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Smart parking prediction for different car models using image processing techniques

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Abstract - *Automatic recognition of car model and manufacturer of the car will significantly improve the general law and order, traffic control and parking management. The realization of the Smart City is now becoming possible with the emergence of the Internet of Things (IOT), which radically evolves the current Internet into a network of interconnected objects, such as sensors, parking meters, energy measuring devices and actuators. These arranged gadgets can process detect and connect with their surroundings in fine spatial and fleeting point of interest, and produce an immense measure of information. One of the key organizations that urban territories need to direct is auto ceasing workplaces and development. Finding an accessible parking space in the city is constantly troublesome for drivers, and it has a tendency to end up noticeably harder with the expanding number of private auto clients. In case the drivers can be instructed early about the openness of parking spaces at and around their arranged objective, the movement stop up can be profitably controlled. This requires canny sensors to be sent in the parking garages for observing the inhabitance and additionally savvy information.*

Key Words: **parking prediction, parking management, image processing techniques.**

1. INTRODUCTION

Vehicle location is an essential issue in many related applications, for example, independently directed vehicles, driver help framework, or canny stopping framework. One of generally normal ways to deal with vehicle identification is utilizing vision-based systems to break down vehicles from pictures or recordings. Nonetheless, because of the varieties of vehicle hues, sizes, introductions, shapes, and postures, building up a powerful and compelling arrangement of vision-based vehicle recognition is extremely testing [1]. To address these issues, there have been many methodologies utilizing diverse elements and learning calculations examined for successful vehicle recognition.

Parking accessibility expectation is among the most critical elements influencing both private car based outing choices and activity conditions. Drivers' decisions are momentarily penniless, deducing that they are influenced by past contribution, and moreover steady (on road) perceptions [2]. Stopping is such a situation where earlier information on conceivable winning conditions (e.g. trouble in finding a parking spot, off-road stopping expenses, et cetera) influences drivers' stopping choices. In the meantime, vehicles looking with the expectation of complimentary parking spots adversely affect activity conditions and the environment.

In this specific circumstance, parking data arrangement is an examination range exceptionally compelling, since present day correspondence advances offer option methods for conveying data to explorers in an auspicious and powerful manner. First, they altogether increment the likelihood of discovering free parking spots and moderate dissatisfaction of those drivers. They should diminish lines before parking structures and reductions add up to vehicle-miles voyaged (especially in the city centre). One of the key organizations that urban zones need to supervise is auto ceasing workplaces and movement. Finding an accessible parking space in the city is constantly troublesome for drivers, and it has a tendency to end up plainly harder with the expanding number of private auto clients.

Programmed acknowledgment of auto makes and models could essentially enhance proficiency in law implementation, activity observation, and stopping administration. In a vehicle-related wrongdoing, law implementation organizations as a rule require seeking and checking a suspicious vehicle from a great many activity pictures in light of general depictions of auto elements from a casualty. Affirmation of unavoidable auto properties, for instance, auto makes and models, is significant to on the web or detached vehicle interest and recognizing evidence, when diverged from standard label affirmation.

Car parking is an overall issue in occupied business areas particularly in created nations, and subsequently clever and programmed stopping winds up plainly mainstream. In a programmed stopping framework, vehicle volumes and measurements are critical parameters for stopping streamlining. The issue of auto model acknowledgment is basically intraclass characterization that particularly recognizes auto models in the same "auto" classification, while run of the mill picture order issue is to characterize diverse protest classes from picture tests containing the articles. Indeed, even an auto with a similar model sort may change in shading and assembling points of interest. The challenges of vehicle unmistakable confirmation in this circumstance are essentially brought by different camera hardware. The pictures gotten by assorted brands of camcorders are generally with different qualities. Include based techniques, for example, Filter, may neglect to discover correspondences from pictures of a similar auto display. Besides, because of restricted lighting power, the

brightening of activity camera pictures differs seriously from a sunny day, a down-pouring day to a night. A shadow or a backdrop illumination condition may hide imperative visual elements to distinguish an auto. Ultimately, however inside a limited range, the perspective changes additionally impact the acknowledgment exactness.

In this paper we propose a system that uses image processing technology; this will be more accurate and will not depend on human intervention. Whenever a car comes, the camera will capture the image of car. From the captured image, car size is detected and compared with stored car models size. If matching is found then suitable action will be taken based on installed application like traffic regulation or parking management. In case this application is used in parking management then the car will be directed to suitable parking slot.

2. RELATED WORK

Object recognition is generally utilized as a part of the machine vision industry for the reasons for assessment, enrolment, and control. In any case, current business frameworks for protest acknowledgment depend solely on connection based layout coordinating. While extremely compelling for certain designed conditions, where protest posture and brightening are firmly controlled, format coordinating turns out to be computationally infeasible when question revolution, scale, light, and 3D stance are permitted to shift, and significantly more so when managing incomplete visibility and vast model databases [3]. There has been late work on growing considerably denser accumulations of picture elements. One approach has been to utilize a corner identifier (all the more precisely, an indicator of crests in neighborhood picture variety) to distinguish repeatable picture areas, around which nearby picture properties can be measured.

Picture arranging is a key issue in PC vision that happens in many picture dealing with uses in an accumulation of fields, including picture recovery for security use and robot course. A typical approach is to find trademark picture components (or key focuses) from the pictures and think about them through descriptors of these elements. Prior inquire about for trademark key concentrations join the Harris corner discoverer and key concentrations invariant to rotate and understanding. Most of the methodologies concerning vehicle producer acknowledgment VMR portrayed in the writing centre around scale-invariant feature transform (SIFT) and picture coordinating utilizing vehicle pictures legitimately fragmented over the tag region. The SIFT keys gotten from a picture are utilized as a part of a closest neighbour way to deal with ordering to distinguish hopeful question models. Accumulations of keys that concur on a potential model posture are first distinguished through a Hough change hash table, and afterward through a slightest square fit to a last gauge of model parameters [1]. At the point when no less than 3 keys concede to the model parameters with low remaining, there is solid confirmation for the nearness of the protest. Since there might be many SIFT enters in the picture of a run of the mill protest, it is conceivable to have generous levels of impediment in the picture but then hold abnormal amounts of unwavering quality.

Huge advance has been made as of late in perceiving objects with huge varieties in survey conditions by using both protest appearance and geometry information. Most techniques speak to question classes as accumulations of striking components with some invariant portrayals of their appearance. Geometry imperatives are implemented in a free or inflexible way to determine appearance vagueness and enhance acknowledgment execution [3]. In general these techniques just deliver a scanty arrangement of elements that cover a little bit of the whole protest, and along these lines may miss some imperative and discriminative areas for dependable question acknowledgment.

The greater part of the current vehicle identification a framework manage just vehicle/non-vehicle recognition, characterization into general classes or following vehicles and is an assignment that has been satisfactorily tended to. Be that as it may, Vehicle Manufacturer and Model Recognition (VMMR) is a subject with moderately constrained research announced in the field, since picture obtaining is performed in outside condition where brightening conditions are uncontrolled and differing, therefore making acknowledgment a troublesome errand. Given the wide assortment in the presence of vehicles inside a solitary class alone, it is hard to sort vehicles utilizing a straightforward model. A relative information obtaining framework comprising of a few question acknowledgment modules, which speak to an auto picture seen from the back, for example, a window, tail lights, et cetera, in view of shading acknowledgment. This approach has the downside of being touchy to lighting conditions.

To screen the quantity of accessible spaces in the stopping zones a minimal effort, low-vitality WSN will be utilized. This implies a perplexing take off or new cabling framework won't be required in the zone where the proposed framework is conveyed. The sensors will distinguish the entry of vehicles on the streets into and out of the stopping regions situated on open streets continuously. The experts and drivers will, in this manner, know the inhabitance levels of the stopping zones at all circumstances. The constant reaction is basic in light of the fact that the framework would not be practicable if there was an extensive postponement in refreshing this information. Transferring pseudo continuous data to drivers keeps away from them spending additional time out and about scanning for a parking spot, which frustrates the dissemination of different vehicles and expands fuel utilization, emanations, and commotion contamination [6].

Car stopping is an overall issue in occupied business regions particularly in created nations, and in this manner shrewd and programmed stopping winds up plainly well known. In a programmed stopping framework, vehicle volumes what's more, measurements, which compare to auto makes and

models, are essential parameters for stopping improvement. As activity cameras turn into a standard office in many urban communities, acknowledgment of auto makes and models has huge down to earth and prudent values. The difficulties of vehicle ID are principally brought by assorted camera equipment, different lighting conditions, and point of view mutilation. The pictures caught by distinctive brands of camcorders are as a rule with various qualities [3].
Car districts are extricated from foundations through surface examination. Car identification in a movement camera picture is testing at the point when part of an auto is blocked by different autos and offices or undetectable because of extraordinary climate and lighting conditions [5].

3. CAR DETECTION

Car areas are removed from foundations through surface examination. Car identification in a movement camera picture is testing at the point when part of a car is blocked by different cars and, or imperceptible because of extraordinary climate and lighting conditions. In our approach we use image processing techniques. Initially the video is captured from the camera and the first frame of the image is copied and converted to grayscale image to obtain a blur image. The next frame of the image is extracted from the video and it is also converted to grayscale image to obtain the blurring image. The background objects are removed by subtracting the blur image of the second frame by the blur image of the first frame. The edge of the obtained image is detected using threshold edge detection method which includes an assortment of numerical techniques that go for distinguishing focuses in an advanced picture at which the picture splendor changes pointedly or, all the more formally, has discontinuities. The focuses at which picture shine changes forcefully are commonly composed into an arrangement of bended line sections named edges. A similar issue of discovering discontinuities in one-dimensional signs is known as step location and the issue of discovering sign discontinuities after some time is known as change detection [4]. Edge discovery is a major apparatus in image processing, machine vision and PC vision, especially in the ranges of feature detection and feature extraction. The contours of the image are recognized. If the number of contours is zero, the next frame of the car is taken, and if the contour count is not zero, the largest contour is found. Contours can be clarified essentially as a curve joining all the ceaseless focuses (along the limit), having same shading or force. The forms are a valuable instrument for shape investigation and object detection and recognition. The largest contour is recognized first followed by the second largest contour to get the vehicle area. For better accuracy binary images are used and threshold or canny edge detection is applied before we find the contours. Contour tracing is one of numerous pre-processing strategies performed on computerized pictures keeping in mind the end goal to concentrate data about their general shape. Once the shape of a given pattern is separated, its distinctive qualities will be analyzed and utilized as elements which will later on be utilized as a part of pattern classification. Subsequently, revise extraction of the form will create more precise components which will build the odds of effectively grouping a given pattern [5]. A rectangle is drawn on the second largest contour and the width and the length of the rectangle is determined through which the actual width of the car is determined by;

$$width\ of\ the\ car = width\ of\ the\ rectangle \div scaling\_factor$$
$$scaling\_factor = rectangle\ width \div actual\ length$$

The car is grouped into three categories:

- Small car: where the width of the car is less than 90mm.
- Medium car: where the width of the car lies between 90mm and 130 mm.
- Large car: where the width of the car is greater than 130 mm.

Fig-1: The contour image of a car.

Once we get the actual size of the car, we check for the free slots in the parking lot that would match the estimated car size. If the slots are filled a “slots filled ” message is displayed and the next frame of the car that enters the system is taken, and if the slots are not free, the parking lot is checked again untill at least one slot free is available. The fee slot is made available only when a car leaves the system. That free slot is allocated to the car that enters the system. The Entry time of the car is the current system time. Once the vehicle enters the system;

- The slot number is generated as OTP,
- The slot is marked as filled,
- The car count in the parking lot is incremented by one,
- The next frame of the car that enters the system is obtained.

Whenever a car leaves the system;

- The OTP of the car is entered. If the enterd OTP is wrong, the "wrong password" message is displayed and the correct OTP needs to be entered.
- Once the OTP is valid, the car is allowed to leave the system. The ExitTime of the car is the Current System Time.
- The exact time the car was available in the system is calculated by taking the difference of the entry time with the exit time of the car.
  $time\_difference = Exit\_time - Entry\_time$
- Once we obtain the actual time_difference, the amount for the car is charged by;
  $charge = (time_{difference} * chargeperhour) \div 3600$
- The car count in the parking lot is decremented by one and the slot is marked as free.
- Again the next frame of the car that enters the system is obtained.

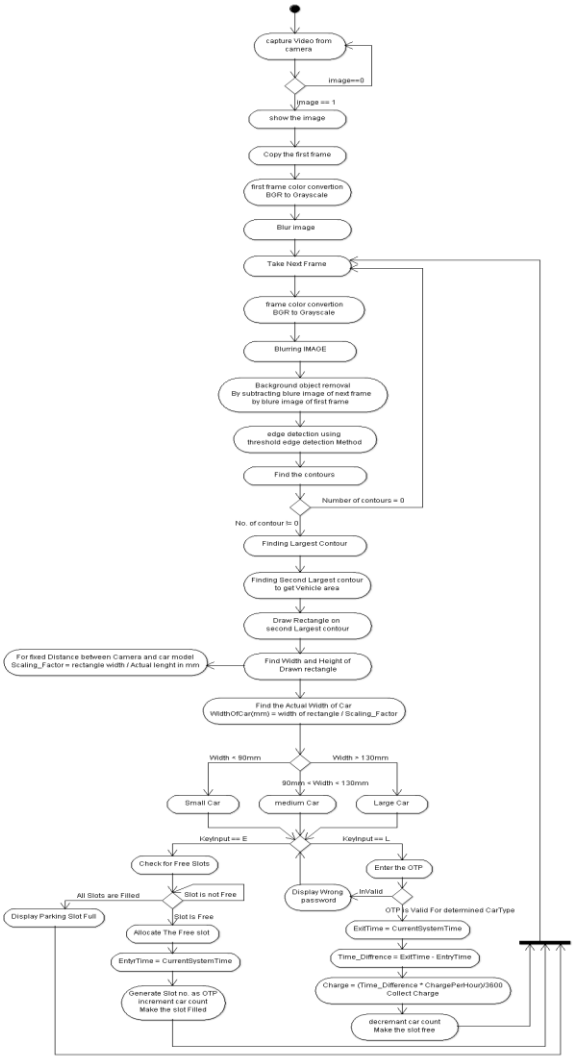

Fig -2: Flowchart that depicts the complete process.

4. CONCLUSIONS

This study shows the efficient use and method of the Smart Parking System in alleviating and solving the common problem of allocating parking space in busy areas in big cities such as shopping complexes, stadiums and other popular places, especially during their peak hour. The Smart Parking System also offers a better and more efficient alternative for car park management. By using Image Processing Technologies to determine the availability status of parking spaces the traffic congestion, noise, pollution, can be avoided to a minimal extent.

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