

Automated Vehicle Parking System And Unauthorized Parking Detector

Ishraq Haider Chowdhury^{1,2,3}, Afsana Abida^{1,2,4}, Md. Mehedi Hasan Muaz^{1,2,5}

¹Military Institute of Science and Technology, Dhaka, Bangladesh

²Department of Computer Science and Engineering

Email: ³ishraq.h.c@gmail.com, ⁴afsanamist37@gmail.com, ⁵mehedihasan2760@gmail.com

Abstract— In this modern world, with the rapid growth of population vehicle traffic has become a part of our day to day life. Moreover, unauthorized vehicle has also increased. Thus our proposed system aims to ensure proper management of vehicles in the public places such as educational institute, office etc in order to prevent unauthorized vehicle parking and traffic.

The features include detection of permitted and non-permitted vehicles on the main gate, detection of unauthorized vehicle parking in the restricted zone thus sending SMS to the authority to take action and taking fine from the vehicle user. Parking charge is also taken from the parked vehicles inside the parking lot before they leave. There are also parking lights which will be lit whenever a car enters a specific parking lot.

Keywords—RFID Reader, GSM Modem, SMS, IR Sensor Module, Alarm, Resistor, Visitor Counter, Automated Light, Unauthorized Parking Detection

I. INTRODUCTION

In this new era, everywhere we can see that modern technology has changed the way of living. With proper use of technology, it is possible to build a world where everything can be accomplished more easily with the help of technology. Vehicle parking management requires automation like any other field to ensure security and comfort. With the vast growth of population and increasing amount of vehicles it has become difficult to find sufficient space for vehicle parking in public places. This does not only waste our energy but also we lose our valuable time. Thus, the concept of automated vehicle parking system and unauthorized parking detector has been a necessity for a while.

The main motivation behind the project was to maintain security of the parking area and reduce system loss in parking lot. The project aims to make an automated parking system which helps to restrict unauthorized vehicle parking in the restricted area and generates fine if a vehicle is parked violating the rules by sending an SMS to the registered owner of the vehicle. The authorized vehicles are identified with the help of a registration process which is integrated with the system. Whenever a car tries to enter into the restricted zone, it can be verified if it is already registered and authorized. If it is found to be authorized, then it will be allowed to enter into the restricted area. Again inside the restricted area, there is a parking space with a limited capacity. If the capacity is yet to be full, then the car entering the area will be allowed to park. If it is full, then that car will be given five minutes time to drop or pick the passenger and leave. Otherwise its owner

will be charged with a pre-allocated fine as late fee. There will also be a system of parking charges in an hourly basis. The sensors inside the parking space will show the unoccupied space available for parking. It is hoped that this project may have a great impact in making lives easier and contribute in building smart cities.

We have organized the rest of the paper as follows. Literature Review of our work is given in Section II, in Section III, we give the description of our system architecture and the overall model. Section IV describes the System Implementation process. Section V concludes the paper and finally Section VI describes the future extension of the project.

II. LITERATURE REVIEW

The need for vehicle parking place in urban areas is increasing day by day. The need to get a secured parking lot and get it reserved before reaching there is more than before. Many research works have been conducted in this sector. Some research papers were found that discussed about the systems quite similar to the proposed work.

In a study [1], a two module system is developed. One module shows the layout animation of the parking lot status and the other module is made to reserve a parking space through sms. In some other studies [2]- [6], parking lot status is made visible using LED lights. Harishraghav et al. used IR sensor modules for the LED to light up [6]. Again, in another study, a smart phone based parking system that detects if there is a parking spot vacant [14]. Another study shows that cars' drivers are given the accurate information about location and availability of car parking spots [21].

In some studies [9]- [10], a research has been conducted about wireless sensor technology providing advanced features like remote parking monitoring, automated guidance and parking reservation mechanism. In another study [13], wireless sensor networks can monitor the state of every parking space by deploying a magnetic sensor node on the space.

In a study [5], an android based system is made that regulates the number of cars to be parked on the designated parking area by automating parking and exiting the parking area. In another study, a two module system have been discussed where one is identification of visitors and the other is parking slot status checking [7]. Another study talks about a car alarm getting activated with the owner getting notified by sms using GSM technology [8].

In some studies [15]- [17], a smart system of parking reservation, payment and enforcement have been discussed. Amalendu et al. [15] described that, there was also a system of searching for a vacant spot and the central computer communicates with user terminals and service terminals. In another study [16], identification of urban parking spaces is done by a user-engagement and sonar based prototype. In a study, it is seen that a vehicle parking detection method using normalized cross-correlation of magnetic signals generated by magneto-resistive sensors [19]. And there is also a system that uses automated number plate recognition cameras to efficiently manage, monitor and protect the parking facilities of a university [20].

III. SYSTEM ARCHITECTURE

The system consists of RFID module, GSM modem, Infrared Sensor module, Servo motor, Arduino UNO, Arduino Mega. The system architecture is shown in the figure 1.

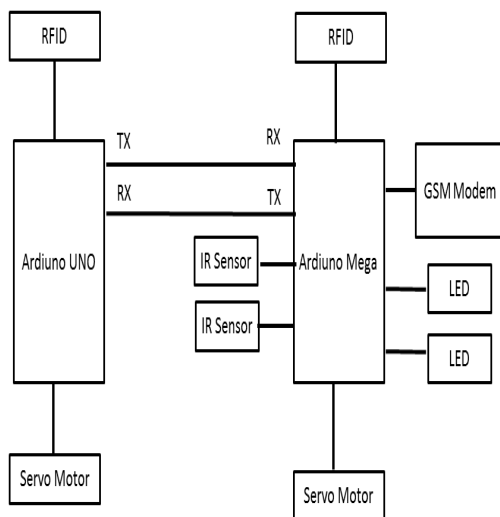


Fig. 1: System Architecture Block Diagram

A. RFID

The entire RFID system consists of RFID tags, two RFID modules and two RFID Reader each at the entry point and exit point. The RFID reader is connected to RFID module. The RFID tags are read by the RFID reader to determine whether the RFID tag number matches with any of the RFID numbers of the registered vehicles. The RFID at the entry point helps to determine entry time for a specific vehicle and the one at the exit point is used to determine the parking charge for that vehicle depending on the time of exit. The RFID used for entry is connected to Arduino Mega and the one that is used for exit is connected to Arduino UNO.

B. GSM Modem

The GSM modem is used for SMS generation for unauthorized parking. It is a specialized type of modem which accepts

a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network.

C. Servo Motor

The servo motor is used for controlling the parking gate.

D. Infrared Sensor Module

The IR Sensors helps to detect the presence of the vehicle in the parking lots.

E. LED

The LED lights turns on whenever a vehicle is detected in the parking lot. Also these lights get on whenever a registered vehicle is identified at the entrance otherwise they remain off.

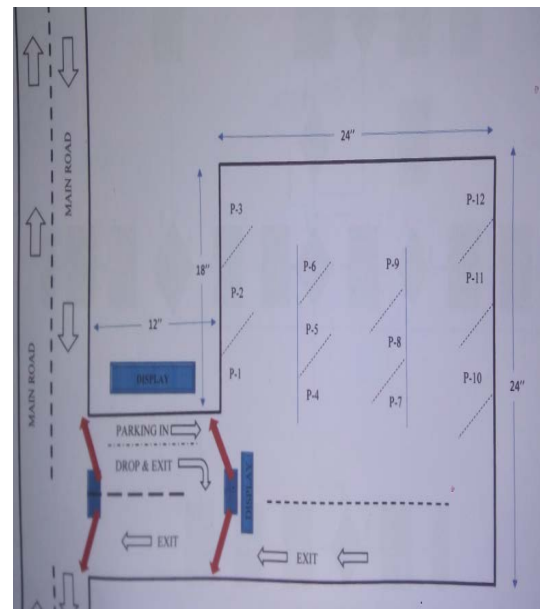


Fig. 2: Top View of Proposed Model

The overall functionality of the system, according to the top view of the model in figure 2, is as follows. Whenever there is a vehicle at the entry point which is not registered, all the information related to the vehicle is checked to find if the information is valid or not. If the information is valid then it is sent to the server. In case of already registered vehicle, vehicles RFID card is detected and the validity of RFID information is checked. If the RFID is valid then the vehicle can check in. After the vehicle is checked in, the time of entry is stored. When the vehicle is about to check out from the parking zone, its bill is generated and then the vehicle is allowed to exit.

The system is made in some parts where some work is done in an individual part. That means that the modules used are interfaced using different arduino.

In the first arduino uno, the pins 2 and 3 are used as receiver and transmitter of the RFID reader module. That means the readings obtained from the RFID reader module is taken as the entry of a particular vehicle and its reading goes to pin

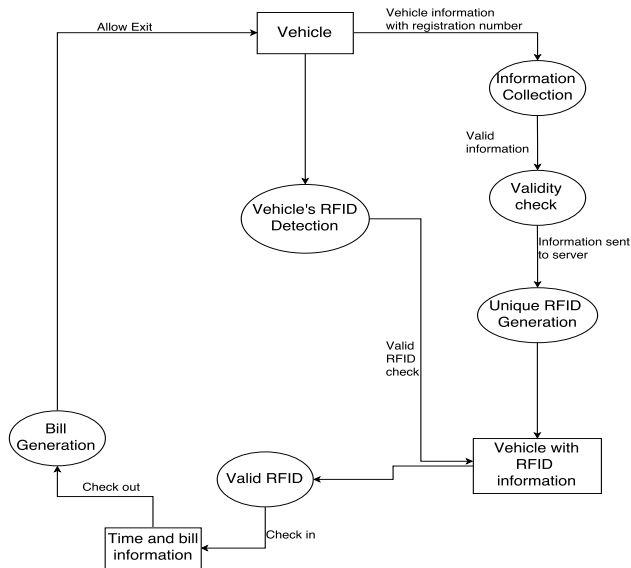


Fig. 3: Data Flow of the System

2 which acts as the receiver and the pin 3 is the transmitter. This acts as the registration of vehicles and deleting a vehicle from the database. This is mainly the main entrance to the parking lot. Here two servo motors are connected. One goes to the pin 5 which acts as the entry barrier which opens if the card punched is accepted. And the other servo motor is connected to the pin 7 which acts as the exit barrier. The time is calculated and it is saved in the database. A GSM module for sending sms in case of unauthorized parking is set at pins 11 and 12. And there is a buzzer which is set at the pin 9 of the arduino.

In the second arduino uno, the pins 2 and 3 are used as receiver and transmitter of the RFID reader module. That means the readings obtained from the RFID reader module is taken as the exit of a particular vehicle and its reading goes to pin 2 which acts as the receiver and the pin 3 is the transmitter. Just like the previous arduino here there are two servo motors one connected to the pin 5 acting as entry barrier and the other at pin 7 acting as the exit barrier. Here the time is also taken into account and saved in the database.

A third arduino mega is used for the LCD display, the IR sensors in the parking lot and the LEDs to be lit corresponding to the IR sensors in the specific parkings. The IR sensors are connected to the pins A0, A1, A2 and A3 and their output LEDs are connected to 9, 8, 7 and 6 respectively. The LCD display shows the number of vehicles currently present in the parking area.

IV. SYSTEM IMPLEMENTATION

At first, a vehicle needs to be registered to gain access in the restricted zone and the parking area. So they are first registered

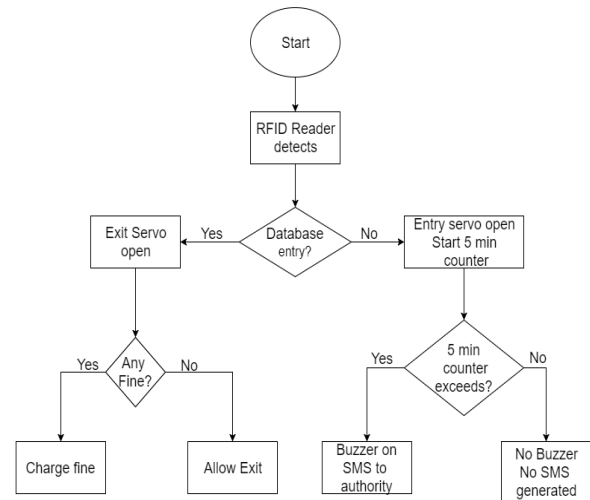


Fig. 4: Main Gate Entry

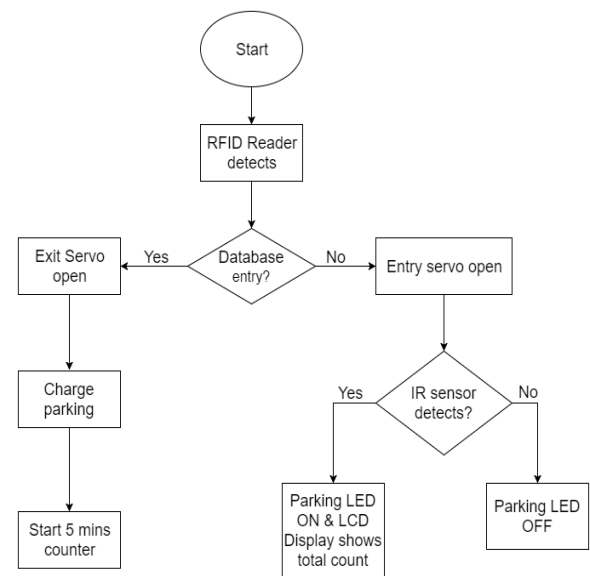


Fig. 5: Parking Gate Entry

by the RFID reader in the main entry. If a vehicle is to be cancelled out of registration, it is also done in the main entry RFID reader.

Then if the car is registered, it punches the RFID tag to the main entry and the gate opens recording the time of the entrance. From then onwards, a time of 5 minutes is started to check whether the vehicle leaves or enters the parking lot. If the vehicle remains in the no parking area, an SMS is sent to the owner and authority informing about the illegal act and fine is charged. With the timer crossing its limit, a buzzer starts alarming.

If the vehicle punches the card for the parking entry, then the timer is stopped and the time of parking entrance is noted. Inside the parking lot, in whichever parking the vehicle parks, the corresponding led is lit and the number of cars inside the lot is displayed in the LCD screen.

When the car punches the RFID reader in the parking entry again, then the time is noted and parking charge according to the duration of parking is charged. And from then onward, another timer starts to check if the vehicle leaves within the given time, otherwise the buzzer will go on, an SMS will be sent and fine will be charged.

When the car finally punches the main entry RFID, then the time is noted and kept into account in the database and the car leaves the restricted area. These overall functionalities are shown in the figures 3, 4 and 5.

V. CONCLUSION

As the number of vehicles continues to increase rapidly, parking spaces are at a premium in city streets. Moreover, due to the lack of knowledge about street parking spaces, circling the blocks in search of empty slot not only costs drivers time and fuel, but also increases city congestion. In order to build Bangladesh as a convenient, green and energy-efficient smart city a user friendly, simple, yet effective parking system is needed. The system that we have designed does not only help to manage unauthorized parking but also reduces traffic congestion and saves our time. Thus we can say that our system is suitable to ensure proper parking management system in any public places of Bangladesh.

VI. FUTURE EXTENSION

In near future when the technology of automated vehicle parking system will be in use in a larger scale, this system can be updated and made more advanced so that this vehicle parking system becomes more and more convenient to the users. Thus, we have the urge to upgrade our system by ensuring vehicle registration via any smart card, fine and parking charge collection via online payment and parking slot booking in advance via SMS.

REFERENCES

- [1] Yusnita Rahayu, Fariza N. Mustapa *A Secure Parking Reservation System Using GSM Technology.*
- [2] *Automatic Vehicle Parking Indicator and Traffic Violation Detection System*
- [3] John Rey Ancheta and John Marthin San Gregorio *Smart Parking System using LDR.*
- [4] *Automated Parking System with Bluetooth Access.*
- [5] Pallavi Mane, Radha Deoghare, Samiksha Nagmote, Shubhangi Musle, Shraddha Sarwade *Android based Smart Parking System . International Journal of Innovative Research in Computer and Communication Engineering*
- [6] R.S.Harishraghav, G.Sri Naga Chaitanya. *Advanced Embedded Automatic Car Parking System .*
- [7] *Design and implementation of car parking system on FPGA .*
- [8] N. A. Ali, A. S. Jaafar, A.Salleh, M. A. M. Razali and N. M. Z.Hashim *Prototype of Vehicle Security Alert System on Proton Iswara 1.3 International Journal of Computer Science and Mobile Computing*
- [9] S.V. Srikanth, Pramod P.J, Dileep K.P, Tapas S, Mahesh U. Patil *Design and Implementation of a Prototype Smart PARKING (SPARK) System Using Wireless Sensor Networks*
- [10] Jihoon Yang, Jorge Portilland Teresa Riesgo *Smart parking service based on Wireless Sensor Networks*

- [11] Eric Groft, Kirby Andrews, Howard Kuff, Larry Berman, Martin Hald, Jonathan Pullen and Bruce Sherry *Smart meter parking system*
- [12] Yanfeng Geng, Christos G.Cassandras *Smart Parking System Infrastructure and Implementation* Procedia - Social and Behavioral Sciences Volume 54, 4 October 2012, Pages 1278-1287
- [13] Xiaoyun Li, Huaqiang Yuan, Fengqi Yu *A Street Parking System Using Wireless Sensor Networks*
- [14] Sarfraz Nawaz, Christos Efstratiou and Cecilia Mascolo University of Cambridge, Cambridge, United Kingdom *ParkSense: a smartphone based sensing system for on-street parking*
- [15] Amalendu Chatterjee, Dwijadas Raha, Joseph Fobert, Sorin Cohn-Sfetcu *Parking system with centralized reservation, payment and enforcement*
- [16] Shin-Yan Chiou and Yi-Cheng Chen *A Mobile, Dynamic, and Privacy-Preserving Matching System for Car and Taxi*
- [17] Dongxu Zheng, Xi Zhang, Yuanchao Shu, Chongrong Fang, Peng Cheng and Jiming Chen *iParking: An intelligent parking system for large parking lots*
- [18] Ruizhi Liao, Cristian Roman, Peter Ball, Shumao Ou, Liping Chen *Crowdsourcing On-street Parking Space Detection*
- [19] Hongmei Zhu, Fengqi Yu *A vehicle parking detection method based on correlation of magnetic signals*
- [20] Mohammed Y Aalsalem, Wazir Zada Khan and Khalid Mohammed Dhabbah *An automated vehicle parking monitoring and management system using ANPR cameras*
- [21] Soukaina Elaouad, Salima Benmakhlouf, Naoufel Tobaji, Mohamed Amine Dmini *Car parking management system using AMR-sensor technology*



Ishraq Haider Chowdhury was born in 1993 at Dhaka, Bangladesh. He is a final year student of Military Institute of Science and Technology (MIST) in Department of Computer Science and Engineering. He has research Interest in Image Processing, Computer Interfacing and Artificial Intelligence. His projects include controlling intensity of light in a room using artificial intelligence. He also has a certification on Mobile Application Development.



Afsana Abida was born in 1996 at Chittagong, Bangladesh. She is a final year student for BSc in Computer Science and Engineering in Military Institute of Science and Technology (MIST). She has research interest in Image Processing, Cyber Security and Artificial Intelligence. She has done a project named A Smart way to Control the Intensity of Light in Artificial Intelligence. She has two web development projects named CureCancer.net and MybookPal. She has received a certification on Mobile Apps Development Course. She has also

made a game development project named The Adventures of Lara Croft on Computer Graphics.



Mehedi Hasan Muaz is a final year student of department of Computer Science and Engineering in Military Institute of Science and Technology (MIST). He was born in 1994. His research interest is machine learning and algorithms. He has been working as a software engineer on laravel platform during last 1 year. Currently, his research is on improvement of diabetes prediction models with machine learning techniques