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Cloud Server Based Wind Turbine Parameters Monitoring and Physical Fault Diagnosis Using Can Protocol

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***Abstract*—Electrical energy can be produced using fossil fuels and also by natural resources. The production of electrical energy using fossil fuels is costlier when compared to natural resources. Solar, wind, thermal and tidal energy are most widely used natural resources for the production of electrical energy. The cost of the wind turbine is extremely higher and work is harsh and unattended environment. Hence the monitoring and the automation of wind turbine is necessary. The project describes the monitoring and fault diagnosis system for wind turbine using CAN interface. Wind turbine monitoring system collects the parameters such as Speed of rotation, Temperature, Voltage and Oil level from the wind mill unit and it will send to the Cloud Server. Depending on the collected data from the monitoring system the fault diagnosis unit sends SMS to the corresponding person in case of fault occurrence. The system consists of GSM modem, microcontroller, CAN controller, Cloud Server database and sensors for measuring parameters of wind turbine. Microcontroller is the key element in processing module which keeps on monitors the wind turbine parameters. CAN controller is used to communicate between the monitoring unit and fault diagnosis unit. For every particular amount of time, microcontroller pre-processes the sensed data and it will update the parameter values to the corresponding data base using Cloud Server.**

***Keywords*—CAN Bus, LPC 1768, RS232, GSM 300, LCD16X2, Motor driver, DC Motor, Speed sensors, Temperature sensor, WIFI to serial converter**.

1. INTRODUCTION

Wind is the movement of air from high pressure area to low pressure area caused by change in temperature within the atmosphere. Wind energy a kind of Green energy is utilized because of development in technologies and low cost. Wind energy is the most developing renewable energy now a days. Using such wind energy a turbine is allowed to rotate and electricity is generated. Wind turbine is a rotating mechanical device that converts wind energy in to mechanical energy resulting in the production of electricity. However, Wind turbines are fault prone, that is they are deployed in harsh environment such as desert, plains apart from that they are complex electromechanical system that are located far away from the control center. So the chance of fault occurrence and the side effects will be more, even it leads to power off.

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It is necessary to develop the remote monitoring and fault diagnosis system to monitor the run time status and the diagnosis of fault to improve the efficiency and the life time service of the wind turbine. Wind turbine monitoring system collects the parameters such as Speed, Temperature, vibration, power, voltage and current from the main components of turbines such as shaft, gear box, generator and nacelle. Depending on the collected data from the monitoring system analysis is done and the fault diagnosis system makes the decision of location and the type of fault to be occurs in the wind turbine. This analysis is uploaded to the mobile web server and an SMS is sent if there is chance of fault occurrence. CAN bus is the Field bus control system used in automation, intelligence and networking. CAN protocol have been designed by Robert Bosch in 1986 for automotive applications as a method for enabling robust serial communication. The advantage of using CAN bus in the automation is an added value to the system and increase its reliability. The purpose of using CAN bus is to enable any system to communicate with other system without putting too much load to the main controller. CAN bus is a fast serial bus with the speed of 1 Mbps that is designed to provide an efficient, reliable and economical link between various CAN systems, sensors and actuators. We use CAN to communicate between the Wind turbine and the control center which adopts client/server frame works to implement the monitoring and fault diagnosis system.

1.1 INTRODUCTION TO CAN

CAN bus is a network protocol which is used for communication between the microcontrollers or any other devices without the use of any master computer. CAN is basically designed for industrial networking but now a days it finds wide use in automation, mobile machines, military and other harsh environment monitoring application. CAN bus does not hold any address between the transmitter and the receiver. Instead it holds the unique identifier which is a numeric value used to label the message throughout the network. Each of the receiving nodes provides the acceptance or uses the filtering to check whether the message is relevant to the particular node or not. If the message is relevant to the particular node the message is received and processed or else the message gets distorted.

1.2 INTRODUCTION TO CLOUD SERVER

A Cloud Server is an on demand virtual machine that is engineered to deliver customizable performance and reliability. We can also think of Cloud Server as the primary compute engine behind our application running in the open cloud and one of the fundamental building blocks in cloud architecture.

2. LITERATURE REVIEW

Wang chuhang Network Center of Chanchun Normal University, remote monitoring and diagnosis system for wind turbine [1] describes the monitoring and fault diagnosis system for wind turbine using CAN interface. Electrical energy can be produced using fossil fuels and also by natural resources. The production of electrical energy using fossil fuels is costlier when compared to natural resources. Solar, wind, thermal and tidal energy are most widely used natural resources for the production of electrical energy. Presently wind energy is most widely used natural resources which could reduce the emission of carbon dioxide. The cost of the wind

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turbine is extremely higher and work in harsh and unattended environment. Hence the monitoring and the automation of wind turbine are necessary. This paper describes the monitoring and fault diagnosis system for wind turbine using CAN interface. The monitoring parameters and CAN interface are described in detail.

Wenyi Liu, Baoping Tang, Yonghua Jiang[2] designed a system that describes monitoring and fault diagnosis in Wind Turbine based on CAN Bus. The source of electrical energy is fossil fuels and also natural resources. The electrical energy can be produced by using fossil fuels but it is costlier than the natural resources. The natural resources like wind, thermal, Solar and tidal energy are utilized for the production of electrical energy. In present days the mostly wind energy is used as a natural resources which can reduce the emission of carbon dioxide. But the wind turbine costs extremely higher and it is used in under different environment. Thus, it become necessary for wind turbine to be monitored frequently and it should be automated. This paper describes in detail the monitoring and fault diagnosis system using CAN interface for wind turbines. The parameters used for monitoring and CAN bus interface are described in detail.

I.Nilsson and L.Bertling proposed Maintenance management of wind power systems using condition monitoring systems life cycle cost analysis [4]. Wind is a clean and renewable natural resource for power generation. At present, the greatest widespread solution of wind power generation in the world is based on the wind turbines. Thus, to ensure safe operation of these turbines, a close health monitoring of is needed. This paper aims in describing the health monitoring system for wind turbine using Controller Area Network (CAN) bus. This system is accountable for monitoring the tower, blades, shaft, gear box, generator and overall conditions in nacelle/hub. This includes a variety of sensors for e.g. accelerometers, temperature sensors, oil/liquid level sensors. It will collect all the parameters from main components of the turbine and sends it to the control room via RF module/RS232. At Control room through PC (Personal Computer) it is possible to view the current status of the Wind Turbine using MATLAB. So if there is any possibility of fault occurrence, then it can be predicted and prevented.

Fang Li, Lifang Wang,C henglin Liao proposed CAN (Controller Area Network) Bus Communication system Based on Matlab/Simulink [5].Controller Area Network (CAN) is an effective choice for the automotive industries due to its simplicity, low cost nature, and in addition to that it provides connectivity with multiple nodes with single wiring pair. This paper aims in describing an ARM 7 LPC 2129 based Vehicle Monitoring System with Controller Area Network (CAN) bus. Objective of this paper is to construct a hardware proposal for communication between nodes with CAN bus. A Node to Node communication link has been established which are connected via CAN bus so as to observe and control the different parameter values, transfer on the CAN bus and send the control signals onto the another node. This Hardware is connected in loop with the help of LABVIEW HIL capable of Monitoring and Controlling different signals on CAN.

3. PROPOSED SYSTEM

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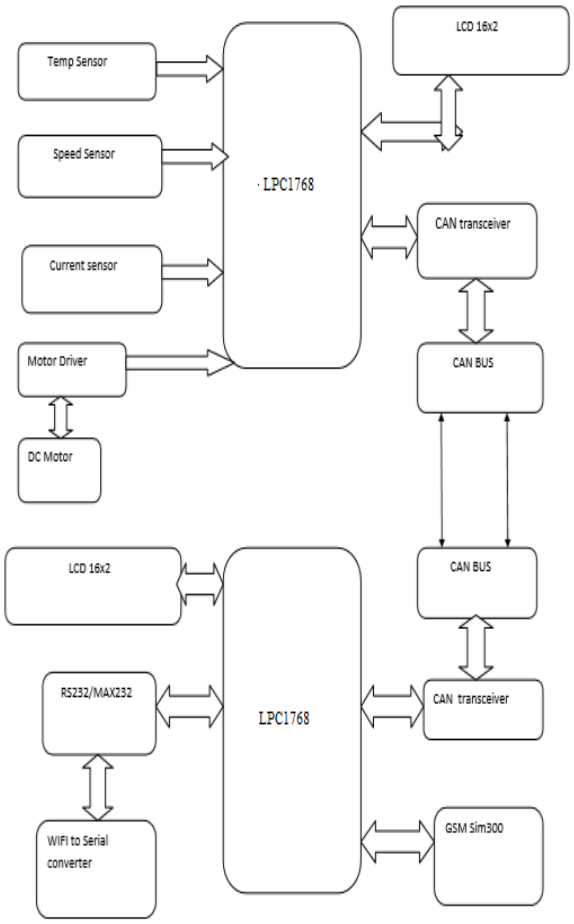

Figure: Proposed system block diagram

Wind turbine monitoring system collects the parameters such as Speed, Temperature, vibration, oil level from the main components of turbines such as shaft, gear box. Depending on the collected data from the monitoring system analysis is done and the fault diagnosis system makes the decision of location and the type of fault to be occurs in the wind turbine. This analysis is uploaded to the web server and an SMS is sent if there is chance of fault occurrence. We use CAN to communicate between the Wind turbine and the control center which adopts client/server frame works to implement the monitoring and fault diagnosis system.

4. CONCLUSION

Currently the wind energy is used for various different applications. Wind Turbines (WT) are employed in unattended and harsh environment. Thus the monitoring of wind turbine is required. With the help of monitoring system we can identify the type and location of fault before they are occurring and are transmitted from wind turbine to the control center through WIFI to the Cloud server. This project deals with the data transmission between two units in the exact time without any disturbance. The main objective of this system is to reduce the possibility of unplanned power off of WT system and thus reducing the downtime cost. Presented study, describe the way of continuously automatically monitoring of WT system which avoids the power off the WT system and improving the lifetime of WT. In this paper we present the system with ARM and CAN protocol to monitor and diagnose and analysis the problems in the wind turbine application. The fault identification is done based on the parameters are measured through the CAN interface module. The CAN bus is used for serial communication which provides high data transmission rate and reliability will maintain parameter database using cloud server on every day to day bases. The future scope of this project is to create a network of all wind turbines which are connected to a one base station. For future reference we can also provide memory module.

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