Managing Car Parking- The IOT Way

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Abstract: **--**This paper is to design a solution for overcoming the parking issues that exist in public places such as malls, multiplexes etc. especially on weekends due to lack of parking facilities and increased amount of vehicles. The aim is to achieve this by using the concept of Internet of Things (IoT). The proposed Smart Parking system consists of an on-site deployment of an IoT module that is used to monitor and signalize the state of availability of each single parking space. A mobile application is also provided that allows an end user to check the availability of parking space and automatic payment accordingly.

Keywords: **--IoT, Car Parking, Aurdino.**

Introduction

Present day's car parking has become a major issue in urban areas with lack of parking facilities and increased amount of vehicle. To avoid the wastage of time in searching the space for parking, an advanced method is used to build a smart car parking system which uses the Internet of Things to make it easy and comfortable. Many researchers have suggested variety of solutions in making parking of vehicles easier. Jatin Desai et al [1] proposed a QR code in conjunction with Rasp Berry Pi camera module and reported success in detecting the presence of a car in a parking slot. The implementation of the solution was via the camera module which is capable of scanning the QR code which consisted of the details of the customer such as name, contact number, registration number of the vehicle and such other details. MasihaSabnam et al [2] reported the use of IR sensors in conjunction with RFID tags. The IR sensor consists of IR transmitter and receiver while the RFID tags consist of customer details. A microcontroller was used to interface the sensor circuit and RFID module for detection and authentication of vehicle. Use of 8051 microcontroller was reported by AbhishekAgrawal et al [3] in providing solution to car parking problems. The proposed method for car parking used transmitter section incorporating IR LEDs making use of 555 timers IC which generates a frequency of 38 KHz, which will be given to IR LEDs. Further, the LCD Display will display the availability of slots. In addition, a payment terminal was established for the customer to pay for parking through which the customer in turn will be issued with a key with a customized code. Bo Yang and Yiqun Lei [4] adopted CC2430 processor and SAMR magnetic sensors for vehicle detection and classification. They tested the classification algorithm for vehicle speed of 30 to 40km/h for normal traffic and 10 to 15 km/h for lows peed congested traffic respectively and reported 100% efficiency and 99% efficiency of the algorithm respectively. Haijian Li [5] proposed three speed estimation methods of Vehicle Length based (VLB), Time Difference based (TDB) and Mean Value based (MVB) to get different reference speeds when a vehicle passes over the sensor and reported that the mean absolute errors (MAE) of VLB, TDB and MVB methods are respectively 4.12km/h, 5.90km/h and 4.05km/h and the mean speed errors of the three methods are all less than 1km/h. Ramya Sri [6] et al adopted Micro Controller AT89C52, IR Sensors, Crystal Oscillator and Stepper Motor for smart car parking and the parking slot available is displayed on LED display. VytautasMarkevicius et al [7] used magnetic field sensors and MSP 430 micro controller for dynamic vehicle detection and reported the average relative error of speed determinations not exceeding 1.5% when the distance between sensors is 2 m. In this direction, a method using ARDUINO Mega microcontroller for smart car parking is proposed.

Methodology

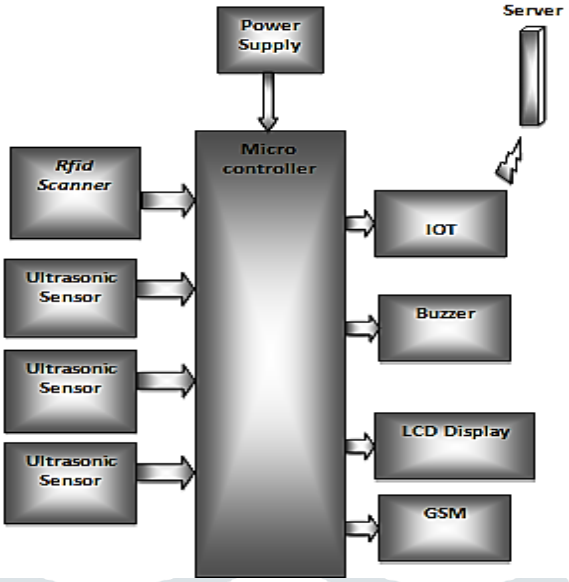

Figure 1: Block diagram of the proposed system

Figure 1 shows the proposed system which uses an ultrasonic sensor that checks the free slot and the free space available between the car and the slot's wall. An RFID scanner identifies the specific user and updates the information in the IoT. When the card is swiped by the user, the payment details are updated through GSM. The IoT website and the LCD display help to view the location details of each parking slot and free parking slot and the direction of free parking slot. All the operations of the system are performed by the ARDUINO Mega microcontroller. When an obstacle is encountered, the corresponding data is sensed and transmitted to the microcontroller by the ultrasonic sensor. The microcontroller in turn transmits the information to GSM module on receiving the signal from RFID scanner. The RFID card holder is fed with the information by GSM through SMS and the LCD displays the slot information. The server in turn is updated with the information through IoT and the power required by various components is supplied by the power supply unit.

Results and Discussion

A. The Hardware Implementation

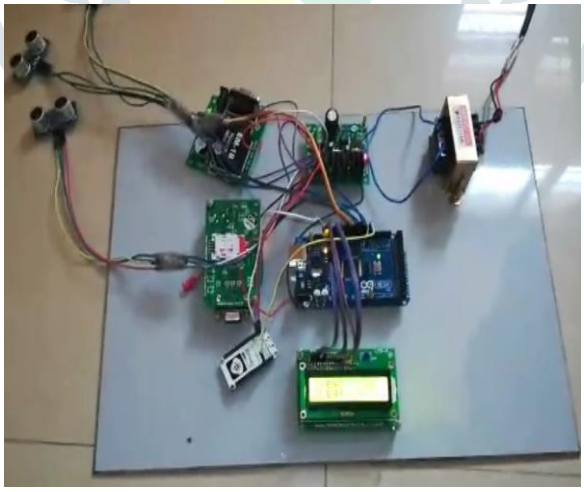

Figure 2: The Hardware implementation

Figure 2 shows the hardware used in the system and various components interconnected for proper functioning of the system. The power supply consists of 230 V mains input which is step down by a transformer to 12 V. This is fed to the supply board consisting of three voltages 12 V, 5 V and 0 V since different components require power input in these three levels. The ARDUINO is connected with RFID reader. When the user swipes the card, the data is fed by the microcontroller into the RFID tag. SMS is sent to the subscribed user regarding the parking charges via GSM module and the payment details are transmitted to the ARDUINO receiver. The system is connected to internet through built-in Wi-Fi in Node Mcu and the LCD screen displays the space available for parking and direction towards the slot. An alarm is used as a collision avoidance measure. The user scans the

RFID tag to the reader while entering the parking zone and a message is sent to the user regarding the payment details via GSM module. Figure 3 shows the RFID card read by the RFID reader and Figure 4 shows the message sent to the registered user using the GSM module.

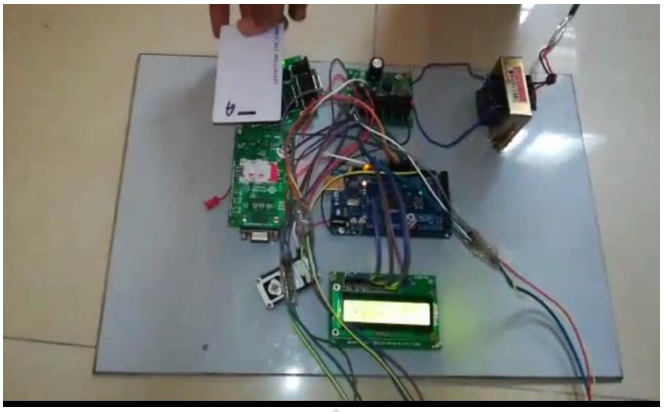

Figure 3: RFID reader reading the RFID tag

Figure 4: Message sent Via GSM

Figure 5: LCD displaying all slots empty

When there is no obstruction near the sensors, the LCD displays that the parking slot is empty indicating that no vehicle is parked in that slot and also displays the direction towards the empty slot as shown in Figure 5. When a vehicle is parked in a slot, the respective sensor slot is shown as full as shown in Figure 6. When a car approaches a parking slot, an alert message is displayed on the LCD screen and buzzer is turned on. The IoT website is updated with information every 15 seconds.

Figure 6: Car parked display

B. Simulation results

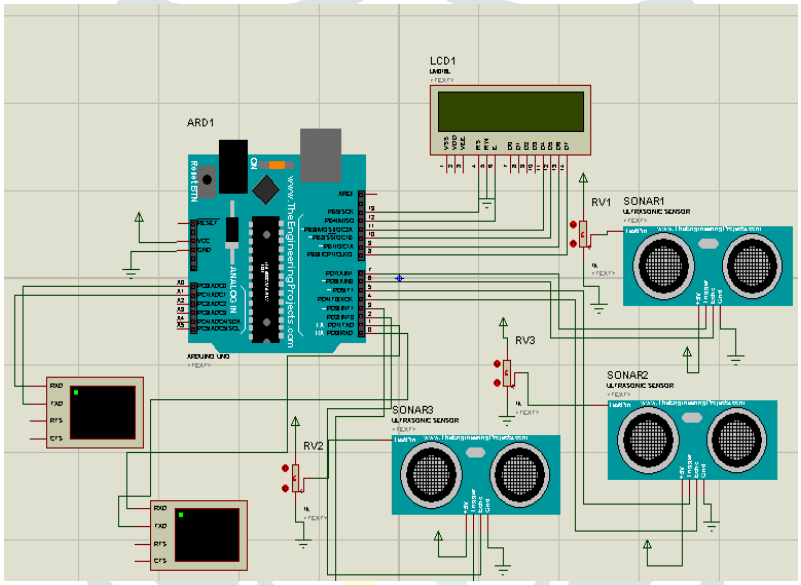

Figure 7: Simulation of interfacing Arduino with ultrasonic sensor

Proteus tool is used to simulate the prototype. The tool box provides a library from which the components are dragged into the working area and are properly connected to get the required output. Log files are generated and added to each component and then simulation is run before hard ware implementation. The resistance across the sensor can be varied and when it reaches maximum, the sensor senses it as an obstacle and the LCD displays the respective sensor slot as full and rest other slots as empty, as shown in figure 8.

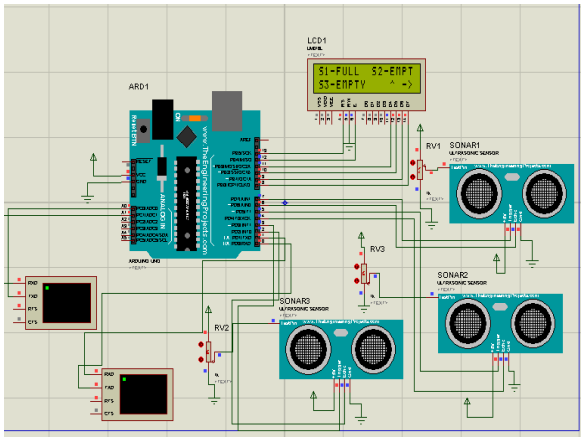

Figure 8: Simulation result with varying resistance

Conclusion

The proposed method of car parking was implemented only for a specific type of vehicle and was 100% efficient in displaying the vacant and filled parking slots. With this success, it is proposed to add a classification algorithm in order ease the task of assigning parking slots based. Further addition of GPS system to this existing system helps to locate and navigate to the exact empty parking slot making the system fully automatic.

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