Automatic License Plate Recognition

Nijad Ashraf, Sajjad KM, Shehzad Abdulla, Saalim Jabir
Dept. of CSE, MESCE

Guide: Sajith N

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Outline

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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.

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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 alphanumerics 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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- **Journey time monitoring.**

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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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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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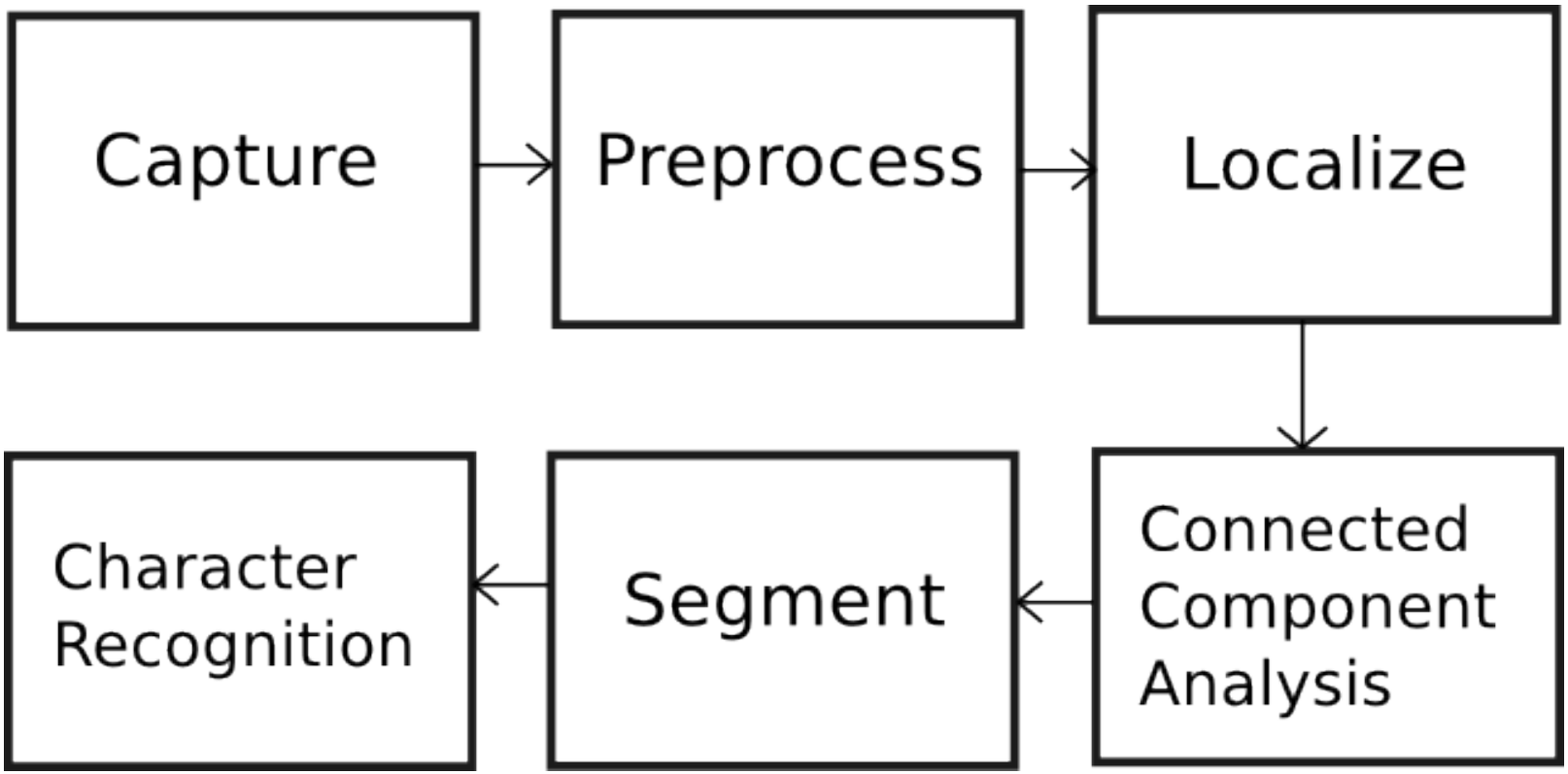
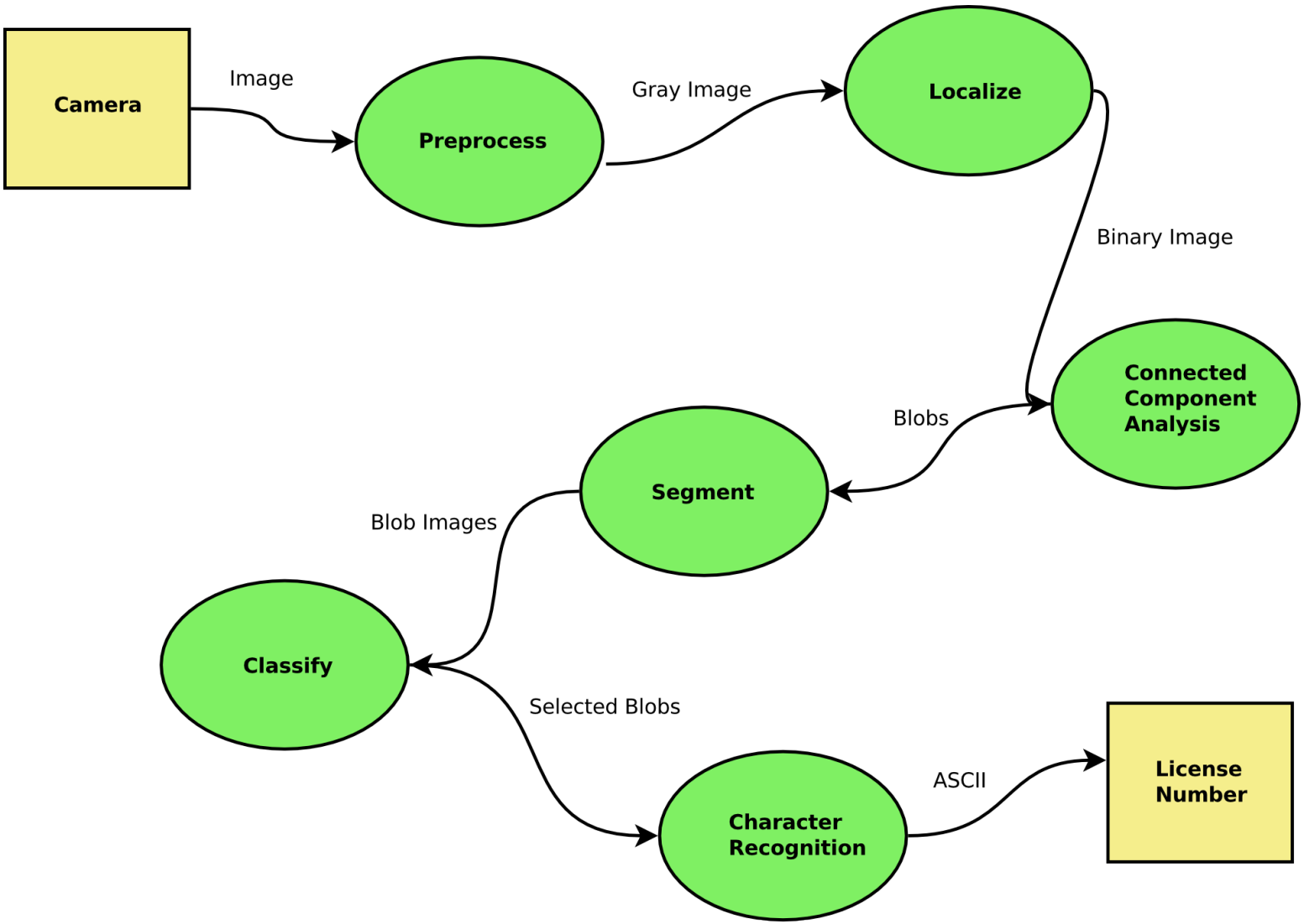
System

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 choosen 3 cameras.

- **Canon 1000D**
  High resolution DSLR camera. HD images.
- **Canon PowerShot IS 800**
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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

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Character recognition

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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.

Outline

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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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.
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Other Tools

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

Document Generation

LaTeX
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Diagram Generation

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

Outline

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).

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Implemented using CV_THRESHOLD_OTSU Method of OpenCV.

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Cropping

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Compares aspect ratio with every other blobs.

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

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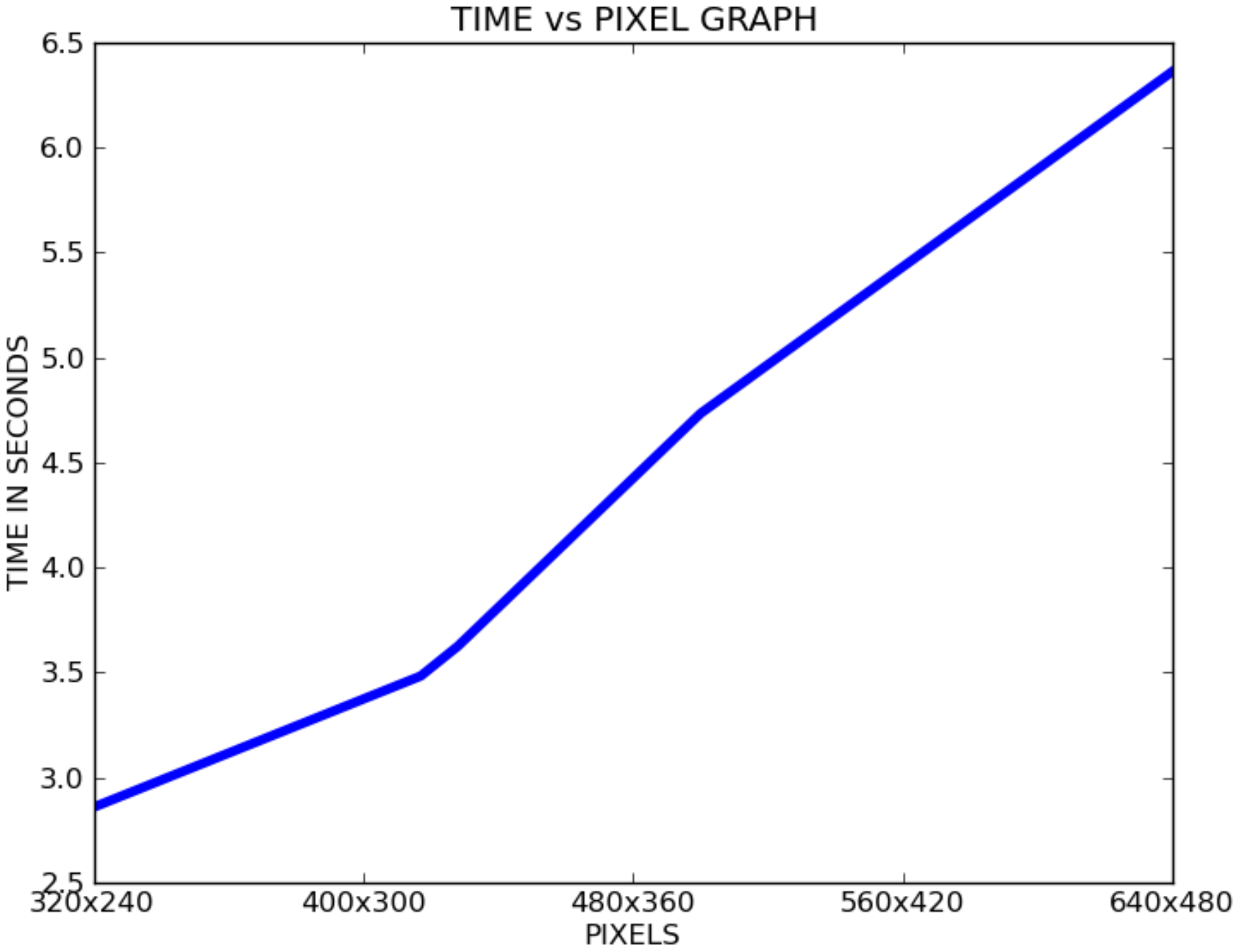
1. **Test for Performance.**
2. **Test for Accuracy.**

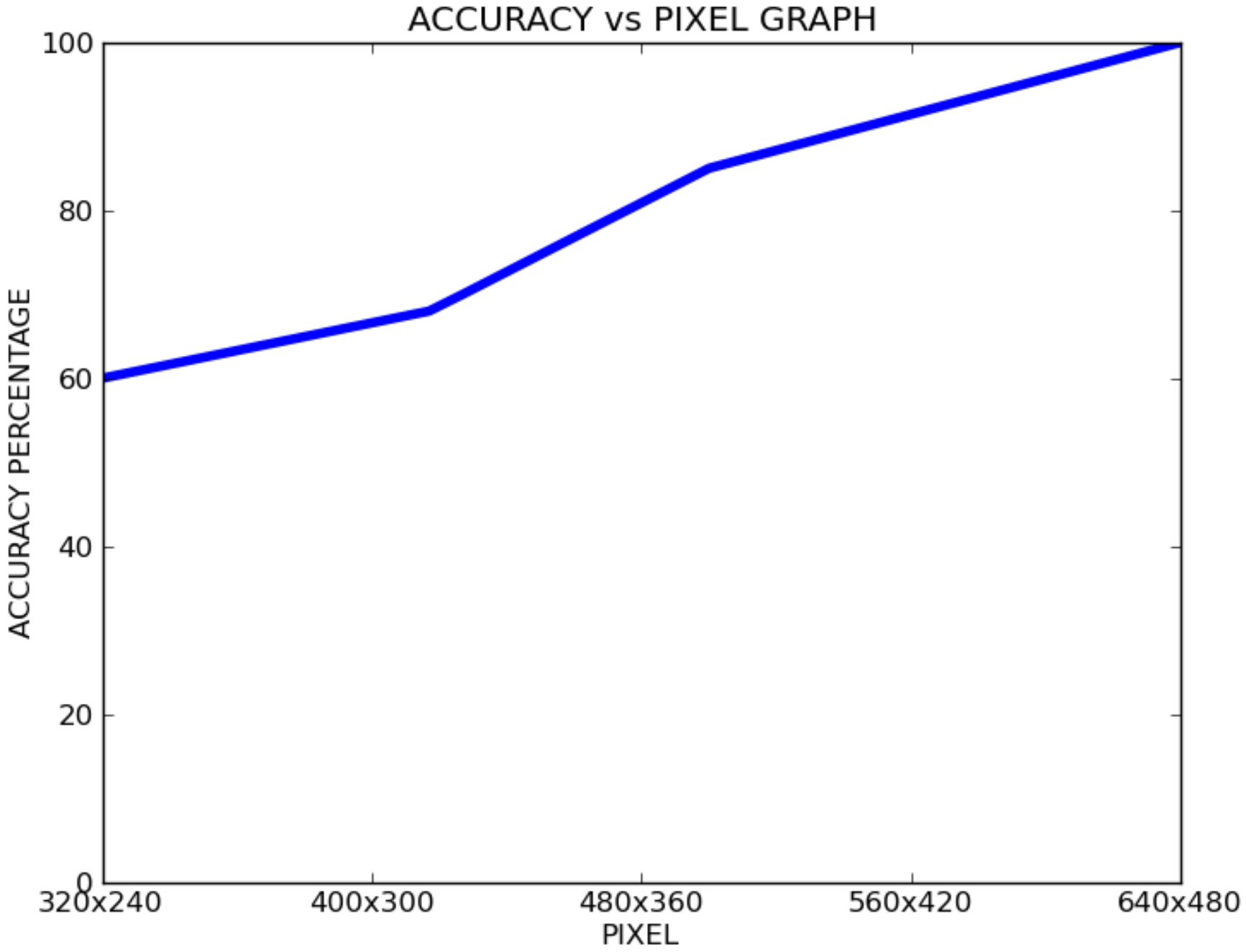
Performance

Image size has been identified to be the key element.


TIME vs PIXEL GRAPH
TIME IN SECONDS
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
320x240
400x300
480x360
560x420
640x480
PIXELS

Accuracy

Larger images leave perfect recognizable blobs.


ACCURACY vs PIXEL GRAPH
100
80
60
40
20
0
ACCURACY PERCENTAGE
320x240
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640x480
PIXEL

Thankyou!

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Group VI

Dept. of CSE

MES College of Engineering