Project Report

On

"PARTICLE ANALYSIS USING VISION AND MOTION TOOLKIT"

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"DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING"

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<u>STUDENT'S DECLARATION</u>

I / We hereby declare that the work being presented in this report entitled "**<u>PARTICLE ANALYSIS USING VISION AND MOTION TOOLKIT</u>**" is an authentic record of my / our own work carried out under the supervision of Mr. "**<u>DEVVRAT TYAGI</u>**"

The matter embodied in this report has not been submitted by me / us for the award of any other degree.

Dated: **Signature :**

(SURYANSH SINGH)

2016BEC1168/1603231196

This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Signature of Supervisor

ACKNOWLEDGEMENT

*I place on record and warmly acknowledge the continuous encouragement, Invaluable supervision, timely suggestions and inspired guidance offered by my guide **Mr. DEVVRAT TYAGI**, Assistant Professor, Department of Electronics and Communication Engineering, ABES Engineering College, Ghaziabad, in bringing this report to a successful completion.*

*I am grateful to **Mr. DEVVRAT TYAGI**, for permitting me to make use of the facilities available in the department to carry out the project successfully.*

Last but not the least I express my sincere thanks to all of my friends who have patiently extended all sorts of help for accomplishing this undertaking.

Finally I extend my gratefulness to one and all who are directly or indirectly Involved in the successful completion of this project work.

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Chapter 1

1.1 INTRODUCTION

In this chapter, the main concept and explanation on the objectives of this project will be introduced. The problem statement explains the project significant and gives the idea on real-time application. The main elements of this project are discussed in the scopes of work and the common structure of this project will be explained as well.

1.1.1 INTRODUCTION OF PROJECT

This Project presents a system developed using graphic programming on LabVIEW using image processing and particle analysis so as to indicate increase in vehicular density on particularly traffic-prone roads and hence alert necessary officials of the same instantly. This system primarily focuses on the vehicular density and sets specific thresholds in accordance with the time of the day to give almost accurate results. It also displays an application of computer vision for traffic flow management and road traffic analysis. The method mentioned provides the functionality of alert during times of road clogging and will hence ensures immediate rectification of the same.

1.1.2 MOTIVATION

In metropolitan citie**s,** especially in overpopulated countries like India, control and regulation of traffic is a very crucial detail to ensure safety for commuters. A recent boom in vehicular numbers just elevates this problem. It is imperative that appropriate measures be taken to curb this problem or at least develop a system to be precise enough to reduce it to a great extent, while decreasing human effort at the same time.
The approach in this article focuses on methods of image processing and computer vision using pre-defined modules of pattern analysis and image filtering with a user-friendly interface for data calibration.

The objective of this document is to provide solution to the aforementioned problem of excessive road traffic using National Instruments' visual programming language, LabVIEW.

Several other systems involving the same idea have been implemented but this system aims at reducing computational costs with respect to simplicity in the algorithm used and the increasing of efficiency due to additional debugging capabilities.

1.1.3 PROJECT OBJECTIVE

The conventional car park system does not have display panel and thus the Vacancy of parking lot cannot be shown. User has to gamble to seek whether there Has any vacancy or not. The Smart Parking System is an electronic application that improves the conventional parking system by using sensors and display panel developed through Graphical Programming Language software. Wired-sensor based technology is used in this car park guidance system.

This project will create the virtual sensor operation system by developing the LabVIEW front panel of image operation data. The system will convert the output from sensors to the programmable language to the PC-based display only desired portion of images panel by using DAQ interfacing device.

The concept of this project is illustrated in Figure 1.1.

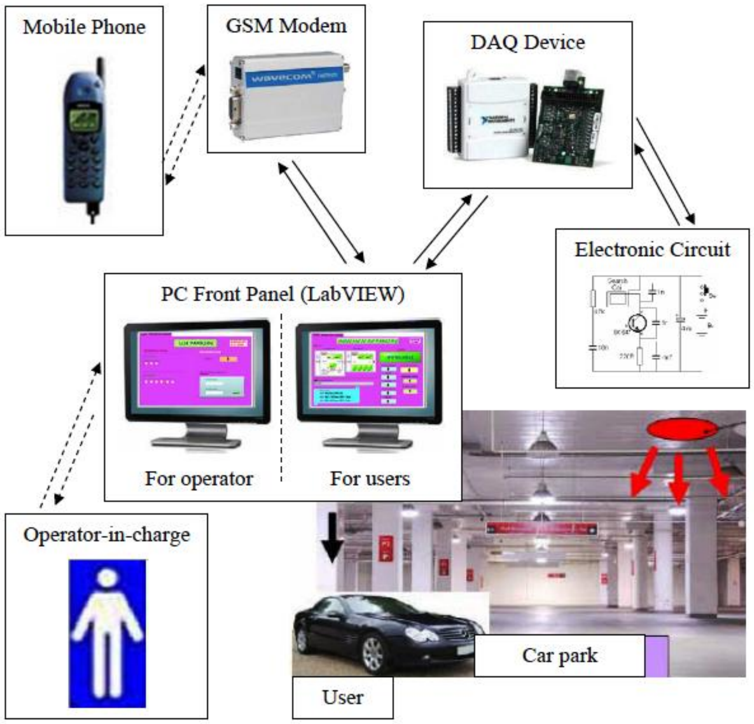


Figure 1.1: Real Implementation Concept Diagram

The objectives of this project are stated as below:

(a) To develop front panels for users and company using National Instrument's LabVIEW software.

(b) To interface the electronic circuit and hardware with the PC-based system through DAQ device.

(b) To take input and perform various pre-defined image processing modules and algorithms to get a more advanced image from road traffic camera footage or Images.

(d) To upgrade the current model of car park system and the electronic circuits in order to save power consumed.

1.1.4 SCOPE OF PROJECT

This part discusses about the elements involved in this project. In this project, the scope is based on five main parts. The scopes of work in this project are:

1.2 **LabVIEW software** (**Lab**oratory **V**irtual **I**nstrumentation **E**ngineering **W**orkbench) is a platform and development environment for a visual programming language from National Instruments. Originally released for the Apple Macintosh in 1986, Lab VIEW is commonly used for data acquisition, instrument control, and industrial automation on a variety of platforms including Microsoft Windows, various 9 lavours of UNIX, Linux, and Mac OS.The programming language used in Lab VIEW, is a dataflow language. Execution is determined by the structure of a graphical block diagram**.** Here it is used to create the front panel of virtual instrument.

(b) **NI VISION** a part of NI Vision Development Module is a library of LabVIEW that one can use to develop machine vision and scientific imaging applications. It enables you to prototype any application strategy quickly without having to do any programming.

(c) **DAQ** is a data acquisition unit that used as an interface between hardware and software. In this project, DAQ will be used to transfer the output signal from electronic circuit to PC using DAQ card. The results are then viewed on the computer screen.

(d) **Car park model** shows the real operation of the system by making simulating operation using car model. It consists of several levels of parking, has metal detector circuit, car model, parking level building and display panels.

(e) **Electronic circuit** consists of sensor that detects car at the entrance and exit of a car park as well as at each parking space. Indicators with different colors are used to show the status of a parking lot – green for available and red for unavailable. EMF (electromotive force) sensor can detect the EMF that has in every car such as metal detector. Relay is used to trigger the circuit from one condition to another condition.

1.2 INTRODUCTION TO TECHNOLOGIES

1.2.1 LANGUAGE

Lab VIEW (acronym for **Lab**oratory **V**irtual **I**nstrumentation **E**ngineering **W**orkbench) is a platform and development environment for a visual programming language from National Instruments. The graphical language is named "G". Originally released for the Apple Macintosh in 1986, LabVIEW is commonly used for data acquisition, instrument control, and industrial automation on a variety of platforms including Microsoft Windows, various flavors of UNIX, Linux, and Mac OS. The latest version of LabVIEW is version 8.20, released in honor of LabVIEW's 20th anniversary.

It offers ***Dataflow programming*** and the programming language used in LabVIEW, called "G", is a dataflow language. Execution is determined by the structure of a graphical block diagram (the LV-source code) on which the programmer connects different function-nodes by drawing wires. These wires propagate variables and any node can execute as soon as all its input data become available. Since this might be the case for multiple nodes simultaneously, G is inherently capable of parallel execution. Multi-processing and multi-threading hardware is automatically exploited by the built-in scheduler, which multiplexes multiple OS threads over the nodes ready for execution.

It is a graphical programming language, rather than a conventional programming language as software development environment. Besides that, it can be used to acquire, analyze, and present the data obtained from the input or output devices. Thus, it is suitable to be used in the development of front panel in this project.

National Instrument LabVIEW is the graphical development for creating flexible and scalable test, measurement, and control applications rapidly and at minimal cost. By using the LabVIEW, engineers and scientists interface with the real world signals, analyze data for meaningful information, and share results and applications.

Chapter 2
OVERVIEW

2.1 ALGORITHM

This system involves usage of various pre-defined image processing modules and algorithms to get a more advanced image.

Following are the methods used :

2.1.1 Color Plane Extraction

An RGB image (of three color planes – red, green and blue) is converted into an 8-bit grayscale image by extracting the information of a single color plane and discarding all the other elements of the original image.The final image after this method is made of three parameters – hue, saturation and luminance (HSL). Leaving just the luminance plane, a final grayscale output is extracted.

2.1.2 Image Reversal

This is a particular toll in the grayscale image tab which operates on 8-bit grayscale images only.This method involves inverting the intensity of gray in the images. Grayscale involves an image of varied intensities. 255 for white and 0 for black.The intensity value at every point is subtracted from 255 to get the inverted intensity.

2.1.3 Grayscale Thresholding

This method involves conversion of a grayscale image to a binary image with respect to a threshold value manually chosen using a scroll-bar on the tool in LabVIEW. The threshold is in essence an intensity value. All pixels with intensities above this value is maintained as one color and all intensities below the value are set as the other color (Black or Red, according to manual controls on LabVIEW. This is further changed to Black and White for processes later).

2.1.4 Image Masking and Arithmetic Operations

These toolboxes consist of arithmetic and logical operations to be performed on the captured images. To provide additional accuracy to the program, images are captured and appropriate logical expressions are created to remove the unwanted parts of the image . This leaves only the images of the desired things in the final output. Now, regions that are not required are masked, i.e. those parts are removed from the image. The final output displays only the desired portion.

2.2 WORK FLOW DIAGRAM

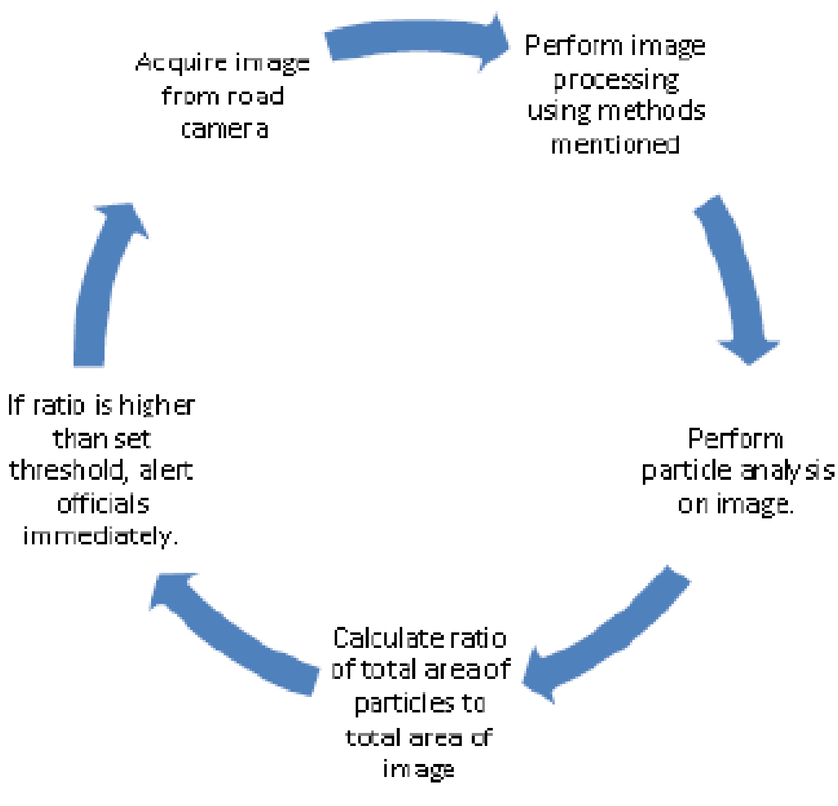


Fig : Basic System Algorithm

First of all, this project is begun by having a discussion with supervisor about the general ideas and concepts that would be used in this project. Next, for literature review stage, the background of this project is studied and research is done by referring various sources such as reference book, I.E.E.E journals, website of National Instrument and data sheet.

Next, the LabVIEW programming is studied; the front panel of virtual instrument is created and simulated. Hardware interfacing would be studied on the following stage. After that, the hardware for this project is built and assembled; and the system is ready for overall system testing. If the desired outputs of this system fulfill the project requirements and specification,

this project is considered success. Otherwise, troubleshooting would need to be carried out until it reaches the project requirements.

2.3. CODE

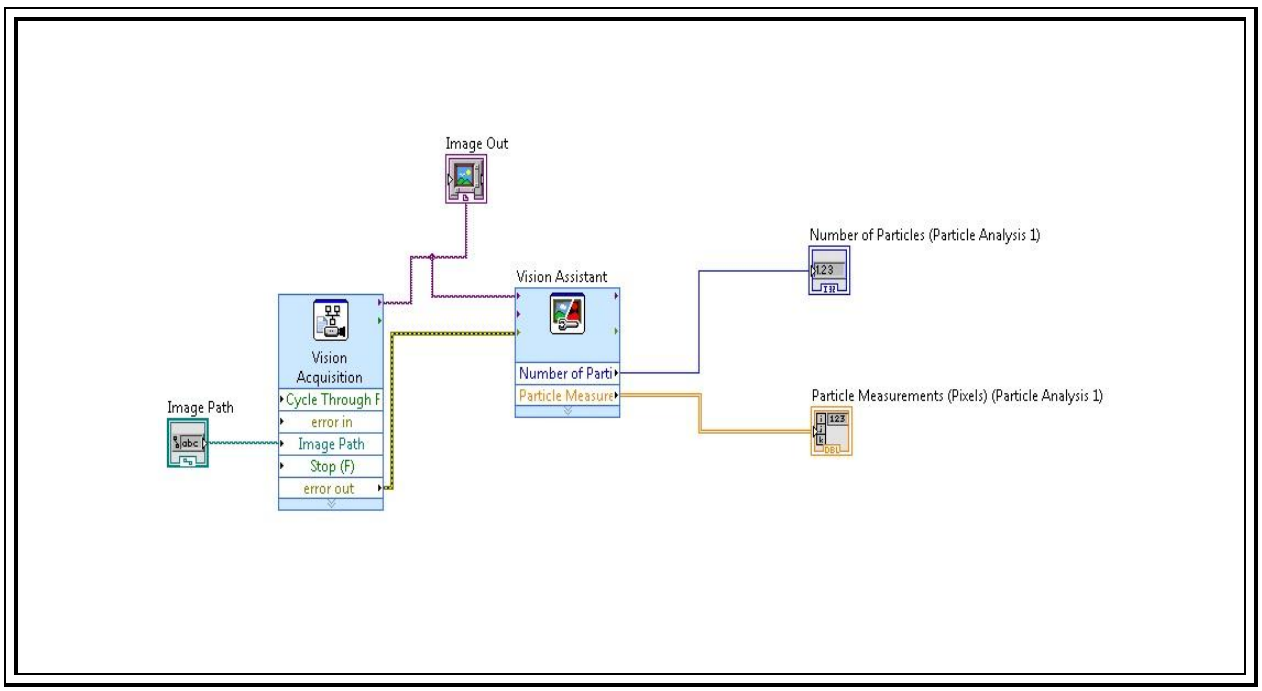


Fig: LabVIEW Code for the Project

Image processing on LabVIEW involves a Vision Assistant module, a tool which can be used to incorporate morphological filters, logical operations and other methods mentioned with sufficient ease.

An image of the subject is captured in different times of the day, masked and is compared with the masked image of the subject with using the exclusive OR (XOR) operation. The end result is an image showing objects not present in one of the images only.

Calibrations are performed on this final image. The images of the calibration process performed during prototyping are shown in Chapter 4.

This calibration process is followed by the calculation of the area of the total part of the image in red. This is compared with the total area of image and is then compared with a set threshold. If the amount of red is more, a signal indicating high density is initiated. All of this is done using the Particle Analysis tool. This tool generates an automated report regarding the particles in the image. The parameters can be chosen.

Chapter 3

RESULT

3.1 SNAPSHOTS OF INTERFACE

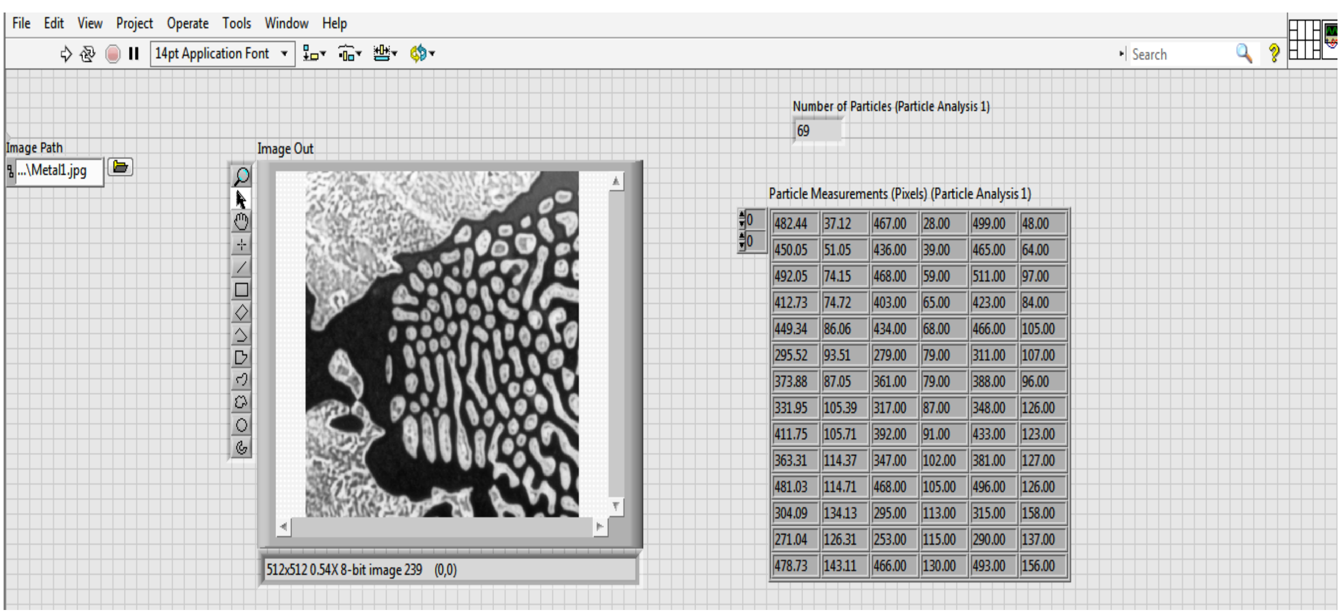


Fig: Front Panel Controls

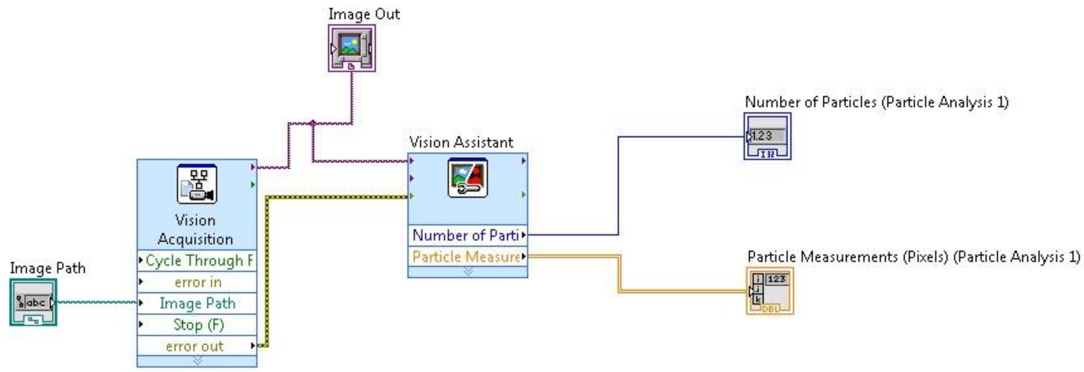


Fig: Block Diagram Window

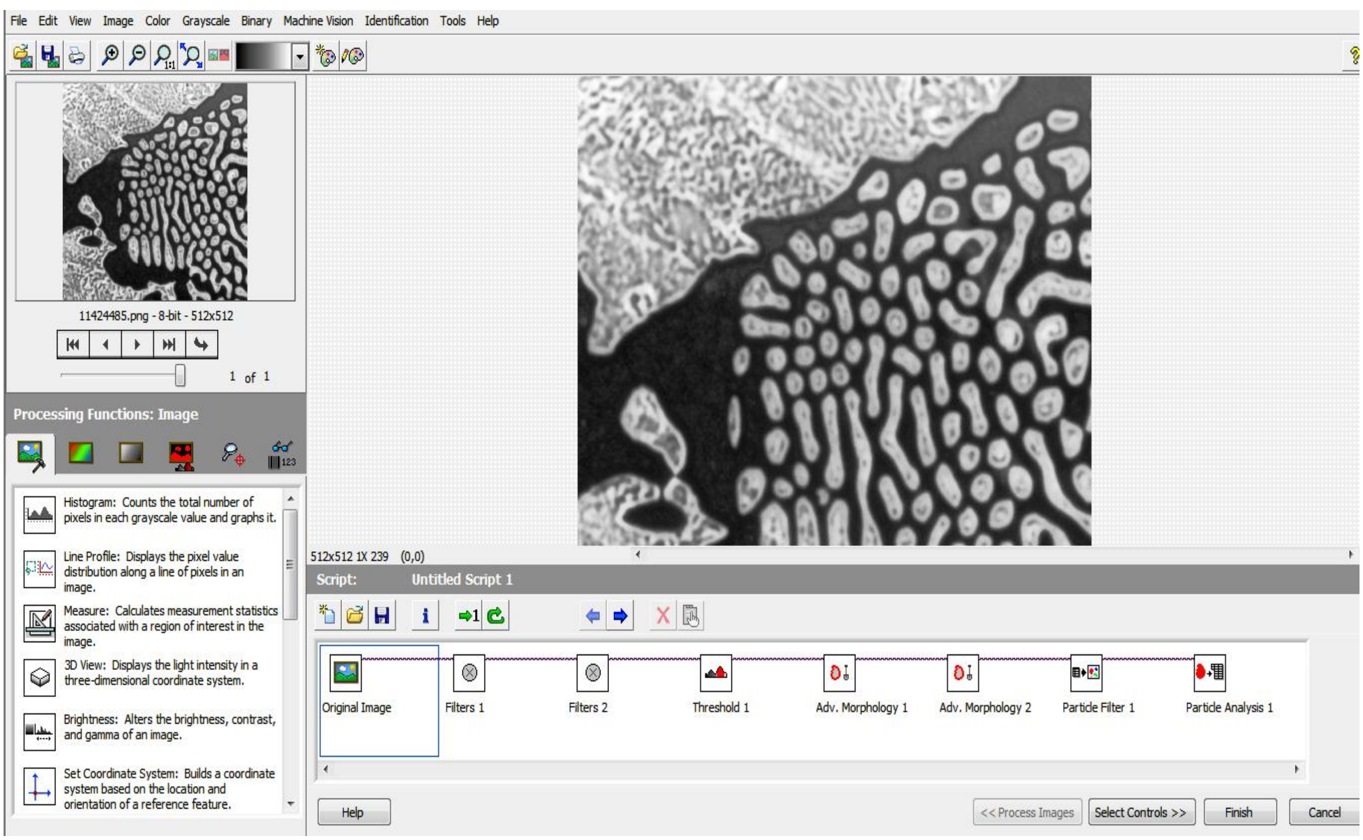
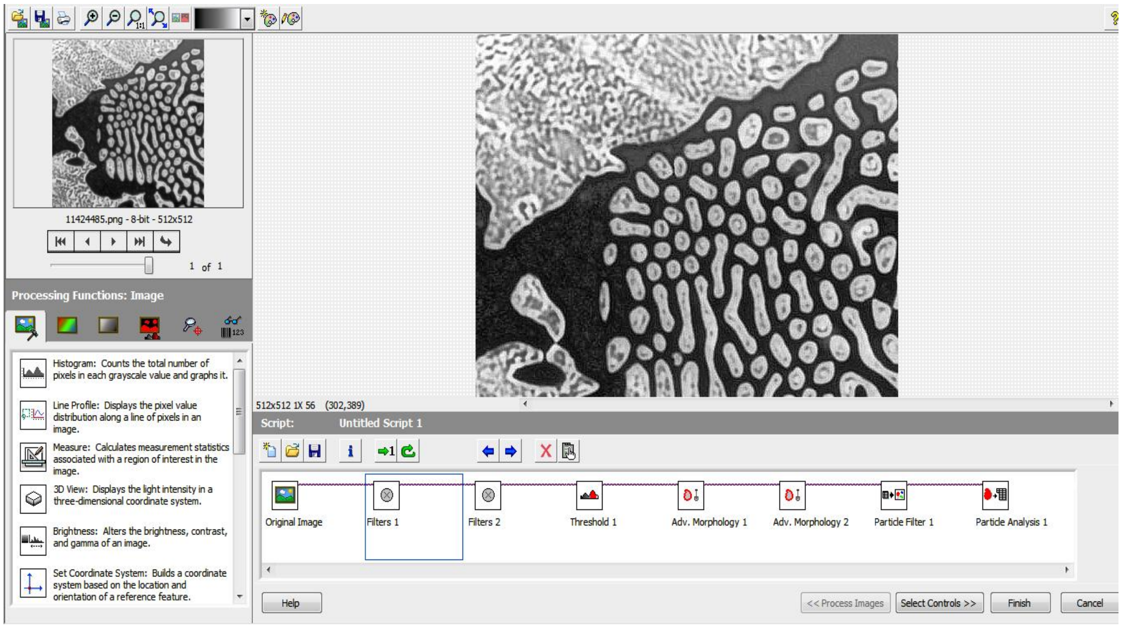


Fig: NI Vision Assistant Panel



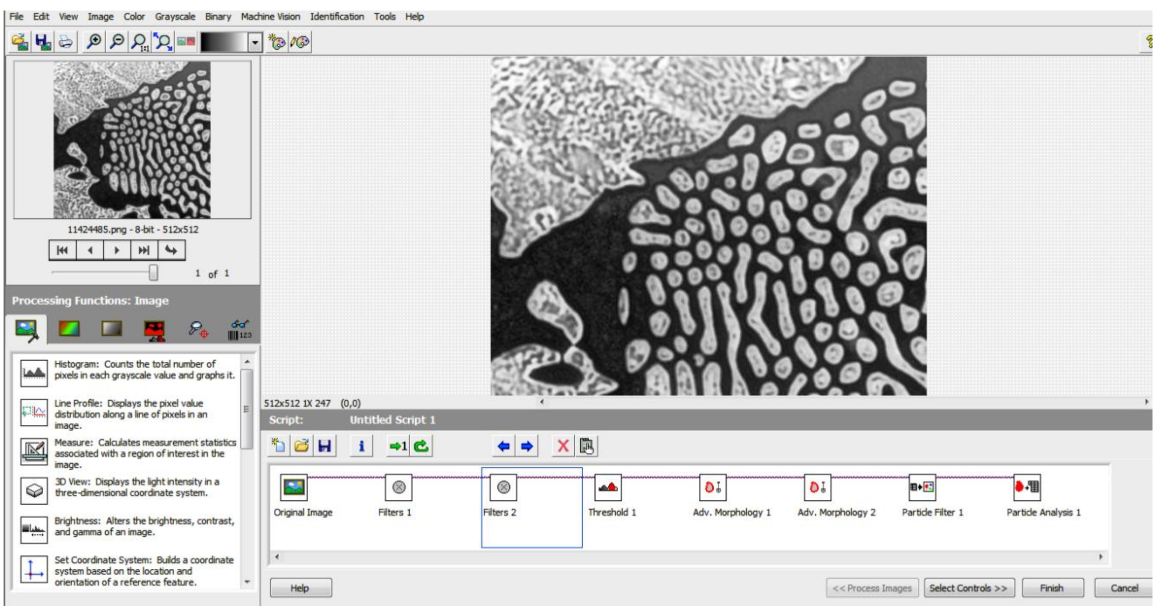
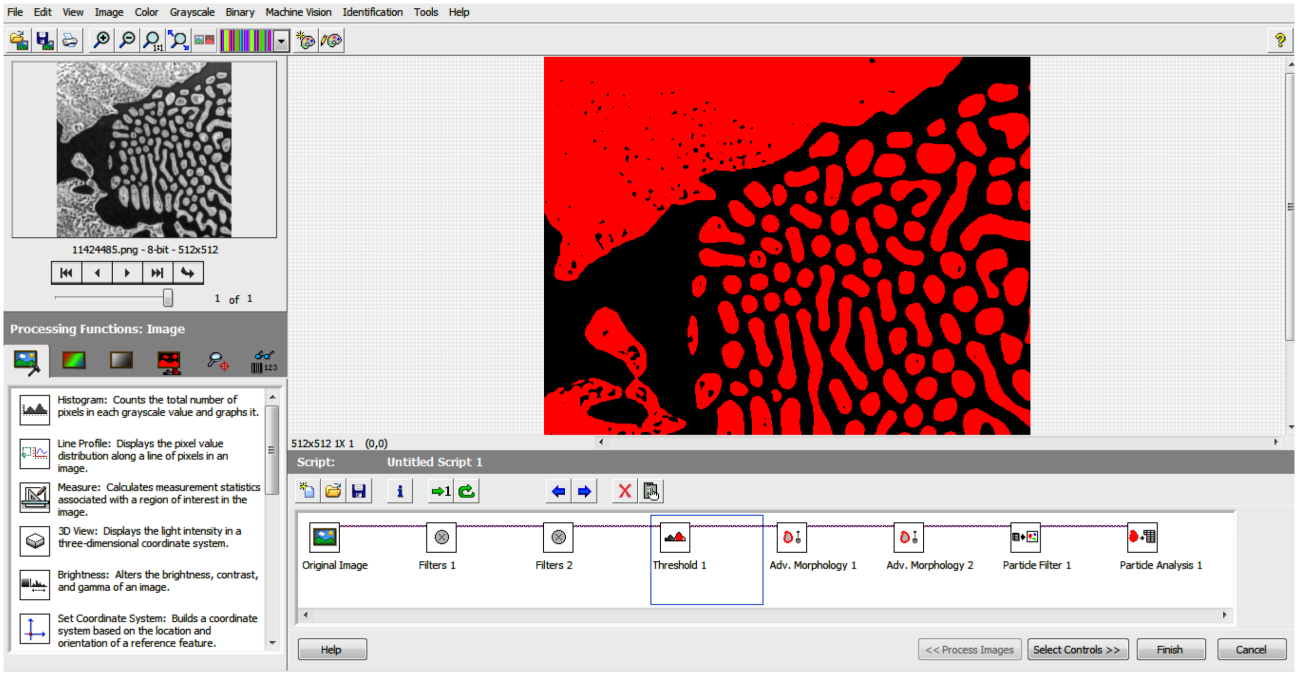


Fig: Image Reversal and Gray Morphology Process



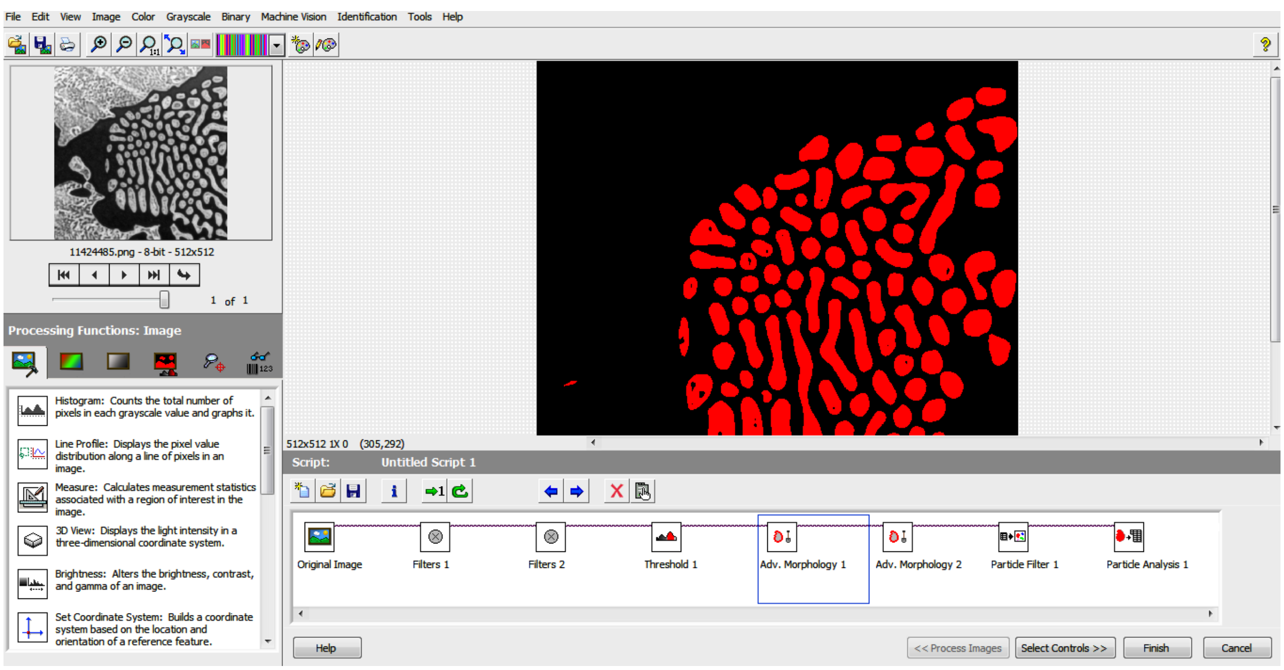
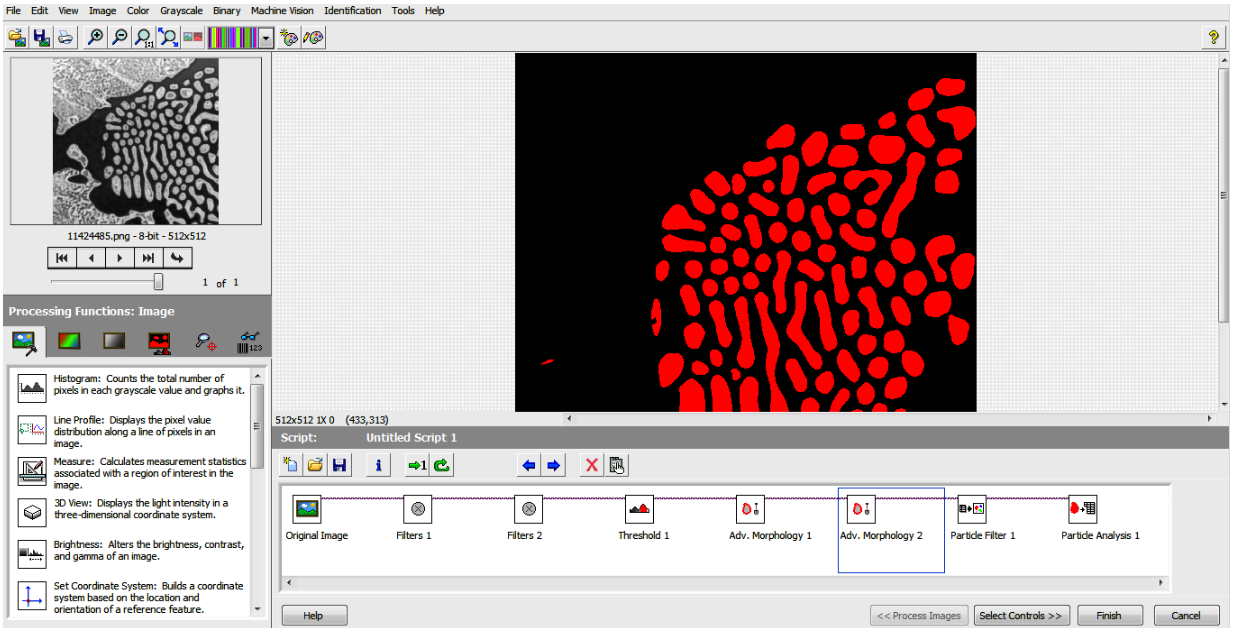


Fig: Image Threshold Process



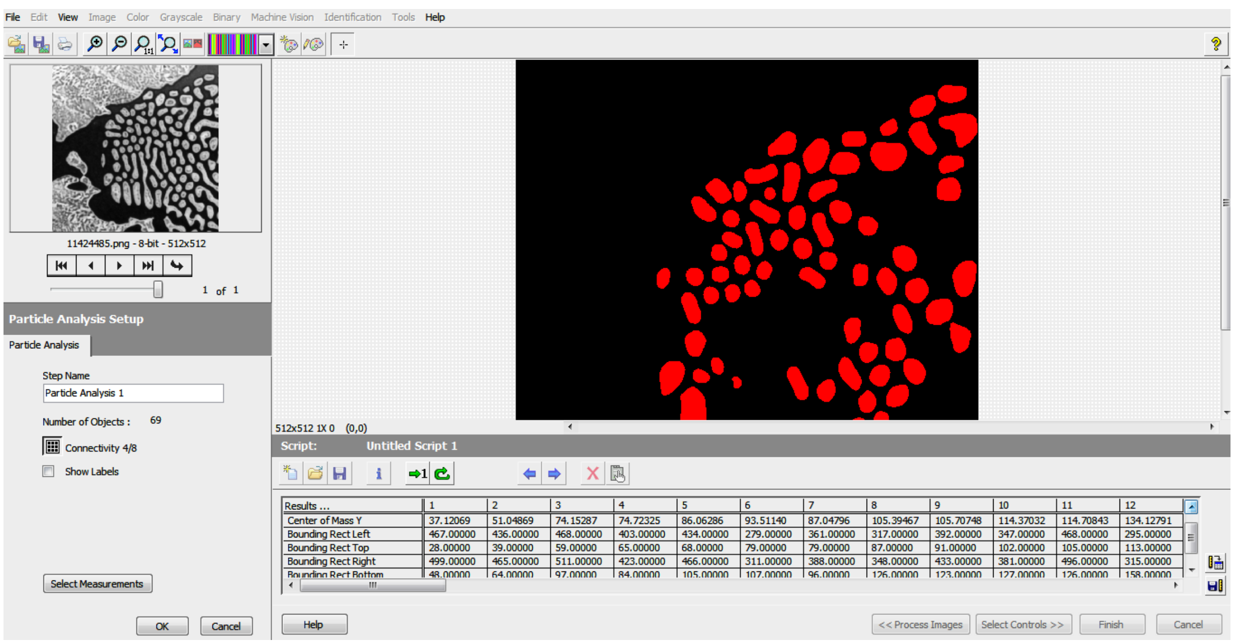


Fig: Final Masking Process and Result

Chapter 4
CONCLUSION

In conclusion, this system could be implemented in the present day scenario regarding road traffic detection and control while reducing manual video stream monitoring time (reduction of human effort). In addition, this system is fairly simple to incorporate and calibrate and as all codes can be converted into executable files, no extra software requirements are required with the currently used systems.

References

[1] LabVIEW Basics I : Introduction Course Material by National Instruments Corporation,Course Software Version 8.5,Part Number 320628R-01,September 2007 Edition.

[2] V. Kastrinaki, M. Zervakis and K. Kalaitzakis, "A Survey of Video Processing Techniques for Traffic Applications", Image and Vision Computing, vol. 21, pp 359-381, Apr 1,2003.

[3] E. Atkociunas, R. Blake, A Juozapavicius and M. Kazimianec, "Image Processing in Road Traffic Analysis", Nonlinear Analysis: Modelling and Control, 2005, vol. 10, no. 4, pp 315-332

[4] Morphological Image Processing: Gray Scale Morphology, Gleb V. Tcheslavski. http://ee.lamar.edu/gleb/dip/index.htm

[5] Kim, K. K., Kim, K. I., Kim, J.B., and Kim, H. J., "Learning based approach for license plate recognition", Proceedings of IEEE Processing Society Workshop on Neural Networks for Signal Processing, vol. 2, pp: 614- 623, 2000.