Intelligent Vehicle Monitoring System

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***Abstract*- This project aims at collecting tax, insurance and toll in an intelligent way. This is a completely automated system using digital image processing techniques. The detected license plate number reveals the identity of the owner of the vehicle. Now the system checks for the penalties and if there is any penalty the amount will be directly deduced from the owner's account. After this deduction process a feedback message will be provided to the owner. The owner details are collected from the RTO site. This helps to reduce the traffic congestion due to periodic police checking.**

Keywords used:- Pre-processing, Number plate localization, Character segmentation, Character recognition. Raspberry Pi.

I. INTRODUCTION

This is a completely automated number plate recognition system that uses image processing for detecting the number plate which is used for further analysis. This automatic system uses digital image processing techniques. This project aims at collecting tax, insurance and toll in an intelligent way. In some countries we have automatic toll collection systems but they are all costly solutions and here we have implemented a cost effective monitoring system. A completely automated number plate recognition system. The process can be summarized as follows. This automatically detects, recognize and identify a number plate. The captured image is then processed by image processing techniques. The detected number plate is further used for other requirements like toll collection, insurance check, tax collection, pollution check etc.

II. EXISTING METHODS

The present system by which we can check for insurance tax payment, validity of RC book, pollution check etc is only by police checking. The process is simple but it causes huge traffic congestion, it takes up our valuable time and the process is not economical. So there must be an alternate way to take up the situation. In India, number plate standards, though they exist, are rarely practiced. As a result, wide variations are found in the number plates in terms of font type, character size and location of the number plate. Also, in certain cases, many unwanted characters are present on the number plate. In India we have various kinds of number plates. Old number plates following 1939 series as well as the vehicles following new number system. The new format license plates can be of lengths 8,9,10. Therefore the recognition of number plate is a tedious job. Regarding toll collection common practice seen in Indian is via Toll booth, people standing there and collecting toll. But the process is not an intelligent way as it takes lot of time and wastage of human power. In some of the developed countries automatic toll collection systems are available but they are costly solutions. It requires at least a system and MATLAB program running over continuously. The solution must be cost effective.

III. PROPOSED SYSTEM

Most of the number plate localization algorithms merge several procedures, resulting in long computational (and accordingly considerable execution) time (this may be reduced by applying less and simpler algorithms). The results are highly dependent on the image quality, since the reliability of the procedures severely degrades in the case of complex, noisy pictures that contain a lot of details. Unfortunately the various procedures barely offer remedy for this problem, precise camera adjustment is the only solution. This means that the car must be photographed in a way that the environment is excluded as possible and the size of the number plate is as big as possible. Adjustment of the size is especially difficult in the case of fast cars, since the optimum moment of exposure can hardly be guaranteed .Number Plate Localization on the Basis of Edge Finding. In the proposed system we have cost effective automatic toll collection, Tax collection, Insurance expiry date check, RC book validity check, Pollution check, Theft detection, red light violation etc. These above mentioned factors are effectively implemented. This is a completely automated number plate recognition system that uses image processing for detecting the number plate which is used for further analysis. This project aims at collecting tax, insurance and toll in an intelligent way. This also checks for the validity of insurance, RC book and any penalty in pollution check. Technologies used include python, open cv, OCR technique etc.

IV. COMPONENT DESCRIPTION

RASPBERRY PI:

The Raspberry Pi is a series of credit card–sized single-board computers. All Raspberry Pi is include the same Video Core IV graphics processing unit (GPU), and either single-core ARMv6compatible CPU or newer ARMv7-compatible quad-core one and 1 GB of RAM , 512 MB or 256 MB. They have a Secure Digital (SDHC) slot or a Micro SDHC one for boot media and persistent storage. It has a new BCM2837 SoC retaining compatibility with the

GPU, CPU and connectors of its predecessors BCM2835and BCM2836.

CAMERA:

A **camera** is an optical instrument for recording images, which may be stored locally, transmitted to another location, or both. Camera may work with the light of the visible spectrum or with other portions of the electromagnetic spectrum. It is an optical device which creates image of an object or scene, and records it on an electronic sensor or photographic film. All cameras use the same basic design: light enters an enclosed box through a converging lens and an image is recorded on a light-sensitive medium. A shutter mechanism controls the length of time that light can enter the camera.

USB INTERFACE

Universal Serial Bus (USB) is a set of interface specifications for high speed wired communication between electronics systems peripherals and devices with or without PC/computer. There are 3 basic formats of USB connectors: the default or *standard* format intended for desktop or portable equipment, the mini intended for mobile equipment, and the thinner *micro* size, for low-profile mobile equipment. Also, there are 5 modes of USB data transfer, in order of increasing bandwidth: Low Speed (from 1.0), Full Speed (from 1.0), High Speed (from 2.0),Super Speed (from 3.0), and Super Speed+ (from 3.1).

SD CARD

An SD Card (**S***ecure* D*igital Card*) is an ultra small flash memory card designed to provide high-capacity memory in a small size. SD cards are used in many small portable devices such as digital video camcorders, digital cameras, handheld computers, audio players and mobile phones. In use since 1999, SD Memory Cards are now available in capacities between 16 Megabytes and 1Gigabyte. An SD card typically measures 32 x 24 x 2.1 mm and weighs approximately 2grams.

GSM MODULE

GSM (Global System for Mobile Communications) is a cellular network, which means that cell phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network—macro, micro, pico, femto, and umbrella cells. The coverage area of each cell varies according to the implementation environment. Macro cells can be regarded as cells where the base station antenna is installed on a mast or a building above average rooftop level. Micro cells are typically used in urban areas. Pico cells are mainly used indoors. Femto cells are cells designed for use in residential or small business environments and connect to the service provider's network via a broadband internet connection. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

BUZZER

A buzzer is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. The piezo buzzer produces sound based on reverse of the piezoelectric effect. The generation of pressure variation or strain by the application of electric potential across a piezoelectric material is the underlying principle. These buzzers can be used alert a user of an event corresponding to a switching action, counter signal or sensor input. They are also used in alarm circuits.The buzzer produces a same noisy sound irrespective of the voltage variation applied to it. It consists of piezo crystals between two conductors. When a potential is applied across these crystals, they push on one conductor and pull on the other. This, push and pull action, results in a sound wave. Most buzzers produce sound in the range of 2 to 4 kHz.

H BRIDGE MOTOR DRIVER (L293D)

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motorwith a single L293D IC. It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for driving a DC motor.

DC MOTOR

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic,to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line.DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.

V. WORKING

In this paper we are presented Intelligent Vehicle Monitoring System (IVMS) using Raspberry P**i** processor. We make use of Debian Operating System from open CV library. When any vehicle passes by the system, the image of the number plate of every vehicle is captured using camera. The image of the number plate details are fed as input to the Raspberry Pi processor. The Processor takes responsibility to check the authentication details of every vehicle. The detected number is used to recognize the owner via RTO site. If there is any penalty, we can directly deduct from owner's account and a feedback will be provided to the owner. Once the vehicle details are recognized then the processor operates the gate using DC motor. The system also alerts the user through buzzer alarm whenever it detects an unauthorized image of number plate was detected.All these operations can be performedwithin few seconds by the system.

The major task of Intelligent Vehicle Monitoring Systemhas three main steps namely the edge detection, segmentation and OCR technique.

EDGE DETECTION

We detect edges using Sobel method. The Sobel operator performs a 2-D spatial gradient measurement on an image. Typically it is used to find the approximate absolute gradient magnitude at each point in an input grayscale image. The Sobel edge detector uses a pair of 3x3 convolution masks, one estimating the gradient in the x-direction (columns) and the other estimating the gradient in the y-direction (rows). A convolution mask is usually much smaller than the actual image. As a result, the mask is slid over the image, manipulating a square of pixels at a time.

The actual Sobel masks are shown below:

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

Gx

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

Gy

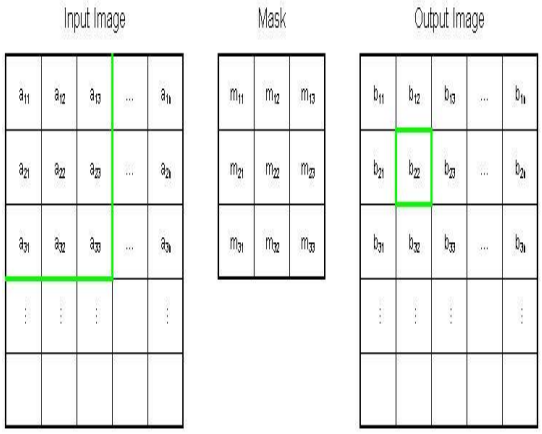
The magnitude of the gradient is then calculated using the formula:

$$|G| = \sqrt{Gx^2 + Gy^2}$$

An approximate magnitude can be calculated using:

|G| = |Gx| + |Gy|

The mask is slid over an area of the input image, changes that pixel's value and then shifts one pixel to the right and continues to the right until it reaches the end of a row. It then starts at the beginning of the next row. The example below shows the mask being slid over the top left portion of the input image represented by the green outline. The formula shows how a particular pixel in the output image would be calculated. The center of the mask is placed over the pixel you are manipulating in the image. And the I& J values are used to move the file pointer so you can mulitply, for example, pixel (a22) by the corresponding mask value (m22). It is important to notice that pixels in the first and last rows, as well as the first and last columns cannot be manipulated by a 3x3 mask. This is because when placing the center of the mask over a pixel in the first row (for example), the mask will be outside the image boundaries.



$$b_{22} = (a_{11}*m_{11}) + (a_{12}*m_{12}) + (a_{13}*m_{13}) + (a_{21}*m_{21}) + (a_{22}*m_{22}) + (a_{23}*m_{23}) + (a_{31}*m_{31}) + (a_{32}*m_{32}) + (a_{33}*m_{33})$$

The GX mask highlights the edges in the horizontal direction while the GY mask highlights the edges in the vertical direction. After taking the magnitude of both, the resulting output detects edges in both directions.

SEGMENTATION

Segmentation produces isolated individual characters from the detected number plate. A contour based method is used to segment characters. To correctly identify the borders of the characters, the number plate border is removed. Here, we check for the white pixels connected with the border of the image and convert them to black. Then we use contour based edge detection method to detect characters in the plate region. After finding all the contours in the image, these contours are filtered using the information about character height, white pixel percentage and character width to height ratio. Filtering constraints are as follows.

- Standard width to height ratio
- Height
- White pixel percentage

Fig 1:Recognized Number Plate and segmented characters

Finally, verified characters are cropped from the plate region and stored in an image vector to be used in the character recognition phase.

OPTICAL CHARACTER RECOGNITION

The optical character recognition is a recognition method in which the input is an image and the output is string of character. OCR is a process which separates the different characters from each other taken from an image. Template matching is one of the approaches of OCR. Template matching affects the accuracy of Automatic number plate recognition. The cropped image is compared with the template data stored in database. OCR automatically identifies and recognizes the characters without any indirect input.

VI. APPLICATIONS

- Vehicle monitoring at toll booths.
- Access Control based management of Vehicles.
- Parking lot automation.
- Unauthorized vehicle detection system.
- Traffic signal breaking detection system.
- Vehicle Monitoring through automated real time alerts for Stolen vehicles.
- Traffic and parking flow surveys .
- Theft Detection.
- Red light violation.

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