MONITORING PARAMETERS OF WIND TURBINE USING WIRELESS COMMUNICATION

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ABSTRACT

Wind Turbines are made in remote sites such as mountains and offshore areas and the cost of implementation and maintenance of wind turbines is very high. Hence continuous monitoring of wind turbines is required. The explosion of Wind Turbine is recognized as a major problem against green energy. It is not only the frightening factor for the people but also origins dangerous hazard for human life. To overcome this problem and to surge the green energy, a simple system is presented to monitor and avoid the error occurrence in Small Wind Turbine.

This paper focuses on monitoring parameters of wind turbine by using wireless communication. This system consist of two sections data acquisition unit and control unit. Zigbee interface module is used to communicate between the data acquisition unit and the control unit. It is possible to observe the present status at control room through PC (Personal Computer) of the Wind Turbine and the error occurrences can be prevented.

Keywords- *Zigbee; Wind Turbine; Wireless; Data Acquisition unit; control Unit; Wireless Communication.*

I. INTRODUCTION

Nowadays, because of rapid exhaustion of fossil fuels and global warming there is an increasing demand for the generation of electricity from renewable sources. There are many renewable sources like solar, wind, thermal and tidal energy etc. But, the wind energy has gained greater attention than other renewable sources. Wind is the movement of air from high pressure area to low Pressure area caused by change in temperature in the atmosphere. Wind energy a kind of Green energy is utilized because of development in technologies and low cost [4].

Wind energy is the most developing renewable energy. Nowadays, most of the wind turbines are built in remote areas or the harsh environment such as desert, mountains etc. so, the monitoring of those wind turbines are difficult and the continuous monitoring is required [3]. Because the chance of fault occurrence in a wind turbine is more. The main contribution of this paper is to monitor the wind turbine.

It is needed to develop the wind turbine which is located in remote areas and fault diagnosis to improve the efficiency and life span of the wind turbine. This monitoring system is used to collect the information like temperature, vibration and speed of the wings of wind turbine from the main components of the wind turbine such as nacelle, gear box and shaft by using various sensors like temperature sensor, MEMS sensor, IR sensor etc. This information is send to the control unit via wireless Zigbee and avoids dangerous hazards [5]. It is not only the frightening factor for the people but also causes dangerous hazard for human life. Then at the receiver section the information is provided to the user through the graphical user interface by using PC (Personal Computer).

In this project there is a two unit i.e. data acquisition unit and control unit. Zigbee is a message based protocol used to communicate between these two units. One of the section runs with Zigbee, PIC MICROCONTROLLER and sensors are connected at data acquisition unit and the other unit is control unit which consist of a Zigbee module and serial interface with PC (Personal Computer).

II. INTRODUCTION TO ZIGBEE

Zigbee is a design for a suite of high level communication protocols using small, low-power digital receivers based on an IEEE 802 standard for particular area networks. Zigbee devices are frequently used to transfer data over longer distances. Zigbee is targeted at applications that need a low data speed, long battery lifetime, and

protected networking. Applications contain wireless light switches, electrical meters with in-home-displays, transportation management systems, and other customer and industrial apparatus that requires short-range wireless transmission of data at comparatively low rates.

The technology well-defined by the Zigbee specification is proposed to be simpler and less costly than other WPANs, such as Bluetooth or Wi-Fi. Zigbee is a low-cost, low-power, wireless mesh network standard. The low cost permits the technology to be broadly installed in wireless control and monitoring applications. In this Paper Zigbee is used for the communication between data acquisition unit and control unit.

III. SYSTEM DESIGN

The system consist of microcontroller, Zigbee and various sensors to monitor parameter of wind turbine. Microcontroller is the key element of the proposed system. The block diagram of the data acquisition unit is shown in fig 1. For every particular amount of time the microcontroller preprocesses the data and sends it to the control unit via wireless Zigbee module. Monitoring the parameter of wind turbine are most important in diagnosis. Control unit of the system is shown in fig 2.

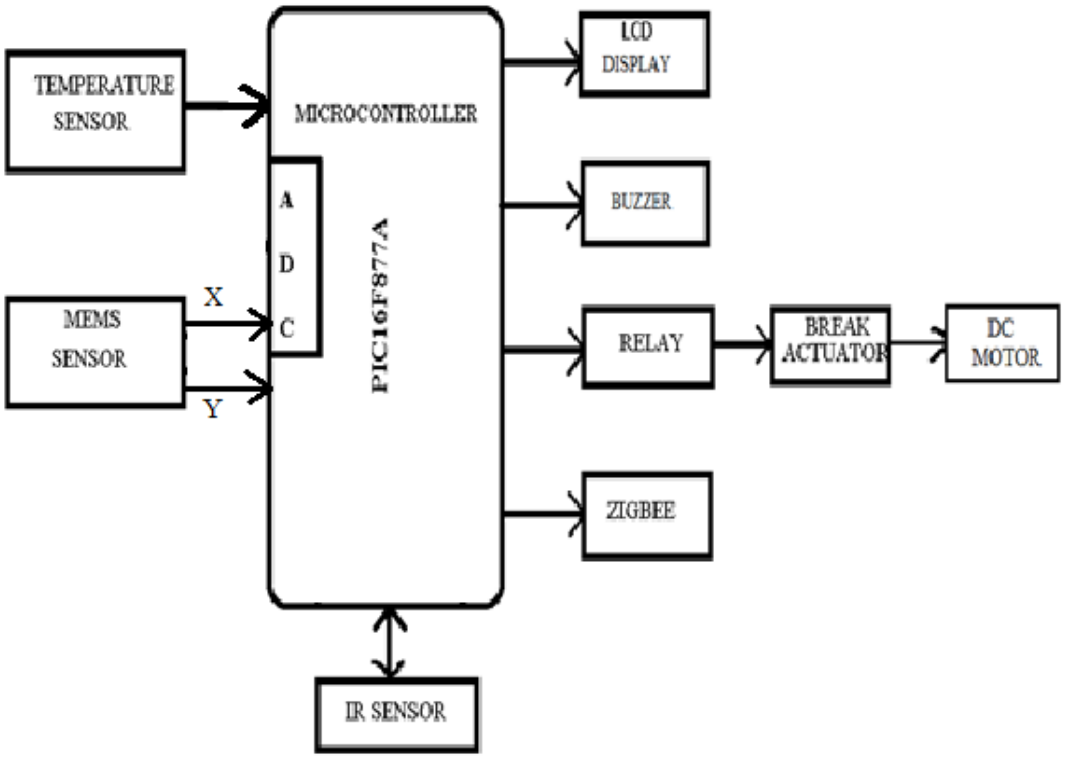

Fig 1. Block Diagram of Data Acquisition Unit of the system

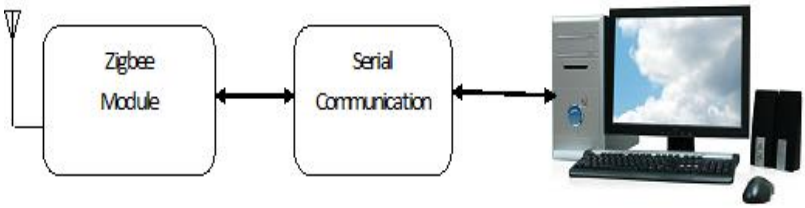

Fig 2. Block Diagram of control Unit of the system

IV. METHODOLOGY

Our project consists of two sections data acquisition unit and control unit. Data acquisition unit consist of temperature sensor for monitoring temperature of wind turbine. The temperature sensor senses the temperature and send to the microcontroller. Microcontroller processes this input and send to the control unit through Zigbee and by using PC it is possible to observe the current status of the Wind Turbine. Data acquisition unit consist of cooler fan in which speed of cooler is controlled directly proportional to temperature of turbine by PWM technique.

MEMS sensor for calculating vibration of turbine and preventing physical damage of the wind turbine. Vibration measurement is generally done in the gearbox, turbines, bearings, and shaft. IR sensors are used to calculate the rotation per minute (RPM) of the wing. Buzzer provides critical alarm in case of instability of turbine due to physical vibrations. A LCD display is used to update all the parameters at minimum time interval. Brake actuators are used to control the speed of the fan.

A Zigbee is connected to the PC (Personal Computer) so the information from the section is transferred to a remote location so the technical person can be available in time to troubleshoot the issue in wind turbine. The basic view of this technique is to reduce the possibility of fault in wind turbine.

V. CONCLUSION

In this paper, a monitoring system has been implemented for a small-scale wind turbine which consists of two main components: data acquisition unit and control unit. Various sensors like temperature sensor, MEMS sensor, IR sensor etc. are mounted at different turbine parts. Data acquisition units are implemented to assemble sensing data from different sensors and transmit sensing data to a control unit via Zigbee. Technical person can be available in time to troubleshoot the issue in wind turbine. This person also communicates with a PC and a smart device.

Zigbee Wireless communication allows the remote monitoring system of all these parameters from control room through PC. This is simple, suitable, time saving and high security system for Wind Turbine.

VI. ACKNOWLEDGMENT

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