

# “Automatic Number Plate Recognition for use in Different Countries Using Embedded System” (Real Time Approach)

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**Abstract:** Automatic Number Plate Recognition (ANPR) is a real time embedded system which identifies the characters directly from the image of the license plate. It is an active area of research. ANPR systems are very useful to the law enforcement agencies as the need for Radio Frequency Identification tags & similar equipments are mini mized. Additionally, there is an option available to the end-user for retraining the Artificial Neural Network (ANN) by building a new sample font database. This can improve the system performance & make the system more efficient by taking relevant samples. Traffic control & vehicle owner identification has become major problem in every country. Sometimes, it becomes difficult to identify vehicle owner who violates traffic rules & drives too fast. Therefore, it is not possible to catch & punish those kinds of people because the traffic personal might not be able to retrieve vehicle number from the moving vehicle because of the speed of the vehicle. Hence, it's a need to develop Automatic Number Plate Recognition (ANPR) system as a one of the solutions to this problem.

**Keywords:** Automatic Number Plate Recognition (ANPR), Artificial Neural Network (ANN), Number Plate, Optical Character Recognition

## 1. Introduction

The Automatic Number Plate Recognition Systems (ANPR) exist for a long time, but only in the late 90's it became an important application because of the large increase in the number of vehicles. The information extracted from the license plates is mainly used for traffic monitoring, access control, parking, motorway road tolling, & border control, making car logs for parking systems, journey time measurement etc. by the law enforcement agencies.

The Arithmetic Capability of Digital Signal processors (DSPs), the multiple peripheral interfaces & the high frequency execution of the ARM processors make them an attractive choice for real time embedded systems. DSPs are already widely used for applications such as audio & speech processing, image & video processing, & wireless signal processing. Practical applications include surveillance, video encoding & decoding, & object tracking & detection in images & video.

On the other hand, rapid development of Field Programmable Gate Arrays (FPGAs) offers alternative way to provide a low cost acceleration for computationally intensive tasks such as digital signal processing.

The recognition problem is generally subdivided into 5 parts:

- 1) Image acquisition i.e. capturing the image of the license plate.
- 2) Pre-Processing the image i.e. normalization, adjusting the brightness, skewness & contrast of the image.
- 3) Localising the license plate.
- 4) Character Segmentation i.e. locating & identifying the individual symbol images on the plate.
- 5) Optical Character Recognition.

Basically, the Number Plate Recognition operation consists in capturing, recognizing and storing information such as images, plate numbers and location on a database for online verification or posterior analysis.

The approach presented in this paper is to extract the region of the number plate from images taken from indoor parking lots, which suffer from various real world problems like lighting condition, luminance, weather conditions etc.

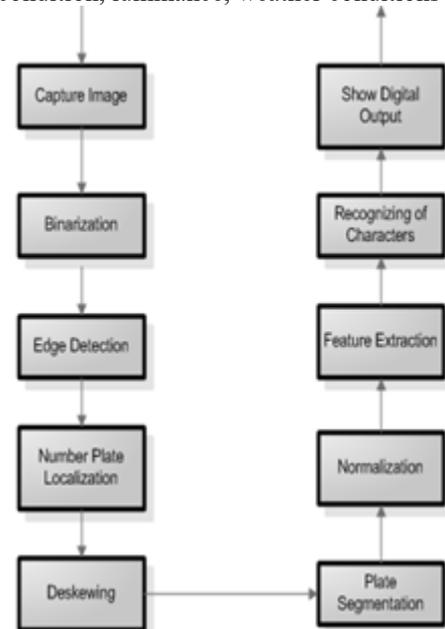


Figure 1: Steps for No. Plate Recognition

### 1.1 Related Works

Such has been the impact of the ANPR systems that the scientific community started to take immense interest in this field since its introduction & today many commercial

systems like Car Plate Recognition (ANPR) by Shyang-Lih Chang, Li Shein Chen, Yun-Chung Chung, and Sei-Wan Chen are now available. The contour based algorithm which is used in this approach followed by Tran Duc Duan, Tran Le Hong Du in association with the Hough Transform to bring down the computational overhead. This contour algorithm narrows down the sample points on which the Hough Transformation is to be applied. This is followed by a projection based segmentation scheme for the component letters.

A problem of the projection based method is that it sometimes leads to under segmentation. A threshold value of pixels needs to be assigned for segmentation.

### 1.2 Contribution of Work

After going through the existing literature it was seen that the Hough Transform & the projection based scheme have been extensively used as the segmentation algorithm but there has been some shortcomings in both of these methods.

### 1.3 Recognition Results for no. Plates of Different Countries

Below Table provides the recognition results of the license plates for some of the countries taken up in research. The plates are deemed to have failed in the recognition test if more than two component characters in the license plate are not recognized correctly.

Recognition Results			
Country	No. of Plates	Pass	Fail
Algeria	3	3	0
Cyprus	4	3	1
Denmark	3	2	1
Germany	5	5	0
Estonia	3	3	0
Finland	4	4	0
France	3	3	0
India	8	7	1
Norway	3	3	0
Slovakia	4	3	1
Portugal	4	4	0
U.S.A.	5	3	2
Bulgaria	2	2	0
Czech Republic	3	3	0

### 1.4 Embedded ANPR

#### 1.4.1 Introduction

Automatic Number Plate Recognition (ANPR) is the heart of today's Intelligent Traffic Systems (ITS). From parking & access solutions to law enforcement, number plate information is electronically captured, processed, stored & acted upon. Concerning parking & access, ANPR is used for gates control & access management. Traffic management systems use high speed ANPR cameras to capture number plate information for the determination of,

**For Example:** Driving patterns of vehicles transporting dangerous goods.

The moving market of Intelligent Traffic Systems (ITS) is in need of a "next step" in ITS



#### 1.4.2 Today's ITS Problems

ITS is on the rise, & it's benefits in combination with ANPR have been discovered by many.

Unfortunately, ITS suffers from its initial ANPR success as well because of the traditional PC-based ANPR systems are that it is non-scalable, non-plug-and-play, non-stable and its physical dimensions are bulky.

Embedded ANPR systems have been specifically designed to address these weaknesses. That's why Rene'voorwinden claims the new approach of Embedded ANPR to be the key factor for the future of ITS.

#### 1.4.3 Benefits of Embedded ANPR Solutions

##### Scalability

Traditional ANPR systems basically represent Optical Character Recognition (OCR) software running on a computer. Within the context of ITS, OCR is a processor demanding task due to high accuracy requirements.

##### For Example

A Police car's built-in computer- which is already used for communication, data base access (number plate or suspect criminal record information), on scene witness statement storage, photo & video upload & car control – often cannot handle additional ANPR software well.

Embedded ANPR systems will not encounter this problem because they function as coprocessors without stressing the existing computer. This means that it is possible to connect multiple Embedded ANPR systems without any complications.

##### SMALL

Embedded ANPR is often called "ANPR in the palm of your hands." This one-liner stands in marked contrast with the traditional approach of "ANPR filling up your entire trunk." Concludingly, Embedded ANPR has major advantages over traditional PC-based ANPR.

The ITS301SI by ARVOO, ANPR in the palm of your hands.



### 1.5 ATmega 128

The ATmega 128 is 100% pin compatible with ATmega 103, & can replace the ATmega 103 on current printed

circuit boards. The application note “Replacing ATmega 103 by ATmega 128” describes what the user should be aware of replacing the ATmega 103 by an ATmega 128.

### 1.6 Overview of ZM Serial Camera Module

The ZM 0.3 Mpixel serial JPEG still camera module as Quick Zoom basic product is provided ZM technology with highly integrated, so as to meet a lot of embedded system’s acquisition imaging that is JPEG compressed format & it’s more convenient data transmission in the low-speed channel condition. Connector it’s build-in a 4-wire connector, four different colour have correlatively stand for 4 wire function.

Red: Power line

Yellow: RX line

Green: TX line

Black: GND line

LED chip: On-board LED chip, once the PCB is provided power or the camera do a snapshot, the LED chip will come a sparkle which indicate operating.

### Overview of ZM serial camera module



#### 1.6.1 Features

The ZM 0.3 Mpixel serial JPEG still camera module compact size, low power consumption, more stable operation, 5.0V DC supply.

#### 1.6.2 Applications

- 1] Embedded systems for imaging acquisition & control.
- 2] Security & control systems.
- 3] Remote or public monitoring.
- 4] Retrieved / object detection & recognition.
- 5] Industrial control, vehicle & medical systems.

### 1.7 Result

ANPR gives us the final result of giving o/p regarding the following substitutes

- a) Gives the complete biodata of that particular person.
- b) Also includes from where he / she belongs.
- c) Information about that vehicle whether it is of Honda or Suzuki or anything else.

## 2. Conclusion

The system has been tested on static snapshots of vehicles, which has divided into several sets according to difficulties.

The development of the Vehicle License Plate Recognition System is quite successful implemented using MATLAB version 7.5

- a) Read the colour image into Matlab.
- b) Manually crop the license car plate region from the colour image.
- c) Analyze the cropped image in its red, green, blue frames.

- d) Convert the image from RGB to gray value.
- e) Results is to be displayed in MATLAB.

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