

**AN APPROACH TO SMART PARKING ALGORITHM USING
ANT COLONY OPTIMIZATION AND DECISION TREE
ALGORITHM**

A Dissertation

Submitted

In Partial Fulfillment of the Requirements for
The Degree of

MASTER OF TECHNOLOGY

In

Computer Science & Engineering

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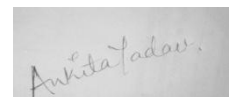
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I hereby declare that the dissertation titled “**An Approach to Smart Parking Algorithm using Ant Colony Optimization and Decision Tree Algorithm**” is an authentic record of the research work carried out by me under the supervision of Dr. Mohammad Arif, Department of Computer Science & Engineering, for the period from August, 2019 to August, 2020 at Integral University, Lucknow. No part of this dissertation has been presented elsewhere for any other degree or diploma earlier.

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ACKNOWLEDGEMENT

I am highly grateful to the Head of Department of Computer Science and Engineering for giving me proper guidance and advice and facility for the successful completion of my dissertation.

It gives me a great pleasure to express my deep sense of gratitude and indebtedness to my guide **Dr. Mohammad Arif, Associate Professor, Department of Computer Science and Engineering**, for his valuable support and encouraging mentality throughout the project. I am highly obliged to him for providing me this opportunity to carry out the ideas and work during my project period and helping me to gain the successful completion of my Project.

I am also highly obliged to **Dr. Mohammadi Akheela Khanum (Associate Professor, Department Of Computer Science and Engineering)** and PG Program Coordinator **Dr. Faiyaz Ahmed, Assistant Professor, Department of Computer Science and Engineering**, for providing me all the facilities in all activities and for his support and valuable encouragement throughout my project.

My special thanks are going to all of the faculties for encouraging me constantly to work hard in this project. I pay my respect and love to my parents and all other family members and friends for their help and encouragement throughout this course of project work.

Date: 05/08/2020

Place: Lucknow

ABSTRACT

This research is conducted in order to deal with the main problem of traffic congestion and road accidents that is basically caused because of the improper parking management. . Hence, it is important that cities have a well managed parking system. In the past various researches has been done to design a suitable smart paring algorithm. However, each research had their own pros and cons. Our research leads to a smart algorithm that is secure and is convenient enough to develop a system that can be manage the available slots and can notify the users about the available parking slot beforehand to the client. The result analysis clearly shows that the algorithm designed is more accurate than other algorithms used in the past. We have designed our algorithm using ACO, decision tree, and GPS mapping. The idea of working on this research was to provide a solution that is cost effective, helps people on large scale and maintains the laws and order.

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LIST OF ABBREVIATIONS

ACO	ANT COLONY ALGORITHM
GPS	GLOBAL POSITIONING SYSTEM
IOT	INTERNET OF THINGS
AES	ADVANCED ENCRYPTION STANDARD
DES	DATA ENCRYPTION STANDARD

CHAPTER 1
INTRODUCTION

1.1 WHY SMART PARKING SYSTEM?

As per the Indian Ministry, the governing body, of Road Transport and Highways, that maintenance and administrations the rules and laws relating to transport ha reported increase the in the transportability and proficiency of the road transport system in India. Moreover, in referring to the aforesaid statistics provided by the ministry of India, the present-day transportation framework and vehicle park solutions are expected to be restricted in defending the incursion of automobile on the road. Therefore, even if we consider the statistics, and data, problems like vehicle overcrowding and limited parking spots will always remain the top post problem by default.

India is ranked 2nd in terms of having the largest population in the world. However, where the rise in population is the root cause of many problems like extreme poverty, unemployment, shortage of land, pollution, and so on, it is also responsible for an increase in private vehicles and that leads to PARKING PROBLEM in India. Vehicle drivers are not aware of the vacant space in the parking areas and hence they abruptly park their vehicles on the road that further leads to congestion and traffic. As per the track of the past records the traffic and parking management system does not work in an organized way in India. Where people from cities like Delhi, Mumbai, Kolkata, and Lucknow go through everyday struggle of searching for a car parking zone, just imagine the problem faced by people living in small towns. From years researchers are working on this problem and are providing the best suitable solution. Even, various steps have also been taken in the past to defeat the problems caused by improper management of vehicle congestion. In addition, there are numerous examinations done in the past about the brilliant stopping approaches that have utilized different innovations, for example, the web of things, remote sensor organize, cloud frameworks, and versatile based application.

1.2 SMART PARKING SYSTEM

In a normal term, a smart parking system may be defined as an intelligent system that can be used for parking vehicles. The system should be intelligent enough to assist or advice the vehicle drivers in finding the right parking spot. A smart parking system may be a vehicle parking system that helps drivers realize an empty parking spot. Many researchers have conducted the study in the past where it was mentioned that by using sensors, as a device in each parking space they can easily discover whether the vehicle is present in the parking space or not. The devices used signs undeviating approaching driver-sty obtainable locations. For example, during early 2000s, a wise parking system was put in at the Baltimore-Washington International airdrome. Before installation, the parking garages closed after they were regarding the ninetieth stuffed. Now, since there is rise in the good parking system, the garages are shutting down at maximum tenancy. But a question is: is the parking problem solved? And the answer is NO! Which leads to the second question: WHY? And the answer is because the main root solution to avoid the parking problem is to make people aware of all the vacant spaces in all the nearby parking zones available for them.

The work presented in this paper combines various algorithms to create an intelligent algorithm that is compatible with user's smartphones and that it is able to trace the vacant areas via monitoring the latitude and longitude with the help of GPS. The data is collected in the cloud database and is then analyzed to provide the optimal solution to all the registered users. As per the mechanism, the users need to register themselves to take the privileges of an empty parking spot in any parking area user. The mechanism is to trace the location of the vehicle driver and as per their location; they will be notified about the parking zones available near them and will also be informed about the vehicles that are taking an exit from the parking zone. Hence the vehicle

drivers not only get to know the parking areas near them, but they also get to know the vacant spaces in those parking areas. Moreover, all the requirements will be taken from the user on the basis of different parameters like vehicle type, preferred timing, and distance. These requirements will be the pheromones for the newly designed algorithm. Once, the data is collected it will be processed by an intelligent algorithm (Combination of Genetic Ant Colony and Decision Tree). And based on the data inputted by the user, the algorithm will predict the best and optimal solution.

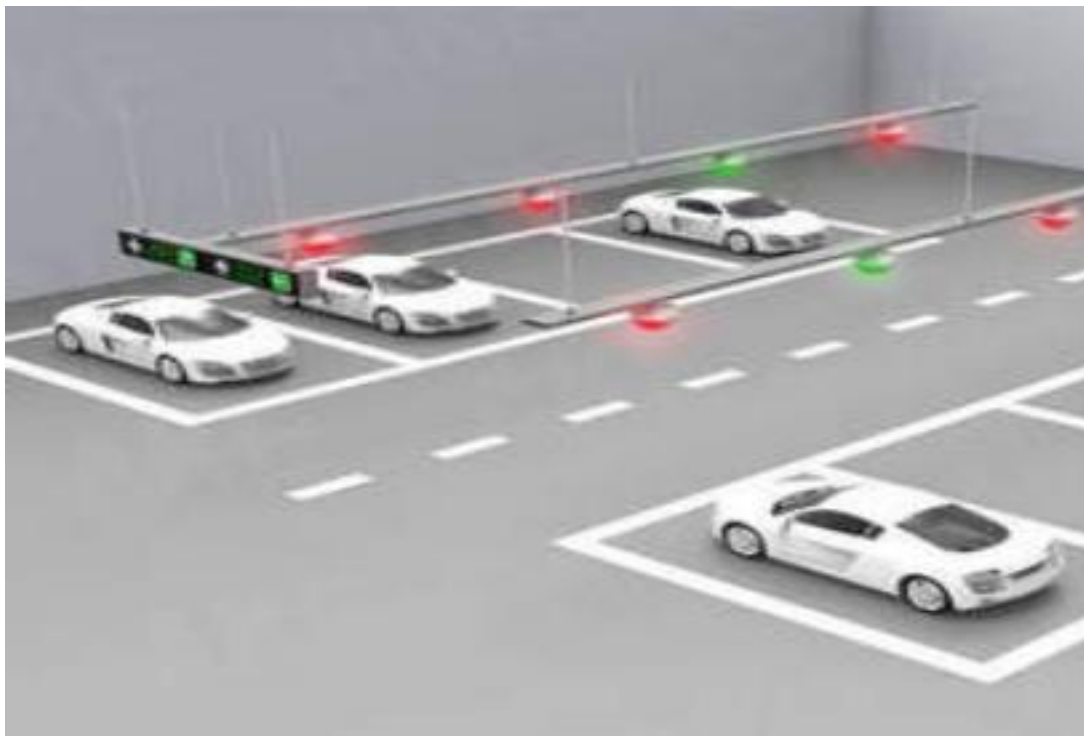


Figure 1.2: Smart Parking System

1.3 REQUIREMENT OF SMART AND ORGANISED PARKING SYSTEM

There is an alarming need for smart, better, and organized parking mechanisms. An outdoor smart parking system offers users with guidance and information with respect to parking areas in the city. It is simply done by monitoring parking area usage. And more importantly, the system

should make people aware of all the vacant parking spaces available. Improper parking of vehicles on the road and pavement leads to traffic jams, accidents, and even restricts the space for pedestrians. All these problems will be solved if the proper parking management is done. Hence to provide an optimal, cost-effective, and user-friendly solution an algorithm will be provided to help the vehicle drivers. Not only this, but the aim of this research is also to record the amount of time for which the vehicle is going to be parked and based on that time it will be decided which slot is preferable for that particular vehicle for the smooth exit and entry of other vehicles in the parking area.

1.4 TECHNOLOGIES USED IN THE RESEARCH

In order to build a smart algorithm that will help us to build a smart parking system, we will be using various technologies in our research process. The major technologies that we have used are named below.

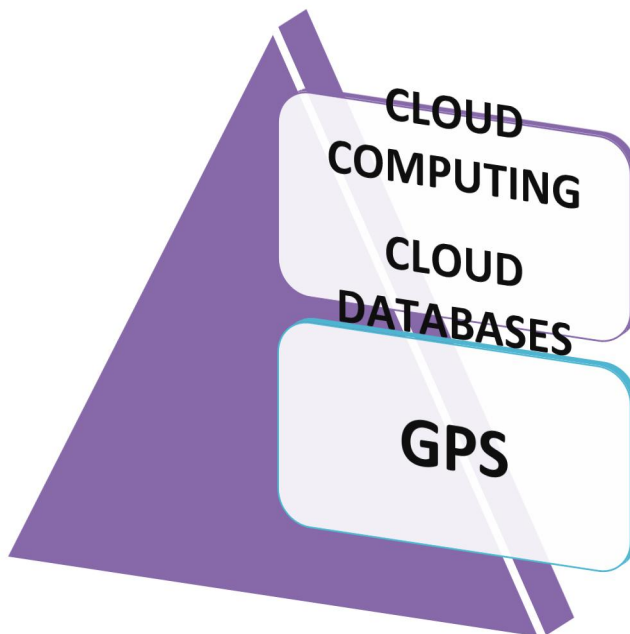


Figure 1.4: Technologies Used

1.4.1 CLOUD COMPUTING

In terms of network security over the cloud, cloud computing is known to be defined as the requested availability of computer system supplies. These resources can be categorized as data storage in the form of cloud storage and computing power. These resources do not require the user's complete and active management. Distributed computing is the term that is commonly used to depict information centers available to a few clients over the web. Moreover, it may be related to a solitary institution or it may be accessible to many big organizations. The cloud available to a single institution is termed business clouds. The cloud accessible to many institutions at the same time is termed as a Public cloud.

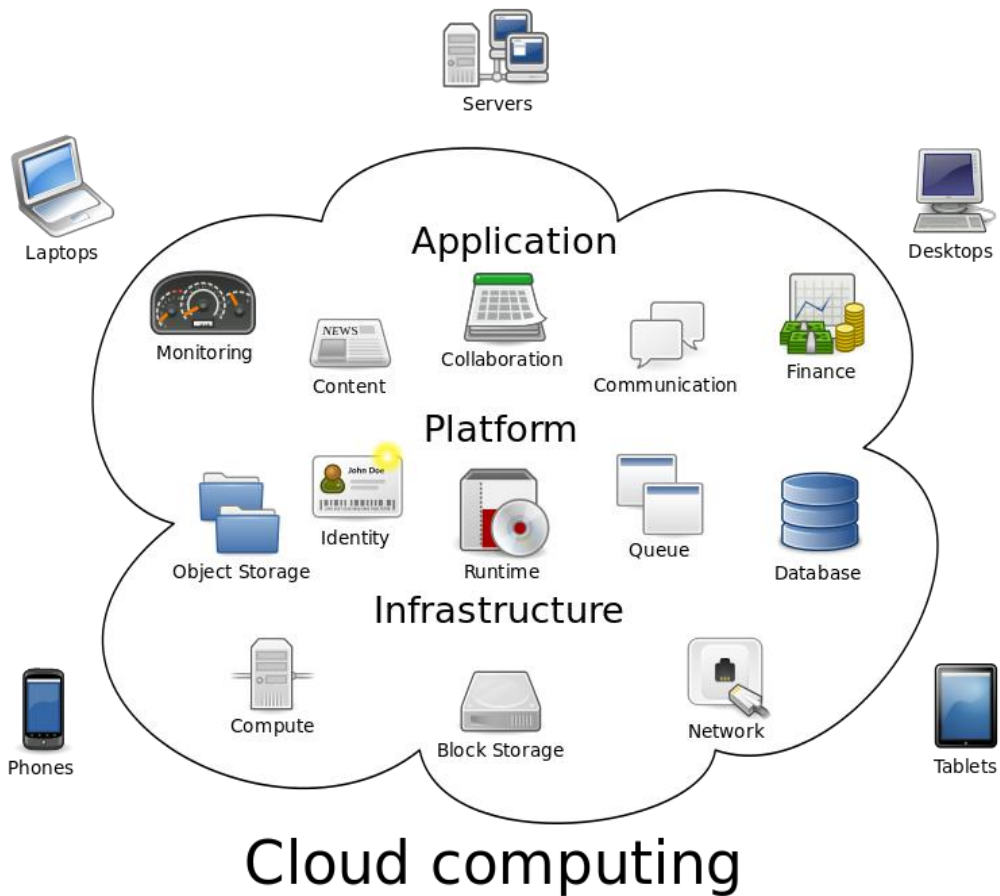


Figure 1.4.1: Cloud Computing

1.4.2 CLOUD DEPLOYMENT MODEL



Figure 1.4.2: Cloud Deployment Models

a. PRIVATE CLOUD

Private clouds are often defined as a cloud infrastructure that's operated solely for one organization. It can either be managed internally or by a 3rd party. Moreover, it can either be hosted either internally or externally. Private Cloud can improve business but every step within the project raises security issues that have got to be addressed to stop serious vulnerabilities.

Private Cloud features a significant physical footprint, requiring allocations of space, hardware, and environmental controls. These assets of personal cloud need to be refreshed periodically.

The periodic refreshment of the assets leads to additional capital expenditures.

b. PUBLIC CLOUD

A cloud is mentioned as a "public cloud" when the services are rendered over a network that's open for public use. It's going to surprise you that the general public cloud could also be free.

However, practically, there could also be little or no difference between public and personal cloud architecture. But when it involves security, both clouds offer different levels of security and privacy. Generally, public cloud service providers like:

- Amazon Web Services (AWS)
- IBM Cloud
- Oracle
- Microsoft
- Google
- Alibaba

All the previously mentioned specialist organizations, claim and work the foundation at their server farm and access is by means of the web.

c. **HYBRID CLOUD**

A half breed cloud is characterized as a blend of an open cloud and an individual domain. for example , an individual cloud or on-premises assets, that stay unmistakable elements yet are bound together. What's more, they're obliged to gracefully the benefits of different sending models. A half and half cloud likewise can mean the ability to append collocation, oversight, and additionally devoted administrations with cloud assets. Half breed cloud administration are regularly characterized as a distributed computing administration that is made out of a mix of individual , open, and network cloud administrations, from various specialist co-ops. A cross breed cloud administration isn't any more drawn out experiencing disconnection and supplier limits. It can't be placed in one class of individual, open, or network cloud administration. A cross breed cloud permits one to increment either the limit or the capability of cloud administrations. It are frequently done by collection, reconciliation, or customization with another cloud administration. This cloud framework fundamentally takes out the limitations that one got to innate to the multi-get to hand-off attributes of individual cloud organizing.

1.4.3 CLOUD DATABASE

In simple terms, a cloud database may be a database that operates on a cloud computing platform.

Access to the cloud database is provided as-a-service. Moreover, database services look out of:

- Scalability of the database
- High Availability of the database
- The services make the underlying software-stack transparent to the user

a) **DATABASE-AS-A-SERVICE**

With this administration model, the machine clients don't have to introduce or keep up the database without anyone else. Be that as it may, the database specialist organization assumes liability for introducing and keeping up the database. Be that as it may, as an application proprietor, you'll be accused reliable of your use of the administration. This is regularly a sort of SaaS - Software as a Service.

1.4.4 TYPES OF CLOUD DATABASES

a) **SQL DATABASES**

These databases run within the cloud, either during a virtual machine or as a service, counting on the seller.

Advantages:

- Easily vertically scalable

Disadvantage:

- Horizontal scalability poses a challenge.

b) **NOSQL DATABASES**

These databases are worked to support overwhelming read/compose stacks and may extent and down without any problem. They're bound to be fit to work inside the cloud. Also, working with NoSQL databases frequently requires a whole rework of the apparatus code.

1.4.5 CLOUD DATABASE EFFICIENCY

1. It is easy to grow your database because in future your needs will grow.
2. Cloud databases offer security and enable database replication across multiple geographical locations.
3. It comes with several backup and recovery options
4. Features flexibility to run your database workloads.

In this research we have created a database using cloud database services as it is flexible, can run with the workloads, can be updated with time and resources, and is efficient.

1.4.6 GPS

Each and each on-demand service needs an integrated location-based service. These services are needed so as to work out service locations, customer locations, track service providers, and help them navigate from their location to service location. GPS stands for Global Positioning System. it's basically a satellite-based radio navigation system. The system is owned by the us government and is operated by the us Space Force. this technique is made to supply geolocation and time information to a GPS receiver. However, obstacles like mountains and buildings block the relatively weak GPS signals.



Figure 1.4.10: GPS

The Global Positioning System doesn't require the users to transmit any data because the system operates independently of any telephonic or internet reception. However, these technologies can enhance the usefulness of the GPS positioning information. Speaking of Accuracy, GPS time is theoretically accurate to about 14 nanoseconds. GPS technology is majorly employed by taxi (OLA and UBER) services. a number of the vehicle drivers use the app for navigation purposes and therefore the upcoming car models are coming with a built-in GPS tracker. during this way, vehicle security is maintained.

1.5 ADVANTAGES OF SMART PARKING SYSTEM

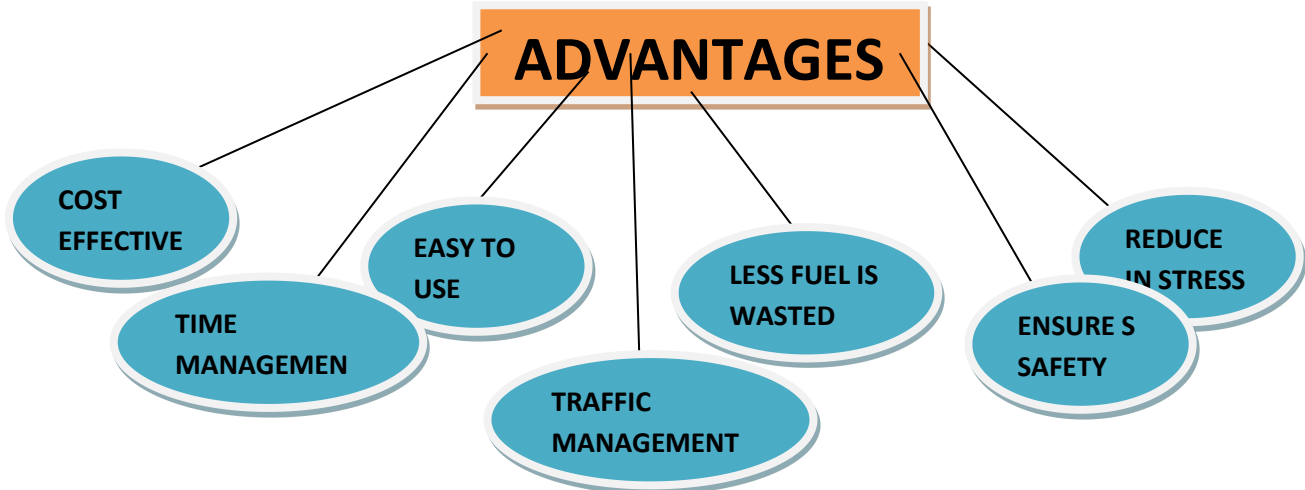


Figure 1.5: Advantages of smart parking system \

i. **Cost-Effective**

The algorithm does not require any extra device apart from their smartphones and the users will not be charged for using this algorithm.

ii. **Time Management**

The vehicle drivers do not need to wait to find the vacant spaces in order to park their vehicles.

iii. **Traffic Management**

Once the users get to know where to park the vehicle, they will not use road and pavement for parking which will not choke the roads, and hence traffic and accidents caused by this will not be the problem anymore.

iv. **Easy to use**

This research is all about using an algorithm that can be easily implemented and will be easily used by the common people.

v. Less fuel is wasted

The drivers are directed straight to an available parking spot. Hence, they waste a few kilometers driving around in a loop and looking for a vacant space.

vi. Ensures Safety of Drivers

When a vehicle driver knows, where he is headed, he feels less distracted and hence pays full attention to the road. In this way, accidents will decrease and safety will increase

vii. Reduce in Stress

A person is already having a lot of stuff going on his mind; imagine him worrying for a parking spot? With the utilization of smart parking, a vehicle driver are going to be conscious of the situation of the available parking lot . they will drive straight to an open, and nearby parking spot, stress-free.

1.6 TYPES OF EXISTING PARKING SYSTEM

Interior parking, linear, no adaptable, single area

Outdoor parking, Linear, no adaptable, single area

Interior parking, mass, no adaptable, single area

Interior parking, mass, no adaptable, multiarea

Outdoor parking, mass, no adaptable, single area

Outdoor parking, mass, no adaptable, multiarea

Figure 1.6: Types of Existing Parking System

1. Interior parking, linear, no adaptable, single area [23]

Advantages

- The flexible and straightforward system implemented.

- The system is private with the spaces reservation via GSM before moving.
- Less costly system.

2. Outdoor parking, Linear, no adaptable, single area [24]

Advantages

- Cloud system supported Google so as to manage mobile applications and services.
- Use of NFC payment system.
- Outdoor route upheld the API.
- The booking framework is sent.
- Management of spaces in a productive manner.

3. Inside stopping, mass, no versatile, single region [25]

Preferences

- A framework upheld ZigBee innovation inside the transmission of distinguished information.
- Internal LCD-based direction gadget .
- The framework might be a mass parking area that utilizes the group engineering inside the self-association of the WSN.
- Flexible and less costly framework.

4. Interior stopping, mass, no versatile, multiarea [26]

Points of interest

- the main impetus can know the unfilled spaces inside the stopping zone .
- The framework envelops a few vehicle leaves dissipated all through the town .
- Drivers can recognize parking spots utilizing an application

5. Outdoor stopping, mass, no versatile, single zone [13]

Points of interest:

- The framework inbuilt this examination is predicated on sending information over IPv6.
- The RFID framework is conveyed.
- An enemy of burglary framework upheld sending GSM messages to the police.
- The usage of half and half sensors in indoor stopping utilizing obstructions to oversee sources of info and yields..

6. Outdoor stopping, mass, no versatile, multiarea [27]

Points of interest

- The framework utilizes the tree geography for the sending of sensors inside the open air vehicle leaves.
- Mobile application for drivers and specialists.
- The specialists have an essential job. The job is to watch the parking spots in every territory.
- Using LEDs all together that one can see the measure of void spaces in every territory.

1.6.1 DISADVANTAGES OF EXISTING PARKING SYSTEM

1. The framework is just substantial for mass stopping [23]
2. The exploration doesn't show the occasion of any application which may encourage the undertaking for drivers when looking at accessible spaces. [23]
3. The outside leaving framework which is substantial only for direct vehicle leaves and not for mass vehicle leaves. [24]
4. The installment isn't checked. [24]
5. Utilization of RFID only for certain parking spots. [24]
6. The framework isn't versatile to straight stopping. [25]
7. The framework does not have a route system or an outer direction gadget . [25]
8. No installment framework is actualized during this framework. [25]

9. The framework utilized is legitimate only for direct open air vehicle leaves. [27]
10. The use of IR sensors is delicate to vehicle lights. [13]

1.7 MOTIVATION BEHIND THE WORK

The car parking problem has affected people to an extent that now they do not even care where they are parking their vehicle. They either park them haphazardly on the road, in front of other people's houses or in the areas which are reserved for children to play. It was also observed in many scenarios where people used the "no parking zone" for parking their vehicles. Hence, the abrupt parking done by car drivers is not only the violation of other people's personal land area it also leads to a situation which causes traffic congestion, and accidents. From the literature survey, it is found that all the existing solution to this issue are not cost-effective and user friendly and hence the motivation is to build an algorithm which does not require much cost and can be easily used by the citizens.

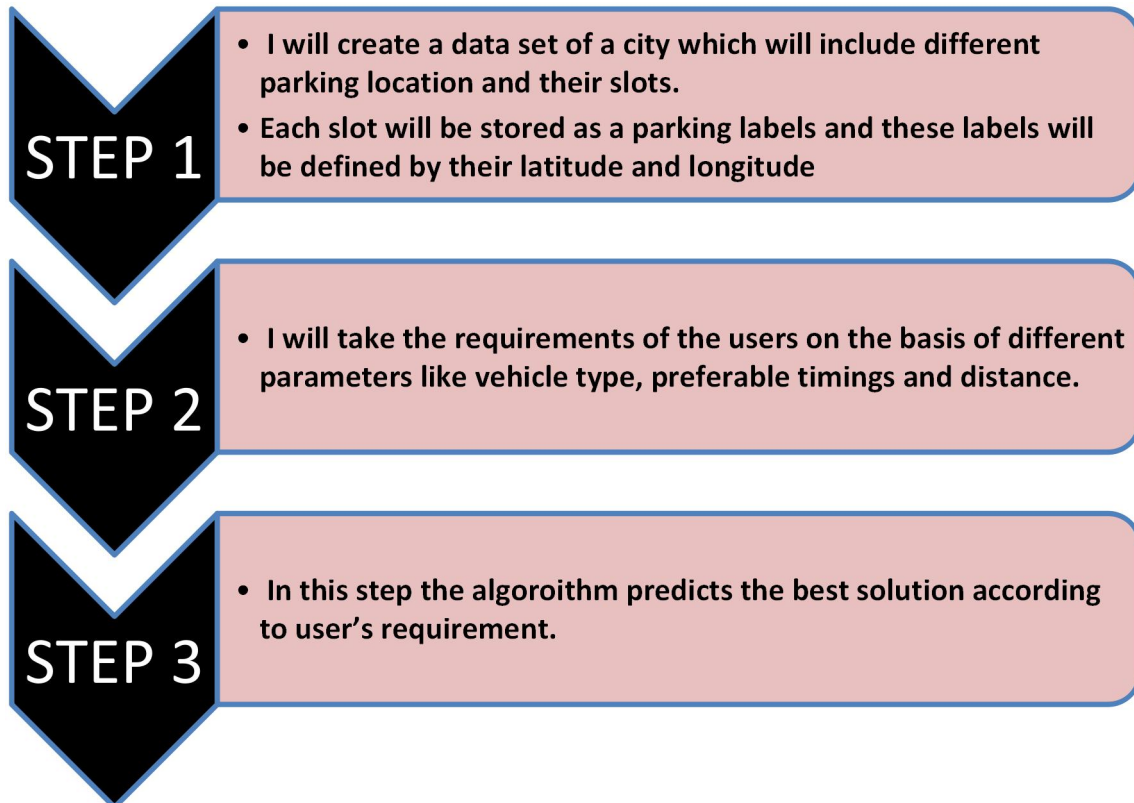
1.8 AIM OF THE WORK

We are not going to see fewer vehicles on the road for sure. And, with the increase in vehicles on the road and current infrastructural challenges, the need for efficient and smart parking system becomes more and more apparent. At this moment, cities need to manage the potential impact of all changes the future might bring. The purpose of the project is to reduce the manpower/work in the garage and also, reduce the struggle of owners of the cars because they always suffer while searching a perfect spot to park their cars. The work aims to build a system that will lead to less congestion on road, the system will be easy to use, cost-effective, and will save a lot of time too. The research work will record the amount of time for which the vehicle is going to be parked and based on that time it will be decided which slot is preferable for that particular vehicle for the smooth exit and entry of other vehicles in the parking area. The relevant data is collected and

analyzed which will ultimately lead to a healthier and smarter city.

1.9 PROPOSED GOALS

The below-mentioned diagram gives a rough idea about the proposed goals:



1.10 BASIC METHODOLOGY

STAGE I: PROBLEM IDENTIFICATION AND DATA SELECTION

The problem is the unawareness of the vacant space available in parking zones which leads to traffic and accidents. The existing solutions have used technologies that use extra devices which are not affordable by common people. I will use, AN APPROACH TO SMART PARKING ALGORITHM USING ANT COLONY OPTIMIZATION AND DECISION TREE

ALGORITHM which will be cost-effective and will be compatible with the Smartphone.

STAGE II: LITERATURE STUDY

Under this section, I have read around 10-15 research papers based on smart parking system researches that have been conducted in the past. This helped me to know more about the advantages of various technologies used in the past and also about the loopholes in each system build in the past. The study of papers helped me to understand that the smart parking system should be a system that is convenient and is super fast.

STAGE III: BUILDING ALGORITHM

The next step was to design a parking algorithm that is super effective and using the algorithm to build a system that can be used by any individual across the world. I researched on GPS mapping and ACA. After the complete research, I have designed an algoirthm that is combination of GPS mapping, ACA and decision tree.

STAGE IV: RESULT ANALYSI

The end was about test and comparison. I have compared my algorithm with various other algorithms that were used in the past. It turned out that the accuracy percentage offered by my algorithms was quit high as compared to the accuracy percentage of other algorithms.

1.11 DISSERTATION OUTLINE

The rest of this document of the thesis report is organized as follows:

Chapter 2

In this chapter, I have discussed about the security challenges and mnore about the encryption and encryption algorithm. A small part of this chapter also depicts the security limitations of our system that is developed using GPS MAPPING AND ANT COLONY ALGORITHM.

Chapter 3

In this chapter, I reviewed various national and international journals and publications to identify the real problem statement for doing the appropriate research to create a smart parking Algorithm.

Chapter 4

In this chapter, our proposed work discusses and explained in detail for detection and verification of the Smart Parking algorithm.

Chapter 5

In this chapter, the metrics that were went to measure the performance of proposed work along side diagrams that illustrate the performance measurements, the implementation details, and therefore the results of the detection mechanism are discussed. so as to offer a more clear view of the implementation details involved a part of the code and results are presented because the algorithm, flow chart, and graphs.

Chapter 6

In this chapter conclusion and some of the future scopes discussed of this work.

CHAPTER 2
SECURITY BACKGROUNDS

2.1 CRYPTOGRAPHY AND NETWORK SECURITY

THREAT

A potential for violation of security that would breach security and cause harm. In other words, a threat is defined as a possible danger which may exploit or destroy vulnerability.

ATTACK

An attack is nothing but a possible threat to the system. The attack springs from an intelligent threat so as to evade the safety services and violate the safety policy of a system.

2.2 TYPES OF SECURITY ATTACKS

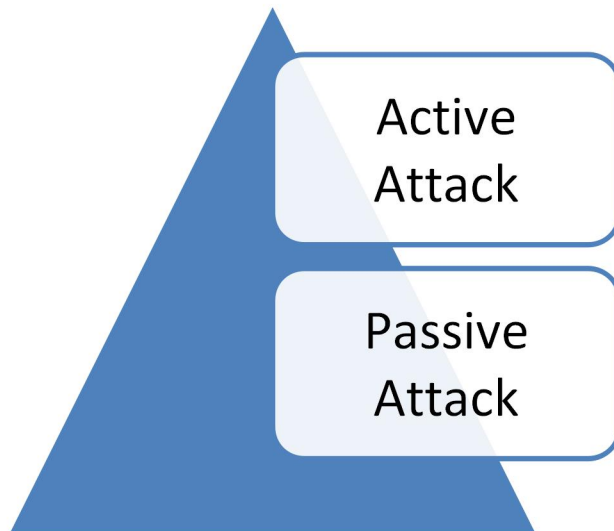


Figure 2.2: Types of Attack

2.2.1 ACTIVE ATTACK

This type of attack attempts to vary the system resources or tries to affect their operations. this type of attack involves some kind of modification of the info stream or the creation of false

statements

2.2.2 TYPES OF ACTIVE ATTACK

a) Masquerade

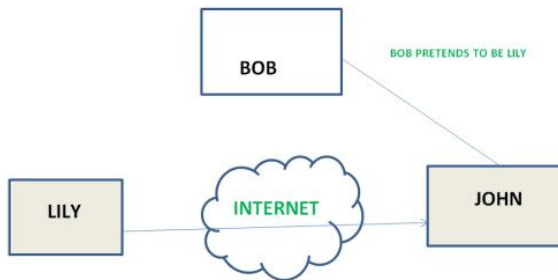


Figure 2.2.2(a): Masquerade

In this sort of attack, one entity pretends to be a special entity

b) Modification of message

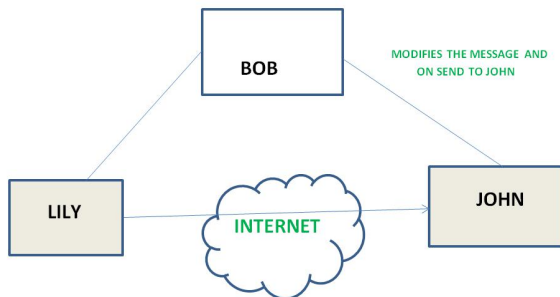


Figure 2.2.2(b): Modification of message

In this sort of attack, some portion of the confidential message is delayed or reordered to supply an unauthorized effect.

c) Replay

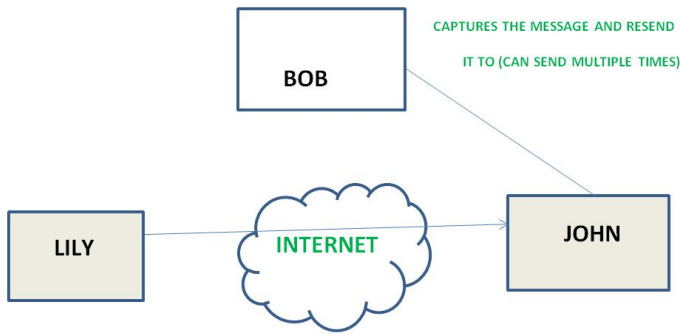


Figure 2.2.2(c): Replay

This kind of attack involves the passive capture of a message and its subsequent the transmission to supply a licensed effect

d) Denial of service

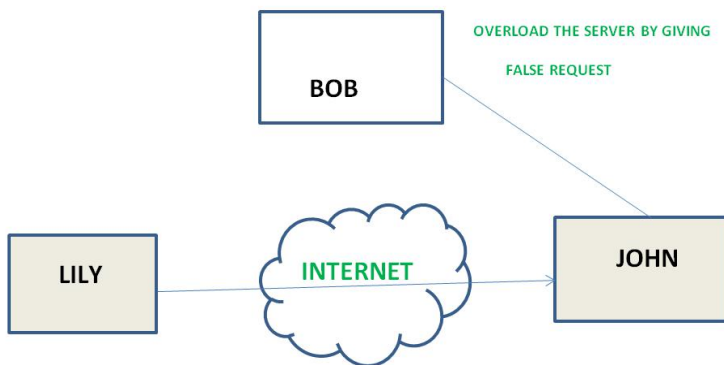


Figure 2.2.2(d): Denial of Service

This attack prevents the traditional use of communication facilities. This attack features a specific target and an entity may suppress all messages directed to a specific destination.

2.2.3 PASSIVE ATTACK

This type of attack attempts to find out or gather information illegally from the system but doesn't affect system resources.

2.2.4 TYPES OF PASSIVE ATTACK

a) The release of message content

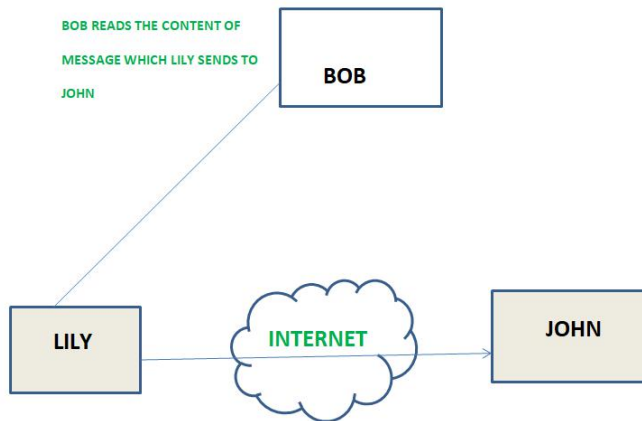


Figure 2.2.4(a): Release of message content

Telephonic discussions or a moved document which will contain delicate or confidential data are regularly constrained by others.

b) Traffic Analysis

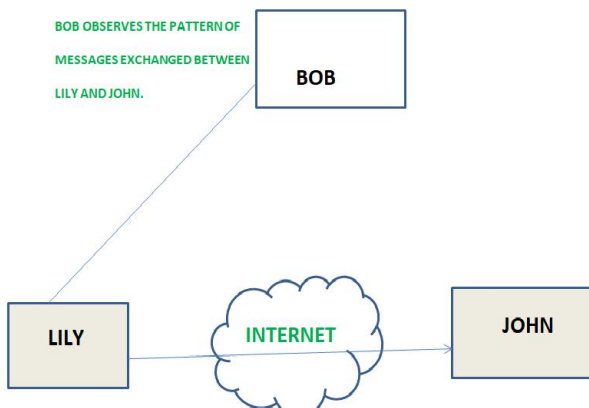
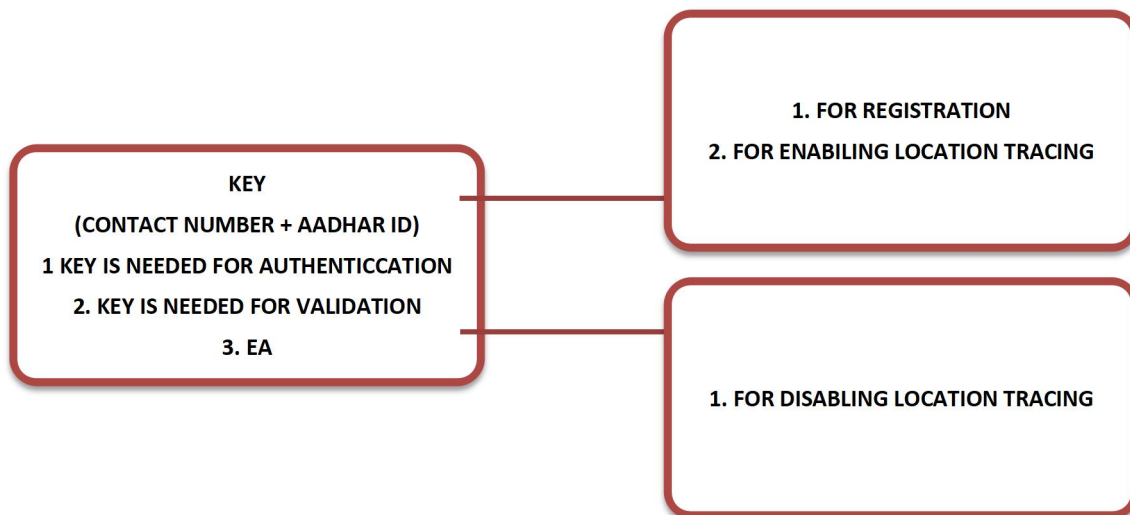


Figure 2.2.4(b): Traffic Analysis

For example, permit us to accept that we've how of veiling (encryption) of information . all together that but the assailant catches the message, he was unable to remove the tip from the message. during this aloof assault, the rival can decide the circumstance and character of the conveying host. The assailant could then watch the recurrence and length of messages being traded. This data at that point are frequently used in speculating the character of the correspondence that was going on privately.

2.3 SECURITY LIMITATIONS IN OUR SYSTEM



1. In our system, we have generated a key for each candidate at the time of their registration.
2. The key is a unique key and is generated with the help of user's mobile number and Aadhar Id number.
3. The key is then stored in encrypted form in our cloud.
4. Whenever the user initiates the login process, the user are going to be asked to enter the key so as to authenticate and validate the user credentials. albeit the car is stolen, the key

are often wont to trace the situation.

5. If anyone wants to deactivate the location tracing, her/she will need the key.

2.4 CLASSICAL ENCRYPTION TECHNIQUES

SYMMETRIC CIPHER MODEL

- **Plaintext**

It is the first message that the user must encrypt.

- **Encryption algorithm:**

The encryption algorithm converts the original text into the ciphertext.

- **Secret key:**

The secret key is used in the process of converting the plain text into the ciphertext. It is used as an input for the Encryption Algorithm. This key is used by the sender to convert the message into a form that is unreadable by the attacker.

- **Ciphertext**

It is an output message. This message is made by the assistance of plain text, secret key and therefore the encryption algorithm. Moreover, if the sender is using two different keys on an equivalent plaintext then it'll produce two different cipher texts. In simple terms, a cipher text may be a random stream of knowledge and, because it stands, is unintelligible, and two different keys will produce two different cipher texts for an equivalent message.

- **Decryption algorithm**

The algorithm used to convert the ciphertext back into the plain text is known as the decryption algorithm. This is the reverse of the main encryption algorithm. It is done by the receiver, and one requires a ciphertext, secret key, and decryption algorithm to get back the plain text.

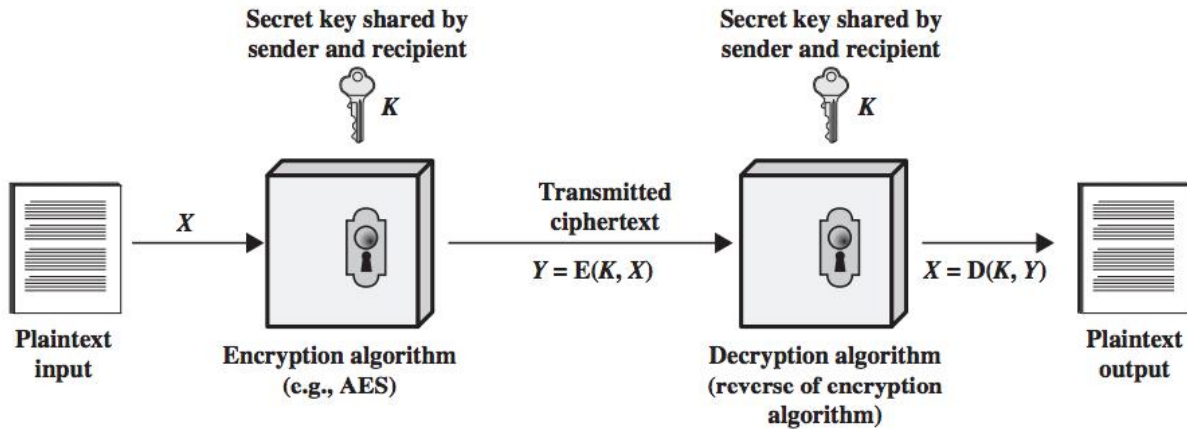


Figure 2.4: Encryption technique

2.5 ENCRYPTION

It is the demonstration of encoding information to deliver it ambiguous to somebody who doesn't have the approval to get to the data . When information is encoded, just approved gatherings who have a "key" can understand it or use it. That is, if the encryption strategy is compelling, it ought to totally shield information from unapproved get to..

2.5.1 HOW DOES ENCRYPTION WORKS?

It is basic, the encryptor substitute's letters, numbers, and images with different characters to make a code. A code is the arrangement of characters that are subbing for the first information. Whoever makes the code has the way to translating it. The "key" is essentially a number that portrays the numerical procedure by which the code was encoded

2.5.2 IMPORTANCE OF ENCRYPTION

- Confidentiality
- Authentication
- Integrity
- Non-repudiation

2.5.3 TYPES OF ENCRYPTION

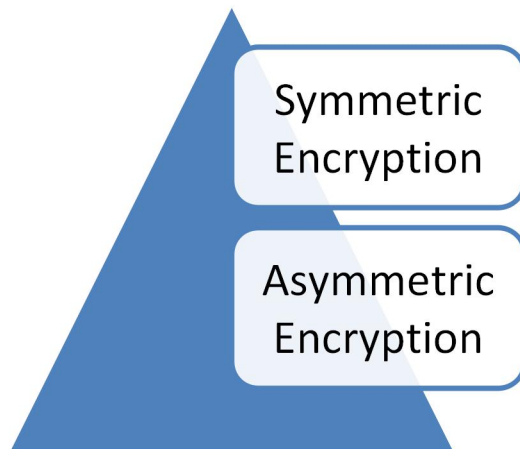


Figure 2.5.3: Types of Encryption

a) SYMMETRIC ENCRYPTION

It is one of the regularly utilized techniques where both the encryption and decoding keys are the equivalent. It requires some investment and cash for a PC to make a moderately solid, little key dependent on the calculation it uses to scramble information.

b) ASYMMETRIC ENCRYPTION

In this, there are two unique keys for encryption and unscrambling. The keys are named as the private keys and open keys. These keys are unique and you can impart the open key to anybody, while the private key is imparted distinctly to the individuals who are intended to get to the information

2.5.4 ENCRYPTION ALGORITHM

a) DES

It is an old and the main most symmetric key technique for information encryption. It works by utilizing a similar key. In this encryption calculation, a solitary key is utilized so as to encode and unscramble the message. Also, DES (Data Encryption Standard) Algorithm is supplanted by an increasingly secure and productive encryption calculation named as AES Algorithm.

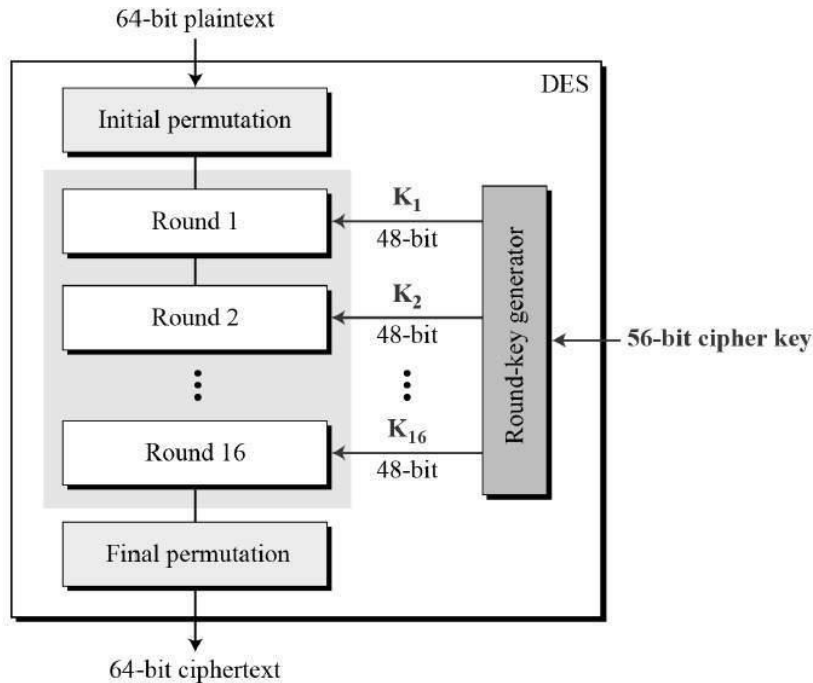


Figure 2.5.4(a): DES

b) Triple DES

This calculation was intended to supplant the first Data Encryption Algorithm. It was when analysts thought about Triple DES as the standard encryption calculation. It utilizes 3 unique keys with 56 piece each.

Complete key length= up to 168 bits, yet specialists state that 112-bits I key quality is progressively similar to it.

Triple DES is as yet utilized as a trustworthy equipment encryption arrangement by budgetary administrations and numerous other corporate ventures

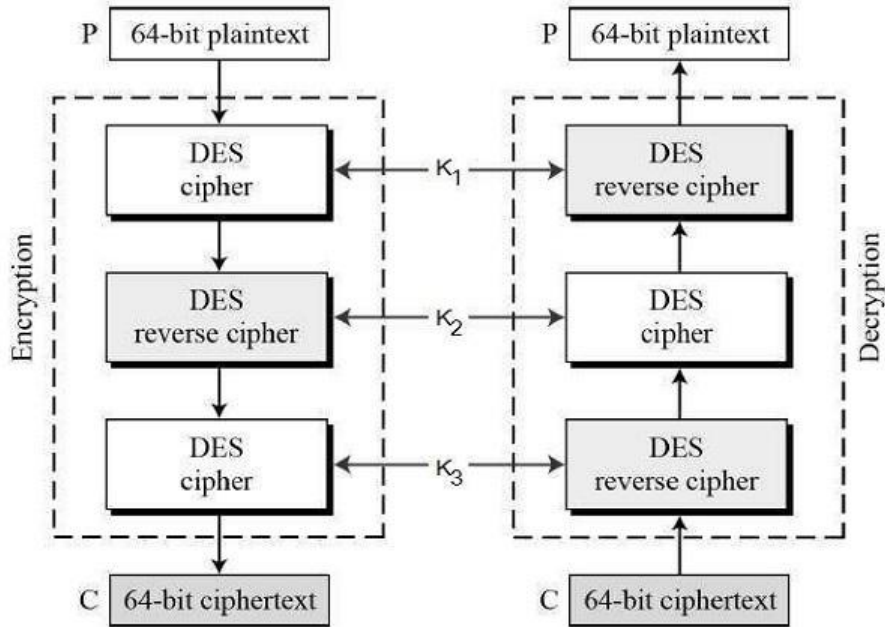


Figure 2.5.4(b): Triple DES

c) AES

AES represents Advanced encryption standard. This calculation is utilized by the US government and numerous different associations. The calculation is generally productive in 128-piece structure, however it additionally utilizes keys of 192 and 256 bits for uncompromising encryption. This calculation is viewed as impervious to a wide range of assaults with the exception of the Brute Force assault.

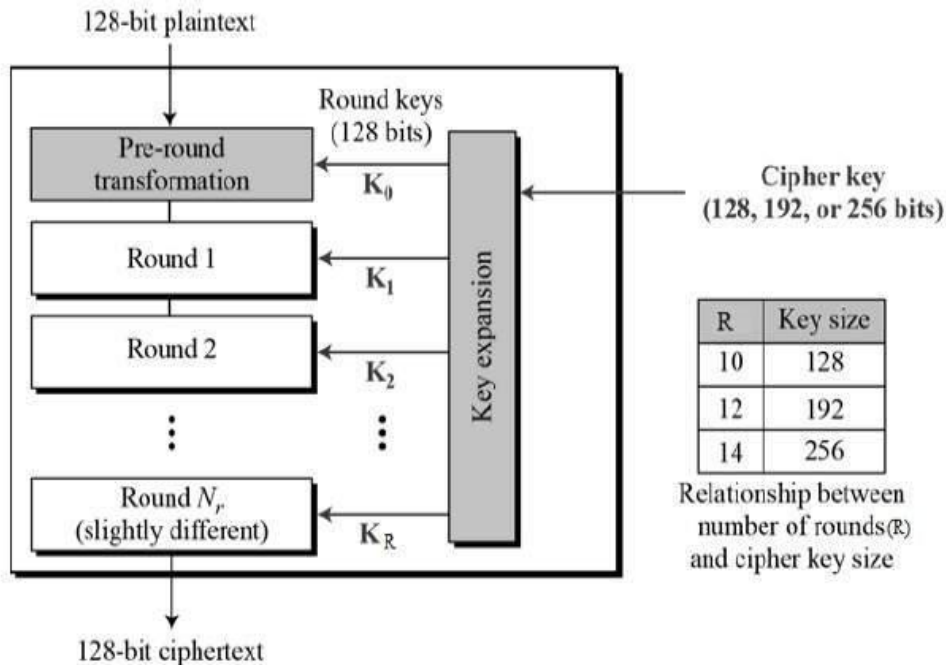


Figure 2.5.4(c): AES

d) RSA

It is an open key encryption calculation. It is likewise the norm for encoding information sent over the Internet. Indeed, even in the PGP and GPG programs, RSA Algorithm is utilized. RSA is referred to as a lopsided encryption calculation as it utilizes a couple of keys. The two keys are named as the open key and the private key. The open key is utilized to encode a message and the private key is utilized to decode a message. It is difficult for the assailants to break this encryption code.

Algorithm

The RSA algorithm holds the following features –

- RSA algorithm is a popular exponentiation in a finite field over integers including prime numbers.
- The integers used by this method are sufficiently large making it difficult to solve.
- There are two sets of keys in this algorithm: private key and public key.

Figure 2.5.4(d): RSA

2.6 WHY IS ENCRYPTION IMPORTANT?

1. Encryption is an essential, yet imperative, segment of information protection and security.
2. Businesses and government associations that have purchaser and worker information must use, at least, AES encryption, just as different instruments and techniques, for example, two-factor verification to guarantee just approved clients can get to this information.
3. An extraordinary numerous applications and sites depend on client passwords and secret word confirmation programming to encourage access to significant information.

2.7 DECRYPTION

It is the transformation of encoded information into its unique structure. The purpose behind actualizing an encryption-unscrambling framework is security. Unscrambling fundamentally requires the opposite of the framework in Hill figure. Thus, while decoding more often than not there is one issue that the reverse of the grid doesn't exist. In addition, If the framework isn't invertible at that point

- The encoded content can't be unscrambled.
- This drawback is completely eliminated and it is then modified into the Hill Cipher Algorithm.

2.8 CLOUD SECURITY

Cloud Security in layman terms is often known as Cloud Computing security. It consists of a set of:

- Policies
- Controls
- Procedures
- Technologies

All these work together to protect cloud-based systems, data, and infrastructure.

The way cloud security is delivered is completely dependent on the individual cloud provider or the cloud security solutions in place.



Figure 2.8: Cloud security

2.8.1 BENEFITS OF CLOUD SECURITY

1. Overall Security
2. les expenses
3. less handling of the Administrations
4. Definitively

2.8.2 CLOUD SECURITY CONTROLS

1. Deterrent controls

These cloud security controls are made so as to diminish the assaults on the cloud framework. We can comprehend this control as a notice sign on a fence or a property. This control framework lessens the danger level by simply advising the potential assailants that there will be antagonistic and genuine results of their activities, in the event of some unforeseen issue on the off chance that they choose to continue.

2. Preventive controls

This sort of cloud security control centers around fortifying the framework against occurrences. They fundamentally lessen the danger by taking out weaknesses. Solid confirmation of cloud clients is required and no unapproved clients can get to cloud frameworks, and more probable that cloud clients are decidedly recognized

3. Detective controls

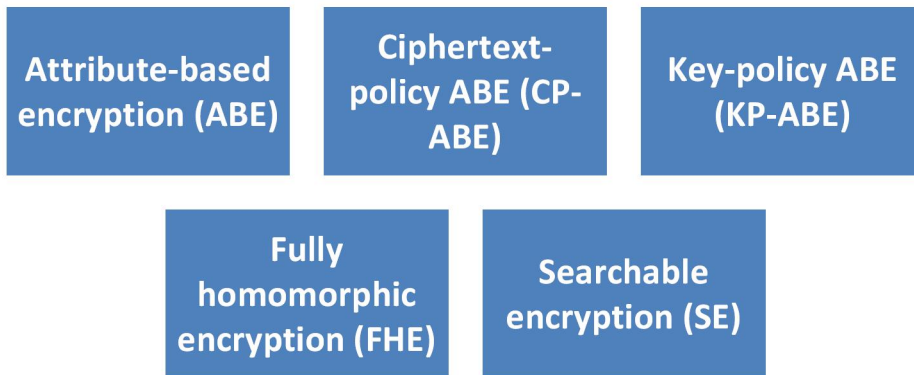
This kind of cloud security control is intended to distinguish and respond properly to any occurrences that happen against the security of the framework. On the off chance that there is any sort of assault adjusted, an investigator control will flag the protection or restorative controls to address the issue. There are different framework and system security observing estimates taken, including interruption discovery and anticipation courses of action, to identify assaults on cloud frameworks and the supporting interchanges foundation

4. Corrective controls

This cloud security control is designed to reduce the consequences of an incident. The consequence is limited by just limiting the damage. These control measures are usually seen in effect during or after an incident. Restoring system backups in order to rebuild a compromised system is an example of a corrective control.

2.9 DATA SECURITY

Here is the list of some advanced encryption algorithms. These algorithms have been applied to cloud computing just to increase privacy and security:



1. ABE

Attribute-based encryption is a type of public-key encryption. In this cloud security encryption, the secret key of a user and the ciphertext are dependent upon attributes.

2. CP-ABE

In this, the encryptor controls the strategy.

3. KP-ABE

In this, the attribute sets are used to describe the encrypted texts and the private keys are associated with specified policies that users will have.

4. FHE

This algorithm allows computations on encrypted data, and also allows computing sum and product for the encrypted data without decryption.

5. SE

It is a cryptographic system that offers secure search functions over encrypted data.

2.10 HOW CLOUD SECURITY WORKS?

- **Micro-segmentation**

It is a sort of security method that partitions the server farm into various security portions down to the individual outstanding task at hand level. This permits IT to characterize adaptable

security strategies and limits the harm assailants can cause.

- **Next-generation firewalls**

More intelligent and more viable than a conventional firewall, a cutting edge firewall utilizes application-mindful sifting to keep through cutting edge dangers.

- **Data encryption**

This procedure encodes information with the goal that a key is expected to unravel it, keeping it from falling into an inappropriate hands.

- **Threat intelligence, monitoring, and prevention**

Every one of these methods are utilized to filter all traffic to recognize and square malware and different dangers.

2.11 DNS ATTACK

This kind of assault is focused to the accessibility or dependability of a system's DNS Service and these sort of assaults by and large influence DNS as its instrument as a feature of its general assault procedure. Hereditary assaults against DNS Service:

-]Network Floods
- Software Vulnerability

CHAPTER 3
LITERATURE REVIEW

3.1 REVIEW OF PAST RESEARCHES

Abstract—the rapid increase in vehicle density often leads to congestion and traffic. Hence, it is important that cities have a well managed parking system. In the past various researches has been done to design a suitable smart parking algorithm. However, each research had their own pros and cons. In this chapter, we have reviewed fifteen past researches in the field of smart parking system. Along with them, various algorithms have been explained with their respective purpose, advantages and disadvantages. The chapter also includes a section of future scope where we have clearly mentioned what are the next level developments that can take place in the field of Smart Parking System.

This paper [1], could be a useful paper to prompt the total information with respect to the reasonable stopping framework. The creator has to sum things up depict stopping as a rich strategy as far as either money, time and vitality for the "free spot pursuing." The Authors state that their build is to blend ongoing reservations (RTR) with share time reservations (STR) so the thought process power will save a spot while heading thereto. The RTR are accomplished by acting powerful asset assignment (like aptitudes based for the most part directing in choice focuses) while the STR are accomplished by acting static asset allotment that is upheld time arranging. The intention power will pick the popular asset and in this way the time period to at that it'll be involved whenever in future. [18]However, there will be distinctive rating arrangements for each the classifications of reservations that are honest for drivers and stopping directors. The rating arrangements are arranged during this paper. Likewise, the creators have moreover outline the dynamic worth motor that may irregularly refresh the stopping costs bolstered continuous asset usage. the framework is plot as iParker by the creators and it choices conventional and impaired parking spaces that the drivers are given the freedom of choosing

various goals and conditions. The creators ended inside the wrap up by the raw numbers that top to bottom reproduction results demonstrate that the arranged framework extensively cuts the whole viable cost for all parkers by the greatest sum as twenty eighth, boosts the whole use by up to twenty first and in this way the complete income for stopping the board up to Sixteen Personality Factor Questionnaire when contrasted with the non-guided stopping framework.

In this paper [2], the creators present an absolutely interesting calculation which will build the intensity of this cloud-based savvy stopping framework and builds up a spec upheld Internet-of-Things innovation. This examination causes the clients to precisely see a free vehicle parking garage at the most diminutive sum cost upheld new execution measurements to compute the client leaving cost by thinking about the space and along these lines the whole scope of free places in each parcel. The arranged framework underneath this examination originates from the idea of IoT. The framework utilizes the WSN comprising of RFID innovation so on watch car leaves. The RFID peruser checks the portion of free stopping territories in each part. the usage of the RFID innovation encourages the execution of an enormous scope framework at low cost. inside the completion the creators ended that their arranged framework has been effectively mimicked and implemented in an extremely genuine situation. The arranged calculations lessens the standard sitting tight time of clients for stopping. the main con of this examination was that the arranged framework can't be upheld in goliath scales inside the significant universes.

Points of interest:

- Better Performance
- Low Cost
- Provides goliath scale stopping framework
- Includes asset distribution system

Impediment:

- Car Park should be enrolled inside the reasonable Parking System to offer support.
- The Service can't be given if there is no cell phone.

In this paper [3], the creators the stopping issue that causes traffic. This exploration paper clarifies route and reservation-based stopping proposition framework for brilliant urban communities The proposed strategy includes the improvement of little gadgets that are utilized to send information to the web utilizing the IoT innovation and the hereditary calculation is utilized to locate the free parking spot nearest to the current area of the client. At long last, the creators have inferred that the exhibition results demonstrate that great outcomes have been accomplished. Nonetheless, the exploration has certain downsides like the proposed technique burns through a great deal of time of individuals at the stopping space.

In this paper[4], the creators have introduced a completely versatile and circulated engineering that can be effectively incorporated with numerous detecting sources. The paper is about sensor based stopping framework where a brilliant camera model for vision based savvy stopping is likewise introduced. The primary accentuation is given to the vision board, which is a custom PCB produced explicitly for the sensor. At long last, the creators have closed their exploration by the way that their proposed approach is very successful in being applied to regular urban conditions as the organization of such foundation happens continuously after some time and with totally different geological separations.

In this paper [5], the creators proposes a reasonable Parking System that gives an ideal answer for stopping issue in metropolitan urban communities. The proposed framework utilizes the distributed computing and Internet of Things (IOT) innovation. Additionally, a fitting most limited way calculation is utilized to search out the base separation between the client and each

parking garage inside the framework and in this way, the holding up time of the client is limited. The paper likewise clarifies the utilization of Android application utilizing cell phone for the collaboration between the Smart Parking System and in this way the client. in order to maintain a strategic distance from human mediation the proposed framework utilizes the RFID innovation. As far in light of the fact that the ideal arrangement cares , the proposed framework is sufficiently fit to search out the free parking area effectively.

The Proposed System is:

- Secure
- Provides Better Performance
- Cost Effective

In this paper [6], the brilliant stopping framework gives direction to the drivers to search out accessible parking spots to abstain from expanding stopping issues. GPS is utilized to follow the driver's course to the stopping goal once the parking area is held. What's more, this prompts gridlock as different clients are being coordinated towards an identical parking garage at a comparable time. [17] a run of the mill A-star way discovering calculation is executed to follow numerous clients simultaneously, while thinking about each other's closest separation to the parking garage in their individual courses. This methodology encourages the client to stay away from over possessing a comparable parking area by taking diverse choice on the separate most limited course. The paper likewise clarifies an assortment procedure which is utilized to spot and flexibly the preeminent productive answers for all clients at a specific time.

In this paper [7], a substitution brilliant stopping framework is actualized for urban areas. The framework appoints and saves a parking area for an utilization (for example Driver) upheld the

client good ways from the parking garage and stopping cost and in this manner the framework likewise guarantees that the overall stopping limit is adequately used. [19] This methodology by the clients unravel a Mixed Integer Linear Program(MILP) issue that each choice point during a period driven arrangement. This examination gives a response to each MILP which given an ideal allotment upheld client's present status of information and furthermore underpins irregular occasions like new client demands and parking area accessibility. When it's set, the allotment is then refreshed at resulting choice point that guarantees that there's no stopping space reservation struggle which no client is ever relegated a stopping opening with over the current cost work esteem. inside the end, the creators have finished up this exploration with an undeniable certainty that the component depicted during this paper[7] guarantees a far superior reaction from the framework close by guaranteed reservations.

In this paper [8], a reasonable stopping framework has been proposed which comprises of ZigBee Network that sends the client mentioned data to PC through a facilitator and further updates the database. It utilize Internet to flexibly the stopping data to the machine layer to shape it helpful for the individuals looking for the stopping zone . The customer at that point demands the worker for stopping data through web-administration interface then at long last the significant time update status is out there to the portable customers to ensure the rightness of the predefined data inside the procedure.

In [9], reasonable stopping framework is anticipated abuse web Of Things (IoT). the most target of this examination is to look out free spaces in any vehicle leave. It allows the framework to enlist a free opening with clients subtleties thus the particular ID is created for that individual space. As by and by in light of the fact that the vehicle enters the leaving opening, the framework requests the ID that was produced though reserving, in the event that the ID is legitimate, at that

point exclusively it allows the entryway of the vehicle into the car parking spot. Toward the start of the paper[9], the creators give a brief presentation concerning IoT expressing that, the net of Things alludes to the association of frameworks and sensors to the more extensive web, still as serve of administrator web innovations. Inside the later a piece of the paper[9], the creators have clarified the anticipated Methodology underneath the fragment anticipated procedure. Here the creators put forth a defense for that their investigation is predicated on IoT which this examination is accomplishment to the people and extra. All over people face drawback to leave their vehicles in urban areas. The framework makes end-client coordinated towards to appear at a near to put during an exceptional spaces. Inside the completion the creators all over by the very reality that their anticipated framework decreases time and is cost prudent.

In this paper [10], the authors emphasize on the facts that a decent sensible parking system might incorporate transit-based info, sensible payment, and automotive vehicle parking as all of them square measure best and serves customers numerous wants. The authors intercity that in most of the sensible parking, vehicle detectors square measure indispensable element. [20] The creators anticipated to utilize optical identifier in Wireless finder Network to trade usually utilized circle locators. Optical WSN square measure utilized for basic establishment and support with indistinguishable or higher exactness. With the help of 2 identifier heads, vehicle is recognized from people on foot still as bikes. [21] The vehicle bearing information likewise can be acquired with 2 locator heads. We tend to imagine to execute this optical WSN at our fundamental stopping zone and investigate its work capacity.

In this paper[11], the creators have anticipated an a savvy stopping proposition abuse lining hypothesis approach which can be model the stopping framework as a line and along these lines the investigation boundary like hang tight an ideal opportunity for client during a line or during a

framework is measurable. the vehicle parking garage closest to this area is discovered abuse various worker different line framework and enhancing this framework for higher client encounters. [22] The framework model is utilized for an improved client skill by abuse lining hypothesis and mix it with IOT. The creators conjointly clarifies the day's end extent of the investigation done by them. They previously mentioned that they are getting the opportunity to execute the anticipated framework for the significant time circumstance inside which the client will see the live remaining of parking area in field, client a will book a parking area , client are getting the chance to be prompted the nearest and most appropriate parking area ,during the pinnacle hours need based assignment are getting the chance to be in edgy waterways accomplishing this in their future anticipated model ,they are getting the opportunity to display the stopping framework as a line to instigate the examination boundary like what is the hang tight an ideal opportunity for the client during a framework ,what is the hold up time during a line.

In this paper[12], Parking accommodation Prediction for Sensor-Enabled car Parks in reasonable Cities, they have done partner estimation approach for the leaving abuse 3 capabilities with certain boundaries to implies the utility of these capabilities has been given and broke down the exhibitions of some AI systems like counterfeit neural system, bolster vector machines, and relapse) in abuse these choices for forecast abuse realistic data concur from 2 urban areas as Melbourne and purpose of section.

In this paper[13], exemplification of IoT based for the most part car leaving the executives framework for reasonable urban areas, here writer conquer the changed gifts like client will see the vehicle parking spot comfort, inside which IoT offer the data stockpiling ,handling and variety of data ,driver will book space, anyway the restriction for indistinguishable is Absence of

illegal leaving discovery administration this methodology can't be investigated to open leaving framework for example exclusively fitting just if there should be an occurrence of indoor and structure stopping.

In this paper[14], A remote reasonable leaving framework here The client will discover partner realistic vehicle parking spot and the impediment for indistinguishable is that the reasonable telephone application is affordable if the client is among a couple of kilometer of the circumstance. The creators portray a few stopping direction gadget that comprises of PC code and equipment to serve the point of basic and safe stopping. they need basically coordinated the equipment locator, light-emitting diode show and remote specialized gadget, identifier mounted on the stopping floor that is utilized to locate the remaining of stopping field for example climate involved or void.

In this paper [15], a reasonable Parking System abuse Wi-Fi and Wireless identifier Network, this investigation work bolstered the vehicle parking spot recognition module, the Wi-Fi indoor situating module and a foundation worker. they embraced the locator to discover the car parking spot, the foundation worker can utilized for correspondence and preparing.

The paper [16] is about a Reservation based for the most part Multi Objective reasonable Parking Approach for reasonable Cities, received a multi objective reasonable stopping abuse the mimicked solidifying based for the most part meta heuristic to improve the stopping area.

3.2 COMPARATIVE STUDY OF VARIOUS EXISTING SMART PARKING ALGORITHM

Sr.No	REFRENCES	ALGORITHM USED	TECHNOLOGY USED	PURPOSE OF GPS	ADVANTAGES	DISADVANTAGES
1.	Thanh Nam Pham et.al , 2015 [2]	Shortest Path Algorithm	IoT, Cloud Computing and Android.	For Identifying and tracking the vehicles.	1. Better Performance 2. less value	1. Car park should be added in the wise parking system.
2.	Callum Rhodes et.al. 2014 [6]	A-star Path Finding Algorithm	Parking Guidance and information system	To Plot the driver's route to parking destination.	1. It improves efficiency of smart parking system. 2. It reduces traffic congestion.	1. It is a complex system protocols to domain of commercial interest.

3.	Yanfeng Geng and Christos G. Cassandras 2013[7]	Dynamic Resource allocation using queuing model	Parking Guidance and information system	Accurate localization and speed estimation of vehicle.	1. Users can receive a quick response from the system and have guaranteed reservations .	1. The parking system is efficient for urban environment only.
4.	Cui Shiyao et.al. 2014[8]	Real Time Client sever	ZigBee Technology and Android	For Navigati on	1. It uses an efficient database.	1. The system choices are more expensive.

Table 3.1: review of various existing smart parking algorithm

3.3 CONCLUSION

With the help of Smart Parking Algorithm, it is easy to build software or use of software with the minimal effort and at a reduced cost that provides services at each level to all the users.. A smart Parking System is used to serve unlimited users in the parallel way to fulfill their requirements in the form of available parking slots. User satisfaction is the main aim of Smart Parking Algorithms. There are many researches done on the same and each research has considered the fact that user satisfaction is the main aim of designing Smart Parking Algorithms. However, all these researches have their own advantages and disadvantages. The Future scope gives us an idea that in future an algorithm can be designed that can remove all the defects of the past algorithms used.

CHAPTER 4
PROPOSED METHODOLOGY

4.1 OBJECTIVE

The purpose of thesis is:

To develop an algorithm for smart parking management, this will make people aware of all the vacant parking areas available in parking zone. Also, the aim of this research is to record the amount of time for which the vehicle is going to be parked and based on that time it will be decided which slot is preferable for that particular vehicle for the smooth exit and entry of other vehicles in the parking area.

The smart parking algorithm is designed to build a system that will be very beneficial at this time when social distancing is so much needed. The traditional method of parking used to involve human touch. Parking tickets and handing over the cash can be avoided if a system is built where every basic things go digital. the algorithm focuses of building a system with least human contact involvement.

Moreover, lack of proper parking management system lead to accidents. If we will have a proper management, not only accidents will be prevented but, laws and order will also be maintained. In short, our algorithm fulfills purpose.

What does the system does?

1. Maintains laws and order
2. Prevents accident
3. Saves time
4. No human touch, takes care of the social distancing.
5. Makes people aware of the parking spots

4.2 METHODOLOGY

- In the first step I have created a data set of a city which will include different parking location and their slots. Each slot will be stored as parking labels and these labels will be defined by their latitude and longitude.
- In this step I have taken the requirements of the users, on the basis of different parameters like vehicle type, preferable timings and distance.
- In this step all the requirements will be processed by Algorithm (Ant Colony and Decision Tree)
- The users have to register themselves using their contact number and Aadhar Id. By doing so they will be provided with a unique Key.
- The key will be stored in our cloud database in encrypted form.
- After that the Algorithm predicts the best solution according to user's requirement.

The main motive behind working on this research was to design an algorithm for smart parking management which will make people aware of all the vacant parking areas available in parking zone. Also, the aim of this research is to record the amount of time for which the vehicle is going to be parked and based on that time it will be decided which slot is preferable for that particular vehicle for the smooth exit and entry of other vehicles in the parking area.

4.3 PROCESS DIAGRAM

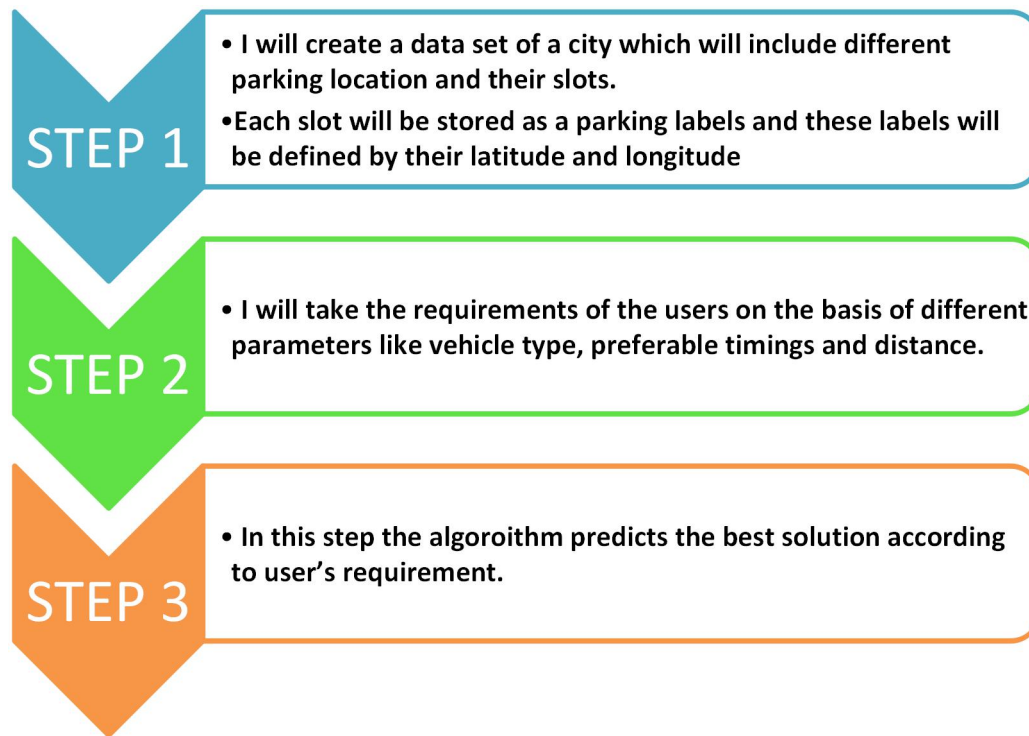


Figure 4.3: Process diagram

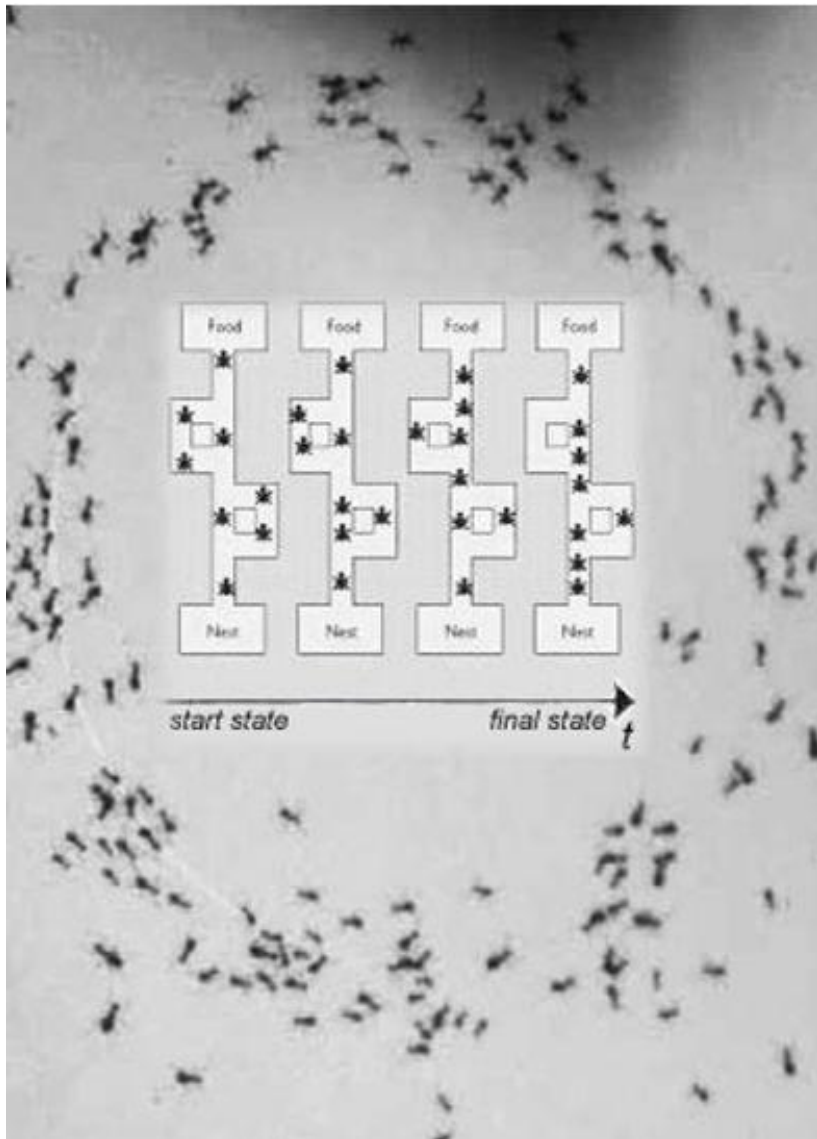
4.4 ALGORITHMS USED

GENETIC ANT COLONY ALGORITHM ALONG WITH GPS MAPPING AND DECISION TREE ALGORITHM

i. GENETIC ANT COLONY ALGORITHM

In registering and examination, the subterranean insect province streamlining calculation (ACO) might be a probabilistic strategy for taking care of computational issues which might be decreased to discovering great ways through diagrams. Counterfeit Ants speak to multi-specialist

strategies enlivened by the conduct of genuine ants. The pheromone-based correspondence of natural ants is generally the prevalent worldview utilized.



The main quality of the colonies of insects, ants or bees lies in the fact that they are part of a self-organized group in which the keyword is simplicity.

Every day, ants solve complex problems due to a sum of simple interactions, which are carried out by individuals.

The ant is, for example, able to use the quickest way from the anthill to its food simply by following the way marked with pheromones.

Figure 4.4(i): Gentic Ant colony Algorithm

ii. GPS MAPPING

The Global Positioning System (GPS), initially NAVSTAR GPS, might be a satellite-based radio route framework claimed by the us government and worked by the us Air Force. it's an overall route satellite framework (GNSS) that gives geolocation and time data to a GPS recipient anyplace on or close to the reality where there's an unhindered view to at least four GPS satellites.

Deterrents like mountains and structures obstruct the generally frail GPS



signals.

Figure 4.4(ii): GPS Mapping

The GPS doesn't require the client to transmit any information, and it works freely of any telephonic or web gathering, however these innovations can improve the helpfulness of the GPS situating data. The GPS gives basic situating abilities to military, common, and business clients around the globe.

iii. Decision Tree Algorithm

This calculation has a place with the group of managed learning calculations and this calculation is utilized for tackling relapse and order issues. the most point of utilizing this calculation is utilized to frame a preparation model. The preparation model would then be able to be utilized to foresee the class or estimation of the objective variable by taking in basic choice standards surmised from earlier data(training information)

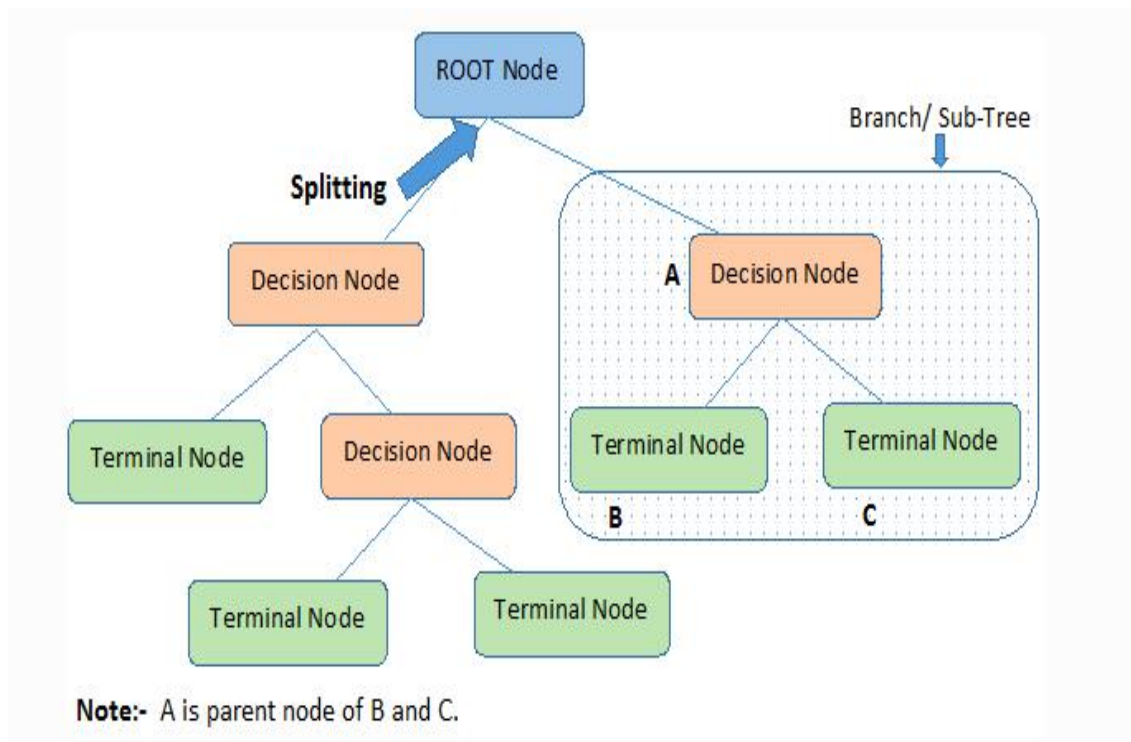


Figure 4.4(iii): Decision Tree

4.5 FLOW CHART

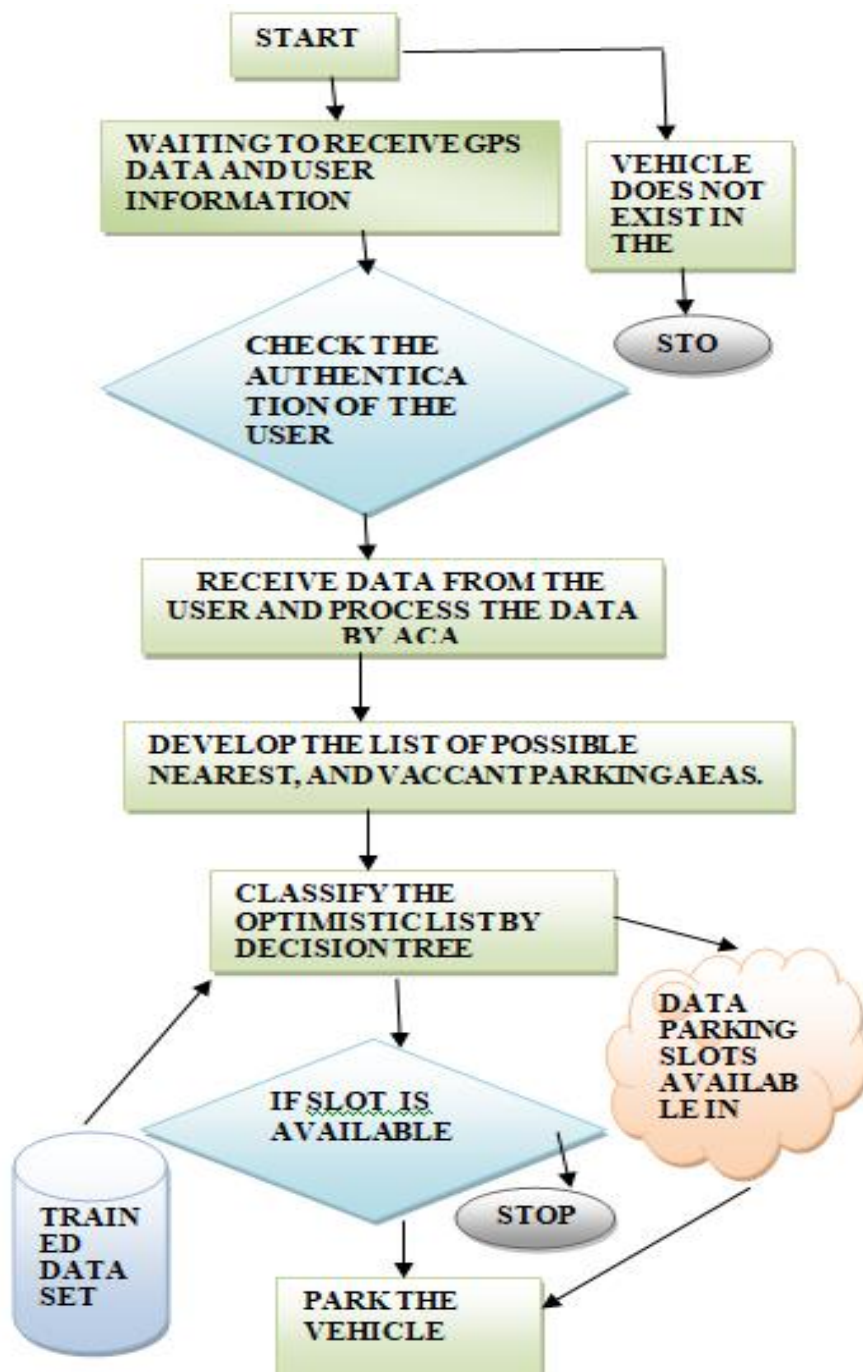


Figure 4.5: Flow chart of the system

4.5.1 EXPLANATION FOR THE FLOWCHART

1. The system will start to function only if it receives GPS data and user information.
2. As soon as the user enters the data, the system will check for authentication.
3. If the authentication fails, then the vehicle does not exist in the system or is not registered. Now, the user needs to register into the system using their contact number and Aadhar number.
4. If the authentication succeeds, the system will receive data from the users. These data will act as pheromones and will be processed by Ant Colony Algorithm.
5. The algorithm will then develop the list of possible nearest parking areas.
6. The list will be then classified using the Decision tree algorithm. The data will be taken from the tainted data set.
7. If the slots are available then the user can happily park the vehicle. Else, the user will need to wait for another slot.
8. The taken slot will then be updated in the cloud which will help the system to classify the optimistic list by Decision tree Algorithm.

CHAPTER 5

ALGORITHM, RESULT ANANLYSIS AND DISCUSSION

5.1 ALGORITHM

5.1.1 INPUT

- a) GPS BASED PARKING MATRIX WHERE THE DATA SET IS STORED IN D
- b) NUMBER OF PARKING DATA WILL BE STORED IN A VARIABLE NAMED N
- c) NUMBER OF RUNNING VEHICLE DATA WILL BE STORED IN M
- d) THE STATISTICAL SIGNIFICANCE THRESHOLD IS P
- e) INITIAL PHEREMONE IS TAKEN AS K. FOR NOW WE WILL BE CONSIDERING INITIAL PHEREMONE FOR VACANT SPACES AND TIME REQUIRED REACHING THAT SPOT.

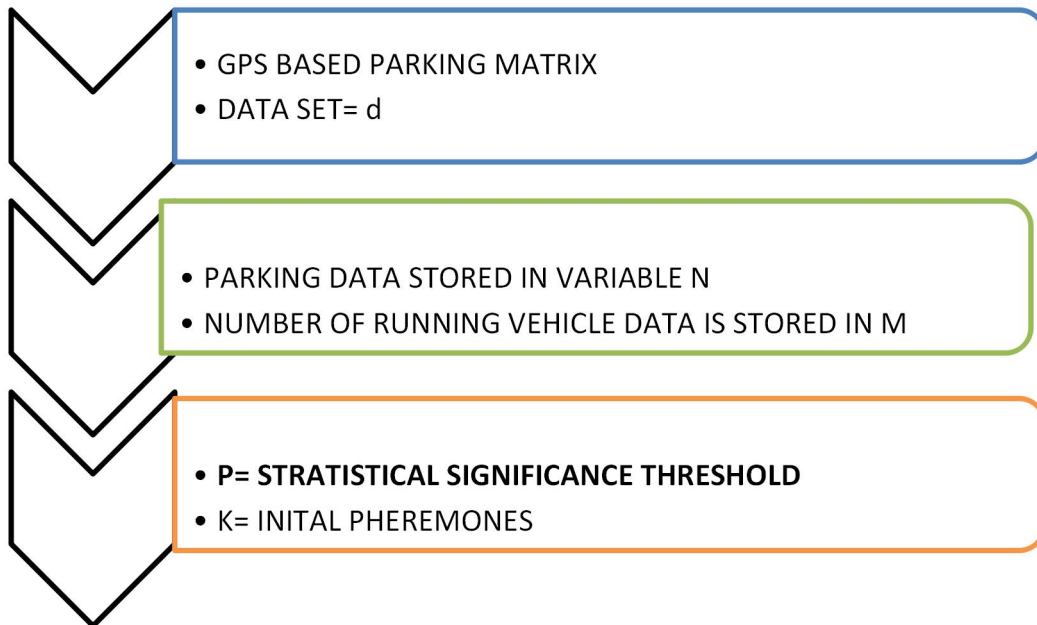


Figure 5.1.1: Input

5.1.2 EXPLANATION FOR THE INPUT

- The smart parking system we are talking about collects the location of all the available parking areas available in a particular city by using GPS. Each parking area is then divided into grids (slots) based on their longitude and latitude via GPS Based parking Matrix. The grid (slot) wise data is collected and it is then stored in a database named D.
- We have taken a variable N which will store the value of number of parking in a particular zone. The variable will keep on changing.
- We have taken another variable named M that stores the number of automobiles that are already parked in the zone or are near the parking area.
- Whenever the condition is satisfied and the lot is made available to the user, the value of threshold changes significantly and is updated.
- Now, the user needs to input his/her requirement. For now the system will work on two requirements. Vacant spots in the parking zone and time required by the user to reach that vacant spot. Both of these will act as pheromones and will be processed by Ant Colony Algorithm. The requirement will be stored and updated in K. The algorithm will then develop the list of possible nearest parking areas. Now, the list will be classified using the Decision tree algorithm. The data will be taken from the tainted data set.
- Now based on the if condition it will be checked whether the slot is available or not.
- If the slots are available then the user can happily park the vehicle. Else, the user will need to wait for another slot.
- The taken slot will then be updated in the cloud which will help the system to classify the optimistic list by Decision tree Algorithm.

5.1.3 ALGORITHM: STEP BY STEP

Step 1: we will run a for loop **from i is equal to 1 to i is less than equal to N**, for number of parking areas

Step 2: now, we will calculate the distance and time based on the clients requirement. The data will be stored in the form of **array H[d][t]**

Step 3: In this step we will run another loop **for j=1 to j= M**, just for the calculations of the number of running vehicles that are either parked inside or are near parking areas.

Step 4: now, one by one we will select a parking set with K set and this **K set will act as pheromones**. The data will be stored in the form of array.

Step 5: we will now calculate the **value of x^2 for each parking** and this data will be updated every time the vehicle enters or leaves the system.

Step 6: After calculating the value of x^2 for each parking system we will now **update the pheromone i.e. K**

Step 7: For operation gets terminated.

Step 8: Now, we will record the k set with the highest value of x^2 as a **PARKING SLOT**.

Step 9: After the value is being recorded we will now check for the following condition:

if ($H[i] - H[i-1] > 0$)

This condition helps us to understand if the spot in a parking area is available or not.

If the above “if condition” is satisfied:

Step 10: Select the Slot

If the above “if condition” is not satisfied

Step 11: else

Step 12: The slot is not available and hence the **access will be denied.**

Step 13: if operation gets terminated

Step 14: For operation gets terminated.

5.2 RESULT ANALYSIS

- a) As soon as the user enters the system, he needs to enable his location if it is not already done.

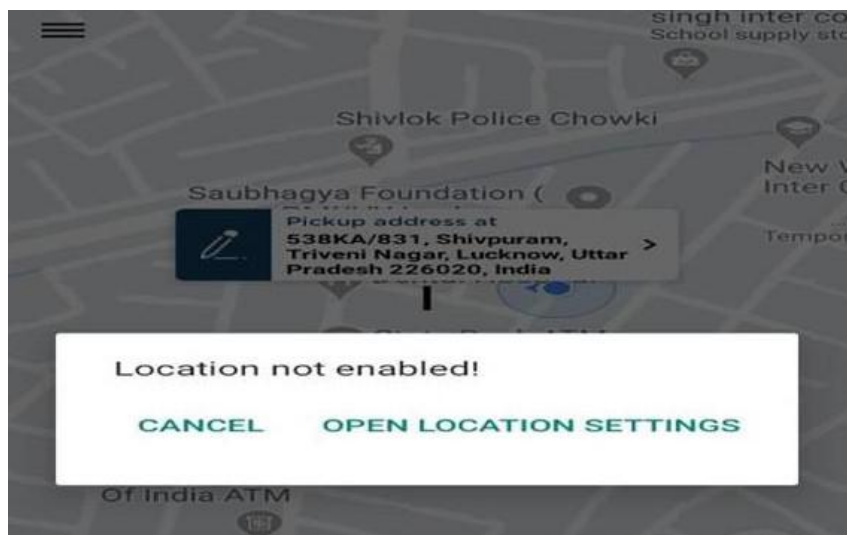


Figure 5.2(a): enable location

After the user logs in into the proposed system, he needs to verify the credentials. Once the user authentication process is done, the user has smartly entered into the smart parking system. The system will ask the user to enable the locations by making changes to the location settings. Once the user has enabled the location access we move to b).

b) User Location along with nearby parking spots spotted

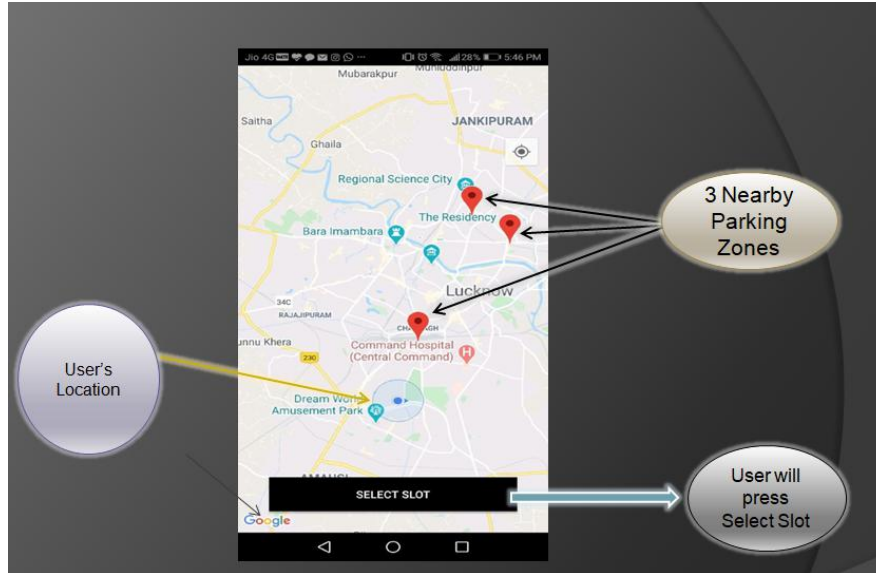


Figure 5.2(b): spot your slot

Now, user can spot his location as well as the location of nearby parking areas. But in order to know vacant spot, the user will have to click on SELECT SLOT option.

c) Slot Allotted

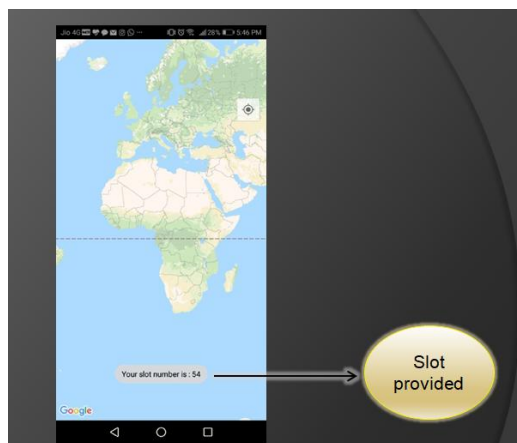


Figure 5.2(c): Slot Allotted

After, the user has selected the slot; the system will let the user know the slot number as well as the parking area where the slot is vacant.

d) Parking Spot spotted

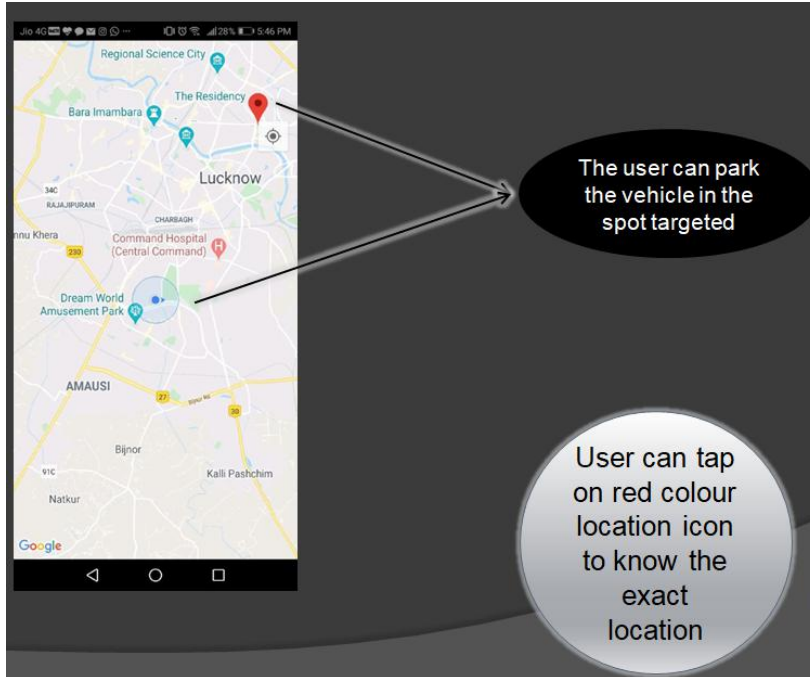


Figure 5.2(d): Slot Allotted

e) Check the distance as the user can be directed to the Google Map

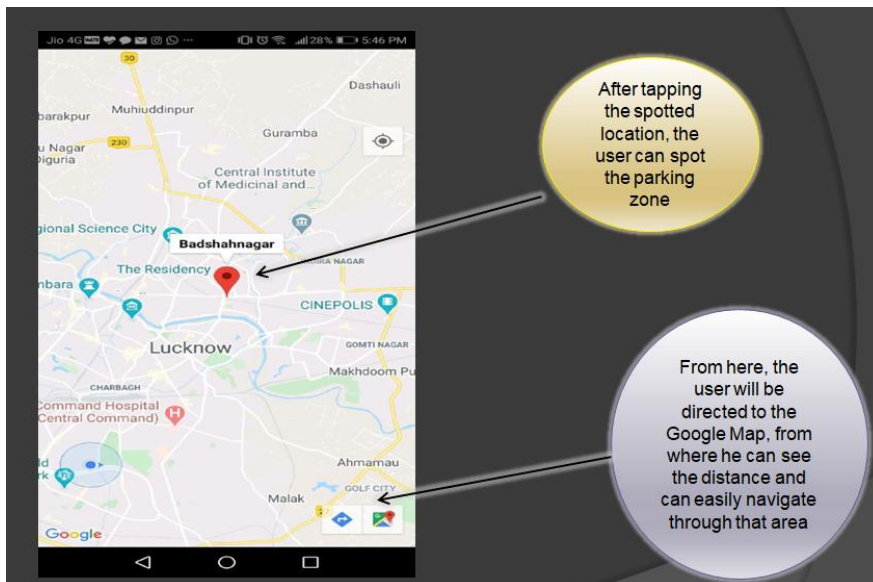
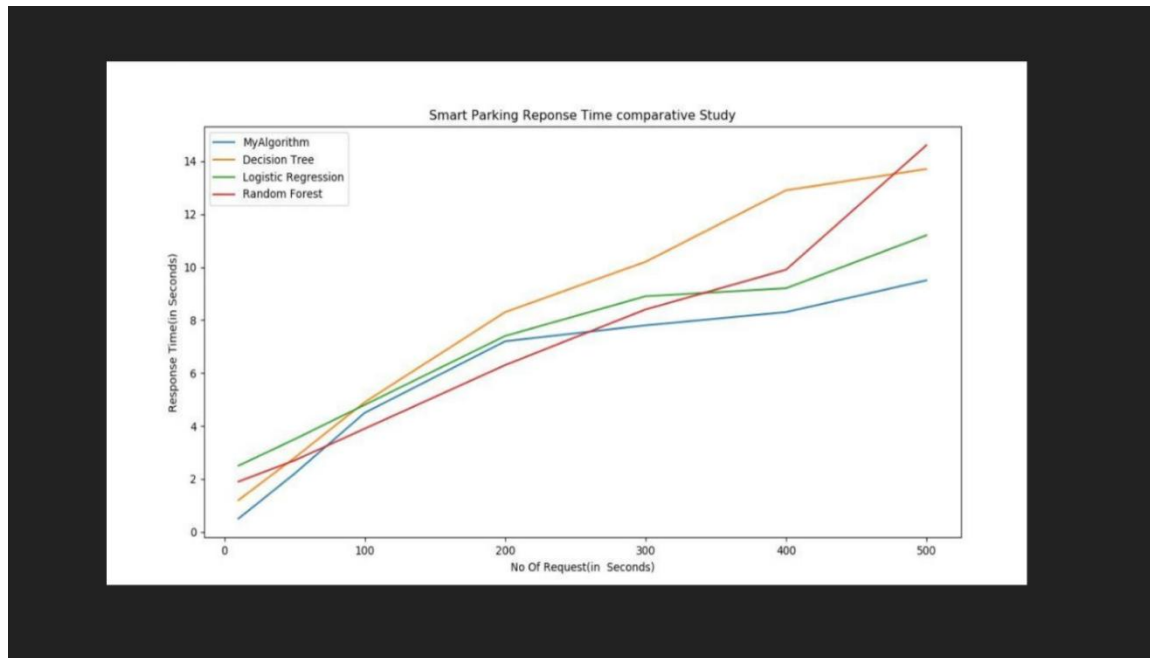


Figure 5.2(e): directed to the Google Ma

5.3 GRAPH



Graph 5.3: Smart Parking Response Time Comparative Study

- **My Algorithm**

The algorithm that we have used in designing the smart parking system can process 800 requests in 9.5 seconds.

- **Decision tree**

This calculation has a place with the group of administered learning calculations and this calculation is utilized for taking care of relapse and order issues. the most point of utilizing this calculation is utilized to make a preparation model. The preparation model would then be able to be wont to foresee the class or estimation of the objective variable by taking in straightforward choice principles surmised from earlier data(training information).

The choice tree alone can accomplish a proportionate work however it'll take 13.7 seconds to process 500 solicitations.

- **Logistic regression**

It is an appropriate regression analysis is conducted when the dependent variable is binary. In this case if we consider logistic regression to predict a parking slot then on an estimate it will take approximately 11.2 seconds to process 500 requests and will only be able to give response in binary.

- **Random Forest**

It is often known as Random Decision Forest and it is a kind of ensemble learning method that is used as a method for classification, regression and other tasks. This supervised learning algorithm is usually trained with bagging method that is basically combination of learning models. However, because of its simplicity and diversity it is one of the most used algorithms.

In our graph, the red line depicts the line of Random Forest algorithm. This algorithm takes more than 14.6 seconds to process 500 requests. Though, the algorithm is simple, yet it takes the maximum time to process the requests.

On the basis of performance MY ALGORITHM is more convenient and faster than other algorithms.

MY ALGORITHM > DECISION TREE > LOGISTIC REGRESSION > RANDOM FOREST

5.4 SMART PARKING RESPONSE TIME COMPARATIVE STUDY

SMART PARKING COMPARATIVE STUDY				
REQUESTS(PS)	MY ALGORITHM	DECISION TREE	LOGISTIC REGRESSION	RANDOM FOREST
10	0.5	1.2	2.5	1.9
50	2.2	2.8	3.5	2.7
100	4.5	4.9	4.8	3.9
200	7.2	8.3	7.4	6.3
300	7.8	10.2	8.5	8.4
400	8.3	12.9	9.2	9.9
500	9.5	13.7	11.2	14.6

Table 5.4: smart parking comparative study table

5.4.1 TABLE EXPLAINTATION

As per the comparative study shown in the table it is clear that algorithm, designed by us to built a smart parking system is more accurate as compared to other algorithms.

My algorithm can process 10 requests in 0.5 seconds, 50 requests in 2.2 seconds, 100 requests in 4.5 seconds, and 500 requests in just 9.5 seconds. Whereas, the decision tree algorithm is turned out to be the second best algorithm that takes 1.2 seconds to process 10 requests, 2.8 seconds to process 50 requests, 4.9 seconds to process 100 requests and 13.7 seconds to process 500

requests.

The third and fourth algorithm that we have used for comparison is logistic regression and Random forest algorithms. The Logistic regression algorithm takes 2.5 seconds to process 10 requests, 3.5 seconds to process 50 requests, 4.8 seconds to process 100 requests and 1.2 seconds to process 500 requests. Whereas, the random forest algorithm can process 500 requests in 14.6 seconds.

This comparison table clearly depicts that algorithm is fast enough to process with n number of requests. The algorithm takes less time to find the vacant spaces in the nearby parking zones. The algorithm is convenient and fast.

ACCURACY PERCENTAGE OF MY ALGORITHM = 86.7%

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION

With the help of Smart Parking Algorithm, it is easy to build software or use of software with the minimal effort and at a reduced cost that provides services at each level to all the users. The smart parking Algorithm is designed to help the mankind by limiting the traffic and congestion. A smart Parking System is used to serve unlimited users in the parallel way to fulfill their requirements in the form of available parking slots. User satisfaction is the main aim of Smart Parking Algorithms. There are many researches done on the same and each research has considered the fact that user satisfaction is the main aim of designing Smart Parking Algorithms. However, all these researches have their own advantages and disadvantages. The Future scope gives us an idea that in future an algorithm can be designed that can remove all the defects of the past algorithms used.

The dissertation summarizes the algorithms used and what that algorithm holds with respect to benefit and advantages. The accuracy percentage and comparison gives a clear idea about the perfection of the algorithm and the system built using that algorithm. The current situation states the alarming rate of need of a proper parking system and also a system that is beneficial to maintain social distancing. The current system is destined to benefit the people, a nation or a city in which it will be implemented as it is the best way to maintain the laws and order.

6.2 FUTURE SCOPE

The prospects of an excellent parking system are predicted to be considerably influenced by the arrival of automobiles. Many cities round the world are already commencing to trial self-parking vehicles, specialized Jewish calendar month parking tons, and robotic parking valets. However, there are countries wherever automatic vehicles are still not launched and other people still struggle to park their vehicles. For those countries associate degree algorithmic program ought to be designed that considers user needs and supply the provision of parking slots for the vehicle drivers.

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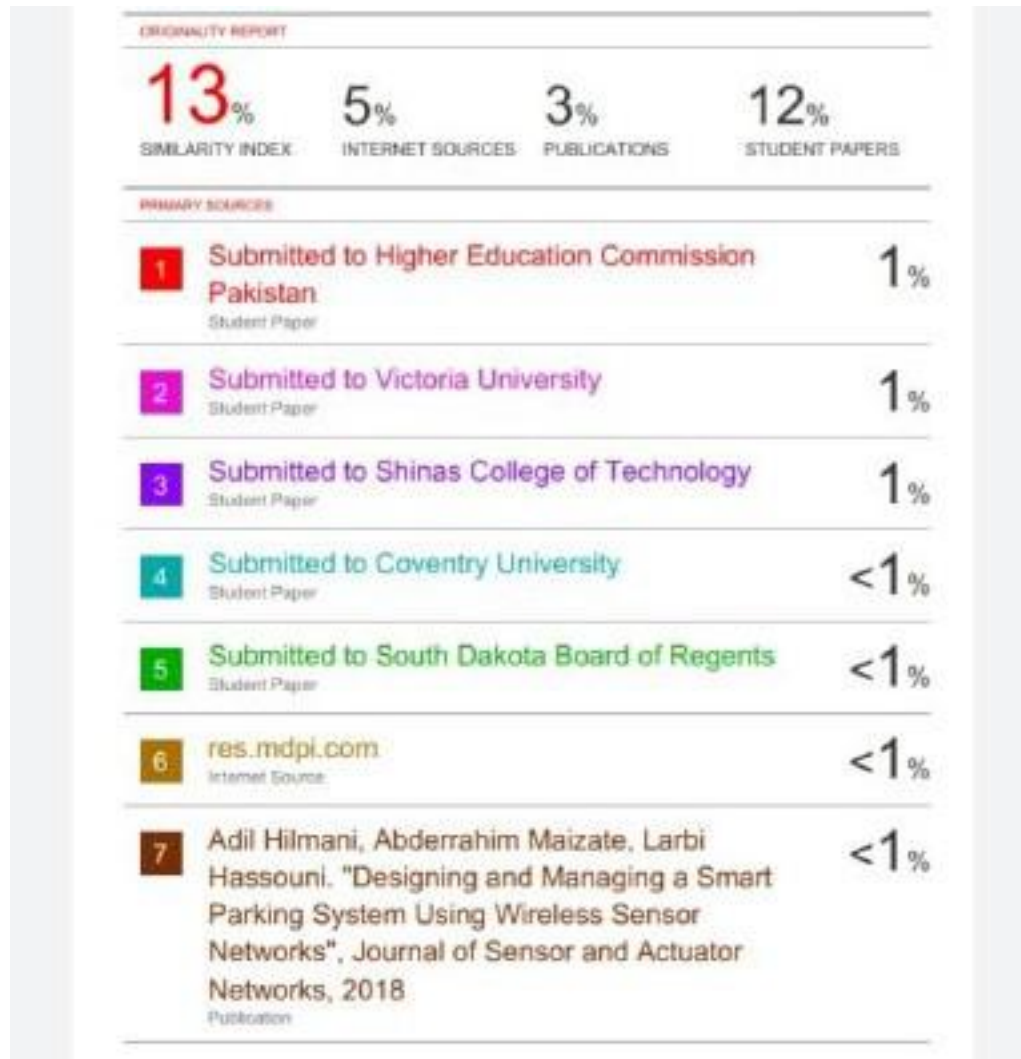
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CHAPTER 1 INTRODUCTION 1.1 WHY SMART PARKING SYSTEM? As per the Indian Ministry, the governing body, of Road Transport and Highways, that maintenance and administrations the rules and laws relating to transport ha reported increase the in the transportability and proficiency of the road transport system in India.

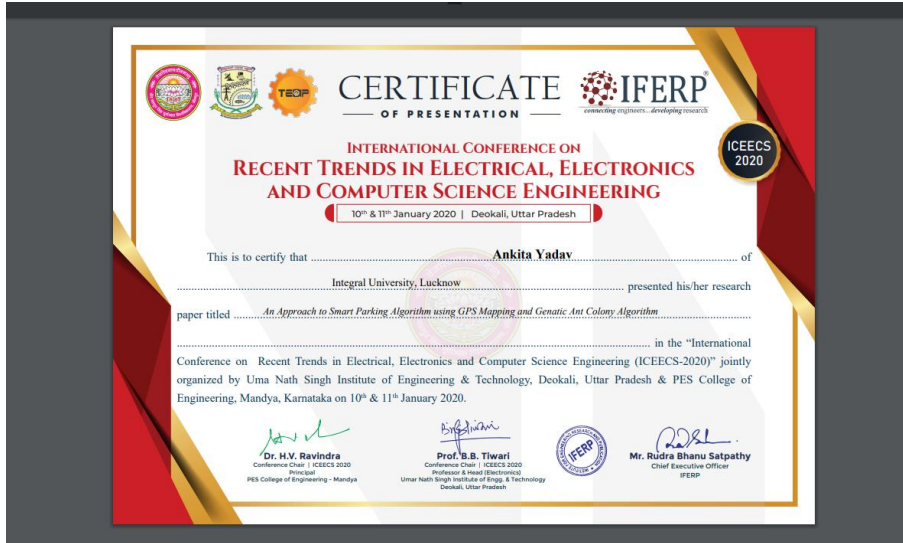
Moreover, in referring to the aforesaid statistics provided by the ministry of India, the present-day transportation framework and vehicle park solutions are expected to be restricted in defending the incursion of automobile on the road. Therefore, even if we consider the statistics, and data, problems like vehicle overcrowding and limited parking spots will always remain the top post problem by default. India is ranked 2nd in terms of having the largest population in the world.

However, where the rise in population is the root cause of many problems like extreme poverty, unemployment, shortage of land, pollution, and so on, it is also responsible for an increase in private vehicles and that leads to PARKING PROBLEM in India. Vehicle drivers are not aware of the vacant space in the parking areas and hence they abruptly park their vehicles on the road that further leads to congestion and traffic. As per the track of the past records the traffic and parking management system does not work in an organized way in India.

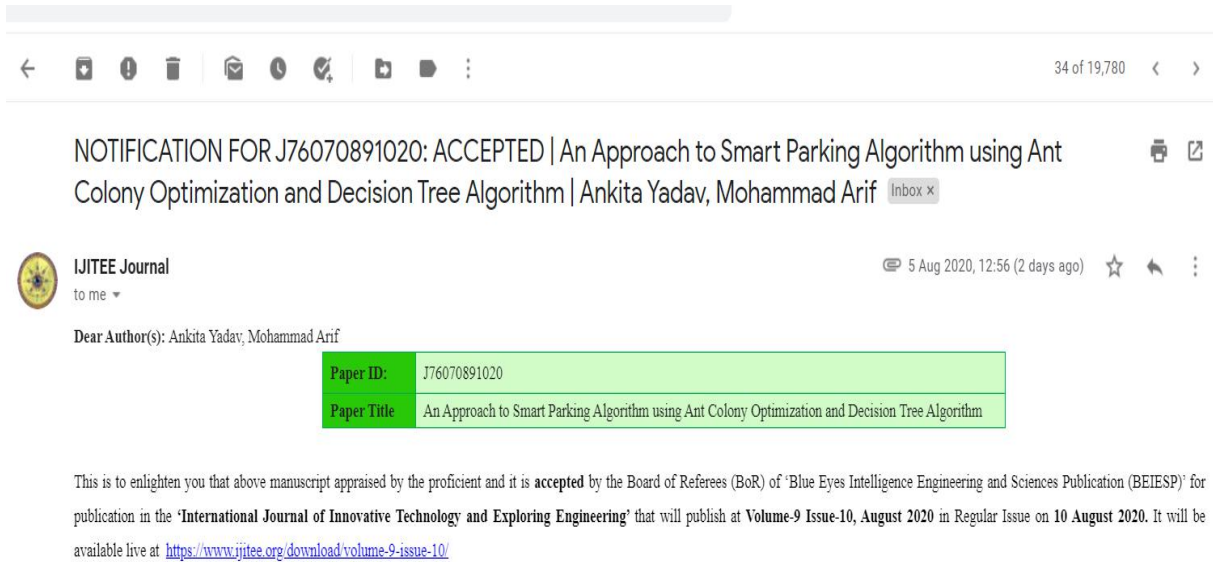
Where people from cities like Delhi, Mumbai, Kolkata, and Lucknow go through

PUBLICATION FROM THIS WORK

- 1) “An Approach to Smart Parking Algorithm Using GPS Mapping and Genetic Ant Colony Algorithm” has been accepted in the **International Conference on Recent Trends in Electrical and Computer Science Engineering (ICEECS - 2020)** held at Uma Nath Singh Institute of Engineering and Technology, Purvanchal University, Jaunpur and to be published in **Scopus Indexed Journal**. *(delayed because of COVID-19)*



2) **“An Approach to Smart Parking Algorithm using Ant Colony Optimization and Decision Tree Algorithm”** has been accepted by the Board of Referees (BoR) of ‘Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)’ for publication in the **‘International Journal of Innovative Technology and Exploring Engineering (IJITEE)’** that will publish at **Volume-9 Issue-10, August 2020, a Scopus Indexed Journal.**



The screenshot shows an email notification interface. At the top, there is a navigation bar with icons for back, home, notifications, trash, mail, clock, checkmark, share, and print. The notification title is "NOTIFICATION FOR J76070891020: ACCEPTED | An Approach to Smart Parking Algorithm using Ant Colony Optimization and Decision Tree Algorithm | Ankita Yadav, Mohammad Arif". Below the title, the sender is identified as "IJITEE Journal" with a profile picture and the text "to me". The date and time are "5 Aug 2020, 12:56 (2 days ago)". The main body of the email starts with "Dear Author(s): Ankita Yadav, Mohammad Arif" followed by a table containing the paper ID and title.

Paper ID:	J76070891020
Paper Title	An Approach to Smart Parking Algorithm using Ant Colony Optimization and Decision Tree Algorithm

This is to enlighten you that above manuscript appraised by the proficient and it is **accepted** by the Board of Referees (BoR) of ‘Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)’ for publication in the **‘International Journal of Innovative Technology and Exploring Engineering’** that will publish at **Volume-9 Issue-10, August 2020** in Regular Issue on **10 August 2020**. It will be available live at <https://www.ijitee.org/download/volume-9-issue-10/>.

