DESIGNING OF EMBEDDED SYSTEM TO MONITOR A WIND TURBINE

T. Karpoora Eswari[1], R. Karpaga Priya[2]

[1,2] *PG Scholar, Raja College of Engineering and Technology, Madurai, Tamilnadu, (India),*

ABSTRACT

Wind Turbines are one of the fastest growing renewable energy sources of power production in the world today and there is a constant need to reduce the costs of operating and maintaining them. Condition monitoring various parts is commonly employed for the detection of faults/failures. Maintenance of the wind turbine is required to make sure that the components continue to perform the functions for which they were designed. Condition monitoring systems comprise combinations of sensors that provide continuous indications of components in the wind turbine including vibration analysis, oil analysis, temperature measurement, speed measurement. This measured parameters are controlled and monitored by the user through the GSM module. They are used to monitor the status of critical operating major components such as the blades, gearbox, generator, main bearings and tower of the blades.

In case of any fault occurrence like Temperature hike it is identified easily and immediately a comment will be sent from the control room to Wind turbine and the cooler will be switched on to reduce the temperature. If there is higher vibration immediately Turbine will be shut down and manual operation will be conducted to recover that fault. If there is lesser lubrication the auto lubrication process is implemented. The DC motor will be switched on automatically which pumps the oil and fills the lubricant in appropriate parts of the Wind turbine. The speed measurement is very useful parameter depend upon the speed the wind farm is fixed in particular direction to produce the maximum power.

Keywords: Gear box, GSM, Wind Turbine

I.INTRODUCTION

The world produces carbon dioxide that is released to the earth's atmosphere. This increased content of Carbon Dioxide increases the warmth of our planet. To reduce the global warming effect the alternative energy sources are used. A wind power is one of the renewable energy source. The Wind Turbine blast is identified as a major problem against green energy. It is not only the threatening factor for the people but also causes dangerous hazard for human life. Condition monitoring is a tool commonly employed for the early detection of faults/failures so as to minimize downtime and maximize productivity. Wind energy is now more affordable, more available, and pollution-free .There is a constant need to reduce the costs of operating and maintaining them. To overcome this problem and to

increase the green energy, a simple system is introduced to monitor and prevent the fault occurrence in Small Wind Turbine.

II. RELATED WORK

Wind turbine condition monitoring systems collect data from the main components of a wind turbine such as the generator, the gearbox, the main bearing, the shaft, and the yaw system. The purpose of this data-gathering is to minimize downtime and maintenance costs while increasing energy availability and the lifetime service of wind turbine components. As renewable energies have gained dramatically increasing attention from industries and academia, a great deal of new research has been reported with regard to condition monitoring and fault diagnosis. The drawbacks of the existing system like limited wireless access, consider the critical components only, usage of SCADA system and knowledge of it required, manual operation to measure the parameter. To overcome this drawbacks the proposed system is designed.

III. PROPOSED SYSTEM

The core objectives of this proposed management of small wind turbine system are to detect the present health condition of the machine, to prevent catastrophic failures caused by the various components of the wind farm, to improve the power quality before the problem is corrected, to predict the severity level of fault, and to estimate the useful life of the machine. The use of this type of health monitoring system helps to reduce the failure frequency and amount of downtime, maximize the utilization of the wind turbine, and minimize the maintenance overhead and cost due to production lost. Moreover, under the wireless sensor network system, there is no need to install wiring for data collecting and monitoring, thus eliminating the cost of installation and maintenance that would be required by communication cables. The overall performance and reliability of the wind form is improved dramatically**.**

IV. BLOCK DIAGRAM AND DESCRIPTION OF THE PROPOSED SYSTEM

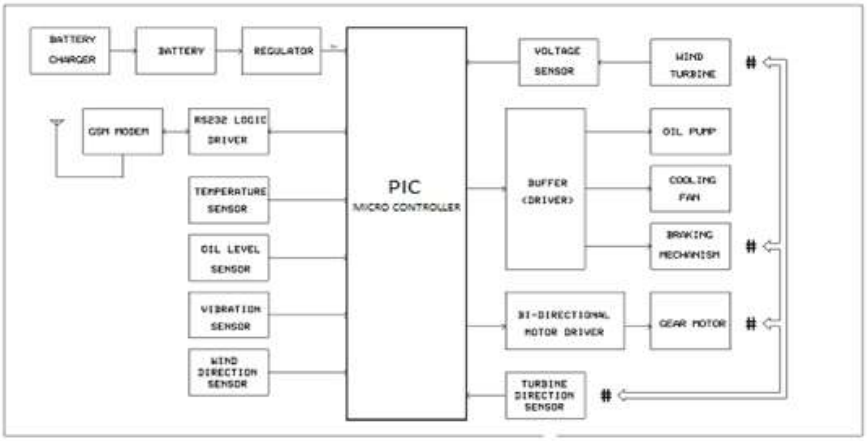

Fig 1 Block diagram of Transmitter section

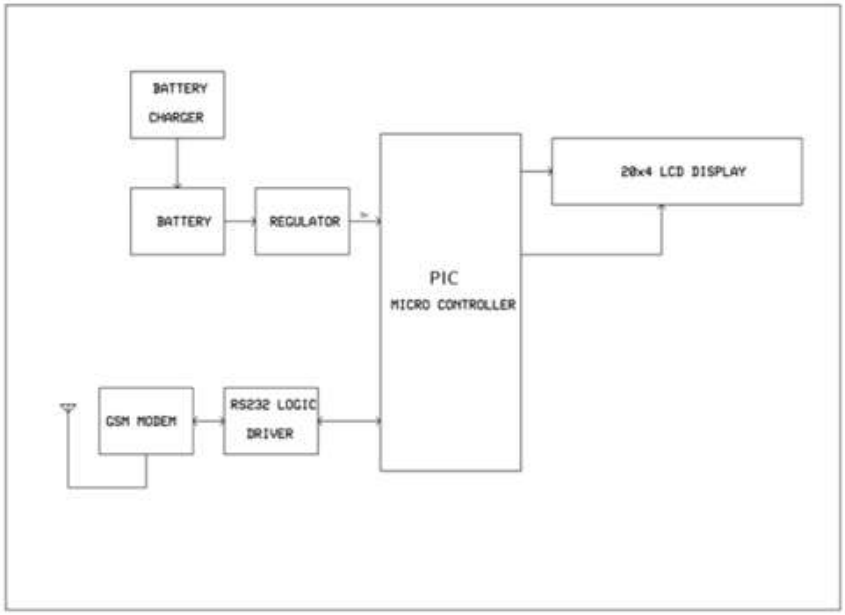

Fig 2 Block diagram of Receiver section

In the transmitter section consists of the combination of the sensor which are temperature sensor, oil level sensor, vibration sensor which are used to monitor the various components of the wind farm. These sensors are connected to the microcontroller. This microcontroller is the main execution part of the system. It collects all the sensors values simultaneously. This sensor values are serially transmitted by the controller with the help of GSM module. The GSM module is driven by RS232 logic driver. It is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The function of MAX232 is to communicate the data signal between microcontroller and GSM modem. The oil pump, cooling fan, braking mechanism are connected to the controller to take the appropriate action in the critical situation to provide the complete protection to the system.

In the receiver section microcontroller receives the parameter values through GSM module and diaplay the values in the display unit. With the help of the values necessary feedback action is accomplished. Because of this incessant wireless monitoring the falut/failure of the the components is identified before turn out the treacherous hazards. The productivity and overll system relaiabilty is increased.

V. RESULT AND DISCUSSSION

The transmitter sections consist of combination of sensors and monitor the parameters like temperature, oil level, wind direction, vibration. This sensor values is continuously monitored and serially transmitted through gsm module. This serial transmission is shown through hyper terminal in the simulation tool. When temperature is high to reduce the temperature the cooling fan is on. When the vibration is high to save the wind farm the wings rotation is stopped. When the oil level is low to inject the oil for proper operation the oil pump is on and inject the oil for

lubrication. Three motors are shown in the simulation result and explain the operation of above. This simulation model shown in the below fig.

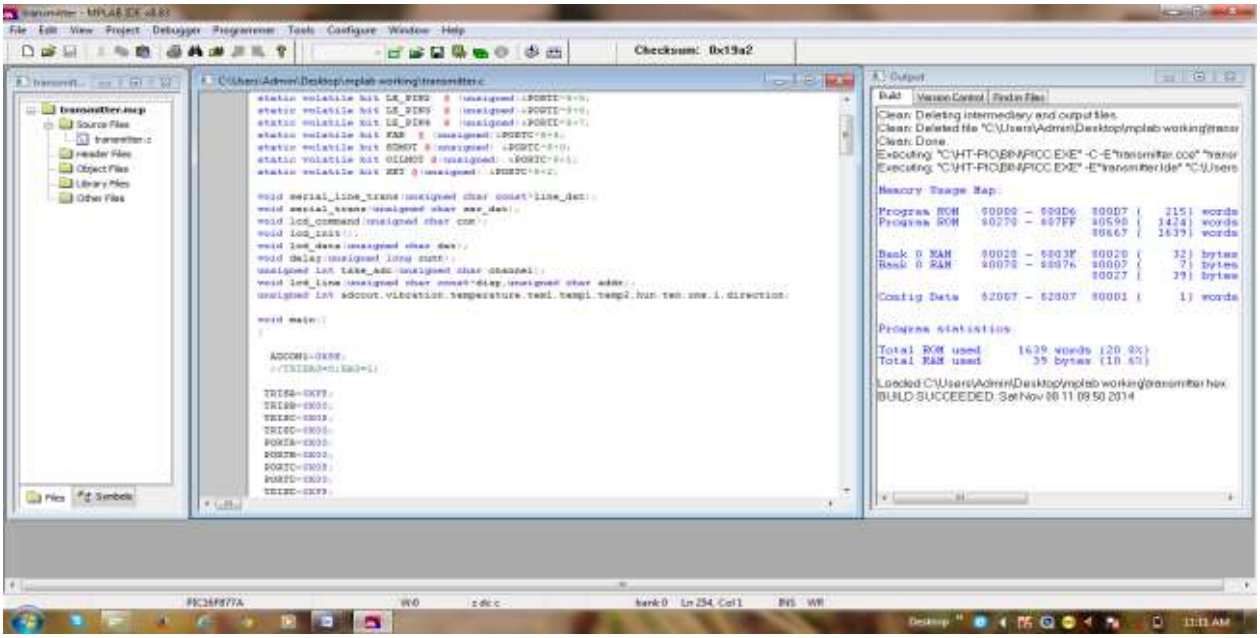

Fig 3 Transmitter code execution, target creation and hex file creation in MPLAB simulation tool

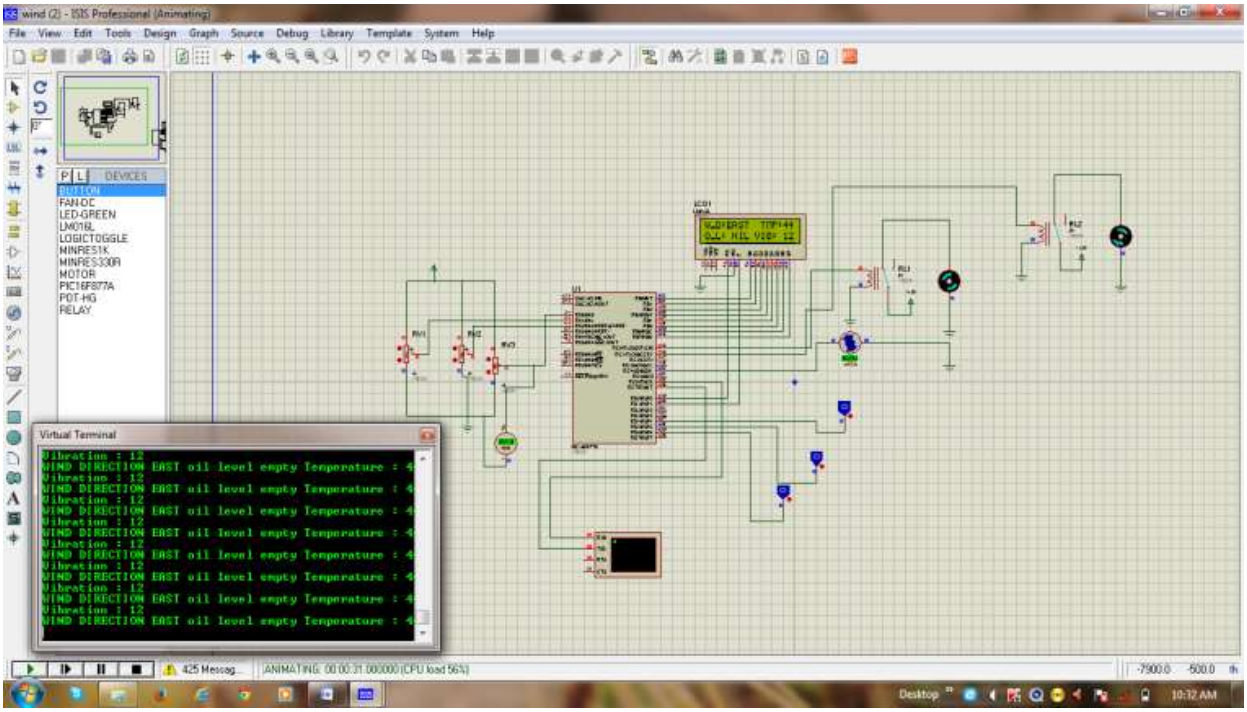

Fig 4 Proteus simulation model of the transmitter section.

Receiver section is serially received the parameter values and display the values in LCD. This simulation model is shown in the below fig.

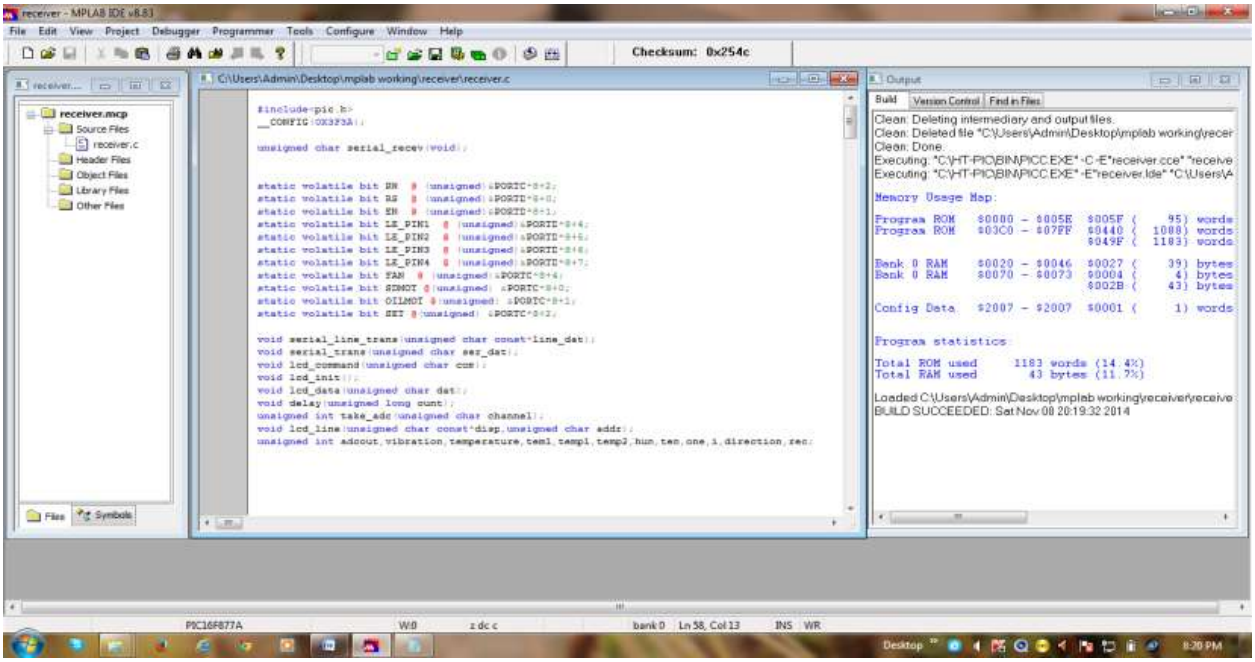

Fig 5 Receiver code execution, target creation and hex file creation in MPLAB Simulation tool.

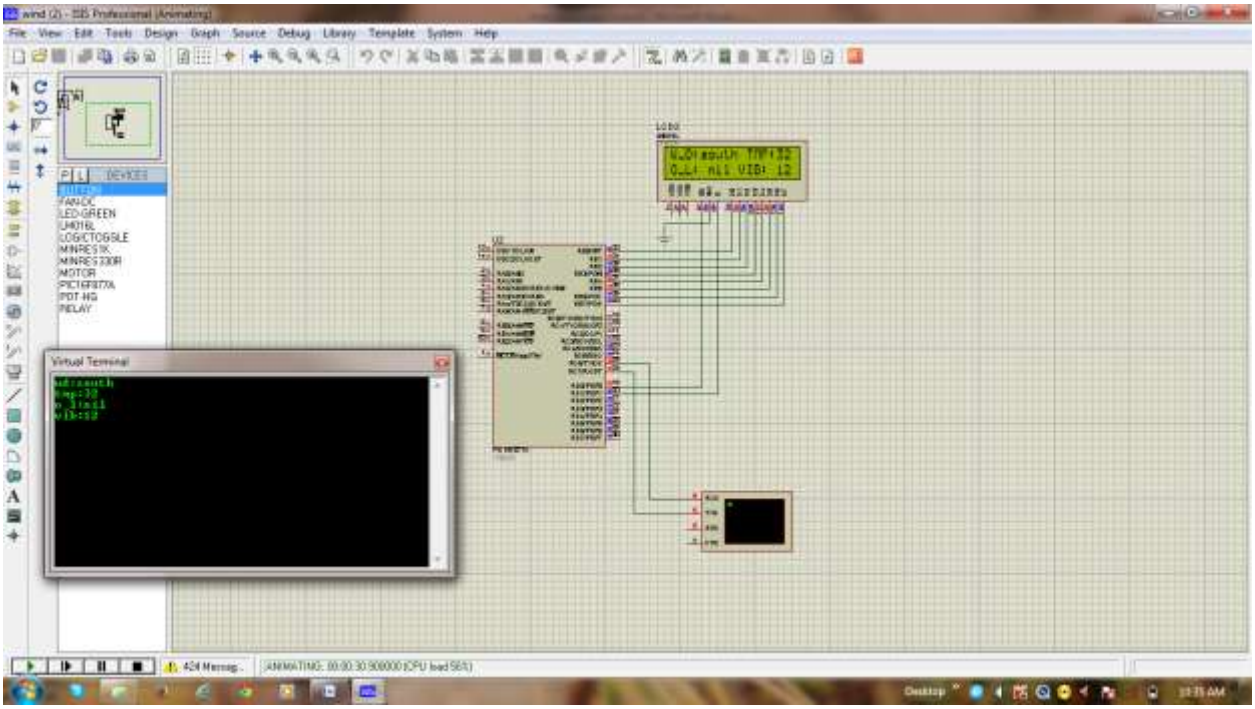

Fig 6 Proteus simulation model of the receiver section

VI. ADVANTAGE AND APPLICATION

- Condition based monitoring is a reliable and cost-effective approach in maintaining and running expensive equipment and machines.
- This system is simple, convenient, time saving and high security system for Wind Turbine.
- Because of the immediate decision making and interface provides an instant diagnosis based on limits provided by the user which is also used to lock and release the wind turbine acting directly on hardware.
- The focus of this project is to develop a system effective and robust, easy operation and mainly low cost which permits to manage the vibration indicators and temperature elevation to maximize the life of turbines contributing to the increase of reliability and improve power quality.
- The permanent plant protection and efficiency of the whole system is increased dramatically.
- Various sensors are used to monitor the wind turbine functions, it may be implemented to various fields like industry, hospital, agriculture and anywhere at which wireless monitoring is required.

VII. CONCLUSIOM AND FUTUREWORK

A wind turbine consists of thousands of components and one of the most serious problems in wind turbines is the possibility of mechanical failure caused by various rotating parts of gears and generators. The machine health management system is a very important tool in wind turbines. The Wind Turbine blast is identified as a major problem against green energy. It is not only the threatening factor for the people but also causes dangerous hazard for human life. To avoid this hazards, this proposed system is valuable. The proposed system enables the monitoring and prevention of higher vibration, rise in temperature, higher speed as well as lesser lubrication of the Wind Turbine using the developed methodology to avoid blasting hazard. The software proposed a friendly graphical interface, assisting in making Decision to avoid catastrophic failures. The Wireless communication enables the remote controlling system of all these parameters from control room. The purpose of this system can be applied to many areas of the industry applications which provide the high security to protect the wind turbine.

To make the software even more versatile, were embedded storage functions and data query historical that allows monitoring of the evolution of failures allowing the application of technical maintenance, which facilitate the programming stops reducing costs operational, and other advantages.

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