

Automatic License Plate Recognition

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Guide: Sajith N

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Outline

- 1 What?
- 2 Why?
- 3 Scope
- 4 System
 - Design
 - Licensing
- 5 Issues
 - Standardization
 - Image Quality
- 6 Tools
 - Language
 - Libraries
 - Others
- 7 Implementation
 - Otsu Thresholding
 - Blob Classification
- 8 Testing

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What?

Automatic License Plate Recognition (ALPR) is a real time embedded mass surveillance system that captures the image of vehicles and recognizes their license number.

ALPR technology tends to be region-specific, owing to plate variation from place to place.

The crude system was invented in 1976 at the Police Scientific Development Branch in the UK.
And none for India.

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The first arrest due to a detected stolen car was made in 1981.

Uses series of image manipulation techniques to detect, normalise and enhance the image of the number plate. Optical Character Recognition (OCR) to extract the alphanumeric of the licence plate.

Active research area for implementing fool proof solution with international support.

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Making the process fast, effective and cost efficient

Some applications of the system are:

- Automated traffic surveillance and tracking system.
- Automated high-way/parking toll collection systems.
- Automation of petrol stations.
- Journey time monitoring.

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Why?

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These countries enforced standards on the license plates in terms of dimensions, borders, colour, font size and type. Thus making the system easy to implement.

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Indian situation is very different, as we cannot expect the strict following of the standards, making the system complicated.

Wide variations are found in font size, type, shape and colours.

Hitachi offers a near real solution right now for a cost of more than Rs. 1000K per single license.

Systems have been implemented using proprietary tools and libraries.

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Scope

Understand the image processing techniques involved.

Realize the issues and challenges for implementing the system.

Gain basic project management skills.

Familiarize several tools for developing an intuitive system.

Develop basic document writing and presentation skills.

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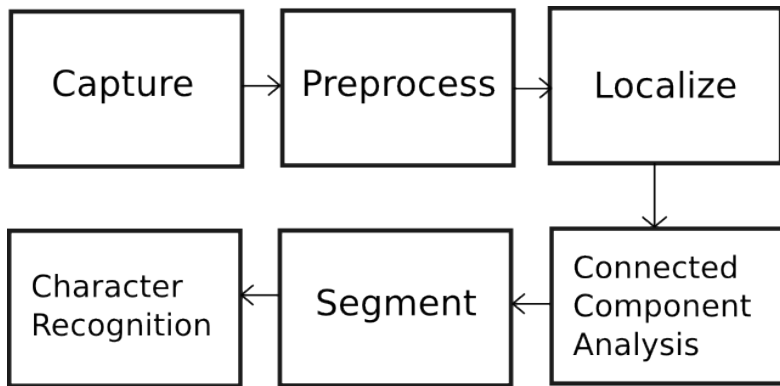
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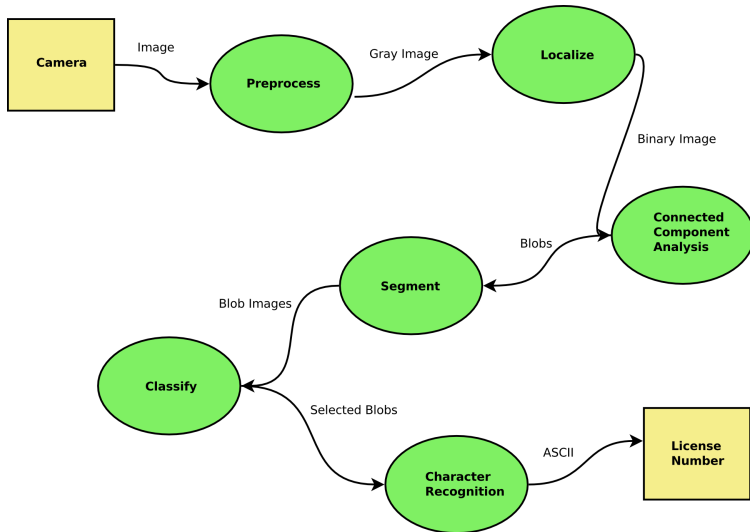
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System

The proposed system consist of 6 phases



Data Flow Diagram



Capturing Image

The image of the vehicle is captured using a high resolution photographic camera.

To understand the variations in settings like exposure, frame aperture etc, we have chosen 3 cameras.

- **Canon 1000D**
High resolution DSLR camera. HD images.
- **Canon PowerShot IS 800**
8 MP digital camera with Image Stabilization.
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Preprocessing

Two operations involved are:

1. Resize

Image from the camera is to be resized for optimization reasons.

2. Change color space

Image is converted to Grayscale from RGB.

Localization

Threshold is an image processing operation by which the pixels of the image are truncated to two values depending upon the value of threshold.

We use this operation to convert the image to binary and localize the license plate from the image of the vehicle.

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Thresholding requires pre image analysis for identifying the suitable threshold value.

Many statistical and physical modelling algorithms have been developed for the same purpose. Normal thresholding techniques are inefficient due to several reasons. Hence, adaptive thresholding is used.

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Connected Components

Connected component analysis is performed to identify the characters in the image.

Basic idea is to traverse through the image and find the connected pixels. Label them and extract.

cvBlobsLib is a library under OpenCV which extract 8-connected components in binary or grayscale images.

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Segmentation

Crop out the labelled connected components called blobs.

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Character recognition

The blobs are send to an Optical Character Recognition engine for returning the ASCII.

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License

The system will be released under the GNU General Public License (GPL).

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Issues

Complexity and probability of failure of the system increases as there are multiple issues.

Flaw in license plate standardization

- **Dimensions**
- **Fonts – type, size**
- **Art works**
- **Colours**
- **Position of the plate**

Thresholding

- **Colour spaces**
- **Camera**
- **Lighting**

Blob Classification

Undesirable blobs creep in during connected component analysis which if un-noticed can cause trouble in the character recognition phase.

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Tools

**The entire system is implemented using free software.
Ubuntu GNU/Linux operating system is used.**

Python

Python is an interactive, interpreted, dynamic language which is free and highly efficient.

Python is language libre. Shaped by the users around the world. Attracting more developers due to its simplicity.

The entire ALPR system is implemented in Python

Libraries

Open Computer Vision

OpenCV library is developed at the laboratories of Intel Corporation. They contain sets of highly efficient multimedia processing functions.

Python Imaging Library

PIL is the base image processing library from Python.

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Tesseract OCR

Tesseract OCR library from Google is used as the OCR engine.

Developed at HP between 1984 and 1994.

The code is available at

<http://code.google.com/p/tesseract-ocr>

Qt Designer and PyQt

The GUI is designed using Qt designer and Python code for the same generated using PyQt.

Qt is an extensive GUI library developed at Trolltech Inc.

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Project Management

Subversion Source code control system.

is very powerful, very usable, and very flexible, free software version control system.

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Diagram Generation

Dia

is a free **Diagram editor software**. **With templates for drawing DFD's, UML's etc.**

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Following algorithms have been used:

- **Otsu thresholding technique.**
- **A linear-time component labeling using contour tracing technique.**
- **Blob Classification.**

Otsu Thresholding

Adaptive thresholding.

Considers that the image contains two classes of pixels (e.g. foreground and background).

Introduced by Nobuyuki Otsu.

Implemented using `CV_THRESHOLD_OTSU` Method of OpenCV.

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Compares aspect ratio with every other blobs.

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Pixel coordinates are chosen to match the area of the plate.

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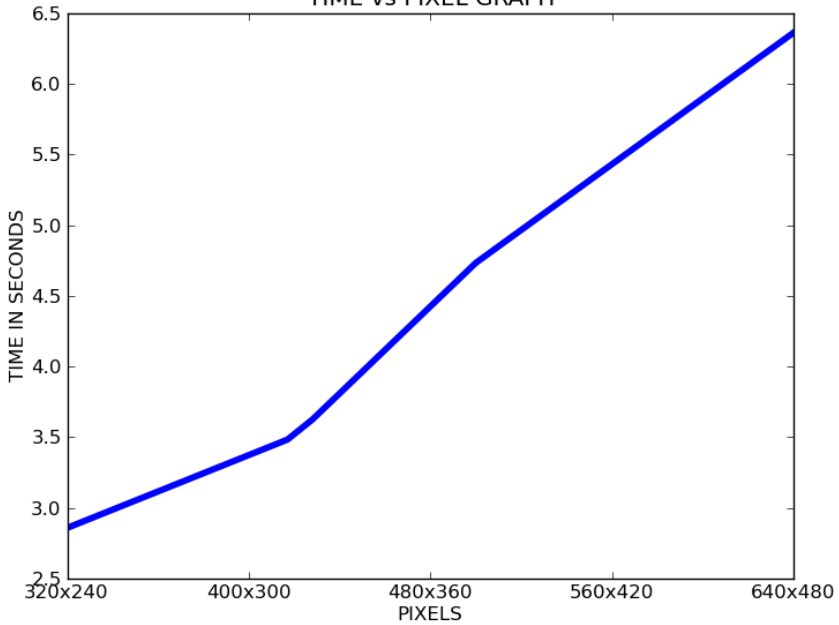
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- 1 **Test for Performance.**
- 2 **Test for Accuracy.**

Performance

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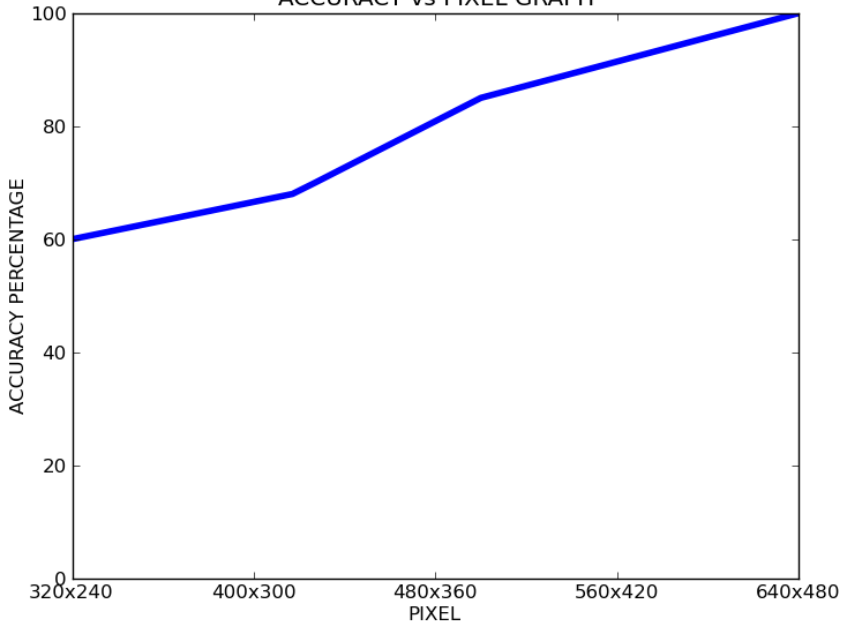
TIME vs PIXEL GRAPH



Accuracy

Larger images leave perfect recognizable blobs.

ACCURACY vs PIXEL GRAPH



Thankyou!

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Group VI

Dept. of CSE

MES College of Engineering