

Embedded System Based Secured Car Parking System

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Abstract: Due to increase in both population and in the usage of cars the city experiences traffic congestion and air pollution. In a way of overcoming these issues, a scheduled parking system must be deployed. As the population increases, number of persons roaming around the city in searching for parking slots also increases. Though many solutions have been proposed, those solutions were not scalable. But this paper proposes a scalable and cost-effective solution for car parking and pre-booking. This can be implemented using sensors and processors. Ultrasonic sensors are placed in each slot for finding the presence of cars and the data of ultrasonic sensor is fed to the Arduino Mega for processing. The processed data is transmitted to the cloud server using Node MCU and that information can be accessible by a user through a mobile application or webpage and mechanical system is added for security purposes.

Key Words: Sensors, Processor, Arduino Mega, Node MCU, Ultrasonic sensor, Cloud server, Mobile application and Webpage.

I. INTRODUCTION

Sales of the cars in India have been increased rapidly in last few years compared to all the other developing countries in the world. If the purchase of cars increases then the parking allotted for the cars must also be increased. Nowadays people visiting malls have been increased due to there as on that all the goods are available in single market place and more over theaters also. IoT plays a vital role in finding a solution to the parking. IoT is the emerging trend in the 21st century. IoT is a network of connecting devices; those devices could be tracked, controlled and monitored using remote processors that are connected to the internet [1]. Different protocols are used for communication between two devices. The cloud is the best technology to store the current data and information; it can also be processed for future reference.

The major challenged faced by the parking management system in the Indian malls is finding a free slot in the malls. The manual slot finding increases the need for manpower.

Arduino UNO is open source software for implementing our ideas in a simple way. It has 14 digital input and output pins of which 6 are used as PWM outputs 6 are analog inputs. The processor of an Arduino UNO is ATmega328P. It has 10bit inbuilt ADC. The ultrasonic sensor is used to find out the free slot in the parking place and the corresponding data is transfer into microcontroller for processing. The processed data is sent to the cloud server or database and using a webpage or mobile application corresponding free slot can be displayed [2]. The information

user can pre-book the slot or it is easy to find out the free slot in the parking area. By using the app it can also display the exact amount of payment for the corresponding parking times.

II. LITERATURE SURVEY

Based on survey our project an IoT based E-parking system for smart cities on 30 September 2017. In this paper, a prototype of the proposal is presented. A new device called parking meter is used for implementing the smart parking system. The charging process done is similar to the charging process for electric vehicles. Plug-in Electric Vehicles (PEVs) and Plug-in Hybrid Electric Vehicles (PHEVs) charging scenarios are calculated with corresponding control strategies prescribed.

A Prototype for IoT based Car Parking Management System for Smart Cities. Due to lack of parking facilities in present day's due to the high density of vehicles in the urban areas causes the major issues at present, In peak hours drivers are highly stressed in finding the parking space in the city[3]. This causes high impact In two aspects one is on fuel and other is on air pollution. IR and RFID are used to find the car details and this methodology will reduce the traffic and helps in the parking slot. Smart Car Parking System Based on IoT concept, the Major problem in day to day life is parking of vehicles especially the car parking at an in appropriate place. And this issue indirectly leads to traffic congestion. This paper presents the basic concept of using server or cloud-based smart parking services in smart cities as an important application of the Internet of Things (IoT) paradigm. This system can be monitored to find the empty slot through a mobile app or through the webpage.

III. SYSTEM OVERVIEW

The sensor-based car parking and pre-booking system are developed to finding a free slot in the parking zone. The system detects the arrival and the departure of the car for the can find out using different types of sensors. The proposed system uses two ultrasonic sensors to identify the arrival and departure of the car. The system also implements for pre-booking [4]. Programming for the sensors are done using Arduino UNO micro-controller.

Revised Manuscript Received on December 28, 2018.

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Fig.1.Vehicle Detection Sensors

A. Ultrasonic sensors

Ultrasonic sensors are used to detect the presence of car. Ultrasonic sensor's ranging for module HC-SR04 is 2cm-400cm for non-contact measurement function and the ranging accuracy can reach up to 3mm.Those modules include ultrasonic transmitter, receiver and control circuit [5].



Fig.2. Ultrasonic Sensors

RTC is a computer clock, it is used in devices requiring to maintain accurate track of time .Along with time tracking, RTC is also used to free the main systems for critical tasks and for low power consumption[6].RTC does not require power from the main power supply, they use power from the additional power source. This helps in tracking the time even when the primary source is switched off.



Fig.3.RealTimeClock

The controller of Arduino Mega is ATMEGA. It has a reset button, 1-ICSP header, 1-Power jack, 1-USB connection, 1-16MHz crystal oscillator, 4-Universal

Asynchronous Receiver and Transmitter, 16- analog inputs and 54-Digital IO pins.



Fig.4.ArduinoMega

B. DC Motor operation

A motor is an electrical machine which convert electrical energy into mechanical energy. In this proposal, dc motor is used to ON and OFF mechanical system automatically with the help of controller and corresponding code for controlling the DC motor [9].

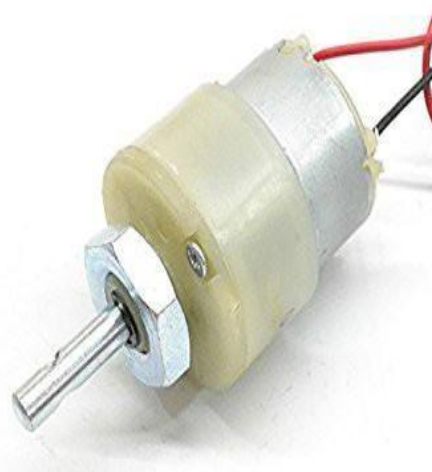


Fig.5.DCMotor

C. GSM Module

Global System for Mobile communication has been used in this system for sending the message to home-owner. The purpose of GSM in this system is to send a message of door opening and closing [10].

IV. BLOCK DIAGRAM

Fig 6, 7, 8 explains the block diagram of the system. Arduino Mega is interfaced with the ultrasonic sensor, keypad, RTC, LCD display, DC motor and GSM module. Arduino is powered using a 12V battery source. The slot availability for the vehicle can be viewed on the mobile application or webpage [11], [12].



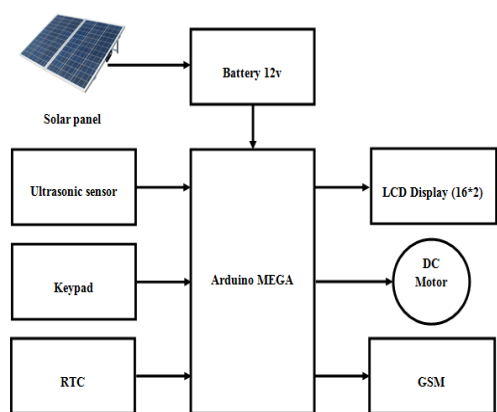


Fig.6. Block Diagram of the system

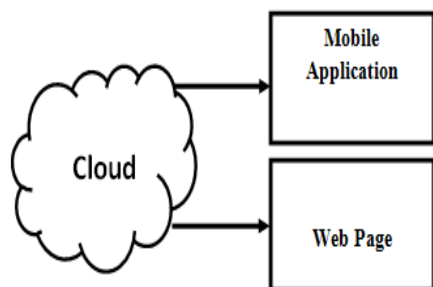
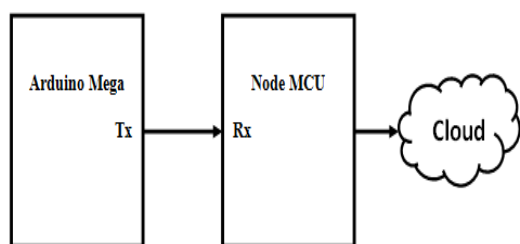
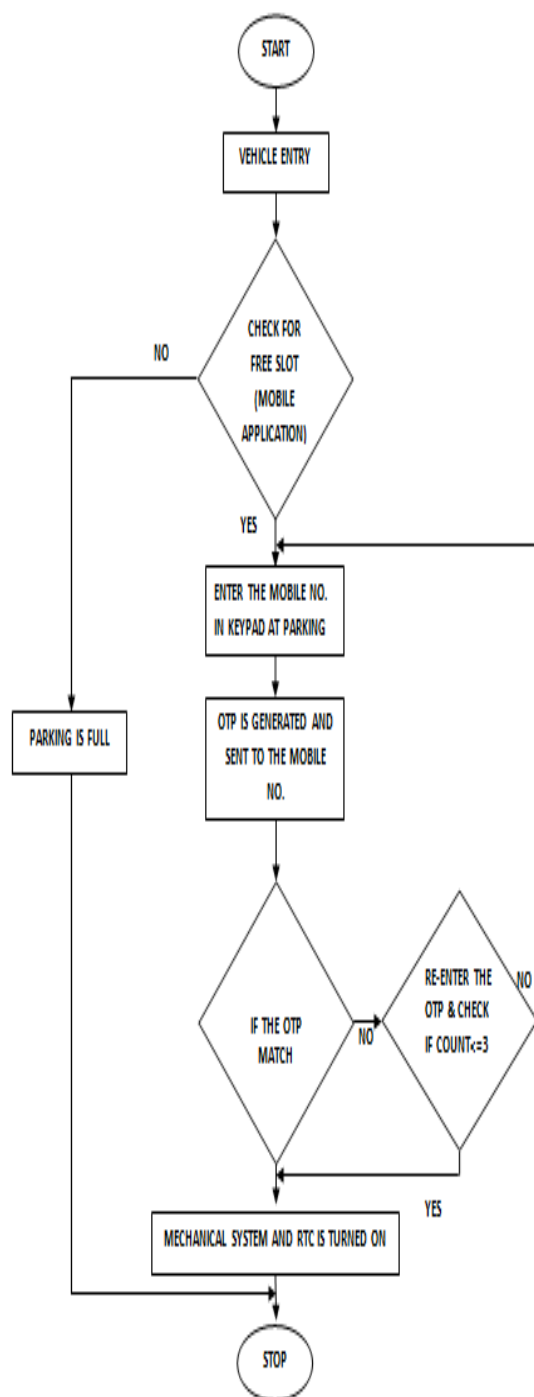


Fig.7. Block Diagram of the system

FLOW CHART— VEHICLE ENTRY

- STEP-1: The vehicle enters the parking area.
- STEP-2: Empty slot for parking the vehicle is checked.
- STEP-3: Exit the parking if the slot is full.
- STEP4: If an empty slot is available, enter the mobile number. Enter the mobile number on the keypad of the slot.
- STEP5: OTP of 4 digit is generated by a random variable algorithm and sent to the corresponding mobile number.
- STEP6: Generated OTP is entered in the keypad and if the OTP matches, the mechanical system is turned ON.
- STEP-7: If the OTP does not match, it can be re-entered up to 3 times on the keypad of the slot.
- STEP-8: If there-entered OTP is wrong more than 3 times, the system exits the process and to be begun from the initial step.
- STEP-9: Exit the system.



V. FLOW CHART-VEHICLE EXIT

- STEP-1: Initiate the system at the vehicle parked slot.
- STEP-2: Reenter the same OTP sent to the corresponding mobile number.
- STEP-3: If the OTP matches the mechanical system is turned OFF.
- STEP-4: Exit the system

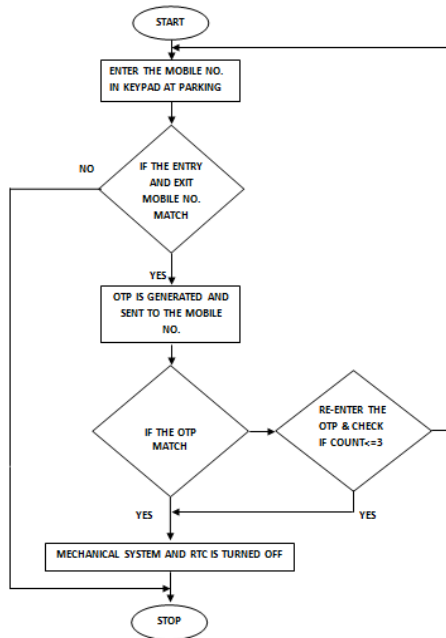


Fig.11. Flow chart of the system

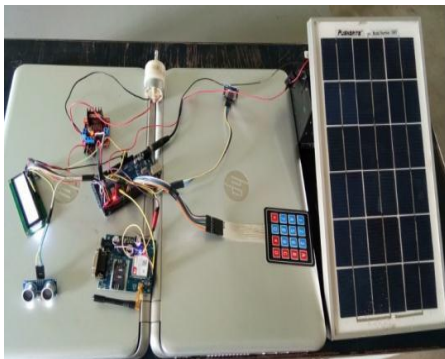


Fig.12. Complete Hardware Module



Fig.13 .Mobile number entering using keypad

VI. EXPERIMENTAL RESULTS

The proposed system practically experiments as a working model for Indian malls. The major components used in the model are shown in below figures i.e. Two ultrasonic sensors, one LCD to display a number of the parking slot.

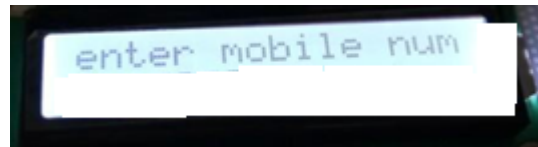


Fig.14 .Mobile number displayed on the LCD

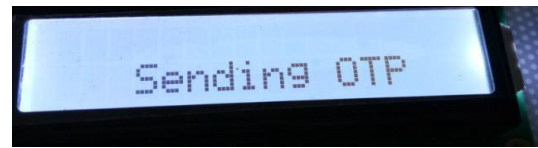


Fig.17.OTP Generation



Fig.18.OTP received and entered



Fig.19.Parking Slot Engaged

VII. CONCLUSION

This proposed system, we can find-out the free slot in the parking area and it can also be used for security system. This can be implemented in a real-time environment and the corresponding data can be computed and displayed on the web page or mobile application. This system can reduce the manpower radiates an effective solution for the real-time problem. Thus, this design finds its applications in many cases [13], [14]. The system has satisfactorily fulfilled the basic things such as finding a free parking slot in the parking area inside the mall. But still, the power supply for the processor and sensors has been powered ON for the fulltime. In future enhancement payment for parking time corresponding to the particular car can be calculated and payment through online by connecting banking account to the mobile application [15]. Another solution for calculating the parking time is by using the camera. This captures the image of the incoming cars in the mall, that captured images can be converted into a barcode.



The barcode that contains an image of the car has the date and time of the car entered in the mall. While the car exits the mall parking, the barcode retrieves the image and calculates the amount spent for parking. The metal detector sensor is used to sensor detect a car that passes over it. These sensors that are placed on both entry and exit of the mall are used to control automatically the opening and closing of gates.

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