

Advanced CAR Parking System using Arduino

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Abstract— This paper explains the architecture and design of Arduino based car parking system. Authorization of driver or user is the basic rule used to park a vehicle in a parking place. Authorization card will be given to each user, which carries the vehicle number or other details. If the user is authorized and space is available in the parking, then the parking gate will open and the user is allowed to park the vehicle in parking place else the user is not allowed even the user is authorized person. If car is allowed to park, then mobile notification will be send to user about parking. It solves the parking issue in urban areas, also provides security to a vehicle and an unauthorized user is not allowed to enter into a parking place. It helps to park vehicle in multifloored parking also as it will display which floor has free space.

Keywords— *Arduino ; Relay ; Motor ; RFID Reader ; IR Sensor . Transformer ; RFID Tag ; Display*

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 and while searching unintentionally it effects environment by the emission of harmful and dreadful gases from automobiles. This emission adulterates the air by CO₂ and other gases by combustion of fuel. 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 and improve air quality at important locations where traffic rush is more.

In metropolitan areas, during peak hours when people going for offices and school, finding free parking slot becomes impossible that may lead to miss classes and important office meetings. This problem continues in densely polluted area, person wastes time and fuel in search of parking space. Higher increasing pollution and

automobiles exigency an implementation of advanced parking system which will be tracked and monitored easily. 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 multistory parking spaces. Instead we need to enhance our available parking system to advanced monitoring parking system.

“Arduino Based Car Parking” is an exigency because the most serious problem of any developing country is traffic (Congestion) on a road and pollution. In addition to this, 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. As the whole system is automated, there are no chances of any bribe to park a vehicle or anything. Hence, all the money will go to government account and better facilities can be provided.

Authorized card will be given to user which ensures that only valid person can park his vehicle, unnecessary or fraud vehicle cannot be parked in the given slot. This will also help to check unauthorized use of parking space as well as loot of vehicles. As mobile notification message, will be send to user, helps to ensure more security.

II.BACKGROUND

Important meeting might be missed because unavailability of free parking space or some other unauthorized person parked his vehicle in wrong place. Lot of money and time have been wasted to solve it but till now didn't get the satisfactory solution. So, the advanced parking system is an very important and crucial solution to this problem. This solves many issues like, it can reduce congestin of vehicle on roads which in return helps fast moving traffic, reduces time waste on traffic, less burning of fuel which again results in god quality of air, disabled and old people can find parking place easily.

This system also helpful to recognize the spots where more parking spaces can be build. This system also provides secure environment for parking and safety of vehicle and parking space Project has four main subsystems, first is Arduino controller system [2], [17], [18], [19] and power supply. Second is display which will display available parking spaces, third is sensors, RFID [3] sensors are used for authorization and IR sensor to sense car. Fourth subsystem is database, which is maintained to store the details of user's.

In advanced parking system, IR sensors will be placed at each parking slot to sense vehicle and obstacle. Sensor values will be displayed on display at entry gate. Entry and exit gate will be opened only if authorized RFID is punched. Unauthorized person will not be allowed to park in parking space. If free parking space will not be available, then gate will not be opened even if authorized card is punched. Database is maintained to check who is entering and leaving the parking premises. Once car gets entry in parking, immediately notification will send to the mobile that car has been parked at particular position. Overall system will allow to track the user's tendency and by this we can improve its security by not allowing unauthorized persons to enter. All the required components are of good quality such as IR sensor is used which will sense any obstacle also. Good quality RFID card which can be carried easily anywhere and this card also have different access if required. Power supply is required to run the whole system. Power backup should be there to provide 24X7 power supply.

Entry: When the user reaches parking gate, he will punch the RFID card on RFID reader. Reader will read the tag and sends its information to Arduino and check whether ID is authorized or not. If it is authorized, then signal will be send to electric motor to open gate. Once the car gets entry, gate will be closed and once parked free parking space counter will be reduced by 1. Immediately notification will be send to user's mobile that car has been parked at this place. If the user is authorized and free parking space is not available, then Arduino will send signal to display that parking is not free and hence gate will not be opened. If the user is unauthorized then again Arduino will send it to display to show that UNAUTHORIZED and will not allow to open gate.

Exit: Car moves from the parking space, IR sensor sense it and increases free parking space by 1. User punch its card to RFID reader, If he is authorized the Arduino will send signal to motor to open gate. If he is not authorized then gate will not be opened and he will not be allowed to go out and if he is fraud then easily he can be caught. The entry and exit loop is shown in Figure 1. The car enters from entry point. When the car is parked on parking slot, IR sensor at this place sense the car and hence it reduces available parking slot counter by 1 and display on LED. When the car comes out of the parking slot to exit, then IR sensor at sense no car and increases the available parking slot counter by 1.

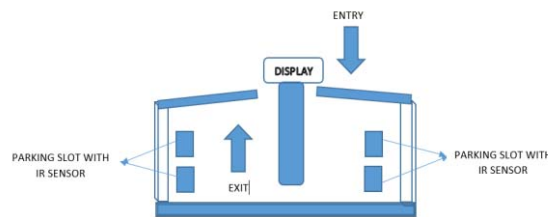


Fig.1. Entry and Exit loop

II.RELATED WORK

When we saw how people park these days we came up with this idea that we certainly need a better parking system that exist today as there is no authorization and anyone can park their vehicle where they want.

Vehicle counter is used in Ardunino based car parking, which counts the cars and a vacant space currently present in a parking lot.

iParking: A Parking Management Framework [4] used a magnetic sensor to count the number of vehicles present in the parking lot. The same can be shared on social.

Harvesting Real Time Vehicular Parking Information Mobile sensor can be used [5] in this, they used mobile technologies and ultrasonic sensor that was fitted on the side which detects vacant spots and parked cars.

Magnetic Field Sensor technology is used in Parking Monitor System [6] used a passive magnetic sensor to tell whether the parking slot was available or not at a particular place.

Architecture for Internet-Scale Sensing Services [7] used iris technology to find the parking space, webcams are used to tell which parking space is available near the user.

Monitoring Parking Lot Occupancy [8] which is Embedded Sensing Approach shows us how we can make our project cost effective by using some other technologies like sonar rangefinders and an In-Situ vehicle detection algorithm.

Real Time Car Parking System using Processing [9] image gave us the insight of the parking lot system used and how can we implement our project in different ways like using image processing technology.

III.DESIGN

Arduino, 16*2 Display, 1 Relay switch, motor, 4 IR Sensors, RFID Tag, RFID Reader and Transformer are used in designing the automated car parking [10], [11], [12], [13]. All the hardware is connected to the Arduino and it is shown in Figure 2. The real time working model is shown in Figure 3.

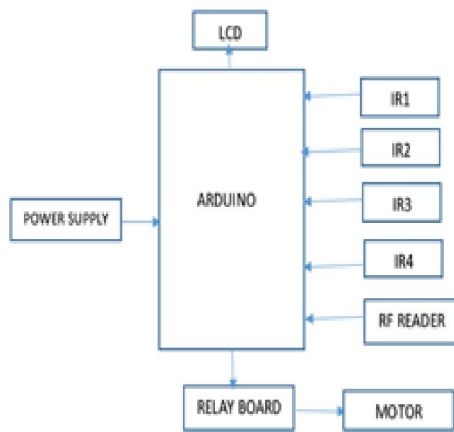


Fig. 2. Components with connection



Fig. 3. Real Time Working Model

We have used a passive RFID card in the project. Passive tags do not have a battery and powered by a separate source typically the reader. Microchip here used is Tag, which is compact package antenna, antenna is used to pick signal from RFID reader and then return with additional data. In datasheet, serial number is used as a primary key to differentiate between the other users. Additional information is stored with the serial key. We have stored vehicle number with a primary key. When the reader reads the card and finds serial number in datasheet then it sends output to display board to display "AUTHORIZED" with vehicle number. At the same time, an Arduino board receives the IR sensor values to check whether slot is free or not. If the slots are free then it sends an analog signal to relay switch to open the gate with the help of a motor. If the slot is not free then "NOT FREE" message will be sent to display board to display and no signal will be given to relay board. If the serial number is not present, then "UNAUTHORIZED" will be displayed on the display board

```

/* Step 1: Initialize Analog input pin */
const int analogInPin1 = A1;
const int analogPin2 = A2;
const int analogPin3 = A3;
/* Step 2: Starting setup Function */
Starting setup()
  lcd.begin(16,2);
  pinMode(8,OUTPUT);
  digitalWrite(8,LOW);

```

```

lcd.setCursor(0,0);
lcd.print("VIT PARKING");
Ending setup();

```

```

/* Step 3 : Loop to read the sensor value */
Starting loop()
  sensorValue1=analogRead(A0)/1000
  sensorValue2=analogRead(A1)/1000
  sensorValue3=analogRead(A2)/1000
  sensorValue4=analogRead(A3)/1000
  delay(20);

```

```

/* Step 4: Function to print the available parking space */

```

```

  lcd.print(sensorValue1+sensorValue2+sensorValue3
+sensor Value4);
  if(inputString[9]==2)
    lcd.setCursor(0,0);
    lcd.print("AUTHORIZED");
    digitalWrite(8,HIGH);
    delay(1000);
    digitalWrite(8,LOW);
  Endif

```

```

  if(inputStrng[9]==3)
    lcd.setCursor(0,0);
    lcd.print("UNAUTHORIZED");
    lcd.setCursor(0,1);
    lcd.print("UNAUTHORIZED");
  Edif

```

```

Ending loop() .

```

IV.IMPLEMENTATION

The overall flow diagram of Arduino based car parking system is shown in Figure 4.

Step down transformer is used to give 12V to the Arduino board. This transformer step downs from 240V to 12V. To convert Alternating current (AC) to Direct current (DC) we used bridge rectifier. Microcontroller has three parts and they are Microcontroller Arduino (Datasheet), Crystal Oscillator and Reset Button. The datasheet contains all the data related to the authorization of the user. In this project, it contains the authorization details like car number and about driver. Crystal Oscillator generates clock pulses (i.e.) 0 & 1. The reset button is used to start the execution from start itself. It is useful if project hangs somewhere. RFID Tag is coded and has some unique number. The unique numbers are stored in datasheet with details. Once the RFID card punches on RFID reader, reader send a unique number to a datasheet, it checks for the authorization. If it is authorized, then it will be displayed on screen and the signal will be sent to relay board to open gate. If parking slot is available, then with the help of the relay board gate will be opened and the car can be parked. If parking slot is not available, then the gate will not be opened even if he is authorized. For unauthorized users, the gate will not be opened. IR sensors are used to check the availability of free parking slot. Relay board is used to vary the voltage

to open gate [14], [15], [16]. Figure 4 shows the overall flow diagram of Arduino based car parking system.

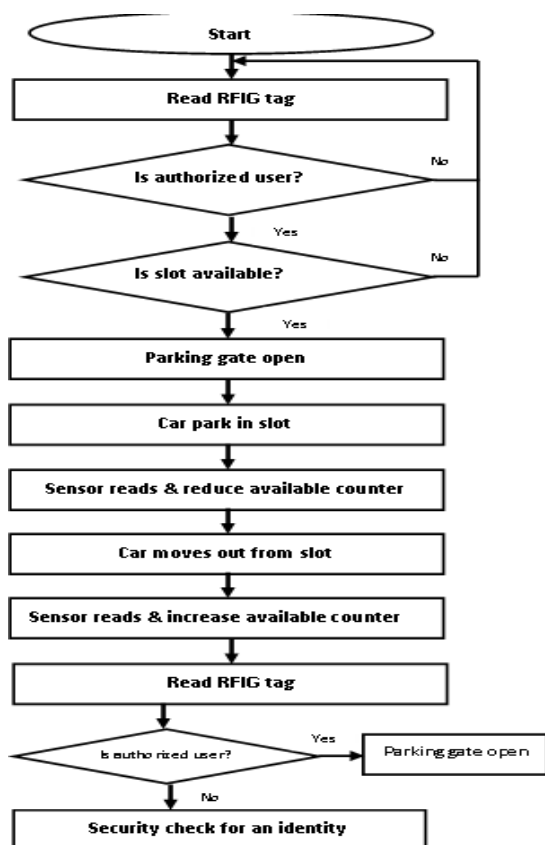


Fig. 4. The overall flow diagram of Arduino based car parking system.

V.CONCLUSION

The project is completed successfully. Once the user with valid card punch on RFID reader, if a slot is available and he is authorized then gate will be opened and he will park his vehicle in the available slot. If he is authorized but free slot is not available, then the gate will not be opened and he is not allowed to park. If the user is not authorized, then gate will not open and doesn't allow him to park. The project is working fine, but, as IR sensor is of low cost, it sometimes gets heated and not working properly. So, we need to give some time to cool as IR sensors sense both heat and movement. The sensors which are used also sense sunlight, so we need to carry out the demo in dark room. The prototype of our idea is ready and can be launched anywhere for the betterment of society.

This model can reduce congestion on the road, time of users, human power, pollution, security for vehicles.

Figure 5 shows that the user is authorized and hence his vehicle number is displayed on the display. "1" on display shows that one parking space is available. Figure 6 shows that "4" space is available in the parking slot. "VIT PARKING" is the name of parking. Figure 7 displays that the user is authorized and his vehicle number is displayed on the display. "NOT FREE" means slots are

not available to park, hence gate will not be opened. Figure 8 shows that the user is unauthorized; hence it displays "UNAUTHORIZED". The gate will not be opened even if space is available.

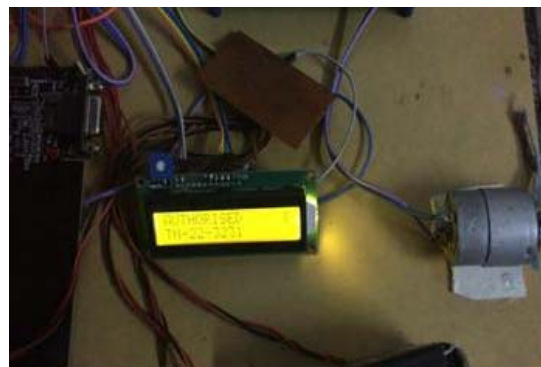


Fig. 5. Authorized user



Fig. 6. Slots Available



Fig. 7. Authorized but slot not free

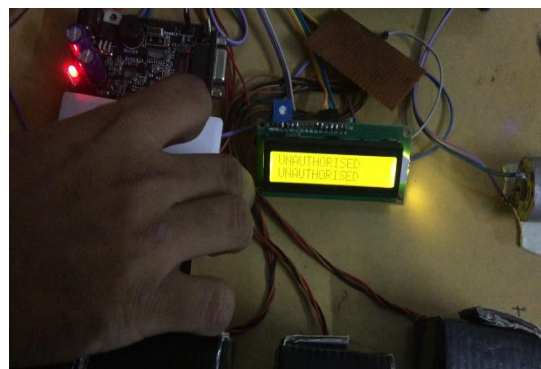


Fig. 8. Unauthorized User

VI.FUTURE WORK

One thing which can be implemented in large scale is assemble all advanced parking in single app/platform. For example, a city where hundreds of this type of parking are available. All parking can assemble and connects the available slot or current status of all parking into the computer. Android app can be developed which uses the current location of the user and show the nearby parking places where parking slot is available.

REFERENCES

- [1]. Vinnay Chadda: Electronics for you “Arduino Based Vehicle Parking Counter” (2013)
- [2]. Alan G Smith “Introduction to Arduino”. (2011)
- [3]. Ladyada “IR Sensor” (2013)
- [4]. Chinrungrueng, S. Dumnin, and R. Pongthornseri. iParking: a Parking Management Framework, Proceedings of the 11th International IEEE Conference on ITS Telecommunications (ITST), St. Petersburg, FL, (2011) 63-68
- [5]. S. Mathur, S. Kaul, M. Gruteser, and W. Trappe. ParkNet: a Mobile Sensor Network for Harvesting Real Time Vehicular Parking Information, Proceedings of the MobiHoc S3 Workshop on MobiHoc S3 (MobiHoc S3 '09), New York, (2009) 25-28
- [6]. J. Wolff, T. Heuer, H. Gao, M. Weinmann, S. Voit, and U. Hartmann. Parking Monitor System Based on Magnetic Field Sensor, Proceedings of the 2006 IEEE Intelligent Transportation Systems Conference (ITSC '06), Toronto, Canada, (2006) 1275-1279
- [7]. S. Nath, A. Deshpande, Y. Ke, P. Gibbons, B. Karp, and S. Seshan. IrisNet: An Architecture for Internet-Scale Sensing Services, Proceedings of the 29th International Conference on Very Large Data Bases (VLDB '03), Berlin, Germany, Vol. 29, (2003) 1137-1140
- [8]. J. Propst, K. Poole, and J. Hallstrom. An Embedded Sensing Approach to Monitoring Parking Lot Occupancy, Proceedings of the 50th Annual Southeast Regional Conference (ACM-SE '12), Tuscaloosa, AL, (2012) 309-314
- [9]. U. Hartmann. Parking Monitor System Based on Magnetic Field Sensor, Proceedings of the 2006 IEEE Intelligent Transportation Systems Conference (ITSC '06), Toronto, Canada, (2006) 1275-1279
- [10]. S. Nath, A. Deshpande, Y. Ke, P. Gibbons, B. Karp, and S. Seshan. IrisNet: An Architecture for Internet-Scale Sensing Services, Proceedings of the 29th International Conference on Very Large Data Bases (VLDB '03), Berlin, Germany, Vol. 29, (2003) 1137-1140
- [11]. J. Propst, K. Poole, and J. Hallstrom. An Embedded Sensing Approach to Monitoring Parking Lot Occupancy, Proceedings of the 50th Annual Southeast Regional Conference (ACM-SE '12), Tuscaloosa, AL, (2012) 309-314
- [12]. S. Banerjee, P. Choudekar, M. Muju. Real Time Car Parking System Using Image Processing, Proceedings of the 3rd International IEEE Conference on Electronics Computer Technology (ICECT), Kanyakumari, India, Vol. 2, (2011) 99- 103
- [13]. D.J. Bonde, R. Shende, K. Gaikwad, A. Kedari and A. Bhokre, "Automated car parking system commanded by android application", International Conference on Computer Communication and Informatics, (2014) 4
- [14]. E. Soni, K. Kaur and A. Kumar, "Design And Development Of RFID Based Automated Car Parking System", The International Journal of Mathematics, Science, Technology and Management, Vol. 2. (2016) 3
- [15]. L. Chen, J. Hsieh, W. Lai, C. Wu, and S. Chen. Vision-Based Vehicle Surveillance and Parking Lot Management Using Multiple Cameras, Proceedings of the 6th International Conference on Intelligent Information Hiding and Multimedia Signal Processing (IIH-MSP), Darmstadt, Germany, (2010) 631-634
- [16]. S. Lee, D. Yoon, and A. Ghosh. Intelligent Parking Lot Application Using Wireless Sensor Networks, Proceedings of the International IEEE Symposium on Collaborative Technologies and Systems (CTS 2008), Irvine, CA, (2008) 48-57
- [17]. Yan, G., S. Olariu, M. Weigle and M. Abuelela, Smart Parking: A Secure and Intelligent Parking System Using NOTICE', Paper presented at the Conference on Intelligent Transportation Systems Beijing, China, (2008)
- [18]. Victor, P. Bilodeau, “Intelligent Parking Technology Adoption”, (2010)
- [19]. Jian-Min Wang, Sen-Tung Wu, Chao-Wei Ke and Bo-Kai Tzeng, “Parking Path Programming Strategy for Automatic Parking System” Vehicle Engineering (VE) Vol. 1. (2013) 57-63
- [20]. Sumathi, V., N.V. Pradeep Varma and M. Sasank, “Energy Efficient Automated Car Parking System”. Paper published in International Journal of Engineering and Technology (IJET). ISSN: 0975-4024 Vol. 5. (2013) 2848-2852.