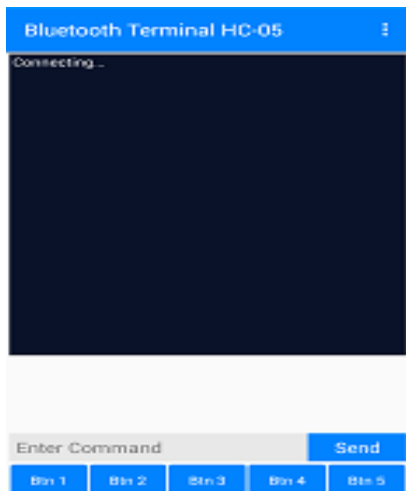


Figure 12: After selecting the device

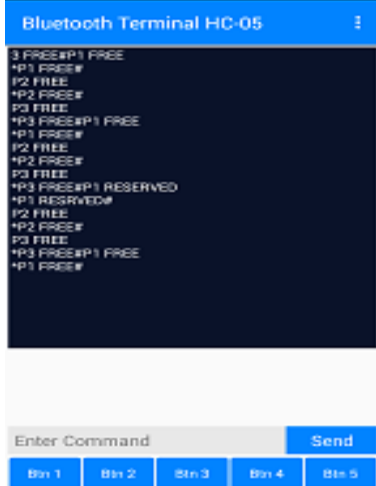


Figure 13: Status of the parking slot

The hardware modules of the proposed system is with the sensors, IOT module, Bluetooth module, LCD display with the microcontroller is in connection. Which exhibits the status of the sensors as the slot is free or reserved

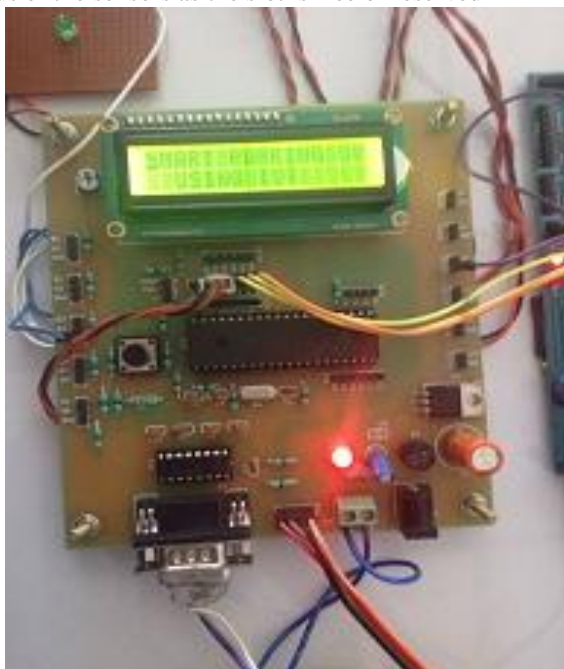


Figure14: Display of LCD

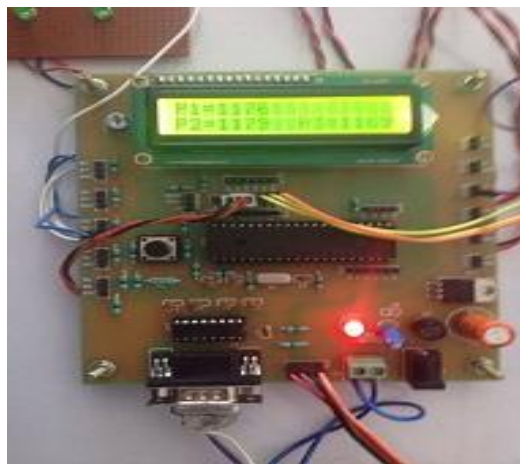


Figure15: Ultrasonic sensors reading

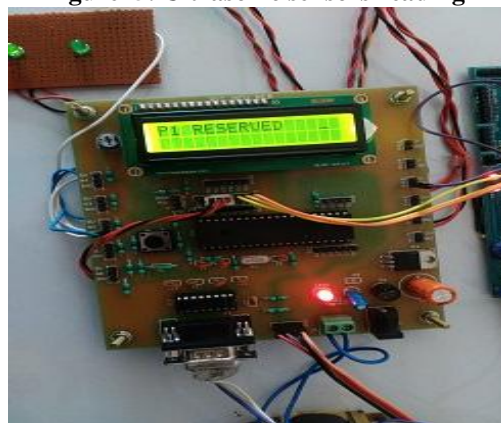


Figure 16: Status of Parking Area

VIII. CONCLUSION AND FUTURE ENHANCEMENT

In this paper, the smart parking system proposed on Bluetooth for non-internet user and android application using IOT. To alleviate the above mentioned problems faced by the users we created an android application. This will make the management of parking space effectively, by eliminating manual labor work.

In the future enhancement recognition of the drivers so as to avoid theft and automatic billing process can also be designed. For identification of the entering and leaving of the parking slot PI camera can be implemented. The more accurate RSSI measurement method [21] will be added as an additional application such as accident alarm and online payment.

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