Intelligent Parking System

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Abstract:

Finding a parking spot has become esoteric in today's environment. Individuals who live in metropolitan regions by and large waste time searching for a parking space for their own vehicle. In the meantime, fossil fuel by products hurt the climate and result in fuel squander, the two of which clients and nature should bear. Because of the extensive use of smartphones, application-based service solutions have emerged. After considering all of these factors, we've come up with a solution that will help to solve the problem to some extent. Our report shows a beginning to end plan that we have done with the help of an adaptable application. It will help people to find nearby parking spots using various filters users can make choices on their own.

Introduction:

In the current context, private automobiles are witnessing a tremendous boom as a result of past centuries' modernism. People pay no attention to the reverberations of vehicles on the society and environment. All of these resolutions have negative consequences for the environment. Earlier there was no such awareness about global warming but as the use of vehicles is growing

exponentially and it has been an alarming problem at a global level. It leads to a variety of problems such as traffic congestion, damaging air quality, and wastage of the world's oil every day. This shows to advancement of an answer that can beat all such unsafe impacts partially so it doesn't hurt nature and individuals in the public eye. As people's expectations rise, the lack of well-structured infrastructure and solutions will exacerbate the current situation. Finding a parking spot for a specific time has become quite difficult. People usually reach the parking area sometimes find no space and have to search repeatedly for a long time. It becomes quite tedious when you arrive in an unknown location. There has been some small change in society as a result of government agencies' initiatives such as campaigns.

There are some initiatives taken by global organizations to develop smart cities and some of them already progressing at a fast pace. Considering shrewd city applications, a smart stopping framework assumes a critical part beginning from tracking down parking spots, looking at parking spaces, working out distance, assessed costs, and so forth. To decide this issue, we have return up for specific movements in ancestor spread out structures to surrender this detriment a contemporary reaction that is property and basic. As an outcome, it is very difficult to develop a system that makes real-time allocation, and many use cases need to be taken into consideration before building a product that aims to resolve it. To achieve this plan, we isolated this issue into modules so it turns out to be clear to appreciate and cultivate tests for something almost identical. We implemented different activities starting with User Registration, User Verification, Maps Module, and User support, Booking Module, Filters, and Routing to destination. In addition, we created a number of algorithms to provide customers with a seamless experience in finding a parking space in a nearby location and the option of reserving that place for a period of time. a stipulated amount of time. Solving this problem with a traditional approach was

quite difficult so we incorporated new techniques to give address this problem with a modern solution.

RELATED WORK:

The brilliant halting framework makes use of a variety of enhancements. There are recorded beneath with some short portrayal of every strategy.

(a) Wireless sensor systems-based frameworks

The materials that go with it discuss the WSN-based stopping structure, which is a type of framework that uses sensors to monitor natural circumstances and is popular in the intelligent community because of its simplicity. sensible cost of installation and design. The design utilized for cross bow items is that they have lower unit costs.

(b) Intelligent halting frameworks in view of vehicle-to-establishment correspondence (V2I)

(c) Frameworks for smart halting that rely on global positioning systems (GPS)

Worldwide Positioning Systems (GPS) development is utilized to decide and follow the specific piece of a vehicle. It is used to offer data on access to destinations and parking spots in this area. This method is proposed to show a part based structure called NAPA.

(d). Savvy halting systems subject to RFID advancement:

The presence of a car or other objects is detected using RFID sensors. The system must be able to alert drivers regarding a parking spot being occupied after a car has been recognised. The downside is that the parking spot will only be identified in close proximity because there is no GPS sensor to search for parking slots from afar.

(e) Other cross sort Algorithm based, M2M, IOT Systems

We have implemented a smart parking system which uses the cloud based IoT architecture for smart parking system

Reference: http://www.ijstr.org/final-print/jan2020/An-Analysis-Of-Smart-Car-Parking-Management-System.pdf

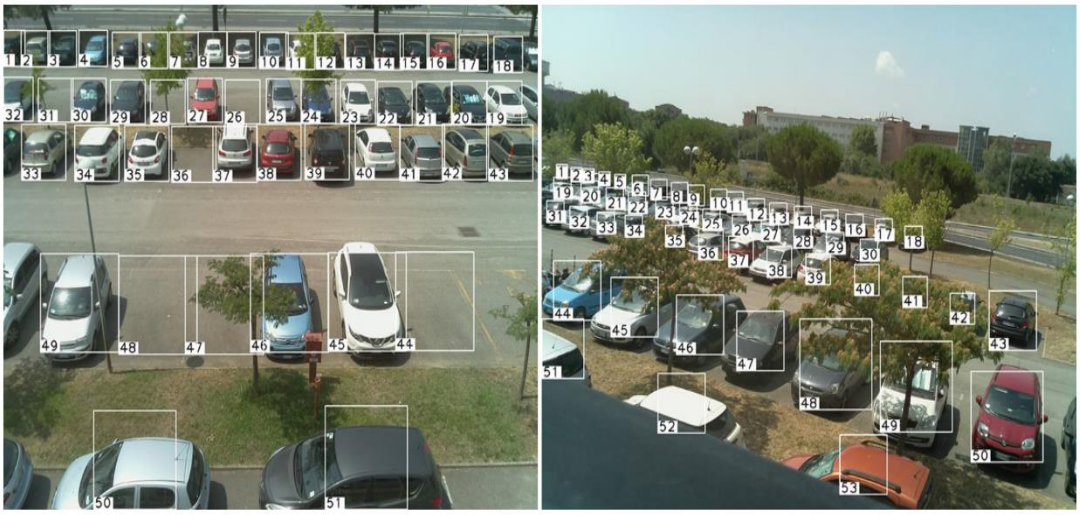
https://www.ijert.org/research/Review-Paper-on-Smart-Parking-System-IJERTCONV7IS08017.pdf

Keywords: intelligent parking system, image detection system, management information system, license plate recognition, CCTV, sensors.

1. Problem Specification

1.1 Dataset:

camera	datetime	day	hour	image_url	minute	month	occupancy	slot_id
A	20150703_0805	3	8	CNRPark/A/free/20150703_0805_1.jpg	5	7	0	1
A	20150703_0810	3	8	CNRPark/A/free/20150703_0810_1.jpg	10	7	0	1
A	20150703_0815	3	8	CNRPark/A/busy/20150703_0815_1.jpg	15	7	1	1
A	20150703_0820	3	8	CNRPark/A/busy/20150703_0820_1.jpg	20	7	1	1
A	20150703_0825	3	8	CNRPark/A/busy/20150703_0825_1.jpg	25	7	1	1
A	20150703_0830	3	8	CNRPark/A/busy/20150703_0830_1.jpg	30	7	1	1
A	20150703_0835	3	8	CNRPark/A/busy/20150703_0835_1.jpg	35	7	1	1
A	20150703_0840	3	8	CNRPark/A/busy/20150703_0840_1.jpg	40	7	1	1
A	20150703_0845	3	8	CNRPark/A/busy/20150703_0845_1.jpg	45	7	1	1
A	20150703_0850	3	8	CNRPark/A/busy/20150703_0850_1.jpg	50	7	1	1
A	20150703_0855	3	8	CNRPark/A/busy/20150703_0855_1.jpg	55	7	1	1
A	20150703_0900	3	9	CNRPark/A/busy/20150703_0900_1.jpg	0	7	1	1
A	20150703_0905	3	9	CNRPark/A/busy/20150703_0905_1.jpg	5	7	1	1
A	20150703_0910	3	9	CNRPark/A/busy/20150703_0910_1.jpg	10	7	1	1
A	20150703_0915	3	9	CNRPark/A/busy/20150703_0915_1.jpg	15	7	1	1



Fields of view of the two cameras (A, B) of the **CNRPark subset**.

The dataset addresses the visual inhabitancy identification of parking areas. In the dataset, we had the data about the cameras that is used in detecting the license plates and type of vehicle. It additionally contains data about the date and season of when the vehicle is left in the leaving opening and when it left the leaving space. It will help to determine the availability of parking slots.

1.2 Problem Analysis:

This system is entirely hooked in to the web and makes in depth use of the network. It also relies on the cameras, sensors, and display unit's autonomous analysis system. Since this framework collaborates with online course observing frameworks like Google Maps and others, it should be associated with a higher-speed organization. The following are some additional challenges:

- The major challenge in implementing the Smart parking systems is of system integration due to wide variety of hardware and software platforms involved and hence possess a great threat or concern to the system scalability

- The technology platform supporting those systems which comprises of a myriad of hardware sensors, dynamic messaging systems and traffic control devices, wireless, computer clients, servers, hardware drivers and application interfaces.
- Enabling all these devices from thousands of different vendors to communicate and tying them together into one platform is the greatest challenge in reducing the cost and complexity of smart parking. Electronic payment manufacturers are another important aspect. The variety of infrastructure hardware and software systems that need to be integrated is large and adds to it. For a comfort expense, some instalment processors supply grant based electronic instalment. Many of these hosted solutions rely on scalability, or the transaction processor's capacity to cover a wide range of geographical, market, and service sectors at low cost.

2. Design and Milestones

2.1 Proposed Method:

When customers use this upgraded parking system, they encounter a variety of conditions. The following are two possibilities that will be discussed:

First Scenario:

The guest comes to the per client's requesting for a ticket before this guest goes to the block he/she could see the bulletin out which is related with the system, it is shown whether there is an open park or it's at this point full. If it's full then they'll visit another barrier, maybe they're going to the barrier already and request for a price ticket, during this case, the parking area is full, in this

way the peruse will give them a ticket without park ID and permit them to leave in somewhere around a short ways from the leave boundary. If the parking lot isn't full, the guest will ask the reader for a ticket.

Ticket generation requires two processing

- Check an accessible park and add its ID to the ticket.
- The CCTV on the barrier takes a picture of the car plate and sends it to the server

The server will utilize the plate acknowledgment framework to extricate the vehicle number and added to the ticket.

Later on, we will talk about the utilization of this number in dealing with the vehicle leave, from that point forward; the ticket will be produced including the vehicle plate number and the particular park ID 362.

The barrier will then open, allowing the driver to pass through to his or her parking spot, and the mission will be done.

Second Scenario:

If the guest arrives at his park and discovers that someone else has parked there, the guest will proceed to the next reader fine reader and insert his ticket into the reader.

The reader will take the following two steps:

- The first action that the reader makes is to order the CCTV for the specific park, take a picture of the plate of the violation car, the plate recognition, and analysis plate, and charge a fine on the ticket that has the same car plate number

- ❖ Issue a new car park ID hence he/she may space be able to have a new car park for parking

The guest will return to his park, and the assignment will be finished.

Third Scenario:

If the parking lot is filled, the reader will issue a new ticket without a number, allowing the gusset 20 minutes to exit the lot areas, with minimal cost.

2.2Data Processing:

The Intelligent Parking System's data flow is represented in the diagram below.

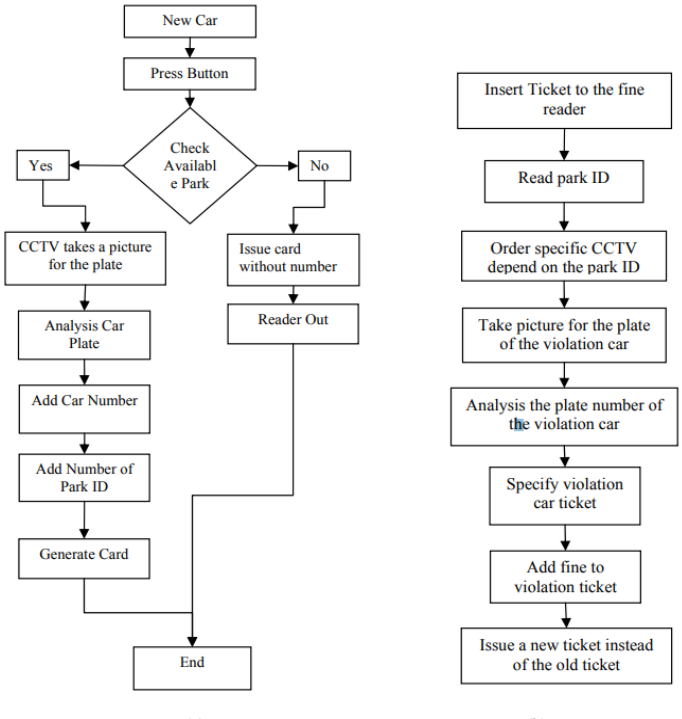


Fig: Flowchart for Intelligent Parking System

2.3Experimental Settings:

An examination drove with an age worth can show up at a precision extent of 40-half. By ever-changing associate epoch worth to one hundred underneath smart lighting conditions associate accuracy of 80- eighty fifth will be achieved. Previously, the detection rate employing a digital camera was as low as 50-60%, mistreatment Deep Learning-based Region of Interest choice algorithms, and also the detection rate was multiplied to eightieth. For text recognition in Vehicles License plate this system is capable of identifying all character fonts of different sizes.

2.4Validation Methods:

Validating intelligent parking system plays a major role. Without validating, they might cause very costly errors. Intelligent parking systems can be validated in a number of ways.

Intelligent parking systems are highly valuable for new drivers since they can reduce the number of accidents that occur during the parking process. As a result, they are extensively employed. Parking assistance systems, remote control parking systems and valet parking systems are all examples of intelligent parking systems, but the related test and evaluation standards for remote control parking There are few worldwide applicable test and evaluation methods for systems and valet parking systems, and there are few globally applicable test and evaluation methods. This research looks at the technological elements of today's intelligent parking systems, discusses the testing and evaluation technique for parking assistance systems, and

develops a realistic assessment standard and test scheme. The analysis criteria and check procedures are valid in parallel parking conditions.

The suggested evaluation markers for stopping execution, stopping proficiency, stopping security, and different regions of full assessment in this review include stopping search capacity, stopping productivity, pose subsequent to stopping, and driver's ability to take over.

This study examines intelligent parking systems based on several perceptual systems and presents a way for creating test scenarios for each system.

The VBOX device is utilised in this study to verify the evaluation index test method given in this paper, and the experiment introduces the VBOX usage method. The test results are also analysed.

Limitations:

Construction costs per square foot are greater.

The expense of using redundant systems will be higher.

For new users, it may be a little perplexing.

It is not suggested for facilities with a large volume of traffic during peak hours.

There can be apprehension over a breakdown (How will I get my car out?).

The assessment and approval process of the building department is unreliable.

It necessitates a contract with the supplier for maintenance.

Future Work:

A smart parking system based on slot booking is being developed using Android software. Using the slot allocation method, we may book our own cheapest parking spot. It is a useful tool for resolving parking issues, as it reduces traffic congestion and allows for automated billing.

2.5 Results and analysis

The results of this study are based on two algorithms, MaskRCNN and Yolo-V5, for classifying parking slots as free or occupied. We tested this technique on two datasets: the PKLot Dataset and the CNRpark Dataset. The performance, efficiency and evaluation are done in three parameters- Precision Score, Recall Score and F1 score. The algorithm's efficiency is proportional to the value of these parameters. The dataset includes images of both free and occupied parking spaces. The dataset is split in an 8:2 ratio for training and testing purposes. 80% of images are used for training and 20% for testing. We were able to gather very precise data and provide it in the form of tables and graphs.

PKLot

MATRICES	MaskRCNN	YOLO-V5
TP	5946	5815
FP	511	642
TN	5803	5861
FN	156	98

Metrics for PKLot Dataset

Reference: https://www.ijert.org/an-elaborative-study-of-smart-parking-systems

3. Project Management

3.1 Implementation Status Report

3.1.1 Work Completed:

We completed the work and implemented our intelligent parking system in a real-time scenario.

3.1.1.1 Description:

Our intelligent parking system needs various sensors to identify and collect information such as text and numbers on the license plate, and the type of vehicle. We also need to install CCTV cameras, check the availability of parking slots, and generate parking IDs because they play a vital role in detecting whether the parking slots are accessible or not, and the information gathered by sensors help to make a continuous computerized stopping map.

3.1.1.2 Responsibility:

The prominent task in implementing our system is to detect whether the parking slots are available or not and to navigate the drivers to the most convenient parking spot by using LED displays. We need to guarantee that the IoT gadgets like sensors and cameras are working precisely.

3.1.1.3 Contributions:

We are a team of two members working consistently to complete the project in the desired time. We are putting our efforts into building better intelligent parking systems that provide accurate outcomes. We use the latest IoT devices such as parking and counting sensors, microcontrollers, LED

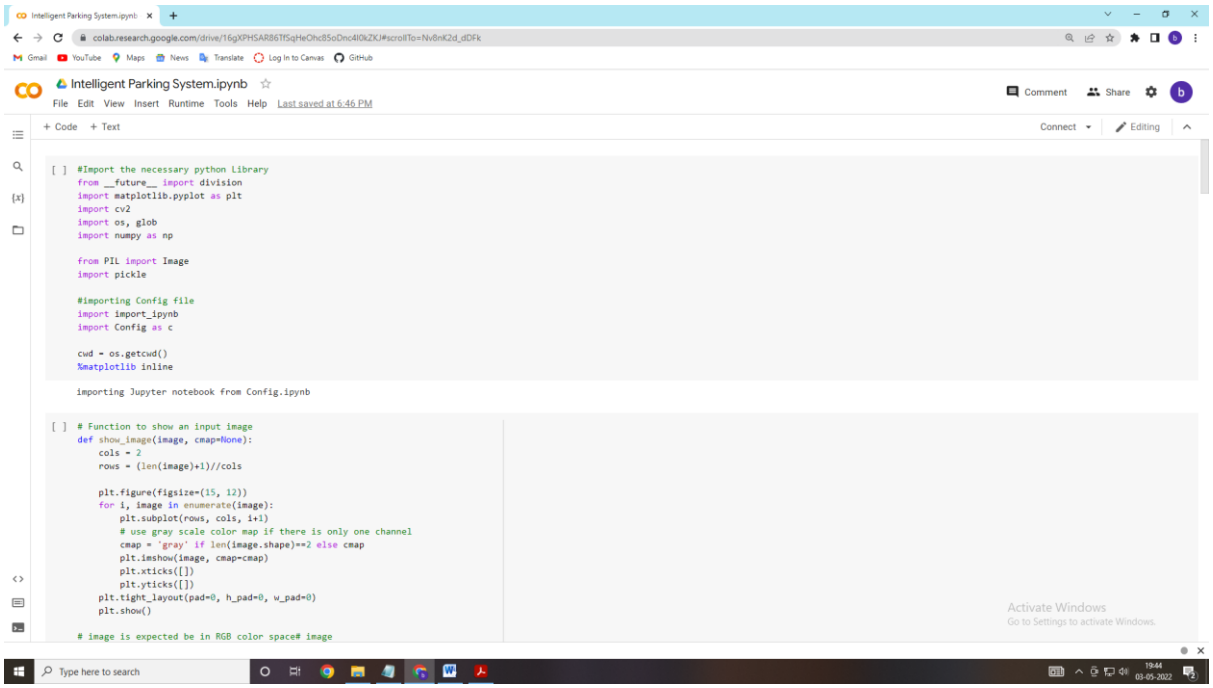
displays, and fast-tracking cameras to detect and identify the license plate and navigate the best available parking slot.

3.1.1.4 Issues/ Concerns:

The issue with our smart stopping frameworks is the enormous measure of equipment and programming expected to carry out our framework appropriately. It additionally requires the utilization of additional handling power and assets. These frameworks are tough for quite a while however it requires a lot of capital that don't ensure the benefits in the underlying stages.

Most people are unfamiliar with intelligent parking systems. So, they need to be aware of the guidelines or directions given by the system while parking. People need to take care of themselves by considering the other people while parking in the desired parking slot. Human assistance is also required to run these systems more efficiently.

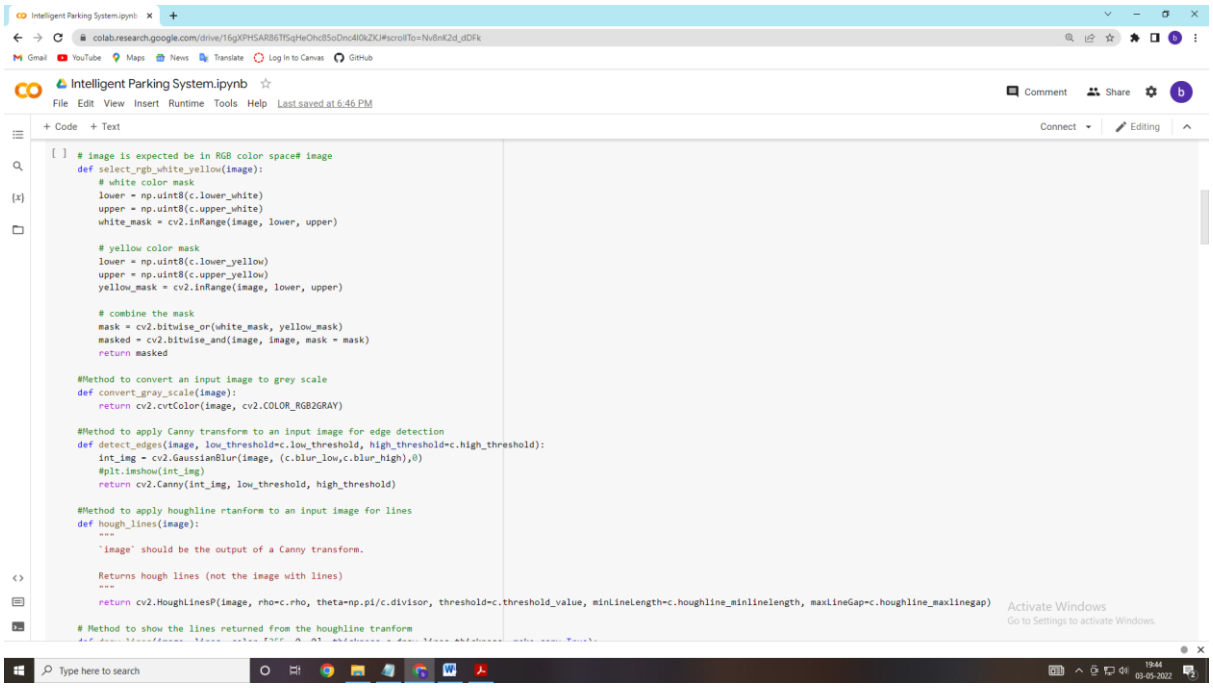
Source Code



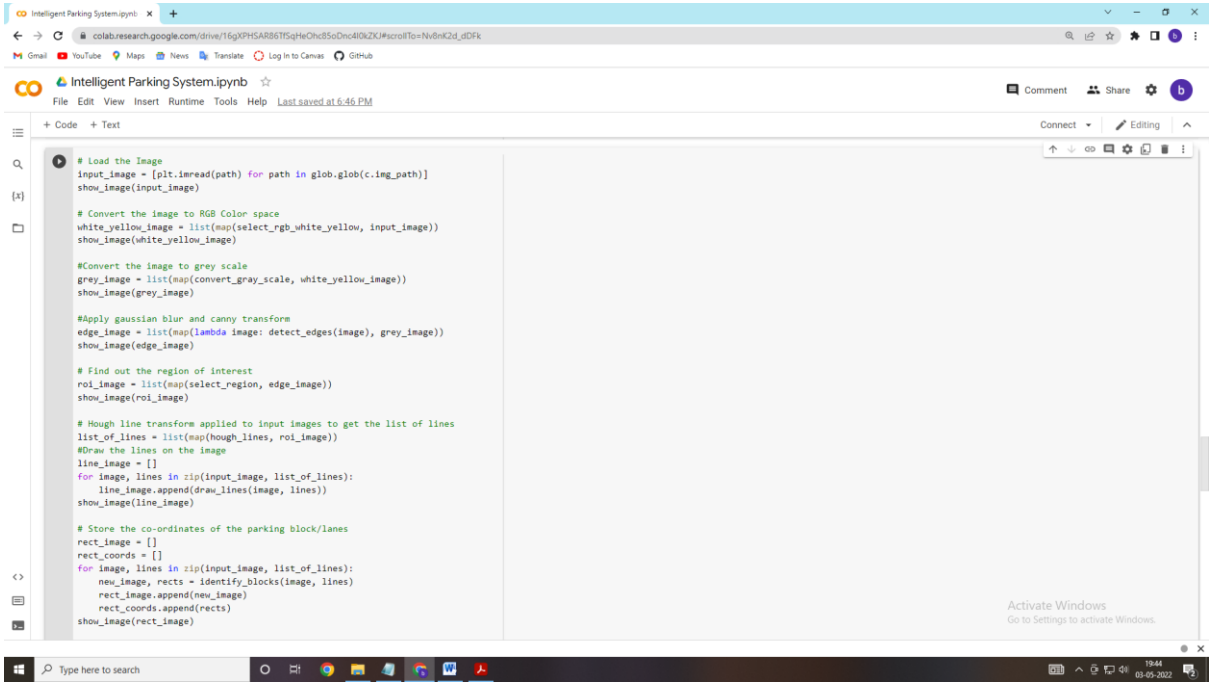
```
#Import the necessary python Library
from __future__ import division
import matplotlib.pyplot as plt
import cv2
import os, glob
import numpy as np

from PIL import Image
import pickle

#importing Config file
import import_ipynb
import Config as c

cwd = os.getcwd()
%matplotlib inline
```

```
importing Jupyter notebook from Config.ipynb
```

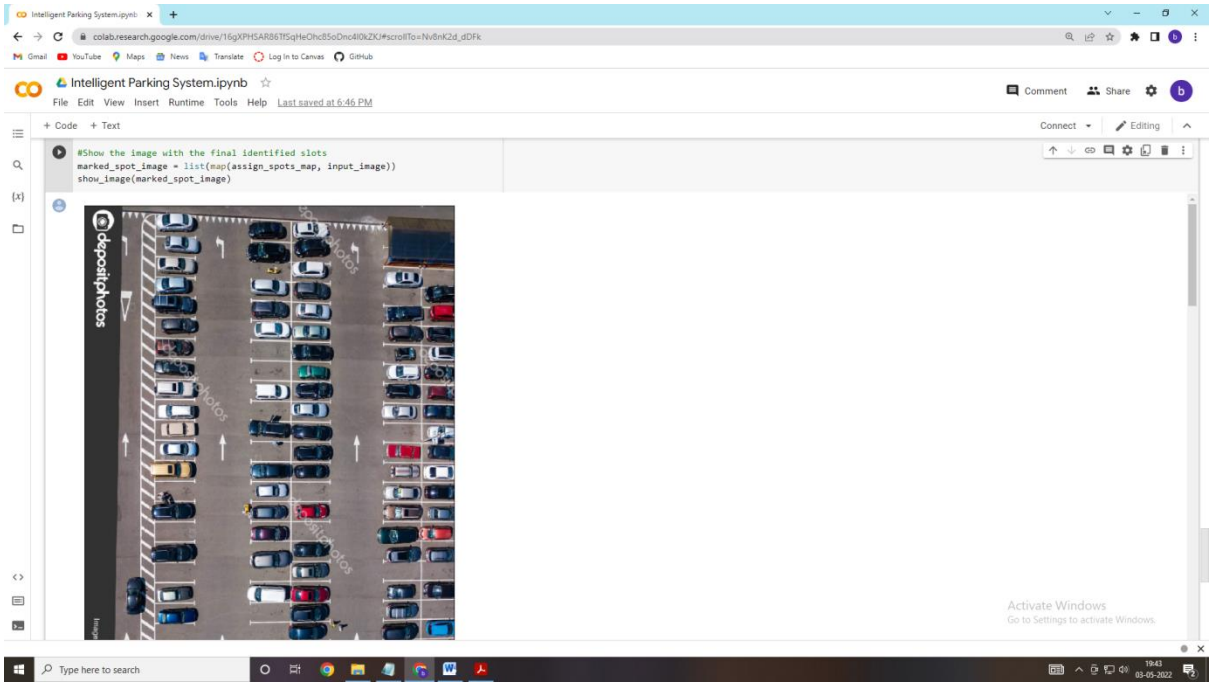
```
# Function to show an input image
def show_image(image, cmap=None):
    cols = 2
    rows = (len(image)+1)//cols

    plt.figure(figsize=(15, 12))
    for i, image in enumerate(image):
        plt.subplot(rows, cols, i+1)
        # use gray scale color map if there is only one channel
        cmap = 'gray' if len(image.shape)==2 else cmap
        plt.imshow(image, cmap=cmap)
        plt.xticks([])
        plt.yticks([])
    plt.tight_layout(pad=0, h_pad=0, w_pad=0)
    plt.show()

# image is expected be in RGB color space# image
```

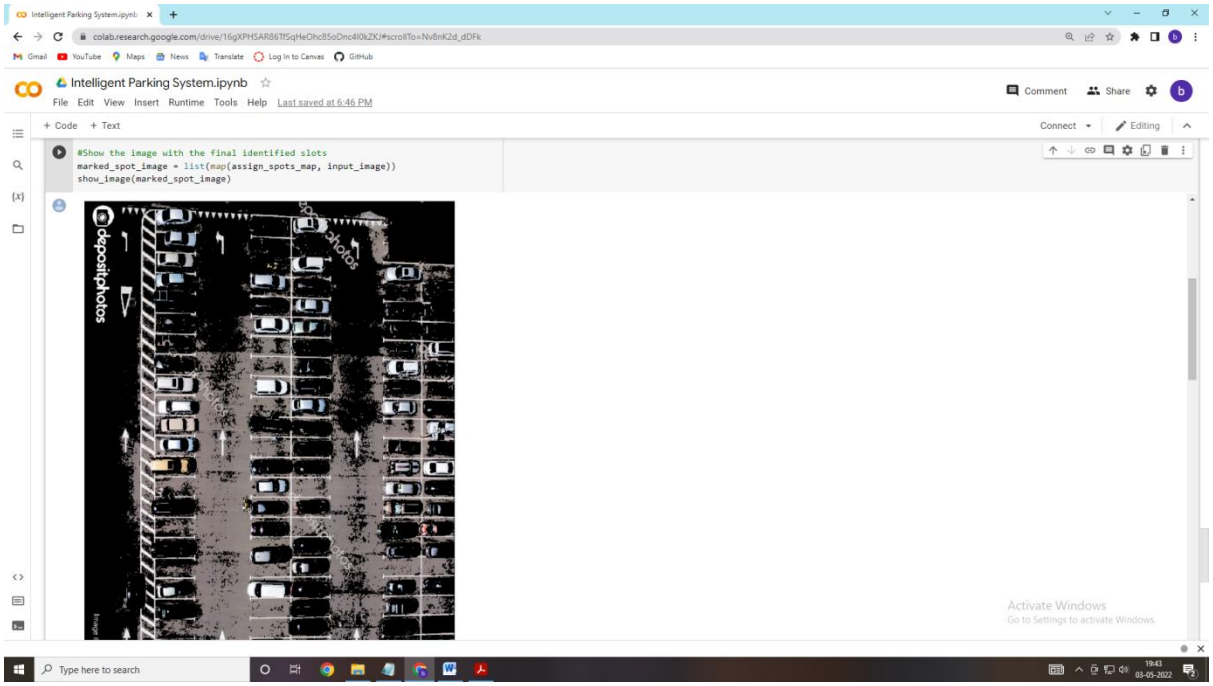


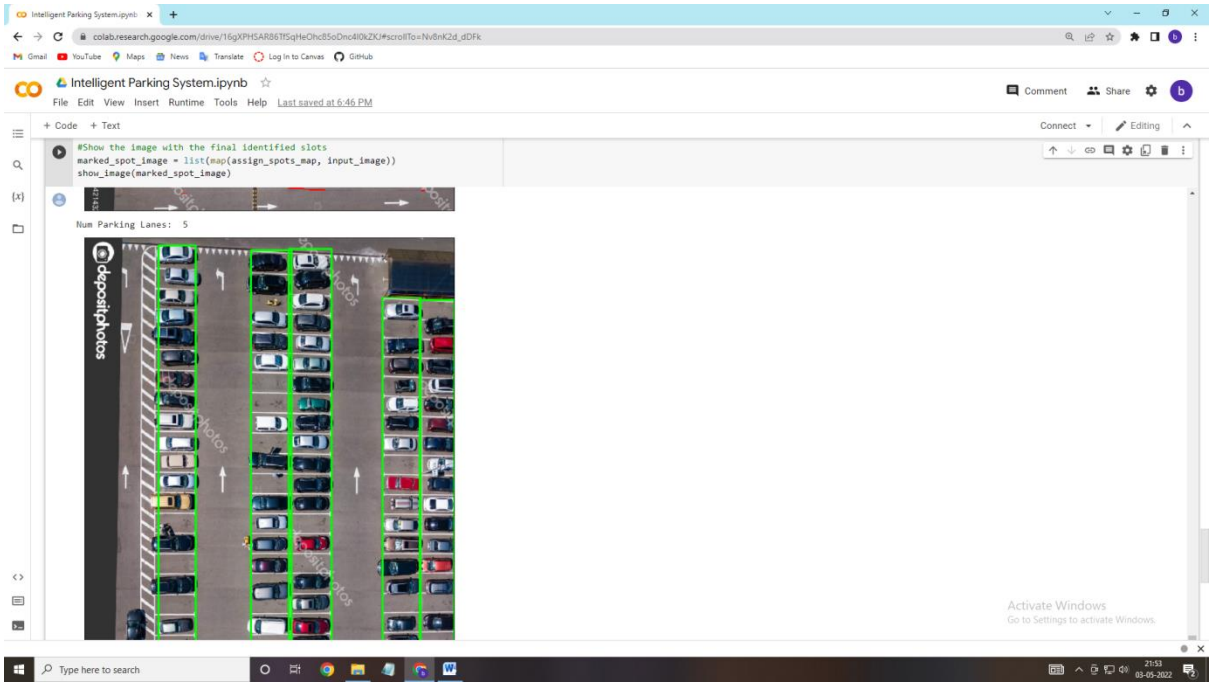
```
# image is expected be in RGB color space# image
def select_rgb_white_yellow(image):
    # white color mask
    lower = np.uint8(c.lower_white)
    upper = np.uint8(c.upper_white)
    white_mask = cv2.inRange(image, lower, upper)

    # yellow color mask
    lower = np.uint8(c.lower_yellow)
    upper = np.uint8(c.upper_yellow)
    yellow_mask = cv2.inRange(image, lower, upper)

    # combine the mask
    mask = cv2.bitwise_or(white_mask, yellow_mask)
    masked = cv2.bitwise_and(image, image, mask = mask)
    return masked

#Method to convert an input image to grey scale
def convert_gray_scale(image):
    return cv2.cvtColor(image, cv2.COLOR_RGB2GRAY)

#Method to apply Canny transform to an input image for edge detection
def detect_edges(image, low_threshold=c.low_threshold, high_threshold=c.high_threshold):
    int_img = cv2.GaussianBlur(image, (c.blur_low,c.blur_high),0)
    #plt.imshow(int_img)
    return cv2.Canny(int_img, low_threshold, high_threshold)

#Method to apply houghline rtanform to an input image for lines
def hough_lines(image):
    """
    `image` should be the output of a Canny transform.

    Returns hough lines (not the image with lines)
    """
    return cv2.HoughLinesP(image, rho=c.rho, theta=np.pi/c.divisor, threshold=c.threshold_value, minLineLength=c.houghline_minlinelength, maxLineGap=c.houghline_maxlinegap)

# Method to show the lines returned from the houghline tranform
```


Intelligent Parking System.ipynb
colab.research.google.com/drive/16gXPHSAR86TfSqHeOhc85oDnc4I0kZKJ#scrollTo=Nv8nK2d_dDFk
Intelligent Parking System.ipynb
File Edit View Insert Runtime Tools Help Last saved at 6:46 PM
Comment
Share
+ Code + Text
Connect
Editing
# Load the Image
input_image = [plt.imread(path) for path in glob.glob(c.img_path)]
show_image(input_image)
# Convert the image to RGB Color space
white_yellow_image = list(map(select_rgb_white_yellow, input_image))
show_image(white_yellow_image)
#Convert the image to grey scale
grey_image = list(map(convert_gray_scale, white_yellow_image))
show_image(grey_image)
#Apply gaussian blur and canny transform
edge_image = list(map(lambda image: detect_edges(image), grey_image))
show_image(edge_image)
# Find out the region of interest
roi_image = list(map(select_region, edge_image))
show_image(roi_image)
# Hough line transform applied to input images to get the list of lines
list_of_lines = list(map(hough_lines, roi_image))
#Draw the lines on the image
line_image = []
for image, lines in zip(input_image, list_of_lines):
line_image.append(draw_lines(image, lines))
show_image(line_image)
# Store the co-ordinates of the parking block/lanes
rect_image = []
rect_coords = []
for image, lines in zip(input_image, list_of_lines):
new_image, rects = identify_blocks(image, lines)
rect_image.append(new_image)
rect_coords.append(rects)
show_image(rect_image)
Activate Windows
Go to Settings to activate Windows.
Type here to search
19:44
03-05-2022

Output Screenshots






Intelligent Parking System.ipynb
File Edit View Insert Runtime Tools Help Last saved at 6:46 PM
Comment
Share
Connect
Editing
+ Code + Text
#Show the image with the final identified slots
marked_spot_image = list(map(assign_spots_map, input_image))
show_image(marked_spot_image)
Num Parking Lanes: 5
depositphotos
Activate Windows
Go to Settings to activate Windows.
Type here to search

Github link: https://github.com/mbhanutejaswi/Intelligent-Parking-System.git

Demo link:

https://drive.google.com/file/d/1sLSLK93GcFI5epRfnFh49yOZJL39QoWW/view?usp=sharing

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