
Development of Intelligent Car-Parking System

Ayantika Dey¹, Arjun Dutta^{1,*}, Manisha Sen¹, Debkanya Banerjee¹, Darothi Baidya¹, Abhijit KarGupta^{1,*}

¹Institute of Engineering and Management, Saltlake Sector V, Kolkata 700091, India

Email: arjuncode47@gmail.com, abhijit.kargupta@iemcal.com

Abstract

In this modern world, the paradigm of smart cities has gathered major popularity. Thanks to the evolution of microcontroller, the notion of smart city seems more convincing. This paper proposes an algorithm that helps users to find a free parking space for cars automatically. Microcontrollers and sensors have already made a huge impact on learning and predictive analysis. The widespread affirmation gave a new life to this open source hardware component which potentially became a big challenge to many industrial products and new interests in electronic system and prototyping.

This paper deals with effective parking solution which involves the use of ultrasonic sensor, atmega series, wireless signal module, cloud server and decrease the time spent for searching parking spaces. IoT based new parking platform enable to connect, analyze and automate data gathered from devices and execute smart parking possible. The proposed system not only reduces manpower but also reduces traffic congestion, and facilitating secure parking system within a limited area.

Keywords: *Microcontrollers, Smart Cities, IoT, Traffic-Congestion*

1. Introduction

Traffic congestion, an alarming problem at a global scale has been growing exponentially over the years. With the gradual development of robotics and intelligent systems, industrial automation has gained major importance in the modern era. Initially it all started with the wireless internet connectivity but now the need of intelligent system became demanding. Rather than traditional use of manpower control and monitoring, automated car parking provides many facilities. Like, excess investment upon man-power, traffic congestion can be ignored. Moreover, the proposed architecture controlled by Atmega microcontroller is faster, easy to operate and can meet up with the market needs.

T.N Pham implemented an architecture which reduces the average waiting time taken by the users for favourable parking their cars when the communication mode was based upon intelligent wireless systems [2]. Whereas, Wang Guang proposed a similar model using microcontroller and IR sensors for counting number of cars coming in/out of the parking bay. With the enhancement of sensors and IoT., interest towards 'smart city', came into picture[3].

On the other side, A. Dutta projected a unique system which is composed of RF sensors and four different controller setups which is used to avoid traffic congestion and control heavy traffic flow in metropolitan city like Kolkata, India. He depicted the use of wireless technology to solve the heavy rush throughout the junction of different corridors (North-East, South-West) [4].

Papacostas devoted a design of parking system based on control system paradigm. The proposed control system paradigm acts as an important aspect for the passage of cars in/out of the parking spot. However it also depicts a low cost multi-level parking lot which allows the provision for more number of cars in a small area (Papacostas, C.S, 1993). A specially designed, multi-level parking system was proposed by A. Albagul which facilitates the passage of cars on both the sides in the garage system. This passage of cars are doing through elevator like system driven by PLC control, facilitates quick destination and ease in accessibility of vacant spots for parking [5]. Similar model was also depicted by Papacostas, whose design and paradigm based upon the passage of cars in/out of the intelligent parking spot. It claims out to be manufactured at lower cost which also allows for the permit of more cars in a stipulated area [6].

Arjun Dutta et al. projected upon developing an intelligent friendly automated car parking system which not only reduces man power but also reduces traffic congestion which facilitates traffic congestion and secure parking system. In his study he implemented motor driver, ultrasonic sensor and specially fabricated circuit to demonstrate automated car parking system. For safe passage of cars in/out of the garage system he implemented manual counter along with processor circuit. He also showed comparative performance analysis between sensor functionality w.r.t atmospheric conditions [7].

Aniket Gupta proposed a wireless frame which provides optimize usage of parking space within considerable revenue generation, solving proliferation in the number of cars used by people. It involves the use of wireless sensors like ESP8266-01, WiFi Module, Cloud server. The Internet of Things integrates the hardware, software and network connectivity that enable objects to be sensed and remotely controlled across existing network. Such system improved efficiency, accuracy and economic benefit [8].

The implementation of IoT technology by using Pi camera is to detect the number of vacant slots in the area. This data is sent to the server. The stored data is accessed by the users via application. The number of slots available for booking/parking are checked using RFID in [9]. The main disadvantage of RFID implementation is high cost due to use of RFID tags and scanners. Another approach includes the use of image processing techniques as done in [10, 11].

In this 21st Century, automobiles are used in huge number by all class of people. And for this there have been a lot of problems faced by people in keeping their automobiles in parking lot of any shopping complexes or hotels, etc. Among all the difficulties faced by people in everyday life one of the most unavoidable difficulties is getting a parking spot for an automobile. Amid the crucial hours the client scans for parking area but when finds none he/she moves to some different spot in search of a parking area which causes more movement in vehicles creating congestion later. To defeat this issue in business ground there are composed parking available. In order to access parking area reservations has to be made which depends on cost and time. However, this paper is totally about time grouping strategy that takes care about the issue of parking, utilizing opening assignment technique. Thus, concludes the introduction section of the manuscript. The next section highlights about the proposed architecture followed by Conclusion and References.

2. Proposed System

2.1 Overview:

These sensors depend on ultrasonic sound, rather than light thus enabling it to be used outdoors. Ultrasonic sensors having easier installation techniques and being available at low cost can be installed in various

places of a parking lot to get information about the available parking spaces as referred in Fig 1. A mobile application will be available to the drivers who can book a parking space in their desired space. Moreover he/she will be able to view other vehicles in that parking lot, the available and the used spaces.

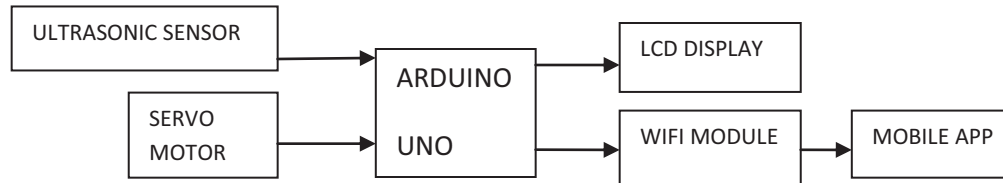


FIG 1: depicts the block diagram of the proposed architecture

2.2 Operation:

2.2.1 Registration: Interested people can register themselves via the mobile application with their name, driving licence, e-mail id, contact number. They will have to fill in the vehicle details which include the vehicle number, colour and model.

2.2.2 Finding Nearest Location and Booking: Users will be able to find the nearest parking lot; the system will send message regarding information about the vehicle, time in, time out and mode of payment. The driver will get a receipt with a QR code, vehicle information and parking lot number.

2.2.3 Parking: On reaching the gate the driver will have to scan the QR code to enter and he/she will get a receipt showing the path to his/her lot. After the car has been parked, the ultrasonic sensors detect changes and are used to update the information about the empty/used spaces.

The parking area can be divided into four parts: busy, allowed, reserved, unavailable. The system will allow only allowed slots to be booked by the driver.

2.3 Algorithm:

Control variable :

duration: used for calculating the distance range as sensed by the ultrasonic sensor

distance: used for initialising the duration estimated

Control Function :

digitalWrite :used for controlling the motor of the vehicle

delay :suspends the execution of the code for milliseconds

pulseIn :counts in the duration

```
duration = pulseIn(echoPin, HIGH)
```

```
distance = (duration/2) / 30
```

```
if (distance < 7)
```

```
digitalWrite(9,LOW)
```

```
digitalWrite(10,LOW)
```

```
analogWrite(6, 150)
```

```
analogWrite(5, LOW)
```

```
delay(50)
endif

// 1st. Step
digitalWrite(10,LOW);
digitalWrite(9,HIGH);
analogWrite(5, 150); //Motor Power
analogWrite(6, LOW);
delay(900);

// 2nd. Step
digitalWrite(9,LOW);
digitalWrite(10,HIGH);
analogWrite(5, 150); //Motor Power
analogWrite(6, LOW);
delay(500);

//Car Stops automatically when any object is detected
digitalWrite(10,LOW)
digitalWrite(9,LOW)
analogWrite(5, LOW)
analogWrite(6, LOW)
```

2.4 Material Inventory List & Connections

2.4.1 *Arduino components:*

The system uses the following components-

- i. Arduino UNO
- ii. LCD: Liquid Crystal Display
- iii. Servo Motor (SG90)
- iv. Wi-Fi_ Esp8266
- v. Ultrasonic
- vi. Push button

2.4.2 *Connections:*

The required connections are shown in the picture below

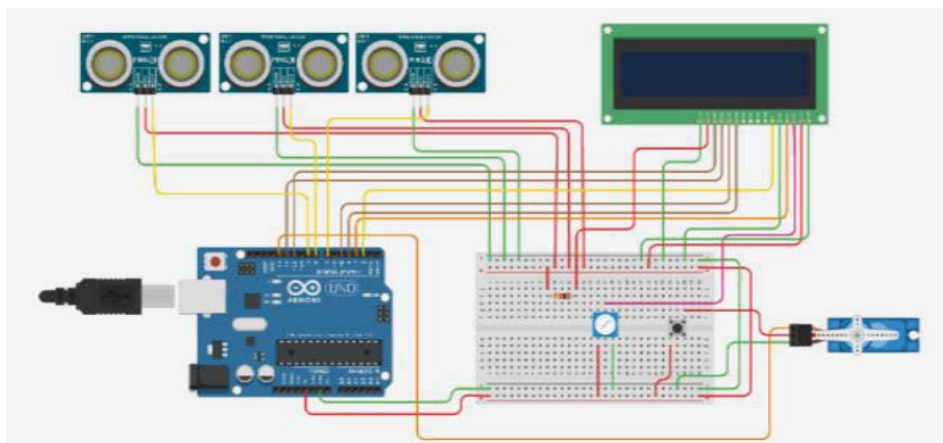


FIG 2. Schematic diagram of the proposed system

2.5 Execution Plan

Step 1: Completing the circuit fabrication – Arduino, ultrasonic-sensor, motor

Step 2: Software Programming of the sensor as desired and assigning values of the outlets, Vcc, ground, trigger, echo, etc.

Step 3: Inserting data to the webpage using HTML, CSS and PHP.

Step 4: Data Streaming-Microcontroller connection with PC-port.

Step 5: Final assembly of the design required for functioning.

Step 6: Test and execute.

3. Results and Discussions:

- i. This system ensures a computerised method of parking with quick and easy recovery of vehicles.
- ii. It is highly effective and safe for parking cars in shopping malls and workplaces.
- iii. It is a minimal effort framework with maximum computerisation.
- iv. There is cordial reorientation of vehicles going in and out.

4. Conclusion

The concept of smart city has been a dream in the 21st century. Since this past decade researchers have been in a quest for building smart cities a reality. The growth of Wireless Sensor technology and Cognitive Systems has introduced new possibilities in development towards smart city. Our proposed study of parking system improves productivity by eliminating the stress of the users who fail to park at a proper parking area. This system also plays a bigger role towards Green Earth. It reduces the fuel consumption which in turn reduces carbon footprint in the atmosphere. The main advantages are space optimization, cost effectiveness and security.

Development towards smart city facilitates the problems faced towards urban living. Autonomous car-parking system enhances productivity and service levels, in-operation. It is also beneficial in terms of lower operating costs with increase in revenue and facility value [1]. In the future proposition, advancement of the system can be done by adding online booking system where the user or driver can book their prospective parking slot as per vacant availability. Towards making the system intelligent different sensors, advancement towards mechanical structures and other fabrications should be improvised and made more eco-friendly.

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