

REAL-TIME CAR PARKING SYSTEM IN SMART CITIES USING IMAGE PROCESSING

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ABSTRACT

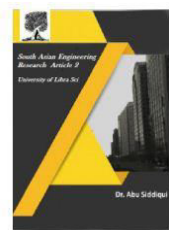
Urbanization has made inefficient parking a significant issue for vehicles. especially in cities where parking on the side of the road is prohibited. This smart parking device simplifies the entire car parking process for both drivers and administrators. Smart parking systems use image processing techniques to take real-time pictures with a camera. The parking spaces can be photographed by the system to provide information on available spots for parked cars. Cameras can take pictures of both full and empty parking spots in parking lots. The pointed parking lot's empty space can be identified by its photograph, saving time and gas when searching for a spot. The management of parking spaces can be crucial in reducing traffic . In our nation, a manual parking system is used to maintain the majority of the parking spaces . Our goal in this article is to device and construct a smart car parking system to address the confusion and detect parking spaces using cameras in public buildings , such as offices and shopping centers.

KEYWORDS: Image Processing, parking space detection, camera, OpenCV

INTRODUCTION

The entire parking process is made simpler and more effective for both drivers and parking unit administrators by using an automated parking system. This automation may be fully software-based or hardware-based. Thus far, no system that is solely software-based has been used. The goal of this project is to replace the current automated parking systems, which mostly rely on different sensors for daily operations, with a system that uses software more often.

Since the suggested system doesn't employ any sensors, its mechanical and electrical liability is greatly decreased. The suggested method simply uses image processing techniques to automate parking using video captured by the security cameras in the parking lot. When an empty parking space is detected, these algorithms notify the drivers who are entering the parking lot.



LITERATURE SURVEY

Intelligent Parking System Based on Image Processing One of the nations with the densest populations is India. Transportation and vehicle parking are the main problems that people confront because of this large population. The purpose of this paper is to use image processing to provide an intelligent parking system. The image processing technique can be employed in this methodical approach to find the free, unoccupied parking space where we can park our cars. The suggested procedure would label the parking place with a specific number and a sensor, which would then be used to identify any unoccupied spots where a car may be parked.

The seven real-time display parts make up the image processing display. To offer verbal information on the parking system, an audio system has been interfaced with the display. The vacant parking space with particular numbers can be located using the seven-segment display. To park the car in a vacant spot without difficulty, the precise numbers can be shown. With the aid of image processing techniques, the suggested procedure can be implemented in software platforms, and by integrating with the Arduino Uno, it may be realized in hardware. A Novel Approach to Signal-to-Noise Ratio Estimation in UAV.

It is very challenging for cars to find a parking spot in a crowded metropolitan metropolis. Unavailable parking spaces may result in severe traffic congestion. Computer vision researchers were drawn to contribute to the rapidly developing field of automatic smart parking systems. In order to help drivers discover and reserve a parking space quickly, we have provided a vision-based smart parking framework in this study. First, we used calibration to divide the parking lot into blocks. Next, categorize each block to identify the vehicle and notify the driver if parking is free or reserved. The superiority of the suggested framework is validated by the possibility that the performance accuracy of the suggested system surpasses that of cutting-edge hardware solutions.

The absence of smart parking zones exacerbates issues like fuel waste and traffic congestion as vehicle traffic rises. Smart parking solutions have already been made possible by the Internet of Things. The disadvantage of these solutions is that they are not always scalable or available. Furthermore, it's not always feasible to put the proposed reservation models into practice. The approach suggested in this paper to show the quantity of available parking spaces in a certain parking location is durable, scalable, and reasonably priced. In order to accomplish this, infrared sensors are placed in each bay and connected to a Raspberry Pi. All of the data is transferred by the Raspberry Pi to a cloud server that users can access through a mobile application.

Smart Parking System based on IoT The idea of "smart cities" has become very popular in recent years. The concept of a smart city today appears to be feasible due to the development of the Internet of Things. To increase the efficiency and



dependability of urban infrastructure, constant efforts are being made in the IoT space. IoT is being used to address issues including traffic congestion, a lack of parking spaces, and road safety. We describe an IoT-based cloud-integrated smart parking system in this research. An Internet of Things module is deployed on-site as part of the suggested Smart Parking system, which tracks and signals the availability of every parking place.

Utilizing IoT Technology for Smart Parking Finding parking spots for cars is one of the biggest issues in many large, congested cities. In this article, we suggest a design and development of a true smart parking system that can reduce traffic in the parking area by using IoT technology and mobile applications to help users find the best place to park their car in addition to providing information about available spots. Additionally, we employ computer vision to identify the number on the license plate to keep an eye on the cars in the parking lot to improve security and to assist users in finding their cars when they lose their location.

Make Use of IoT Technology with an Automated Cashier Machine and Smart Parking System Finding a parking space has become a major factor in the creation of this paper, which focuses on developing our suggested smart parking system. Aside from that, internet of things (IoT) technology has emerged as one of the best tools for complicated systems that require little hardware. It is anticipated that the concept of a smart parking system would be able to offer services for automobile parking spot allocation and search through a mobile application as a result of the deployment of IoT based on cloud computing, a number of smart devices, and smart automatic machines.

The implementation of smart parking in smart cities Nowadays, practically every city struggles with inadequate parking capabilities. Finding strategies to maximize the available parking space is crucial, especially when considering on-street parking, as the demand for parking spaces is far greater than the availability and building additional parking facilities is extremely difficult from an economic standpoint. Therefore, the goal is to implement systems that make effective use of the available parking spaces, with a special emphasis on tracking parking spot occupancy and informing drivers of this information. The second half of 2017 saw the implementation of a large-scale pilot project in UherskéHradiste. It included keeping an eye on turnover and testing parking management tools and subsystems.

Internet of Things-based intelligent distributed parking system Urban corporations may have difficulties as cities and populations continue to expand. Parking space regulation is one of these difficulties. Weekends and festival season make this a tiresome task. Inadequate parking space regulations impact fuel economy and cause traffic jams. Numerous parking solutions have been offered in the literature that make use of sensor networks and image processing techniques. Single parking space

management is insufficient for creating a smart city environment, and image processing-based parking systems are only suitable for vast areas. A distributed parking management system is proposed in this research. There are now three parking spaces available. The infrared sensors communicate with the cloud and record the space's condition.

ExistingSystem

The manual drawing process will be implemented during the System Initialization Process. The park slot number can be included in the image during the manual drawing process, which will aid identify the empty parking place. This technique' primary goal is to locate the empty parking space without causing any manual disruptions. The diagram should be easily readable, legible, and provide comprehensive information regarding the parking space. It should also be adequate while the initialization procedure. During the system architecture's initialization plan, the sensor and camera should remain motionless. The following steps are involved in determining and processing whether or not the parking lot is empty.

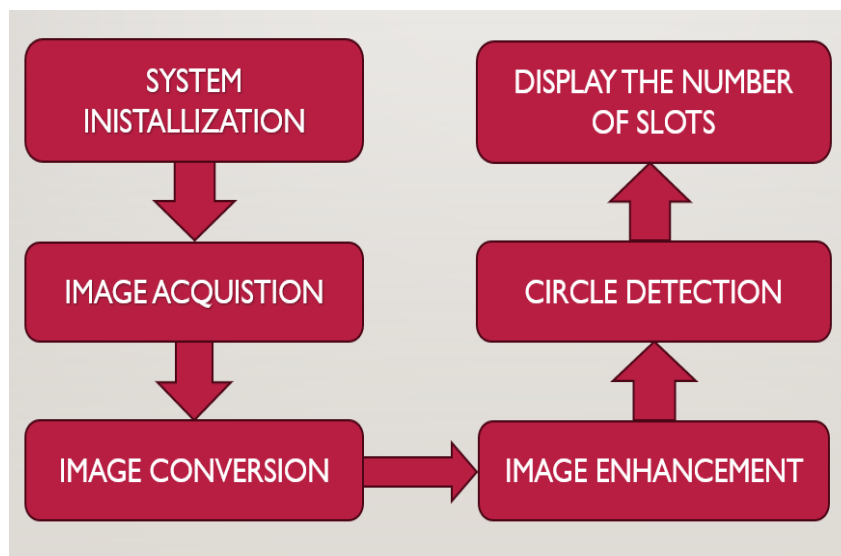


FIG.1: PROCESSOFTHEFLOW CHART

IMAGE ACQUISITION

The following processing module, known as the picture acquisition module in the picture Processing Techniques, can begin when the System Initialization module is finished. The camera in the Image Acquisition module can take pictures from the parking lot. High definition cameras in the parking lot can be used to take the pictures needed for processing.

IMAGE SEGMENTATION

The binary image acquired from the image segmentation module is taken into consideration by the image enhancement module. The image has been enhanced in



this process in order to eliminate the undesirable noise that was produced during the binary image conversion. They can be used to trace the detected image's outline. Images from different locations with some noise will be captured by the digital camera. A method known as morphology can be used to eliminate the obtained noise. One unique method for ignoring the imperfections discovered during image segmentation is morphology. The opening and closing morphological processes are the most often utilized of the four processes that the morphological mechanism goes through: dilation, erosion, and opening and closing processes.

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IMAGEDETECTION MODULE

Only when the Image Enhancement Module has determined the precise edge and outline boundaries of an image can the Image Detection Module be implemented. To determine the precise shape of an image, the dimensions of area and perimeter must be taken into account during this process [5]. To tell drivers to park their cars in the vacant parking space, an image's precise shape is required. The equation provided below can be used to determine the shape of an image.

Circledetection

$$(x-a)^2 + (y-b)^2 = r^2$$

Since the number of circles is equal to the number of empty parking lots, this procedure is crucial to the system. In many image processing systems, circle detection is the only application for the Hough transform. One feature extraction method for finding circles is the Circle Hough Transform (CHT). It is a Hough Transform specialty. Finding circles in poor image inputs is the technique's goal. The local maxima in a so-called accumulator matrix are chosen after the circle candidates are created by "voting" in the Hough parameter space. The CHT equation is provided by

$$(x-a)^2 + (y-b)^2 = r^2$$

Decide on a threshold. Once the circles have been located, measure each one's diameter. Next, determine how many diameters there are in the picture. There are exactly as many circles as there are diameters. The number of open spots is implied by the number of circles.

PROPOSED SYSTEM

To create an averaged backdrop reference image, a predetermined number of photos are taken in the first step, and their average is determined. There are no automobiles in this reference photograph. Finding the parking spaces in the picture is the primary goal. The camera that is used to take the pictures is set in place and always faces the same direction. The device, which is placed at the parking lot's entrance, uses pictures rather than an electrical camera to identify cars. It will record sequences of images. Using an image of an automobile as a reference, image matching is used to match the collected photographs one after the other.

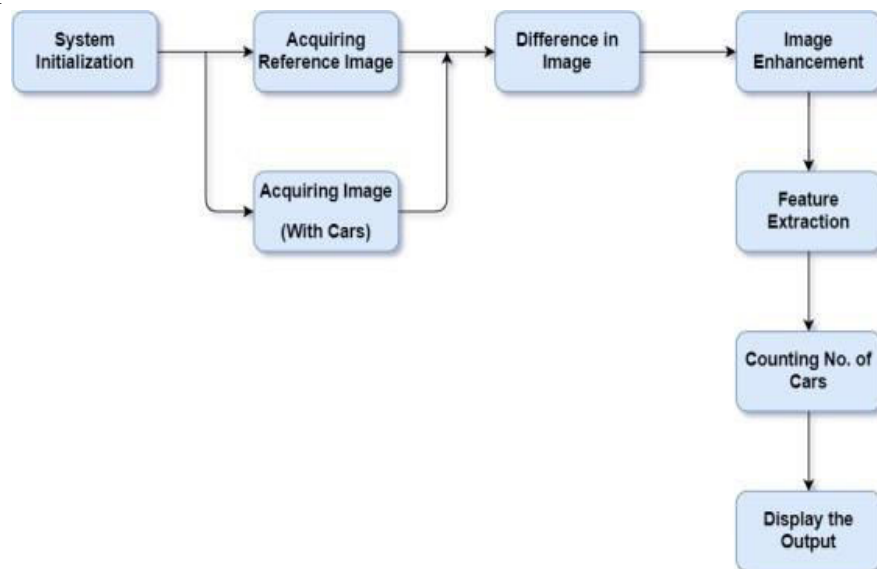


Fig 2: Proposed System block diagram

The suggested algorithm's primary steps for detecting parking spaces are: i. The camera will provide the system with live streaming video of the parking lot. ii. When a car pulls into or out of the parking lot, pictures are taken. iii. Grayscale images are created from RGB photos. iv. Perform calibration, which entails choosing the parking slot's coordinates first. This will crop the image to remove the excess area that isn't the parking lot. Second, choose the single parking slot's coordinates. This will create slots of uniform size in the parking lot. v. To make the car white and the parking lot black, each block is first transformed from grayscale to binary, and then inverse binary. 22 vi. Each block's threshold value is determined to determine whether or not a car is present. vii. The block is free and available for parking if the value is less than the threshold value; if the value is larger than that, the block is occupied. Only until the

Image Enhancement Module has acquired the precise edge and outline boundaries of an image can the Image Detection Module be put into use. To determine the precise shape of an image, the dimensions of area and perimeter must be taken into account during this process [5]. To tell drivers to park their cars in the vacant parking space, an image's precise shape is required.

DESIGN METHODOLOGY

In order to determine the amount of available spaces, this research study has suggested a system that uses OpenCV, one of the most potent computer vision libraries, together with image processing algorithms. Videos are captured from the top perspective of the parking lot using a fixed camera. The background reference image was taken at the time of installation by a reliable CCTV camera. This reference image does not include any cars. Video is segmented using frames. The pickle module in OpenCV is then used to store the segments once a key frame has been taken from each one to lower the computational cost. Pixel arrays and other extracted image features for use in machine learning models can be saved and loaded using the pickle module in image processing. After then, the segments go through another processing. The primary objective is to locate the parking spots in the picture. Always facing the same general direction, the camera used to snap the photos is stationary. An image of a parking lot filled with automobiles is captured by a high-definition camera. Within the visual frame including lanes, lanes are divided. First, a grayscale image is created from the received RGB image. and a binary image is then created in the Image Segmentation module. For feature extraction, we have employed an algorithm called GLCM (Gray-level-co-occurrence-matrix). It examines the relationships between pixels and indicates the frequency with which a particular pixel combination appears in an image in a particular direction. We utilize a kernel to highlight each pixel and improve the color it emanates in order to enhance the image.

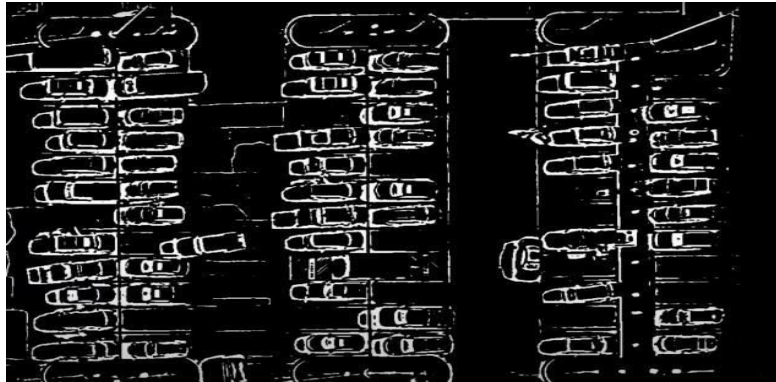


Fig 3:Image after Adaptive Thresholding

The generated grayscale image is converted to a binary image using the adaptive thresholding technique. Instead of employing a single global threshold value for the

entire image, adaptive thresholding computes the threshold value based on local variables inside blocks of pixels. The threshold level is set so that the background is black and the relevant objects are white. The binary image provides a complete description of the place and shape of interest.

Fig 4. Image after Adaptive Thresholding



To lessen the amount of noise in the binary image, the Weiner filter, other morphological procedures, and dilation are applied.

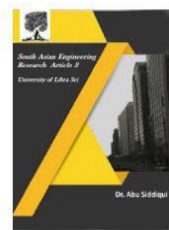
The feature is designed to show the occupied areas with red and the vacant spaces with a green rectangle mark. The vacant spaces are detected by comparing the pixels of the empty space and the image with the car. After that, the number of automobiles is computed and shown as an output.

RESULTS

Using image processing techniques, our suggested system finds empty parking spots and, as an output, shows the number of open spots for a car as well as the total number of parking slots in that parking area.



Fig 5: Final result



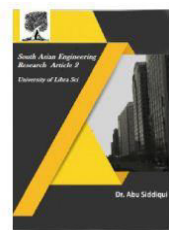
It has been successfully demonstrated by the parking slot detecting system whether or not a parking space is occupied. Rectangle-shaped zones were set as input before the program ran. If a vehicle reaches the specified Rectangle shape's designated zone, the area's pixel will change. As a result, the program would switch the color from green to red. When there is accessible parking or open pavement, the designated boxes are displayed in green, resulting in low pixels. When a particular parking place is taken by a car, the layout instantly changes from green to red since the pixel in that region has grown.

CONCLUSION

The parking space detection system based on image processing in MATLAB was designed and tested. It is possible to manage large area by just using several cameras. It is consistent in detecting incoming cars because it uses actual car images. It is cheap and easy-installed because of the simple equipment. Drivers can get useful real-time parking lot information from this system by the guidance information display. Future researchers can focus on allocation specific location to customers already registered from online parking management system.

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