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Can Interfaced With Arm to Maintain a Regular Surveillance of Wind Turbine

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ABSTRACT: Wind energy is the most widely used natural resource for the production of electrical energy. Presently wind energy is used to reduce the emission of carbon dioxide. During the transmission of data from one node to another, node disturbance occurs. To avoid these disturbances, to monitor and to detect the fault, CAN protocol is used. CAN is a Message based protocol designed especially for Automotive, later Aerospace, Industrial automation and Medical equipment's. CAN interface module is used to communicate the monitored parameters between the wind turbine and the control centre. Earlier, the vibration analysis, vibration signals produced by the rotating components, temperature is sensed and turning on the cooling fan automatically, slow down the blade speed to overcome the damage in Wind Turbine's whose current health conditions need to be diagnosed are commonly analyzed either by broad band based methods or spectral line analysis methods. In our paper we declare the system with ARM and CAN protocol to monitor and diagnose the problems in the wind turbine application. The project deals with the data transmission between two units in the exact time without any disturbance. The data transmission time is increased with the CAN protocol. ARM core1 runs with CAN and wind turbine unit to which sensors are connected and ARM core2 as Fault diagnose and monitoring section. Data acquisition node collects the sensor data through CAN protocol. The basic view of this technique is to reduce the fault occurrence and increase the monitoring of wind turbine.

KEYWORDS: Wind turbine, ARM processor, monitoring parameters, Controller Area Network, Fault Diagnosis.

I. INTRODUCTION

Wind turbine is a rotating mechanical device that converts wind energy into mechanical energy resulting in the production of electricity. 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. 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 display then and there, this will help to reduce the fault occurance through regular monitoring. 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.

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II. RELATED WORK

The most common faults that can occur within the system and the current methodology for the inspection:

a) Negative sequence over current fault Protection

Rotor thermal protection of directly connected wind turbines is provided through monitoring of negative esequence current, which is a significant contributor to the rotor heating to ensure it does not increase above the generator's capability limits The scheme provides a negative sequence over current element that can be configured to trip instantaneous upon reaching predefined levels of negative sequence current or have delayed tripping.

b) Abnormal voltage fault Protection

Over voltage and under voltage elements are provided to ensure that the generator is providing power at nominal voltage levels as well as to isolate the generator when system instabilities are causing the abnormal voltages to be induced upon the generator

c) Voltage unbalance fault Protection

The scheme has a definite time voltage unbalance function, operating on the ratio between negative and positive sequence voltage. The voltage unbalance elements can be used to protect directly connected turbines from excessive unbalance voltage and associated unbalanced currents that lead to damaging rotor heating. For electronically
regulated wind turbines, the voltage unbalance element can act as back up protection for malfunctioning voltage regulators in the turbine.

d) Over current fault Protection

Instantaneous and time over current functions are available for phase neutral, ground and negative sequence currents. The phase time over current elements have a voltage restrained feature that when enabled can be used for providing more sensitivity under conditions that cause the measured voltage to drop to below nominal levels.

e) Directional current fault Protection

Directional elements are provided to detect the direction of current flow and supervise or block the operation of overcurrent elements thereby allowing for proper coordination between internal and external faults. Directional over current elements are available for phase, neutral and ground currents.

f) Reverse Power fault Protection

The directional power element detect srevere power conditions on directly connected wind turbines thereby preventing cases of generator motoring and associated turbine damage. Two levelsof settings are available providing differentiation between low forward power and reverse power conditions.

Problem Statement:

The system is automatically monitored and it avoids the automatic power off system and also gives indication before any weather condition is changed to the control section using ARM LPC2148 microprocessor. In our paper we declare the system with ARM and CAN protocol to monitor and diagnose the problems in the wind turbine application. The project deals with the data transmission between two units in the exact time without any disturbance. The data transmission time is increased with the CAN protocol. ARM core1 runs with CAN and LPC2148 as wind turbine unit to which sensors are connected and ARM core2 as Fault diagnose and monitoring section. Data acquisition node collects the sensor data through CAN protocol. The basic view of this technique is to reduce the possibility of fault diagnosis and increase the monitoring of wind turbine.

III. SYSTEM HARDWARE DESIGN

The system consists of ARM7, CAN controller, and parameters of wind turbine. The block diagram of processing module is shown in Fig1.CAN controller is used to communicate between the wind turbine and the database. Memory module is also provided for future references.

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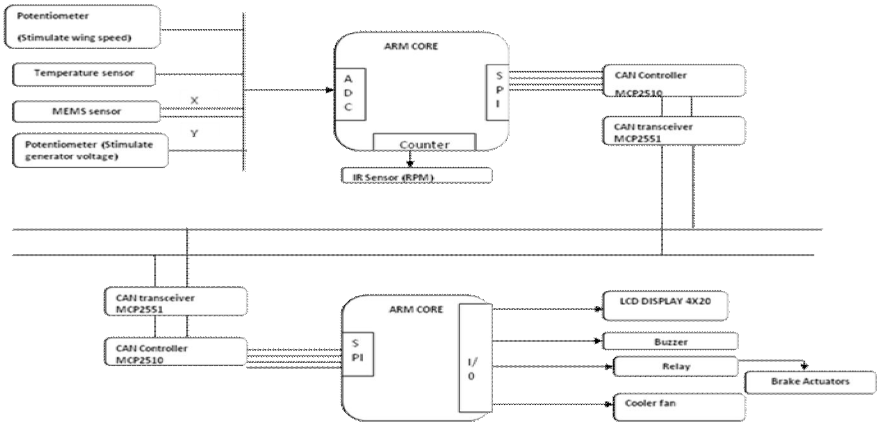

Fig1. System Design Of Wind Turbine Monitoring And Fault Diagnosing

IV. CAN INTERFACE MODULE

A CAN bus automotive electronic control system, each controller through the CAN bus interconnected together to exchange information (such as temperature, rpm, vibration etc).This mutual connection to the benefits of the sensor signal can be used for many controllers at the same time, and all controllers have the same information. The other hand, this connection can be increased throughout the system the new node, the development of updated features, and lower system cost. Electronic automotive instrument cluster node can fully reflect the car factor, product design and technical standards. Intelligent sensor nodes to accurately receive various types of sensor signals, at the same time to eliminate interference signals. Auto clock node for the entire system to provide the clock information.

Node Design:

Each CAN node by the power supply circuit, a microcontroller, CAN controller, CAN transceiver (CANController Interface), the watchdog reset circuit and peripheral circuits and other system hardware block diagram (electronic automotive instrument cluster nodes, for example) shown in Fig 2.

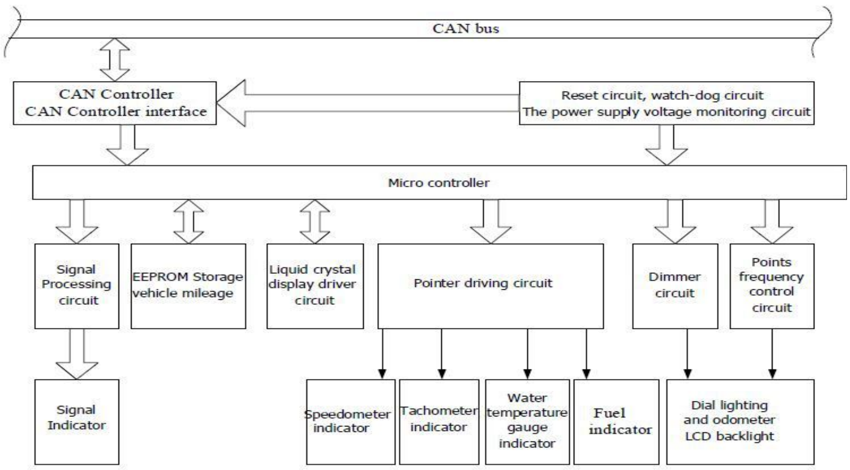

Fig2.Electronic Automotive Instrument Cluster Nodes

CAN interface module is used to communicate the monitored parameters between the wind turbine and the Control centre. The CAN interface module consists of three components CAN Transceiver (MCP 2551), CAN Controller (MCP

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2510), ARM LPC2148. The MCP2551 is a high-speed CAN, fault-tolerantdevice that serves as the interface between a CAN protocol controller and the physical bus. The MCP2551 provides differential transmit and receive capability for the CAN protocol controller. It will operate at speeds of up to 1 Mb/s.CAN transceiver is required to shift the voltage levels of the microcontroller to those appropriate for the CAN bus. This will help to create the differential signal CAN High and CAN Low which are needed in CAN bus. This device must be able to withstand voltage tolerance which may be caused by noise pickup.Temperature sensor used here is Transformer probe which is used to monitor in low voltage transformer's windings. MEMS DC accelerometer is used to measure static, as well as dynamic acceleration. The DC-response device, it can handle static acceleration and produce accurate velocity and displacement data.

V. SOFTWARE REQUIREMENTS

Software and language used for programming the ARM microprocessor are shown below. The circuit design can be simulated using the Orcad software for the corresponding signal response of wind turbine.

Keil Ide:
We use KEIL µ vision3 software for programming the LPC2148 microprocessor. The software solves the complex problems facing embedded software developers. While starting a new project, first we have to select the microprocessor, that we are going to use for our project from the device database and the µ Vision IDE sets all compiler, assembler, linker, and memory options.

Flash Magic:
Flash Magic is a PC tool for programming Flash based microcontrollers/microprocessors from NXP using a serial or Ethernet Protocol while in target hardware. The use of flash magic is to download the .hex file to the ARM processor.

Proteus:
Proteus Design Suite (also known as Proteus VSM or Proteus [version number]) is a powerful electronic design application, available from Labcenter Electronics. It offers a range of design features including: Schematic capture,Mixed-mode (analogue and digital circuit) electronic circuit simulation,Microprocessor / microcontroller simulation,PCB design with manual and autorouter options Graph-based simulation. Proteus 8 is one of the must tools for Circuit designing and simulation which includes:

Application Framework – Single integrated application with ISIS, ARES and 3D Viewer appearing as tabbed modules. Switch between tabs on a single monitor (e.g. laptop) or drag and drop tabs to view in separate windows.
Common Parts Database – Unified database of all parts and elements in the current project. Enables automatic updating of data between Proteus modules (e.g. Schematic and PCB).
Live Netlisting – A live netlist is now maintained and accessible throughout the system. Enables changes on the schematic to be reflected across PCB, BOM and Design Explorer in real time.
3D Viewer – Now supports DirectX (as well as OpenGL) and runs multithreaded. Includes live update mechanism so changes made in ARES are reflected in the 3D Viewer.
*Bill of Material*s – Completely new BOM module with PDF, HTML and Excel output. New Property Editor grid allowing you to easily add data to the report.
VSM Studio – Integrated IDE for Proteus VSM simulation and debugging. Automatically sets up compilers and debugs target firmware.
Installation Steps:
Run the installer and install Proteus 8 Software. When you are asked for a license, use the file "LICENCE" and install it. After the installation of proteus do not run/start the software.
Copy the folder "BIN", paste in the following path and replace/overwrite:"C: \ Program Files \ Labcenter Electronics \ Proteus 8 Professional" Copy the folder "MODELS" and paste in the following path according to your windows:Windows XP:
C: \ Documents and Settings \ All Users \ Application Data \ Labcenter Electronics \ Proteus 8 ProfessionalWindows 7/8: C: \ ProgramData \ Labcenter Electronics \ Proteus 8 Professional

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VI. RESULT AND CONCLUSION

The location and the type of faults are analysed before they occurand are transmitted from wind turbine to the control center through CAN bus. The fault identification is done using ARM and the parameters are measured through the CAN interface module.The CAN protocol which is used for serial communication provides high data transmission rate and reliability. ARM gives the output of parameter

Measurement such as rpm, vibration and temperature. The effect of harsh condition and the nature of large electromechanical system are the causes of fault to be occurred in the wind turbine. It is very important perform the monitoring and fault diagnosis of wind turbine parameters. Therefore, here is designed of a remote monitoring and fault diagnosis system based on CAN and the ARM is sent regarding the location and the type of fault is proposed. Finally the performance and the efficiency is effective and reliable.

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BIOGRAPHY

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