Smart Parking System using Facial Recognition

Dhruv Khanna, Aditya Nanda, R. Subash

Abstract--- With the rapid increase of cars, availability and usage in past few years, searching a free parking slot is becoming more and more difficult and time consuming, resulting in various number of serious conflicts. This is about developing a goodand efficient system that takes over the problem of identifying vacant slots in a parking place and maintaining the record of vehicles parked accurately. Human word is lessened at the parking area to a great extent such as in case of finding free slots by the person driving the vehicle. The various steps that this project comprises of are web app, face recognition and free slot detection. Face recognition is done and the car is directed towards the vacant parking slot.

Keywords--- Image Processing, Smart Parking.

I. INTRODUCTION

In many large cities and busy business areas, free parking space is very strenuous to discover. As the number of cars in today's worldare increasing, it is more and more strenuous and takes additional time to discover available parking slots.The traffic jam situation not only focuses on the roads but also in the parking destinations where the parking space is bounded. The smart city scheme of many countries such as Thailand requires smart parking facilities that can help drivers to locate the available/free parking area in order to restrict time constraint and traffic issues.

Related work

In previous works, there are many solutions which have been taken into consideration in [2], [3], [4], [5] and [6] for improving the parking task. Paper [2] consisted of a smart parking system using ultrasonic sensors.

In [3] a method was proposed in which vehicle license plate was detectedusing neural network.

[4] In this paper, a sensor-based smart parking solution was reviewed, describing how it was taken into consideration and its vehicle detection algorithm.

[5] In this paper, RFID reader and tag were used to recognize the car.

[6] In this paper, user was directed to a vacant parking slot with help of navigation.

Person entering the parking slot had to scan a QR code at the time of entry and the path to the vacant parking slot was displayed in his google map.

Contributions

This system assistsmanagement/improvement of a parking area. These are uncomplicated for user to book the parking slots. The user can get information about the parking slots which are free, number of parking slots and all other possible parking area's information.This information provides user convenient into application and also has a feature of functions such as facial recognition. The system uses camera to extract faceof a humanwith the help of a web app and store the photos of the person in a database.

II. SYSTEM ARCHITECTURE DESIGN

Beforedesigned system assumes that 6LR, provided with a light sensor, are placed on each and every parking lot in order to detect cars' existence, while 6LRR nodes are placed on poles located near the parking spaces reserved for people with special authorizations.

Indeed, in the proposed system, facial recognition is used to check that the person who has booked the parking slot can only enter the parking area.

Parking management systems will vary at levels of potency primarily due to the nature of parking areas that is generally to occupy a big range of parking areas, and therefore the traffic of cars coming back in and out parking areas.

With that, entry and exit become of the utmost importance as this is wherever the traffic and identification may be monitored with a larger deal of scrutiny. As such, image process technology comes into play, used to manage vehicle IDs and human faces the utilization of this was to scale back human error concerned that will be inaccurate because of the frequency of parkers. Image recognition through image process is that the detection and identification of pictures through the use of patterns and comparison of objects.

During this case, image process is to be used as a registration and recognition tool for a car parking zone in a very housing space.

Image process is a tool at the time of which pictures are digitalized and examined To this purpose, Webapplication has been developed.

The WebApp allows the driver to find the parking spaces available in a given area.

Also it stores the face of the person who is booking the parking slot so that it can be matched at the time when he enters the parking area.

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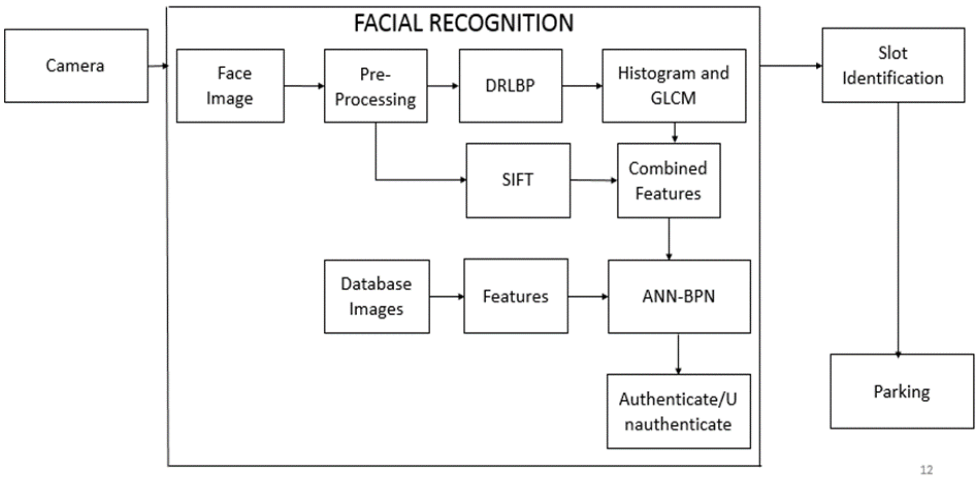

Figure 1:Architecture diagram for Smart Parking System

System Overview

Web Application will store the person's identity by storing the image of his face by capturing the image through camera.

The obtainable/unobtainable parking spaces are shown simply such as parking slots graphic, signs and colours on web application.

Real-time (obtainable/unobtainable) informative parking spaces is revised immediately on web application.

First, the person will book a parking slot through the web app. After that when the person will comeinto parking slot then facial recognition is done at the time of entry, person's face is matched with the faces stored in the database. Database consists of the images of person's face who has booked the parking slot through the web app. Then if the face is recognized then he/she is given access to the parking area otherwise the person is denied the access to the parking lot.

The camera will capture an image ofthe vehicle driver and compare the new captured image with the owner profile picture which exists in the data base. IF the system found a match, thegatewillbeopened and IF not then gate will remain closed.

Required Technologies

- *DRLBP*: It is used for different object texture, edge contour and shape feature extraction process. It is strong to illumination and contrast changes as it only takes the signs of the pixel differences. The proposed characteristics retain the contrast data of image patterns.
- *SIFT:* thisis a feature detection algorithm in computer vision to identify and describe local features in pictures.
- *GLCM:* The texture sifter functions give a statistical view of texture found on the image histogram. These functions can give useful data about the texture of an photo but cannot givedataabout shape, i.e., the spatial relationships of pixels in an photo.
- *ANN*: The neural network is not considered as an algorithm, but rather a framework for various machine learning algorithms to work collectively and operate complex data inputs. An ANN is based on agroup of connected units or nodes called artificial neurons, which loosely construct the neurons in a biological brain.

Face Processing

The Face recognition is a optical pattern recognition issue. There, a face as a 3-Dmaterial subject to altered illuminations,expression and so on is to be explored based on its 2-D image (three-dimensional images e.g., acquiredvialaser may also come into use). A face recognition system usuallycomprises of four modules detection, alignment, feature extraction, and matching, where localization and normalization (face detection and positioning) are the major handling steps which are done before face recognition (facial feature extraction and matching) is completed. Face identification segments the face places from the background. In the case of video, the identified faces are needed to be followed using a face tracking constituent. Face positioning targets at attaining more correctconfinement and at normalizing faces of the personand hence face detection provides rough estimateof the location and scale of every detected face. Facial constituents, such as eyes, nose, mouth and facial border, are placed; based on the location marks, the input face photo is normalized in accordance to geometrical possessions, such as pose and size, using geometrical transforms and morphing. The face is generally further normalized with respect to photometrical aspects such illumination and gray scale. Later a face is normalized geometrically and photo-metrically, characteristic extraction is done to provide particulars that is helpful for differentiating between faces of different people and stable with in accordance to the geometrical and photometrical variations. For face equating, the extracted feature of the face is matched against those of faces already stored in the database; it verifies the identity of the face when a match is identified with sufficient confidence or depicts an unknown face otherwise. Face recognition outcome depends highly on characteristics that are extracted to represent the face pattern and classification techniques used to differentiate between faces whereas face localization and normalization are the base for taking out effective features.

Slot Identification

Identification of vacant slots in a parking area is done with the help of cameras.And the slots which are vacant or booked are shown on the web app. Then the person can book the vacant slot according to his convenience. When person arrives at the entrance of the parking then after the facial recognition he is directed towards the slot he has booked.

III. SYSTEM ALGORITHM

Haar Cascade Algorithm

Haar-cascade is associate degree object detection algorithmic program wont to find faces, pedestrians, objects and facial expressions in a picture and principally used for face detection. In Haar-cascade, the system is given many numbers of positive pictures (like faces totally different |of various} persons at different backgrounds) and negative pictures (images that don't seem to be faces however may be the rest like chair, table, wall, etc.), and also the feature choice is finished at the side of the classifier coaching technique Adaboost and Integral pictures. A Haar-like trait considers adjacent rectangular places at a selected location during a detection window, sums up the picture element intensities in every region and computes the distinction between these sums.This distinction is then wont to categorise subsections of a picture. for instance, allow us to say we've a picture info with human faces. it's a typical consideration that among all the faces the place of the eyes is darker than the place of the cheeks. Thus, a typical Haar feature for face detection can be a frame of twoneighbouring rectangles that are on top of the eye and also the cheek region. The position of those rectangles are outlined comparable to a detection window that acts as a sort of a bounding package to the target object (the face during this case).

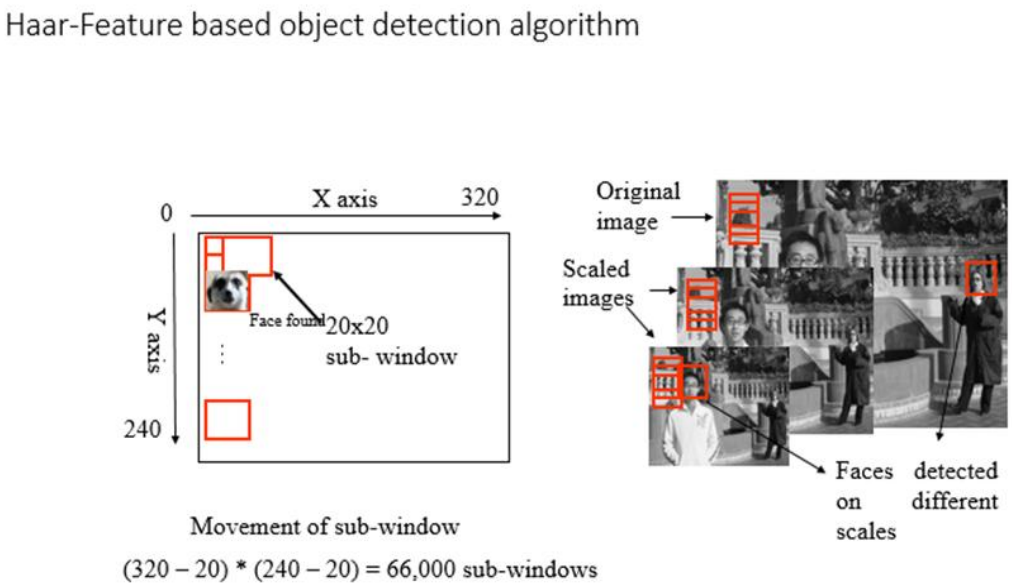

Figure 2: Haar-Feature based object detection algorithm

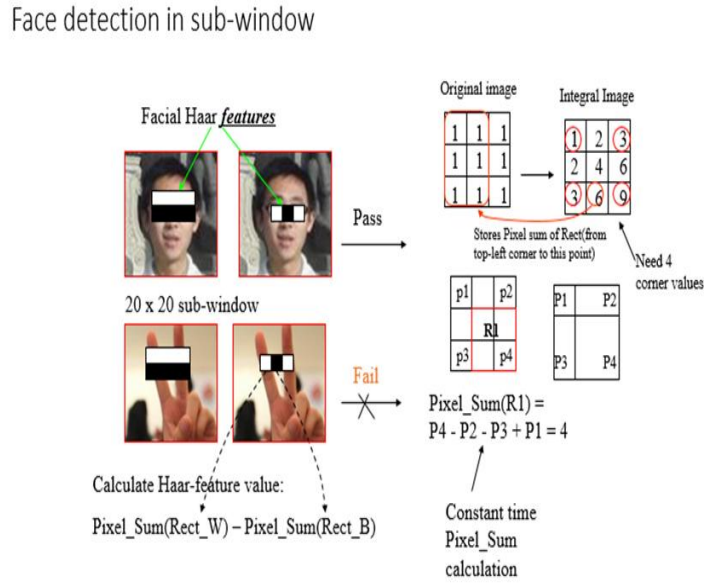

Figure 3: Face detection in sub-window

Scale-invariant feature transform

The scale-invariant feature transform (SIFT) is a characteristicsidentification algorithm in computer vision to detect and explain local components in images. It was patented in Canada and published by David Lowe. Applications consists ofobject recognition, robotic mapping and navigation, photo stitching, 3D modeling, gesture recognition, video finding, individual identification of wildlife and match moving. SIFT keypoints of components are first taken out from a set of reference images and kept in a database. A component is recognized as a new image by individually comparing every feature from the new photo to this database and searching candidate matching features based upon Euclidean distance of their feature vectors. From the whole set of matches, subsets of main points that agree on the component and its location, scale, and orientation in the new image are detected to filter out good matches. The inspection of consistent clusters is performed again and again by using implementation of a good hash table of the Hough transform which is generalized. Each cluster which containsthree or more characteristicsconcur on an object and then its pose is subjected to further detailed model verification and after that the outliers are rejected. Ultimately, the probability that a peculiar set of features which designates outto the presence of an object is measured, given the stats of fit and number of false matches. Object counterparts that survives all these tests is considered to be correct with high confidence.

Application operation

When a user wants to use the application, user first hasto register on application. When user will login into the application,there will be a function like book a slot,user will be able to see which all parking slots are available and then he/she can book a slot according to his/her convenience.

IV. CONCLUSION

This paper proposes an Image processing based smart parking system that can provide information about vacant space to help driver to book an available parking slot from their respective homesin order to reduce the traffic situation in the parking area. The system will detect the face of the person who is driving the vehicle and use it to match the face with faces stored in the database at the time of slot booking. We design this smart parking system with the help of hardware and software based on Image Processing concept, and web application, the driver can easily check parking stats. The main motive of our study is to revamp the parking process by reducing the time that is demanded to park a car.

To the best of our awareness, we are the first to blueprint this kind of device planning to detect the face of the person and also use web application. We tested system to find the best range camera for the face detectionand take a picture with good clarity.

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