Smart Vehicle Monitoring System Using Opencv

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Abstract: The number of vehicles is increasing over the decay very fast as the standard of living has been raised. So, there is a need for a monitoring system for vehicles from unknown parking and security reasons. Many residential buildings administrations, tolls, business complexes, and parking spaces in India lack an automated car parking system and vehicle monitoring for security purposes. Many of the commercial and residential places face an essential problem of illegal car/vehicle parking inside their premises. This issue is not bounded to just for parking but also adds to the security concerns inside those establishments. In this regard, an affordable solution that caters to the Indian markets can be made using the Image Processing method of Open CV. A database of the vehicles in the complex is created to solve these problems existing in the residential complex. The proposed Smart monitoring system process the vehicles appearing in the footage and list the known and unknown vehicles as residents and others not registered in the database to be considered as visitors.

Index Terms: ANPR, Cloud, OpenCV, Vehicle Monitoring System,

1 INTRODUCTION

Vehicles have always been an essential part of human civilization; the rising affluence of urbanization of India has made the ownership of vehicles a necessity. This has resulted in numerous problems in vehicle identification and monitoring. Nowadays there is overcrowding in parking areas due to the increasing number of vehicles. The Automatic Number Plate Recognition System plays a significant role in addressing these issues from parking admission to monitoring vehicle traffic and tracking theft of automobiles. The proposed system in this paper offers a novel method to detect vehicle monitoring in real-time without any human supervision or any prior knowledge [1] [2]. It eliminates human intervention on the building entrances, and the paperless feature is being managed. It is an efficient way of managing the In/Out records for the Vehicles with 100% Accuracy. Vehicle numbers can now be added as credentials within access control systems, offering businesses and residential buildings the ability to streamline vehicle entry and can be used for another purpose like tracking of stolen vehicles that evade traffic signals, tickets toll collection, or vehicle's taxes, etc. [4]. In literature, there are several methods that are used for monitoring vehicles like GPS, Soble filter, Contourlet Transform, and Support Vector Machine. GPS can be used only to track the location, but its monitoring features and limited [6]. Soble filter is used to detect the number plate, but it lacks speed and accuracy when compared to the canny edge method [3]. Contourlet Transform and Support Vector Machine (SVM) were used to find out the model of the vehicle. But they cannot be used for real-time monitoring of vehicle [1]. The proposed product has been designed for smooth and effortless execution in real-time [2] to overcome all these problems.

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Parking can be simplified by the installation of cameras at a parking lot entrance and exit. As soon as someone pulls up to a garage at an apartment building or drives up to a gated lot, the Automatic number plate recognition (ANPR) system will scan the plate. The IoT enabled smart appliance verifies the credentials (once approved), permit them in. From the security room, the operator receives a video of the vehicle, credentials, and their picture. This smart monitoring system makes use of a microprocessor connected with a Camera and local database to provide high tech monitoring at a low cost. The proposed product can be used in the home, residential society, business complex, and many other places. It overcomes many problems in the present traditional system, and it is very economical. This proposed product will alert the owner at the time of vehicle entry and takes video of the place at that instant via camera and recognizes the number plate details and owner credentials. It then stores it in APP via the cloud server.

2 THE PROPOSED PRODUCT:

Once the vehicle entry is detected by the camera, the Automatic number plate recognition system will scan the plate and recognizes the vehicle number. The Microcontroller compares vehicle number with the database, and collects the car owner credentials, and sends the data to the app via the cloud.

Basic outline:

When the vehicle enters in the place,

1. **Number Plate Detection:** The first step is to detect the number plate from the vehicle. The image of the vehicle is captured using a camera and fed to the processing system. The Contour option in OpenCV is used to detect rectangular objects.

2. **Character Segmentation:** Once the Number Plate is detected, it is cropped out and saved as a new image.

3. **Character Recognition:** Optical Character Recognition (OCR) is used to detect the number and characters in the Number plate.

4. **Data Acquisition & Transmission:** The vehicle number is used to collect the details of the detected

vehicle. The details are collected from the database using Python Mysql connector and sent to the app via the cloud.

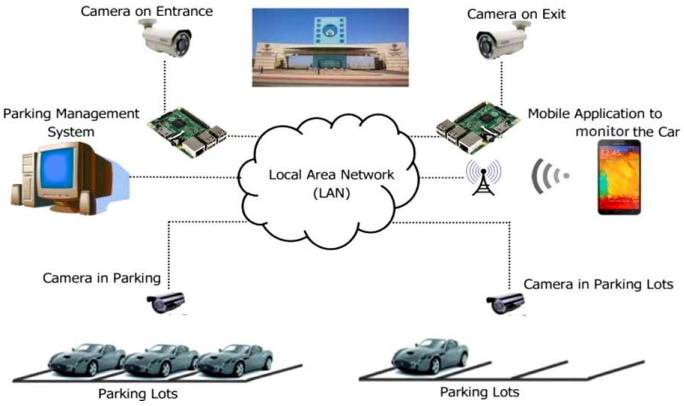

Fig. 1: *Block diagram of the proposed smart monitoring system*

3 HARDWARE COMPONENTS

3.1 Raspberry Pi:

The Raspberry Pi is a mini-computer that runs Linux, but it also provides a set of GPIO pins that allow you to control electronic components for physical computing and explore the Internet of Things [9].

CPU : 4× ARM Cortex-A53
GPU : Broadcom Video Core IV
RAM : 1GB LPDDR2
Networking: 2.4GHz 802.11n wireless
Bluetooth : Bluetooth 4.1 Classic, BLE
GPIO : 40-pin header, populated
Ports : HDMI, 3.5mm jack, USB 2.0, Ethernet, CSI, DSI

4 SOFTWARE TOOLS

MySQL is the language that is used to create, modify the database. Netbeans is an Integrated Development Environment that is used to write and debug code. Xammp is a GUI tool that is used to create and manage the database in a user-friendly environment.

4.1 MySQL:

MySQL is open-source software under GNU General Public License terms and under a variety of proprietary licenses. It is a fast, easy to use a relational database. It is currently the most popular open-source database. It is commonly used along with PHP scripts to create powerful and dynamic applications on the server-side.

4.2 Netbeans Ide :

NetBeans IDE is an official Integrated Development Environment for Java 8. We can smoothly upgrade our applications to use new Java 8 language converters using its editors, code analyzers, and quickly and, we can construct lambdas, functional operations, and method references. It helps to design GUI for Java, HTML, PHP, C,C++, and Java EE and ME applications quickly. NetBeans GUI Builder automatically correct the spacing and alignment, while supporting in-place editing for Java SE applications,

4.3 Xampp :

XAMPP is a tool that uses Apache, MySQL, PHP, and Perl. Xampp is a simple and light Apache distributor that makes it easy for developers to create a local web server for testing. The server application (Apache), a scripting language (PHP), and database (MySQL), which is needed to set up a web server, can be included in a simple extractable file. XAMPP is also a cross-platform tool that works on Windows, Mac, and Linux .The transition from the local test server to a live server becomes simple as many web servers use the same components as XAMPP.

5 NUMBER PLATE RECOGNITION:

5.1 Number Plate Detection:

- First, the image is resized to the required size, and then it is greyscaled.

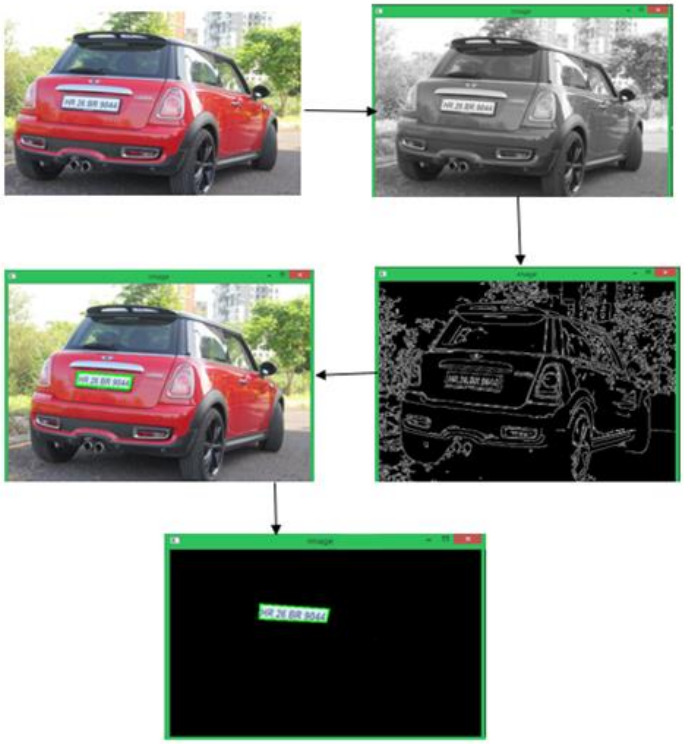

Fig.2*: Block diagram of license plate detection*

- The image fed will have both useful and useless data; here, the Number plate is useful data, and other information is considered as mere useless. This useless data is noise. Usually, a bilateral filter (Blurring) is used to remove the unnecessary details from the image
- Then the Canny Edge method is used to perform edge detection in the image.
- As the location of the number plate is determined, the remaining useless information is masked. Now the entire picture except the number plate is masked.

5.2 Character Segmentation:

The license plate is segmented out of from the image, and it is cropped and saved as a new image using ANPR in Raspberry Pi. The image is then used to detect the character in it.

Fig.3: *Character Segmentation*

5.3 Character Recognition:

The last step in this ANPR using Raspberry Pi is actually to read the number plate information from the segmented image. Tesseract package in Open CV is used to read characters from the image.

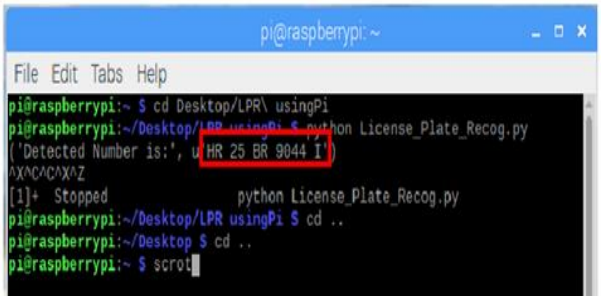

Fig.4: *Character Recognition*

6 DATA ACQUISITION & TRANSMISSION

6.1 PYTHON MYSQL Connector

- In order to access the MySQL database using Python, we require a database driver. MySQL Connector is a standard database driver provided by MySQL. MySQL Connector/Python supports most of the features provided by MySQL version. It allows you to convert the value of the parameter between Python and MySQL data types, e.g., Python DateTime and MySQL DATETIME.
- MySQL Connector/Python is designed specifically for MySQL, supporting all MySQL extensions.
- MySQL Connector/Python uses protocol compression to compress the data stream between the Python and MySQL database server. It uses TCP/IP socket to supports connections and uses SSL to secure TCP/IP connection.
- MySQL Connector/Python is an API implemented by using Python so that it avoids any need for installing any MySQL client library or Python modules except the standard one.

Fig.5: *Output with Number plate recognition*

6.2 Android APP Management

The android app is developed in Android Studio, and to make the app stay connected with the cloud server, PHP codes are developed and uploaded to the Cloud Server. The app has a sign-in screen in which the customer can log in with a unique code for the product. The app has separate windows to view the Vehicle number, owner details, and timing, which will be sent automatically by the product vehicle enters the area. This app can be used for a variety of customers like residential society and business complex . This app supports almost all android versions.

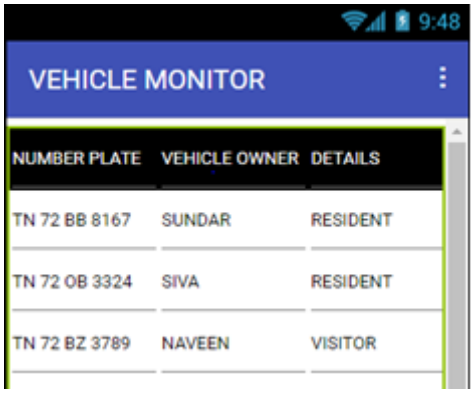

Fig.6: *App Layout*

8 CONCLUSION:

The invention originates from the thirst of researchers to develop a low cost, lightweight, highly reliable, and user-friendly monitoring system that can be used in important places such as business complex, office parking, or residential parking. An ANPR system encourages a smoother parking process and an easier way to manage site security for employees and guests. The aim is to monitor vehicles without any human intervention and send the details to the person in charge of the place at the time of vehicle entry. This can potentially improve staffing, develop better procedures, provide better service, and reduce your organization's liability.

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