Toll Tax Collecting System Using Optical Character Recognition

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Abstract

Now a day there is too much traffic at the toll plazas. The vehicle has to stop on the toll plaza to pay the toll amount. Therefore, we are trying to develop a system that would pay the toll amount automatically and reduce the traffic at the toll plaza. In our system, by using image processing technology vehicle number is recognized to identify the number plate from real time reflections. Webcam is used to capture number plate of the vehicles. Templates matching technique identifies originals. The vehicle number is then matched with the accessible database of all the vehicles. System will check the database; if match is found then toll amount will be deducted from the user's account. Notification will be sent to the user via message. By using image processing technology the system will work automatically and also will reduce the traffic at the toll plazas which indirectly results in the reduction of time.

Keywords— OCR, SMS, MATLAB, RFID, PC, LCD.

I. INTRODUCTION

Transportation is the backbone of any country's economy. Improvement in it result into good lifestyle hence we are proposing a new approach for toll payment at the toll plazas. Increasing number of vehicles on the road, result into number of problems such as congestion, accident rate, air pollution, wastage of fuel, journey time, etc. This system will work throughout the day as well as night. Ever increasing need for efficient, reliable and safe toll tax payment along with image processing resulted in the development of different kinds of solutions. Our project "Toll tax collection using optical character recognition" the name itself suggests that we use OCR and process the captured image into grayscale. Here morphological operations are performed. Optical character recognition (OCR) is used for character recognizing using template matching. After recognition of data, the owner will receive notification on mobile through GSM system. Toll tax Collection System by using image processing aims at successfully removing unnecessary traffic delays, faster and reliable processing etc. In this paper we present a system which is based on image processing which can be work for real time vehicle toll collection system. A Webcam is used to capture the number plate of incoming vehicles. Verification is done and deduction process is carried out hence allowing the vehicles to pass.

II. LITERATURE REVIEW

In [1], the author proposed that the system is able to count the total number of vehicles that are passing through the toll plazas. All these things are performing in matlab by using image processing. Number plate recognition is used to recognize number plate of vehicle captured by camera as well as

text from number plate. Plate localization is responsible for finding and isolating the plate on the image. By using Regionprops function of matlab the characters of the resulted number plate region are separated which gives us the defined boxes for each of the characters. The smallest defined box that contains a character is returned by regioncrops function. This method is used to obtain the defined boxes as all characters in the number plate. Character segmentation is used to find the individual character. From this paper, we are for finding the individual characters on the number plate by using character segmentation method.

In [2], the author described that the image is taken by the camera, there are different methods and function for text extraction. Text extraction means to extract the text from an image. The text is in the form of structured or unstructured. Before the extraction of text noise needs to remove from the image. Median filter is used to remove the noise. This is used because it is good in removing noise from any of the image. Morphological algorithm basically used to detect the structure taken. Basically use to detect and then to modify it into proper form.

In [3], the author described that the aim of the project is to make the system automated. To start the process image needs to be captured. As the vehicle enters on the toll plaza camera senses the movement of vehicle as object and according to the microcontroller instruction it takes the snapshot of the vehicle. For this there are several ways are present to this. Like, the tolling system works through RFID, thus reducing the manual effort. When the vehicle moves through the gate it is indicated on RFID reader that it has crossed the clearing and further it notifies the microcontroller to control the gate movement. From this paper, camera and photovoltaic sensor is used to detect the motion of the vehicle entering the toll booth area.

III. OBJECTIVE AND AIM

The main aim of our project is to decrease the traffic by reducing the manual work and is also time saving as there will be no giving and taking of money or the receipt.

- To capture the number plate of the vehicle.
- To perform pre-processing steps of the image like noise removing.
- To convert the image into binary for OCR.
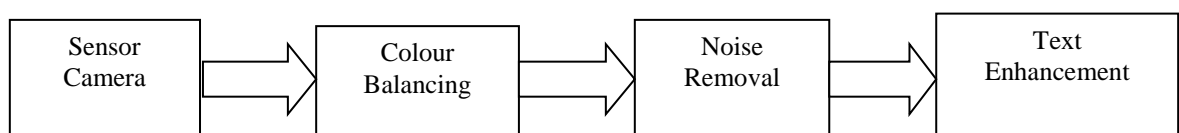- To verify the generated number and sending notification to owner.

IV. METHODOLOGY

A. User Registration

In our system first user registration is done with the information like user name, address, mobile number, vehicle number plate, vehicle type, email- id, owner name etc.

B. Camera

It attached to the PC and interfaced with MATLAB to capture the image of vehicle, features; fixed focus lens on board 8 mega pixel native resolution, sensor capable of 3280x2464 pixel static images.

| Sensor Camera | → | Colour Balancing | → | Noise Removal | → | Text Enhancement |

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┌──────────────┐      ┌──────────────┐     ┌──────────────┐      ┌──────────────┐
│ Regenerated  │ ◀━━━ │ Verification │ ◀━━━│   Optical    │ ◀━━━ │ Binarization │
│    Image     │      │ (Simulation  │     │  Character    │      │   Layout      │
│              │      │   time       │     │  Recognition  │      │  Analysis     │
│              │      │  8-10sec)    │     │              │      │              │
└──────────────┘      └──────────────┘     └──────────────┘      └──────────────┘
```
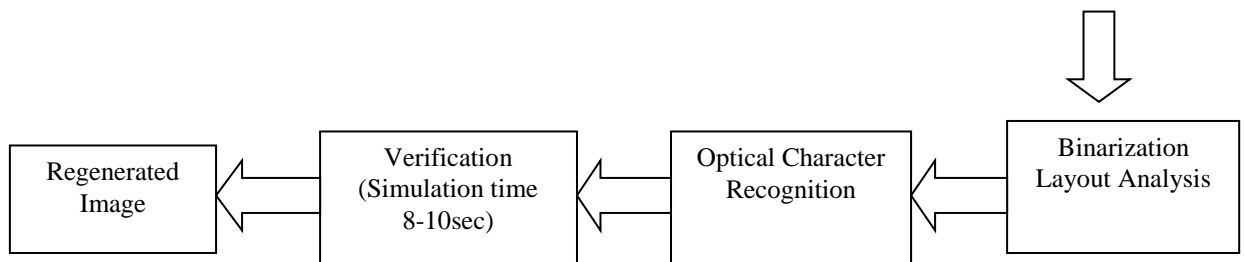
Fig. 1 Block diagram of image processing.

C. Noise Removal

It may produce at the time of capturing or image transmission. Noise means, the pixels in the image show different intensity values instead of true pixel values that are obtained from image. Noise removal algorithm is the process of removing or reducing the noise from the image. In our system for removing the noise we are using Median filter.
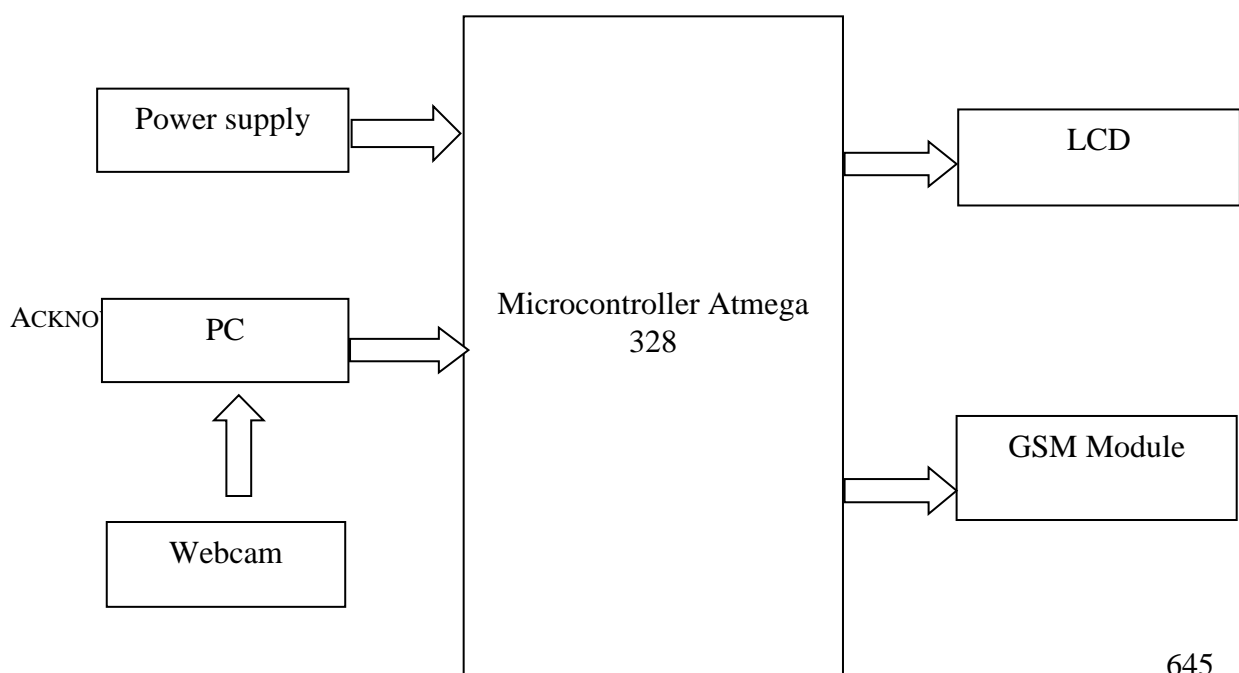
D. Text Enhancement

Text enhancement is the process of adjusting the digital image so that the results are more suitable for display and further image analysis. For example, we can remove the noise, sharpen or brighten the text in the image. The aim of the text enhancement is to improve the interpretability or perception of the information in the images for human viewers.

E. Binarization Layout

Binarization is the process of converting a pixel image to a binary image. Binarization is the pre-processing step for document image analysis and processing. It enhances the performance of the document processing techniques like OCR (optical character recognition) and layout analysis. Binarization is the conversion of document image into bi-level document image.

F. Optical Character Recognition

OCR (optical character recognition) is the recognition of printed or written text characters by a computer. This involves photo scanning of the text character by character, analysis by scanned in image, and then translation of the character image into character codes, such as ASCII, commonly used in data processing. Template matching is also done.

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┌──────────────┐                                          ┌──────────────┐
│ Power supply │ ━━━▶                              ┌──▶   │     LCD       │
└──────────────┘         ┌─────────────────────┐   │      └──────────────┘
                         │                      │ ──┘
                         │  Microcontroller     │
ACKNO ┌──────────────┐   │  Atmega 328          │
      │     PC       │━━▶│                      │ ──┐      ┌──────────────┐
      └──────────────┘   │                      │   └──▶   │  GSM Module   │
            ▲            │                      │          └──────────────┘
            ┃            └─────────────────────┘
      ┌──────────────┐
      │   Webcam      │
      └──────────────┘
```
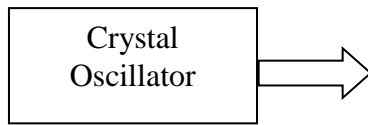
Fig. 2 Generalized block diagram of toll tax collection system

A liquid-crystal display (LCD) is used to display the processing result of the microcontroller Atmega 328. After the number is obtained in MATLAB then it is comparing with the database stored in microcontroller. The microcontroller uses simple C program to compare the obtained number plate number and database. And results are shown on lcd. After identifying the owner and allotting tax to that owner one notification is send on the owner's mobile by using GSM module. Send instruction is display on the lcd.

V. RESULT
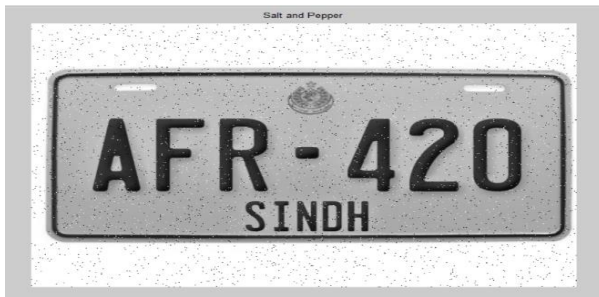
Fig. 3   Fig. 4   Fig. 5

Fig 3 shows, the original image is then converted into gray scale image. Gray scale is range of shades of gray without apparent color. The reason for differentiating such images from any sort of color image is that less information needs to be provided for each pixel.

Fig 4 shows the gray scale image. In the previous figure, there was no noise present. Therefore, we added 20% salt and pepper noise to the image to check the result of different filters.

Fig 5 shows the Salt and Paper image. Noise is added by us in order to define the use of noise filter

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Fig. 6

Fig. 7

Fig 6 shows, the median filter image and Fig 7 shows, the Weiner filter image, the purpose of Weiner filter is to filter out noise that has corrupted the image. It performs filtering from different angle which is based on statistical approach. The weiner filter output would come as close to the original as possible but it does not remove all the noise as compared to median filter. So we are approaching median filter for the proposed system.

Fig. 8   Fig. 9   Fig. 10

Plate region is found out by passing a rectangular image over the previous using cvMatchTemplate() function. Characters are segmented from the number plate image which is then used for template matching. Segmented characters are template matched with the templates of each character as shown in below and the number plate is identified as a string.

Fig. 11

VI.   CONCLUSION

In this paper we describe that traffic can be reduced on the toll plazas by using toll tax collection system using optical character recognition. As we are using median filter to remove all the noise so that process of recognition of number plate could be fast as possible. As allowing high quality camera it will capture image and perform pre-processing steps on it After number plate extraction characters are segmented and each character is matched with stored database and result will be displayed as a string. Our system uses OCR technique to recognise characters on the number plate. Then it verifies the owner and one text is send on a registered mobile number. The entire system will take 8-10 sec to perform all steps.

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