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Automatic Number Plate Recognition Using Image Processing

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Abstract- A vehicle license plate recognition system is an important proficiency that could be used for identification of vehicle all over the earth. A number plate recognition system is a piece of technology that automatically recognizes and reads license plates from pictures or videos using machine learning and image processing algorithms. Number plate recognition using image processing methods is a potential research area in smart cities and Internet of Things. The system captures a picture of the license plate, extracts the characters, and then turns them into text so that it may be stored or examined later. In the pre-processing phase of this work, morphological transformation and Gaussian smoothing are two of the image processing techniques used. Subsequently, border-following contours are applied and filtered according to character dimensions and spatial localization for number plate segmentation. Character recognition is then accomplished using the K-nearest neighbour algorithm following the region of interest filtering and de-skewing processes. It can be used for many different things, such as law enforcement, toll collecting, parking enforcement, and traffic control. The systems accuracy and efficiency depend on factors such as image quality, lighting conditions, and the complexity of the license plate design.

Keywords- license plate recognition, morphological transformation, Gaussian smoothing.

1. INTRODUCTION

India is a huge nation that is expanding. Both the people and economy of the country are undergoing amazing change. The amount of traffic on the roads rises along with population growth. The following reason contributes to the higher rate of crime associated with traffic. Many burglary, hit-and-run, grabbing, and on-street fatalities remain investigated because the involved car was not clearly visible. This is a result of the inability of the human eye to read license plate characters from quickly moving cars [1].

The huge amount of cars on the road nowadays makes it challenging for law enforcement and security agencies to monitor vehicles [2]. One instance is the security system at the university campus gate entrance, where checking each car's license plate physically and visually takes

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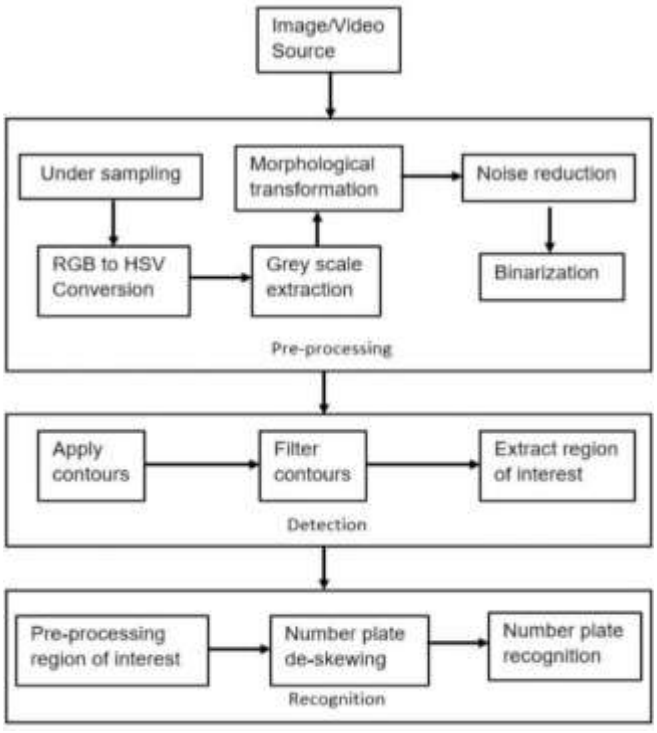
a lot of time for the security guard. Furthermore, hiring many guards to serve as full-time license plate inspectors is not practical. To begin with, the use of stickers as a means of identifiable identification to allow access to the campus is not infallible. It has security issues, such as duplication's ease of use. A method for tracking and identifying license plates ought to exist that doesn't require constant human services support [3]. Automatic number plate recognition (ANPR), which defines each individual character of the number plate using an optical character recognition (OCR) approach and image processing technique, can be used to do this.

Consequently, a number of earlier experiments on license plate recognition systems for cars have been conducted. The data from the license plate is obtained by the vehicle license plate recognition system through a variety of methods [4-6]. For example, Rajput and Som [7].suggested a framework for an automated vehicle license plate recognition system that automatically looks for ways to improve on the drawbacks of current methods. Three stages make up this process: image capture, number recognition, and license plate localization. This method, which is based on a single-stage wavelet transform, is helpful for practical applications because it has shown to be effective in a variety of scenarios. The suggested method has achieved high accuracy, with an average accuracy of 97.33%, according to experimental results.

In order to deploy intelligent transport systems, Quiros et al. [8] presented automated plate detection using contour matching and edge detection in image processing. With an average accuracy of 96.67%, the suggested strategy has been successful. Davix et al. [9] proposed a license plate detection system based on colour detection combined with channel scale space methodology. To distinguish the license plate and identify the vehicles, the aspect ratio is calculated using the suggested method. An accuracy of 94.23% was obtained using the CIE-XYZ color model in the process.

2.METHODOLOGY



2.1.1 Input Image

The original license plate can be found in the photos, which is where the license number must be obtained. The system gets photos as input through the camera module.

2.1.2 Under Sampling

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In image processing, under sampling is a technique used to reduce the size of an image by deleting some of its pixels. In automated number plate recognition (ANPR) systems, under sampling is used to reduce the computational complexity of image processing algorithms and improve system efficiency.

Automatically identifying license plate characters from a recorded image is the aim of ANPR systems. The high resolution of modern cameras can result in massive image files that are challenging to process computationally. By using under sampling to reduce the image's size, the ANPR system can process the image more quickly.

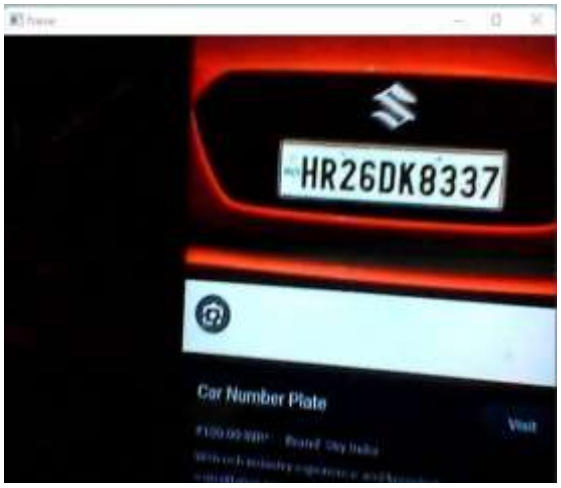

FIGURE: 2.1 UNDER SAMPLING

2.1.3 Modification of Morphology

An image processing technique called morphological transformation is used to analyze and change a picture's object shapes. You can extract specific features from the image, such as corners, blobs, and edges, by performing a number of mathematical operations on the image. In the context of automatic number plate recognition (ANPR) systems, morphological alterations can be used to enhance the number plate image and extract the characters for recognition.

Morphological changes can aid ANPR systems in enhancing character identification accuracy by sharpening and enhancing character contrast, as well as by removing artifacts and noise that may impede the recognition process.

2.1.4 Noise Reduction

In image processing, noise reduction is an essential step, particularly in automatic number plate recognition (ANPR)systems that aim to recognize license plate characters accurately. Random fluctuations in brightness are one way that noise might appear in automatic number plate recognition system.

ANPR systems can enhance the precision of character recognition, resulting in more dependable and effective identification of license plate numbers, by decreasing noise in the license plate image.

2.1.5 RGB TO HSV Conversion

RGB to HSV conversion is the process of converting an image from the RGB colour space (Red, Green, and Blue) to the HSV colour space (Hue, Saturation, and Value). To enhance the contrast and sharpness of the number plate image, this conversion can be useful in the context of automatic number plate recognition (ANPR) systems.

By transforming an image from RGB to HSV, ANPR systems can

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modify an image according to its colour properties, such as adjusting the brightness or saturation of specific colours. This can assist make license plate characters stand out and be easier to see by increasing their contrast and sharpness.

2.1.6 Removal of Grey Scale

The grayscale extraction approach in image processing converts a colour image into a grayscale image, which solely consists of shades of grey. In the context of automatic number plate recognition(ANPR) systems, grayscale extraction can be useful for simplifying and reducing the complexity of the number plate image, which can improve character recognition accuracy.

Every pixel in a grayscale image is represented by a single intensity value, with grayscale values falling between black (0) and white (255). As opposed to this, each pixel in a colour image contains three intensity values—one for each of the three colour channels (red, green, and blue).

FIGURE:2.2 IMAGE OF GREY SCALE EXTRACTION

2.1.7 The Binarization Process

A grayscale or colour image is converted into a binary image with only black and white pixels during the binarization process. In the context of automatic number plate recognition (ANPR) systems, binarization can be useful because it streamlines the number plate image and makes character segmentation and recognition easier.

In a binary image, each pixel is represented by a binary value, typically 0 for black and 1 for white. When a threshold is applied to a grayscale or colour image, during the binarization process, the pixels above the threshold are set to white and the pixels below the threshold are set to black.

2.1.8 Number Plate De-skewing

An image processing method called "number plate de-skewing" aligns and centers a number plate picture on the horizontal axis. In the context of automatic number plate recognition (ANPR) systems, de-skewing can improve character identification accuracy by making the characters appear more consistent and reducing the effect of perspective distortion. There are numerous factors that could cause license plate photos to be skewed or rotated, the camera angle and the location of the car being only two examples. Determining the skew's angle and rotating the image are the steps involved in de-skewing.

3.HARDWARE SETUP

3.1 Block diagram

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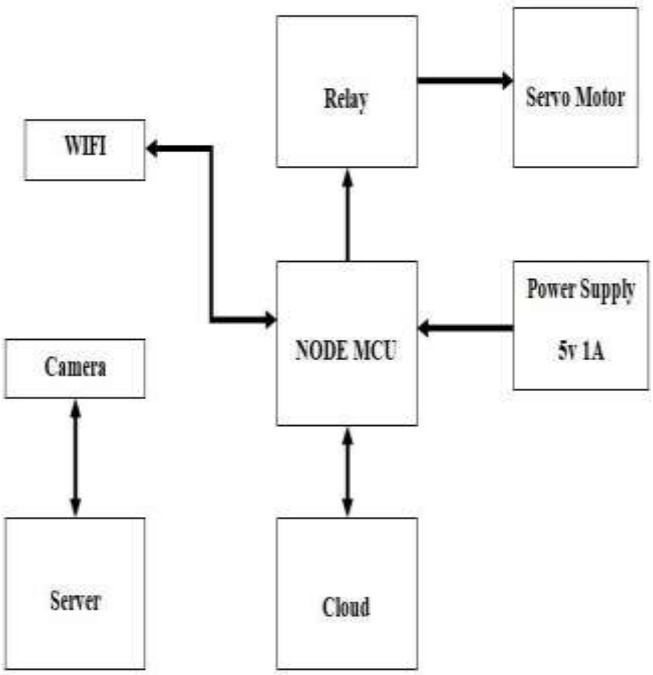
FIGURE:3.1 BLOCK DIAGRAM



3.2 HARDWARE SPECIFICATION

3.2.1 NODE MCU

FIGURE:3.2 NODE MCU

An open-source development board called Node MCU ESP8266 is built around the ESP8266 microcontroller. Because it has Wi-Fi connectivity, it can be used for Internet of Things applications. The Lua scripting language is supported by the Node MCU ESP8266, which is a great option for novices and enthusiasts as it is simple to learn and operate. Fig. 3.2: Node MCU The 32-bit RISC CPU of the ESP8266 microcontroller operates at 80 MHz clock speed. It contains an integrated Wi-Fi module that may operate as an access point or client and supports 802.11 b/g/n protocols. Additionally, it contains a number of GPIO (General Purpose Input/Output) pins that are useful for integrating with other hardware, like displays, actuators, and sensors.

Using Lua scripts, Node MCU ESP8266 offers an easy and practical approach to program and interface with the ESP8266 microcontroller. A computer may be used to program and debug the board thanks to its included USB-to-serial converter. Additionally, it offers a specialized API (Application Programming Interface) that grants access to the ESP8266 microcontroller's GPIO pins, WiFi module, and other functions. Because of the Node MCU ESP8266's low cost, simplicity of usage, and integrated Wi-Fi connectivity, it is frequently used for IoT project development and prototyping. Numerous uses for it exist, including data logging, sensor networks, home automation, and remote monitoring.

3.2.2 SERVO MOTOR

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An electromechanical device that transforms electrical signals into rotating motion is a servo motor. It is frequently used to regulate the position and motion of mechanical systems in robotics and automation applications. Figure 3.3: Motorized Servo Typically, a DC motor, a gear train, and a control circuit make up a servo motor. The control circuit uses the signals it gets from a microcontroller or other control device to adjust the motor's direction and speed. The gear train increases the motor's torque and decreases its rotational speed, enabling it to precisely drive mechanical loads.

FIGURE:3.3 SERVO MOTOR

A servo motor's control circuit is made to precisely and steadily maintain the motor's speed and position. It accomplishes this by means of a feedback device that modifies the motor's speed and direction in response to a comparison between the motor's actual and desired positions. Usually, an optical encoder or potentiometer is used to achieve this feedback system.

3.2.3 SINGLE CHANNEL RELAY

An essential part of a smart lock system for parking two-wheelers can be played by a single channel relay. Relays function as switches that microcontrollers can operate. The relay

turns on or off in response to signals from the microcontroller, permitting or prohibiting electricity to get to the lock.

FIGURE:3.3 SINGLE CHANNEL RELAY

The lock, the relay, a power source, and a control signal must all be connected for the smart lock to function with the relay. The lock will be connected to the output side of the relay, and the microcontroller's control signal will be connected to the input side. For the lock to be powered, the relay and the power source must be connected.

3.3 SIMULATION

Python is a general-purpose, interpreted, high-level programming language. With a strong emphasis on indentation, its design philosophy prioritizes code readability.

Python was developed as a replacement for the SETL-inspired ABC programming language in the late 1980s by Guido van Rossum at Centrum Wis Kunde & Informatica (CWI) in the Netherlands. It was designed to handle exceptions and interface with the Amoeba operating system. It started to be implemented in December 1989. Python boasts a syntax that makes it possible for programmers to write programs in less lines than some other languages.

Python is an interpreter-based programming language, which means that code can be run immediately upon writing. Prototyping can therefore be completed relatively quickly. Since 1.5.2b1, the default Python implementation has come with an integrated programming environment called IDLE, which stands for

Integrated programming and Learning Environment. It comes supplied as an add-on module for Python.

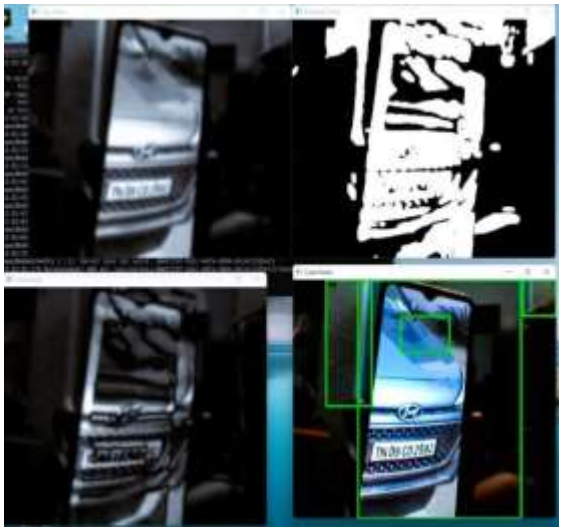

FIGURE:3.4 SIMULATION RESULTS

CONCLUSION

ANPR systems using image processing have many advantages, including high accuracy, speed, and flexibility. They can handle various license plate formats, lighting conditions, and perspectives. However, they also have some limitations, such as sensitivity to noise, occlusions, and variations in font and style. ANPR systems using image processing are an effective and efficient way to automatically recognize license plate characters from images or videos captured by cameras. They have many real-world applications and can help to improve traffic management, safety, and security.

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