A Study on Smart Parking Space Allocator and Parking Management Using Opencv

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Abstract

In today's society, the number of vehicles on the road is rising quite quickly every single day. Due to the small number of parking spots compared to the rising number of vehicles, finding a suitable parking space can be difficult and time-consuming. Traffic congestion is the outcome of this. According to this area's research, drivers only go a half-mile at a speed of 10 mph while seeking for parking, spending an average of 15 minutes doing so. Successful implementation of smart parking solutions can greatly decrease these issues. The traditional method requires the installation of multiple sensors at each parking lot, which is not only expensive but also quite challenging.This study presents a smart parking system based on image processing for open parking lots, multi-story parking garages, and other applications. Edge detection and coordinate bound pixel sections are combined in the suggested system design to assess whether a parking space in the obtained footage is occupied or not. It also illustrates the process of text to image conversion. Tesseract is used to extract text from the processed image. The variable level of image processing makes sure that various photos receive varying degrees of processing in order to produce text results that are optimum.

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Introduction

Globalization has led to an increase in urban migration, which has resulted in major urban centres like Bangalore becoming overcrowded and congested. The expansion of the population also contributes to an increase in human mobility. When a result, as the number of vehicles rises, the parking issue is impacted. Some people purchase automobiles today despite not having a garage. In any event, a lot of traffic is caused by some roadways turning into parking lots.Regular parking lots, which usually lacked empty spaces, required people to search manually for available spots.This way

of parking is not only very time-consuming, but it is also ineffective, particularly in multi-story buildings where vehicles must search through several floors and evaluate each location to find a parking spot.

Any city can be considered a smart city initiative by putting in place systems like smart parking, which uses a mobile app to help drivers find parking spots, smart traffic management, which tracks and analyses traffic flows, electronic information sharing, environmental monitoring, sanitation, and so on.Technology advancements have caused significant changes in the world. These modifications have not, however, had an impact on the lengthy and unchanged parking system. It takes a lot of time and effort to locate a parking space that is free. It is well known that traffic congestion is a major problem, especially in countries with large populations. More people will park in the few spots that are available when there are many people around.

This study examines the use of automated parking lot management to rationalise traffic control in contemporary cities. In order to make complex services available over the Internet, the potential integration of networked sensor/actuator and radio frequency identification (RFID) technologies is being looked into in the context of the impending internet of things (IoT).Based on this integration, we suggest a car parking framework (CPF) that is adaptable and affordable. A basic prototype of a few of the proposed CFP's modules has been tested and put into use. The I2C protocol was used in the prototype to connect sensors (sensing boards) into a single mote. The outcomes of the experiment demonstrate how much less energy is used and costs are reduced.

Literature Review

The fast increase in automobile availability and usage over the past several years has resulted in a number of conflicts, including traffic problems, making it more and more difficult to get a parking space. The master module and the monitoring module for vacant parking lots make up the system. The digital infrared sensor, LCD, and Zigbee module of the parking lot vacancy monitoring module are interfaced with the PIC microcontroller. Zigbee and laptop GUI displays are examples of master modules. On the LCD of the monitoring parking vacancy module, the user can elaborate on traffic issues on the LCD of the system.

The monitoring parking vacancy module's Zigbee transmitter interacts with a microcontroller to transfer the infrared sensor data and display the parking lot status in the master module via a graphical user interface when the digital infrared sensor detects a car in the parking areas.

This study suggests a Smart Parking Management System based on wireless sensor network technology with cutting-edge features like automatic guidance, parking reservation, and remote parking monitoring. The paper illustrates our installed framework's whole design, from hardware to software implementation, from the perspective of sensor organisations. This article also demonstrates the use of existing CCTVs for security surveillance as sensing nodes to find open parking spaces. The image will be processed by the ARM7 Microcontroller, and the information generated will be transmitted to a central computer through ZigBee in order to save and update the database's occupancy status for open parking spaces.Finding empty parking lots takes less time because to real-time information display, clever reservation systems, and the effectiveness with which this WSN-based system can solve the needs of ongoing parking challenges.

Proposed Methodology

After a car enters the parking lot, the empty slots are scrutinised. The first camera reads the vehicle's licence plate, stores it in the cloud, and, if any parking spaces are available, allows the vehicle in. If there are no vacant slots, the same will be shown. When the car exits, the second camera scans the number plate once more, and the time it arrived is contrasted with that. The length of time the car is left parked determines how much the cost will be.

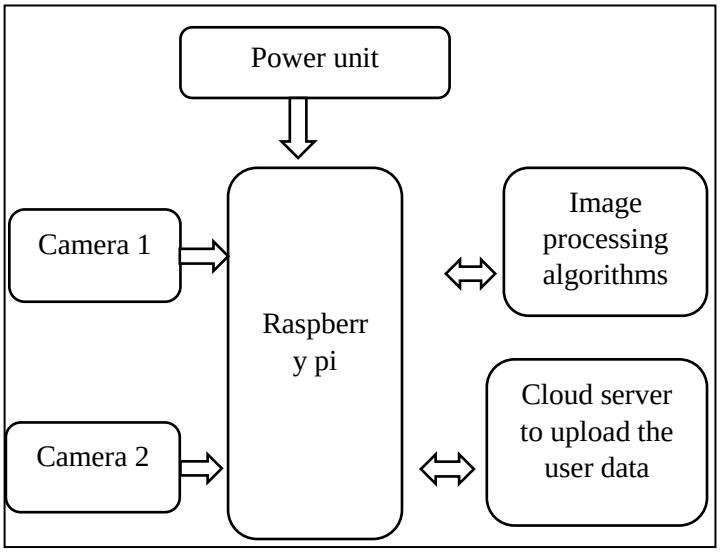

Figure 1: Proposed Hardware model

A frame from the video clip is included in the still image file. The still image appears once the code has been executed, and by using the mouse, a quadrilateral with its three input points can be created. The letter "q" will be hit to start the video feed display after the coordinates of the input points are saved in a YAML file. The quadrilaterals that will be utilised to zone each parking place are indicated by either red or green lines. Red denotes that the computer has concluded that the parking space within the quadrilateral is occupied by a vehicle, while green denotes that it is accessible for parking.

As soon as the automobile pulls into the parking lot, we snap a photo of the licence plate. We apply image processing methods to the acquired image. The image is then cropped in accordance with the plate's contours when we have located them. The Tesseract character recognition algorithm is then given the processed image. The retrieved image is then verified to see if it is present in the cloud. If the plate already exists in the cloud, we calculate a bill based on how long it has been there. If the plate doesn't already exist in the cloud, we upload it there along with the entrance time.

A few of the many uses for OpenCV include ego motion estimation, facial recognition, gesture recognition, motion understanding, object identification, segmentation and recognition, and motion tracking. The older, more thorough C interface is still available even though OpenCV's main interface is in C++ and is written in C++.OpenCV comes with libraries of predefined functions that help with image processing.Because it is open source, it was selected as the testing platform for the project.With the aid of the OpenCV libraries, we have implemented image processing techniques including RGB to grayscale conversion, erosion, and dilation.

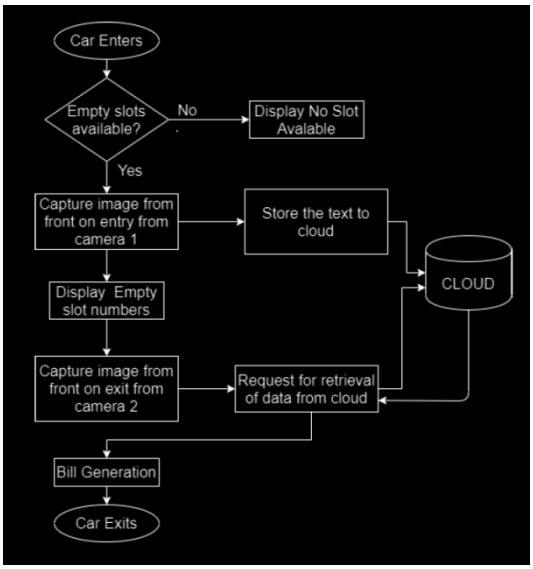

Figure 2: Workflow of the system

The open spaces are examined after a car pulls into the parking lot. If any parking spaces are available, the first camera lets the car in after reading the licence plate and storing it in the cloud. The same will be displayed if there are no open slots. The second camera scans the number plate once more when the automobile drives away, comparing the reading to the time it arrived. How much it will cost depends on how long the automobile is left parked.

Results and Discussion:

The Empty slot detection system has been successful in demonstrating whether a parking space is occupied or not when the application is running. Figures 3 and 4 display the building's and parking structure's conditions while concealing them with coloured rectangles.

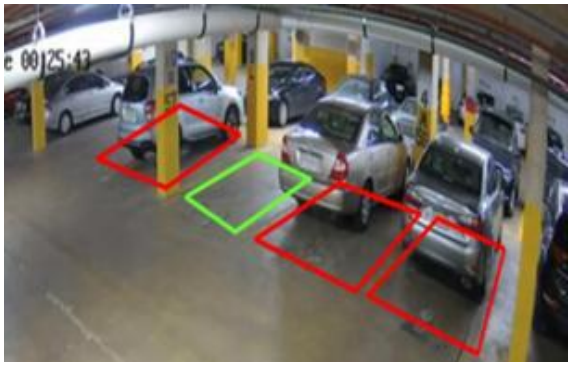

Figure 3: Parking space with red and green allotment

Zones for input rectangle shape were set before the programme was launched. The location of a vehicle within the rectangle-shaped zone will affect both the colour of each individual pixel and the overall colour. The program's colour would change from green to red as a result.Nevertheless, on sometimes a parking space may turn red whether or not a car is actually parked there.

Figure 4: Parking allotment

The quadrilateral regions are primarily caused by the first still image that was separated during system activation. In the event that the video outline departs from the marked image, the hidden video feed output would show an uprooted square form. Because of this, the system would function best if the video feed came from the installed CCTV security cameras that are positioned stationarily around the parking space.

As seen in Figure 6, the algorithm may interpret any major obstruction, such as a person passing by or a garage post, that modifies the overall average pixel colour of the square-shaped zone as a vehicle, turning the layout red.

Figure 5: Number plate recognition

By hitting the button, the number plate's image is taken for number plate detection, and OCR is then used to extract the characters. Along with the time, the identified number plate character is saved in the Firestore cloud as text. When the automobile exits the parking lot and the bill is created, this will be used once more. Figure 5 displays a photo of the car that was taken at the entry.

```
2020-05-12 15:04:11.443530
Checked In : 2020-05-12 15:04:11
Checked Out : 2020-05-12 15:06:19
You've stayed for 0:02:08
Your Bill = Rs.50

Process finished with exit code 0
```

Figure 6: Bill generation for parked car

Figure 6 displays the results of the character detection from an automobile entry and exit image.Additionally, it displays the bill that was produced based on the parking interval.

Conclusion:

In order to reduce congestion in the parking sector, this study will largely contribute to improving the detection of parking spaces that are available. The suggested model quickly and accurately accomplished this goal. The device was made simple and less expensive thanks to an image processing technique that concentrated on identifying vacant parking spaces. Image processing is essential for extracting any information from an image. A suggested design for a smart parking system based on image processing has been successfully evaluated and implemented in this study using a few movies captured from indoor parking garages. By showing a red outline if a vehicle is inside or occupying a spot and a green outline if it is vacant, the system reliably assesses whether parking slots are occupied. We initially applied image processing methods to photos in order to recognise number plates, and then we extracted text from those images using Tesseract software.Additionally, it serves as an example of text to image conversion. Text is extracted from the altered image using tesseract. In order to achieve the best text results, different photographs are processed to different degrees using a variable level of image processing.

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