# SMART PARKING SYSTEM

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*Abstract*—A successful business attracts lot of customers and to keep your business intact, you need a way to manage the crowd of customers.
Simple parking spaces cause a lot of management issues thereby leaving a dark spot in your business. Therefore, its necessary to maximize the potential of your business (be it a mall or a restaurant) by introducing smart ways to implement parking

## 1 INTRODUCTION

Our model is designed to use a low-cost hardware to detect the number of spots empty in the parking lot and to generate automatic bill for the user through interactive chatbot interface.
The user will be informed the number of vacant spot left in a parking slot and a bill will be generated for him/her.

## 2 LIMITATIONS OF EXISTING MECHANISMS

*2.1)High Costs*

As the existing models rely on cameras providing high resolution feedback to the algorithms the cost of installing the system increases

2.2) HIGH COMPUTATION POWER

The current model relies on using detecting the number of cars to the by using object detection which requires a huge amount of computation

## 3 INTRODUCTION TO OUR APPROACH

3.1) COLOR THE SLOTS

We will color the slots with using special fluorescent color stripes which will enable visibility in all weather conditions

3.2) Detection of free slots

The slots which will have cars parked on them will cover the stripes and thus those stripes won't be visible to the camera.

3.3) ANALYSIS OF VIDEO

Combining various filters innovatively to clean the image and extract the nummber of slots in the image into a binary video feed

3.4) DETECTING THE STRIPES

On the detected stripes we use a function in cv2 to make boundaries of the stripes. Then we connect all the dots and based on the number of slots we predict whether it is a circle or not. This helps us make avoid any false positives as our empty parking slots will have only empty circle stripes.

## 4 .METHODOLOGY

The model is split into two modules

a) Detection of the number of slots
b) User interface for the user and admin

### *4.1) DETECTION OF THE NUMBER OF SLOTS*

*1.1) Converting to hsv:*

OpenCV usually captures images and videos in 8-bit, unsigned integer, BGR format. In other words, captured images can be considered as 3 matrices, BLUE,RED and GREEN with integer values ranges from 0 to 255.In Open Cv image analysis is more efficient with HSV values. Thus, we convert it into HSV value.

*1.2) Filtering out the required color*

The color which was painted in the parking slots is filtered out by providing the lower threshold and higher threshold for the range of the color. A binary video mask is created which will help us directly analyze the video for detection.

1.3) *Cleaning the image:*

*For detection to take place with higher accuracy we will clean the image by the following steps*

*1.3.a.) Smoothing the edges:*

*Median Blur: It is a very efficient filter and replaces the entry value by the median of the pixel value in the neighboring regions .*

*1.3.b) Removing false positives:*

*Dilation*- It is just opposite of erosion. Here, a pixel element is '1' if at least one pixel under the kernel is '1'.So it increases the white region in the image or size of foreground object increases. Normally, in cases like noise removal, erosion is followed by dilation. Because, erosion removes white noises, but it also shrinks our object. So we dilate it. Since noise is gone, they won't come back, but our object area increases. It is also useful in joining broken parts of an object.

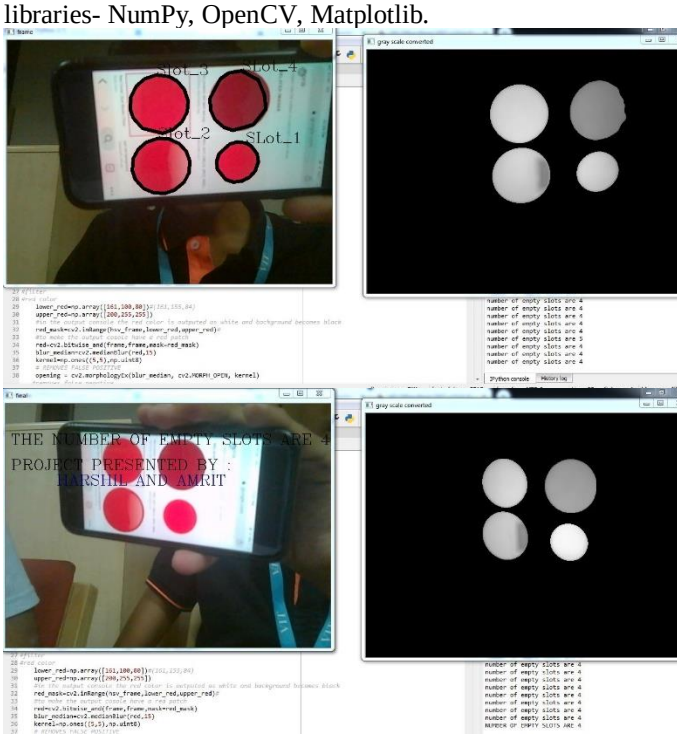
*1.3.c) Removing false negatives:*

*Erosion*-So what happens is that, all the pixels near boundary will be discarded depending upon the size of kernel. So, the thickness or size of the foreground object decreases or simply white region decreases in the image. It is useful for removing

small white noises (as we have seen in colorspace chapter), detach two connected objects etc.

1.4) Detection of Shapes
After the filter, the number of vertices on the object are approximated and then they are joined. If the number of edges exceed ten, then it is a circle and hence it is a free slot.

1.5) Environment Setup:
We have used Spyder on Anaconda environment using libraries- NumPy, OpenCV, Matplotlib.

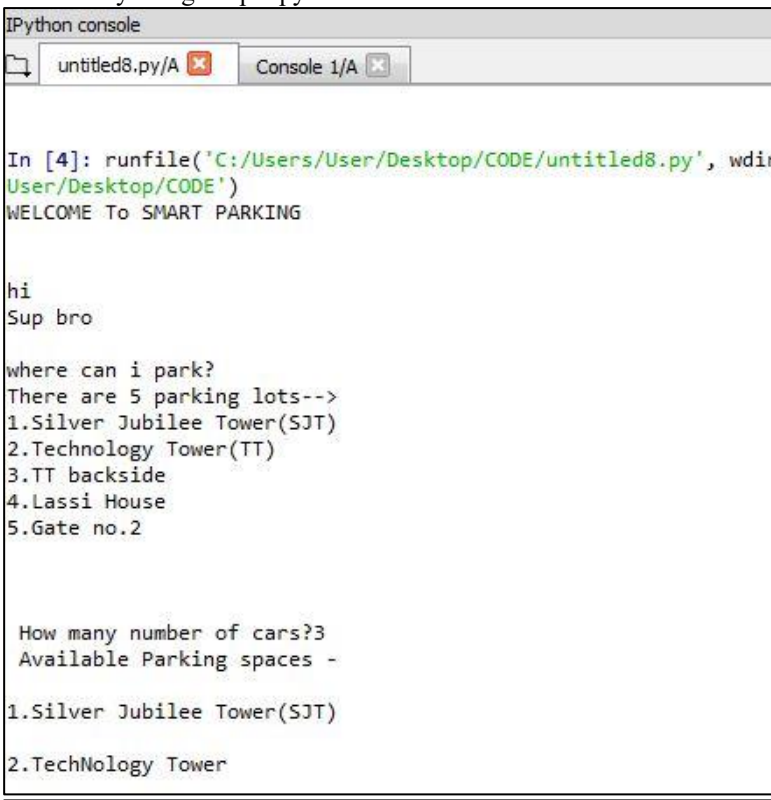



### *4.2) User interface for the user and admin*

***Chat Bot for parking system-->***
This chat bot will interact with the user and ask for the number of cars need to park, which parking spaces they can park. It includes a set of trained data which contains data on which way to respond to the question asked by import 'random' library.
**Input Questions**-place to park, time of stay, number of cars

**Process-**It contains a list of specific keywords and their corresponding responses already stored in form of lists
It counts the number of parking spaces at respective lots by multiple cameras by using above mentioned object detection and assigns the user the places where parking is available and gives a choice to user to select their parking lot. E.g. SJT, TT, Lassi house, Gate No. 2, etc.

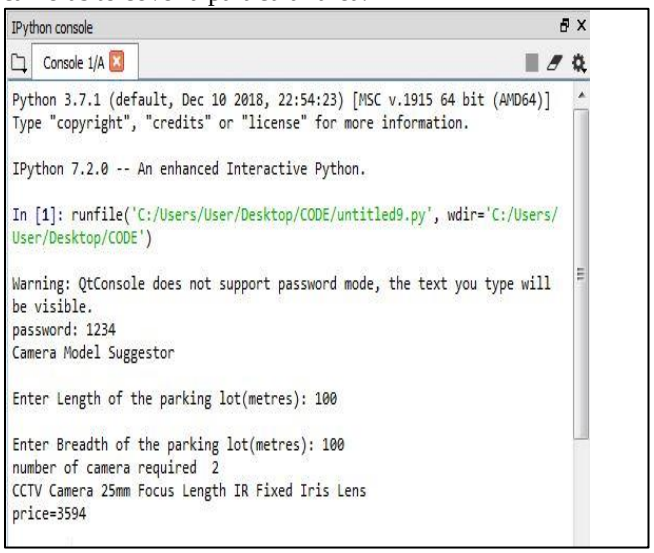
**Output**-prints the bill with all the necessary details.
This innovative method cuts down the man-labor as everything is auto-generated. Further, this can be updated regularly on the questions asked thereby creating and maintaining a huge database. On a simple level, this is achieved by using simple python function 'random'.




***CCTV camera installation-->***
In this system, the admin can only access the model by a designated password. The system requires
**Input-** length and breadth of the parking lot for which CCTV camera is required.

**Process-**The program then selects an optimum camera for installation

**Output-** displays the number of cameras required and its features and cost.
The database can be further increased after research on various CCTV cameras and their features. This software gives an easy decision to select the type and number of cameras to cover a particular area.




## 5.)KEY FEATURES-

*ADMIN*:

1. E-bill generation
2. Low cost hardware setup
3. Open source library for easy modularity of code
4. Chatbot to setup hardware

*USER:*

**1.**hassle free bill generation
**2.**convenuence while parking car

## 6.) *LIMITATIONS*

6.1) ***COLOR OF STRIPE:***

More research has to be done into investigating the wide spectrum which can be analyzed in any weather conditions.

6.2***) SLOT DETAILS***:

Current model is designed as a low-cost solution to smart parking management system and hence it cannot detect the slot number as it would require high resolution camera's and also the cost of hardware setup required to process the video will increase exponentially.
i.e.-Cost of a basic computer with specifications (Overclockable GeForce GTX 1080 -8GB MAX-Q Design, 32GB DDR4, 512GB SSD (256GBx2), RGB Mech KB) to sufficiently run the model is $2448.

## III*)CONCL*USION AND FUTURE WORK

Thus, this low-cost model if implemented will surely help increase the profit margins for business and would be easy to deploy. In future, we can create more powerful filters for more accurate result .

## IV)REFERENCES:

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