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SMART CAR PARKING SYSTEM USING IOT

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Abstract: ***Parking the car is one of the difficult task that we are facing in our day to day life. The main issue is providing the sufficient parking system. Now a day it is very hard to find the availability of parking slots. The various places (public) that is shopping mall, cinema hall etc. find it difficult to search the available parking area or slot. This calls for the situations of Smart car parking system which is based on IOT and commanded by Android. In this project a small prototype of smart car parking system which is based on IOT is implemented. In this project, proposed system that the user will automatically find the parking space through an android application via server. In addition to this we can say that the it's a new way of communication between humans and things with the help of new technology based on IOT.***

Keywords: *Internet of things (IOT), Global Positioning System (GPS), Android Application, Sensors, K-Nearest Neighbor.*

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I INTRODUCTION

Rapid advancements in the information and communication technology are urging people to move to urban areas, and consequently, the cities have become overpopulated. Due to the migration of a significant population to cities, the number of vehicles used for commuting daily has increased The associate editor coordinating the review of this manuscript and approving it for publication was Christos Verikoukis. enormously [1].

Therefore, the parking spaces in large cities have shrunk due to the growing number of vehicles. In this situation, it has become challenging for the drivers to find the car parking slots in peak hours in populated cities. More vehicles pursuing the same parking space create traffic congestion. Consequently, people spend a lot of time finding the place for parking, which results in wastage of time, added fuel consumption, and environmental pollution. The authors state that, according to an estimate finding the car 159100 parking space in Loss Angles costs around 730 tons of CO2, 95,000 hours, and 47,000 gallons of gasoline.

The population of the world is rapidly urbanizing, and the increasing number of automobiles will add to the traffic congestion problem [2]. Parking problems have enticed more consideration in the last few years due to significant increase in the number of vehicles [3].

The proposed system is derived from the idea of Internet of Things (IOT). We implement the website for the admin and android application for the user. The system uses the Global Positioning system (GPS) technology of smart phone for tracking car parking places. GPS traces the nearest locations of car parking and check for available space for park the car. This system can reduce the time for searching nearest parking slots. In this system we can book the parking space in the Proposed system user can easily check online for parking is available or not if the parking is already book than automatically display red mark or book the parking slot so user can check other available parking location [4].

Introduced the Intelligent parking system using the Android application and described the methodology to develop the system. The author also described all the modules of intelligent parking system such as the system offered to check parking status (available or booked) by the user and booking the specific slot in advance [5]. The authors had described a different type of Admin and customer module features such as addition of parking location, viewing parking location, viewing all booking slots, user feedback and so on [6].

II DESCRIPTION

In modem society, detecting and cell phones are accessible wherever to assemble information about the earth and human exercises, which invigorate novel savvy city applications. Portable applications are getting progressively main stream these days. For instance, cell phones are furnished with an extensive variety of sensors and correspondence modules.

The GPS on the cell phones is utilized to screen the areas of vehicles and foresee the movement stream and travel time in the city. The sensor information gathered by versatile sensors at various circumstances and areas can be totaled to manufacture a movement outline the activity request of the city

for better city and foundation arranging. A versatile application is produced for nationals to get ready for their courses, get timetables of transports and prepares, and even indicate which prepare compartments have more vacant seats.

III SYSTEM ARCHITECTURE

The system provides a mechanism to prevent disputes in the car park and helps minimize wasted time in looking for a parking space. After logging into the system, the user can choose a suitable parking space. Information on the selected parking location will be confirmed to the user via notification. Then, the system updates the status of the parking space to pending during which time the system will not allow other users to reserve it. If after a certain period of pending time the system determines that no car is parked in that space, then it changes the status to available. The system will update the status from the WSN node (the status of car park spaces) when a new car joins in the system. Therefore, the status of the overall parking system is always updated in real time. The system will help plot the parking time for each parking space in real time and can support the business with hourly parking charges.

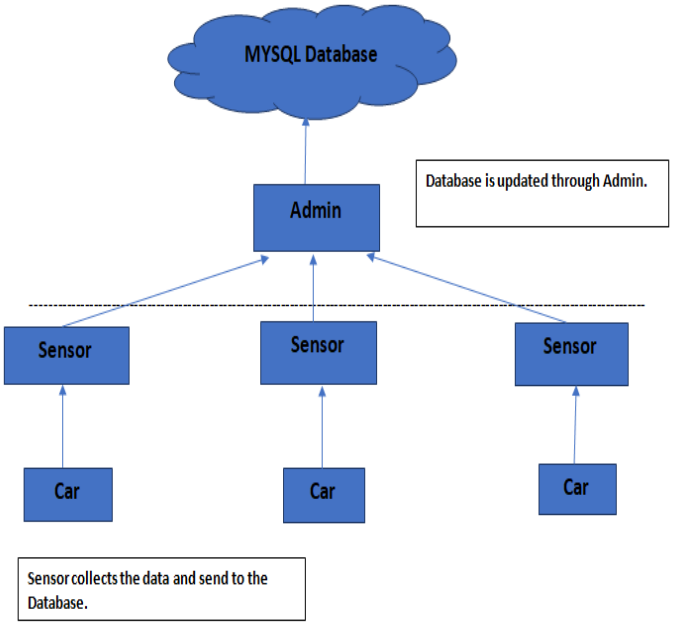

Fig.1. System Architecture of smart car parking system

Advantages –

- Reduces fuel consumption and time delay. Spare time can be used for other work.
- Manpower is reduced by this automation
- Reduces cost for users by notifying the time wise cost.
- Shortest waiting time and also guided for the nearest place.
- Time saving.
- Consistent parking experience.
- Car is parked safe and secure.
- Reduce the carbon emission.

The fig.1 shows the system architecture of smart car parking system. The proposed architecture consists of three mail layers 1st layer is to sensing the data , 2nd layer is to processing the data and 3rd layer is to stored the data into the database. The system consist of various devices, such as sensors, microcontroller chip, Android phone, Arduino ,IR Sensor, ATmega 16 controller and the cloud server.

The user interface layer contains the website at admin module and android phone at user module. The sensors in the proposed architecture are responsible for collect the data of the parking slots. Arduino is responsible for to control/manage to all the devices in the system. Microcontroller chip is used to processing the collected data. All the collected data is stored into the database at the server side. And system makes the changes at the interface side according to the updated data. Therefore, the status of the overall parking system is always updated in real time. The system will help plot the parking time for each parking space in real time and can support the business with hourly parking charges.

Multiple sensors are placed in the parking area to cover all the parking lanes. For collect the data of parking slots from end-devices where the slot is available or not. And that will use to allocate the slots to the users [7].

IV SYSTEM CONNECTIVITY

The fig.2 show the system flow of the smart car parking system. Registered User can login into the system by entering username and password. If the user is not register ,it is must to register first. After successful login user can check for slot availability. Slot is available in parking or not.

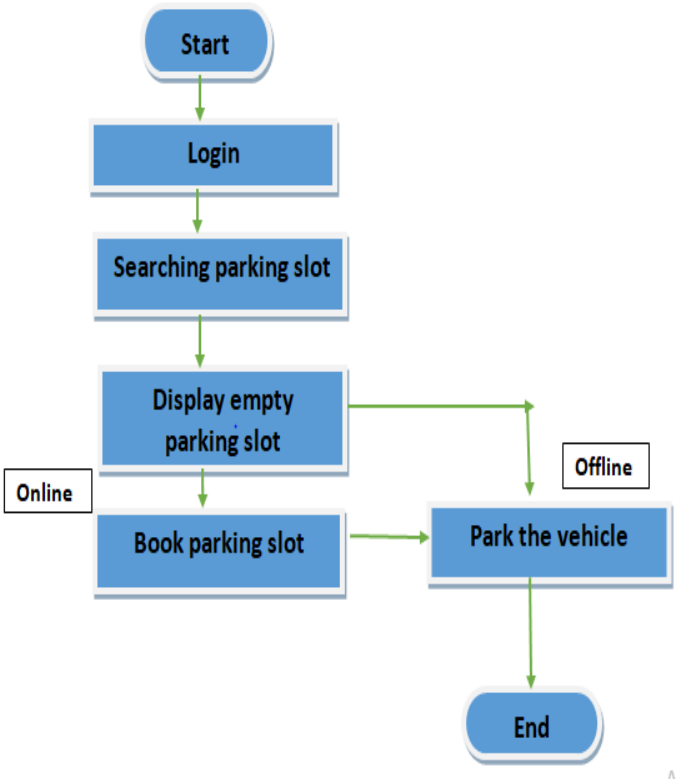

Fig. 2. System Connectivity

In this phase searching parking slot KNN searching algorithm is used. System checks whether the parking slot is available or not. To search the parking slot or parking user needs to

turn on the GPS(Global Positioning System). By turning on GPS and using KNN searching phase we can detect slot is available or not.

After searching for slot availability system displays list of empty slots. This process is KNN filtering process. If user is registered on app and not available in parking area then user can book the parking slot online through the application. After booking the slot user can receive the notification of slot booking is successful and display the parking information like parking name, slot no, time ,etc.

Once booking slot is done and user reached to parking space user can park the vehicle in registered slot. But if slot is not booked by the user then user can directly park the vehicle. Then system shows the status of particular slot is "Full".

V ALGORITHAM

1) FLOWCHART : K-NEAREST NEIGHBOR(KNN)

KNN did not use not separate different model other than that is stores the entire dataset, by doing this their no learning phase is required. KNN try to make prediction by use of training data set directly. KNN make prediction for new instances (x) by doing search in complete dataset for the k most matching instances (considered as neighbours) and by doing summation to the output variable for that k instances. The following fig.3 shows the flowchart of K – Nearest Neighbour Algorithm.

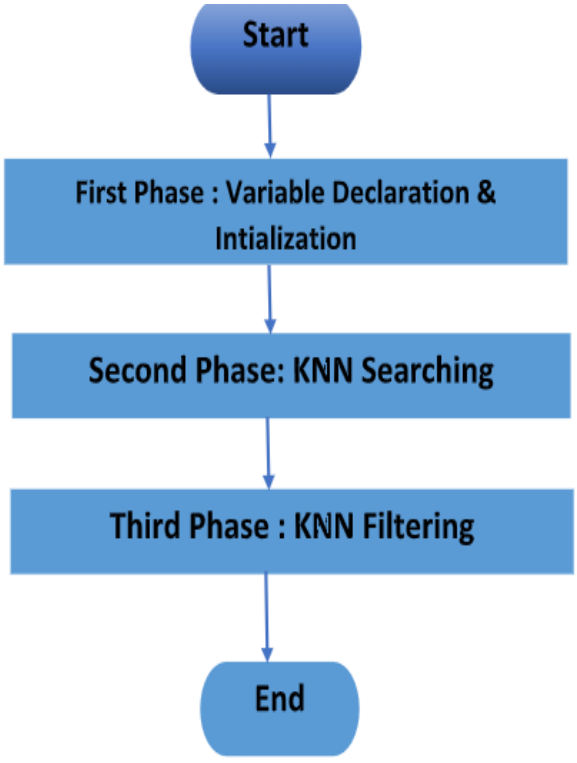

Fig. 3. Flowchart of K- Nearest Neighbour Algorithm

- **Ease to interpret output :** It can be easy and simple to guess output using KNN compared to other algorithms.
- **Calculation time :** The time required for KNN is very less as training phase is omitted data available in dataset can be used directly for testing phase.
- **Predictive power:** KNN is most suitable for the prediction. There is good solution given by using KNN algorithm for prediction.

(a) KNN SEARCHING

1) Start
2) for i:=1 to pixels_in_the_image do
3) for j:=1 to pixels_in_the_window do
4) compute the euclidean distance between i and j
5) end for
6) sort the array containing the distances
7) select the K nearest neighbours
8) update the window border for the next pixel
9) end for

(b) KNN FILTERING

1) Start
2) for i:=1 to pixels_in_the_image do
3) for j:=1 to pixels_in_the_classes do
4) for k:=1 to K do
5) sum the SVM probabilities
6) end for
7) divide each probability for K
8) end for
9) select the highest probability
10) assign the label to the pixel
11) end for

(c) KNN WORK

Step-1: Select the number K of the neighbors.

Step-2: Calculate the Euclidean distance of K number of neighbors.

Step-3: Take the K nearest neighbors as per the calculated Euclidean distance.

Step-4: Among these k neighbors, count the number of the data points in each category.

Step-5: Assign the new data points to that category for which the number of the neighbor is maximum.

Step-6: Our model is ready.

VI IMPLEMENTATION

In the proposed system we implement the user module (website) and admin module(android application) for the system. Following is the interface of the admin module (website) :

Login:

The fig.4 shows the user can login into the system by entering username and password if he/she already registered.

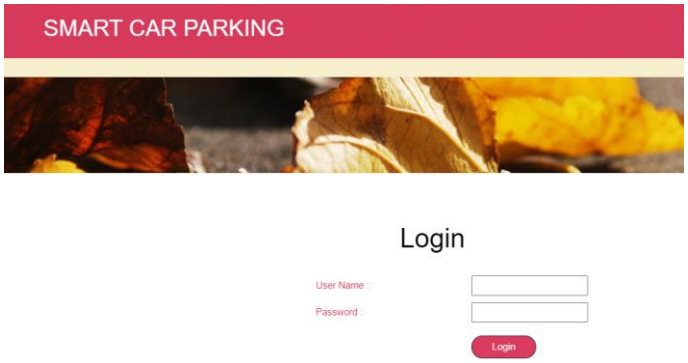

Fig.4. Login page of admin of smart car parking system

After successful login home page of smart car parking is displayed which shows various tabs like view user details, view node details etc.

The fig.5 shows "view node details" there are 4 nodes and its lot and dimension information is displayed.

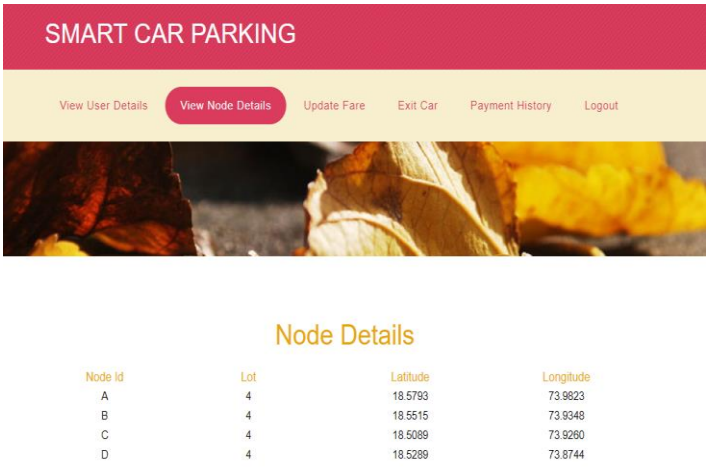

Fig.5. Details of nearest parkings

The fig.6 shows we can update the charges by entering the charges and by clicking on the update button charges are shown to the user.

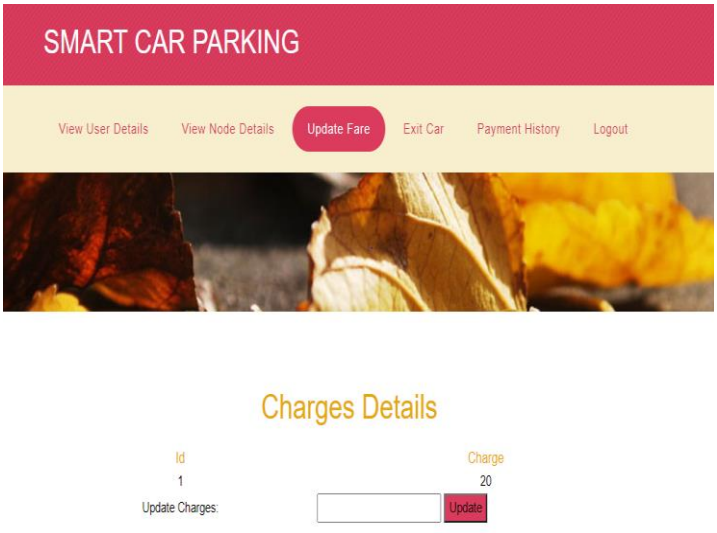

Fig.6. Update charges for car parking

The fig.7 shows we can exit the car by entering the node name in which node car is parked using "Exit car" tab then the information of that particular car is removed from database and it shows the status of node "available".

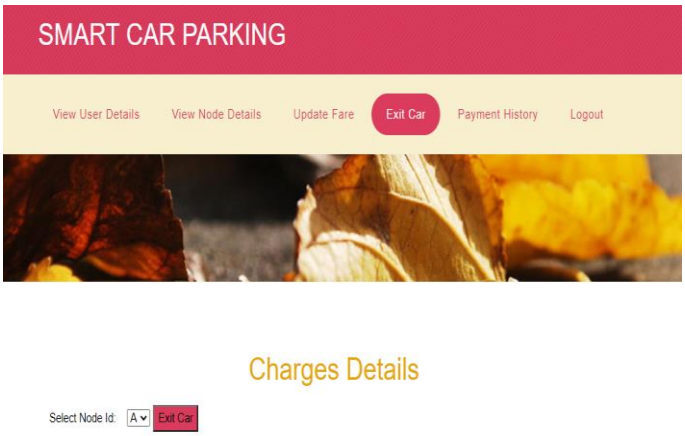

Fig.7. Exit Car function of admin module of smart car parking system

The fig.8. shows we can view the details of the user in "view user details" tab id is given to the user and user id, car no, in time , out time, hours and charges per hour, etc. information is displayed.

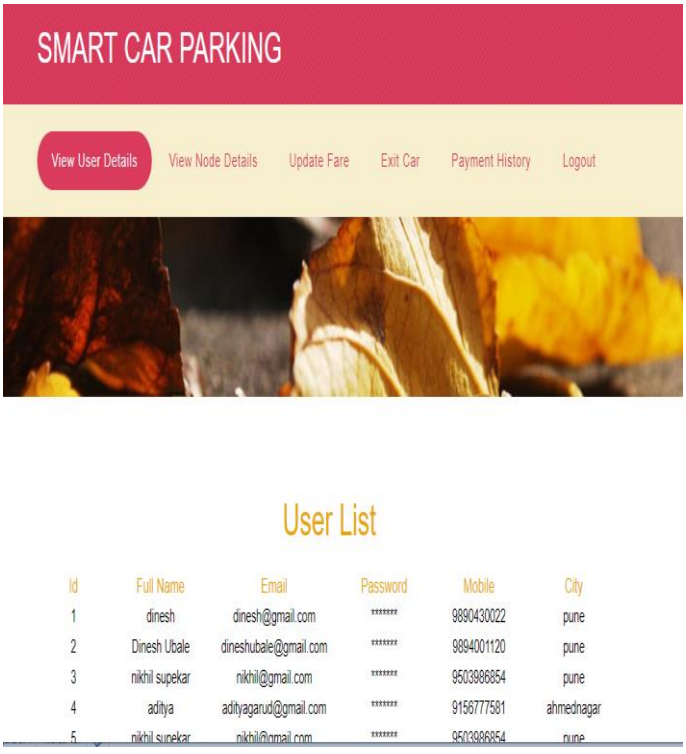

Fig.8. Details of the users of smart car parking system

The fig.9 We can view the details of the user in "Payment History " tab .id is given to the user and user id, car no, in time , out time, hours and charges per hour, etc. information is displayed.

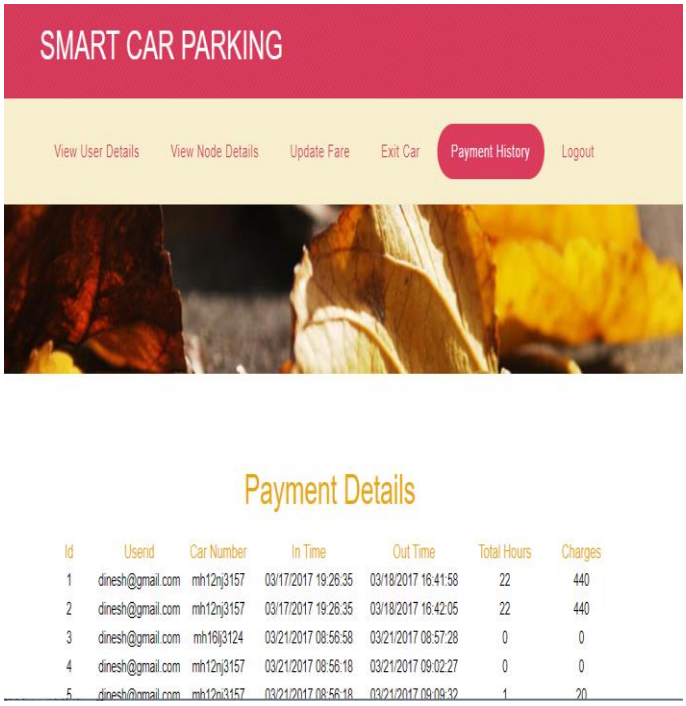

Fig.9.Payment History of the user

Following is the interface of the admin module (android application) :

The fig.10. Shows dashboard of the user of smart car parking system.

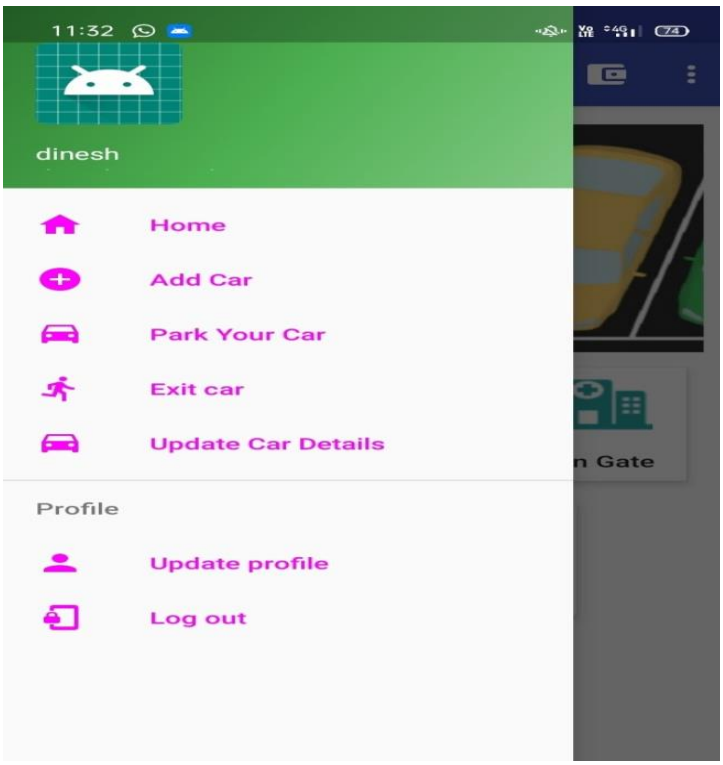

Fig.10. Dashboard of the user of smart car parking system

The fig. 11 shows the history of car parking of the user. It includes the in time, out time, total hours and payment of the parking.

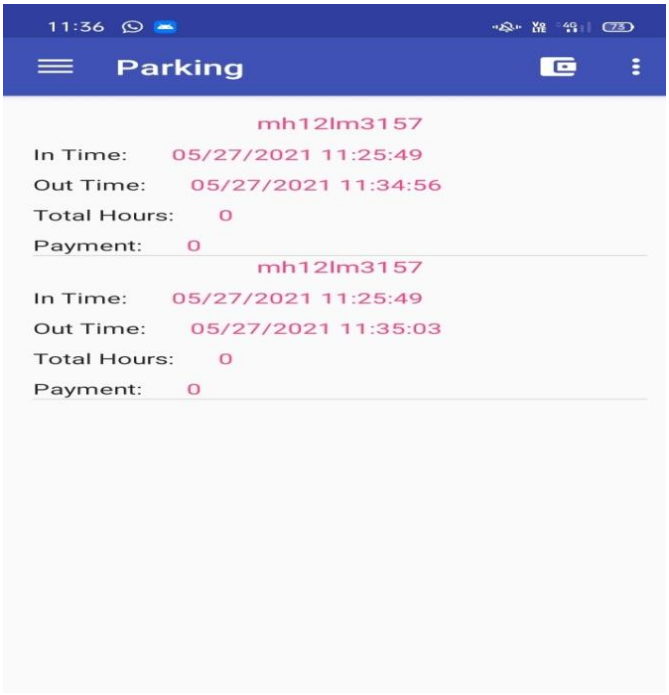

Fig.11. History of parking to the users of smart car parking system

The fig. 12 shows the user able to add/register car into the system.

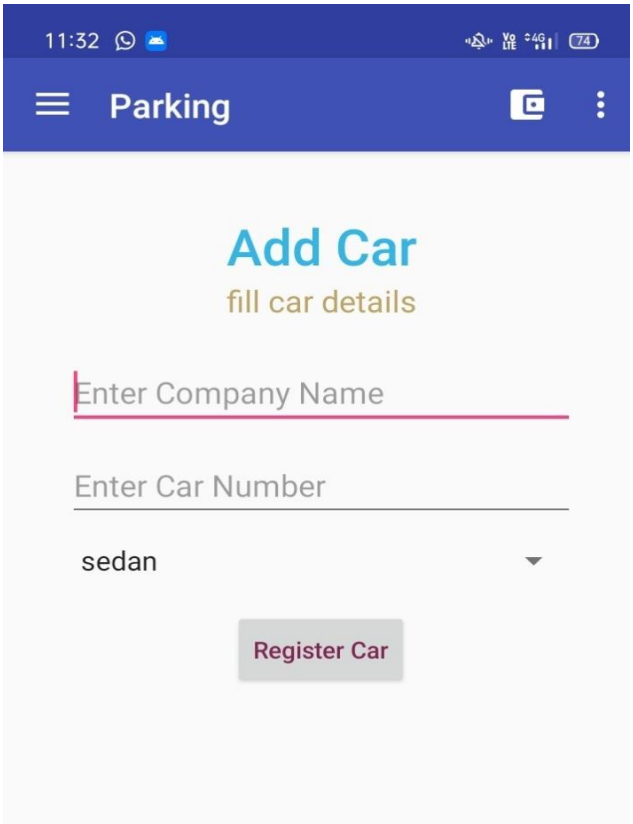

Fig.12. Add Car

The fig.13 shows the total four nodes in the parking and user able to select any one node of them if it is free.

Fig.13. available and booked parking slots

The fig. 14 shows the distance from users location to the nearest paring.

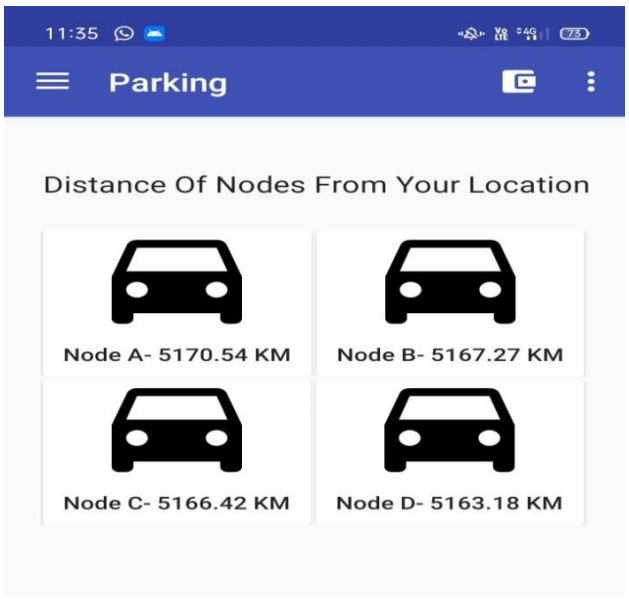

Fig.14. Parkings with distance from the user

The fig.15 shows the user able update their profile.

Fig.15.Update user profile

The fig.16 shows users are able to update their car details.

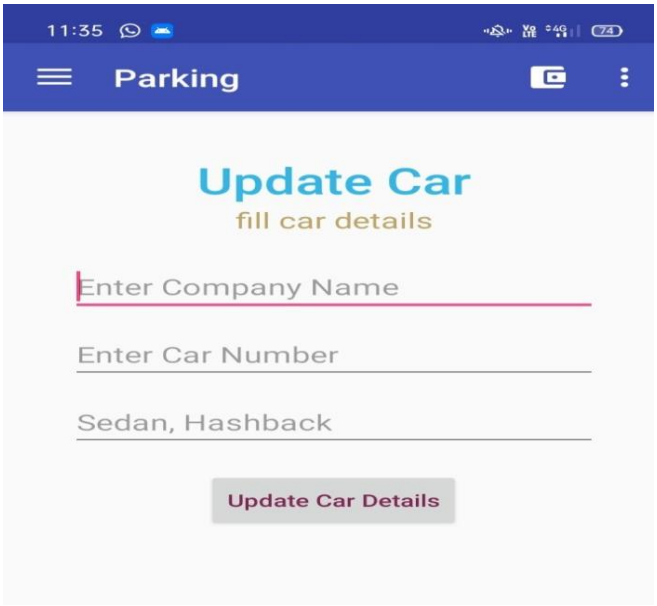

Fig. 16. Update car details

VII EXPERIMENTAL RESULT

This section presents the results of the proposed IOT-based architecture in terms of vacant slot available, sensors, android application, vollet, algorithm, booking of slots and compares them with the existing system and proposed system implementation. Experimental results demonstrate that the IOT-based implementation results in android application, vacant slot detection, list of empty slot, booking of slot, algorithm used as compared to the existing system implementation.

Table 1 represents the hardware cost of existing system and the proposed system.

Index	System	Cost comparison
1	Exist system cost	High cost during camera use.
2	Proposed system cost	80% Low cost by using sensors

Table 1. Simulation of cost for the proposed car parking architecture and exiting car parking architecture.

Table 2 presents the Simulation results for the proposed car parking architecture and exiting car parking architecture along with the results of IOT-based implementation.

Index	Parameter	Existing system	Proposed System
1.	Vacant slot detection	Takes more time.	Save 99% time as compare existing system.
2.	Booking of slot	Slot booking is done manually it will take more time and no confirmation is given.	It required only 2 minutes.
3.	Algorithm used	Fog Computing is used which requires high	KNN(K nearest neighbor) is used to find the nearest slot which is free.

		maintenance and cost.	
5.	Online Application for user	manage 90% controls like no of slot available. User has no rights.	User have 60%/70 % right such as find space, payment, history.
6.	Payment Details	100% done offline so need for payment.	60% overcome the problem in system by using Wallet.
7.	Wallet	Not used (0% used of Wallet)	100% give result to user can add money to the Wallet.
8.	Android Application	Not used(0% used of android application)	100% use app ,registered user can use the app and book the slot via application.

Table 2. Simulation results for the proposed car parking architecture and exiting car parking architecture.

VIII CONCLUSION

The parking system that improves performance by reducing the number of users that fail to find a parking space using KNN algorithm with GPS. This study has proposed a Parking system that improves performance by reducing the number of users that fail to find a parking space and minimizes the costs of moving to the parking space. The simulation of our system achieved the optimal solution when most of the vehicles successfully found a free parking space. The average waiting time of each car park for service becomes minimal, and the total time of each vehicle in each car park is reduced. The allotment of the parking slot by an autonomous searching method makes the parking of vehicles at public places more efficient. The searching and allotment of parking slot, based on the status of available slots, as communicated to the microcontroller, makes the path-tracing for the vehicle, to the appropriate free slot easier.

The proposed system makes use of Android application to facilitate the parking and retrieval of the vehicle, for the user. We hereby aim to reduce the human efforts required for parking of vehicle at public places like shopping malls, public parking, 5- star hotels etc. Thus, the proposed design would provide an efficient car parking system by using an efficient searching method.

A favorable IOT solution must make parking facility easy to upload field data to the cloud with no need to abandon established assets, all with minimum additional investment, reduced maintenance burden and cost. In the future plan we can implement the IOT using the windows application. The COAP (Constrained of application protocol) implementation is in the future use using the internet of things.

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