Car Parking System using ALPR and CPS

M.Madhuram , Logitha Anandan , Harika.K , Avula hanumayamma

Abstract- IoT has become the greatest demand these days due to automation. Every system that helps us on a daily basis has improvised to an internet of things where data are transferred with no human to human or human to computer interaction. There are numerous projects over IoT parking lots, but the efficiency of the system for the underlying demand of the fast world with huge data is yet to be satisfied. In the existing system, using proximity sensor, the parking lots are checked if full and the end-user is notified through app or token for the vacant space and when the lots are full the gate remains closed until space is free to park.

In the proposed system the capacitive proximity sensors are used to calculate the dimensions of a car to categories them into macro, sedan, and SUV models and provides the exact level to park. The automatic license plate recognition (ALPR) is used to note the minimum time of parking used by the particular car on two or many occurrences by calculating their mean, thus making efficient usage of space and time for a thriving smart city.

Keyword- Alpr,Cps,Iot,macro,SmartParking.

I. INTRODUCTION

With the number of cars on road growing exponentially, traditional parking management systems are becoming obsolete. Improper management of parking space has become a widespread issue in most cities. The common problem faced by suburbanite at a car parking lot is short of space and longer waiting time . Especially when large parking areas are considered the problem is intensified. Many existing systems do not take into account the efficiency in this case and rather work on other areas like online tokens and applications. In this system, we mainly deal with efficient usage of space and calculated waiting time hence making a progress in parking system as per the demand of smart cities.

Here, when the car enters the slot capacitive proximity sensors detect the length and breadth of the vehicle, and further classify them into a macro, sedan, and SUV type cars. They are sent to the respective floors where the empty slots are present accommodating its type. At the same time using the automated license plate recognition, the unique car numbers are collected along with their entry and exit time. This record along with many occurrences is used to calculate the meantime that is the average waiting of the next car. Thus provisions a better organization of the parking system.

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The existing system had inductive proximity sensors at the parking slot to detect the presence and absence of the car, which reports the main entrance about the vacancy. If the slots are full the tokens are not given and cars are to wait until the next slot is free. This when applied to multi stored buildings and huge data might not apply. Which is being sorted using the capacitive proximity sensors and automated license plate recognition at the entrance of the slot hence calculating the appropriate place to park hence consuming the space to its fullest and effectively calculating the waiting time of other cars.

II. LITERATURE SURVEY

There are numerous projects over IOT parking lots, but the efficiency of the system for the underlying demand of the fast world with huge data is yet to be satisfied. In**[1]** The system focuses only on filling the empty lots. Empty lots are detected using the proximity sensor which then passes a token stating the empty lots. The effective way of parking stays unnoticed, which is detecting the lengths of different car's and their required spaces. Only the metallic objects are detected using the inductive proximity sensor, which acts as a major drawback. In**[2]** Techniques used in the system includes ALPR, RFID, OpenCV, python and embedded systems. Even though It provides high security, Only authorized vehicles are permitted to park by checking some condition. The unauthorized vehicles cannot be parked, which acts as the drawback. In**[3]**Parking sensor data, parking violation management, ITs are the techniques used in this system. It does not identify whether space is free for parking. It allows the vehicle to be parked in some random free space. In**[4]**Prediction model, machine learning is the technique used in this system. It shows the best results even in bad weather conditions. Prediction of error time condition is the system's demerit. In**[5]** Face recognition algorithm has been used in this system. Camera is installed at the entrance and the exit of the parking lot such that it recognizes the image of the person, If the ticket of parking lot containing the check-in time of the vehicle is lost, using the face recognition algorithm the parking time of the vehicle can be calculated using the image of the person at the exit . But there is a Lack of Clarity in the image during bad weather conditions. In [**6**]Car detection, hierarchical model, occlusion modelling are the techniques used in this system. It provides a Multi-layered car parking system. HOG can be substituted by the CNN(convolutional neural network) features for better performance.

III. EXISTING SYSTEM

The existing system focuses only on filling the empty lots, detecting the empty lots using proximity sensor, passing a token stating the empty positions and the end-user is enabled to use

mobile application for searching and checking various availability of slots. this requires installation of the application and manual searching of available slots in different levels of parking, according to the make of the vehicle.

The main issue of effective parking stays unnoticed, which is the different lengths of different makes of cars and their required space. The waiting time for each vehicle during a busy day is not calculated or specified.

IV. PROPOSED SYSTEM

To efficiently use the available parking place, the dimension of a Vehicle is found out. Based on the dimensions the vehicle is sent to the desired parking lot. Five Proximity sensors that will be present on front, rear, top and sides will work together to find the dimension of the vehicle. Capacitive Proximity Sensors are used here since they can detect both Metallic and non-Metallic Objects.

To predict the waiting time for a vehicle to park, the estimated time of exit of the parked vehicles is found. When a vehicle enters the parking lot, Using Automatic License Plate Recognition(ALPR), Store their number plates in the database. This happens only at first entry to the parking lot. While vehicles exit the parking lot, the total time the vehicle was parked will be calculated and stored. When the particular Vehicle frequently visits the Parking lot, the database will be updated. After a few frequent visits, the average time taken for the vehicle to exit will be found. With the estimated time of exit found, the Waiting time for a vehicle to park can be predicted.

V. SYSTEM ARCHITECTURE

This system includes the feature that helps to make use of available parking place efficiently. The dimension of the vehicle is found out, such that the vehicles are sent to the accurate parking slot. It also predicts the waiting time of a vehicle. the modules involved are :
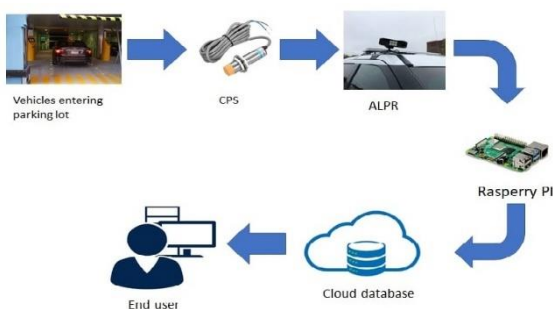

FIG.1.ARCHITECTURE DIAGRAM

A. First in first out algorithm

In order to minimize parking traffic, the FIFO rule is used. This algorithm suits mostly for large parking areas. The car that arrives first to the parking area is allocated with the nearest parking space, such that the time for searching for a parking space can be saved and the traffic is also avoided.

B. Capacitive proximity sensors

The capacitive proximity sensors are used since it can detect both the metallic and non-metallic objects. It shows good results in bad weather conditions. To efficiently use the available parking place, the capacitive proximity sensors are used to calculate the dimensions of a car. Five Proximity sensors that will be present on the front, rear, top and sides at the entry of the parking area will work together to find the dimension of the vehicle and categories them into macro, sedan, and SUV models. Dijkstra algorithm is used to calculate the shortest path between the vehicle and the parking slot.

C. Automatic license plate recognition

To predict the waiting time for a vehicle to park, the estimated time of exit of the parked vehicles is found. When a vehicle enters the parking lot, Using Automatic License Plate Recognition(ALPR), Store their number plates in the database. This happens only at first entry to the parking lot. While vehicles exit the parking lot, the total time the vehicle was parked will be calculated and stored. When the particular Vehicle frequently visits the Parking lot, the database will be updated. After a few frequent visits, the average time taken for the vehicle to exit will be found. With the estimated time of exit found, the Waiting time for a vehicle to park can be predicted.

D.Rraspberry pi

The ALPR is used to store the entry and exit time of the vehicle using their number plates in a database . Raspberry pi can be used as the microcontroller that helps in handling the opening and closing of gates.

E. Parking status

Capacitive proximity sensors are fixed in the parking slots such that it provides a slot to the vehicle with exact dimensions. It is also used to determine whether the slot is available for the vehicle to park or not. Using the average time detected by the ALPR the parking time of the vehicle can be found, such that the waiting time of the vehicle to be parked can be obtained and traffic can be reduced.

VI. MODULES

A. Classification of car

After determining the dimension of the car, they are classified as follows

Vehicle model	Example	Size in feet
macro	Hyundai i20	13.8
sedan	Honda city	14.4
suv	Xuv5oo	15.7

B. First in first out

After the classification the car that enters the parking area first gets the first priority to park to the nearest vacant slot .therefore the traffic can be reduced while searching for the parking slot.

C . Creating a database using sql in cloud

A database is created using structured query language in cloud by acquiring the registration number and entry and exit time of the particular
vehicle . the minimum time

of parking used by the particular car on two or many occurrences can be found out by calculating their mean. considering a parking time of a vehicle on two occurrences a database is created as follows in cloud sql.

s.n o	Date of parkin g	Registratio n number	Entry time	Exit time	Total hours parke d
1	12-3-2019	tn09cl0000	6:00am	5:00pm	11 hrs
2	15-5-2019	tn09cl0000	6:30am	4:30pm	10 hrs

D. Calculating the average time

From the database stored for a particular vehicle the parking time of that vehicle can be determined by finding the average .from the above database the average is taken for the total hours parked .

(Total hours(1)+total hours (2)…+total hours (n)) / Total number of times parked)

From above database

(11+10)/2=10.5

So the estimated parking time of the vehicle is calculated to be 10hours 30min
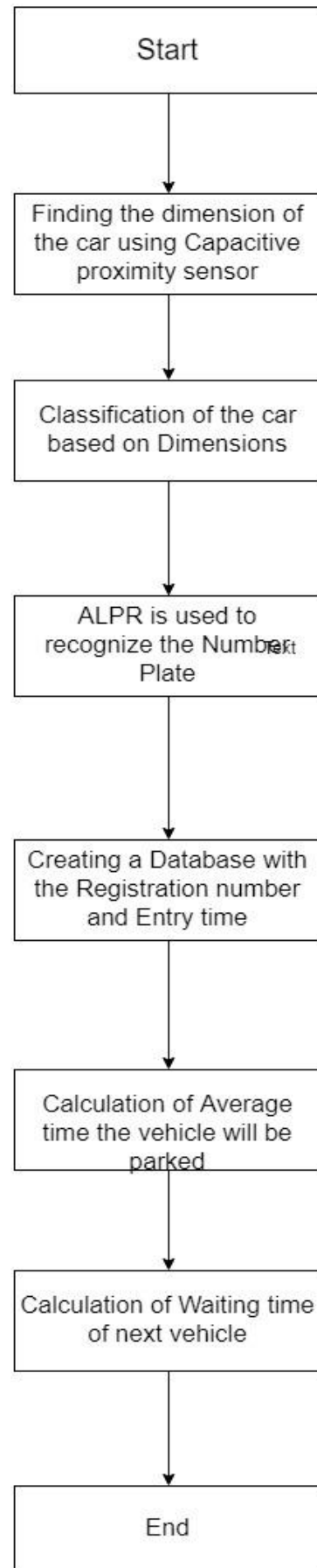
E. Calculating the waiting time

The waiting time of another vehicle is calculated by the vehicle that is going to exit in less time .In order to find this the entry time of the parked vehicle is obtained and parked hours is calculated which is then subtracted from the average time of that vehicle from the database.

Average time of a vehicle – parked hours of the vehicle =waiting time of vehicle to be parked next

Using this formula the waiting time can be determined.

VII. IMPLEMENTATION

The implementation of the project uses an IoT system that is cloud-based such that it provides storage space to validate the make of the car and calculate the meantime of a car occupying the parking slot. The communication between the database and the cloud implemented using the help of raspberry pi as explained in fig.1. network has several secured gateways through which the details can be accessed. The first in first out and shortest path algorithms are used to navigate the vehicle to the accurate parking level and slot. the ALPR helps in storing the registration numbers in the database along with which the time-in and time-out of the vehicle is also stored. hence using the stored data, the approximate waiting time of the upcoming vehicle is calculated.

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VIII. EXPERIMENTAL RESULT

The capacitive proximity sensors, the automated license plate recognition (ALPR), and the microcontroller Raspberry Pi have confederated with each other which helps in analyzing the dimensions of the vehicle and their unique registration numbers. The Liquid Crystal Display will provide the information on which level the car has to be sent and the available places at that particular level. When there is no slot available a parking full message is displayed.

The calculation of the approximate waiting time of the upcoming cars is also calculated by calculating the meantime of the car using the slot in a certain number of occurrences such that no time is wasted while parking.

IX. CONCLUSION

In this paper, an effective way of car parking system has been proposed using the capacitive proximity sensors and (ALPR) automatic license plate recognition. These devices show good results even in bad weather conditions such that accuracy is not missed in allotting the parking slot effectively and storing the vehicle number in a cloud database. using first in first out algorithm, parking slots are allocated to the vehicles without creating the traffic .using the average time of frequently parked vehicles the parking time can be determined .due to automation, IoT is of great demand these days. This system consisting of IoT devices helps in building a smart city and can also be used for future developments.

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