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AUTOMATIC PARKING SLOT DETECTION USING IMAGE PROCESSING AND IOT

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Abstract:- *One of the most common problems in metropolitan cities is to find a vacant parking spot. It's often that we just circle around the parking lots just to realize that there isn't a single vacant spot! , Hence it is very frustrating for the drivers and extremely difficult for them to find a vacant spot. Moreover, in recent years there has been a growing interest in automatic parking systems. When we initially started to build this prototype, the first question that popped in our head was, and "Do we need a smart car or a smart parking system…?" which leads to an answer that is both! But buying a smart car is expensive. So we can implement this model in such cases. Before we started this project, we went through a lot of cool techniques to build this system. Some of them were purely based on computer vision and image processing techniques, while some were based on cool innovative ideas by various people around the world.*

Keywords: *computer vision, smart parking, IOT and python.*

1. INTRODUCTION

In this model we have developed a video-based system for vacant parking space detection which can be adopted by a car-park routing system to navigate drivers to a comfortable parking space. We evaluated different combinations of image features and background subtraction algorithms. The final system relies on using technique like Adaptive Background Subtraction.We turned Complex problem into a relatively easy problem to solve using image processing in OpenCV. All that is needed is an aerial shot of the parking lot. So that our model is highlighting all available parking spots on the parking lot as well as displaying a count of how many spots are available. And best of this entire can work real time!

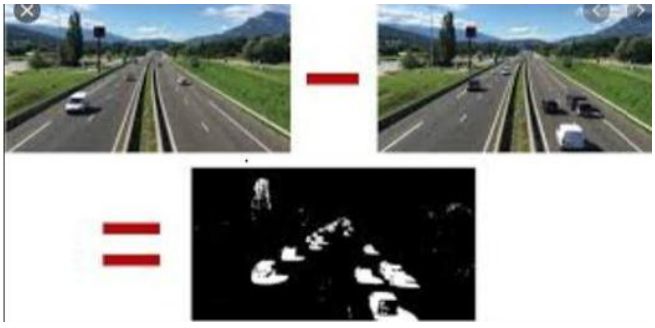

Fig. 1 Back ground subtraction

2. MOTIVATION TOWARDS THE WORK

Background subtraction is the mainly used fundamental method in many open CV applications; some are parking lot occupancy or traffic monitoring. It is difficult to produce a robust background subtraction model that works well under many situations. The best background subtraction model should have the features as: accuracy in detection and reactivity to changes over time; it should work under different lighting conditions, and also efficiency for real-time.

3. EXISTING SYSTEM

Most of the present models uses "Haar cascade algorithm". Dis-advantages of this method is it is significantly slow & poor classification among vehicles. The classifier needs at least 60% accuracy; but Haar cascade has less than 50% accuracy. So we moved to another model.

4. PROPOSED SYSTEM

The two main steps in building this parking detection model is:

- Detecting the position of all available parking spots
- Passing the data of available slots to server so that user can find the vacant parking slots

In order to do so we first need to identify the parking spot. The best approach to identify the parking spot is to use adaptive background techniques.In this approach, two images are acquired one is the background and other is foreground. The background image is dynamically updated to compare each pixel with the corresponding distribution which leading to the foreground mask which is separated from the background.

The foreground mask which generated is the binary image, whereas foreground objects are the white pixels. One or more objects can be detected in the foreground the image. The resulting background image is used as input for the next stage, the extraction of parking vacancy. Finally the extracted parking vacancy variable is passed to server so that the user can find the vacant parking slots.

5. RELATED WORK

- First user needs to initiate a program using a mobile/Local setup, whenever he/she needs information about vacant slots.
- This leads to capturing video from available cameras in parking lots.
- This video is given input to Raspberry pi, for future processing.
- The output of the program consists, No.of Vacant slots & positions.
- Finally he/she can find their vacant slots, in limited amount of time.

For this we first need to convert the image to a gray-scale image. It uses the feature extraction and detecting shapes of objects. It initializes the accumulator by using an array based on the cumulative decision of the accumulator and then detects the edge. It uses the basic math formula of a slope y = mx + c to evaluate the slope.

$$P = x\cos(\theta) + y\sin(\theta)$$

Fig. 2 Background image subtraction

The current edge holds the recently presented object with the foundation. At that point the calculation of the outright contrast between the foundation model (which is a component of time) and the current edge (which is a recently presented object) is finished. Running normal is processed utilizing the condition is,

$$dst(x,y) = (1-alpha).dst(x,y)+alpha.sc(x,y)$$

The boundaries passed in this capacity are:

[1] src: The source picture. The picture can be a hued or grayscale picture and either a 8-cycle or 32-digit skimming point.

[2] dst: The gatherer or the objective picture. It is either 32-cycle or 64-digit skimming point.

[3] alpha: Weight of the info picture. Alpha chooses the speed of refreshing. On the off chance that you set a lower an incentive for this variable, running normal will be performed over a bigger measure of past casings and the other way around.

A. HARDWARE REQUIREMENTS:

- Camera
- Raspberry pi
- LCD(TV or Monitor)

B. SOFTWARE REQUIREMENTS:

- Python 3
- Raspbian sketch OS

C. BLOCK DIAGRAM:

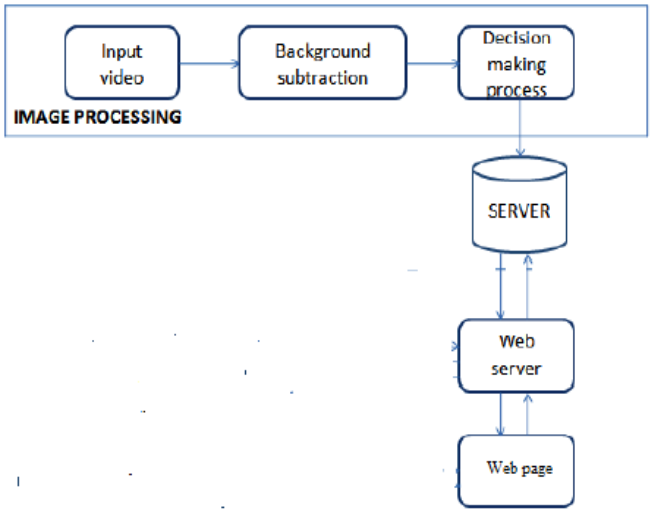

Fig. 3 Block diagram of proposed system

D. COMPONENT DESCRIPTION:

i). Raspberry PI: The Raspberry Pi is an insignificant exertion, charge card estimated PC that associates with a PC screen or TV, and uses a standard support and mouse. It is an able little contraption that enables people, taking everything into account, to examine figuring, and to sort out some way to program in lingos like Scratch and Python. It can do all that you'd envision that a work station ought to do, from scrutinizing the web and playing unrivaled quality video, to making accounting pages, word-getting ready, and playing.

Raspberry Pi can interface with the rest of the world, and has been utilized in a wide exhibit of advanced producer ventures, from music machines and parent indicators to climate stations and tweeting perch rooms with infra-red cameras. We need to see the Raspberry Pi being utilized by kids everywhere on the world to figure out how to program and see how PCs work.

Fig. 4 Raspberry pi

ii). Camera: The Raspberry Pi Camera Modules are legitimate items from the Raspberry Pi Establishment. The first 5-megapixel model was delivered in 2013, and a 8-megapixel Camera Module v2 was delivered in 2016. For the two cycles, there are noticeable light and infrared variants. A 12-megapixel Top notch Camera was delivered in 2020. There is no infrared rendition of the HQ Camera, anyway the IR Channel can be taken out.

Fig. 5 Camera module

iii). LCD (TV or Monitor): We can interface raspberry pi to LCD TV or monitor if we look at bottom edge of raspberry pi, is the HDMI connector. We can simply insert our HDMI cable in the Raspberry Pi board, and then the other end is connected to the monitor.

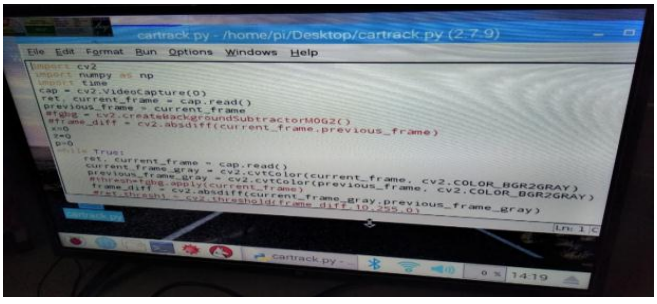

Fig. 6 LCD TV showing Raspbian sketch and python IDLE

iv). Python 3: Python is a most powerful language used for programming and easy to write and read with raspberry pi as it includes vast libraries so we preferred to program parking slot detection using python and open CV.

v). Open CV: Open CV is a cross-platform library with which we can develop the real-time **computer vision applications**. It is one which mainly focuses on image processing; video capture and analysis including features like face detection and object detection.

6. RESULTS

Raspberry pi interfacing to external modules using HDMI and USB.

Fig. 7 Raspberry pi setup

Camera looking downwards so that it can capture the area of parking slot

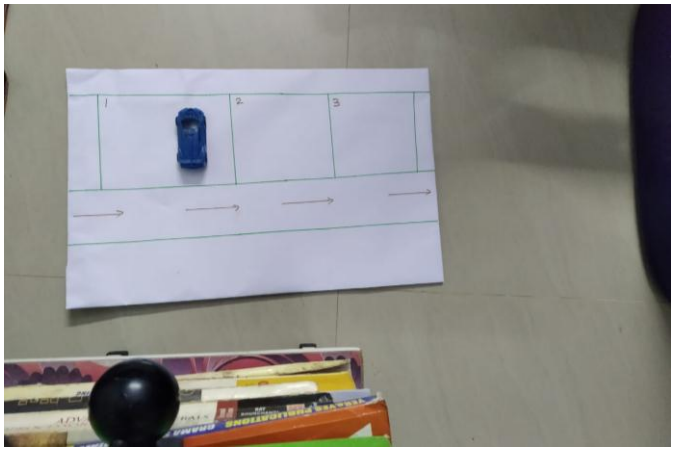

Fig. 8 camera view capturing the parking slots

Background subtracted image showing single car in parking slot

Fig. 9 background subtraction showing single slot occupied

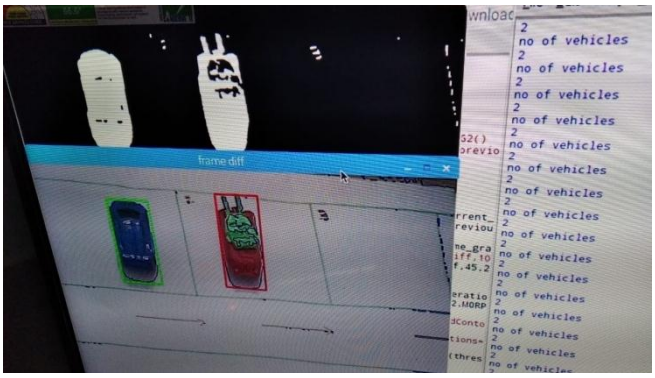

Fig. 10 background subtraction showing two slots occupied

Information that two slots occupied is passed to the server which can be seen by user by this user interface

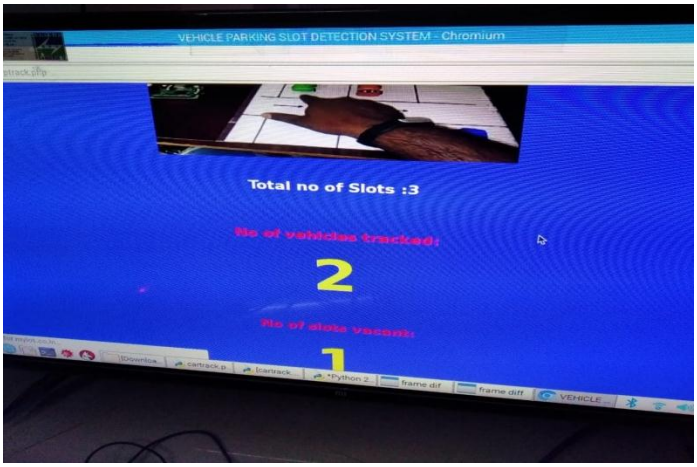

Fig. 11 user interface showing no of slots occupied and the vacant slots

Displaying all the three slots occupied and no vacant slot

Fig. 12 background subtraction showing all three slots occupied

7. ADVANTAGES

It is highly feasible for extremely big sites that are unable to find vacant slots for parking.

It is possible that the retrieval time is lower than the combined driving/parking/walking time in conventional ramped parking structures.

8. DISADVANTAGES

Since the coordinates are static if the camera angle is moving the static coordinates will map the bounding boxes to the current frame in the video, due to which the overlapping of the image with the static coordinates will not map with the video frames.

9. CONCLUSIONS

Numbers of vehicles are developing dramatically, particularly in metropolitan zones, which bring about more hard to track down openings in the current circumstance.

The background image is dynamically updated to compare each pixel with the corresponding distribution which leading to the foreground mask which is separated from the background.. As of late, the advances in profound learning controlled PC vision calculations have indicated promising outcomes

10. FUTURE WORK

The keen stopping industry keeps on developing as an expanding number of urban communities battle with gridlock and insufficient stopping accessibility. While the arrangement of sensor advances keeps on being center to the improvement of savvy stopping, a wide assortment of other innovation developments are additionally empowering more versatile frameworks—including cameras, remote interchanges, information investigation,

acceptance circles, shrewd stopping meters, and progressed calculations.

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