

A Smart Android Based Parking System to Reduce the Traffic Congestion of Dhaka City

Nawsheen Promy, Sadman Islam

Department of Computer Science and Engineering, Military Institute of Science and Technology, Dhaka, Bangladesh
nawsheenpromy@gmail.com, sadmanarko3921@gmail.com

Abstract— Traffic congestion is a common phenomenon in developing countries like Bangladesh. This is the quotidian scenario in most of the metropolitan cities of the world. Because of heavy traffic, people lose their valuable time from their busy schedule. One of the prime reasons of this traffic congestion is parking on the roadside. So, a need arises to develop a parking system so that it can reduce the traffic congestion in near future. The paper focuses on a smart android based parking control application which will help you to find out a parking area in nearby your location. The mobile application will also help you to pay the parking charge by online payment system. A counter will be there in the application which will help you to count the amount of time your car have spent in the parking lot. This application will also track the entire process and all the previous records.

Keywords—Traffic Congestion, Parking Area, MAC address, Attendance System, Smart Android Based Mobile Parking Control Application, Location, Track.

I. INTRODUCTION

Dhaka city is one of the most crowded and busiest cities in the world. Almost 20 million people live in this city [1]. The total number of registered vehicles in Bangladesh is approximately 3.1 million [2]. Thousands of people daily move from one place to another for doing their respective work. But due to inefficient traffic management system, lack of strategic planning poor traffic infrastructure facilities, it always takes more time to go from one place to another [3]. Because of this unbearable and seemingly incorrigible traffic inside the city, people miss their important work, or cant even reach their respective destination in due time.

One of the major reasons for this traffic jam is parking beside the roads. Unnecessary parking on the roads make the roads narrow and thus create traffic congestion. In a metropolitan city like Dhaka, if drivers park cars in the busy roads, the roads become scanty. It will take more time to cross the roads. This scenario is seen in front of school buildings or offices. A huge number of cars are being parked in the nearby roads and create this unbearable traffic in Dhaka city.

Again, it can't be denied that there are not enough parking slots as per the number of vehicles in this metropolitan area as people haven't followed the urban rules in the past times. The high-rise buildings aren't built according to the building code. Instead of making parking in the basement or parking, many building owners decided to make it another floor to give rent for extra profit.

Now, it is not possible to make the ground floor into a parking area. This will destroy the infrastructure of the

building. So, we need to come up with a digital plan to solve the parking problem in this metropolitan city.

After observing all the parking problems of Dhaka, this proposes a smart android parking control system which will help you to find out the nearest parking area or any parking slot which is being empty as the owner of that parking may have taken his/her car somewhere else. If a car owner finds a parking slot in anyone's parking area, when he/she will enter into that parking area, the timer will start by the parking lot owner. When the car owner wants to leave the parking slot, he/she will call the parking owner to stop the counter. When the counter will stop, it will automatically generate a parking bill for the car owner. Now, there will be 2 ways to pay the bill to the parking lot owner. If the car owner wants to pay the bill in cash, he/she will directly pay this to the customer or if he/she wants to pay the bill any mobile banking system like bKash or DBBL rocket. Once the bill is paid, the parking slot owner will give a confirmation that the bill is paid. In that application, there will be calling system to both parking slot owner and car owner. They can also rate each other as per their behavior.

The rest of the paper is organized as follows. The literature work of our work is presented in Section II. In Section III, we discuss the need findings, the conceptual architecture of the proposed system. The development of the system is given in Section IV. The result of the evaluation of our system is demonstrated in Section V. The discussion, implications, an idea for future work are presented in Section VI. Finally, the conclusion the paper in Section VII.

II. LITERATURE REVIEW

This research is focused to achieve a smart parking control and management system for Dhaka city in an Android platform. This will alleviate our contemporary problems, leading towards a better lifestyle. To find out the related literature, we have conducted searches in the major scholarly databases including ACM scholar, Google Scholar, IEEE explorer, Researchgate and ScienceDirect using suitable search strings.

A parking-lot management system was proposed by Parki, Thakur Chauhan where the user can book parking-lots with the help of RFID [4]. The payment could be done by crosschecking the check-in and out time. But the system allowed to pay after checking out from the lot, then later paying the fines for further checking-in, which clearly didnt help the scarcity of parking necessity hence anyone could take advantage of the system.

Another GSM based parking system was discussed by Sahu, Gulhane Shelokar, where the system was divided into 3 modules [5]. The system interacted with the user with SMS-based authentication in each step, which enhanced the security but brings complexity in every step.

A cloud-based car parking system was introduced by Zhanlin, Ivan, Droma and their co-authors [6]. But the cloud-based parking system included a lot of software like Kafka/storm/HBase clusters, OSGi web applications in addition NoSQL. The entire propose was very complex and not user-friendly as people were looking for easy solutions all the time.

Bilodeau, Victor P [7] came up with a different technology which is called IPT (Intelligent Parking Technology). They had focused on the problem that drivers usually faced regarding parking ticket issues. But this technology was also based on different sensors and GPS technology. So, this research also relied on hardware and the complexity of the hardware was not warmly welcomed by the general people because if the hardware disturbs the entire system will collapse.

III. DESIGN OF THE PROPOSED ARCHITECTURE

In this section, the system design is discussed. To discuss the system architecture, we have worked on two processes 1. Finding the necessity of this system, 2. Developing the conceptual design.

A. Finding the Necessity

Our proposed system can supersede the tradition parking system of any country. We have found some primary issues that led us to establish the system. To aggregate the need findings we have visited different offices, shopping malls, and some police stations. We have talked with different office staffs, shop owners, to ask them about the parking system of their buildings. We tried to collect the information about their current parking slots. Then we have talked with the traffic police officers about the current traffic system and how they have been working to minimize the illegal parking in our country. We have also talked with the parking slot owners and asked them if they would be comfortable to use their parking slots in the absence of their cars. Then, finally, we have talked with the drivers who are mainly responsible for the illegal parking and asked them the necessity of this type of application to reduce the traffic congestion. Based on their answers many inconveniences caused by the existing parking system has been found which we have stated below.

- 1) In traditional parking system, it takes a lot of time to find a parking slot. So, it is kind of time-consuming.
- 2) Generally, traditional parking system requires hardware equipment, which makes the entire system complex.
- 3) If the hardware system disturbs, the entire traditional parking system collapses for that day until the hardware problem resolves. At that time, the whole organizations maintain the parking system by writing the details of a car in a paper.
- 4) There is no rules found in the tradition parking system, if the car is being parked in the area for 1hr or for the whole day.

- 5) Many parking slots owner take their cars in the very early morning with them at work and there parking slots has been left unused whereas at the same time some car owners are looking for a parking area but can't find one in that same location so he/she needs to park his/her car on roadside.

We have talked with our respected traffic police officers and also the owners of the parking slots and drivers. They all have agreed that there should have a system that can bring the parking slot owners and car owners under one roof to reduce the traffic control by providing the parking slot to the car owners in the absence of their own car.

B. Developing the conceptual design

In this sub-section, the conceptual design of the system is given below which is the representation of the system. This will help you to understand it clearly. The block diagram of the system is given in Figure 1

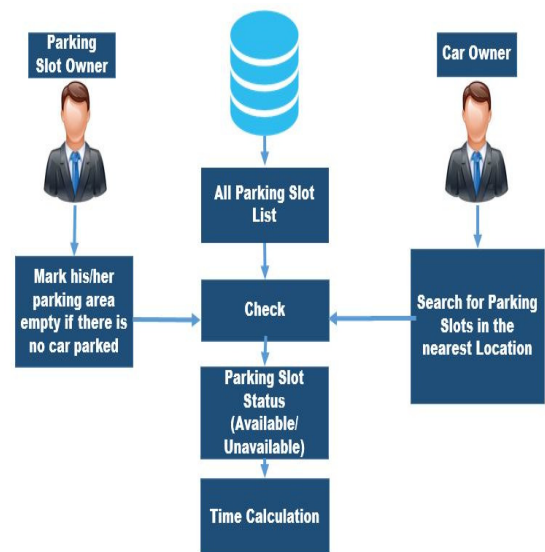


Fig. 1: Block Diagram of The Proposed System

User authentication is one of the prime factors of our proposed system. To make sure the user is authentic, we will use their mobile numbers to register. As, we all know in Bangladesh, all the mobile numbers are being verified by the National ID. So, once the owners install the APK files of the system to their Android phones, they need to register himself with their phone numbers. After giving phone number, a 6 digit code will be given to an user for further process. The user needs to add the other information like his/her name, Email Address, Car Number, Parking Slot Number. An user can register himself as a car owner, a parking slot owner or both.

Once, you have registered as a parking slot owner, you need to press the button empty whenever you want to give rent to your parking slot. Now, if you are a car owner, after completing the registration you need to search by location. When you will search if any parking slot is

found empty, it will notify you. The application will also show the nearest parking location from your current location.

If the parking slot is available, you will call the parking slot owner and ask him/her if you can park your car there. After the car is being parked, a timer will start to count the amount of time the car is spent in the parking lot. When the car owner wants to release the parking slot, he/she will take away the car and the timer will be stopped. After the timer is being stopped, an automatic report will generate about the rent of the car owner. Then the car owner can pay the bill to the parking slot owner and leave the parking area.

The flowchart of the system is given in Figure 2. This will give you a clear vision how the entire system will work.

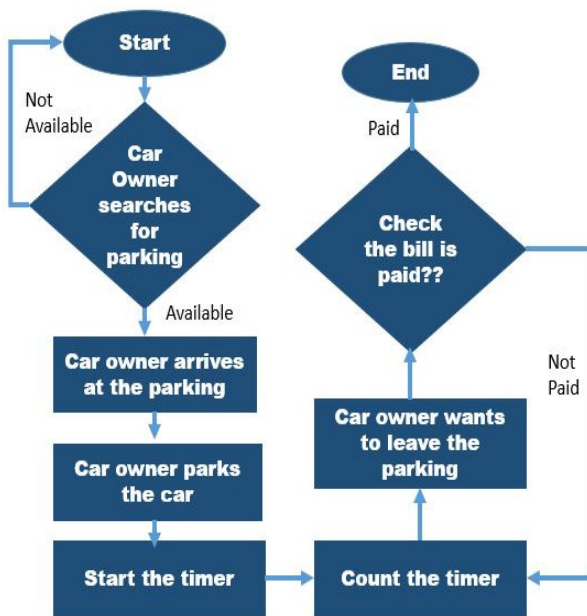


Fig. 2: Flow Chart of The Proposed Architecture

At the end of the entire process, the status column will show every detail of the owners. In the application, the owners can also give ratings to both the owners. Both owners have access to complain. For example, if any damage is done to the car during the parking time, the car owner can simply take the photo and other necessary evidence against the parking lot owner. The application authority will take necessary actions against the owner. If any of the owners behave rudely, they can also complain about that.

IV. DEVELOPMENT OF THE PROPOSED SYSTEM

In this section, we have discussed how we have developed our proposed system.

A. Components

The mobile application is basically an Android based application. So, it basically required a mobile device which supports Android operating system. To develop the entire process, we need a heavy duty laptop which will support Android studio desktop application to write the code.

B. User Interface

The layouts of the UI design are taken care of by Extensible Markup Language (XML) which is a markup language that exemplifies a set of rules for encoding documents in a format that is both machine and human-readable. We have used the Android platform to develop the whole development system in Android Studio. We have also used Java for the development purpose which is the official language of Android development and is well supported by Android Studio. The UI design of our mobile application is given in Figure 3.

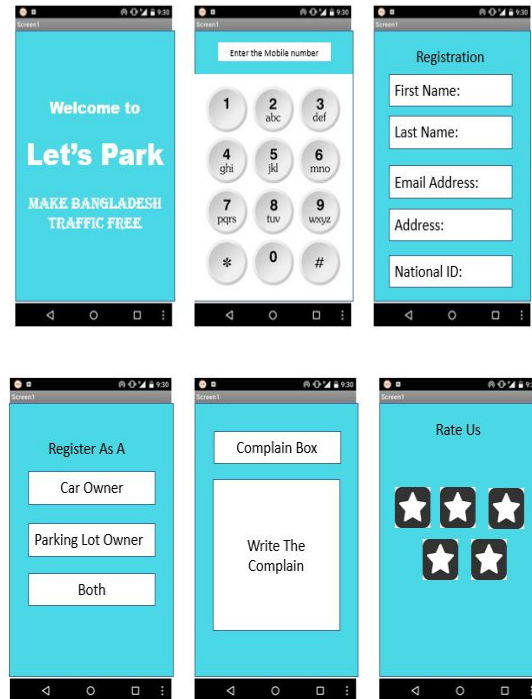


Fig. 3: UI of the Mobile Application

C. Database

We have used MySQL database, the most widely used open source server to store both the car and the parking lot owners information and the timing of arrival and departure of the car. After registration of the owners into the system, they will be uniquely identified by their email address and mobile number. In the MySQL server, there will be several rows where they can put the information like their name, email address, mobile number, address, etc.

D. Server

PHP is the server-side scripting language that we used to connect the MySQL database server to Android Studio.

E. Android Based Mobile Application

Android-based built-in security features like Android Application Sandbox (which isolates the app data and code execution from other apps), application framework (Cryptography

and permissions) are used so that it can significantly minimize the frequency and impact of application security issues. The development of the app is designed in such a way with the default system and file permissions so that it can take difficult decisions about security such as User-granted permissions to restrain access to system features and user data. For better understanding the whole technical process is depicted in Figure 4

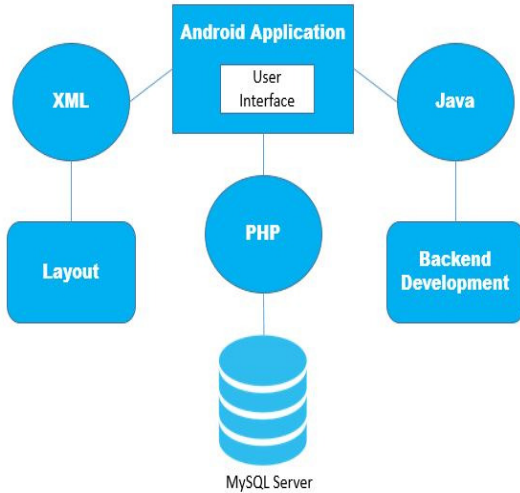


Fig. 4: Block Diagram of the Technical Part of the System

V. EVALUATION

After developing the system, we have done an evaluation for measuring the accuracy and correctness of the system. We have also measured the rate how much it is better than the traditional ones.

To evaluate the process, we have taken two steps. At first, we have gone to different shopping malls parking lot to check how the traditional system works. We have seen their is very big queue in front of the parking lot. The guard is giving tickets to each of the drivers. Then he gives a pass to each driver. When the drivers are leaving the parking areas, they are paying the guards, but there is no checking of the arrival and the departure time. Then we have also visited some official areas and some schools. There we have seen that drivers are waiting for the students in front of the school gate and made a huge traffic congestion.

After surveying this areas, we have selected some areas and trained some drivers how to operate the mobile application and also have been to some parking owners house and asked them if they want to rent their parking when their own car isn't there. Some of them willingly participated in our campaign where others don't find the process trustworthy. After observing several days, we have seen we have found a revolutionary result. We have been to an school area which is located near a residential area. Before our mobile application is being operated, there used to be huge congestion due to traffic. But suddenly the local people have found that there

is something new. Basically, during the working hour the parking lot owner of the residential area leaves their parking lot in rent. As, the driver knows after dropping the student the car needs to get parked. So, he tries to find a parking which is near the school so that he can come before the school breaks.

From the above experimental results, it is assured that this system has the following benefits-

- Accuracy: This system can accurately calculate the rent of the parking charge of any car.
- Time Consuming: This system reduces the time of finding suitable parking lot. Because the application will give you the chance to find the nearest parking location.
- Reducing the traffic congestion: As the drivers park the car in the parking lot, they don't need to park the car in the road. So, the roads are properly used by the vehicles. So, it minimizes the traffic congestion.

Thus the system has advantages which make it separate from the existing attendance taking method. The difference between this method and the existing method are given in Table I.

TABLE I: Difference between the existing system and the proposed system

Existing Systems	Our Proposed System
1. Most of the existing parking systems are hardware based.	1. This parking system is software based. It is just a mobile application.
2. The existing parking system is usually placed in front of the parking area. A guard will give a token to every car and allow the car get inside the parking area.	2. Our system is a software based system. So, it doesn't require any hardware set up in front of the door or any token.
3. The existing parking system has a fixed car parking rate. There is no difference if a car is parked for 1 hour or 8 hours	3. In our proposed system there will be a counter inside the application. It will act like a stop watch in the parking slots owner application. So, it will help to generate the exact parking bill for each of the car.
4. In existing systems, there is no opportunity to utilize someones personal parking area when they aren't utilized their parking area. The existing all systems are for the large parking areas.	4. In our proposed system will give the personal parking slot owners an opportunity to utilize their parking in the absence of their cars and make some profits.

VI. FUTURE EXTENSION

The parking system is currently developed for the android platform but we are focusing to expand it on iOS platform as well in the upcoming days. Besides, we will try to make the parking system more space optimized [8] and efficient. Again, in this android based parking system the payment method is relied on cash or any mobile banking system. In future, we will try to build our own mobile banking system inside the application so that people don't need to depend on other mobile banking system or cash.

VII. CONCLUSION

The proposed smart android based parking system has been developed using the existing technology. This system

automates the process of parking system, thus saves a lot of time . It is also a cost-effective system because it relies only on a smart-phone. As this completely automates the parking system, it leaves no room for any kind of error. This system will provide a safety and hassle free parking to the car owners as the parking slot owners are being registered with details. Unused parking slots in working hours will add some extra money to parking slot owners. Thus, it will help both the parking slot owners and car owners. Our system will solve the excruciating traffic problem and make our life better and more productive.

REFERENCES

- [1] W. U. P. Bangladesh Bureau of Statistics, "Dhaka population," Oct. 20 2017, [Online; accessed 9-June-2018]. [Online]. Available: <http://worldpopulationreview.com/world-cities/dhaka-population/>
- [2] B. R. T. Authority, "Number of registered motor vehicles in bangladesh (yearwise)," 2017, [Online; accessed 15-September-2017]. [Online]. Available: <http://www.brta.gov.bd/newsite/en/whole-bangladesh-up-to-sep-2016/>
- [3] A. Quium and S. Hoque, "The completeness and vulnerability of road network in bangladesh," *Engineering Concerns of Flood*, pp. 59–75, 2002.
- [4] C. S. Parkhi P, Thakur S, "Rfid-based parking management system." *International Journal of Advanced Research in Computer and Communication Engineering*, 2014.
- [5] V. G. Sahu, V. Gulhane, and N. Shelokar, "A web based centralized vehicle parking system using gsm security," *IJAIEEM*, vol. 2, no. 4, 2013.
- [6] Z. Ji, I. Ganchev, M. O'Droma, L. Zhao, and X. Zhang, "A cloud-based car parking middleware for iot-based smart cities: Design and implementation," *Sensors*, vol. 14, no. 12, pp. 22 372–22 393, 2014.
- [7] V. P. Bilodeau, "Intelligent parking technology adoption," Ph.D. dissertation, University of Southern Queensland, 2010.
- [8] Y. Zhao and E. G. Collins Jr, "Robust automatic parallel parking in tight spaces via fuzzy logic," *Robotics and Autonomous Systems*, vol. 51, no. 2-3, pp. 111–127, 2005.



Nawsheen Promy was born in 1996. She has completed her B. Sc from Department of Computer Science and Engineering from Military Institute of Science and Technology of Bangladesh in 2018. She has passed her Higher School Certificate exam from Holy Cross College School Secondary Certificate exam from Shaheed Anwar Girls School College. Nawsheen was also a member of IEEE. Her current research work is mainly on wireless communications, networking and website developing.



Sadman Islam was born in Dhaka, Bangladesh in 1996. At present he is pursuing his B.Sc. degree in Computer Science and Engineering from Military Institute of Science and Technology at Dhaka, Bangladesh. He passed his School Secondary Certificate exam from Motijheel Ideal School College and Higher School Secondary Certificate exam from Dhaka City College. He will receive her B.Sc. degree from CSE in January 2019.