AUTOMATIC NUMBER PLATE RECOGNITION SYSTEM

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technology that uses optical character recognition on images to read vehicle registration plates.

Automatic number-plate recognition (ANPR; see also other names below) is a technology that read car registrations plate and create vehicle position data usiing optical character recognition on pictures. It can leverage existing closed-circuit television, traffic enforcement cameras, or cameras created particularly for the job.

Abstract:

In traffic systems, ANPR (Automatic Number Plate Recognition) has a variety of applications (highway toll collection, red light violation , border and customs checkpoints, e t c.). Licence plate recognition AVI systems are quite effective. Plate region extraction, character segmentation, and plate character identification are the three aspects of the proposed method. While acting the plate region, edge detection and In the segmentation part, smearing algorithms, filtering, and other morphological approaches are used. Finally, statistically based template matching is used to identify plate characters. The performance of the suggested algorithm was tested using real pictures.
According to the results of the tests, our technology
outperforms the competitors in car licence plate recognition.

Introduction:

1 Automatic License Plate Recognition (ANPR) Automatic number plate recognition (ANPR) or licence plate recognition (LPR) has emerged as one of the most successful ways for vehicle monitoring in recent years. It can be utilised for traffic enforcement, automatic toll text collection [1], car park system [2], and automatic vehicle parking system [3] in a range of public contexts.

The following are the four steps of an ANPR algorithm: (1) Vehicle image capture

(2) Number plate detection (3) Character segmentation and (4) Character recognition Figure 1

i.e., while it may appear to be an easy process, capturing an image of a moving car in real time while ensuring that none of the vehicle's components, particularly the vehicle number plate, are missing is a difficult tasks. Many systems currently detect and recognise number plates in less than 50 milliseconds [4]. The efficiency of the fourth step is determined by the second and third phases' capacity to recognise the car number plate and distinguish each character. These systems employ a variety of techniques to locate the vehicle's licence plate and then extract the vehicle number from the image.

Artificial neural networks (ANN) [5], [1],[6],[7],[8], [9], [10], Probabilistic neural networks are used by the majority of ANPR systems (PNN) [11], [5], [12], [2], [13], [7], [14], Optical Character Recognition (OCR) Sliding concentrating window [15], MATLAB[16], Configurable method[17], Feature salient (SCW) [14], [8], [29] is a fantastic case study of a licence plate reader (LPR). To boost the resolution of low-resolution picturess, some researchers utilise a technique termed super resolution [30], [31]. It's sometimes necessary to assess an ANPR system's quality. [9.] describes a visual and ANPR quality assessment in detail. [4] examines the recognition of licence plates in depth (LPR). In this

literature, the phrases number plate and licence plate are used interchangeably. The second section digs more into the specifics of each ANPR.

1.2 The scope of this study Because determining which strategy is preferable is impossible, various papers based on the steps mentioned in Fig. 1 are surveyed and classified based on the methodologies utilised in each approach. Parameters such as speed, accuracy, performance, image size, and platform are reported for each approach when they are available. Commercial objects are outside the scope of this study since they frequently claim better accuracy than is true for promotional goals. The following sections make up the remainder of this work: The second section looks at several methods for detecting licence plates. Part 3 discusses character segmentation methods, whereas section discusses character recognition methods. 4. The study concludes with a discussion of what isn't included in ANPR and what forms of research are possible.

2. 2. NUMBER PLATES DETECTION The bulk of number plate recognition algorithms are divided into several categories based on their methodology. When

recognising a vehicle number plate, the following factors should be taken into account: (1) Plate size: A plate in a vehicle image might be different sizes. (2). Plate location: a plate can be located anywhere on the vehicle. (3). The background colour of a licence plate may differ based on the type of vehicle. A government vehicle number plate, for example, may have a different background than other public vehicles. (4). A screw, for example, could be considered a character on a plate. There are different picture segmentation methods in various literatures. The majority of the methods make use of image binarization. Several author use Otsu's image binarization methods to transform a colours images to grayscale. Some plate segmentation methods employ colour segmentation. [22] presents a study of colour segmentation for licence plate positioning. The sections that follow provide an overview of common number plate extraction methods, followed by a detailed evaluation of photo segmentation techniques utilised in various ANPR or LPR publications.

Binarization of pictures (2.1) Image binarization is the process of turning a pictures to black and white. This approach uses a threshold to classify certain pixels as black and others as white. The most difficult part is

calculating the appropriate threshold value for each image. It can be difficult, if not impossible, to choose the optimal threshold value. Adaptive thresholding can be used to solve this problem. Automatic thresholding is when a user sets a threshold manually rather than automatically using an algorithm. Finding the edges A fundamental method for detecting or extracting features is edge detection. When an edge detection algorithm is used, the outcome is usually an object border with connected curves. Some of the edge detection methods and operators used are Canny, Canny-Deriche, Differential, Sobel, Prewitt, and Roberts Cross. Hough Transform It's a feature extraction technique that was first used to detect lines. It was then extended to find the position of any arbitrary form, such as a circle or an oval. D.H. Ballard generalised the original algorithm.

Blob detection is a technique for detecting brighter or more colourful areas or regions than their surroundings. This method's main

purpose is to find complimentary regions that edge detection and corner detection methods miss. Some typical blob detectors are the Laplacian of Gaussian (LoG), Difference of Gaussians (DoG), Determinant of Hessian (DoH), maximally stable extremal regions, and Principle curvature based region detector. Connected Components Component Analysis (CCA) Blob extraction (also known as CCA) is a heuristic-based method for labelling subsets of related components in a unique fashion. It scans a binary image and labels pixels based on the connection circumstances of the current pixel, such as north, north west, and west (8-connectivity). Only the current pixel's north and west neighbours are used for connection. The algorithm is more efficient and is suitable for automated image analysis. This method can help with plate and character segmentation.

Mathematical Morphology In mathematical morphology, set theory, lattice theory, topology, and random functions are all used. Although it is most commonly used with digital images, it can also be used with other spatial structures. It was created to process binary images before being expanded to include grayscale operations and images. Some of the basic operators are erosion, dilation, opening, and closing.

Proposed Methodoloogy:-

In our proposed methodoloogy, we used multiple procedures for licence plate recognition. The steps are as follows: In the first phase, a high-resolution digital camera is used to capture an image of the licence plate. The input image is then turned to a grayscale image, as shown in Figure 1.
UP 15 Z 4974
Gray scale image of car plate

The median filter is then applied to the grayscale image to decrease noise. Altering the grey scale image's threshold value improves the image's contrast, which is then followed by morphological operations like dilatation and erosion. As shown in Figures 1 and 2, the image quality is increased, and it is also used to detect the image's character margins.

UP 15 Z 4974
Dilated image of license plate

UP 15 Z 4974
Eroded image of license plate

This paper's simulation was done in MATLAB version R2012a (7.14.0.739). The number plate image's licence number is converted into a text file that can be changed. The method is tested on a small dataset of 60 pictures. The images of the licence plates were all found on the internet. Discussion of Results:

In most research, number plate segmentation algorithms only work when certain conditions are met, such as illumination, number plate shape (which is usually rectangular), size, distance between camera and vehicle, and colour. Only a few algorithms [33], [30], [39], [51], [61] work for real-time video images of licence plates; otherwise, a static image of the licence plate is provided to ANPR for analysis. The success rate of plate segmentation detection versus plate resolution for various ANPR is shown in Table 1. Table 1 eliminates systems when the image size and number plate detection success rate are not stated. Processing times for plate segmentation have been seen to range from 15ms to 1360ms. [52] reported a 15ms processing time reduction, whereas [53] claimed a 1360ms processing time increase. Character segmentation and identification are clearly influenced by number plate detection rate, which in turn effects overall recognition rate.

According to the literature reviewed in this section, image binarization, Sliding concentric window (SCW), Sobel operator, Canny-edge operator, Connected component analysis (CCA), Hough Transform (HT), Fuzzy discipline based approach, Probabilistic neural network (PNN), and trichromatic imaging with color-discrete characteristic approach can all provide promising results for number plate segmentation. To proceed with character recognition, more image processing in the form of character segmentation is required, which is discussed in the next section.

Conclusion:

ALPR is essential for averting a variety of crimes, including theft, accidents, and burglary. ALPR collects the image of a car licence plate and recognises the licence number using various algorithms to acquire information about the vehicle owner. We offer a method for taking a licence plate image and then conducting noise reduction on it to improve the results in this study. Then, to segment and recognise characters, template matching is performed. The approach, however, can only be used with binary images and not RGB images. Also, because the templates must be 24x42 in size, the template matching technique is not flexible. Future research on this area should address this inflexibility in order to enhance recognition rates.

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