



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 7, July 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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Number Plate Detection with Application to Electronic Toll Collection System

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ABSTRACT : This Paper describes a new approach of tagging of number plate for collection of Toll with application to Automated Toll System. In this system we detect the location of number plate of vehicles with the help of template matching and extract number from number plate and process it for collection of toll. The number plate is tagged in the database with the user's personal information, bank account and vehicle details. Toll is automatically deducted from users bank account or credit card and notification is provided to the user by sending SMS or Mail. Users have to follow standard rules for number plate design prescribed by the toll. Manual toll facility will be provided for unregistered vehicles and in case of system failure. This system can be implemented in different places such as Clubs, Restaurants, Companies, Parking areas etc. The main goal is to create automation in traffic management without much change in current system and should be less expensive .

KEYWORDS: Number plate Tagging, Number plate detection, Toll Collection, Image processing.

I. INTRODUCTION

The purpose of this system is to create a real time application of number plate detection and tagging can be made for car parking systems, Toll collection System, Octroi, etc. The system is based on regular PC's controlling Video Cameras, Barricade, Alarming Systems, database and toll Processing.

The video camera catch video frames which include a visible car license plate , extracting the number and it will be checked with database for verification and the type of vehicle is identification. The toll amount for particular vehicle is collected through credit card or bank account. In case of any crime about a vehicle it also will be recorded in a database so that we can enhance the security and it will be more helpful for the identification of stolen vehicle. This system consists both automated and manual way for collection of toll. For using automated toll collection system, registration is made by giving the details like user identity proof , vehicle details and account details for payment at registration centers before availing the facility . So intimation of toll payment will made by SMS or E-mail .The most obvious advantage of this technology is the opportunity to eliminate traffic congestion in toll booths.

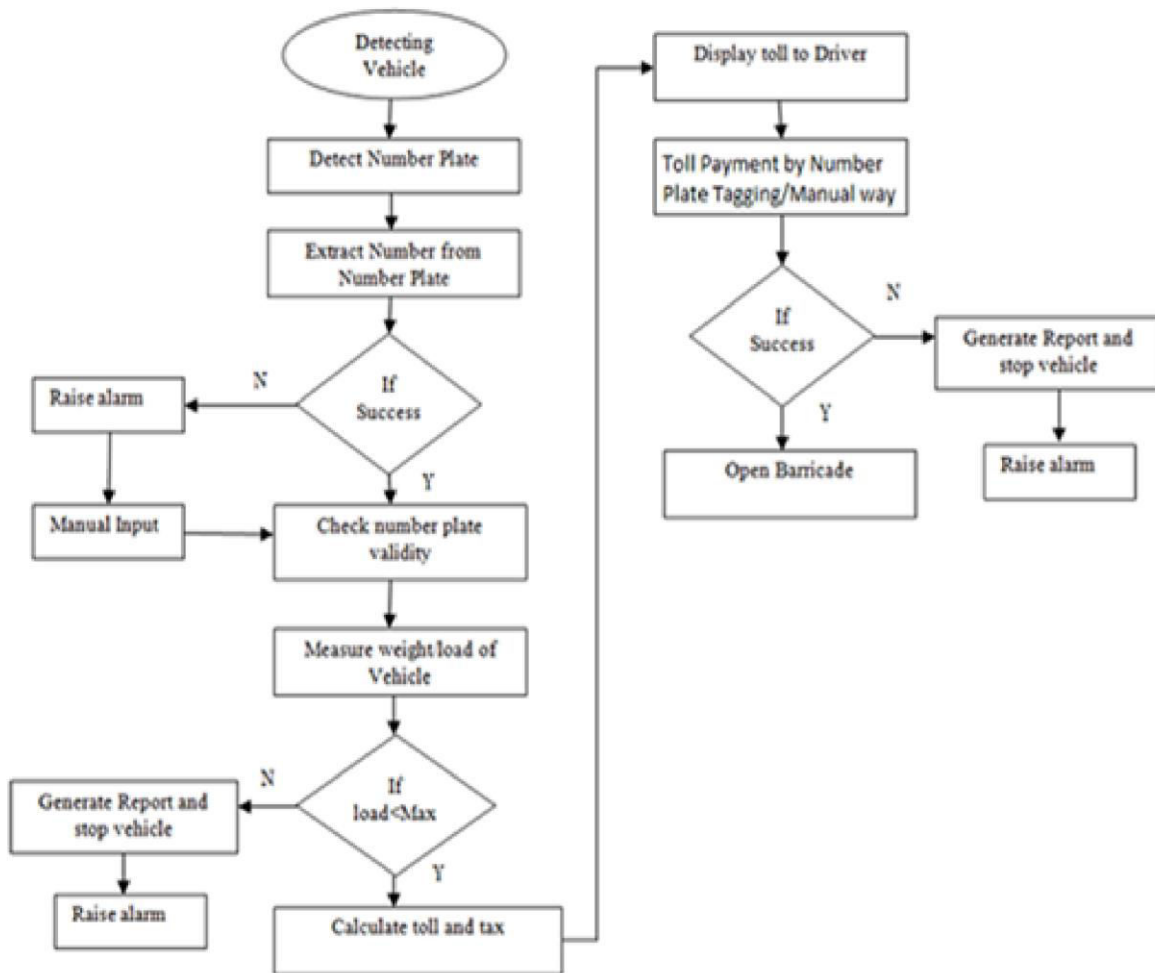


Fig 1: Electronic toll Collection System

II. HARDWARE SETUP

2.1 Webcam:

The hardware setup part consist of Web Camera, Barricade , LCD Display and Infrared Sensors. It is used to capture the images of the vehicles for the detection of number plates.



Fig 2: Webcam

When the car enters the toll, the infrared sensors detect the vehicle and the camera is triggered to capture the image of the number plate.

2.2 Barricade:

For proper traffic management, a barricade is used. It also ensures toll collection from every vehicle that passes through the toll booth. Here a stepper motor is used to control the movement of barricade. A stepper motor (or step motor) is a brushless, synchronous electric motor that can divide a full rotation into a large number of steps. Here a uni-polar stepper motor is used. [3]

2.3 LCD Display:

A LCD display is used here to give the output amount and transaction details. A liquid crystal display (LCD) is a thin, flat panel used for displaying [4] information such as text, images, and moving pictures.

2.4 Infrared Sensors:

An infrared sensor is used for detecting the vehicles exiting and processing inside the toll booth. In this system two Infrared sensors are used. First infrared sensor is used for detecting vehicle inside the toll and other infrared sensor is used for detecting the vehicle exiting the toll. First infrared sensor also triggers the camera for capturing the images of the vehicle for detection and processing the number plate.

2.5 Alarming System:

An alarming system, an amplifier and an alarming speaker is also integrated with the system for detecting any problems with Toll processing, security issues and notifications. They are used for handling control to the manual controller and security systems.[5]

III. CONTROL SYSTEM

A well developed control system is necessary to combine all the sensors and actuators. The control system is designed as an integrated intelligence system. The control system contains code, to perform all the tasks. .

3.1 Barricade control system:

Here the barricade is controlled by the unit-polar stepper motor The stepper motor is run by the ULN2003 IC. This IC is coupled with the Port of the microcontroller.

3.2 Registration System:

Here the registration of the user is controlled by this system. The registration consists of User Personal details, User Bank Account details, Number plate details, Police records, etc. With registration the user has to agree with the conditions specified by the toll system such as standard design of number plate, font size, font type, colors to be used for number plate, size and shape of number plate, etc.

3.3 Notification System:

In the notification system, user will get two intimations, One is SMS notification and the other is E-mail notification.

3.3.1 SMS Notification:

A SMS message is sent to the user when toll is deducted from his account after the successful transaction of Toll Collection, also other schemes and new facilities are provided to the user by SMS.

3.3.2 E-mail Notification:

An Email is sent to the user notifying him about the successful transaction, new schemes and facilities provided by the toll.

3.4. Number plate detection using image processing :



Fig 4: Number plate detection

It can be done in various ways. Every vehicle can be monitored by web cameras .Image can be detected using pixels which can be used as small dots on the screen. The resolution of image comes in picture when pixels of horizontally times number of vertical pixels. Typical size of an image is 512 by 512 pixels.[7]

For example: If in general case an image of size m by n is composed of m pixels in vertical direction and n pixels in horizontal direction. The format comes in picture 512 by 1024 pixels. This means that the data for image must contain information about 524288 pixels, which requires lots of memory. Hence we are using compress image processing that will help to reduce the amount of data required to store an image. By this method the X-axis is vertical and Y-axis is horizontal. Most commonly JPEG images widely used for compression method

3.4.1 Implementation:

Template Matching: The templates of all characters will be defined with some test points. The character will compare to those templates. The template with the highest match point will be characterised as an image. The system is capable to recognize car plate number automatically. After reorganization the plate number will be compared with the list of plate numbers in database. If the number plate is in the list of plate numbers then the system will allow further processing.

3.4.2 Image Representation:

3.4.2.1 Gray scale Method: m pixel \times n pixel image can be represented as matrix. Value (m,n) represent the gray scale intensity in the form of either 0 or 1 with 0=black and 1=white.

3.4.2.2 True colour RGB: In this method image can be represented as 3 dimensional double matrixes. Each pixel has red, green and blue component along with the third dimension with the values (0,1).

Example: $(m,n,1)$ =red, $(m,n,2)$ =green, $(m,n,3)$ = blue.

Images can be represented with an index matrix of size $M \times N$ and a colour map matrix of size



Kx3. The colour map holds all colours used in the image and the index matrix represents the pixels by referring to colours in the colour map. For example, if the 22nd colour is magenta Color map (22)=[1,0,1], then Image(m,n)=22 is a magenta-colored pixel. Image can also be represented as m X n matrix with the values 1 or 0. That is only 2 possible values in an image Binary image is the digital image that has only two possible values. Two colours used for a binary image are black and white. The colour used in this image is the foreground colour while the rest of the image is background colour. Binary image 1 bit is used for each pixel. This image can be stored in memory as a bit map or a packed array of bits.

License plate matching is a technique compares portion of images against one another. GUI is the main panel of this system. Image processing module that analyses the image of a car and return the plate number. java provides features for image processing, but it can be also implemented with MATLAB 7.0 and Visual basic 6.0. If standard deviation of template image is compared to source image is small enough, then template matching is used. Templates are more often used to identify printed characters, small objects and car number plate [9]. Matching process can be done to all possible positions in a large source image and computes the numerical index that indicates the position of image in a template matching method. This process can be done by pixel by pixel basis. Template size is 166 x 59 pixels and has a random white box pattern that detects to minimize the false detection. We are going to use template matching method to reduce processing time. This leads to inaccurate detection. Hence we are giving input image and processing had filtering on it to get the lowest white region without affecting number plate clarity.

3.4.3 Steps for Extraction of number:

- 1) Plate Localisation:
- 2) Plate Orientation and sizing
- 3) Normalisation
- 4) Character Segmentation
- 5) Character Reorganization
- 6) Syntactical Analysis

IV. CONCLUSION

In a populated country like India implementing new techniques is extremely difficult and this technique can be easily implemented without much change to the current toll system and also with least expense. We conclude that if properly implemented, E-Toll system can help the society to achieve proper traffic management, accurate Toll collection and Enhanced security.

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