

Embedded System Design for Smart Parking System

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Abstract— Moving towards the development of smart city, various smart applications like smart home, healthcare, street lighting, parking system, waste management system etc. are part of it. With the advent of IoT, these concepts can be readily achievable; it can increase the quality of services in cities and can improve productivity and reliability. IoT enables the connectivity between surrounding environmental things to the internet. Out of these applications smart parking system is an important part of so-called smart city. It solves the parking issue in urban areas. Smart parking system allows the user quick access which helps in reduction of time in searching the parking spot, reduction in traffic congestion. It can be used to monitor parking systems and exhibit the parking lot situation at any given moment.

Keywords— Internet-of-things (IoT), Smart parking system, parking lot smart city.

I. INTRODUCTION

Building an advanced parking system is essential in a developing country like India where population and automobiles are increasing rapidly. Usage of the automobiles is increasing very rapidly, but the efficient parking slots are not available to park an automobile, which force the driver to park a vehicle on the roads, which is the reason for heavy congestion on the roads and slow movement of traffic. Although, lot of time is wasted in searching for parking slot. Also, while searching parking slots, movement of traffic becomes slow. To overcome all the problems mentioned above, we need an efficient parking system which would help to reduce traffic congestion at important locations where traffic rush is more. Arduino based car parking will provide automatic management of parking lots without any error. This problem cannot be solved by adding parking spaces or by making multi-storey parking spaces. Instead we need to enhance our available parking system to advanced monitoring parking system. This project will help to ensure the security of a vehicle, reduce corruption, man power and makes the whole parking as an automated system which will be error

free and can reduce time of users in parking their vehicle. Because of, not properly maintained parking spaces, peoples are forced to park their vehicle on the roads which result in heavy congestion as well as road blockage. Our automated parking provides the user-friendly environment to park a vehicle in a safe place because only an authorized person can park their vehicle. As congestion on a road reduces, it will automatically reduce pollution generated by vehicle in traffic.

II. OBJECTIVE

“The main objective of this project is to use Arduino to implement a smart parking system in order to reduce the problems such as reduction in the traffic congestion at heavily occupied locations”.

The prime objectives of this project are:

- To reduce pollution generated by vehicle in traffic.
- To check unauthorized use of parking space as well as loot of vehicles.
- Provides the user-friendly environment to park a vehicle.

III. HARDWARE REQUIREMENTS

A. Arduino uno

The Arduino UNO is a widely used open-source microcontroller board based on the ATmega328P microcontroller. The Arduino UNO board has six analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor. The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labeled “~” can be used to generate PWM. The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top

of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz's

B. Servo motor

The TowerPro SG90 9g Mini Servo is 180° rotation servo. It is a Digital Servo Motor which receives and processes PWM signal faster and better. In this system servo motor is used at the entrance and exit to open the gate. It is operated by the digital signals sent from arduino.

C. IR sensor

An IR sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. In this system IR sensor is used to detect the vehicle at the entrance, exit and at the parking lot.

D. LCD display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. In this system LCD display is used to provide the information about the number of parking space occupied or free.

E. GSM module

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. In this system gsm module is used for vehicle authentication by sending and receiving SMS at the entrance and exit respectively.

IV. METHODOLOGY

The proposed system performs three fundamental operations:

- 1) Incoming vehicle detection and parking spot navigation.
- 2) Spot allocation and vehicle monitoring.
- 3) Authentication for the genuine user to avoid vehicle thefts.

In the proposed system, Arduino microcontrollers are used to develop the control system. When vehicles enter the parking lot, the sensors at the entrance detects the vehicle and sends the signal to the control system in order to collect the user information for the purpose of authentication.

The vehicle number through user mobile number (by sending SMS) will be collect by GSM module interfaced to the microcontroller. After storing the data, microcontroller gives the signal to servo motor in order to open the gate and allows the vehicle to enter into the parking area.

The available parking slot will be indicated in LCD display, which guides the user to the free space. After user parks the vehicle in the slot, the sensors detects the presence of the vehicle and sends the signal to the system. System records time from when the vehicle is parked to its exit time and sends the parking slot number to the user mobile number through SMS. When user wants to exit, once again the vehicle number through user mobile number will be

collected and compared with the data which is pre-stored during entrance. If there exist a mismatch, information will be sent to the authorized user and the exit gate will be kept closed till the authorization.

The time duration will be calculated and appropriate bill will be generated at the exit gate. After the payment, the exit gate will be opened by the system and car exits.

V. BLOCK DIAGRAM

Fig 1, 2, 3 explains the block diagram of the system. Arduino UNO is interfaced with the IR sensor, keypad, LCD display, servo 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 [11], [12].

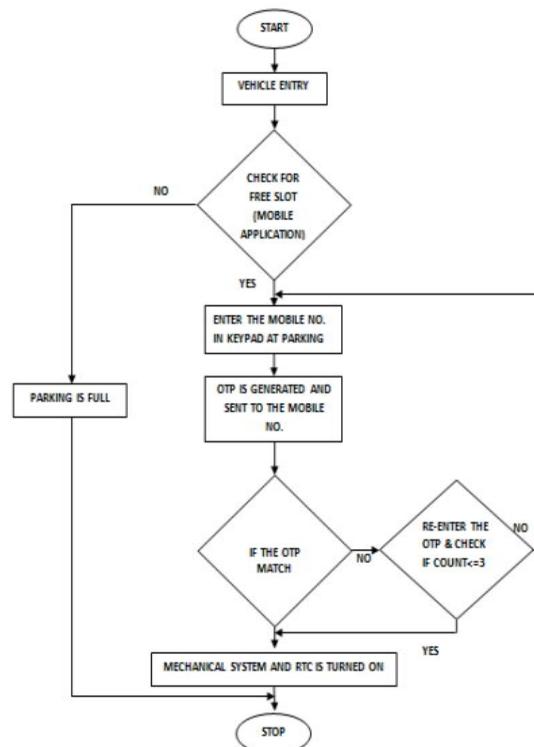


Fig. 1 Block diagram for entrance.

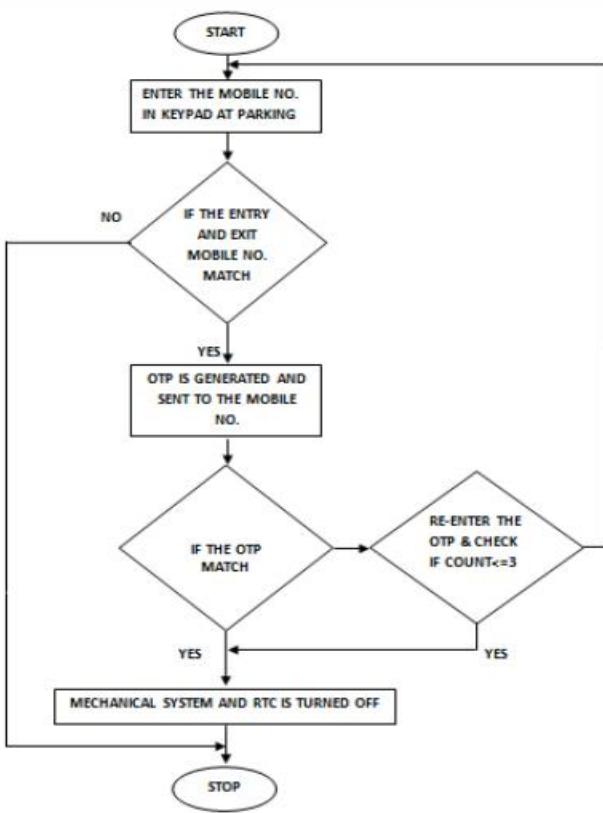


Fig 2 Block diagram for exit.

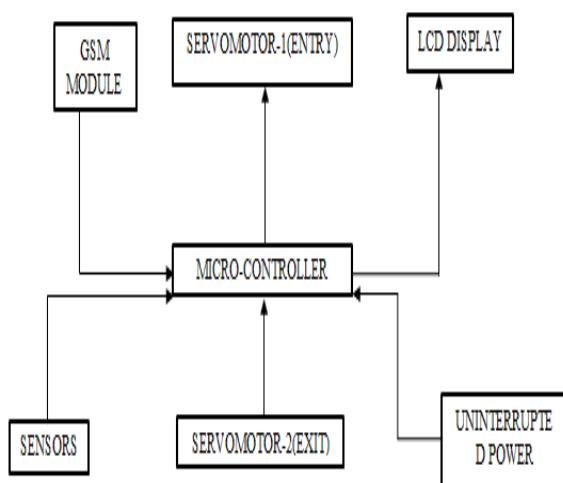


Fig.3 Block diagram for arduino interface.

VI. 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 IR sensors, one LCD to display a number of the parking slot.

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. 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.. Another solution for calculating the parking time is by using thecamera. This captures the image of the incoming cars in the mall, that captured images can be converted into a barcode.

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