



**UNIVERSITI PUTRA MALAYSIA**

**DESIGN AND IMPLEMENTATION OF THE FIRST TRIP SIGNAL  
DETECTION IN A MACHINERY ASSEMBLY SYSTEM**

**LUTFI MOHAMED ZAMSELENI**

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**DESIGN AND IMPLEMENTATION OF THE FIRST TRIP SIGNAL  
DETECTION IN A MACHINERY ASSEMBLY SYSTEM**

**By**

**LUTFI MOHAMED ZAMSELENI**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in  
Fulfilment of the Requirement for the Degree of Master of Science**

**August 2007**



## **DEDICATION**

**To my dear Mother, the Soul of my Father, Wife, Daughters, Brothers, Sister and  
Friends; your patience and support has been my motivation**

**&**

**To the rest of my extended families; your encouragement has seen  
me through this long journey**

**I love you all**



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

**DESIGN AND IMPLEMENTATION OF THE FIRST TRIP SIGNAL  
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**Chairman: Professor Mohamed Daud, PhD**

**Faculty: Engineering**

This study can give the solutions for many problems. The water pump or boiler in the vapory power station for example, often gets out of service. The main causes for this problem and the reasons behind its repetition can be due to both human and technical factors, i.e., the causes can be from the maintenance operators in the control room, mechanical maintenance, and electrical maintenance and protection systems. Similarly, the malfunction of device may occur as a result of incorrect connection of the wires or the problem of the virtual design of the machine. Therefore, reliable solution to entirely get rid of these problems or the substantial part of them is required. These can be achieved by designing a system to capture these problems, which then be accordingly tackled by finding the virtual and direct solutions. The thesis describes the design and implementation of the first trip signal detection in machinery assembly system. The program used in this study was written specifically to handle above-mentioned problems for this system using the Microsoft Visual Basic 6.0. The system consists of the system circuit-using personal computer, ADAM-4561, ADAM-4068, ADAM-4051,



RS-485 networks, power requirements, 16-external input relays and alarm sound. The system catches both 0 and 1 input digital trip signals. Any type of voltage relay DC or AC Voltage is used for external relays and the system can also be used for both digital and analog signals, operating between 5.5V to 10V for the digital signal; and between 5.5V to 10V for the analog signal. It is important to note that the system used in this study has top security secured by the use of a main password in the software system and can't be using the system without knowing the Executive. Similarly, the system has been designed to be easily carried to any unit by choosing the entire device as small as possible and connecting to the laptop. The system is designed to easily test by including the sixteen external input relays (AC Relays or DC Relays) to test the system. Energize any relays from the sixteen relays or two or three relays together, etc., and users can clearly see on the computer screen the first trip signal data and hear the alarm sound when the first trip signal comes in. Then the system can using to catch sixteen problems in any workplace by using the sixteen channels that in the system. The system includes being accurate between 5.5 V to 10 V for both analog and digital signals directly to the system without relays to catch the first trip signal for this type of signals. To add to this, the system has also been successfully designed and implemented for quick and accurate results. The design, the construction and the testing of the system are presented in this thesis. The system is a simple, fast and accurate method to catch the first trip signal for any machinery assembly system that has sixteen channels and save all the information related to the first trip signal (name, location, office and control room telephone numbers, date, time, etc.). The accuracy of the system was tested and the test has been successful.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan bagi mendapat Master Sains

**REKABENTUK DAN PELANCARAN PENGESANAN PERJALANAN  
PERTAMA DALAM SISTEM PENGUMPULAN MESIN**

Oleh

**LUTFI MOHAMED ZAMSELENI**

**Ogos 2007**

**Pengerusi: Profesor Mohamed Daud, PhD**

**Fakulti: Kejuruteraan**

Kajian ini dapat mengatasi banyak masalah. Air mengepam atau dandang dalam stesen kuasa wap merupakan contoh yang sentiasa tidak dapat berfungsi dengan baik. Sebab utama masalah ini dan alasan di sebalik pengulangan ini selalunya hasil daripada faktor manusia atau faktor teknikal. Sebab boleh wujud dari operator penyelenggaraan dalam bilik kawalan, penyelenggaraan jentera, dan penyelenggaraan elektrik dan perlindungan sistem. Kepincangan peranti boleh disebabkan oleh sambungan wayar yang tidak tepat atau rekabentuk maya jentera itu. Jadi, penyelesaian munasabah yang menyelesaikan masalah keseluruhan adalah diperlukan. Masalah ini dapat diselesaikan dengan merekabentuk satu sistem untuk mengatasi masalah serta mencari penyelesaian maya dan langsung untuk masalah ini masing-masing. Tesis ini menghuraikan rekabentuk dan pelaksanaan pengesanan isyarat pertama dalam sistem jentera pemasangan. Program yang digunakan dalam kajian ini adalah khususnya ditulis untuk sistem ini dengan Microsoft Visual Basic 6.0 bagi menangani masalah-masalah ini. Sistem ini terdiri daripada litar bagi sistem yang menggunakan komputer peribadi, ADAM-4561,



ADAM-4068, ADAM-4051, rangkaian RS-485, keperluan kuasa, geganti input luar 16- dan bunyi penggera. Sistem ini boleh mengesan isyarat perjalanan digital input 0 dan juga boleh menangkap isyarat perjalanan digital input 1. Sebarang jenis geganti voltan DC atau voltan AC boleh digunakan untuk geganti luar. Sistem ini boleh menggunakan kedua-dua isyarat digital dan analog. Sistem ini berfungsi dalam lingkungan 5.5V ke 10V bagi isyarat digital; sistem ini juga berfungsi dalam lingkungan 5.5V ke 10V bagi isyarat analog. Elemen istimewa dalam kajian ini adalah sistem mempunyai jaminan keselamatan tinggi dengan menggunakan kata rahsia yang utama dalam program sistem dan tidak wujud pakai sistem tanpa mengetahui perlaksanaan. Demikian juga, sistem ini direkabentuk untuk mudah dibawa ke sebarang unit dengan pilihan peranti yang kecil semungkin dan sambungan kepada laptop yang mengandungi program. Sistem ialah reka bentuk kepada dengan senang sekali ujian dari mengambil kira enam belas geganti input luar (AC geganti atau DC geganti) kepada ujian sistem. Energize apa sahaja geganti dari enam belas geganti atau dua atau tiga geganti bersama, dan penggunaan boleh jelas lihat atas komputer tirai pengesanan isyarat pertama butir maklumat dan dengar bunyi amaran bunyi bila pengesanan isyarat pertama mari di dalam. Ketika itu sistem boleh pakai kepada tangkap enam belas masalah di dalam apa sahaja tempat kerja pakai enam belas saluran yang itu di dalam sistem. Sistem mengambil kira kepada wujud tepat di antara 5.5 V to 10 V bagi kedua-dua isyarat digital dan analog terus kepada sistem tanpa gegant kepada tangkap pengesanan isyarat pertama bagi yang ini jenis dari isyarat. Sistem ini telah berjaya direkabentuk dan dilaksanakan untuk keputusan cepat dan tepat. Rekabentuk, pembinaan dan ujian terhadap sistem ini telah dibentang dalam tesis ini. Sistem ini adalah kaedah ringkas, cepat dan tepat untuk

mengesan isyarat perjalanan pertama bagi sebarang sistem jentera pemasangan yang mempunyai enam belas saluran dan menyimpan semua maklumat berkenaan isyarat perjalanan pertama (nama, tempat, telefon pejabat, telefon bilik kawalan, tarikh, masa, dan lain-lain). Ketepatan sistem ini telah diuji dan ujiannya adalah berjaya.



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I certify that and Examination Committee has met 8<sup>th</sup> August 2007 to conduct the final examination of Lutfi Mohamed Zamseleni on his Master of Science Thesis entitled “Design and Implementation of the First Trip Signal Detection in a Machinery Assembly System” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the degree of Master of Science.

Members of the Examination Committee were as follows:

**Senan Mahmud Abdullah, PhD**

Associate Professor  
Faculty of Engineering  
Universiti Putra Malaysia  
(Chairman)

**Norman Mariun, PhD**

Professor  
Faculty of Engineering  
Universiti Putra Malaysia  
(Internal Examiner)

**Hashim Hizam, PhD**

Lecturer  
Faculty of Engineering  
Universiti Putra Malaysia  
(Internal Examiner)

**Mohd. Fua’ad Hj. Rahmat, PhD**

Associate Professor  
Faculty of Engineering  
Universiti Teknologi Malaysia  
(External Examiner)

---

**HASANAH MOHD. GHAZALI, PhD**

Professor/Deputy Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date: 27 September 2007



This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

**Mohamed Daud, PhD**

Professor  
Faculty of Engineering  
Universiti Putra Malaysia  
(Chairman)

**Abdul Rahman Ramli, PhD**

Associate Professor  
Faculty of Engineering  
Universiti Putra Malaysia  
(Member)

**Samsul Bahari Mohd Nor, PhD**

Lecturer  
Faculty of Engineering  
Universiti Putra Malaysia  
(Member)

---

**AINI IDERIS, PhD**

Professor and Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date: 15 November 2007



## **DECLARATION**

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

---

**LUTFI MOHAMED ZAMSELENI**

Date: 17 September 2007



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## LIST OF ABBREVIATIONS

AC	Alternating Current
ADO	ActiveX Data Object
ARTDBS	Active Real-Time Database System
BODHI	Bio-diversity Object Database architecture
bps	bit per second
CPU	Center Processing Unit
Ch.	Channel
DAO	Data Access Object
DC	Direct Current
DPDT	Double-Pole/Double-throw
DRAM	Dynamic Random Access Memory
E	Emergency Push Button
EMTP	Electromagnetic Transient Program
EMR	Electromechanical Relay
EMTP	Electromagnetic Transient Program
F	Flow Switches
FTS	First Trip Signal
GW	Gigawatt
IC	Integrated Circuit
I/O	Input/Output
Kbps	kilobits per second



L	Level Switches
LED	Light-emitting diode
m	Meter
mA	milli-Ampere
MATLAB	High-level Programming Language
NC	Normally Closed contactor
NO	Normally Open contactor
ODBC	Open Database Connectivity
OO	Object-Oriented
OOP	Object-Oriented Programming
OLE DB	Object Linking and Embedding for Databases
P	Pressure Switches
PC	Personal Computer
PDB	Protein Databank
PDC	Primary Domain Controller
RAD	Rapid Application Development
RAM	Random Access Memory
RDO	Remote Data Objects
RSS	Relay Supervisory System
RTS	Request to Send
SRAM	Static Random Access Memory
SQL	Structured Query Language
SW	Switch



T	Temperature Switches
USB	Universal Serial Bus
U. S.	United States of America
V	Voltage
VDC	Voltage Direct Current
3D	Three Dimensional
3PDT	Triple-Pole/Double-Throw



# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

Digital control systems have one of the central and most compelling applications in the 21<sup>st</sup> century's highly information-based societies. Microsoft Visual Basic Programming development is also one of the popular knowledge technologies, of which the content of the resource requirement user information needs Windows 95/98/ME/NT/2000/XP computers with minimal specifications and the necessary support and associated files that can run the compiled Microsoft Visual Basic version of the program without difficulty, and to easily provide the technology and obtain research resource information in a much faster way using database development application, the Database which is a set of data that required for specific purposes is employed (Halvorson, 2006).

The required control system technology is divided into three main resources of the communication technology, namely the operating field, control room and operating maintenance. This technology makes use of the network aspect in a software application that allows users to access a server computer (NERC, 2003).

In a server technology aspect, the server is a Network device that provides service to the network users by managing the shared resources. This system provides solutions to



many maintenance operating-related problems, for instance, not knowing the source of the first trip signal, or whether it is from the control room or from the operating field or maintenance. This problem has become so appalling that it compels the maintenance engineers to work round the clock with the hope of tackling the above-stated problem.

In this study, the system has been designed to catch the first trip signal, providing solutions to many problems related to maintenance operation. The system is able to catch 0 input digital trip signals and also can catches 1 input digital trip signals. For external relays can used any type of voltage relay DC or AC Voltage. The system can use for both the digital and analogue signals.

The important criterion of this study is that the system has the top security by including the menu password in its system program which can be used only by Executive. Similarly, the system is designed to be easily carried to any other unit by choosing all the components as small as possible and connecting them to laptop that has the software.





## 1.2 Statement of the Problem

The signals contain information on a variety of things and activities related to our physical world. For example, information that is related to water supply like the pressure, flow-rate and water level controller (Paulsen *et al.*, 2007); weather monitoring like the signals that represent variables such as air temperature, pressure, and wind speed (Seiler *et al.*, 2000); or simply the voice of a radio announcer reading the news into a microphone provides an acoustic signal that contains information on the world affairs. To monitor the status of a nuclear reactor, instruments are used to measure a multitude of relevant parameters, with each instrument producing a signal (Sedra *et al.*, 2004).

Electrical or machinery system blackouts are some serious problems in today's world and in the exchange of information stemming from worldwide blackouts, power industry professionals can consider the costly lessons of the past, maintain a library of historical lessons about "What and why it happened?" However, electric power stations, water stations, factories and manufacturing companies still face problems in locating where the first trip signal comes from as this signal can be from any sub-stations or sub-units as illustrated in Table 1.1.

Solving these problems has become increasingly important day to day for all the electric power stations, factories and manufacturing companies.

