UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPEMENT OF CONTACLESS BUSBAR TEMPERATURE MONITORING SYSTEM IN LOW VOLTAGE DISTRIBUTION BOARD

This report submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Power) with Honours.

by

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **DEVELOPEMENT OF CONTACLESS BUSBAR TEMPERATURE MONITORING SYSTEM IN LOW VOLTAGE DISTRIBUTION BOARD**

SESI PENGAJIAN: **2019/20 SEMESTER 2**

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

……

(Project Supervisor)

ABSTRAK

Sistem voltan rendah tidak mempunyai pemantauan suhu kerana terlalu panas di papan pengedaran (DB). Komponen di DB mungkin rosak kerana terlalu panas jika tidak ada pemantauan tetap. Oleh itu, tujuan projek ini dibuat untuk memantau busbar dalam sistem voltan rendah untuk mengelakkan sistem daripada rosak. Sistem pemantauan suhu yang diletakkan di dalam kotak pengedaran (DB) akan dapat mengesan suhu busbar dan akan diprogramkan oleh Arduino Uno. Paparan lcd akan digunakan untuk memaparkan suhu bas di papan pengedaran. Jika bas mempunyai suhu yang tinggi, papan panel akan memaparkan tanda menggunakan LED di luar yang dapat menyelamatkan dari berlakunya perjalanan atau menyebabkan kebakaran di papan pengedaran. Kelebihan projek ini adalah di mana sistem voltan rendah tidak mempunyai sistem pemantauan, dengan projek ini sistem dapat memantau jika ada masalah dengan DB. Sistem ini juga boleh menghalang DB daripada membakar pada masa yang sama mengelakkan kerugian pada sisi pengguna.

ABSTRACT

The voltage system does not have any temperature monitoring due to the overheat in the distribution board (DB). The components in the DB may be damaged due to the overheat if there is no regular monitoring. Thus, the purpose of this project was created to monitor the busbar in low voltage systems to prevent the system from being damaged. The temperature monitoring system placed in the distribution box (DB) will able to detect the temperature of the busbar and will be programmed by the Arduino Uno. Lcd display will be used to display the busbar temperature on the distribution board. If the busbar has a high temperature, the panel board will display a sign using the LED on the outside that can save from the occurrence of the trip or cause a fire in the distribution board. The advantage of this project is where the voltage system low does not have a monitoring system, with this project the system can monitor if there is a problem with the DB. The system can also prevent the DB from burning at the same time avoiding loss on the user side.

DEDICATION

Specially to my beloved parents
Idris@Idris bin Sulaiman and Sarifah@Sarifah binti Nafi

Siblings,
Khairul Nizam Bin Idris And Nur Azreen Bin Idris

Course mates,
BEEI KOHORT 6

Faculty lecturers,
FTK lecturers

Dedicated in thankful appreciation for supporting, encouragement and best wishes.

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SCADA	-	Supervisory Control and Data Acquisition
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
DB	-	Distribution Board

CHAPTER 1

INTRODUCTION

1.1 Background

The monitoring system have been increasing now days and one of the growing assets in the world of electricity. Power system have 2 types that is high voltage system and low voltage system. In low voltage system, there is 2 type of distribution board (DB) that are 240-volt and 415-volt. For high voltage systems, it is controlled by the Supervisory Control and Data Acquisition (SCADA) system. Due to the high voltage stresses, this system is introduced to reduce costs and increase efficiency in operation. The contactless busbar temperature monitoring system is able to solve the problem in the low voltage system. This project will monitor the entire time of busbar condition for the user. Connections between busbars can lead to a hot spot over time. When no regular monitoring will cause arc leakage and damage all components in the distribution board. Temperature monitoring can prevent injuries and losses to some parties. In this project, temperature sensor of MLX90614 type for monitor temperature on 3 phases 415-volt busbar in the laboratory. This project also uses Arduino to control data taken and display on LCD display. In addition, the used of LED for the purpose of showing signs to inform that busbars have problems.

1.2 Problem Statement

Low voltage system did not have a system that can monitor the situation on DB. If anything happed on DB such as overvoltage and overcurrent, it will be an arc and it can be exploded due to the stresses the overvoltage and overcurrent. So, this system can be preventing the occurrence and reduce the cost of DB. Most systems on the advertising are more expensive and more complex to installed. Thus, this project can monitor the condition of the busbar either damaged or not.

1.3 Objective of Project

i. To build a prototype contactless busbar temperature monitoring system for low voltage distribution board

ii. To determine the effective distance of temperature sensor for busbar's temperature measurement.

1.4 Scope of Project

Temperature Monitoring System is consisting of two-part software programming and hardware. It has a limitation of the project. The limitation is:

i. Build prototype contactless busbar temperature monitoring system for low voltage distribution board using Arduino Uno.

ii. Use LCD Display as temperature monitoring and provide alarm system in this prototype

1.5 Research Methodology

There are various ways that can be done to complete this project. Before doing this project should identify the components used and this project is as simple as possible but still able to produce the required data in this project. The first step is to identify the types of sensors that need to be used. The temperature sensor has been selected to carry out this project. At the same time, the specification of this sensor should also be calculated as well, the durability, the accuracy, the distance between the sensor and busbar, thus the MLX90614 type sensor has been selected for this project. The second step is to select the type of microcontroller for this project. Selecting the type of microcontroller needs to be taken into account specification, durability, digital i / o pins. After studying the data obtained, Arduino Uno has been selected. In addition, displaying the LCD display data has been selected and some components are LEDs to monitor the condition of the busbar. After completion of selecting the type of component used it has entered the project designation phase. All hardware will be placed in the DB box to ensure the accuracy of the data being retrieved. After completion of all designation then now can lad insert coding on a project and simulate. Data will be taken after ready everything.

1.6 Thesis Outline

This project uses both types of software and hardware. This project is divided into two parts where part A and part B, part A are combined while others are considered to enter the manufacturing phase. Part A begins on February 2019 and ends June 2019 content on Part A that should be submitted on the project title, chapter 1,2,3 and also some hardware developmentPart B begins on August 2019 and ends January 2020 where the solution for hardware will run before it is finalized and the project will be

executed as expected. Finalized this project Part A and also B combined and concluded.

1.7 Project Deliveries

This project will be made to monitor the temperature of the busbar in the low voltage distribution board. To get good and accurate analysis by using various methods and simulations to get good results.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Nowadays, there has been an increase in technology as well as more complex. In the past, we have never heard of monitoring the system because of the less sophisticated tool. operating temperatures are important things to consider and can also affect the life span of electrical equipment. Incorrect installation/power overload can cause hot joint busbar and when this is left it may cause arc leakage and damaging electrical equipment. Protective systems used in local areas typically consist of circuit breakers where it will break the supply when reaching a level such as when a current conduction/earth leakage current reaches a limit level. Many users often never know the damage in the power system until the supply circuit is disconnected. Therefore, the circuit breaker always performs tasks when the damage occurs, but that is not enough to achieve the perfect security level in the electrical system.

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2.2 Temperature Sensor

History shows that the advancement of science as well as engineering for driving materials is important in the development of sensor technology. In early 1800 and was invented by Wilhelm von Siemens in 1860 to make temperature sensors based on copper resistors (NICHOLAS G. EROR, 1995). Contactless is new technologies being developed all time being use critical installations, where reliability and dependability are not only desirable but essential. There are many kinds of contactless in the world that been use as it is one of the developments that been approved will make our daily life easier. Contactless can be applying to any kind of technologies such as sensor, card reading/smart card, laser, wireless, this kind of technologies are been used in world-wide. The function to improve the dependability of sensors is to eliminate mechanical failure by using these contactless technologies.

The non-contact infrared sensor has several types of sensory eliminates wherein this element is initially vulnerable to remote objects by generating radiative flux. For the second element, it is the same as the first element but the radios from the remote object are transferred to both elements and are compared, and the component transfers heat to the flux and converts to the temperature signal. This was stated that the creation of previously non-contact infrared sensors is identical to the non-contact temperature sensors of the system where the signal for the discarded is aimed at ensuring the accuracy of the sensor. (Fraden, 1997). Infrared and non-contact sensors are sensors that are so suitable for use in measuring this high temperature because when the sensor is in contact with the heat part to be measured it will produce noise on the tool and the accuracy of the measurement tool is not very accurate (Bohm, 1992) (Gruner, 2003) (Sullivan, 2007).

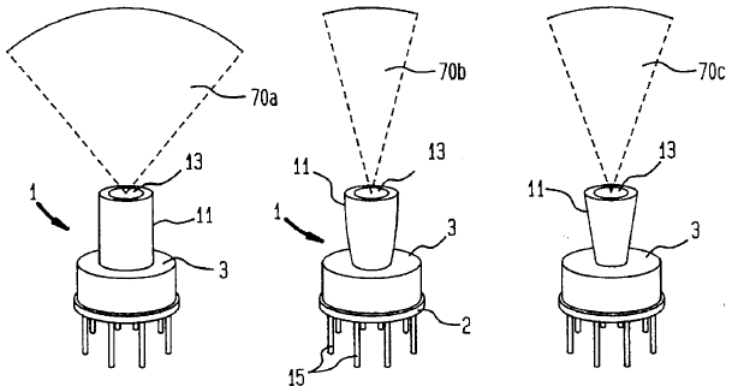

Figure 2.2.1: Scematic diagram non contact temperature sensor. (United States Patent No. 5,645,349, 1997)

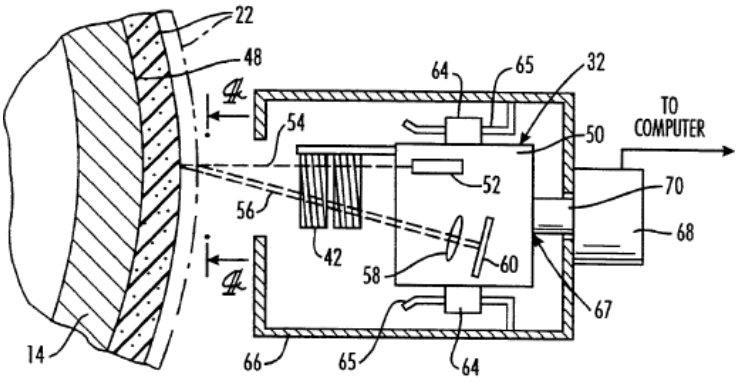

Figure 2.2.2: Scementic diagram non contact sensor (United States Patent No. 5,355,083, 1994)

2.3 Electrical busbar

Busbar is one of the conductors in the conducting group to transmit electrical power from input to distribution. In terms of catalysis, it is a junction where inputs and current outputs meet. Thus, the electric busbar places the group for electric power in one area. In the system busbar, there is an insulator and also the supply circuit breaker. When the fault occurs in the supply, the circuit breaker will decide on the circuit. Electrical busbars are also available in many types of shapes such as rectangular, round, cross-sectional and many other forms. For the rectangular shape, it is used in power systems. The material for the manufacture of this electric busbar is copper and aluminum. In addition, there are also various types of busbar arrangements in the power system. In nowadays, there have been interested in replacing the copper busbar to aluminum as the shortage of materials and the cost is very high (NATH, 1986). This has open to some industries, that as time goes by the load demand keep increasing. For currents carried through the busbar is limited to the highest limit for working at temperatures allowed for work by the system to be accounted for the properties of the conductor material used on the bar and the limit on the cable that connects the bar. For national and international standards such as British standard BS 159 and also the American standard anion c37.20 for the highest limit temperature rises and also high ambient temperatures. As the BS 159: 1992 example stipulates a high temperature rise 50 ° C above 24 hours means ambient temperature up to 35 ° C and also the peak for ambient temperature is 40 ° C. So for the solution ANSI C37.20 allows the temperature up to 65 ° C and above for the ambient maximum ambient temperature is 40 ° C. The highest limit is selected to limit the potential for surface oxidation on the conductor material as well as avoiding the occurrence of mechanical pressure due to cycle temperature. In practice for limiting temperature rise on busbar if using y insulation, the appropriate. for a nominal 60 ° C increase over permissible ambient temperatures of 40 ° C is permitted by EN 60439-1: 1994 in conjunction. EN 60439-1: 1994 also states the increase in busbar temperature and also the conductor is limited by the mechanical strength of the material, the impact on the equipment, the increase in the permissible insulation temperature in relation to the bar and the effects on devices that come in contact with the busbar. For this final consideration limit, the

maximum working temperature to the cable insulation connected to the bar is usually 90 ° C or 70 ° C. (Norris, 1994) (Standart, 2004).

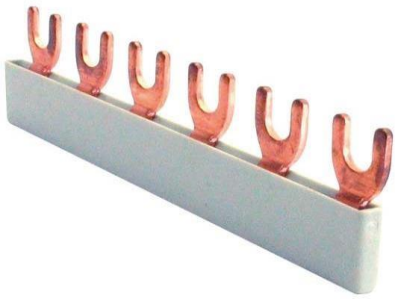

Figure 2.3.1: Type of busbar

Figure 2.3.2: Type of busbar