

**TISHK INTERNATIONAL UNIVERSITY**

**Faculty of Engineering**

**Department of Computer Engineering**

**Graduation Project**

**Automatic Number-Plate Recognition in Kurdistan**

**By**

Ahmed Bahram Maghdid, Mohammed Omar Hamad, Brwa Muhsin Khdir

**Supervised By**

Dr. Abubakar M. Ashir

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# 1.1 Introduction

Automatic Number Plate Recognition (ANPR): Is a highly accurate system capable of reading vehicle number plates without human intervention. Through the use of high-speed image capture with supporting illumination, detection of characters within the images provided, verification of the character sequences as being those from a vehicle license plate, character recognition to convert image to text; so, ending up with a set of metadata that identifies an image containing a vehicle license plate and the associated decoded text of that plate. ANPR is therefore the underlying technology used to find a vehicle license/number plate and it, in turn, supplies this information to a next stage of computer processing through which the information can be interpreted, stored or matched to create an ANPR based application. Most members of the public will be aware that ANPR is used by many police forces to track down criminal behavior and is also seen on many UK Motorways as a method of detecting speeding through average speed calculation. However, ANPR is used in a variety of other ways to support the security and safety of the public as well as supporting efficiencies in the way we interact with transportation and vehicle-based infrastructure.

ANPR is sometimes known by various other terms:

* **Automatic (or automated) license-plate recognition** (ALPR)
* **Automatic (or automated) license-plate reader** (ALPR)
* **Automatic vehicle identification** (AVI)
* **Automatic number plate genkendelse** (ANPG)
* **Car-plate recognition** (CPR)
* **License-plate recognition** (LPR)
* **Lecture automatique de plaques d'immatriculation** (LAPI)
* **Mobile license-plate reader** (MLPR)
* **Vehicle license-plate recognition** (VLPR)
* **Vehicle recognition identification** (VRI)

## THE HISTORY OF Automatic Number-Plate Recognition

The History of ANPR is considerably longer than most people realise. Because of its prolific use in more recent years for a broad range application such as traffic studies, access control and parking, many people, if asked, would guess at it being an invention belonging to this millennium. Surprising to most people, the history of ANPR stretches into the last century as it was invented in 1976 in the UK at what was then known as the Police Scientific Development Branch (PSDB) (now titled Home Office Scientific Development Branch) and early systems were developed for use from 1979.Early trial systems were deployed in the UK on the A1 Road and at the Dartford Tunnel crossing on the M25 motorway and the first arrest that was credited to ANPR detection of a stolen car did not come until 1981. Since its inception, ANPR Technology has evolved and adapted with the times, finding new outlets and applications taking it beyond the boundaries of just policing and security. Below are a few notable milestones along our journey to date:

* **1993** - ANPR is deployed for the first time as part of a "Ring of Steel" camera network around the City of London.
* **1997** - The Police National ANPR Data Centre (NADC) formed as an extension to the Police National Computer service.
* **2003** - The London Congestion Charge scheme is introduced which was aimed at reducing traffic in central London for a number of reasons.
* **2006** - ANPR International deployed its first static camera system for Parking Management - bayGAURDIAN which is the first module built for the eyeTRAFFIC back office system.
* **2009** - ANPR International develops its first mobile ANPR product - streetSWEEPER, which is designed for multiple applications including Traffic surveys, Mobile surveillance and untaxed vehicle enforcement for the Driver and Vehicle Licensing Agency (DVLA).
* **2013** - ANPR International wins Technology Award for mobile traffic survey work carried out for Gloucestershire County Council.
* **2016** - Vehicle Damage Recording System (DRS) extended to include dual lane capture, allowing for multiple lanes and up to 14 cameras to be integrated with ANPR data and vehicle pre-booking software to speed up the customer experience and increase convenience. The first dual lane system goes live at Doncaster Sheffield Airport with average times for visitors to drop-off their vehicle recorded at 32 seconds.
* **2018** - The all new ASPEK Digital Camera range is launched which replaces our tried and tested D-ANPR range.

## Why Automatic Number-Plate Recognition is important

In this day and age, cyber threats to businesses are so prominent and physical threats are sometimes cast aside and deemed as less important. It is still vital for companies to think about and prepare for these physical threats and a huge part of this is ensuring that the perimeter of the premises is protected.

The evolution of technology has enabled security solutions to develop so, there are now multiple solutions available that all provide numerous benefits to the user. [Automatic Number Plate Recognition](https://www.ea-group.co.uk/security-systems/anpr-automatic-number-plate-recognition/) (ANPR) technology is now the first choice for many businesses looking for suitable perimeter protection. If you have been considering this security solution yourself then keep reading today, the [EA Group](http://www.ea-group.co.uk/about-ea/) have put together a list of irresistible benefits of ANPR for any business owner.

### automatic license plate recognition can be used for:

* Parking: the plate number is used to automatically enter pre-paid members and calculate parking fee for non-members (by comparing the exit and entry times).
* Access Control: a gate automatically opens for authorized members in a secured area, thus replacing or assisting the security guard. The events are logged on a database and could be used to search the history of events.
* Border Control: the car number is registered in the entry or exit to the country, and used to monitor the border crossings.
* Stolen cars: a list of stolen cars or unpaid fines is used to alert on a passing ‘hot’ cars. The ‘ black list’ can be updated in real time and provide immediate alarm to the police force.
* Enforcement: the plate number is used to produce a violation fine on speed or red-light systems. The manual process of preparing a violation fine is replaced by an automated process which reduces the overhead and turnaround time. The fines can be viewed and paid on-line.
* Traffic control: the vehicles can be directed to different lanes according to their entry permits (such as in University complex projects).The system effectively reduces traffic congestions and the number of attendants.
* Marketing tool: his car plates may be used to compile a list of frequent visitors for marketing purposes, or to build a traffic profile (such as the frequency of entry verses the hour or day).
* Travel: a number of LPR units are installed in different locations in city routes and the passing vehicle plate numbers are matched between the points. The average speed and travel time between these points can be calculated and presented in order to monitor municipal traffic loads. Additionally, the average speed may be used to issue a speeding ticket.
* Airport Parking: in order to reduce ticket fraud or mistakes, the LPR unit is used to capture the plate number and image of the cars. The information may be used to calculate the parking time or provide a proof of parking in case of a lost ticket—a typical problem in airport parking which have relatively long (and expensive) parking durations.
* **Provides evidence:** Similarly, to CCTV, automatic number plate recognition systems can provide you with the details regarding when someone was at your premises, whenever they are required. The images taken by this camera can be used as evidence and can provide valuable information that can be used in investigations. You can easily prove when the vehicle in question was on your premises and it will be all the hard evidence you need.
* **24/7 monitoring:** protecting your car park, Also monitor the access too. With ANPR cameras, you will have eyes on your car park 24 hours a day, 7 days a week. You will know exactly who has entered your premises, the time they enter and also the time they leave. This can be incredibly helpful in many situations.

## Challenge of Automatic Number-Plate Recognition

### Circumvention

Vehicle owners have used a variety of techniques in an attempt to evade ANPR systems and road-rule enforcement cameras in general. One method increases the reflective properties of the lettering and makes it more likely that the system will be unable to locate the plate or produce a high enough level of contrast to be able to read it

If an ANPR system cannot read the plate, it can flag the image for attention, with the human operators looking to see if they are able to identify the alphanumerics. In 2013 researchers at Sunflex Zone Ltd created a privacy license plate frame that uses near infrared light to make the license plate unreadable to license plate recognition systems.

# 1.2 Problem Definition

As we know there are many criminals that are driving and entering places easily without any monitoring for their vehicles automatically and efficiently. But if this system is installed on important points on roads. For sure it will influence directly finding out where the specific vehicle is and help police and security to detect the criminal following them.

Otherwise for detecting a particular number they have to watch every recording videos in cameras and it take too much time and attempt for finding the right vehicle.

It can also be used in other fields, for example, to determine the speed of a vehicle, which we can save the number of a vehicle when it enters a particular street (specially on high ways) and exiting the same vehicle then calculating the distance and time to make sure the speed of the car is limited to speed and has not been ruled out unless They can face the law and legal action can be taken with it.

Also somehow security can detect a vehicle which has no number plate if the system develop well in future, and many other ideas which can be perform with that system.

One of our problem is **Image acquisition**,The initial stage is called Image Acquisition and it simply consists in capturing images or videos of different vehicles as they pass along the road. The distance at which the images should be taken so that the number plate can be read is approximately 3 meters.

Another our problem is **Number plate extraction,** Once the image of the vehicle is obtained, the next step is to extract the number plate from the it. For this purpose, this second stage is based on the identification of number plate features within the image, such as its color, shape or characters, in order to detect its position and thus be able to extract it.

Also we face extracting from the number plate image each of the characters that appear on it which is called **Number Plate Segmentation.** For this purpose, first, a pre-processing step is usually carried out on the image in order to improve its quality and thus facilitate the extraction of the characters. For example, a commonly tackled problem in this pre-processing step is tilt correction. In general.

The final stage of every ANPR system is successfully recognizing each of the previously extracted number plate characters. At this point, some new problems arise, such as different size and thickness of characters due to zoom factors, different character fonts for different countries, noisy or broken characters, etc.

# 1.3 Aims

The aim of this project is to be able to develop a system for automatically recognising Kurdistan number plates from High Resolution (HR) digital images by combining advanced Computer Vision techniques with some of the most powerful Machine Learning algorithms.

# 1.4 Objectives:

• Create a real time application

• Create a machine-vision model

• Implement a image segmentation for region of interest extraction

• Create Optical Character Recognition system with OpenCV

• Creating an API which can be deployed in other applications

• Developing an interactive user interface

# 1.5 Scope

Number plate recognition is realized by acquiring images of either the front or the rear of vehicles

with cameras and then by image processing to identify license plates. It consists of three mains

stages. First one is Number Plate Identification & Localization in this segment the visual of the

scene is improved with is image processing. Second is Character Segmentation in which characters

segmented from the detected number plate for retaining the useful information to the system so

that further processing can take place. Third is OCR Optical Character Recognition in which text

is transferred into encoded text information.

A feedforward Artificial Neural Network is used which is based on OCR Algorithms.

For this purpose, MATLAB matrix library is used. MATLAB is a high-level language and

interactive environment for numerical computation, visualization, and programming. Using

MATLAB, you can analyse data, develop algorithms, and create models and applications. The

language, tools, and built-in math functions enable you to explore multiple approaches and reach

a solution faster than with spreadsheets or traditional programming languages, such as C/C++ or

Java.

MATLAB is used for the development of system in very limited time because we don’t have enough

time for development.

For enhancement of scene MATLAB’s image processing toolbox is used this toolbox provide

some built-in functions for reading image, cropping it, converting it into binary image then labelling

it for accessing the text in the scene.

For machine learning MATLAB’s Neural Network toolbox is used. This tool box provide built-in

functions for creating network, setting its parameters and its hyper parameters according to the

user requirements.