



# Machine perceiving smart vehicle parking detection using image processing system

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## Abstract

Scope of this project is to provide a safe working environment to the drivers. The driver will get frustrated for waiting for allocation of parking space. Our project will help to identify the exact parking area without any difficulties by sending SMS to the specific driver. In our project we can able to view the parking area using CCTV Footages. The scope of future enhancement in smart parking system for improved efficiency in allocating a particular slot & intimate the information to the particular driver. improvement is identifying injuries for multiple person at a time and giving solutions.

In some of the parking areas are lacking such facilities and hence fail all the security norms necessary to park a vehicle. By looking such a huge concern it is highly required that each and every parking areas should be well equipped with high tech parking control systems, that nevertheless lasts the best. These innovative parking control systems not only make a bright choice but also allow you to pay the right price without getting any worry.

Key Terms: CNN – Convolutional Neural Network, GPU – Graphical Processing Unit, GUI – Graphical User Interface

## 1. Introduction

The primary intent of this paper is to implement smart parking slot to reduce the congestion of traffic in urban areas. The main concept comes under image processing, which uses images of the parking area to point out the empty slots with the help of CCTV footages.

Our project will facilitate reading and the use of digital systems that are growing rapidly. The image processing for car detection is performed on Python Pi interfaced with the Firebase cloud platform through an API.



## 2. Literature Survey

Imam Muhammad and Hakin David Chirstover proposed a smart parking system with automated car detection is required so that the car drivers would have minimum effort and time to access the available parking location. This paper presents an implementation of image processing based smart parking system using Haar-Cascade method. The aim of this project is to develop a smart parking system on a single-board computer and a camera installed at a parking area.

Athira A and Lekshmi S made a successful implementation of smart parking systems can effectively reduce a lot of problems related to traffic congestion in urban areas. Wastage of fuel and time in search of a vacant parking space will be significantly reduced and the complete utilization of the available parking areas can make our cities really smart. Parking slot detection and user notification are the two major sections of a smart parking system. The empty parking space detection was initially done by deploying a number of sensors in the

parking lot. It is highly expensive and complicated to install.

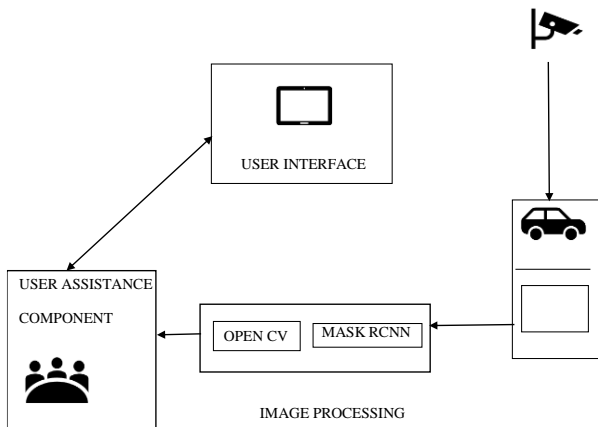
Tom Thomas and Tarun Bhatt proposed an automatic system that counts the empty spaces in a parking lot, by giving the image of the parking lot as the input. The output will be obtained as a display on the output console. this paper proposes a classifier, which is a Convolutional Neural Network that is capable of finding if the parking lot is occupied or not.

Wael Alsafery and Badraddin Alturk proposed that the Internet of Things (IoT) is able to connect billions of devices and services at any time in any place, with various applications. Recently, the IoT became an emerging technology. One of the most significant current research discussion topics on the IoT is about the smart car parking. A modern urban city has over a million of cars on its roads but it does not have enough parking space.

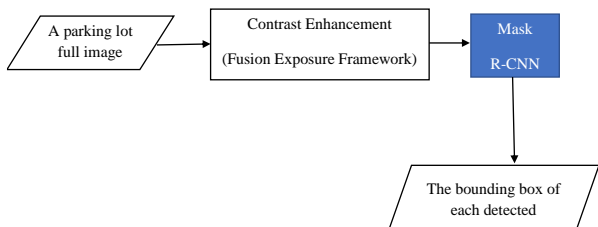
## System Design

In our proposed system, we assign the location of each parking space by a unique number to each and every parking slot. As we mentioned before, a camera is needed

at the parking area, it is placed in a way that it will capture entire slot number in a singleframe.



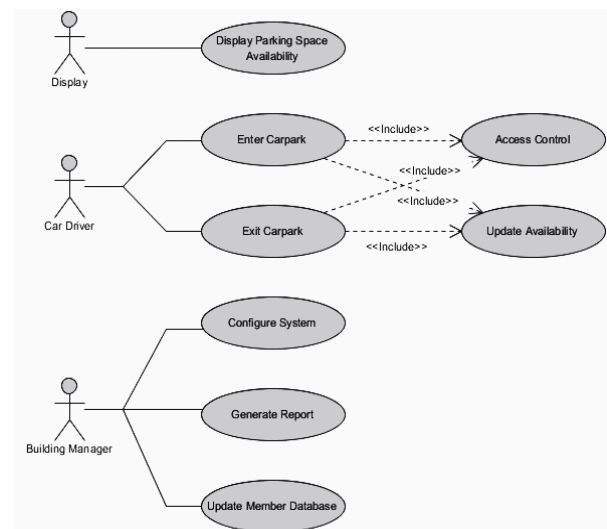
A Convolutional Neural Network (CNN) is the foundation of most computer vision technologies. Unlike traditional multilayer perceptron architectures, it uses two operations called ‘convolution’ and pooling’ to reduce an image into its essential features, and uses those features to understand and classify the image.



Open cv (open-source computer vision library) is an open-source computer vision and machine learning software library.

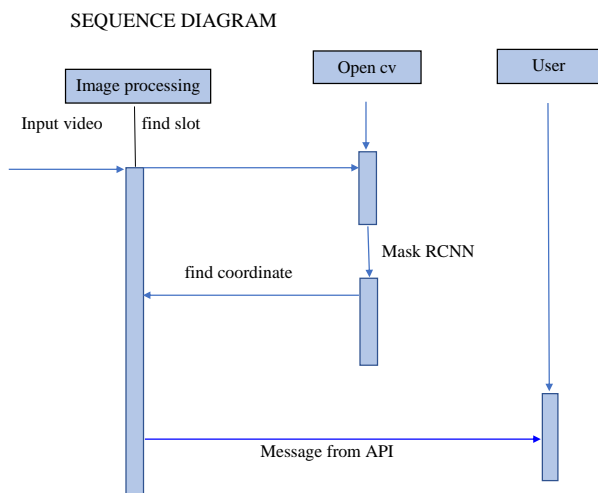
Open cv is a cross platform library using which we can develop real time computer vision applications. It is an open source for image and video analysis. It extracts Particular area, which coordinates the Mask RCNN.

Use object detection to identify all cars and then check if the location of the car overlaps with a parking spot. But using Open CV for this purpose we detect only 30% of the cars. To overcome this factor, we use Mask R-CNN (Regional convolutional neural network). Since Mask R-CNN uses masks for training classes, we used bounding boxes to create masks.



TensorFlow uses GPU computing, automating management. It also includes

a unique feature of optimization of same memory and the data used.



NumPy is often used along with packages like SciPy (Scientific Python) and Matplotlib (plotting library). This combination is widely used as a replacement for MatLab, a popular platform for technical computing. However, Python alternative to MatLab is now seen as a more modern and complete programming language.

It is open source, which is an added advantage of NumPy.

## 2. Implementation

Mask RCNN is a deep neural network aimed to solve instance segmentation problem in machine learning or computer vision.

There are two stages of Mask RCNN. First, it generates proposals about the regions where there might be an object based on the input image. Second, it predicts the class of the object, refines the bounding box and generates a mask in pixel level of the object based on the first stage proposal. Both stages are connected to the backbone structure.

Loading the image data:  
`img=cv2.imread('parking.jpg',1);`

`#Reading the image`

Initiating the region of interest selection process:

`r=cv2.selectROI (img);`

`#Storing the region of interest into r variable`

Creating the target image by using the portion of the image.  
`sub_img=[int(r[1]):int(r[1]+r[3]),int(r[0]):int(r[0]+r[2])] #Generating a separate image out of the r variable`

Count the number of pixels from the frames:

`pix=cv2.countNonZero(img)`

#Counting the white pixels of frames and storing them into pix variable

Validating the spot as either free or occupied:

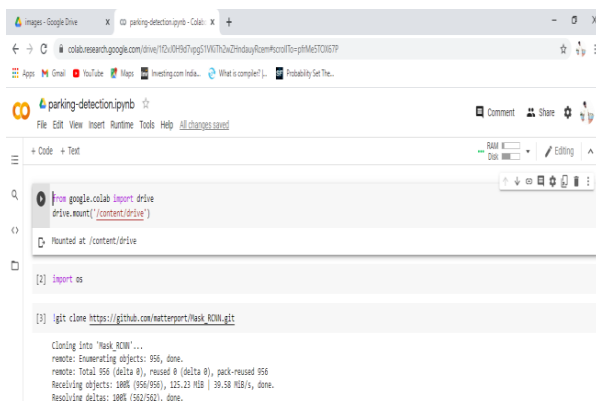
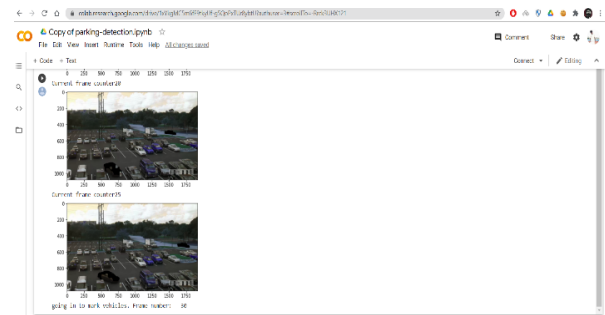
if pix>1500:

#draw a red rectangle if the number of pixels exceeds 1500 cv2.rectangle(img, (int(r[0]), int(r[1])), (int(r[0] + r[2]), int(r[1] + r[3])), (0, 0, 255), 3)

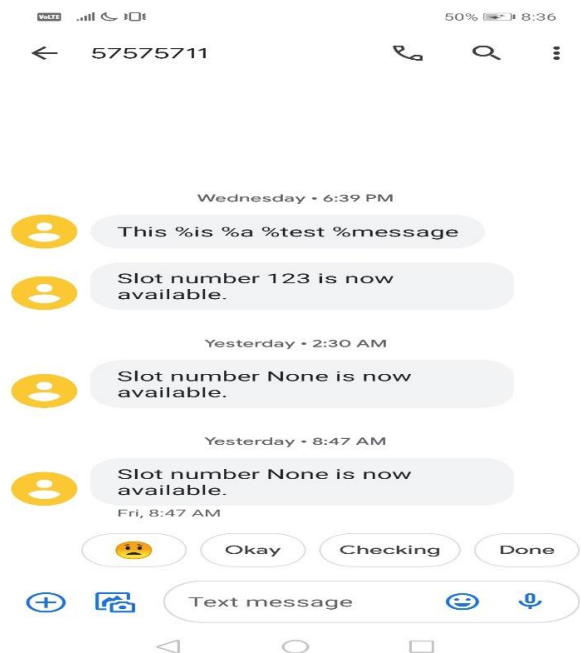
else: cv2.rectangle(img, (int(r[0]), int(r[1])), (int(r[0] + r[2]), int(r[1] + r[3])), (0, 255, 0), #draw a green rectangle if the number of pixels is bellow 1500

Fast2SMS is a popular bulk SMS service provider in India. Famous for its performance driven messaging services, we can expect a high-quality SMS service from them.

Internet and sends data to a server. The server then retrieves that data, interprets it, performs the necessary actions and sends it back to our phone. The application then interprets that data and presents the information you wanted in a readable way. This is what an API is - all of this happens via API.



When we use an application on our mobile phone, the application connects to the





## Conclusion and Future Enhancement

To reduce traffic congestion in parking areas, the proposed system uses machine learning technique to enhance parking functionalities.

The technique uses R-CNN to detect the parking images i.e., Vehicles, which is based on image processing, when two cars are parked close to each other the camera detect it as a single car, R-CNN is used to overcome this factor.

This model can be applied in many fields by applying conditions based on the requirements. Training the model with custom datasets can enhance the on the Prediction probability of the model.

Usage of TPU (Tensor processing unit) instead of a GPU can drastically increase the training speed and accuracy. The console command output can be used as the condition parameters parking lot.

## References

1. Donald. C. Shoup, "The High Cost of Free Parking", Chicago:Planners Press, American Planning Association, 2017.
2. Praveen Meduri, and Eric Telles "A Haar-Cascade classifier based Smart Parking System. International Conference. IP, Comp. Vision, and Pattern Recognition. 2018.
3. Gulraiz Khan, Zeeshan Tariq, and Muhammad Usman Ghani Khan. Multi-person tracking based on faster r-cnn and deep appearance features. In Visual Object Tracking in the Deep Neural Networks Era. IntechOpen, 2019.
4. A. Awan S. Agarwal and D. Roth. UIUC Image Database for CarDetection. <http://cogcomp.cs.illinois.edu/Data/Car/>, 2004. [Online; accessed 29-April-2019].
5. T. Lin, H. Rivano and F. Le Mouël, "A Survey of Smart Parking Solutions," in IEEE Transactions on Intelligent Transportation Systems, vol. 18, no. 12, pp. 3229-3253, Dec. 2017.
6. R. Grodi, D. B. Rawat and F. Rios-Gutierrez, "Smart parking: Parking occupancy monitoring and visualization system for smart cities," SoutheastCon 2016, Norfolk, VA, 2016, pp. 1-5.