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# DESIGN OF MONITORING AND FAULT DIAGONISIS SYSTEM IN WIND TURBINE BASED ON CAN BUS

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**Abstract-** In this paper, design of a monitoring and fault diagnosis system in Wind Turbine based on CAN Bus have been described. 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.

**Index Terms: - CAN (Controller Area Network), Wind turbine, Fault Diagnosis, monitoring parameters.**

## I INTRODUCTION

Wind turbine is a rotating mechanical device used for generation of electrical energy by converting wind energy into mechanical energy. Mostly Wind turbines are prone to faults because they are employed in harsh environment such as desert, hill areas and when compared to control center these are located in longer distance. Thus due to the chance of increased fault occurrence may leads to power off. The development of remote monitoring and fault diagnosis system has become necessary to monitor the status of run time and to diagnosis the fault to improve the efficiency and also the life span of wind turbine.

The Wind turbine monitoring system gathers the parameters namely Temperature, Speed, power, vibration, current and voltage from the major components of turbines such as gear box, shaft, nacelle and generator. The analysis is done by collecting the data from the monitoring system and the fault diagnosis system diagnosis the faults occurred in the wind turbine.

The use of CAN bus in an automation system results in advantages of a system and increases its reliability. With the use of CAN bus in any system the communication is done very simple without making involve of main controller completely. The CAN bus is a serial bus operates with a speed of 1 Mbps which is designed to provide a reliable, efficient and economical link between various CAN systems, actuators and sensors. The CAN bus is used in a design for making communication between the control center and the Wind turbine which acquires client/server frame works to perform the monitoring and fault diagnosis system.

## II INTRODUCTION TO CAN

CAN is a broadcast digital bus which operates at a speeds from 20kb/s to 1Mb/s, it is standardized as ISO/DIS 11898 for high speed applications (500 Kbit/s) and ISO 11519-2 for lower speed applications (125Kbit/s). CAN transmission rate depend on the bus length and transceiver speed. It results in many embedded control systems due to its low cost, a light protocol management and the built-in properties for error detection and retransmission. CAN bus interface does not hold

any address for the synchronizing the transmitter and the receiver. But it contains a unique representation which is a numeric value used for labeling the message in the entire network. With the use of unique representation each of the receiving nodes uses the filtering to verify the received message is related to the particular node or not. The message received is relevant to the particular node and then it processed or else the message gets distorted. Nowadays most of the Controllers will support the CAN communication standards. CAN networks are widely used in many application domains like avionics, automotive, plant and factory control, medical devices, elevator controls and possibly in many areas .

## III FAULT DETECTION IN WIND TURBINE

The termination of an object capability to complete a function is called as a fault. Most of the failures occurs inside the wind turbine is due to high oil temperature in gearbox, as the failure is detected the control unit logs the fault and immediately responds to the type of the malfunction occurred. Once fault is detected turbines are made to shutdown to avoid the main system breakdowns. If it detects as a wrong failure then the system gets restarted, failures can be caused due to noise in the system and hence these faults are not considered as a crucial problems. The faults occurred are detected as serious problem then the operator's starts inspecting the system. If the major failure has happened then it is report is documented.

The blades of wind turbine rotors can observe cracks and delaminations because mostly these are prone to obtain creep and corrosion fatigue. Certainly the blades can cause imbalance and asymmetric aerodynamic due to dirt, bird collisions, ice, dampness or manufacturing. Mostly the failures occur in the wind turbine gearbox is Gear tooth damages, a high speed and low speed shafts faults. Mostly, vibration measurement and spectrum analysis are preferred for gearbox monitoring.

Main causes of failures are due to Stator, bearing and the rotor inside the generators. Typically, generators faults can be identified by current measurement. The system efficiency can be affected by Pitch mechanism, Electrical system and Yaw system faults.

## IV SYSTEM DESIGN

The system design consists of microcontroller, CAN controller, GPRS module and some of the parameters of wind turbine. One of the key elements in processing module is Microcontroller which keeps on monitors the parameters of wind turbine. Fig.1 shows the block diagram of processing module. The communication between the wind turbine and the database is done by CAN controller. Microcontroller preprocesses the sensed data for an every moment of time and using GPRS module parameter values are updated to the central database. And also memory module is used for future references. The RS232 is provided for serial communication from simulink to CAN Bus.

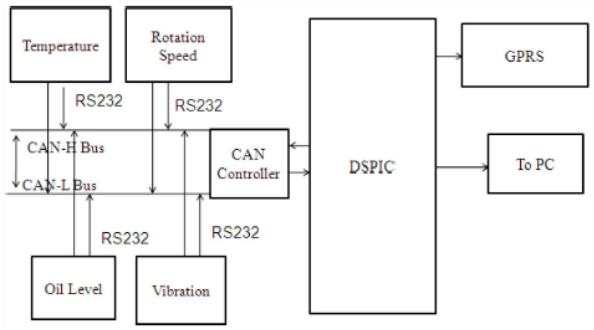


Fig.1. Block Diagram of Processing Module

The more important parameters in diagnosis system are monitoring parameters. The vibration parameters are observed from gear box, generator shaft, nacelle. The rotation speed is measured from generator shaft, slow shaft and fast shaft. Brake oil and lubricants oil levels to be monitored every moment. Yawing is observed from the nacelle.

## V CAN BUS INTERFACE

One of the main module used for communicating the monitored parameters between the control center and the wind turbine done by a CAN interface module. This module consists of three components CAN Controller (MCP 25 10), CAN Transceiver (MCP 255 1), DSPIC.

The Fig.2 shows the block diagram of CAN interface module. CAN Controller (MCP 25 10) have two modes of operation one is a basic CAN operation which is a default mode and another is PeliCAN. The CAN transceiver is used to make the communication between microcontroller and CAN bus by shifting the voltage levels with each other. With the help of this procedure it is useful to produce the differential signals such as CAN high and CAN low signals are required in CAN bus. The device has been designed in such a manner which can be able to oppose the voltage tolerance be caused by noise pickup. Signal processing is one of the features contained by the DSPIC module. The reliability of CAN interface module is improved by optocoupler and power isolator. Entire nodes may not be used for complex functions and algorithms.

The development cost is reduced by replacing a node consisting of an MCP25050 chip specially manufactured for a CAN bus system for simple input output application and simultaneously increases the system integrity.

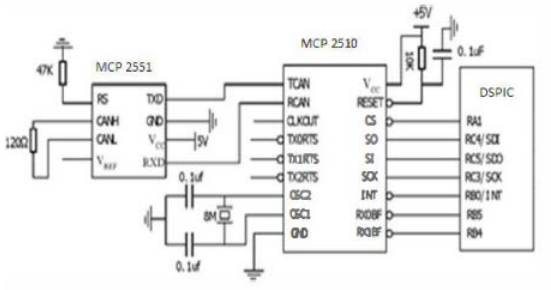


Fig.2. CAN Interface Module

## VI RESULT AND CONCLUSIONS

CAN interface module is used for measuring the parameters, the analysis of monitored data done by neural network. The monitoring system analyzes the location and the type of faults before occurring and by using CAN bus transmitted to the control center from wind turbines and then an SMS is sent from the GPRS module to the technical person to resolve the fault.

The fault occurrence in the wind turbine is only due to the severe condition and the identity of large electromechanical system. So the wind parameters should be monitored for fault diagnosis. The serial communication protocol provides high data transmission rate and reliability. Hence in the proposed work, the design of a remote monitoring and fault diagnosis system in wind turbine based on CAN is proposed. Finally, observed that the System performance is effective and more reliable.

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