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"VEHICLE NUMBER PLATE RECOGNITION"

An Application of "DIGITAL IMAGE PROCESSING"

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Abstract:
Automatic vehicle identification (AVI) has many applications in traffic systems. Vehicle number plate recognition is an effective form of vehicle identification. This paper mainly focuses on three major areas: extraction of plate region, subdivisions of characters and recognition of plate characters. This system takes a vehicle image of any size, break into smaller image pieces; these pieces are then analyzed to locate the exact location of the number plate in the image. Once the area of the number plate is found, the plate is parsed to extract the characters from it. These characters are then given to OCR (Optical Character Recognition) module. OCR technique recognizes those characters and converts them into text format. The process of OCR involves several steps including segmentation, feature extraction and classification. Signature technique is used for the implementation of NPR (Number Plate Recognition). Thresholding the row and column wise signature at the respective median values. Adaptive thresholding techniques can be used to work on pictures having non uniform illumination Variations in contrast levels and the sharpness of the edges in the images made the task of involving a threshold to the edge image to convert it to a binary image difficult to do reliably for all cases. The threshold is too low, there will beseveral edges and the boundaries will run together, making the object separation tough.

INTRODUCTION:

Digital image processing is an area characterized by the need for extensive experimental work to begin the viability of proposed solutions to given problem. The objective of this paper is to build a real time application which recognizes number plates from cars image processing is processing of images using mathematical operations by means of any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters connected to the image. Most image-processing techniques include treating the image as a two-dimensionalsignal and applying standard signal-processing techniques to it. Imagesare also processed as three-dimensionalsignals where the third-dimension being time or the z-axis.

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DESIGN:

Our license plate recognition system can be roughly broken down in to the following **Block-Diagram:**

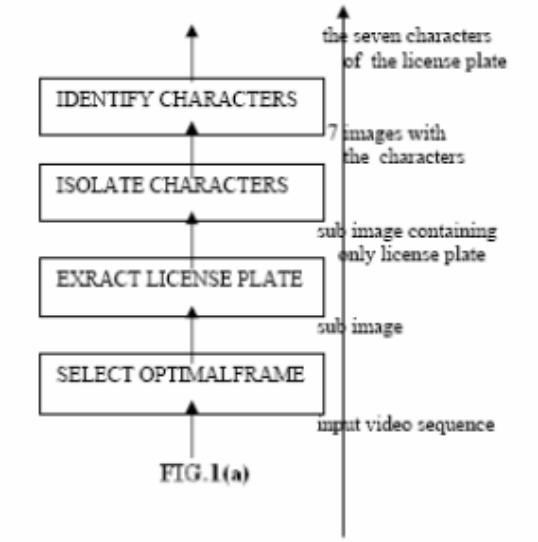

FIG.1(a)

LICENSE PLATE DETECTION:

FIG.1(b)

Plate region extraction is the firststage. Image captured from the camera is first converted to the binary image containing of only 1,s and 0's by thresholding the pixel values of 0 for all pixels in mthe input images with luminance less than threshold value and 1(white) for all other pixels. The binarized image is then processed using particular methods. To catch the plate region, firstly smearing algorithm is used. Smearing is a method for extraction of text areas on the mixed image.

LOCALIZATION:

After extracting the text area, the license plate is to be localized. Initially, the picture is threshold so that the license plate characters were represented in the picture in a color different from the background.

BINARY IMAGE OF THE CAR:

A special filter whose aim is to select such areas of the picture in which the contrast between neighboring points which will certainly exceeds certain, threshold, was designed to binarize the picture.

NUMBER PLATE EXTRACTION:

Signature searching:

The second method of license plates localization is based on localization of theirsignatures. The signature is a characteristic sequence of minimum and maximum in the brightness function calculated on a single row of input image.

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HORIZONTAL SIGNATURE OF THRESHOLD VALUE OF 49:

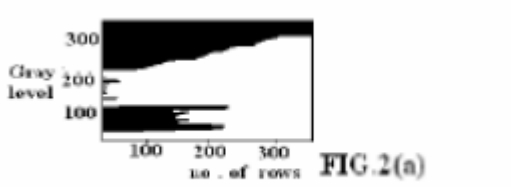

FIG.2(a)

CHARACTER LOCALIZATION:

Main task of the character localization and segmentation is to find which parts of the license plate candidate image contain characters and tochanged out these parts as individual images for further processing.License plate candidate image is normalized, interchanged to get a license plate horizontal and redundant borders are cut-off. Then, based on its horizontal and vertical projection, candidate is splitted into two rows in event of double row license plates and initial charactersegmentation is performedprocessing.License plate candidate image is normalized, rotated to get a license plate horizontal and redundant borders are cut-off. Then, based on its horizontal and vertical projection, candidate is spitted into two rows in case of double row license plates and initial character segmentation is performed.

CHARACTER SEGMENTATION:

In the segmentation of plate characters, license plate is segmented into its constituent parts obtaining the characters individually. Image is filtered for enhancing and removing the noises unwanted spots.

SOBEL OPERARATOR MASKS:

OCR(Optical CharacterRecognition):

The goal of OCR is to classify optical patterns(often contained in a digital image) corresponding to alpha numeric or other characters. The process of OCR involves several steps including segmentation, feature extraction and classification.

-1	-2	-1
0	0	0
1	2	1

-1	0	1
-2	0	2
-1	0	1

FIG.2(c)

The boundary will be then processed to define a sub image enclosing object.

There are two basic methods used for OCR:

Matrix matching and feature extraction.

• Matrix matching compares what the OCR scanner sees as a character with a library of character matrices or templates.

• In feature extraction, the computer looks for general features such as open areas, closed shapes, diagonal, line intersections etc.

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DIGIT RECOGNITION:

Using euler number:

Euler number is a structural property of a image, defined as the total number of objects in an image, minus the number of holes in them.

FIG.2(d)

Number = 1 – 2 = -1.

By calculating the Euler number of the image, it is possible to distinguish between three main sets of digits:

DIGITS WITHOUT HOLES:


FIG.2(e)

DIGITS WITH ONE HOLE


FIG.2(f)

ONE DIGIT WITH TWO HOLES


FIG.2(g)

(b)CHARACTER RECOGNITION**:**

Before recognition, the characters are normalized. Normalization is to refine the characters into a block containing no extra white spaces in all the four sides of characters. Each characters fit into equal size.

EQUAL SIZED CHARACTERS:

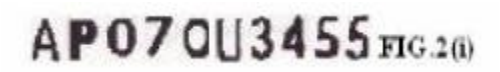

FIG.2(i)

The next step is template matching where character image is compared with the ones in the data base and the best similarity is measured. For this cross-correlation which is a measure of similarities or shared properties between two signals.

IMPLEMENTATION:

Matlab provides an intuitive language and a flexible environment for technical computations which integrates mathematical computing and visualization tools for data analysis and develpement of algorithms and applications.

TYPICAL APPLICATIONS:

Parking:

The plate number is used to automatically enter pre-paid members and estimate parking fee for non-members by comparing the exit and entry times. In this example, car plate is recognized and stored. When the car plate exits later through the right side, car plate is read again and the driver will be charged for the period of the parking. The gate will be automatically opened after payment.

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FIG.3(a)

BORDER CONTROL:

The car number is registered in the entrance or departures to the country, and used to monitor the border crossings. It can short the border crossings turnaround time and cut short the typical long lines. This installation is used to track all border crossings.

FIG.3(b)

ACCESS CONTROL:

A gate automatically opens for authorized members in a secured area, thus replacing the security guard. The events are logged on to a database to search the history.

FIG.3(c)

In this example, the gate has been just automatically raised for the authorized vehicle, after being recognized by the system. The event (result, time and image) is logged in the database.

ENFORCEMENT:

The plate number is used to produce a violation fine on speed or red-light systems. The manual process of preparing violation fine is replaced by an automated process.

FIG.3(d)

The photo is an example of a speeding car caught by the traffic camera. The data block on the top-right side is additional speeding information that is spontaneously extracted from the developed film, used to complete the fine notice and inserted to a database. The violators can pay the fine on-line and are obtainable with this photo as a proof with the speeding information.

AIRPORT PARKING:

In order to reduce ticket fake or faults, the NPR unit is used to capture the plate number and image of the cars. The information may be used to analyze the parking time or provide a proof of parking in case of lost ticket. This photo shows the gate of long term airport parking.

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FIG 3(f)

Conclusion: This paper described about the implementation of Vehicle Number Plate Recognition and various techniques involved in it. This is one of the applications of image processing.

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