APPLICATION OF REGION BASED VIDEO SURVEILLANCE IN SMART CITIES USING DEEP LEARNING

A Project Work Submitted to Jawaharlal Nehru Technological University Kakinada, Kakinada in the Partial Fulfillment for the award of the degree of

Bachelor of Technology

in

Computers Science and Engineering

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2023-24

SRINIVASA EDUCATIONAL SOCIETY'S

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Certificate

This is to certify that the project entitled **"APPLICATION OF REGION BASED VIDEO SURVEILLANCE IN SMART CITIES USING DEEP LEARNING"** is the bonafide work of

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ACKNOLEDGEMENT

We thank the almighty for giving us the courage and perseverance in completing the main-project. This project itself is acknowledgement for all those people who have give us their heartfelt co-operation inmaking this project a grand success.

We extend our sincere thanks to **Dr. M. VENU GOPAL RAO,** **B.E, M.B.A, D.M.M.,** chairman of our college, for providing sufficient infrastructure and good environment in the college to complete our course.

We are thankful to our secretary **Dr. M. SRIDHAR,** **M.Tech., M.B.A.,** for providing the necessary infrastructure and labs and also permitting tocarry out this project.

We are thankful to our principal **Dr. G. V. K. Murthy,** **M.Tech., Ph.D.,** for providing the necessary infrastructure and labs and also permittingto carry out this project.

With extreme jubilance and deepest gratitude, we would like to thank Head of the Computer Science and Engineering Department, **MR. S. Giri Babu,** **M.Tech., (Ph.D),** for his constant encouragement.

Our Special thanks to our project coordinator **MR. D. Janardhan Reddy,** **M.Tech., (Ph.D),** Assistant Professor, Computer Science and engineering, for his support and valuable suggestions regarding project work.

We are greatly indebted to project guide **Mrs. S. Suneetha,** **M.Tech.,** Assistant Professor, Computer Science and engineering, for providing valuable guidance at every stage of this project work. We are profoundly grateful towards the unmatched services rendered by him.

Our special thanks to all the faculty of Computer Science and Engineering and peers for their valuable advises at every stage of this work.

Last but not least, we would like to express our deep sense of gratitude and earnest thanks giving to our dear parents for their moral sup port and heartfelt cooperation in doing the main project.

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ABSTRACT

Now a day's traffic problems are increasing day by day and transport traffic is becoming a serious problem in the world. Various traffic monitoring systems have been developed. This paper presents the research on controlling the real-time traffic using various image processing techniques in which the pictures are captured using the webcam of various lanes of roads where traffic takes place. The counting of transport vehicles in each picture is computed using image processing techniques in the Matlab tool and the timer is allocated to lane based on a number of vehicles counted in the video processing of the vehicle. In this model LED's are used to show the green and red signals and seven segments are used to show the decrementing timer of signal green.

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4. Effect on image quality of reducing the intensity resolution of the image, i.e., the number of gray levels used to represent the underlying continuous intensity signal

LIST OF ABBREVIATION

Acronym	Abbreviation
MWSDs	Magnetic Wireless Sensor Detectors
RF	Radio Frequency
RA	Regression Analysis
MVT	Motion Vector Technique
RSS	Received Signal Strength
GSM	Global System for Mobile Communication
ANN	Artificial Neural Network
GPS	Global Positioning System
SMS	Short Message Service
ITS	Intelligent Transportation Systems

CHAPTER 1

INTRODUCTION

The traffic signal causes people on uncongested routes, stops at traffic signals disrupt an urban or suburban area expedition School children obediently wait for a traffic signal to interrupt traffic so they can cross a busy thorough accuse examine .positive travel system have been term adaptive, that is, they have the ability to mechanically change signal time in response to both small term and longer term variation in traffic. These system not simply give more competent control of traffic but also need smaller amount human and monetary capital to update the system's database. However, they often necessitate more strong operation of traffic detectors. Operations based edge detection is used to calculate the vehicle density.

1.1 Problem in Traffics

The most irritating problem that the people face in their everyday life is that they get caught in traffic jams. In our country, the vehicle density on the road is slowly becoming greater and much uncomfortable, which portray the breakdown of transportation base in our country that keep place with the developing cities of the country. In various countries the traffic problems are being increasing day by day and traffic is becoming a more serious issue. The main cause for increment in traffic deadlocks is the increment in the number of transportation objects, the deprived development of roads and no appropriate allocation of resources. Basically, the recognition and organization of traffic transportation are very fundamental for controlling the traffic effectively by this the traffic vehicle-related data is to be analyzed and collected. Few other techniques are MWSDs magnetic wireless sensor detectors, RF Radio Frequency, RA Regression Analysis, MVT Motion Vector Technique, etc. traditionally the traffic is controlled manually which requires more man-power and other resources since it is very difficult to control over the traffic manually. Some of other traffic controlling system is an automatic traffic control system which focuses on time for each step, In which electronic wireless sensors are used to detect the traffic and generate the indicating signal. But the main delay of this system is that the green light may effect to waste the time when the road is empty.

1.2 Image Processing

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.

Image processing basically includes the following three steps:

- Importing the image via image acquisition tools;
- Analyzing and manipulating the image;
- Output in which result can be altered image or report that is based on image analysis.

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction.

The image processing can be used to eliminate all of these drawbacks effectively which focuses to detect the vehicles through images rather than wireless sensors. Initially, the traffic compactness will be measured for a signal and accordingly, the time delay takes place when the traffic is more at a particular side of the traffic signal. Nowadays traffic and transportation are very important since the traffic is increased because of this to control the system we need a better traffic controlling system which must be able to control the traffic signals according to the situation rather than manual and time dependent. This system has focused to reduce the traffic without affecting the transportation and it has given a new picture to take the automatic decision for changing the red, green and amber lights based on the number of vehicles counted in a particular picture.

1.3 Sampling and quantization

In order to become suitable for digital processing, an image function f(x,y) must be digitized both spatially and in amplitude. Typically, a frame grabber or digitizer is used to

sample and quantize the analogue video signal. Hence in order to create an image which is digital, we need to covert continuous data into digital form. There are two steps in which it is done:

- Sampling
- Quantization

The sampling rate determines the spatial resolution of the digitized image, while the quantization level determines the number of grey levels in the digitized image. A magnitude of the sampled image is expressed as a digital value in image processing. The transition between continuous values of the image function and its digital equivalent is called quantization.

The number of quantization levels should be high enough for human perception of fine shading details in the image. The occurrence of false contours is the main problem in image which has been quantized with insufficient brightness levels.

1.4 Aliasing and image enhancement

Digital sampling of any signal, whether sound, digital photographs, or other, can result in apparent signals at frequencies well below anything present in the original. Aliasing occurs when a signal is sampled at a less than twice the highest frequency present in the signal. Signals at frequencies above half the sampling rate must be filtered out to avoid the creation of signals at frequencies not present in the original sound. Thus digital sound recording equipment contains low-pass filters that remove any signals above half the sampling frequency.

Since a sampler is a linear system, then if an input is a sum of sinusoids, the output will be a sum of sampled sinusoids. This suggests that if the input contains no frequencies above the Nyquist frequency, then it will be possible to reconstruct each of the sinusoidal components from the samples. This is an intuitive statement of the Nyquist-Shannon sampling theorem.

Anti-aliasing is a process which attempts to minimize the appearance of aliased diagonal edges. Anti-aliasing gives the appearance of smoother edges and higher resolution. It works by taking into account how much an ideal edge overlaps adjacent pixels.

CHAPTER 2

LITERATURE REVIEW

1. Title: Traffic Congestion Monitoring Using Image Processing And Intimation of Waiting Time 2017

Author: M.Sujatha1 , Renuga Devi2 , Bragadeesh.S.A

Description: Frequency of traffic congestion is almost high in India. The density of vehicles on the road keeps increasing to higher amount these days. In traffic signal, people waste much time particularly during the peak hours of the day. In order to solve this problem of high traffic pressure, it is indispensable to solve the traffic congestion. Thus an idea of monitoring the traffic congestion using real time image processing techniques and informing the waiting time to the public, through a mobile application has been proposed. The theme is to determine the traffic density on each side of the road by calculating the number of vehicles at the traffic signal zone at regular interval of time by using Image processing techniques. The vehicle density in the signal juncture calculated so far, is further processed to determine the waiting time at that particular moment in each traffic signal juncture. Through the mobile application, the path with minimum waiting time is informed to the public, so that they could easily overcome the problem of traffic congestion in their route to reach the destination. This application clearly intimates the people that which route is best and thus helps the public to get prior knowledge regarding the traffic juncture waiting time in their respective route.

2. Title: Traffic Signal Control System using Morphological Operation based on Boundary Detection 2018

Author: Mithuna B N

Description: Boundary detection aim to score pointed intensity change in an images and is a based on big quantity of image study and machine vision applications. Traffic is the major trouble which every country faces because of the enlarge in quantity of motor vehicle during the world. Driver should stay for the predefined traffic signal timings flat though the quantity of vehicles is very a lesser amount of other directions, especially in little cities..This trouble

can be solved based on the dimension of traffic thickness on the road. This technique presents based on morphological edge detection. The effort is mainly careless for the traffic of town such as, Chikkamagalur, Hassan etc..

3. Title: An advance towards Traffic organization System using Density computation and Emergency Vehicles Alert 2014

Author: Farheena Shaikh, Dr. Prof. M. B. Chandak

Description: Now a day's many of the things get controlled automatically. Everything is getting controlled using the mechanical or the automated systems. In every field machines are doing the human works. But still some area is controlled manually. For example traffic controls, road control, parking controlling. Keeping these things in mind we are trying to develop the project to automate the traffic tracking for the square. To make any project more useful and acceptable by any organization we need to provide multiple features in a single project. Keeping these things in consideration proposed system is less with multiple methodologies which can be used in traffic control system It is important to know the road traffic density real time especially in mega cities for signal control and effective traffic management. In recent years, video monitoring and surveillance systems have been widely used in traffic management.Hence, traffic density estimation and vehicle classification can be achieved using video monitoring systems. In most vehicle detection methods in the literature, only the detection of vehicles in frames of the given video is emphesized. However, further analysis is needed in order to obtain the useful information for traffic management such as real time traffic density and number of vehicle types passing these roads. This paper presents emergency vehicle alert and traffic density calculation methods using IR and GPS

4. Title: A Survey of Vehicle Position Prediction System based on GSM and ANN Structure 2015

Author: Sonal Suryawanshi, Vaishali Sahare

Description: The need for determining the positioning information of any vehicle is becoming popular in recent year. This survey paper compares and summarizes the different techniques used to find the position of any vehicle using Received Signal Strength (RSS) from

Global System for Mobile Communication (GSM) network available at the instant, GSM and Global Positioning System (GPS) modem, GSM and Google Map and other positioning Algorithms. The existing system uses the GSM and Artificial Neural Network (ANN) structure in location estimation so that the positioning accuracy of the overall system is increased. The role of ANN structure in location estimation is that it not only a substitute for positioning algorithms but it will also substitute of overloaded map- matching.

5. Title: Remote Vehicle Tracking System using GSM Modem and Google Map ,2013

Author: Muhammad Ridhwan Ahmad Faud and Micheal Drieberg

Description: Around the world and in Malaysia, the number of vehicles theft cases has been increasing at an alarming rate whereas the rate of recovery of the stolen vehicles is still minimal. Furthermore, many service provider companies lack proper fleet management system which causes low efficiency of services and reduced profit as the company could not monitor transportation operations. A real-time remote vehicle tracking system is one of the possible solutions to overcome these issues. This paper presents the development of the remote vehicle tracking system which integrates the Global System for Mobile Communications (GSM) Modem and Google Map. The GSM modem at the control center will receive the coordinates through Short Message Service (SMS) and updates the main database. The information then will be accessed by the website and the position of the vehicle will be displayed through the Google Maps application. A website has been developed to aid the user to track and view the vehicles' location and can be access anytime and anywhere as long as Internet connection is available. The three working functions are the latest tracked vehicle location, route history and route planner. The developed remote vehicle tracking system demonstrates the feasibility of real-time tracking of vehicles, which can be used for many applications including vehicle security and fleet management.

6. Title: Vehicles tracking and classification using Traffic zones in a hybrid scheme for intersection traffic management by smart cameras 2010

Author: Peyman Babaei

Description: This paper proposes an automatic vehicles counting, classification and tracking for identifying Traffic flows in an intersection which is a fundamental task for video surveillance in urban traffic management. In intelligent transportation systems (ITS), especially in field of urban traffic management, intersections monitoring is one of the critical and challenging tasks. Where, objects have different characteristics such as varying velocities, stop and go. Therefore it is necessary to use a hybrid scheme of adaptive background mixture model to learn background model faster and more accurately, instead of using single rate of adaptation, which is not adequate. The main focus of this paper is to analyze activities at intersection in number of traffic zones for counting and classifying vehicles and then tracking to extract traffic flows which assists in regulating traffic lights for using in smart cameras. Traffic zones definition in intersection video, based on trajectories clustering; greatly reduce the time and volume of computations. Smart camera's fundamental purpose is to efficiently reduce the transmission rate and also analyze an intersection scene and report statics and information of interest which is not an image. Ground-truth experiments with urban traffic sequences show that our proposed algorithm is very promising relative to results using other techniques.

CHAPTER 3

PROBLEM STATEMENT

This existing system presents the research on controlling the real-time traffic using various image processing techniques in which the pictures are captured. The counting of transport vehicles in each picture is computed using image processing techniques in the MATLAB tool and the timer is allocated to lane based on a number of vehicles counted in the specific picture of the lane for showing the green signal to pass the vehicle. In this model LED's are used to show the green and red signals and seven segments are used to show the decrementing timer of signal green.

Drawbacks:

- Image given input as image format
- Inaccurate
- Low performance
- Inefficiency

CHAPTER 4
DEVELOPMENT PROCESS

4.1 REQUIREMENT ANALYSIS AND SPECIFICATIONS

The requirement engineering process consists of feasibility study, requirements elicitation and analysis, requirements specification, requirements validation and requirements management. Requirements elicitation and analysis is an iterative process that can be represented as a spiral of activities, namely requirements discovery, requirements classification and organisation, requirement negotiation and requirements documentation.

4.2 INPUT REQUIREMENT AND OUTPUT REQUIREMENTS

INPUT DESIGN

The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data in to a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, avoiding delay, avoiding extra steps and keeping the process simple. The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things:

- What data should be given as input?
- How the data should be arranged or coded?
- The dialog to guide the operating personnel in providing input.
- Methods for preparing input validations and steps to follow when error occur.

OBJECTIVES

1. Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system.

2. It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make data entry easier and to be free from errors. The data entry screen is designed in such a way that all the data manipulates can be performed. It also provides record viewing facilities.

3. When the data is entered it will check for its validity. Data can be entered with the help of screens. Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus, the objective of input design is to create an input layout that is easy to follow

OUTPUT DESIGN

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and also the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

1. Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is designed so that people will find the system can use easily and effectively. When analysis design computer output, they should Identify the specific output that is needed to meet the requirements.

2. Select methods for presenting information.

3. Create document, report, or other formats that contain information produced by the system.

The output form of an information system should accomplish one or more of the following objectives.

- Convey information about past activities, current status or projections of the
- Future.
- Signal important events, opportunities, problems, or warnings.
- Trigger an action.
- Confirm an action.

4.3 RESOURCE REQUIREMENT

HARDWARE REQUIREMENT

- Processor Type - Pentium -IV
- Speed - 2.4 GHZ
- Ram - 4 GB
- Hard disk - 20 GB HD

SOFTWARE REQUIREMENT

- Operating System - Windows 7
- Software Programming Package - MATLAB R2020 a or b

4.4 DESIGN PROCESS

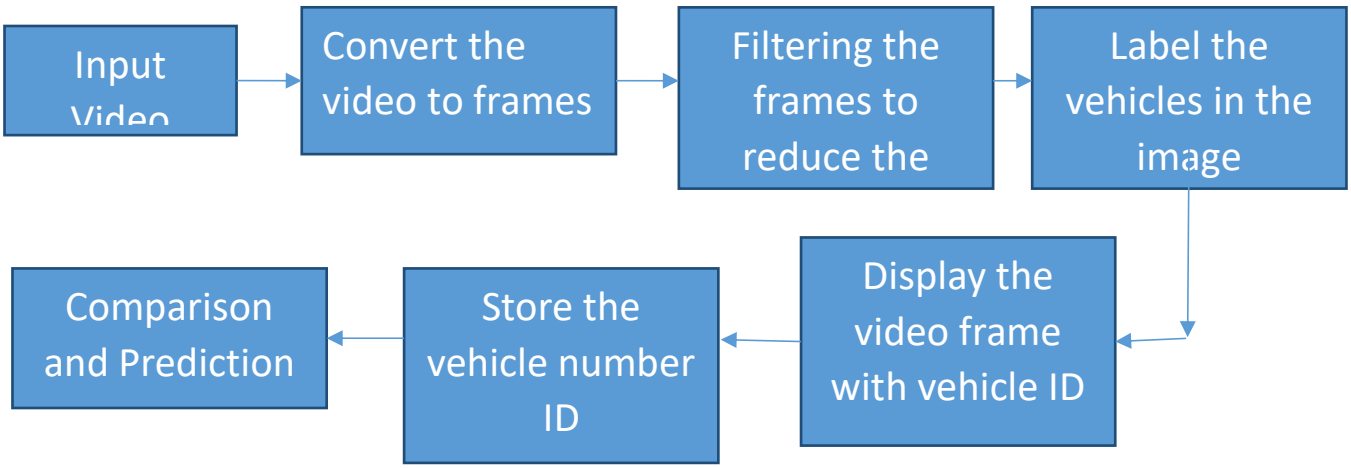
4.4.1 Proposed System:

In the proposed system surveillance video is given as a input to the system To detect the presence of cars and some vehicle on the road lane is very difficult.Some Techniques is used in image processing are image analysis, image segmentation and morphological operation. Segmentation not come in accurate way to obtain the result based on the requirement. In which electronic wireless sensors are used to detect the traffic and generate the indicating signal. But the main delay of this system is that the green light may effect to waste the time when the road is empty. The work presents a method for tracking multiply moving objects in the surveillance cameras .This work will uses the morphological operations the unwanted noise is removed from the frames. All the vehicles in the surveillance video are identified and numbered. Using the number of vehicle present in the video the automatic prediction is obtained**.**

Advantages:

- Better Performance
- Accurate result
- All vehicles are identified and labelled accurately.

4.4.2 SYSTEM ARCHITECTURE



Modules

- Input video
- Pre-Processing
- Split the video to frames
- Display tracking results

Modules Description:

Input Video: A collection of data is called as datasets. An input data can be obtained from the traffic signals. We can collect the data set from the traffic signals. First we have to collect the as video format Taken video from the traffic signals by using the surveillance camera.

Preprocessing:

- The aim of pre-processing is an improvement of the image data that suppresses undesired distortions or enhances some image features relevant for further processing and analysis task. Data Cleaning/Cleansing. Cleaning "dirty" data. Real-world data tend to be incomplete, noisy, and inconsistent.
- Data Integration. Combining data from multiple sources.
- Data Transformation. Constructing data cube.
- Data Reduction. Reducing representation of data set.

Split the video to frames

We have collected the video .In the video format can be changed as the frame for getting the particular image for implementation. After we have to convert the video format .We have to use the filtering for getting the proper image. After the image filtering, all the images should be labels based the vehicles.Label the every vehicle images. Display the vehicle based on the across during the green signals based on Vehicle running one by one within the 10 minutes. After all the vehicle ID is stored in the database.

Display the tracking Results:

In our implementation we have taken the Videos during the green signals which are the vehicles is passed. Compare our images which is stored .Based on the comparison we have to predict the output more accurately. Finally, all the process can be obtained to detect the results based on Traffic signals.

4.5 IMPLEMENTATION SOFTWARE- MATLAB

Introduction to MATLAB

MATLAB (Matrix Laboratory)is a matrix-oriented language for technical computing. It is not only used for computation, but also for visualization and programming in an easy-to-use environment. It is an interpreted language (not compiled) that was conceived to provide easy access to matrix and linear algebra software that was written in FORTRAN. One of the main features of MATLAB is that it is oriented toward numerical computing, instead of symbolic computing. The software comes in the form of a core program and additional libraries or *toolboxes.* A toolbox is a collection of MATLAB functions (called M-functions or M-files) that extend the capability of the core environment to solve specific to pic problems.

MATLAB is optimized to be relatively fast when performing array operations, so it is important to take this into account to write suitable instructions, for example, to avoid unnecessary 'for' loops that process individual array elements.

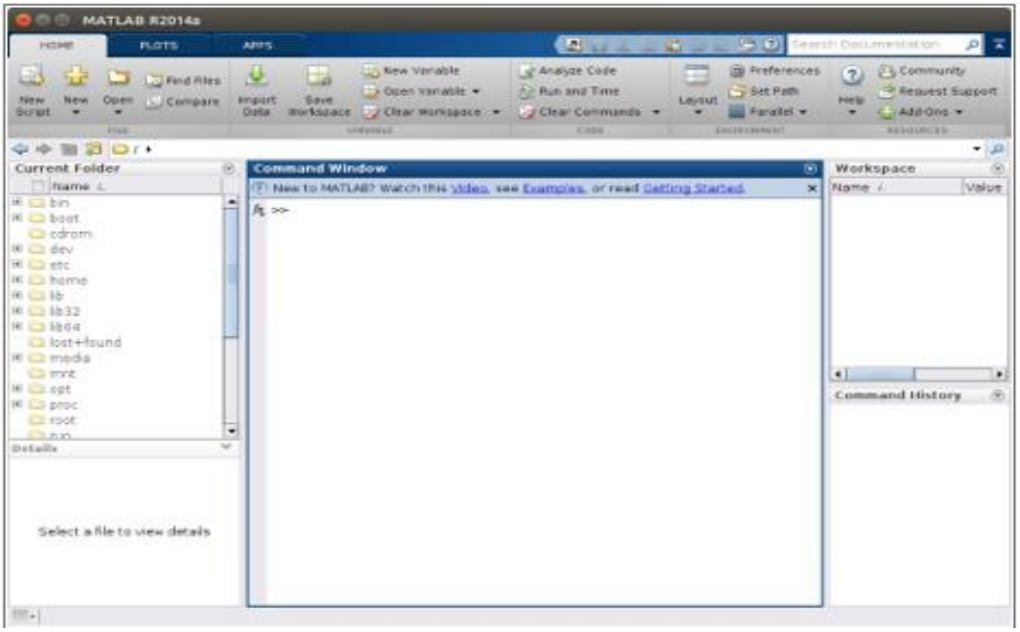
4.5.1 References:

Some useful references that provide a more detailed introduction to MATLAB are available at the following URLs. It is recommended that those of you not familiar with MATLAB invest some effort in getting acquainted by practicing after this first lab session.

Tutorials:http://www.maths.dundee.ac.uk/ftp/nareports/MatlabNotes.pdfhttps://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf
Many MATLAB tutorials available on http://www.youtube.com.
Cheatsheets:http://www.cogsci.uci.edujoachim/ss2012/MatlabCheatSheet.pdf
http://web.mit.edu/18.06/www/Spring09/matlabcheatsheet.pdfhttp://www.econ.ku.dk/pajhede/Cheatsheet.pdf

4.5.2 How to start and quit a MATLAB session

Start a MATLAB session by double-clicking in the MATLAB shortcut icon (or by typing matlab in a UNIX terminal).The MATLAB desktop appears, and it consists of several tools:



The Command Window (where commands are input to the program, interactively), the Command History (shows all previously executed statements. It is not displayed in the latest MATLAB version), the Workspace (with all the variables in the current session and their properties), the Current Folder (and file browser), the Help Browser, and the Start button (for quick access to tools and more, in previous MATLAB versions).

An alternative method to quit the session is by typing ’exit’ or ’quit’ in the command-line prompt: >> exit

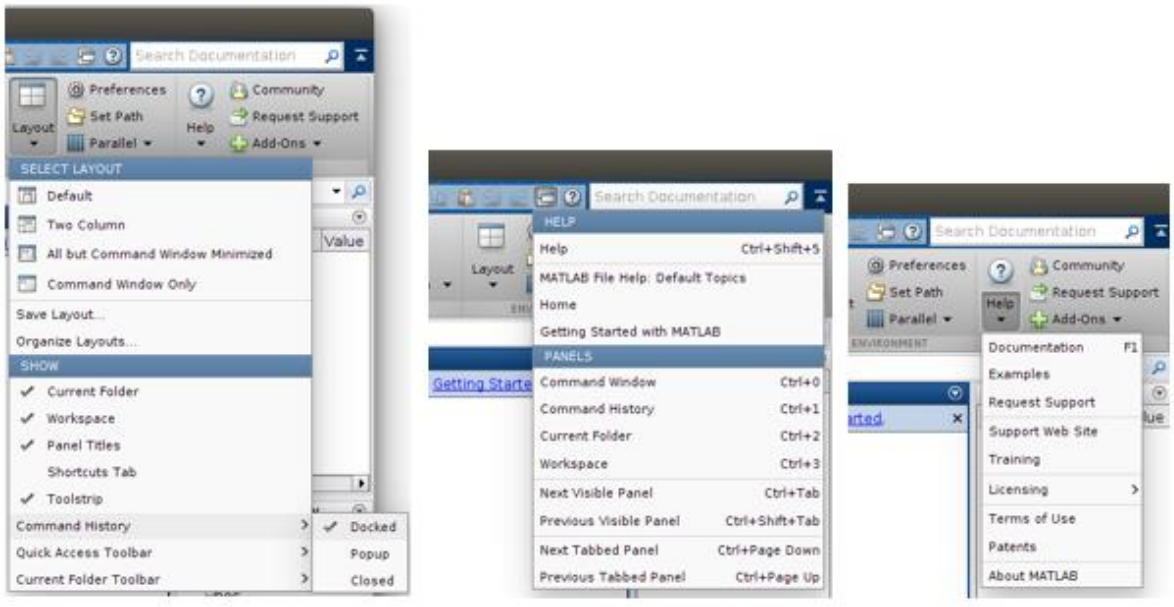


Figure 1: Layout configuration button (left); Panel shortcuts (center), and Help menu (right).

4.5.3 MATLAB help facilities

Type help to find a list of MATLAB help topics, type at the prompt:

>> help

To see the 'Elementary matrices and matrix manipulation' topic, type:

>> help elmat

To see the functions in the Image Processing Toolbox, type:

>> help images

To see the help for a standard plot of (x, y) data, type:

>> help plots

For window-based help, from the MATLAB prompt type helpwin, or, e.g., helpwinelmat. For a friendlier and extended documentation, you may type

>> doc plot

The following MATLAB commands are very useful to determine the available MATLAB variables, and to clear variables. To see the names of all existing variables in the current workspace, type

>> who

To see more details of the variables, type

>>whos

>>whosvariable_name

To delete variables from the current workspace, use the Clear Workspace button or type

>> clear variable_name

>>clear (this deletes all variables, clearing the workspace)

The commands save and load can be used to save (part of a) workspace into a .mat file and to load it from disk. Try….

>> savemyWorkspace.mat

>> loadmyWorkspace.mat

The command to print matlab related files in a folder is

>> what folder_name

The commands 'diary on', 'diary off' may be used to store in a text file called 'diary', in the current folder, the statements written and the output generated in the command window. The written (input) statements are also available in the Command History panel. Other useful tips: auto-completion (tab key) and review of previous commands (up and down keys).

4.5.4 USING MATLAB AS ACALCULATOR

MATLAB can be used as a calculator simply by typing mathematical commands at the prompt. All of the usual arithmetic expressions are recognized. For example, type

>> 2+3

at the prompt and press return, and you should see

ans = 5

The variable 'ans' (answer) contains the result of the last command executed if it is not assigned to a given variable. The basic arithmetic operators are + - * / and ^ ('to the power of',e.g.,2^3=8). Parentheses () can also be used. The order precedence is the usual: Parentheses are evaluated first, then powers, then multiplication and division, and finally addition and subtraction.

Writing a semicolon (;) at the end of the statement prevents from printing the output in the Command window.

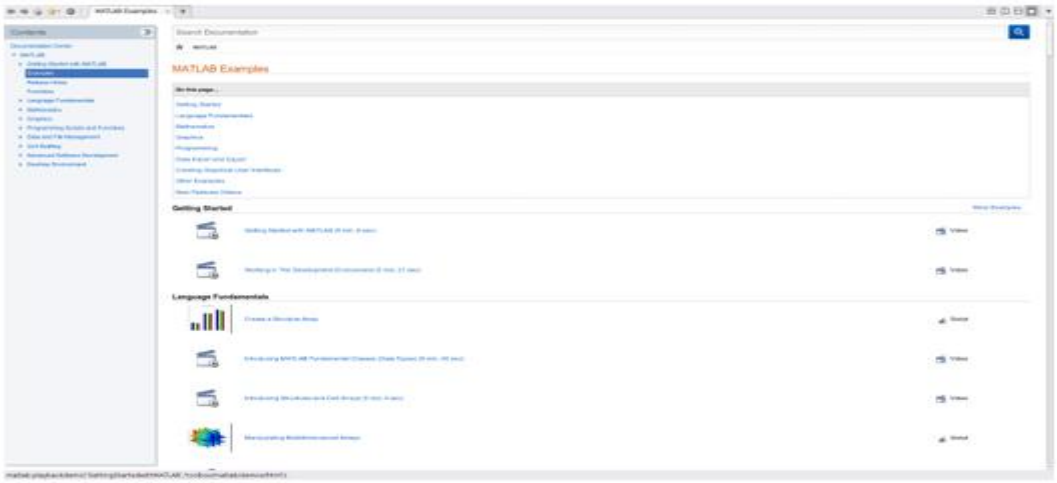
4.5.5 WORKING WITHMATRICES

The default data type in MATLAB is matrix in double floating-point precision. Then, another numeric type commonly used in image processing is uint8 (since intensities are represented with 8 bits, in the range 0..255, thus unsigned integer).

To get started using MATLAB, type in the command window:

>> demo

And go through the excellent examples to learn the environment and some basic commands.



Small matrices can be loaded in MATLAB's memory by specifying its entries, row-wise and separated by brackets. For example, matrix A= [123,456,789]
is loaded as:

```
>> A = [1,2,3; 4,5,6; 7,8,9];
 1   2  3
4   5  6
7   8  9
```

Commas are unnecessary if entries are separated by a blank space. The semicolon inside the brackets signals the row breaks. Larger matrices (or vectors) with structure are more easily coded using some built-in commands: zeros, ones, zeros, repmat, linspace, meshgrid, diag, toeplitz, etc. It is also important to learn how to access the elements of a matrix using indices. For example, returns the entry in the 2nd row and 3rd column of A. Multiple entries can be selected using the colon operator':'.

For example,

```
>> A (1, :)
```

selects the first row of A, whereas

```
>> A(:,1)
```

selects the first column of A. Multiple rows or columns can be selected using the statement
first index: step:last_index. For example, (assuming a large enough matrix A)

```
>> B=A(1:2:7,:)
```

selects rows {1,3,5,7} of A, creating another matrix (B) only with these rows. This statement is very useful in creating vectors of uniformly spaced elements. For example, the command

```
>> x = 0:0.2:1;
```

createsarowmatrixwithelementsbetween0and1instepsof0.2,i.e.,matrix x=[0.0,0.2,0.4, 0.6, 0.8,1.0].
To obtain the dimensions of a matrix, type:

```
>> size(A)
```

Familiarize yourself with the functions in the Elementary matrices and matrix manipulation and Matrix functions-Numerical Linear Algebra topics, and the operations that can be carried out with them.

```
>> help elmat
>> help mat fun
```

For example, arithmetic operations such as matrix addition, subtraction and multiplication are encoded in usual operators +, - and *, respectively. The inverse of a (square) matrix is requested

using the in v command,e.g.,in v(A), or with the backslash command\if followed by another matrix. The transpose of a matrix is specified with a dot followed by the single quote:A.'.The single quote, A', computes the transpose and complex-conjugate of the matrix (MATLAB also supports complex data types).

For example:
>>A_sym = (A+A.')/2 computes the symmetric part of matrix A and assigns it to variable called A_sym.

One thing worth mention is the difference between array and matrix operations. The former is specified with a dot whenever they differ. For example: A.*B computes the product of matrices A and B entry-wise, whereas A*B computes the matrix product (the usual one in the matrix ring).

There are many useful Linear Algebra functions, such as those that compute determinants (det), norms (norm), eigen values and eigenvectors (eig), solutions of linear systems (linsolve),etc. Also, take a look at the functions/commands available in the *Image Processing Toolbox* by typing
>> help images

The functions that we will use for image processing in this session will be mentioned in the second part of these notes, where they are used.

4.5.6 MATLAB SCRIPTS

MATLAB programs can be executed interactively via the command line or sequentially via .m files called scripts. A script is just an .mfile containing a sequence of commands that will be executed as if they were written in the prompt line. However, scripts are highly recommended because they area convenient storage for several instructions and because they execute faster than using the command line.

4.5.7 MATLAB programming: functions

Matlab comes with built-in functions. However, the user can program its own functions (in regular text files with .m extension) to process data in a customized manner.

Check the MATLAB documentation on how to write your own functions with different number of input and output arguments:
>> doc function

4.5.8 BASICS OF DIGITAL IMAGE PROCESSING

Digital Images Monochrome (gray scale) images can be modeled by two-dimensional functions f : R 2 → R. The amplitude off at spatial coordinates (x, y), i.e., f(x, y), is called the intensity or gray level at that point, and it is related to a physical quantity by the nature of the image acquisition device; for example, it may represent the energy radiated by a physical source. We will deal with bounded (i.e., finite) quantities, and so $|f| < \infty$. Common practice is to perform an affine transformation (substituting f ← af +b for all (x, y) by means of some suitable constants a, b) so that f takes values in a specified interval, e.g., $f \in [0, 1]$.

A digital image can be modeled as obtained from a continuous image f by a conversion process having two steps: sampling (digitizing the spatial coordinates x, y) and quantization (digitizing the amplitude f). Therefore, a digital image may be represented by an array of numbers, M = (mij), where i, j and m can only take a finite number of values, e.g., i = {0, 1, . . . , W − 1}, j = {0, 1, . . . , H −1} and m = {0, 1, . . . , L−1} for some positive integers W, H, L (Width, Height and number of gray Levels)2 . That is, a digital image is a 2-D function whose coordinates and amplitude values are discrete (e.g., integers). Specifically, mij = q f(x, y) = q f(x0 + i · Δx, y0 + j · Δy) , where Δx and Δy are the sampling steps in a grid with spatial coordinates starting at some location (x0, y0), and q : R → {0, . . . , L − 1} is the input-output function of the quantizer (stairway shape).

Common practice for grayscale images is to use 1 byte to represent the intensity at each location (i, j) (i.e., picture element or “pixel”). Since 1 byte = 8 bits, the number of possible gray levels is L = 28 = 256, and so intensities range from i = 0 (black) to i = L − 1 = 255 (white). However, to numerically operate with grayscale images, it is convenient to convert the data type of the image values from integers to real numbers, i.e., from 8 bits to single or double precision. Once operations are finished, it may be convenient to convert back to 8-bit format for storage of the resulting image, thus producing a quantization of the data values. Medical images are usually represented with a larger depth (10-12 bits) to mitigate the occurrence of visual artifacts due to the quantization process.

Color images can be represented, according to the human visual system, by the combination of three monochrome images (with the amount of red (R), green (G) and blue (B) present in the image), and so, each pixel is represented by 3 bytes, which provides a means to describe 2 3×8 ≈ 16.8 million different colors. Many of the techniques developed for

monochrome images can be extended to color images by processing the three component images individually. The number of bits required to store a (gray scale) digital image is b = W · H · log2 (L), and so compression algorithms (such as JPEG) are essential to reduce the storage requirement by exploiting and removing redundancy of the image. Spatial resolution is a measure of the smallest discernable detail in an image, and it is usually given in dots (pixels) per unit distance. That is, it is the density of pixels over the image, but informally, the image size (W × H pixels) is regarded as a measure of spatial resolution (although it should be stated with respect to physical units - cm, etc.). It is common to refer to the number of bits used to quantize intensity as the intensity resolution.

Loading an image

To read an image from disk, use the command imread:

>> A = imread (’example.tif’);

To see all the supported file formats and options of this veil-in function, you may type

>> doc imread

Once variable A has been created, we may see its properties by typing:

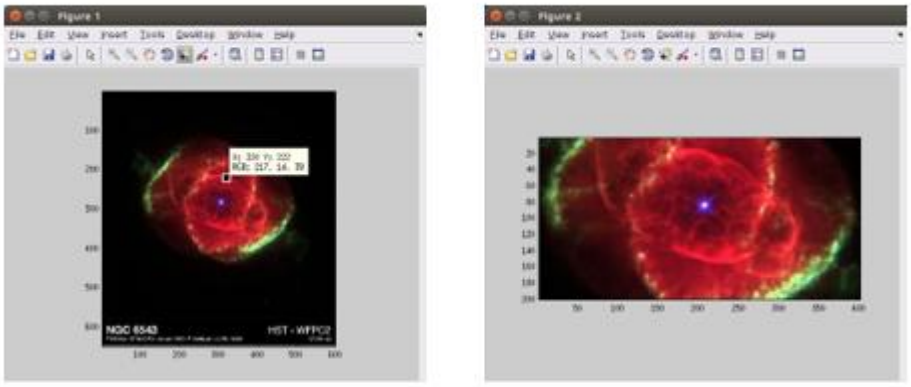


Figure 2: Figures with images ’example.tif’ (left) and a part of it (right).

>>whos A It will return that A is a variable of type uint8 (unsigned integer represented by 8 bits = 1 byte) and it is a multi-dimensional array/matrix of size 650 × 600 × 3, i.e., an image of 650 × 600 pixels and three components or bands, thus, it is a color image (in RGB format).

To know more about the attributes of an image, you may use the command imageinfo, which is part of the Image Processing Toolbox:

>>imageinfo(’example.tif’)

Displaying an image and coordinate axes convention

To visualize an image without loading it in the workspace (not creating a variable), you may type:
>>imageview('example.tif')
To visualize the image that has been previously loaded in variable A, you may type:
>> figure, imagesc(A)
This will create a new window and display a color image. By default, it will also show the tick marks in both axes, in pixel units, and in the "matrix" axes mode (>> axis ij), as opposed to the "Cartesian"axesmodeimpliedby(>>axisxy).In the "matrix" axes mode ,the coordinate system originate the upper left corner, with the positive *i*axis extending down ward and the positive *j*axis extending to the right. This is a conventional representation from the way CRT displays worked.
To properly set the aspect ratio of the figure, use
>> axis equal tight

If you have the Image Processing Toolbox.
type >> figure, imshow(A,[]) to visualize the image in variable A. You may also try (>> axis on) to visualize the axes; (>> axis off) to hide them.
If the image was an indexed image that stores colors as an array of indices into a colormap (e.g., a GIF image), you could use (>> colormap(gray)) to display a binary or grayscale image.
To find out the intensity value at pixel (j, i), type: >>A(222,320,:) It will return three numbers R=217, G=14, B=39. Hence the color is approximately red.
This is depicted in Fig. 2. You may select and visualize part of an image using indices into the array.
For example, to visualize the pixels of A in the rectangular region between rows $i \in [200, 400]$ and columns $j \in [100, 500]$, type: >> B = A(200:400,100:500,:);
>> figure, imagesc(B) This is also shown in Fig. 2.

Figure 3: Effect on image quality of reducing the spatial resolution of the image, i.e., the number of samples (pixels) used to represent the underlying continuous intensity signal.

You may close a figure window from command line by typing

>> close(fig_number) where fig_number is the number in the top bar of the figure window.

To close all figure windows, type

>> close all

Writing an image to disk

To write an array into a file with an image format,

we use the function imwrite:

>>imwrite(B,'SavedImage.tif') This will create a file called SavedImage.tif in the working folder.

You may want to check the supported image format files by typing

>> doc imwrite

Resolution Spatial resolution.

Given a well-sampled digital image, the effect of reducing the spatial resolution while keeping the number of intensity levels constant is coded.

To run the script,

type >> run_spatial_resolution in the command window.

You may have to move to the folder containing the corresponding .m file or may have to add such folder to the MATLAB path. The output produced on the input image is shown in Fig. 3. The image quality degrades as it is represented with fewer numbers of pixels. The coarsening effect or "pixelization" is evident when an insufficient number of pixels is used; such number of samples cannot capture the fine details present in the scene.

Intensity resolution.

The script run_intensity_resolution.m contains the MATLAB statements to simulate the effect of reducing the intensity resolution while keeping the number of samples constant.

To run the script, type in the command window: >> run_intensity_resolution. The output produced on a given image with 256 intensity levels is depicted in Fig. 4. Can you discern the differences between the resulting images? How many intensity levels does the human

Figure 4: Effect on image quality of reducing the intensity resolution of the image, i.e., the number of gray levels used to represent the underlying continuous intensity signal.

visual system needs to represent the scene faithfully? Observe that, as the number of levels decreases, false contours appear in smooth intensity regions. A more evident example is given in Fig. 5.

Filtering

1-D Filtering Convolution.

The convolution of two sequences of numbers ("signals") a[n] and b[n], n ∈ Z, is symbolized by c = a ? b and calculated according to **c[n] = X∞ k=−∞ a[k]b[n − k]**.

The convolution is commutative (a ? b = b ? a), so a and b can be swapped in the previous formula. In practice, we use sequences of finite length, so the summation in (1) is carried over a finite number of products.

2-D Filtering.

The convolution operation can be extend to two-dimensional discrete signals, i.e., monochrome images. Following the notation in the course slides, the convolution of two digital images h, f is given by g = h ? f and calculated as **g [is, j] = X u X v h [u, v] f[i − u, j − v]**.

h represents the filter (and is called "kernel" or "mask") and f the input image.

4.6TESTING

4.6.1 SYSTEM STUDY

FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

Three key considerations involved in the feasibility analysis are

- Economical feasibility
- Technical feasibility
- Social feasibility

ECONOMICAL FEASIBILITY

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

TECHNICAL FEASIBILITY

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

SOCIAL FEASIBILITY

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it.

His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

4.6.2 SYSTEM TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub-assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

TYPES OF TESTS

UNIT TESTING

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

INTEGRATION TESTING

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

FUNCTIONAL TEST

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is cantered on the following items:

Valid Input : identified classes of valid input must be accepted.

Invalid Input : identified classes of invalid input must be rejected.

Functions : identified functions must be exercised.

Output : identified classes of application outputs must be exercised.

Systems/Procedures: interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

SYSTEM TEST

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

WHITE BOX TESTING

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

BLACK BOX TESTING

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box. you cannot “see” into it. The test provides inputs and responds to outputs without considering how the software works.

UNIT TESTING

Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases.

TEST STRATEGY AND APPROACH

Field testing will be performed manually and functional tests will be written in detail.

Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

Features to be tested

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

INTEGRATION TESTING

Software integration testing is the incremental integration testing of two or more integrated software components on a single platform to produce failures caused by interface defects. The task of the integration test is to check that components or software applications, e.g. components in a software system or – one step up – software applications at the company level – interact without error.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

ACCEPTANCE TEATING

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

CHAPTER 5
APPLICATION

Automation of Traffic Control System Using Image Morphological Operations method has been used in other fields, such as detection system based on the video contents. For example we have to detect the thief in the home based on the cameras. Detection efficiency can be obtained in the tunnel application, thousands of images are collected, making the processing of so many images a huge task. Therefore, the image processing process must be fast and efficient. In the future without hardware based we have reduce the traffic signals in the heavy traffic fields.

CHAPTER 6
CONCLUSION

The traffic automation system is implemented using image morphological operations which can help to manage and control traffic more efficiently without wastage of time for green light having no vehicles It is better to use image data to detect the presence of cars on the road lane so confidently performs more efficient to detect the presence of a vehicle. Computer vision and image processing algorithms overwhelmed the drawbacks found in various traditional traffic control systems. It also removes the cost of sensors and other hardware modules. Multiple cameras are used to analyze a load of traffic at the specific lane of the road. This system beats over the present traditional systems in the position of accuracy, time-saving, and effortlessness.

REFERENCE

- Bonnaccorsi, “On the Relationship between Firm Size and Export Intensity,” Journal of International Business Studies, XXIII (4), pp. 605-635, 1992. (journal style)
- R. Caves, Multinational Enterprise and Economic Analysis, Cambridge University Press, Cambridge, 1982. (book style) .
- M. Clerc, “The Swarm and the Queen: Towards a Deterministic and Adaptive Particle Swarm Optimization,” In Proceedings of the IEEE Congress on Evolutionary Computation (CEC), pp. 1951-1957, 1999. (conference style)
- H.H. Crokell, “Specialization and International Competitiveness,” in Managing the Multinational Subsidiary, H. Etemad and L. S, Sulude (eds.), Croom- Helm, London, 1986. (book chapter style).
- Pezhman Niksaz, Science &Research Branch, Azad University of Yazd, Iran, "Automatic Traffic Estimation Using Image Processing ",2012 International Conference on Image, Vision and Computing.
- Chandrasekhar. M, Saikrishna. C, Chakradhar. B, Phaneendra Kumar. P & Sasanka. C. “Traffic Control Using Digital I Image Processing”, IJAEEE, ISSN (Print): 2278-8948, Vol-2, Issue5,2013.
- Gundeep Kaur, Sonia Sharma,” Traffic Management Using Digital Image Processing”, IJCST Vol. 8, ISSue 2, AprIl - June2017.
- Md. Munir Hasan, Aminul Hoque, Gobinda Saha, and Md. Badruddoja Majumder. “Smart Trafc Control System with Application of Image Processing Techniques”, 3rd International Conference on Informatics, Electronics & Vision2014.
- Anil Vishwasrao, Omkar Ramdas Gaikwad, Prof. Kanchan Pujari, Tejas Talathi, “Image Processing Based Traffic Light Control”, International Journal of Science, Engineering and Technology Research (IJSETR) Vol 3, Issue 4, April2014.
- K.M.M. Rao, “Overview of Image Processing”, Proceedings of a workshop on image processing and pattern recognition, IETE, Hyderabad,25- 26 September2004.
- Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, 3rd ed. 2008.
- Vismay Pandit, Jinesh Doshi, Dhruv Mehta, Ashay Mhatre and Abhilash Janardhan, “Smart Traffic Control System Using Image Processing”, International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Vol 3, Issue 1, January – February2014.