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Dynamic Traffic- Rule- Violation Monitoring and Detection System

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Abstracts

In this paper, we present the construction of a system which detects violations at a street intersection such as lane violation during red light running and thereby we can trace each and every individual vehicle and provides information to the concern authority in order to take effective action and hence we can reduce the number of accidents occurring on the traffic junction. The technique we used is Automatic number plate recognition (ANPR) which is a mass surveillance method that uses optical character recognition on images to read the number plates on vehicles. This uses LPC2129 of ARM 7 as the core controller so that it can be implemented in real time, this will be surely become an efficient solution for the problems facing in traffic departments regarding rules violating vehicle identification, vehicles stealing etc. and helps in keeping traffic always in monitored condition.

Keywords: ARM7 Processor, GSM Module, ANPR, Image Processing, IR Transreceiver.

Introduction

Police enforcement is a necessary element in road safety policy. Safety and comfort of road users is becoming a matter of great concern. It is essential to build a safer and much more reliable system for traffic control and management, since the number of on road accidents has shoot up greatly with the increase in vehicle traffic. The objective of this project is to introduce a system which detects violations at a street intersection such as speed violation, stop line violation and lane violation during red light running and thereby we can trace each and every individual vehicle. Automatic number plate recognition (ANPR) is a mass surveillance method that uses optical character recognition on images to read the number plates on vehicles. ANPR uses optical character recognition (OCR) on images taken by cameras.

The cameras used can include existing road-rule enforcement or closed-circuit television cameras, as well as mobile units, which are usually attached to vehicles or ones specifically designed for the task. In this study, a smart and simple algorithm is presented for vehicle's number plate recognition system. The proposed algorithm consists of three major parts: segmentation and extraction of characters, recognition of plate characters and sending vehicle number to pre-entered mobile phone number. The performance of the proposed algorithm has been tested on real images. Based on the experimental results, we noted that our algorithm shows superior performance in car license plate recognition.

Hardware system design

Block diagram

The main hardware system consists of Web Camera, IR transmitter and receiver module, GSM modem, 16x2 LCD module, Mobile unit, Personal computer with Mat Lab and Keil software, and ARM7 TDMI (LPC 2129). The complete block diagram of the traffic monitoring system is as shown in the figure 1

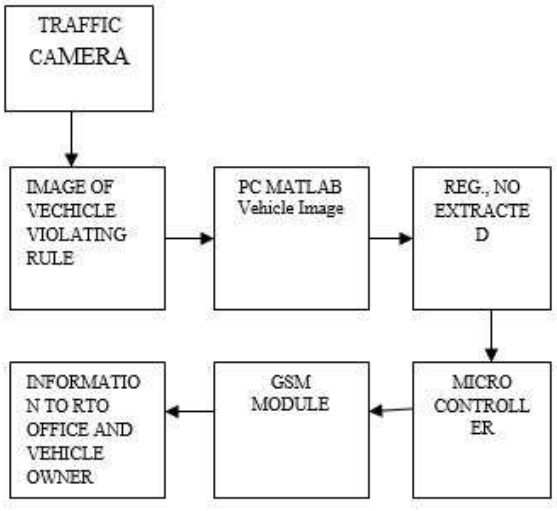

Fig 2.1 Block Diagram of Traffic Rule Violation Detection System

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ARM7 (LPC2129)
Microcontroller

The **LPC 2129** are based on a 32 bit ARM7 TDMI-STM CPU with real-time emulation and embedded trace support, together with 256 kilobytes (KB) of embedded high speed flash memory and 16 kilobytes of Static RAM. A 128-bit wide internal memory interface and unique accelerator architecture enable 32-bit code execution at maximum clock rate 60MHz with PLL.

With their compact 64 pin packages, low power consumption, various 32-bit timers, combination of 4-channel 10-bit ADC with conversion rate of 2.44uS and 2 advanced CAN channels, 2 UART'S, SPI and up to 9 external interrupt pins, these microcontrollers are particularly suitable for high speed applications in industrial control, medical systems, and access control and point-of-sale. Number of available GPIOs goes up to 46 in 64 pin package.

The low power consumption and high performance factors of ARM7 made it to use as heart of the controlling and processing unit in our system to monitor and coordinate all the peripherals connected to the system.

IR Transmitter & Receiver:

To monitor the density of the traffic, we will be keeping a few sets of IR transmitter & receiver sensors on the side of the roads. On side IR transmitter will be placed & right opposite to the IR transmitter, an IR receiver will be kept. This set of IR transmitter & receiver will be kept on roads at different intervals.

Web Camera:

SSD-352 is the web camera included in this project, which has 300k pixels resolution, the frame rate up to 30 fps (40 Mega pixels).True plug-and-play easy USB interface with high quality CMOS sensor and has a adjustable lens for accurate image shooting.

Fig 2.2 Web Camera

The camera may be mounted beside or over a road or installed in an enforcement vehicle to detect traffic regulation violations, including speeding, vehicles going through a red traffic light, unauthorized use of a bus lane, for recording vehicles inside a congestion charge area.

GSM Modem:

Fig 2.3 GSM Module

SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz SIM300 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.The vehicle number from PC given to GSM model which sends that to vehicle owner and RTO office by the SMS message on the GSM net.

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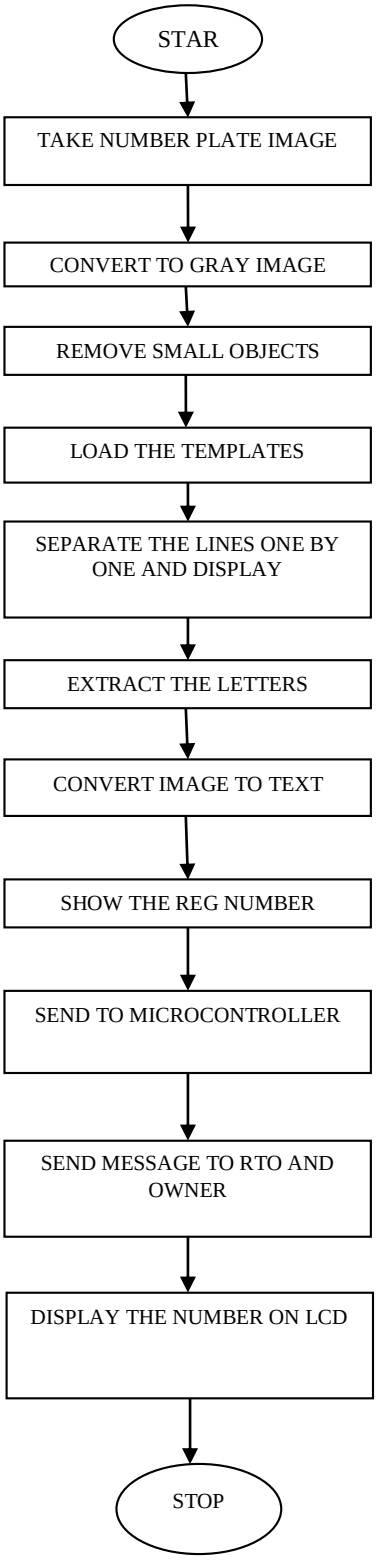
Software design

Flow chart



The procedure followed in the matlab and the control flows according to the steps shown in the flow chart.

I Capturing The Image: Capture the image of vehicle to be monitored using a camera. The image is captured in such a way that, number plate of the vehicle should be visible clearly and illumination is also to be considered.

II Reading The Number Plate Image To Matlab: Image of the vehicle is imported to matlab from the specified directory.

III Preprocessing Of Vehicle Image: Convert the color (rgb) image to gray scale image. Applying prewitt's edge detection method finds the edges of vehicle image. Apply the morphological function "imdilate" to dilute the image, so that edge lines becomes thinner and unwanted small lines will be washed out. Also using "bwareaopen" remove the small objects containing less than 500 pixels. The remaining of the image is the area where number plate is located.

IV. Extract Number Plate From Vehicle Image: Once we get the plate area, it is cropped out from vehicle image and made a separate image. This image is converted to optical image format by complimenting its black and white image.

V.LOAD TEMPLATES FILE: A template file off all optical character image is loaded to matlab. A total of 36 (26 upper case alphabets A-Z, 10 numerals 0-9) optical characters were included in it. Each character is of size 42X24.

VI. Label, Count And Extract The Characters One By One: Apply "bwlabel" command and find how many characters are there in the input image. Label each character, extract them and make that a separate image.

VII. Convert Character Image To Text: Using correlation function a match between extracted image and templates is found. The character in each extracted image is converted to text and stored with a variable.

VII. Interfacing Matlab And Hardware: Matlab is interfaced to microcontroller through DB9 serial com port. The number plate numbers read are sent to microcontroller via RS232 serial connector.

IX. Microcontroller (LPC2129): Microcontroller LPC2129 is used to control the hardware environment.

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Microcontroller is programmed to wait in receiving mode, to receive number plate characters sent from matlab. After receiving the characters, a copy will be sent to display in LCD display, and another copy sent to GSM module which sends it to required persons.

Results and discussions

After compiling the program load the image shown in the figure 4.1 to the matlab and the matlab is made to run. The matlab is going to take the whole image and start extracting the all characters and number present in the board. The matlab starts to show the each character one by one.

Fig 4.1 Vehicle (Car) Image

Fig 4.2 Gray Scale Image

Fig 4.3 Edge Of Fig 4.2 Using Prewitts Method

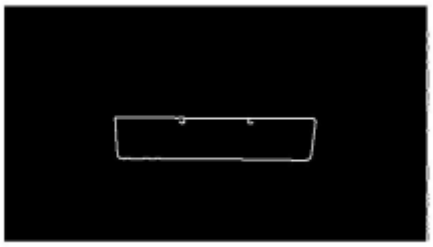

Fig 4.4 Number Plate Area Detected from Fig 4.3

Fig: 4.5 Number Plate Extracted

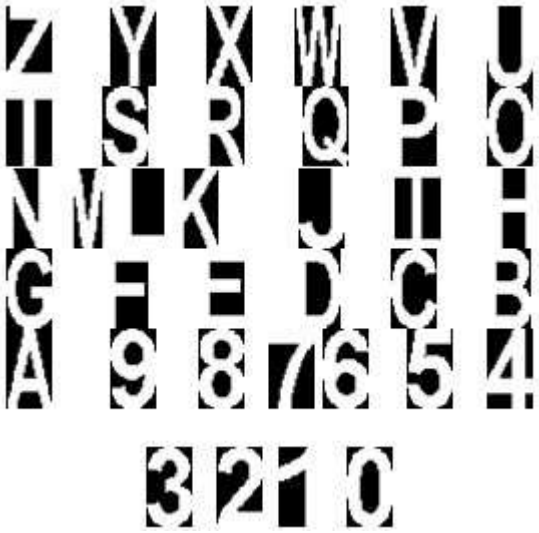

Fig 4.6 Optical Characters Used In Templates

Fig 4.7 Extracted characters from the number plate

These extracted characters are sent to the microcontroller. From the microcontroller plate numbers are sent to the LCD and GSM. And then it reaches to the mobile through the messages. Then in the LCD numbers are displayed.

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Fig 4.7 Overall System Implementation

Conclusions

This project vehicle identification by plate recognition and sending the number using GSM , matlab and microcontroller is efficiently implemented, captured image is loaded to the matlab and characters are extracted , and this will be send to the microcontroller and the number is send to the RTO Office and Vehicle Owner and it is displayed on the LCD display. The hardware which are all used are completely supporting to the work, this system is ready to implement in real time but few more modification are needed to implement in real time regarding capturing image and the human intervention, this will be surely become an efficient solution for the problems facing in traffic departments regarding rules violating vehicle identification, hit and run cases, vehicles stealing etc. and helps in keeping traffic always in monitored condition.

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