UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF REMOTE TERMINAL UNIT (RTU) FOR POWER QUALITY MONITORING SYSTEM

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

by

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Tajuk: Development of Remote Terminal Unit (RTU) for Power Quality Monitoring System

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

Signature: …….

Supervisor : AHMAD IDIL BIN ABDUL RAHMAN

Signature: …….

Co-supervisor: JOHAR AKHBAR BIN MOHAMMAT GANI

ABSTRAK

Projek ini memperkenalkan reka bentuk dan pembangunan Unit Pemantauan Jarak Jauh (RTU) kos rendah untuk sistem pemantauan kualiti kuasa bagi meningkatkan kebolehpercayaan kuasa antara pengguna. RTU memainkan peranan penting dalam mengesan kesalahan dan ditugaskan untuk menghantar mesej dengan segera ke bilik kawalan. RTU menyediakan pemantauan operasi kesalahan dan pengumpulan data untuk analisis. Reka bentuk projek ini akan memberi tumpuan kepada membangunkan satu set model asas yang komprehensif untuk mensimulasikan voltan lendut menggunakan MATHLAB/Simulink. Microchip akan diprogramkan kepada beberapa jenis kesalahan khusus untuk keadaan voltan lendut apabila ia menerima data dari MATHLAB/Simulink. Selepas itu, status kesalahan tersebut akn dipaparkan dalam paparan LCD dan Wi-Fi akan menghantar maklumat tersebut ke bilik kawalan untuk meberi amaran kepada pekerja akan keadaan semasa melalui Paparan Grafik (GUI). Akhirnya, sistem ini dapat mengesan sama ada voltan lendut atau voltan biasa dan masa ketika voltan lendut itu bermula dan tamat, malah ia akan bersedia untuk dihubungkan dengan Unit Pemantauan Jarak Jauh yang lengkap.

ABSTRACT

This project introduces the design and development of a low-cost Remote Terminal Unit (RTU) for power quality monitoring system to increase the reliability of power among the consumers. The RTU plays an important role in detecting faults and assigned it by sending message to control room instead. The RTU provides monitoring fault operation and data collection for analysis. The design of this project will be aimed on developing a set of basic models to simulate a voltage sag using MATHLAB/Simulink. The microchip will be programmed to a specific type of fault for voltage sag condition when it receives data from the MATHLAB/Simulink. After that, the status will be appeared on the LCD display and Wi-Fi Module will send the information directly to control room as warning the operators on the current situation via Graphical User Interface (GUI). Finally, the system is able to detect the voltage sag or normal voltage and the starting and ending time of the voltage sag occurred, thus ready to be interfaced with the complete Remote Terminal Unit (RTU).

DEDICATION

To my beloved parents

Abd Rashid Bin Bambok

Rahayu Binti Osman

Sibling

Nurul Syahidah Binti Abd Rashid

Muhammad Zafran Aqil Bin Abd Rashid

Nurul Syafinaz Hawa Binti Abd Rashid

Supervisor

Mr. Ahmad Idil bin Abdul Rahman

Co-Supervisor

Mr. Johar Akbar bin Mohamat Gani

Thank you very much for the support, support, love, encouragement, help and blessing

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Last but not least, I would like to express my deepest and grateful to my family, especially my parent for giving me their full support, understanding and patience. Without their support, I would not have been able to finish my bachelor degree project. They give a support and lovely companionship; these are my important source strength for me.

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LIST OF SYMBOLS

I/O	-	Input/output
Kv	-	kilovolt
Pu	-	Per Unit
ψ(t)	-	Continuous Function in Both Time Domain
W	-	Angular velocity
X	-	Displacement
Z	-	Height
Q	-	Angle
ms	-	milisecond
s	-	Second
%	-	percent
mV	-	miliVolt
V	-	Volt

LIST OF ABBREVIATIONS

GUI	Graphical User Interface
DAS	Distribution Automaton System
IEEE	Institute of Electrical and Electronics Engineers
PIC	Peripheral Interface Controller
PQM	Power Quality Monitoring
RMS	Root Mean Square
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
GSM	Global System for Mobile Communication
LG	Line-to-Ground
LLG	Line-Line-to-Ground
LLLG	Line-Line-Line-to-Ground
VRMS	Voltage Root Mean Square
CWT	Continuous Wavelet Transform
TNB	Tenaga Nasional Berhad

CHAPTER 1

INTRODUCTION

1.0 Introduction

This part will describe further about the project background, problem statement, objectives, scope of project and expected results for this RTU project, in brief.

1.1 Project Background

Nowadays, the electrical power systems are very vital among the users due to high request of power usage. Electrical power system has many important parts which are the generation, transmission, distribution and load (consumers).This electrical power system has a standardized network that supply power to the area. As a pioneer of the National Grid in Peninsular Malaysia, Tenaga Nasional Berhad (TNB) designated two sort of voltage level networks in electrical power system. Retrieved from (https://www.tnb.com.my/assets/files/ESAHv3.pdf), for transmission grid voltage, the rates are 500kV, 275kV and 132kV while the distribution voltage are rated at 33kV, 11kV and 400/230V respectively.

In the electrical distribution system, too much failure had occurred until the Distribution Automation System (DAS) was introduced. According to (Parikh, 2009), The Distribution Automation System (DAS) is a system that enables an electrical utility to monitor, coordinate, and operate distribution components in a real-time mode from remote locations. (Razak, 2014) studied that DAS is also known as an electrical part on the distribution stage that can run automatically within the system that contain of electrical components or mechanisms on that distribution stage which function consequently at lower voltage level. Among many functions of DAS is to track down the faults position, dissociate faults and recover back the supply services area to the consumer. The DAS can upgrade effectiveness, reliability and grade of electric service with respect to the application of the utilities. The improved technology in DAS and the automation application enables to naturally observing, maintaining and controlling the switches of the framework where it very well can be practiced through the intelligent electronic devices (IED).

Remote Terminal Unit (RTU) is the one of the vital tools for execution for DAS where it essentially acts as a remote that enables checking and controlling of the substations. Besides that, the RTU plays an imperative act in authorizing the operators at the control center area to deal with and run the distribution system. The measured electrical variables will be determined by the RTU at the distribution system.

(Jusoh, 2013) discussed that at remote locations, the collected information from the process equipment will shift back to the focal unit in order to identify the data status. This remote terminal unit can interpret the information in three states which are in analog input, digital (status input) and digital (control outputs). The RTU's information that converge in electrical parameters are the Root Mean Square (RMS) value of voltage and current, frequency, temperature and power.

In this RTU project, generally the tested fault happens at the Three Phases to Ground Fault (L-L-L-G), Single Line to Ground (L-G) and Double Line to Ground (L-L-G) fault. All this type of faults is caused by the voltage sag disturbances. In order to ensure good quality of electrical facilities, the RTU is utilized to control and track the power quality disruption when faults happened. The power quality is an electrical system that forms a stable and clear energy. Furthermore, power quality always accessible in a pure noise-free sinusoidal waveform and it always operated at standard frequency position and voltage level. However, many loads will appoint to these disturbances with the expand of energy request from industrial operation, retrieved from (http://www.comsys.se/solutions/powerquality.html).