FLAME IMAGING USING INFRARED AND OPTICAL SENSOR

MUHAMMAD NUR ZULFADHLI B ABD RAHIM

This report is submitted in partial fulfillment of the requirements for the award of Bachelor of Electronic Engineering (Computer Engineering) With Honours.

Faculty of Electronic and Computer Engineering

Universiti Teknikal Malaysia Melaka

April 2009

UNIVERSTI TEKNIKAL MALAYSIA MELAKA

FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN

PROJEK SARJANA MUDA II

Tajuk Projek	:	**FLAME IMAGING USING INFRARED AND OPTICAL SENSOR**
Sesi Pengajian	:	**2008 / 2009**

Saya **MUHAMMAD NUR ZULFADHLI B ABD RAHIM**

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (√) :

☐	**SULIT***	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
☐	**TERHAD***	(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☐	**TIDAK TERHAD**	

Disahkan oleh:

"I hereby declared that this report entitled Flame Imaging Using Infrared Using Infrared and Optical Sensor is a result of my own work except for the works that have been cited clearly in the references."

Signature : ……...

Student : MUHAMMAD NUR ZULFADHLI B ABD RAHIM

Date : 22 / April / 2009

"I hereby declare that I have read this report and in my opinion this report is sufficient in terms of the scope and quality for the award the Bachelor of Electronic Engineering (Computer Engineering) With Honours".

Signature : ……

Name : EN ADIE B MOH KHAFE

Date : 22 / April / 2009

To my beloved parents, family, fellow friends and supervisor, thanks for all supports in successfully producing this projects.

ACKNOWLEDGEMENTS

First and foremost I want to thank my God Almighty for allowing me to perform this project smoothly even though I face some obstacles throughout my project. I would like to express my gratitude to all those who gave me the possibility to complete this Final Year Project. I want to thank my supervisor, En Adie B Mohd Khafe for providing me his assistance and encouragement to go ahead with my project and for requesting approval to use laboratory tools and equipments required to perform my project. I have furthermore to thanks my Faculty of Electronic and Computer Engineering to provide me adequate tool and equipments to carry out my project. My special thanks to all my family for supporting me through their prayers and words of encouragement to complete this project. Last but not least, I wish to thank everyone who is involved in helping me, directly or indirectly, throughout my project.

ABSTRACT

This project describes and investigations of the visibility of infrared & optical sensor in flame imaging. If the usual method is being used to construct image of the flame or heat distribution a large number of sensors are needed compare to the proposed technology (tomography technology), where this also related to high cost of sensor being used. The objectives of the project is to obtain the cross sectional image of flame by using infrared transmission system. The system is applied to produce cross-sectional images of flames such as that where the flame is fed to can be indentified in a combustion system. This project was divide in two parts which is hardware and software. The hardware will use infrared and the software that been use is visual basic 6.0. To put the infrared and optical sensor in right align Autocad software is use to get the accurate place for the infrared and optical sensor. The successful of this project is when the cross sectional image of flame by using infrared transmission system can be obtains.

ABSTRAK

Projek ini menerangkan dan mengkaji penggunaan cahaya infrared dan optikal sensor dalam menjana gambar api. Jika cara biasa digunakan untuk menjana gambaran api atau pun taburan haba, banyak sensor terpaksa digunakan berbanding dengan teknologi tomography. Dengan menggunakan teknologi tomography, penggunaan jumlah sensor dan kos dapat dikurangkan. Objektif utama projek ini adalah untuk mendapatkan gambaran keratan rentas api dengan menggunakan system infrared. Sistem ini digunakan dalam sistem pembakaran di kilang untuk mendapatkan gambaran keratan rentas api seperti dimana api disuap. Projek ini terbahagi kepada dua iaitu software dan hardware. Infrared digunakan untuk hardware dan software yang digunakan adalah visual basic 6.0. Autocad digunakan untuk meletakkan infrared pada jajaran yang betul bagi memastikan jajaran tepat bagi pemancar infrared dan penerima infrared. Kejayaan projek ini adalah bila gambaran keratan rentas api diperolehi dengan menggunakan sistem pemancaran infrared.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

VB	-	Visual Basic
DAQ		Data Acquisition
PSM		Projek Sarjana Muda
LED		Light Emitting Diode
IR		Infrared
DC		Direct Current
AC		Alternating Current
TV		Television
A/D		Analog to Digital
DLL		Dynamic Linked Library

LIST OF APPENDIX

CHAPTER I

INTRODUCTION

This chapter will explain about the overview of the project, the objectives of the project, problem statement and also the scope of the work.

1.1 Project Overview

The flame imaging using infrared and optical sensor is a project to obtain the cross sectional image of flame by using infrared transmission system. This project describes and investigations of the visibility of infrared & optical sensor in flame

imaging. There are many application especially heat related process which can utilize this form of measurement. One of them is in combustion system. The system is applied to produce cross-sectional images of flames such as that where the flame is fed to can be indentified in a combustion system. The ability to monitor and control of the flame especially, is the key point o the process itself. Besides that, this system can be used to monitor the size, position and velocity of flame fronts in any combustion behavior and emissions.

This involved by taking numerous measurements from sensors which placed around the section of the process being investigated and processing the data to reconstruct and image. This involved the use of noninvasive sensors to acquire vital information in order to produces two or three-dimensional images of the dynamic internal characteristic of process system.

The system employs two orthogonal projections with array of infrared sensors. The amplitude of receive light is compared with the amplitude of light that achieved with obstruction in the light path for the same sensor. The intensity of the transmitted beam is measured by the detector and the transmittance is the ratio of the transmitted intensity to the original beam intensity. This project will make use light beams, so the cross-section of the pipe will be interrogated by a total 8 beams. The flame will be placed in at centers of the measurement in the measurement area and the voltage output will be measured.

Current to voltage converter is added to the optical sensor output and non-inverting input of the op-amp. From the output sensor, the data will be transferred to the signal conditional circuit. The signal conditional circuits consists voltage converter, voltage amplifier and DC to AC converter circuit. After that, the data will be sent to computer using Data Acquisition Card. Visual Basic is used to perform the cross-section image using the data obtained using Data Acquisition Card.

1.2 Objectives of the project

1. To understand the concept of tomography so that a tomography system can be constructed to provide a cross sectional image of flame.
2. To construct jig / fixture to amount emitters & sensors and also the model of the heat related industrial process.
3. To implement and develop Voltage Linear Back Projection Calculation (VLBP) using VB to obtain cross sectional image of flame.
4. To integrate software and hardware and develop infra red base tomography system.

1.3 Problem Statements

Nowadays, most of the factory that using combustion system Currently used conventional sensors such as thermocouple, thermostat & RTD will only give information of temperature at that particular measurement point and not the whole cross sectional plane of the measurement area, hence through this project, a tomography system will be developed where heat distribution (for this project, cross sectional of flame) at a cross section of plane can be monitored and analyzed. If the usual method is being used to construct image of the flame or heat distribution a large number of sensors are needed compare to the proposed technology (tomography technology), where this also related to high cost of sensor being used. For an example: an 8 x 8 pixels of cross sectional image, will take 64 units of sensors to build this type of system. For this reason, by implementing the proposed method of tomography measurement system, the number of sensors used can be reduced, example: for case of 8 x 8 pixels of image, it will only need to use 16 units of

sensors. Besides that this method also can reduce cost to build the system because the infrared and optical now days in quite expensive.

1.4 Scope Of Work

1. To understand the concept of tomography through literature review.
2. To design, construct and improve jig and fixture to mount arrays of sensor at peripheral of the measurement area
3. To study utilize DAQ system to collect data from the signal condition
4. Measure and display by using visual basic
5. To design, construct and implement the signal conditional circuit in PCB form so that, the signal from the sensor can be processed and passed to the DAQ system

1.5 Methodology Introduction

There are many phase in order to finish the project and achieve all the objectives. The first phase is focusing the hardware development where the cross sectional flame image will be measured. The size of pipe is 10cm in width and 10cm in length. The pipe is made of acrylic. To mount the sensors, the gap between each sensors is approximately 1.10 cm. to make sure that between infrared receiver and infrared transmitter is accurate, Autocad been uses to make sure that all sensors is in align

.

For the second phase, the project will proceed to the how to manage all the data from the DAQ card that been connected to the hardware. All the data will be developed

the image for the flame that inside the transparent rectangle shape conveying pipe. The Microsoft Visual Basic 6.0 been used to develop the image from the data obtain from the DAQ card.

The data from the DAQ will be use for develop the image inside the transparent rectangle shape conveying pipe. If there any failure of the flame, the colors of the image will change due to the flame size.

1.6 Structure Report

Generally, this report contains of five main chapters. Those five chapters are start with Introduction, Literature Review, Methodology, Results & Discussion and end with Conclusion & Suggestion. In first chapter, the report is about the overview of the whole project and what is the benefit of this project. There also consist of the main objective in doing this project and how to implement this project.

The second chapter is more about research that have been conducted to the topic that related with this project. It will include about the software and hardware that is been used for this project. Every facts and information which are found from any source will be compared and the better method will be chosen based from the information.

The third chapter is about the process in making this project. Its will start from studying of the project and process in doing this project whether in manage the data using the Microsoft Visual Basic 6.0 or utilize the hardware. The Result and Discussion will consist of the progress for the project. There will be have two phases for the project and this third chapter will state the progress of the project.

The fourth chapter is about the result and the discussion. This chapter is contains the results that been archived and the progress of the project. This chapter also discuss the problem will be facing during develop the hardware and the software.

The last chapter is going to be a conclusion and recommendation. This chapter is contains a suggestion for the project. The upgrading for the project will also been state in this chapter. There will also a project planning for the project that been discuss in this chapter. All this chapters will be separated in sequences in order to give view for readers.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

As defined in one encyclopedia (Helicon 1991). The word "tomography" is derived from the Greek language, which tomo means "Slice" and graph means "picture". In another word, tomography is a method of viewing the plane section image of an object.

Process tomography provides several real time methods of viewing the cross-section of a process to provide information relating to the material distribution. This involves by taking numerous measurement from sensors which placed around the