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Coursework Submission and Feedback Form

Name	Sandesh Subedi (A)			**Name of Group Members (If Applicable)**
Student No.	NPI000040	**Intake:**	NPI2F1909IT	
Module Code & Title	Research Methods for Computing and Technology Module Code : CT098-3-2			
Assignment Title	IoT Based Advanced Car Parking System			
Name of Lecturer	Anup Adhikari			
Date Due	10 March, 2022	**Student E-Mail:** sandeshyes77@gmail.com		

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GROUP ASSIGNMENT

INFOMAX COLLEGE OF IT AND MANAGEMENT

CT098-3-2

RESEARCH METHODS FOR COMPUTING AND TECHNOLOGY

HAND IN DATE : 16/12/2021

HAND OUT DATE: *10/03/2022*

WEIGHTAGE: 50%

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1. **Submit your assignment at the administrative counter.**
2. **Students are advised to underpin their answers with the use of references (cited using the Harvard Name System of Referencing)**
3. **Late submissions will be awarded zero(0) unless Extenuating Circumstances are upheld.**
4. **Cases of plagiarism will be penalized.**
5. **The assignment should be bound in appropriate style (comb bound or stapled)**
6. **Where the assignment should be submitted in hardcopy and softcopy, the softcopy of the written assignment and source code (where appropriate) should be on a CD in an envelope / CD cover and attached to the hard copy.**
7. **You must obtain 50% overall to pass this module.**

Acknowledgement

First of all, I would like to manifest my heartfelt appreciation towards our subject teacher, **Mr. Anup Adhikari** sir. His continual encouragement and positive motivation throughout this project has been huge. Without his productive guidance and assistance, I might not have been able to accomplish the project goal, with this level of comprehensive understanding. His methodology of carrying out the project guidance is extra efficacious and it has been a privilege to work under his enlightenment.

Furthermore, I would also like to convey my sincere thankfulness to APU (Asia Pacific University) for providing me with this wonderful opportunity to learn Information Technology and be a part of this research project. Winding up, I would like to make use of this moment to demonstrate my deep regards to all my colleagues who helped me during this research.

Thank You!

Contents

IoT BASED ADVANCED CAR PARKING SYSTEM

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***Abstract* —** This paper put forward the conception of advanced car parking system that is based on IoT, includes GSM, and is operated by a smart-phone application. It aims to study a feasible parking solution that helps drivers reserve vacant parking slots and consequently minimize the traffic congestion. Highly dense roads and inconvenient parking availability is something that demeans the quality of life. The expeditious increment in automobiles ownership has given rise to some serious parking issues. The research method seeks to emphasize the application of servers, IR sensors, indicators and available systems to establish an advanced parking solution. Moreover, to accumulate precise affirmation, a case study survey is conducted followed by a random sampling approach. Findings shows that the current parking is more careless and unsafe than what previous research verified. Consequences of phone based solution claims to overcome the issue of crammed full parking, resulting in traffic fluency, sparse roads and vehicle safety.

Index Terms : advanced parking, automobile, Internet of Things (IoT), IR sensors, mobile application, traffic congestion

1. Introduction

60 hours. That's the time within which one can travel to Chicago, spend a day over there, and get back to Nepal as well. Also, that is the same duration of time an individual spends a year, to find vacant parking in cities of Nepal. The considerable emergence of automobile in present-day has brought some unprecedented amendments. Automobile brings expedience and it is what most people seek for. However, this increment has not just got utilities but also a plethora of noteworthy challenges. The rise in number of automobiles has increased parking requirements as well. However, it has became tremendously strenuous to cope with existing parking slots. According to a research from Sher Jung Bahadur Chand, report claims that traffic jams has costed around 116 billion rupees in Kathmandu city only (2021). One has to drive his vehicle aimlessly just to find a parking spot for a specific period of time. The problem gets even worse during peak hours when drivers have to park hundreds of meters away from their original destination. Apart from that, the traffic congestion resulted by poor parking management has also increased road accidents. The minimal gap between two automobiles creates high chances of collision, which causes physical and financial damages. This research paper also seeks to investigate how building an insightful parking system contributes in significant reduction of time wastage, excessive fuel consumption & more importantly, the traffic congestion.

For technology, the Internet of Things (IoT) has been advancing in such a way that any intricate issue can easily be implemented. IoT is ascending its scope and the use of efficient

actuators and sensors can definitely play vital role in advanced parking system. The system incorporates usage of devices such as wireless algorithms, IR sensors, LED matrix indicators and microcontroller that helps to provide real-time information. The IR sensors determine the availability of slots using infrared lights. With this, users can simply monitor and make a reservation for a parking slot via their smartphone. Moreover, the system also offers features like online payments and punctuality reminders. When a car arrives at the parking station, the sensor records required details and the LED matrix guides driver to their specific parking slot (Kumar B.E. et al., 2017). During exit, the car driver enters the OTP provided during reservation and retrieves the car.

2. Literature Review

The problem of parking and traffic congestion is global. Most of the major cities around the globe are facing this problem since a long time and the problem does not seem to be diminishing anytime soon. According to some research, a single driver spends an average of 10-15 minutes just to find a suitable parking spot. This has brought a lot of difficulties in maintaining traffic fluency, especially in city areas. The concept of advanced car parking is thus consequential in establishing a rightly-organized parking provisions.

Determining the scope with thematic literature, issues related to research topic are studied and analyzed in detail. Large number of theories related to conception of advanced parking and IoT are investigated and analyzed so that a boundary is created for the review. To solve or at least minimize the issue of poor parking, a plethora of fresh ideas have been presented. Moreover, cities like Barcelona, Marseille, Berlin and Singapore have already implemented advanced parking and made car owners life much easier than it was before. As noted by Adler (2016), the city of Barcelona has provided automobile drivers with a sensor system that automatically escort them towards the vacant parking spaces. This specific program has been consequential in reducing traffic congestion and maintaining vehicle safety. It was found that around 4,000 authorizations were issued each day with this concept of parking.

Similarly, analyzing another empirical theory, Niculescu et al. (2015) put forward an idea of intelligent driver assistant also known as IDA. IDA, unlike most of other applications would interact to drivers via speech. Their intention is to eliminate traffic congestion caused due to poorly managed traditional parking. Fair to say, the objective of IDA is to assist drivers in Singapore to find available parking spots by monitoring the automobile parking area.

Investigating research from Nepal, a research from Karmacharya and Shrestha (2019) notes the use of image processing technology that detects the number of vehicle and captures all available information. According to the paper, there will be automatic doors in parking area so that only authorized automobiles can get access. Besides, their aim is also to maintain parking spaces so that their is no congestion. Ultrasonic sensors are used and the other part used is a pi-camera called Raspberry Pi.

2.1 Similar Systems

Analyzing more researches, there are handful of systems that offers similar smart parking solutions. They are :

a) Blinkay

Blinkay is a Canada based smarty parking app that allows their users to reserve vacant space

to park their cars. Their main aim is to solve user's time and make parking convenient.

Figure : Blinkay Parking (Everyone, 2015)

The application offers online payment service so that a user can reserve or extend his time accordingly. The system sends notification so that users don't miss out their commence and end time. However, the service is unavailable except for Canada and other seven countries including Spain, Mexico, Panama, etc. and it does not focus on traffic congestion either.

b) Parkopedia

Parkopedia is an application released in 12th February, 2012, that provides parking spaces to people in 15,000 different cities.

Figure : Parkopedia App (Parkopedia, 2012)

The parkopedia app allows users to find and book parking spots using their current address or by choosing a specific address. It provides real-time information to users, showing space availability, parking cost and parking time. It also provides information about opening time, latest charges, parking entrance and payment.

2.2 System Comparison

	Blinkay	**Parko pedia**	**Proposed System**
OTP Verify	No	No	Yes
Cross Platform	Yes	Yes	Yes
Real-time Data	No	Yes	Yes
Matrix Indicator Guidance	No	No	Yes
Online Payments	Yes	Yes	Yes

Table : Comparison between available systems

In summary, all these existing systems have similar features to that of proposed system. However, there are notable differences which makes the proposed system different from others. Both Blinkay and Parkopedia do not offer OTP feature so that only authorized user can park and retrieve cars from parking premises. Similarly, those applications do not have any parking guidance functionality so that drivers are guided to their exact parking slot. But in proposed parking system, a LED matrix will be implemented to guide drivers to their specific lot without wasting time in finding correct slots.

3. Problem Statement

A research from Weishuber (2015) claims that around 40% of accidents occur during vehicle parking. In traditional parking system, any random person can easily impede with parked vehicles. This might result into scratches and other sort of vandalisms. That means, there is neither appropriate space, nor vehicle welfare.

Similarly, in context of stadiums, cinema hall, shopping malls and parties, there are plenty of cars. This, without any parking plan, creates a serious mess, resulting in dense road. Besides, a driver has to drive aimlessly for hundreds of meters just to find a vacant space to park his car. In worst case, a driver might even have to return home just because there is no parking spaces available, especially during festivals. And more importantly, traditional and road-side parking causes huge traffic congestion which results in loss of fuel, energy and time.

4. Research Aim and Objectives

4.1 Research Aim

This paper aims to establish an IoT based car parking system that will facilitate users with convenient parking service and reduce traffic congestion in manifold locations.

4.2 Research Objectives

Some objectives of the research were :

- To design and develop IoT based system for parking solution
- Provide facile parking service to diminish time wastage and fuel consumption.
- Differentiate and contrast similar systems to find out problem gap
- To implement the parking system by April 2023, reducing traffic congestion by 60% and making environment carbon free.

5. Research Questions

- What would be the impact of advanced parking system to automobile owners?
- How does the use of LED matrix indicator benefits car owners?
- What role will IoT play in controlling the traffic congestion with advanced parking system?
- Determine both hardware and software components that will be essential for the development of advanced parking system
- Specify the procedures in pre-booking a parking slot through a mobile application

6. Research Significance

This research paper will provide new intuition into the concept of traditional parking system. With inclusive exploration, a new and smart way of parking system has been untangled so that automobile owners will be benefited. The idea of advanced parking system will help drivers easily reserve required parking space from a mobile application. This will save time as well as the amount of fuel consumed. The advanced parking also ensures vehicle safety and outstandingly reduce road congestion.

Using this system, there is no need for drivers to drive their vehicle aimlessly and find space for parking. Overcoming traditional parking, the concept of advanced parking plays an important role in clearing roads. This reduce chances of accidents and minimize emission of C02 as well. Places like shopping mall and cinema halls can accommodate larger number of customers by providing them convenient parking experience without any blockages or obstructions.

7. Methodology

Research methodology is a process of solving the research problem in a systematic method. A research methodology goes beyond method and understands those techniques logically so that we can justify why that specific method was chosen (Kothari, 2004). For this research, survey and sampling methods were chosen so that we can accumulate all the required data. Moreover, the survey will be conducted in two different ways : physically and virtually.

Qualitative and precise data is to be collected and these two methods are possibly the most appropriate approaches. The congregated data will be analyzed properly so that they will be helpful in system improvement.

7.1 Survey

In order to gather afresh and real information, surveys will be conducted. Survey falls under primary data collection method where some circumstances are examined and information is secured. Despite having various methods of data collection in surveys, the questionnaire method will be used so that we get instant and genuine information.

To conduct this method physically, a set of questions will be provided to car drivers and few questions will be asked for their instant responds. Doing this, drivers will be able to express their feelings about existing parking system and convey their discernment about the concept of advanced parking as well. This will be conducted among 120-150 automobile drivers within the span of 3-5 days. Likewise, to conduct an online survey, a set of questions will be posted on social medias where utmost number of people can provide feedback.

7.2 Sampling

In case of our research, the most impactful respondents could be be those people who own automobiles. This includes car owners and cab drivers. However, since the research aims in traffic fluency, traffic officials can be important as well.

A purposive sampling will be conducted to accumulate requisite data. Purposive sample is also known as judgement sampling where specific sample are selected and information are gathered. For our research, a sample of automobile owners, cab drivers and traffic official will be assembled and queries related to parking system will be proposed. Besides, some basic queries related to advancement in parking system will also be asked so that we can receive important feedbacks.

8. Overview of the Proposed System

The name of the proposed system is ‘Advance Car Parking System’. This is a modern notion where parking slots can be reserved through a mobile application. A user can simply login to the application, check available slots, provide the time duration and pre-book the parking space instantly. Appropriate use of Internet of Things (IoT) along with few crucial hardware components will be used in this system. There are four major components that will be used to develop the parking system. Architecture includes application, network, transaction and physical layers which combine to each other and form a functional unit (Biyik et al., 2021). The diagrammatic overview of system architecture is displayed below.

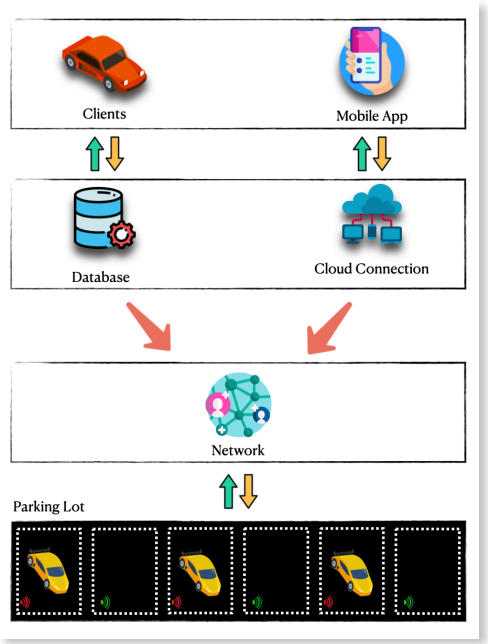

Fig : Architecture overview of proposed system

The application layer is the topmost layer that facilitates user with system interaction. Users can comfortably connect with parking stations and reserve parking slots through application. The network layer is responsible for continual flow of connection among multiple stations, system and users. Similarly, transaction layer authorizes negotiation so that real-time data is being exchanged whereas the physical layer comprise of IoT devices such as sensors, LED matrices and collected data.

8.1 Using Advanced Car Parking Application

The application developed for advanced car parking will be easy and comfortable to use. A normal person with smartphone can easily use our application. The pre-booking process will have few facile steps so that users do not have to spend much time on reserving their parking slots.

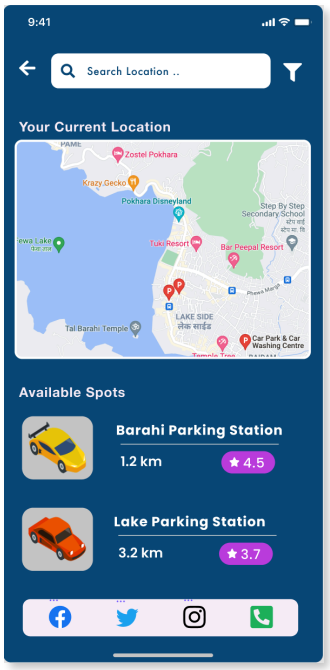

Fig : Interface Overview of Proposed System

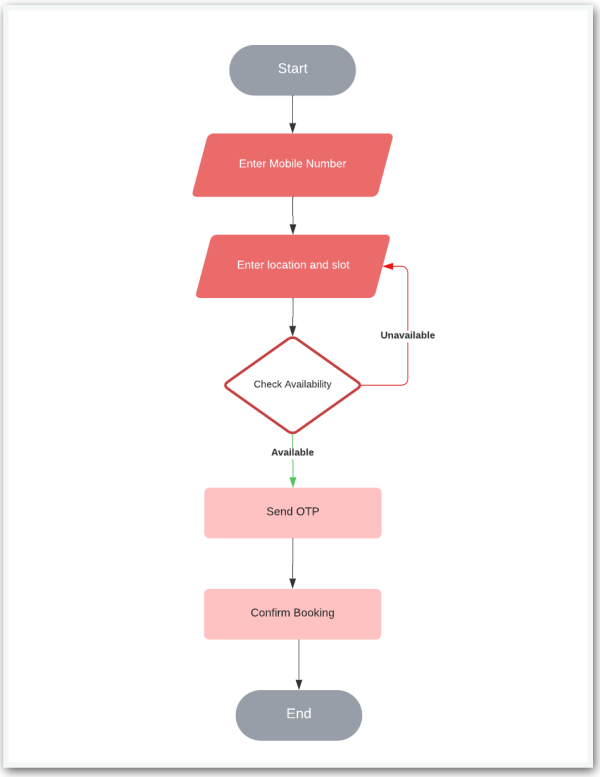

Fig : Flowchart for booking a parking slot

To log into the application, users will have to enter their phone number. Once a user access the application, he can get information about available stations and their availability. Data will be provided in real-time so that there is no conflict in between user selection. A user can simply select their preferred location and choose their slot number. When a parking slot is booked, the application resounds with OTP number. The received OTP will be used while retrieving the car from the parking spot.

Once a car arrives at entrance point, OTP is shown and slot number is entered. This will turn on the LED indicators which guides car to its respective slot. In addition, the season will make a warning sound if the car is parked in improper way : for example, crossing border lines. Furthermore, the application also

offers features such as online payments so that people can pay parking fees online.

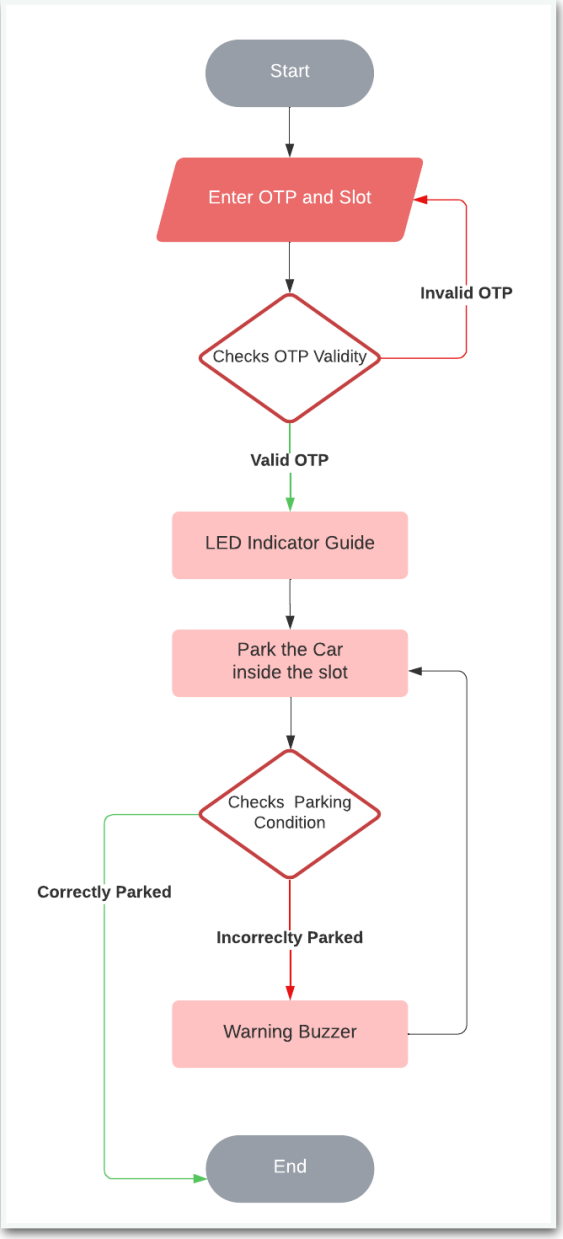

Fig : Flowchart for parking a car

When parking is done in appropriate way, the next thing is to retrieve the car while leaving the parking premises. To retrieve a car, user has to enter the OTP which was received earlier. The system will check the OTP and determine its validity. Only if the entered OTP is valid, the car will be allowed to leave the premises. This is important in maintaining car security and avoid automobiles stealing.

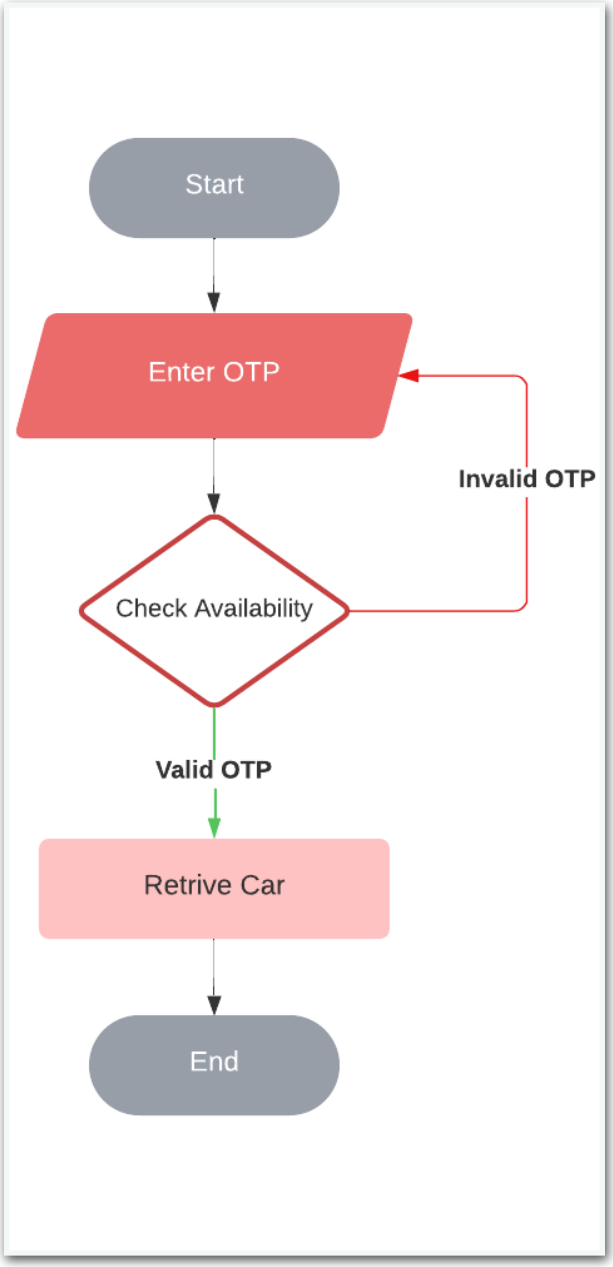

Fig : Flowchart for retrieving a car

8. Conclusion

The concept of advanced car parking system can be consequential in overcoming currently

existing parking issues. With implementation of IoT concept, software and network data, an effectual parking system can be established. The future application of convenient parking and its role in improving traffic has been discussed throughout the research. This notion of parking system can make lives easier for automobile owners whereas it also assists in reducing traffic congestion in dense roads. Successful implementation of this car parking system is expected to reduce traffic congestion by almost 50% along with time saving and automobile security.

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