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SMART PARKING SYSTEM USING FACIAL RECOGNITION, OPTICAL CHARACTER RECOGNITION AND INTERNET OF THINGS (IoT)

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Abstract - *The regular issue in our urban communities is the trouble of discovering free parking openings. The parking issue causes wastage of time and energy especially for those who go to work and are searching for a place to park. The main objective is to develop an efficient model to deal with difficulties, such as improper parking, clog in parking areas, insecurity of vehicles, etc. A platform is given as entryway for booking the parking spots. The proposed framework uses facial recognition and optical character recognition along with IoT (Internet of Things) for accessing the entryway of the parking spot. The proposed framework diminishes the searching time of free space. The goal is to limit seeking time, fuel utilization and CO2 emission and make the process of parking convenient and hassle- free.*

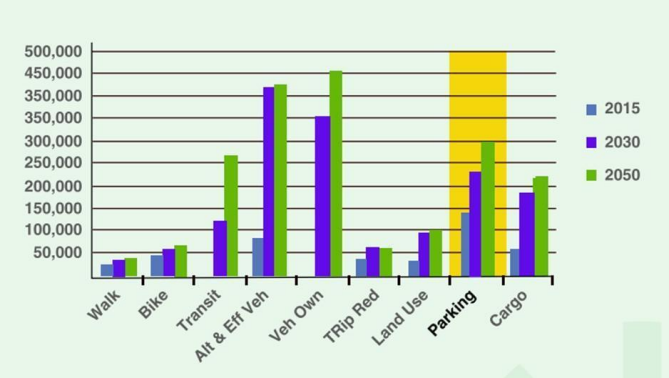
Key Words: Cloud, Database, Face Recognition, Google Cloud, HTTP, IoT, Optical Character Recognition, Python, Raspberry Pi, requests, Sensor, Smart Parking System, SQL

1. Introduction

The population of the world is growing at an alarming rate. It is one of the most rising global concerns and if not properly dealt with would cause a huge amount of problems. Traffic congestion is one of them. It often leads to wastage of time and fuel and often makes us irritated. Urbanization has led to decrease in empty spaces available and has also led to increase in number of vehicles. It is now a lot easier to own a vehicle than few years ago. Finding a parking spot has now become a daily activity for many people around the globe. It may be in office, shopping malls or in colleges. This pursuit consumes around large amount of the world's already scarce oil each day.

These problems will worsen if not dealt with properly. So our main objective is to create a smart parking system using Facial

Recognition and Optical Character Recognition integrated with an IoT device so that we avoid any misuse of space and increase the efficiency of parking. We will use Facial Recognition to identify the driver and Optical character recognition to identify and extract text in the number plate of the vehicle. We will have a Database from which we will verify the driver and the vehicle. The car will be allowed only if the driver and the vehicle image matches with that in the database and IoT would be integrated with the gate of the parking spot and there will be RFID sensor to detect if the parking spot is occupied or not.



Source- https://www.happiestminds.com/

Optical Character Recognition is mainly used for reading text from images and main application of Face

Recognition is to identify and recognize a face of a person.

Optical Character Recognition (OCR) is the identification and validation of printed or written text characters from an image. OCR can either be done offline or online. In Offline Recognition the source is a filtered picture or on the other hand record while in the case of online recognition the source is progressive and is represented as a function dependent on time. In Optical character recognition, the vehicle number plate image is captured as a picture and identifies number plate and which is at that point changed over into text which acts as an input for the database to be validated. The OCR works on images to identify the vehicle by the number plate. It analyzes light and dark areas in a picture to identify text. It looks line by line to find if black and white dots represent a particular character. The steps involved in the whole process in the given order are scanning, location segmentation, pre-processing, feature extraction and final display of output.

Sample Image for Optical Character Recognition (Source- Google)

Face Recognition has its fair share of advantages over other biometric systems such as fingerprint/palm/iris. Distance is not a problem in face recognition so identification does not require direct contact with the person. So time required for biometric verification will minimize to a great extent which makes it the most convenient option. There are various algorithms for facial recognition available. Initially, we have images of people at different angles in our database. So the degree at which car comes would not affect the validation system.

Sample Image for Face Recognition (Source- Google)

The main concept of Internet of Things (IoT) is that it acts as communication devices which are able to interact with each other. The users have the ability to track, control or screen these devices utilizing remote PCs connected through Internet gateway. IoT increases utilization of the Internet giving communication. In IoT nodes or devices can be said to speak with one another and the environment utilizing the internet protocols. IoT has begun the start of a new era where everything can be automated. Creating a Smart City is currently getting to be conceivable with the rapid development in the field of Internet of Things. One of the major issue that savvy urban communities identify with are vehicle leaving offices and traffic the board frameworks.

2. Literature Survey

Various ideas have been proposed using various algorithms. We aim to improve over the negative points in some papers to create an efficient system for parking. There are various algorithms especially for facial recognition and Optical Character Recognition.

In [1] the observations with results are of not more than 2-second performative action and are 85% accurate. We want to reduce the time and increase the accuracy and efficiency of the system.

In [2] we get a good outcome but the variation of image at different is an issue. So for the proposed facial recognition algorithm, we want to overcome this problem.

In [3] It takes lot of time to scan, thus making it inconvenient and the user impatient.

In [4] Results have shown success up to a maximum of 90% accuracy, regardless of the facial pose variation. The only issue is with capturing image from only limited angles to detect vehicles only from frontal and side views.

In [5] Advancements in various technologies has lead to cost effective solutions.

In [6] Internet of Things, in combination with the usage of Ultrasonic sensor has lead to successful results but cannot be implemented because of high costs.

In [7] the results are satisfactory with a high accuracy of 91%. Its accurate in localizing and recognizing the number plate with help of the algorithm used.

In [8] RFID and OCR are the technologies being used. It will be an efficient system from small to large organizations with an accuracy of 89%. Using this method in large organizations will lead to wastage of time as well as makes the whole process complicated.

In [9] Tracking in a huge scenario can be complicated as well as hectic. Accuracy was found out to be 98%.

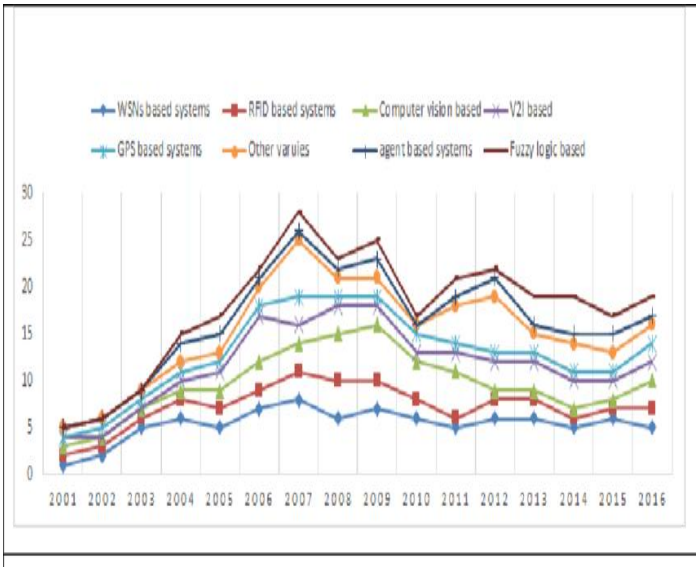
In [10] The accuracy was found to be 94% but implementation was too expensive.

In [11] a wide range of improvement is suggested in the already existing cloud-based parking systems. The paper introduces algorithms to increase the accuracy. The research is based on wireless access in an open-source physical computing platform in cloud based on Arduino with RFID technology.

In [12] a Parking System is designed which enables the user to search for the nearest parking spot. It focuses on

considerably reducing the vital time wasted in finding the parking spots. Thus, it reduces the fuel consumption and saves from pollution.

In [13] users are shown which parking slots are free and in which area. This project is only developed to check the availability of free parking slots.



Source - https://www.researchgate.net/figure/Trend-of-smart-parking-porotypes-in-academia_fig1_311535831

Some of the above mentioned papers are very expensive to be practically used. So we mainly aim to reduce the costs thus making it possible to implement in the daily use system.

3. Proposed System

The Proposed System is using cameras to scan both the vehicle and the face. The vehicle number plate is scanned with the help of Optical Character Recognition Algorithm whereas face is scanned through Face Recognition Algorithm. IoT device is used to access the gate of a parking spot. When we design the database, we will initially have the images of each person at different angles just as shown below so that picture taken from any angle won't affect the result. This way safety is increased as no intruders are allowed. An alarm indication is present if wrongly parked or someone else intrudes in. The proposed system ensures that the whole process is automated and that the accuracy is not compromised upon time.

Advantages –

Optimize parking space usage.

Reduces wastage of time.

Enhanced security.

Reduces CO_2 emission.

Reduces fuel consumption.

Decreases the chances of car – theft.

Disadvantages –

The Camera is always active even when there are no vehicles.

It takes quite a budget to set up the actual model.

Technologies Used –

Number Plate Recognition using Optical Character Recognition.

Facial Recognition System.

Data Processing and Validation from Database.

IR Sensors integrated with Raspberry Pi.

Applications-

Safety is ensured as no intruders are allowed. IoT device integration assures that the system does not require any manual work. It can be used for many purposes like:

Parking Areas in Industries: Reserved parking spots for specific people with higher posts.

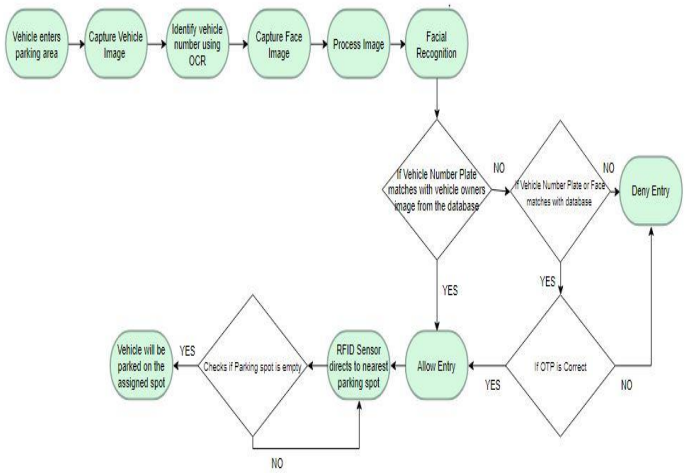
Parking areas in colleges/schools: Separate parking spots for teachers and students. Some reserved spaces for specific teachers, etc.

Parking areas in Malls/Stadiums.

4. Working Process

First, We Capture the image of the Vehicle and the Driver, we get the text in the number plate using Optical Character Recognition and we get the face using Face Recognition. The driver is stopped at the entry gate, and we capture his/her photo. We verify from the database, if the vehicle is registered and if the car owner and the number plate matches. Then IoT device is used to open the gate. Once the user enters the correct OTP received on his/her registered mobile/e-mail the welcome message will be displayed and the gate is opened for the user to park the vehicle. When the vehicle is parked in the available slot the binary value of the IR sensor will change and it will demonstrate Slot unavailable to other users till the vehicle isn't removed.

Some Spots are reserved for specific people. If some other person park in that reserved spot, the alarm is rung until the person removes his vehicle from the reserved space. This way we increase security and reduce car-theft. By specific allocation of places to people of different categories we could decrease the congestion thus reducing traffic, saving time and fuel. Thus making the whole process of parking convenient.



5. Future Scope

Face recognition and Optical Character recognition system used till date works pretty well under limited conditions, although most of the systems work much better with frontal pictures and constant bright lighting. Almost every present-day Face Recognition and Optical Character Recognition fails to a certain extent under rough conditions. Future generation recognition systems should identify and recognize individuals and extract characters from the picture in real time and even in harsh environments.

It is firmly believed that identification and recognition systems that are found to be robust in natural conditions, in the presence of high noise do not give desired results, so we can't rely upon a single technology, so it becomes an absolute necessity to combine two or more technology to come up with an efficient solution.

Technology should be easy to use and user- friendly. Considering all the requirements, recognition systems that use face recognition and optical character recognition seem to be most potential for wide-spread application.

IoT device is the future of technology. In IoT devices can be made to communicate with each other and the environment using the internet protocols.

6. Conclusions

There is going to be rapid growth in the sector of facial recognition and Optical Character Recognition. A lot of research is being done so as to make the process more convenient and at the same time accurate, with an ever-increasing application in the future. Facial Recognition and OCR has a huge number of applications and it will be integrated into various systems in upcoming years. They are one of the most preferred types in biometric domain. It has some drawbacks and we aim to overcome it. Using facial recognition and OCR, our main objective is to reduce the time for the scan and thus making the whole process convenient. The result obtained is verified from the database to prevent intruder entry and exit.

The future of automation lies in the hand of IoT as it helps device I communicating. Several work is going on in this field to automate several tasks.

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