iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** III **Month of publication:** March 2018

DOI: http://doi.org/10.22214/ijraset.2018.3649

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue III, March 2018- Available at www.ijraset.com

Smart Parking System

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Abstract: In current trend, parking area constitutes nearly most of traffic congestion is caused by vehicles searching around their destination and looking for a place to park. Due to this reason many day-to-day activities are affected such as fuel wastage, frustration to drivers, pollution etc. These factors motivated to pave a new method for smart parking system. In this method the detection is reliable, even when tests are performed using images captured from a different viewpoint. It also provides to design a highly reliable & compatible image segmentation measures for parking slot identification system
Keywords: Smart parking, Image processing, Vehicle, Classifier.

I. INTRODUCTION

In current environment there are many parking areas which use ground sensors to determine the status of the various parking spaces. This requires the installation and maintenance of sensors in every parking space. It is highly expensive, especially in wide area parking facility. There is an increase in number of vehicles used over the years it causes significant parking issues. There are various techniques for identifying the car parking space detection which involves effective management of parking lots. To overcome the disadvantages such as waste of time, fuel wastage, frustration to drivers, theft fear, pollution and limited space availability etc. These factors motivated to pave a new method for smart parking system. In today's trend nearly one fifth of the human population has their own vehicles to travel. They do not depend on public transport. In future this rate will increase definitely. Hence the rate of people using private vehicles becomes more with the increase in human population. Nowadays the construction of multiplexes, theatres, and shopping malls becomes high. During this time the search for an efficient system that could provide an effectively manage the parking of vehicles will be in need. By knowing the real-time availability of free parking spaces and communicating to the users can be of great help in reducing the queues, improve scalability, and the time required to find an empty space in a parking lot. Therefore, we propose a system which is highly desirable to have a quick and cost-effective way to track and guide drivers to available parking spaces. The proposed system uses cameras to monitor the vehicles that will provide efficient result for identifying parking spaces by using support vector machine classifier and it is cost efficient. It doesn't require more investment, maintenance
The smart parking system will provide an efficient solution to today's parking difficulties by proving parking lot and guiding them to park in the allotted parking lot.

II. RELATED WORK

The use of image-based approaches for vacant parking space detection has attracted considerable interest from the research community over the years. A review on smart car parking systems is available in the follow. Soomok Lee **,**Seung-Woo Seo proposed a paper which had the facilities such as ,it can distinguish the parking-slot availability of moving or small objects ,cost-effective reliable ,occupancy classification stage of the recognized parking-slots solves parking-slot availability classification issues in 2016. The given algorithm for vacant parking space includes a slot-validation step that identifies multiple slots in a probabilistic integration approach and has more flexibility on irregular patterns slot-occupancy classification stage, reliable parking-availability detection is achieved through visual slot features, including the Histogram of Gradient and frequency magnitude features, via a Support Vector Machine. But it had some defects like temporal information is not included, there is room for the improvement of slot-recognition shows the robustness.

In the year 2013, JunzhaoLiu **,**Mohamed Mohandes, Mohamed Deriche proposed this paper using the method Edge Detection ,Boundary Features Foreground and Background Method and provided some advantages in [2] like a cost-effective robust image-based vacant space detection system could be deployed both indoors and outdoors ,achieve robustness information will also be shown on display boards at the entrance of the parking building. But this method of edge detection, boundary features foreground and background method also lead to the disadvantages like inefficient when the color of the vehicle is very similar to the background, not provide parking vacancy information to drivers through mobile phones. The classifiers are not used for classifying the images. The security issue is not considered.

Another approach was suggested by P.Lu,X.Lin, H.Zhuin [3] 2009 proposed a paper using OBU- On Board Units, RSU-Road Side Unit, RSU's guard to detect the anomaly many RSU's, Trust Authority is used which thereby produced advantages like easy at peak hours ,no frustration ,no sensors, no theft. Some disadvantages are all vehicles must have OBU, no mechanism to track the stolen vehicle, which is driven away, over trust over Trust Authority Even if the vehicle is different from its position, it gives a warning, detection period is long.

Giuseppe Amato , Fabio Carrara, FabrizioFalchi, Claudio Gennaro and Claudio Vairo[4] suggested an approach in for the detection of car parking occupancy based on Deep Learning in 2016.The main advantage of this method is high accuracy and many benefits are present in the raspberry pie camera. It uses Convolutional Neural Networks to classify the parking space occupancy directly on board of a Raspberry Pi camera. But, it provides some inconveniences like even in presence of noise due to light conditions variation, shadows, and partial conclusions. Although it gives this much advantages in raspberry pi camera, it also has some disadvantages like an in-depth analysis of the performance in non-ideal situations such as night, foggy, or snowy conditions

Ms. Sayanti Banerjee , Ms. Pallavi Choudekar, Prof .M.K.Muju in [5]in this paper gives some advantages like cheap and easy-installed because of the simple equipment's in [5].This method was invented in 2011 that drivers can get useful real-time, parking lot information from this system by the guidance information display. It uses the steps like Image acquisition, RGB to gray conversion, Image enhancement, Image matching using edge detection. The disadvantages are Time consumption for processing the image takes place accuracy is less.

Kaarthik. K, Sridevi. A, Vivek.C in [6] suggested the usage of matlab for the image processing for parking slot detection .Some of its advantages are the camera can be used to sense the empty space through video image detection, noise can be removed with the help of a technique called Morphology, Exact Edge and outline Boundaries of an Image is obtained in image processing for parking slot detection. The concluded disadvantages are when the object is moving at high speed it is a tedious jobto take snap on that image, Sensors can be problem.

ImenMasmoudi , Ali Wali, AnisJamoussiand Adel M. Alimi in [7] suggested a Vision based Vacant Parking Lot Detection which had the facilities such overcome the problems of changing lighting and shadow effects better the performance of our approach we introduce a new transitional state "Transition" which represents the passing of a vacant parking space. The method suggested here is combination of the Adaptive Background Subtraction, algorithm and Speeded up Robust, Features algorithm. Although it produces some disadvantages like suffering in case of unexpected scenario like the presence of pedestrians or the inter objects occlusion.

Hilal Al-Kharusi**,** Ibrahim Al-Bahadly in [8] derived an Intelligent Parking Management System Based on Image Processing. This method contains some advantages that overcomes the defects by the automatic parking system is used to make the whole process of parking cars more efficient and less complex for both drivers and administrators. They proposed the method of Intelligent Parking Management System. But it produces some defects like current limitation in this paper is the weather conditions.

In Identifying Parking Spaces & Detecting Occupancy suggested by Xiao Ling**,**Jie Sheng, Orlando Baiocchi in [9] provides the advantages like city-wide parking management system can be quickly deployed at low cost by using machine learning technique named as vision based IOT that dynamically identify the parking spaces without any manual specification**.** Its disadvantages can be grouped as camera-based parking space occupancy a system at night time is challenging.

III. METHODOLOGY

A. System Architecture

Figure1shows the parking slot identification and security for the detected vehicle as a step by step process flow chart and the first step of the process begins with the Image processing denotes a processing step transforming a source image into a new image which is fundamentally similar to the source image, pre-processing results in changing the brightness of individual image pixels. and segmentation is applied to subtract the foreground image from a corresponding reference background image and decompose the image into regions that correspond to objects. In second step, the shape feature extraction is performed in order to obtain the exact shape of the vehicle. It is useful in classifying and recognition of images. The third step, classifier is used for the detection of available spaces.

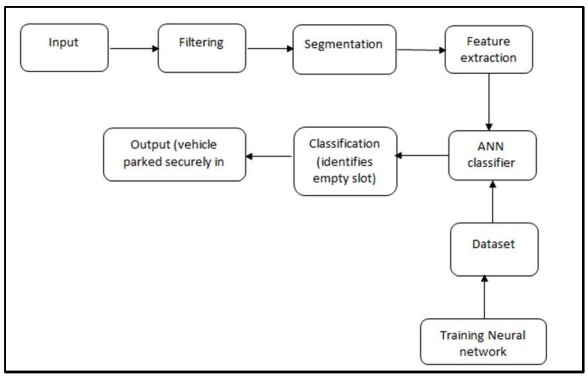

Fig 1 System architecture

B. Segmentation

Segmentation is the process of separating wanted regions from unwanted regions. We exclude distant regions by specifying an ROI for each camera based on the values the region occupied by the vehicle is extracted .The segmenting process is purely based on the intensity values and the edges are marked. The Region of Interest is usually determined on the basis of pixel intensity values or user-determined areas. Pixels are a region that is similar according to some homogeneity criteria such as intensity and textures so as to locate and identify objects and boundaries (lines, curves, etc...) in an image. Segmentation is used to partition the image so that each pixel in the image can be identified easily. Segmentation is done to identify the edges and boundary of the objects. Segmentation is carried out in two steps, they include edge detection and thresholding. Based on the intensity at the region boundaries the edges are identified. Thresholding is the simplest technique of segmentation. Here the threshold value is computed by using some techniques such as k-means clustering or maximum entropy method based on the threshold value the image is segmented as shown in Figure 3.

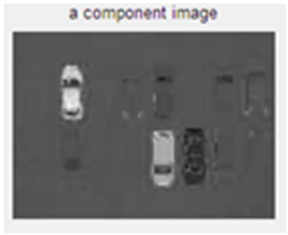

Fig 2 Input Images

Fig 3 Segmented Images

C. Shape Feature Extraction

In order to reduce the amount of data, an image is represented using a set of features. Feature extraction technique is applied to get the exact specific shape of the processed image this is very useful in classifying the regions based on the attributes such as area eccentricity, centroid, convex image, orientation, extent, perimeter etc.. Among these various features only selected features are extracted that helps us to identify the shape of the vehicle as shown in Figure 4.The Grey Level Co-occurrence matrix (GLCM) is one of the feature extraction techniques. GLCM is a tabulation of how often different combinations of pixel brightness values occur in an image. This gives the deviation present in the image when compared with original image by predictive image. After computing the grey level co-occurrence matrix M [i, j] that considers the relationship between two neighboring pixel, the first pixel is known as a reference and the second is known as a neighbor pixel then the features such as contrast, correlation and homogeneity can be computed.

Principal component analysis (PCA) is method that is used to reduce the information contained in a large number of original dataset into a smaller set of new composite dimensions, with a minimum loss of information. So we used the PCA to identify the directions of maximum variance in the 360-dimensional contour vector. It takes the input as the dataset with the matrix dimension M × N and produces an output of Eigen Vectors that carries the essential coefficients that are needed as the input for the classifiers.

```
Area: 50463
MajorAxisLength: 308.3050
MinorAxisLength: 218.2384
Eccentricity: 0.7063
EquivDiameter: 253.4788
Extent: 1
Perimeter: 908
```

Fig 4 Attributes Extracted

D. Classifier

The neural network dataset contains images taken in different light condition that make the occupancy detection task more difficult. The proposed dataset has been manually and exhaustively annotated and made available to scientific community for defining new algorithms for car park occupancy detection. SVMis rarely used for predictive modeling. The Artificial Neural Networks (SVM) usually tries to over-fit the training dataset. SVM is generally used in situations where the already appeared situations are collected and trained to classify the future appearance the same situations. The network consists of a topology graph of neurons, the inputs is carried on the in-edges and sends the output on its out-edges. The inputs and outputs are weighed by weights and shifted by bias factor specific to each neuron.

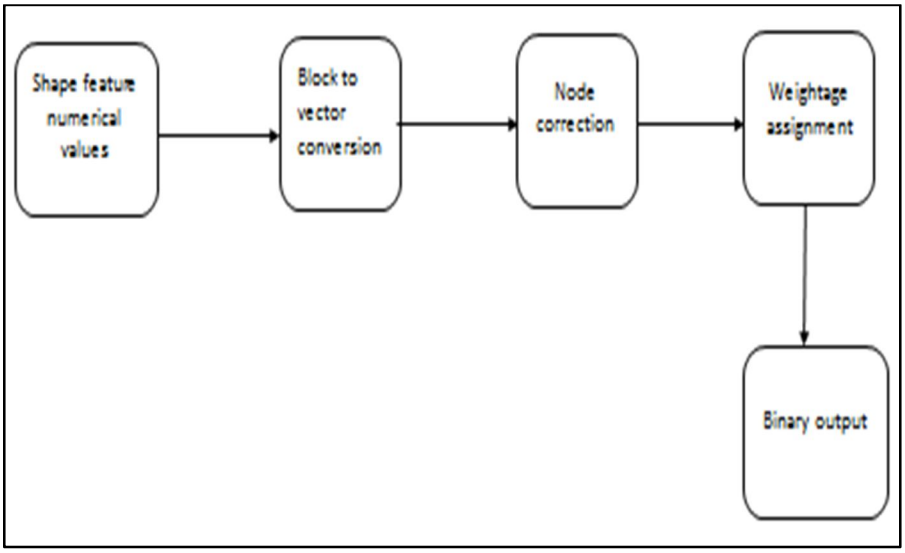

Fig 5 Block Diagram of Classifiers

IV. RESULTS AND DISCUSSION

There are several methods that are used in the detection of empty parking slot. We evaluated the performance and the accuracy provided by our system comparing to other techniques it provides an accuracy of 93% and an additional security by auto theft alarm system. When the vacant parking space is detected the user get notified by voice commands that direct the user to the required parking slot .Here the performance of the proposed system is analyzed as follows.

TABLE I

PAPER NAME	ACCURACY
IDENTIFYING PARKING SPACES & DETECTING OCCUPANCY USING VISION-BASED IOT DEVICES	91%
REAL TIME CAR PARKING SYSTEM USING IMAGE PROCESSING	62%
A CLOUD-BASED SMART-PARKING SYSTEM BASED ON INTERNET-OF-THINGS TECHNOLOGIES	78%
AN INTELLIGENT SECURE AND PRIVACY-PRESERVING PARKING SCHEME THROUGH VEHICULAR COMMUNICATIONS	51%
SMART PARKING SYSTEM	93%

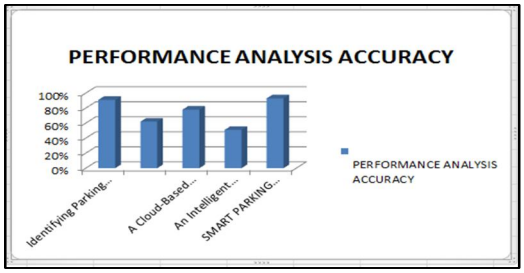

Fig 7 Performance analysis

V. CONCLUSION

In this paper, we have presented a Smart parking system for identifying the parking slot by using classifiers and an auto theft alarm system to provide security for the vehicle. We have collected images from different angle of incidence and a trained data set is provided to the classifiers hence it is very efficient if the cameras are placed anywhere inside the parking area. If infinite numbers of training set are trained then this technique can be widely used in all parking areas. We have also tested our approach using a test set produced with a camera placed in a different place (viewpoint and perspective), with respect to the training set.

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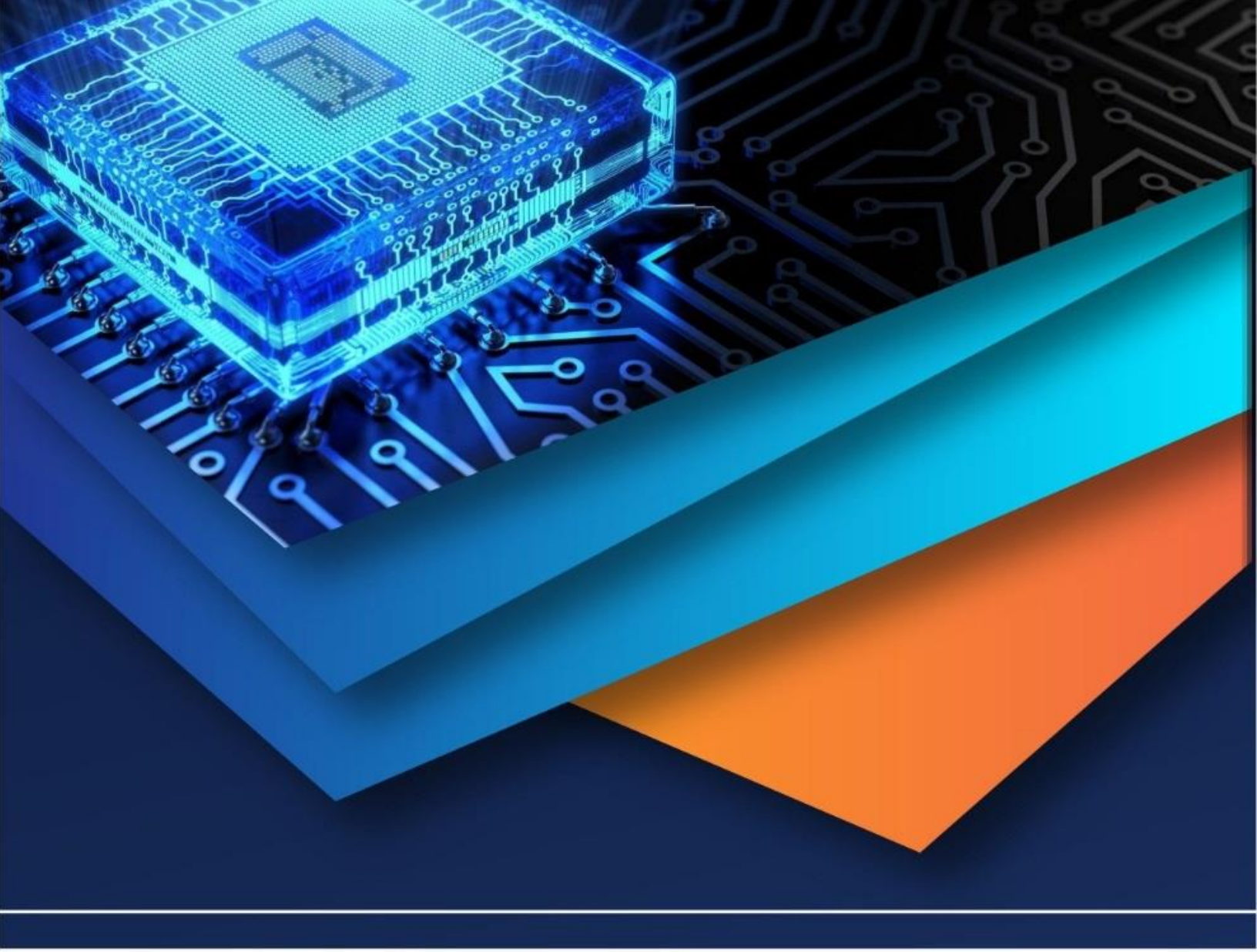

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