

Smart Parking System for Educational Institution

Lalitha Madanbhavi¹, Abhishek D Sawant², Geeta R. Bharamagoudar³, Nihal N⁴, M.R. Patil⁵, Minal S⁶ and Himanshu G S⁷

^{1-2 & 4-7}KLE Technological University, Hubballi, India

lalita@kletech.ac.in, abhi23021998@gmail.com, gshimanshuanu98@gmail.com, nnihal011@gmail.com, mrpatil@kletech.ac.in

³KLE Institute of Technology, Hubballi, India
geetatotad@yahoo.co.in

Abstract—In this ever-growing traffic, the mismanagement of traffic is a growing concern. In educational institutes, vehicle movements are normally very high. This leads to a huge demand for parking space and its management. The proposed work focuses on this pressing issue and uses Internet of Things frameworks to solve the former. The project also deals with identifying the vehicles based on the very secured identity management system that is Radio Frequency Identification based identity management. The project uses Android widget for the administration monitoring. The project uses sensors to check for presence of vehicle in the parking slot. The project also importantly deals with unauthorized entry of vehicles after and during the college working hours. The project also uses Light Emitting Diode display for displaying the available parking spots. The project also uses a central database to store the information obtained from the user's Radio Frequency Identification card which is used to authenticate users. The project also provides an add-on feature to track number of vehicles parked and their history on a given date.

I. INTRODUCTION

Radio Frequency identification (RFID) are a combination of radio broadcast technology and radar facility. It was first developed in U.S in nineteenth century. Radio Frequency identification (RFID) was first used during World War II to identify aeroplanes and fighter planes. Aeroplanes radiate signal to read an identification number that is used to differentiate between aircraft as allies or enemies. In recent years, Radio Frequency identification (RFID) is widely used by consumers and companies globally. Radio Frequency identification (RFID) technology uses electromagnetic field or radio waves to identify objects or livestock attached with Radio Frequency identification (RFID) tags automatically. It is able to read the tag without line of sight which improves the efficiency of processes and ease of use. In 2017, approximate 73 million of cars were produced in the world. In urban cities, buildings are rapidly developed. It is viewed that parking plays an important role for social and economy impacts in urban development. Therefore, an efficient parking system is required in enhancing the current transportation system. Parking is a location where vehicle transit for the next destination or reach its final destination and stop for a period of time. For example, a user will park for long hours while some users will just park for short period of time to carry out some daily activities. Therefore, the convenience of car parks influences the effectiveness of the driver and at the same time prevent unnecessary traffic in academic area. Our System is efficient and convenient, initially all the vehicles will be mounted with Radio Frequency identification (RFID) tags to identify the user as authorized person of campus. This System uses an Android Widgets i.e. for the administrator. The

Front End uses a website using HTML, PHP for the admin and Back end as a SQL Server. When the car enters the parking base, the tag mounted on the vehicle gets scanned and the starting time and the user details is sent to the server and then the details can be viewed by the user via app and also admin. Admin gets another feature to identify vehicles which are parked more than 12 hours. The application also provides an add on facility to track number of vehicles parked and their history on a given date. The contributions of the work areas are as follows:

- To design and implement real time Smart parking system for campus.
- To avoid trespassing of unauthorised vehicles in campus.

To evaluate the performance of proposed mechanism in terms of efficiency.

II. RELATED WORK

A. *Modified RFID Parking Management System based on Existed Gate System Integration: 2008*

In this [1], authors described an application, by using a modular RFID Parking Management System that integrates the traditional boom barrier control system and other system management systems such as database storage. These individual systems are already existing. The model integrates all the existing systems that can independently and individually work without Modular Parking Management Platform. For example, the lane gate management was controlled by the manual operation or parking ticket machine without RFID System and Modular Parking Management Platform added. In the proposed Modular RFID Parking Management System, the RFID antennas and reader are deployed at the gate and UHF type of RFID tag is selected in this paper. For the interactive ability of hardware like Modular Gate-PC Controller and Embedded Gate Hardware is proposed to be the intermediary software to hardware interface (gate to PC interface). And RFID API and RFID parser act to be the middle ware between the RFID System and the Modular Parking Management Platform. The Modular Parking Management Platform based on Java language is independent of operation system. The RFID API uses socket connection to communicate with the RFID reader.

B. *Smart Parking Applications using RFID Technology :2007*

In [2], authors proposed a solution has been provided for the problem encountered in the parking lots management systems via RFID technology. RFID readers, RFID labels, computers, barriers and software are used as for the main components of the RFID technology. The software has been handled for the management, controlling, transaction reporting and operation tasks for parking located on various parts of the institution. Check-in and check-outs will be handled by RFID reader, labels and barriers. An automated income tracking system is utilized for proper transactions.

C. *Smart Parking Management System using RFID and OCR: 2015*

In this [3] provides access control using boom barriers. This will be an efficient system for the small and large organization. Without RFID verification the user will not be allowed to use the parking. Realtime allocation and reallocation of the parking spaces to make it easy for the users. This system purely uses java. It inherits java properties for the security. This project runs on any operating system. OCR recognizes the characters. This captures the image of the number plate and converts it into number format and stores it in the database for any future purposes.

D. *A Smart Parking System based on Internet of Things Protocols and Emerging Enabling Technologies:2011*

In this [4] The authors used a methodology to develop intelligent parking systems, Smart Parking System based on the jointly use of combined technologies, such as RFID, WSN, NFC, Cloud Storage, and mobile application. It is able to collect, in real time, both environmental parameters and information about the occupancy state of parking spaces, and to direct drivers to the nearest vacant parking spot by using a customized software application. This last one leverages an NFC-based e-wallet system to allow users to pay for parking fees and use the facility. Furthermore, a customized software application, installed on a cloud platform, is able to manage alert events (e.g., improper usage of a reserved space and expiration of the purchased time). In such a case, it promptly informs the traffic cop through an Android mobile app, which has been designed ad-hoc for the considered scenario.

E. *Vehicle Monitoring System using RFID: 2016*

In this [5], using RFID they monitor the in and out times of the vehicles are monitored automatically. Monitoring can be done easily; administrator can easily generate reports and verify the owner of the vehicle. This system helps in Loss of vehicles because of automated system. Using this automated system identification can be done easily.

F. Smart Parking Using Image Processing: 2017

In this paper [6], system can detect the circles which are drawn at parking lot and containing the information of empty car parking spaces. In this project camera is acting as a sensor so it can take the images that are under process to show occupancy of car parks and also free parking slots. By having this image, the particular car park vacant can be known rather than wasting time to find one. This proposed system has been developed in both software and hardware platform. This automatic parking system makes the whole process of parking cars more efficient and less complex for both drivers and administrators.

G. Smart Parking System using RFID and GSM Technology: 2017

In this paper [7], The usage of wireless technology with a smart management application is being reflected to solve

electronic security problem of vehicles of the organization. The main components of this system are RFID readers and scanners, RFID labels, GSM kit to inform authorized and authenticated vehicle through SMS notification, Physical barrier to control check-ins and check-outs installed on entry exit points of the parking space, LED display lights with alarms to make security personnel warn and alert about the unauthorized vehicle entry and software to control the management of the system. The check-ins and check-outs can be monitored and accessed with the help of software.

H. A Smart Image processing-based System for parking Space Vacancy Management: 2018

In this [8], the smart parking space management was achieved by using image processing methodology. The empty parking lot can be detected by using aerial images of parking space by feeding the data to a model which uses image processing algorithm. The algorithm processes the image of the parking lot, extracts occupancy information about the parking spots, and their positions therefore. The system also reports if individual parking spots are occupied or vacated. Parking lot occupancy information is always made available to newly arriving vehicle owners by projecting it on large monitor or LED screen positioned at entrance points of the parking area. The smart parking lot management system reduces time associated with car parking and makes management of such areas efficient.

I. Smart Parking System using Internet of Things: 2019

The [9] paper mainly focused to reduce human intervention with the help of internet of things. The project was designed in a way to minimize the user's time and to maintain the efficiency. It also focused to reduce the cost of fuel burnt during searching of parking space. This project includes three sections, first is the Arduino controller and sensor where the user interacts with the parking lot data. In the second section, cloud storage is used where it acts as a mediator between the user and car parking slot. And the last section is to notify the user or the owner with SMS using GSM Module.

III. METHODOLOGY

Safe and systematic transportation Parking plays a crucial part of institution. To achieve the objective an efficient methodology is used to control several vehicles on peak moments of the institution.

A. System Model

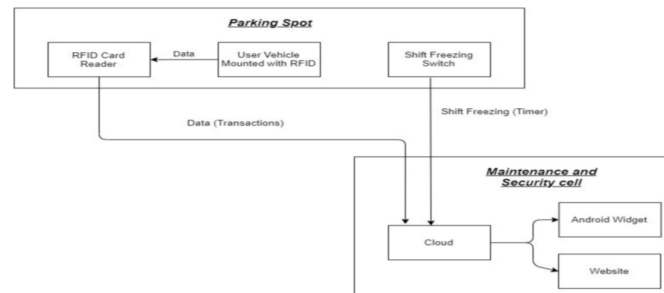


Fig. 1: System model for Smart parking system

The system design has two specific modules which constitute the whole parking system. Following are the two

modules:

- 1) Parking Spot.
- 2) Maintenance and security cell

Parking Spot: This module defines the basic field structure of the whole module. Parking spot will be internet accessed and 24/7 connected to college Wi-Fi network. Parking spot mainly consists of three segments:

- 1) Radio Frequency Identification Card Reader.
- 2) Vehicle Mounted with Radio Frequency Identification Card.
- 3) Shift Freezing Switch.

This module acts as the main interface to the active users (students and faculties of the institution). The parking slot of the institution should be constructed in a way to have one entry and exit way to have a proper vehicle monitoring to reflect it on the cloud server. The booth pole which consists of Radio Frequency Identification Scanner has to be installed on both the entry and exit gates of the institutional parking. The card reader should be placed 5 feet prior to the respective gates to maintain easy transactions. Design of the Radio Frequency Identification cards are done in the manner to play both as a smart student identification card and a unique smart parking card which is supposed to be mounted on the vehicle on the front part of the vehicle which can be easily scanned by the scanner. Module is designed and planned in a way that the system is connected to the institutional Wi-Fi and cloud service 24*7 to maintain the records of the vehicle transaction. The module also includes the special feature called as the "Shift Freezing

Switch" which will be physically deployed in the security cabin of the parking area. This switch is designed to trigger the institutional official timings. The switch is designed by following constraints:

- 1) Institutional daily hours changes due to events, official gatherings, extra classes, fests, submissions and other purposes.
- 2) Freeze the parking after institutional official timings.
- 3) Avoid Unauthorised wandering and vehicle parking after the institutional hours.
- 4) Once the switch is pressed, all the vehicles parked will be shifted to black list and details of the vehicles such as Owners name, vehicle number, contact details and parking duration will be provided to the security head of the institution in excel and Json format which can be easily downloaded or shared from the cloud.

Construction and Maintenance Cell : This module works as the backbone of the whole parking system. This plays a role to connect the cloud and Wi-Fi to store the transaction data recorded by Radio frequency Identification cards in database. The module consists of three segments again.

- 1) Cloud instance.
- 2) Android widget designed for regular updates for the administrator and security in charges.
- 3) Website to monitor overall transaction on regular basis.

B. Algorithms

The algorithms given below are proposed to implement our methodology.

Algorithm 1: Smart Parking System

Input : RFID Card Scanned Data

Output: Transaction Details

- 1 Begin
- 2 Vehicle enters the Parking lot
- 3 Get the unique id card scanned
- 4 Categorise whether "Student", "Faculty", "Visitor"
- 5 If unique ID belongs to student
- 6 Else
- 7 Enter the "enter" details in student category
- 8 If unique ID belongs to faculty
- 9 Else
- 10 Enter the "enter" details in faculty category
- 11 If unique ID belongs to Visitor
- 12 Else
- 13 Enter the "enter" details in Visitor category
- 14 Vehicle leaves the Parking lot
- 15 Get the unique id card scanned
- 16 If unique ID belongs to student

```

17 Else
18 Enter the "exit" details in student category and complete the transaction.
19 If unique ID belongs to Faculty
20 Else
21 Enter the "exit" details in faculty category and complete the transaction.
22 If unique ID belongs to Visitor
23 Else
24 Enter the "exit" details in Visitor category and complete the transaction.
25 After institution official hours
26 Security personal presses the "shift freeze" switch
27 Update the switch parameters on website
28 If vehicle is still present in parking
29 Update vehicle ID in defaulter list
30 Get details of the vehicle
31 If vehicle more than 12 hours
32 Update the details
33 Parking fine and charges on the unique ID
34 Update to security administrator
35 End If
36 End if
37 Save the updated file in KLE Tech cloud
38 End For

```

C. system model

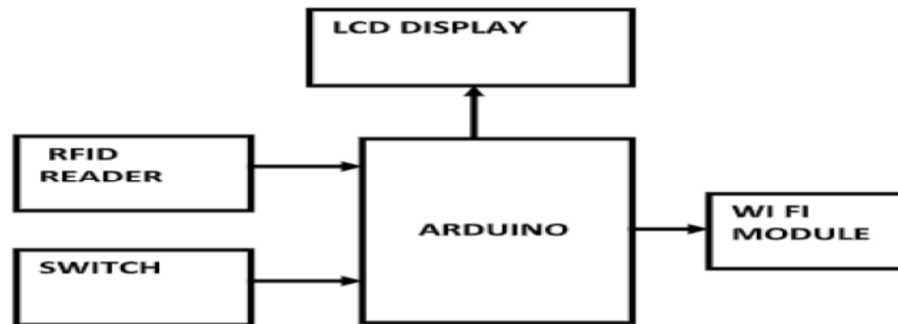


Fig. 2: Flow Diagram for Electronic Connection

Above figure explains the flow of the proposed electronic connection. We have five basic components to complete the project. Arduino acts as the controller for all the features. Wi-Fi module to connect the device and controller to the server and cloud storage. Radio Frequency Identification reader is used to emit the radio frequency to read the Radio Frequency ID cards. Switch plays the special feature of the whole module which acts as the timer to freeze the parking after institution's working hours to control unauthorized trespassing of vehicle.

IV. RESULTS AND DISCUSSION

The smart parking system module is a real time implementation for educational institution with following factors

- 1) Secured campus.
- 2) High Surveillance.
- 3) Digital records.
- 4) Freezing and Unfreezing of parking lot.
- 5) Avoid trespassing.
- 6) Efficient and cost effective.

The intermediate stages are: The data from the scanner is being processed by the Atmega168 microprocessor and output is being sent to a serial monitor window of Cool Term software. Cool Term serial window enables us to capture the output from the microprocessor and save it through the cloud services. A website designed using

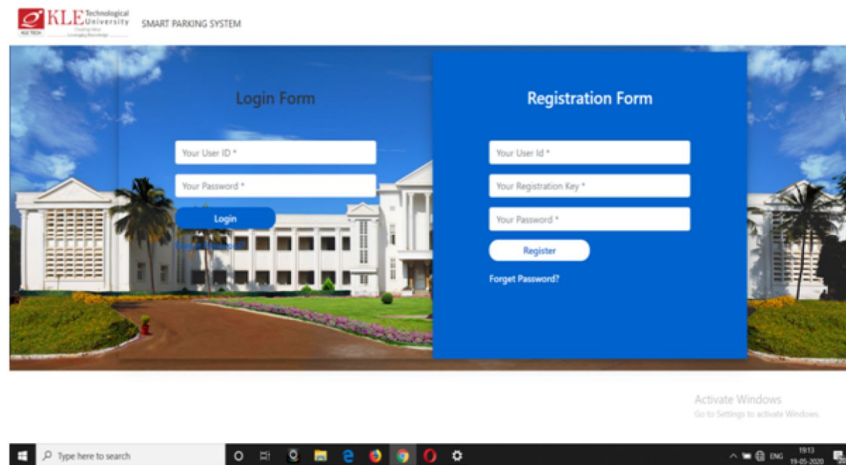


Fig. 3: Website Snapshot

node.js is used to monitor the transactions of vehicle in the educational campus. Website shall be monitored by the chief Security officer and Administrator of the educational premises .Figure 4 is the demonstration of the website page which will be used to monitor and maintaining the security of the premises.



Fig. 4: Prototyping Display screen for Security Personnel

V. CONCLUSION

In this work, we addressed RFID Based Automatic ParkingSystem is in prototype stage and works with a limited number of sensors and on a limited scale. However it is scalable andcan easily accommodate more sensors to monitor a far greaternumber of parking slots in different sectors like informationtechnology , hospitals , hotels and entertainment , factoriesand production units. Thus its scale can be easily adjusted tothe needs of the specificcustomer. Also it can be modifiedto add more features to suit specific needs or to adjust itsbenefit ratio. Efforts are also being made to advance from theprototype stage into a more finished and polished product thatwill be suitable for demonstrations and promotion. All theseaspects are currently being considered in detail to decide futurecourse of the system. Following recommendation are providedas ideas for the expansion of this project work are asfollows:

- 1) Integration of smart parking module with KLE tech cloud and website
- 2) Classification on the basis of vehicle type.
- 3) Implementing staff vehicle classification using Deep learningmodels.

REFERENCES

- [1] Chung Lun Lee Ming Shen Jian, KuenShiuh Yang. Modular rfid parkingmanagement system based on existed gate system integration. 2008.
- [2] Nihat INAN Zeydin PALA. Smart parking application using rfid technology.2007.
- [3] Chetan Ahire Nikhil Alai Yadneesh Joshi, Pratik Gharate. Smart parkingmanagement system using rfid and ocr. 2015.
- [4] Maria Laura Stefanizzi Roberto Vergallo Luca Mainetti, Luigi Patrono. Asmart parking based on iot protocols and emerging enabling technologies.2011.
- [5] DuruguKiranmayi. Vehicle monitoring system using rfid. 2016.
- [6] Sabarpreet Kaur Naveen Reddy Uma Maheswara Rao Jaya Karthik, Dr.Smart parking using image processing. 2017.
- [7] M Sarosh Umar Love Kumar, Muneeb Hasan Khan. Smart parking systemusing rfid and gsm technology. 2017.
- [8] Dr.M.G Sumitra Soundarya Rajesh. Smart parking system using imageprocessing. 2018.
- [9] Pola Ashritha R NamithElakya R, Juhi Seth. Smart parking system usingiot. 2019.
- [10] Sachin Shetty, S. M. Meena, Uday Kulkarni, Harish Basavaraj Hebballi.Special Pedestrian and Head Pose Detection for Autonomus Vehicles