WIND DATA LOGGER

SITI HANIS BINTI SIDEK

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ABSTRACT

When planning to install a wind turbine, one must predict the power output that will generated by studying the wind speed at the potential location. These projects intend to study the potential for wind turbine installation in UMP. A data logger is developed to measure and record the wind parameter, speed. Wind speed is determined by measuring the number rotation of anemometer within a certain period of time. The parameters obtain by these device will be collected by a microcontroller and transmitted to a personal computer through radio frequency signal. All data be recorded and analysis to decide the potential for wind turbine installation.

ABSTRAK

Apabila hendak merancang untuk memasang satu kincir angin, pertama mesti meramalkan pengeluaran kuasa yang akan dihasilkan dengan mengkaji kelajuan angin di lokasi yang berpotensi. Projek ini bertujuan mengkaji potensi untuk pemasangan kincir angin dikawasan UMP. Satu pengumpul data dicipta untuk mengukur dan mencatatkan kelajuan angin. Kelajuan angin diukur berdasarkan jumlah putaran anemometer dalam tempoh masa tertentu. Kelajuaan angin yang diperolehi oleh peranti akan dikumpul oleh satu mikropengawal dan dihantar ke satu komputer peribadi melalui isyarat frekuensi radio. Semua data yang diperolehi akan direkodkan dan analisis untuk memutuskan potensi pemasangan kincir angin.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

°	-	Degree
s	-	Second
V	-	Voltage
GND	-	Ground
Ω	-	Ohm
F	-	Farad
rpm	-	Rotation per minute
rps	-	Rotation per second
Hz	-	Hertz
m	-	Meter
A	-	Ampere

LIST OF ABBREVIATIONS

OSC - Oscillator

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

Renewable energy refers to energy resources that occur naturally and repeatedly in the environmental where it can be harnessed for human benefit [1]. The renewable energy resources include solar, wind, wave, geothermal and biomass. Steps taken to establish these types of resources are a new solution for the present energy shortage. Because of the limited fossil fuel reserves, and also the adverse effects associated with their use, the alternatives energy becomes conventional energy sources, especially the renewable ones become increasingly attractive. Moreover, utilization of solar and wind power has become increasingly significant, attractive and cost-effective, since the oil crises of early 1970s [2]. Both of these and other renewable energy resources are abundant in Malaysia.

Wind which is actually a form of solar energy is one of a kind that currently researchers put efforts in addressing the challenges to greater use. It is said to be a form of solar energy because it involves the heating process of the atmosphere by the sun. Malaysia is one of many other countries that lie in the equatorial zone which climate is very much influenced by the monsoons. Malaysia has vast solar and wind resources available for energy generation through renewable energy technologies. Commercialization of renewable energy technologies is needed especially for rural, social and economic development. Wind energy can be considered a green power technology as it has only minor impacts on the environment. Any means impact might be because of the process of the production of the wind energy itself, but so far

it has not made any major impacts. Wind can be a vital source of energy if properly utilized and exploited. But before high-end projects are implemented, adequate research should be done to study the feasibility and determine a suitable type of project to implement. The primary parameter needed is wind speed and direction [3].

1.2 Problem statement

One of the most important factors of installing a wind turbine is study the wind speed and chooses the site where system will be installed. It will be waste of time and money to build wind turbine without investigating wind potential of the site [4]. This project is intended to study the potential for wind turbine installation in University Malaysia Pahang.

1.3 Objective of Project

The main core of this project is:

I. To study the potential for wind turbine installation in University Malaysia Pahang.

II. Develop the prototype of wind data to collect the data.

III. Interface with Visual Basic to log data.

1.4 Scope of Project

In order to achieve the objective of the project, several scopes have been outlined. The scope of this project is;

I. This project is use wind system concept.

II. The research been taken around University Malaysia Pahang for three week, using microcontroller and interface with visual basic.

CHAPTER 2

THEORY AND LITERATURE REVIEW

2.1 Introduction

Today the need for renewable energies is driven by three impetuses, namely: social; economical; and political. Socially, the increasing effects of pollutants on the environment degradation and contribution towards global warming. Economically, the fossil fuel prices are continuously increasing and warranting renewable energy (RE). Politically, countries are worried about dependence on imported fossil fuels and are seeking alternatives; hence the current surge in RE R&D and implementation. Currently many countries have either set up or are in the process of setting up hundreds of megawatts RE power plants. A number of countries have already implemented and successfully operate multi-hundred megawatts plants of wind power. Just in India, a total of 1,167MW of energy is produced using wind resources.

In the area of solar thermal energy last decade saw a number of research projects being carried out and technology has matured to such an extent that Egypt, India, Spain among many others are in the process of building 100 to 200megawatts of solar thermal power plants. Biodiesel has not seen its usage on such a grand scale as that of solar and wind power but already many countries have started setting up biodiesel power plants of up to a few megawatts and are using biodiesel as a replacement for fossil diesel. Indian Railways has already started using biodiesel in

its engines and is aiming to replace up to 10% of its diesel with biodiesel. In total, 18% of world's energy demands are being met by the renewable sources.

2.2 Wind Energy

Wind energy is really just another form of solar energy. Sunlight falling on oceans and continents causes air to warm and rise, which in turn generates surface winds. The wind has been used by humans for thousands of years, first to carry ships across oceans and, later, to pump water and grind grain. More recently, wind has been harnessed as a clean, safe source of electricity.

All of the related research related to wind data logger are describe in the next section of this report

2.2.1 Wind Turbine in Terumbu Layang Layang

Based study by University Kebangsaan Malaysia 2005, the use of a 150 kW wind turbine in the Terumbu Layang Layang demonstrated with some success. However, the availability of wind resource varies with location. It is necessary to first carry out a general assessment of the wind energy potential nationwide. This can then be followed with detailed assessment in promising locations. These assessments must be completed before further action can be decided on. Understanding the wind resource is a crucial step in planning a wind energy project. Detailed knowledge of the wind at a site is needed to estimate the performance of a wind energy project. Wind energy is considered a green power technology because it has only minor impacts on the environment. Wind energy plants produce no air pollutants or greenhouse gases. However, any means of energy production impacts the environment in some way, and wind energy is no different [5].

2.2.2 Data Logger for Wind Turbine

This project is designed for wind-turbine data storage which has ability to store data into memory card and display all those data as well. Wind-turbine data storage is functioned by PIC30F4011, which is processing unit for incoming input parameters and data transmission for data monitoring on LCD. And it can also store all data into the Card on the specific schedule time. The final result project testing is wind-turbine data storage being able to collect input parameters from six channels with date time data from IC time base (DS1307) into data storage card. This project can also display all the collected data on LCD. Data storage card is able to connect to the computer via USB port for data transfer. The program which is developed by using Visual Basic version 6.0 is able to display data in tables by recorded dates [6].

2.2.3 Feasibility Study on Future Turbine Construction at College University

This project mention that the most common instrument used for wind resource assessment is the cup anemometer. This instrument measure wind speed using three or four cups that rotate around a vertical axis. The anemometer's wind speed data can be used to calculate the average cubed speed, which can then yield maximum and minimum power and Annual Energy Output (AEO) figures for a turbine of a given rotor diameter. Directional data is useful in turbine sitting and also in comparing assessment data to a third party source while allowing for the ability to make corrections in a modeling algorithm due to obstructions that do not fall outside of international weather station sitting standards [7]. This project wanted a professional-grade device that could take both directional and speed data while also having data logging capabilities. They decided to purchase Onset Computer Corporation's HOBO Wind Speed / Direction Smart Sensor that met the accepted error standard of ±3% or less deviation from true wind velocity at speeds greater than 10mph [8].

2.2.4 Data Logging by Using 8051-Based Microcontroller

From this project, 8051-based data logger has been developed to measure wind speed and wind direction to store these data into an EEPROM with the date and time. The data is then transferred to the computer through RS232 serial port. The instantaneous data –wind speed, wind direction, date, time are shown on a 16x2 LCD with the help of an 4x4 keypad. The keypad is also used to set the date and time, and also to define the sampling interval. Three anemometers and one wind vane are used in this study. The anemometer which will be read is selected by a 3-state selector switch. The transferred data to the computer is read by a user-interface program [9].

2.2.5 Low Cost Digital Wind Speed Meter with Wind Direction using PIC16F877A

This project used aerovane to measure wind speed and direction. The wind speed measured using aerovane is much more accurate as it measures the speed of the wind which parallel to the wind direction. This project mainly focuses on using microcontroller PIC16F877A to control the circuit and building the aerovane type wind vane model. Hall Effect sensor is used for speed measurement and 10kΩ potentiometer for direction detection. The sensor resolution for speed measurement is one pulse per rotation. For direction, the specific direction is determined at every 45° rotation of potentiometer. The microcontroller is used as a central controller to measure the speed and direction of the wind and displays it on a 16 x 2 characters LCD. From the measured pulse per minute, the speed is calibrated for displaying the value in km/h. While the direction will be display in specific direction which is North, Northeast, East, Southeast, South, Southwest, West, and Northwest. Based on the output, the PIC16F877A can be an ideal microcontroller for developing this project [10].

2.2.6 PC Based Wireless Wind Data Analyzers

This project presents the development and implementation of a wireless wind data analyzer. The proposed analyzer employs the Global System for Mobile technology to read and transmit the wind data to a PC located at the workplace. The output of anemometer is processed by microcontroller and transmitted to a personal computer via dedicated transmitter-receiver mobiles. The receiver mobile is interfaced to a personal computer, where the received wind data is analyzed to assess the wind potential, annual energy yield and sitting. Two cup type anemometers, set up at different heights, are used for testing the proposed wind monitoring system. The output is compared with the wind data recorded using NRG wind data logger. The results are accurate. The proposed data logger can be effectively used for recording wind data from remote places. [11].

2.2.7 Smart Wireless Temperature Data Logger Using IEEE 802.15.4/ZigBee Protocol

This Paper proposed a portable wireless data acquisition system for temperature in real time process dynamics. Process variables (like temperature, pressure, flow, level) vary with time in certain applications and this variation should be recorded so that a control action can take place at a defined set point This paper proposes an 8 bit embedded platform for a sensor having a network interface using the 802.15.4, ZigBee protocol, that is specially designed for the sensors network. The ZigBee protocol is a wireless technology developed as an open global standard to address the unique needs of low-cost, low power, wireless sensors network .This wireless data logger senses and monitors the variations in the local temperature thereby transmits the data within the range to an assigned embedded processor based server. Received temperature is displayed on a local liquid crystal display (LCD) on assigned server and simultaneously on a computer. [12]

2.3 Solar Energy

For billions of years, the sun has poured out huge amounts of energy in several forms, including light, heat, radio waves, and even x-rays. The Earth, in orbit around the sun, intercepts a very small part of the sun's immense output. On Earth, direct sunlight is available from sunrise until sunset, except during solar eclipses. Solar collectors and modules are designed to capture some of the sun's energy and change it from radiation into more usable forms such as heat or electricity. In fact, sunlight is an excellent source of heat and electricity, the two most important forms of energy we consume. Solar energy is becoming increasingly popular for remote power needs such as telecommunication towers, agricultural applications (irrigation and pasture management), in tropical countries that are not connected to an electrical grid, for heating swimming pools, and many other applications around the world.

2.3.1 Photovoltaic Laboratory for Study of Renewable Solar Energy

Solar energy is one of the renewable energies on which nowadays scientists interested in energy sources are focused. A problem that appears is their output which is intermittent and therefore storage, careful control and parameter monitoring are required. This paper presents a workstation conceived for the study of photovoltaic solar energy. Besides of generated photovoltaic solar energy parameters study, the monitoring using virtual instrumentation is implemented. As a platform for virtual instrumentation National Instruments Lab Windows / CVI environment is used. For future developments remote communication feature is added on which currently remote monitoring of solar photovoltaic energy and electric energy parameters at consumer side are monitored. Remote communication is proposed to be realized on internet network by Data Socket technology for regular wired and wireless network accessibility. [13]

CHAPTER 3

METHODOLOGY

3.1 Introduction

In this project, a microcontroller will be used as the central processing unit for wind speed and direction. The block diagram of the system is shown in Figure 3.1

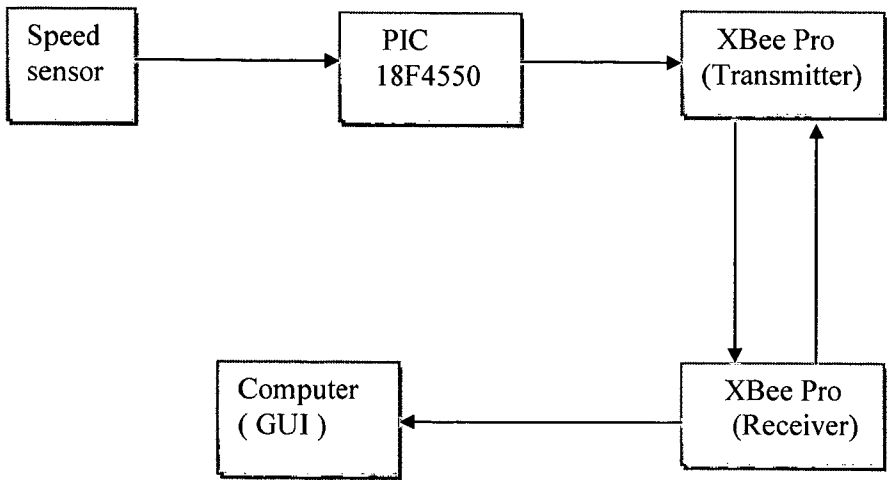

Figure 3.1: Block diagram of wind data logger

The focus of this project is to study the potential for wind turbine installation in UMP. A data logger is developed to measure and record the wind parameter, speed. Wind speed determined by using Omron Rotary Encoder within a certain period of time. For this project, DC fan was used for the basic component for the speed sensor. The wire winding and the permanent magnet is removed. The DC fan is attached Omron Rotary Encoder. The parameters obtain by these device collected by a microcontroller. The PIC18F4550 microcontroller functions as a central processing unit for all the input and output. It receives pulse from Omron Rotary Encoder. The pulse is count in one second interval. The Universal Asynchronous Receiver Transmitter (USART) feature is used to establish RS-232 serial communications with XBee PRO wireless RF modules. The PIC communicates with the wireless modules asynchronously through pins TX and RX. XBee PRO transmitted all the data to a personal computer. All data be recorded and analysis to decide the potential for wind turbine installation.

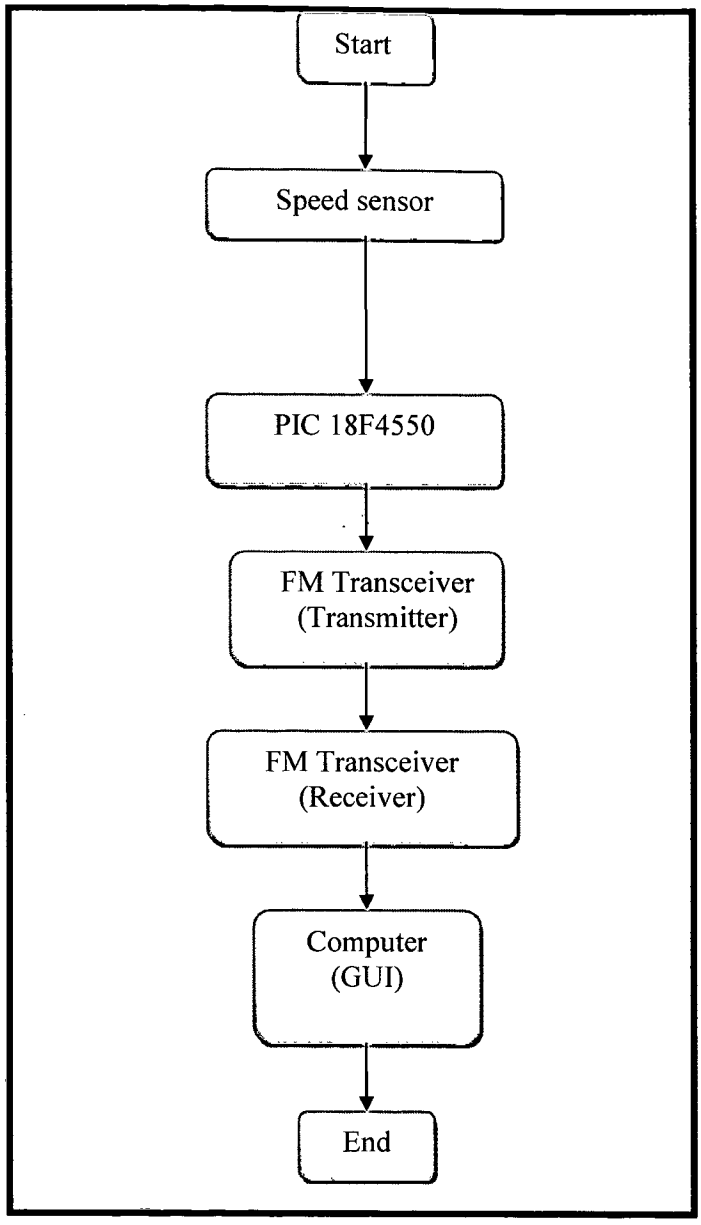

Figure 3.2: Project Flow Chart