

SMART CAR PARKING SYSTEM

Rani Astya¹, Soni Jain², Sukriti Sachan³, Aish Aggarwal⁴

¹ Guide, Department of Computer Science and Engineering, School of Engineering and Technology, Sharda University, Greater Noida, Uttar Pradesh

^{2,3,4} Student, Department of Computer Science and Engineering, School of Engineering and Technology, Sharda University, Greater Noida, Uttar Pradesh

ABSTRACT - The aim of the paper is to provide a user-friendly, real-time and sustainable car parking system. Population in city is increasing multi-fold in present scenario, hence so are the number of car owners, which leads to need of an efficient car parking system which can be used by people at ease. There have been many good approaches earlier in order to contribute to the solution to this issue, but a considerable demerit is that many of them use a lot of hardware equipments which in turn leads to humongous expenditure and also when hardware is used considerably more, maintenance requirement also increases, also there is not an efficient monitoring system, which results in user wasting time to locate an empty slot amongst multiple parking lanes. In our approach we are minimizing use of hardware, along with we are using efficient and present age algorithms which can give maximum accuracy at a great speed, which will overcome the demerits of the current methodologies and can be used at a large scale so that the parking issues which are being faced can be curbed.

Keywords: Car Parking system, monitoring system, minimal hardware use

INTRODUCTION-

In recent years, the world's population has continued to increase, and the complexity of transportation has increased significantly. Due to the rapid increase in the number of vehicles during in recent years, searching for an empty parking space become a serious problem for drivers in dense city traffic areas. Currently, in many public places such as stadiums, market squares, hospitals, shopping malls and airports, there is an obvious shortage of free spaces for cars, so governments are striving to improve their existing transportation systems and infrastructure. Parking becomes one of them major problems facing cities, and increasing costs. An ordinary parking lot has many problems, such as how to control the number of cars inside, how to Monitor internal/external movement of Parking space, what are the safety measures

available in the parking lot. Well, our project helps users find parking spaces in a given architecture. The article proposes an intelligent car parking system that will help users solve the problem of finding a parking space and minimize the time spent searching for the nearest free parking. The purpose of this project is to solve these problems by designing a system parking lot with machines learning-based system that uses image processing and a camera to run the entire operation. The system is designed so that results are faster, more flexible and can meet market demands need. It can also meet the aggregate needs of valuable parking that can keep the car very carefully, there is also a high level of security and also reduces the wastage of fuel consumption. Only one input device is used for the entire operation. All we have to do is place this camera in the ideal position from where we can see every parking space. Thus, our approach uses minimal hardware so that our system is cost effective. Also, High level of security is provided as the cameras would be installed for the image capture.

Literature survey:

In the past, various parking systems were created. It is clear that car parking systems used in developed countries are implemented with advanced technologies in the parking lot. This section examines the various works carried out in smart car parking systems. Some existing parking systems are IOT based [1],[2],[3],[6],[15] has basically focused on the multi-storied parking areas along with the concept of Energy Conservation and Management. In IOT Based existing system some uses LED/RFID, some are GSM based and some are NB-IOT based. IOT based existing system saves the customers time, also user don't really need to wait as they will be notified for occupied as well as vacant spaces. But these systems requires lot of time to maintain and

uses a lot of hardware to implement. Some studies [9],[11],[14] focused on image processing and artificial intelligence consisting of various parts of detection stage of license plate, information processing control system, network and application. These existing systems presents a proposal for an identification and recognition system which provides a highly efficient system and can be used with respect to electronic toll, collection as well as the check points. The work [8] focuses on working on Iot and wi-fi technology providing a real time system. This parking system aims to ensure the user a real time reservation before the time of arrival. The proposed system has been worked out using mobile application connected to Wi-Fi. The system will be using infrared sensor in order to monitor the free parking spaces. Moreover, the study [4] has been focusing to locate a free parking slot in order to reduce the time of the user. The system proposes, collects and filters out the raw data further extracting features by applying filtering and fusion techniques in order to prevent the transmission of extra data over the network. The transformed data will further be sent on cloud in order to process and evaluate using the ML algorithms. The study [7],[12] based on cloud-of-things. These system has been designed as such to calculate the time from entry to exit, and consists of software as well as the hardware equipment's. The system has aimed towards using cloud computing along with the IoT providing a good and low cost storage capacity and the data stored there can be retrieved with the help of IoT providing the real time processing along with providing communication resources. Furthermore, the study in [12] aims for the single or multi floor parking spaces with the help of a partial automated system. The system also focuses to let the user reach the nearest parking slot via less traffic route. The IR sensors will help in detecting the available spaces, and the LED's will be indicating the path for the specified paths.

Proposed Approach:

Smart Car Parking System aims to solve these problems by designing a system to control the parking area using a machine learning-based system. This system is designed so that it results in faster, flexible, and can meet market needs. And it can also fulfil the total needs for valuable parking which can hold the vehicle very carefully and also with high security. The proposed approach focuses in the field of image processing as well as machine learning. The objective is to develop an efficient car parking system following certain major steps starting from research in the focused field, thereby collecting testing data for the implementation.

OpenCV is one of the widely used library in the field of detection and so will be using it for the purpose of detection followed by the implementation of confusion matrix in order to detect the efficiency for the algorithm as well. Moving forward, it'll be followed by marking of the slots in order to give access for the parking algorithm to work upon. This approach will move towards completion with testing and verification as per the requirements.

Training Phase:

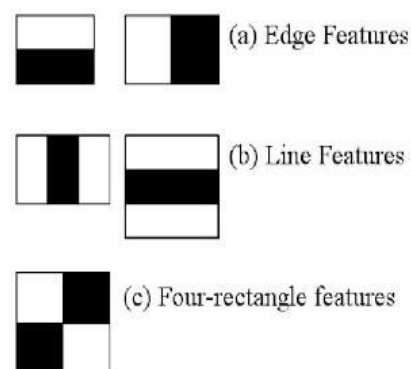
HAAR CLASSIFIER:-

For detecting the presence of vehicle we will need to train our classifier for detection of absence or presence of vehicle in the parking slot. For this purpose we are using Haar cascade classifiers which is an efficient and effective way for object detection. It is a machine learning based algorithm which makes use of positive and negative images in order to train the classifier.

Positive Images: These images indicate that the vehicle is present at the parking slot which means that the parking slot is occupied already.

Negative Images: These images indicate that the parking slot is empty and is yet not occupied by any vehicle.

OpenCV library is being used for implementing HAAR classifier training, HAAR features are represented by black and white rectangles, features are basically single values which are obtained by calculating delta which we can be found by subtracting the sum of pixels under white rectangles from the sum of pixels under black rectangles.



Advantages of HAAR classifier:

- 1) Classifier does not need a large amount of dataset to be trained, the work can be done in less amount of images as compared to

other classifiers which leads to less load on the software and less memory utilization.

It also has higher execution speed even if number of pixels are relatively large and also gives more accurate results.

Motion detection:

Training classifier

Histogram of Oriented Gradients is one of a descriptor being widely used in order to extract the features from the images and is mainly used in view of computer vision and majorly for the detection. The HOG descriptor is one of the finest descriptor as it does not only extracts the structure and shape of the items but also focuses on the edge direction. The feature of gradient helps a lot in the field of edge detection.

The HOG description takes place in different steps. In this project HOG descriptor is being used in order to subtract the background and detect the objects. Along with the HOG descriptor another concept being used is of the contour and the morphological operations.

Contours on an overview is simply the joining of lines to the points around the boundary of the image having equal intensity. It helps in the analysis of the shapes as well as in order to detect objects or motion. The concept of contour has been widely used in order to detect motion and can differ within the moving ones and the non moving ones as well.

Not only this, it also helps in segmentation of background as or the foreground as well. In this project, since we need to detect the moving vehicles and further have to differ between the parked cars as well as the vacant spaces that's why this model has been used in order to train the model and differ between both.

Morphological Operations is simply an operation being performed as per the shapes of the images, the pixels of the images are correspondent to the other pixels as well. Also, there are various kind of morphological operations, dilation erosion, open, close etc, which will be used in order to add or remove the pixels on the boundaries of the object.

Edge Detection:

In order to perform edge detection, the concept that has been used in this approach is of Laplacian operator, it has been widely used in order to find the edges in an image. This operator is different as compared to others because of its being a second derivative mask. This operator works on the basis of the gray level discontinuities.

The operator works different in both the phases, in the positive one it simply subtracts the image from the original one in order to get a sharpened image whereas in the negative it works opposite. This edge detection helps a lot while training the classifiers and the data for the motion detection.

Marking Parking Regions and detecting the parked vehicle:

The phase of marking the parking regions begins with the contouring first, and further followed by firstly working on creating polygon and collecting the coordinates in an yaml file, further with the help of the morphological kernel and contour concept, the marked parking regions will be numbered as per the requirements. The process will be followed by the concept of detecting the parked vehicles and the vacant parking spaces as well which will be then highlighted with the different colored rectangles as per the specification and the status being maintained for the rectangles as per the situation.

The morphological operations, contours and the laplacian operators will be used together in order to extract the difference between the vacant spaces, parked ones and the moving vehicles as well. The trained classifier for the parking regions and the cars will be used in order to keep the status for them and further motion detection will help in creating the rectangle for them and further change the color as per the upgraded status as well.

Conclusion:

With the research study and as per the proposed approach, the conclusion for the Smart Car Parking System-

- Existing systems either don't really use any technology, that is simply user have to find the empty spot for parking thereby wasting time and fuel as well, or most of the smart systems being proposed in multiple literature surveys are either using sensors or IOT based approaches.
- Proposed approach focuses to develop an automatic parking system thereby

fulfilling the requirements along with working on all the feasibility constraints.

- Proposed approach will start with research study followed by implementation, with the help of image processing and other algorithms.

References:

- [1] Prof. Denis Ashok(Ph.D),Akshat Tiwari,Vipul Jirge(2020),Smart Parking System using IoT Technology,2020 International Conference on Emerging Trends in Information Technology and Engineering(ic-ETITE)
- [2] Jahnvi Nimble,Priyanka Bhegade,Snehal Surve,Priya Chaugule,(2016) Automatic Smart Car Parking System, International Journal Of Advances in Electronics and Computer Science,Vol-3,Mar-2016.
- [3]ElakyaR,Juhi Seth,Pola Ashritha,R Namith(2019),Smart Parking System using IoT,International Journal of Engineering and Advanced Technology(IJEAT),Vol-9,October 2019.
- [4] Wael Alsafery,Badraddin Alturki,Stephan Reiff-Marganiec & Kamal Jambi.Smart Car Parking System Solution for the Internet of Things in Smart Cities
- [5] Praveen, M., & Harini, V. (2019). NB-IOT based smart car parking system. 2019 International Conference on Smart Structures and Systems (ICSSS).
- [6] Bonde, D. J., Shende, R. S., Kedari, A. S., Gaikwad, K. S., & Bhokre, A. U. (2014). Automated car parking system commanded by Android application. 2014 International Conference on Computer Communication and Informatics.
- [7] Chowdhury, L. H., Mahmud, Z. N. . Z., Islam, I.-U., Jahan, I., & Islam, S. (2019). Smart Car Parking Management System. 2019 IEEE International Conference on Robotics, Automation, Artificial-Intelligence and Internet-of-Things (RAAICON).
- [8] Jayakshei Dadaji Bachhav1; Dept. Of Electronics and Telecommunication, SNJB's COE, Chandwad,Maharashtra, India ,Prof. Mechkul M. A.2; SDept. Of Electronics and Telecommunication, SNJB's COE, Chandwad,Maharashtra, India," Smart Car Parking System", (IRJET), Volume: 04 Issue: 06 | June - 2017
- [9] Soundarya Rajesh, Dr. M.G. Sumithra, "Smart Parking system using Image processing", International Research Journal of Engineering and Technology(IRJET), Vol 05, Issue 04, Apr2018.
- [10] Balwant K. Patil, Avinash Deshpande, Sonal Suryavanshi ,Rudresh Magdum, Manjunath, "Smart Parking System for Cars", International Conference on Recent Innovations in Electrical, Electronics & Communication Engineering (ICRIEECE).
- [11] Jiang Ruili, Wang Haocong, Wang Han University of Electronic Science and Technology of China, Chengdu, China; Dr Eoin O'Connell Computer Science and Information Systems Department University Of Limerick; Dr Sean McGrath Electronic & Computer Engineering Department University Of Limerick, "Smart Parking System Using Image Processing and Artificial Intelligence", International Conference on Sensing Technology (ICST)-2018
- [12] Abhirup Khanna; Rishi Anand , University of Petroleum and Energy Studies (UPES) Dehradun, Uttarakhand, "IoT based Smart Parking System"; 2016 International Conference on Internet of Things and Applications (IOTA) Maharashtra Institute of Technology, Pune, India 22 Jan - 24 Jan, 2016
- [13] Bibi, N., Majid, M. N., Dawood, H., & Guo, P. (2017). Automatic Parking Space Detection System. 2017 2nd International Conference on Multimedia and Image Processing (ICMIP).
- [14] Jaspreet Kaur,(2019).Implementation of Smart Parking using Artificial Intelligence; Computer Science and Engineering, Patiala Institute of Engineering and Technology for women, Nandpur kesho. August 2019 IJSDR, Volume 4,.
- [15] Vinay Raj Tripathi, Dept. of Electrical & Electronics, KIET Group of Institutions,Ghaziabad;2020 International Conference on Electrical and Electronics Engineering (ICE3-2020).