



IoT Driven Vehicle License Plate Extraction Approach

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Abstract

The objective of the research paper is to capture the design a Vehicle Number Plate Identification System which can be used to identify and read the license number of any vehicle. The basic process involves taking the image of the front/rear of the vehicle which then gets processed and ultimately the number gets displayed on the LCD. This system can be used for a wide variety of installations and establishments such as entry points of schools, colleges, offices and parking spaces. The camera takes an image which is then processed in PC. The result achieved from this is the license number of the vehicle which is then transmitted via the Wi-Fi module and ultimately displayed on the LCD. The hardware especially can be made more rugged and compact so as to handle all the elements of nature and various environments that it can be used in.

Keywords: Vehicle Number Plate Identification, Optical Character Recognition, Arduino UNO, Image Processing.

1. Introduction

1.1 License Plate Format

In India, all motor vehicles registered number plates for two-wheeler and four-wheeler private car owners have black colour lettering embossed or written on a white background. The license number plate for all commercially used vehicles such as cabs and trucks have a black colouring text on a yellow background. Whereas the commercial vehicles accessible on rent for self-drive have yellow colouring letter on a black background. To differentiate the vehicles which all belong to foreign consulates have light blue background with white colour lettering. The official cars of the President of India and state governors have Emblem of India in gold embossed on a red plate without license plate registration numbers.

1.2 License Plate - Current format

The present licence number format of the registration index consists of 4 parts such as State Name, District number, Alphabets, Unique 4 digit number example TN01 SM5499. In this example:

- i. The first two letters "TN" indicate the vehicle belong to TamilNadu state to which the vehicle got registered.
- ii. The second part with two digit numbers indicates the unique sequential number assigned for each district.
- iii. The next part contains two uppercase alphabets.
- iv. The last part is a unique four digit number assigned for each vehicle. In cases, when the 4 digit number run out then a letter(s) is prefixed, next two letters and so on.
- v. Apart from this number format, on the top there is a small blue square along with an international oval with caption "IND".

1.3 Objectives

The goals associated with this work are listed below:

- i. The foremost goal is to develop the system to identify vehicle license number.
- ii. The result obtained from the system should be error-free thereby leading to minimum problems and discrepancies.
- iii. The result should be obtained in a fast and timely manner leading in reduction of waiting time and queues.
- iv. Reduction in queues will lead to saving time, subsequent monetary gains and reduced congestion.

2. Related Work

Many researchers have worked in this field and it has been found that data mining algorithm is majorly used to identify the characters from the number plate. The works and descriptions are as follows:

- Using digital images, the author proposes a detection methodology of car number plates which takes inputs in gray image and extracts the characters from the number plate. The proposed method makes use of the morphological operators like morphological reconstruction, filters and top-hat operators. The method can be applied to access control systems supervising the car traffic in the restricted areas[10].
- Tracking Number plate from vehicle using MATLAB [11]: In traffic surveillance tracking of the number plate from the vehicle is an important task, which demands intelligent solution. In this document, extraction and recognition of number plate from vehicles image has been done using MATLAB. It is assumed that images of the vehicle have been captured from Digital Camera. Alphanumeric characters on plate has been extracted and recognized using template images of alphanumeric characters. This work presents a new algorithm in MATLAB which has been used to extract the number plate from the vehicle in various luminance conditions. Extracted number of the license plate can be

seen in a text file for verification purpose. Number plate identification is helpful in finding stolen cars, car parking management system and identification of vehicle in traffic. Image processing is a form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing will be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it.

3. System Design

The schematic of system design flow is given in figure 2.

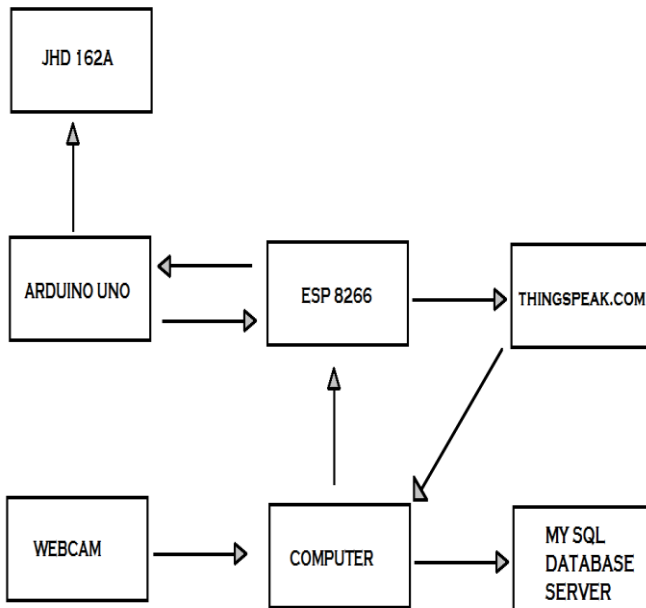


Fig. 2: Schematics of System Design Flow

The description of the components is given below:

- i. Camera: The intended image is captured using a camera. The user should ensure that the camera is steady and the backlight should be proper.
- ii. Character Recognition Module: It uses the character recognition module to extract the number from the image of license plate.
- iii. Arduino board: This primarily uses Arduino board as the interfacing medium. The board is interfaced with Wi-Fi Module (ESP 8266) and the LCD (JHD 162A).
- iv. ESP 8266: This module is a TTL (Time To Live) Serial to Wireless Internet device. The Arduino board has the ability to communicate to a TTL serial device.
- v. LCD (JHD 162A): The LCD panel is used to display the final output.
- vi. Database: The license number extracted from the image by the OCR algorithm is stored in a database. The date and time along with the vehicle's license number are stored so as to monitor the vehicles. This also enables us to keep a log of the vehicles. The process flow chart is shown in figure 3.

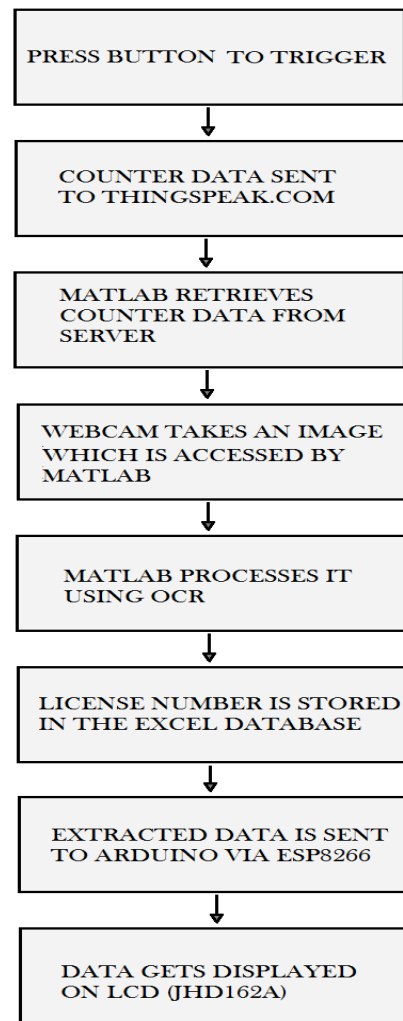


Fig. 3: Process Flowchart

3.1 Serial Data Communication

All the processed data are sent across the computer and Arduino by setting a pin high or low. Sketches are sent to the Arduino using Serial data transfer. When the sketch is compiled/verified, it is converted into binary data. Through USB all these data are uploaded one at a time to the Arduino. Acknowledgment from Arduino board for its data transmission and reception are done through two LEDs blinks near the USB connector.

3.2 Serial Communication with Wi-Fi Module

It uses Software Serial Communication where Pin 2 and 3 of the Arduino UNO board are used as TX and RX respectively. Pin 2 is used for transmitting data while Pin 3 is used for receiving data. In Software Serial Communication any pin of Arduino UNO can be used to act as TX and RX. A special library "Software Serial.h" has been used to achieve this.

It is generally believed that parallel communication is faster than serial because more data is sent simultaneously. However, in order to achieve a higher data rate in serial communication, the links can be clocked faster than parallel communications links.

The module includes the following features:

- i. 802.11 b/g/n protocol
- ii. Wi-Fi Direct (P2P), soft-AP
- iii. Integrated TCP/IP protocol stack

When power is applied to the module it is seen that the red power light turn on and the blue serial indicator light flickers briefly.

The Wi-Fi module is plugged using Arduino IDE Serial Monitor with appropriate serial port selection. Configure the default firmware version (00160901) to ensure carriage return is selected and ensure the default firmware version with communication speed set to 9600 baud.

4. Conclusion and Future Scope

The proposed system is successful in identifying and recognizing texts in the vehicle number plates with accuracy. Although some factors such as lighting, camera quality and other environmental factors do determine the success of the system but given ideal conditions the system performs as intended and gives satisfactory results. This system can be used for a wide variety of installations and establishments such as entry points of schools, colleges, offices, parking spaces and toll-booths. Future scope involves use by law-enforcement agencies. If a central database is created and it is linked up to the system then blacklisted vehicles used in numerous unlawful activities can be identified and monitored. It can also be used by traffic police to identify, monitor and impound stolen vehicles.

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