



SCADA Integrated With Mobile Phone for Wind Mill Monitoring System

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ABSTRACT: Efficiency of any wind farm relies on wireless control strategies. In this project, a modern approach for interconnecting the windmill system with the mobile phones to enable monitoring of windmill operation through mobile phones is proposed. In this project the access to the windmill system is established by connecting a micro controller with SCADA system using RS232 cable. A mobile phone is also connected with the system through modem to send and receive messages. The operating status and the operational parameters of wind mill can be known through the messaging system. This system includes only some microprocessors, microcontrollers, ICs, modem and communication wires.

KEYWORDS: SCADA, transceiver, 8051, remote control, mobile phone, wind mill

I.INTRODUCTION

As concerns over the global warming continue to grow, green technologies are becoming increasingly popular. In India especially in Tamil Nadu wind power is the major renewable energy source. Wind farms provide an excellent alternative to burning of fossil fuel by harnessing kinetic energy from wind and converting into electricity. A typical wind farm may include over 80 wind turbines. So an efficient and reliable network becomes mandatory to manage and monitor these installations.

Each windmill includes a generator and a variety of serial components such as high voltage transformer, ultrasonic wind sensors, yaw gear, blade bearing, pitch cylinder and hub controller. All these components are controlled and monitored by SCADA system.

Mobile phones become an essential thing now a day. Usage of mobile phone is also easy to everyone. Like in any modern power systems, the Supervisory control and Data Acquisition (SCADA) system plays an important role in wind farms. The main task of SCADA system includes data collection and processing, alarm processing, remote control etc. In this paper connection of mobile phone with SCADA system through a transceiver circuit is discussed. The main purpose of the transceiver circuit is to send and receive message between SCADA system and mobile phone. This transceiver circuit includes 8051 microcontrollers, EPROM, Power supply arrangement, Modem, Antenna and some ICs.

II.RELATED WORK

For this we referred an IEEE paper titled 'Quality of optical channels in wireless SCADA for offshore wind farms' by Xian Liu ., IEEE Transaction Smart Grid , Vol 3, No 1, March 2012. In this paper , the performance of Wireless optical communication in the windmill is discussed. Communication between system of the windmill and remote device is established using optical channels. Instead of optical signals SMS can be used.

We also referred another one paper named 'Microcontroller based remote monitoring using mobile through spoken commands' by Naresh P Jawarkar, Siddharth A Ladhake, Vasif Ahmed, Rajesh D Thakare., journal of networks Vol 3, No 2, February 2008. A system is developed to remotely monitor process through spoken commands using mobile. A

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text message is generated and sent to control system mobile in the form of SMS. On the receipt of SMS, control system mobile informs microcontroller based card, which performs specific task

III.EXISTING SYSTEM

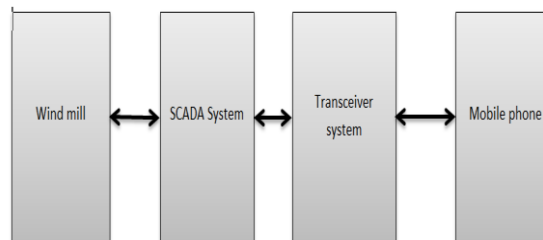
In an existing system the entire operation of windmill is monitored by a SCADA system. This SCADA system brings the information to the control room. This SCADA system employs a number of sensors to sense each part of the windmill. These sensors sense the parameter from windmill in the form of analog signal. These analog signals are then fetched to the analog to digital converter circuit. The produced digital signal from the A/D converter is then sent to SCADA system. These signals are analyzed and can be monitored in the SCADA system. The main drawbacks of the existing system are

- Difficult to get the operating status
- More manpower needed
- Difficulty in determining the faults in the windmill at quick phase

In this project a mobile phone is integrated with the SCADA system of the windmill via a transceiver circuit. This arrangement enables the authorized users to monitor the windmill globally from any part of the world.

IV.PROPOSED SYSTEM

Normally windmill is monitored by a SCADA system. To achieve the goal of remote monitoring through mobile, a mobile phone is connected with a SCADA system which monitors the entire operation of the windmill.



In ordinary wind mill we can get the information from the SCADA system. In this proposed system a transceiver system is introduced after the SCADA system through which the mobile is attached with the system.

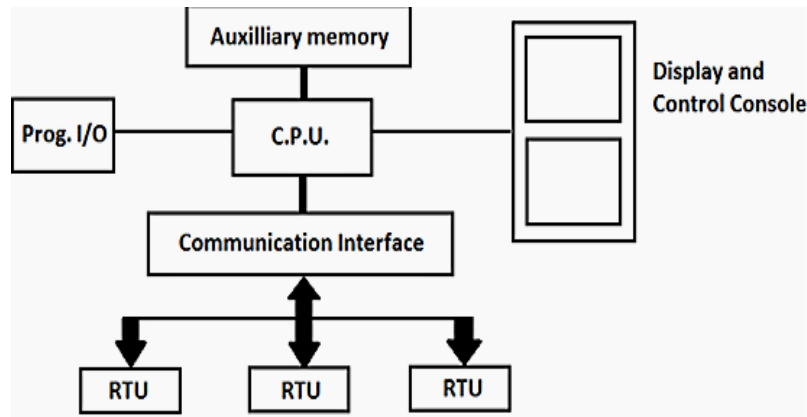
V.SCADA SYSTEM

SCADA system operates through communication that takes place on the communication channels to provide control any equipment at the remote distance. A SCADA system normally consists of many subsystems. Remote Terminal Units is a major part of SCADA system. It converts sensor signals to digital data. Programmable logic Controllers (PLC) has been used instead of RTUs at some places since they are economical. Versatile and also flexible. These RTUs and PLCs are connected with control centres by a telemetry system. The control actions are done by the RTUs and PLCs automatically whenever any abnormal conditions occur. SCADA system normally implements a distributed database, generally referred to as a tag database. It contains data elements called tags or points. RTU is a microprocessor controlled device. It acts as an interface between the objects in the real world to a distributed control system. SCADA performs the following functions. Real world system has thousands of components and sensors. So collecting the information from all these sensors is very important. Normal SCADA system uses wired network to communicate between user and devices. Sensors and relays cannot communicate with each other. So RTUs are used to make communication between them as well as between the sensors and system. SCADA system provides onboard mechanical and graphical data. It can be expanded easily.

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VLSMS COMMUNICATION

Number mobile phone users are increasing rapidly. Due to widespread growth of cellular network and drastic reduction in call rates and lower-end handsets, mobile usage has percolated all sections of society. Any mobile having messaging facility and capability support common AT commands can be used in this system. SMS is stored way of transmitting messages to and from mobiles. Each short message should not be longer than 160 characters (text / binary). Since SMS uses signaling channels, these messages can be sent/ received simultaneously with voice/fax/ data services over GSM network. The major advantage of using SMS is provision of intimation to the sender when SMS is delivered at the destination and ability of SMSC to continue efforts for delivery of message for the specified validity period if network is presently busy or called user is outside the coverage area.

A system is developed for remote monitoring and control of wind mill. The system offers several attractive features like –

- Control from anywhere in the world if cellular coverage is available
- Acknowledgement about execution of command from system to user
- Uses SMS for user control
- Alerts user on occurrence of any abnormal conditions like power failure, parameters exceeding prescribed limits ,etc.,
- Ease of implementation and cost effective approach

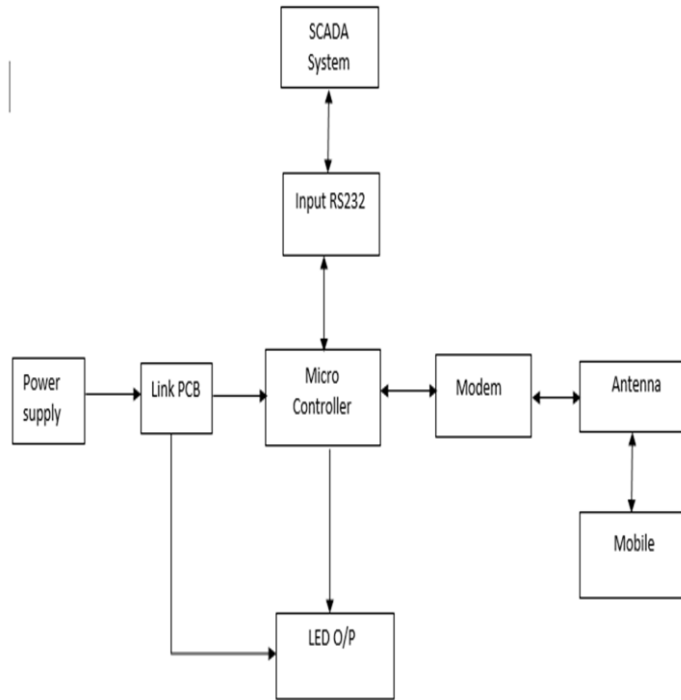
VILBLOCK DIAGRAM OF THE TRANSCEIVER SYSTEM

A transceiver system which connects the mobile phone with the SCADA system is shown below. In this system we have used a microcontroller which acts as the main part required to connect with the modem . This modem sends and receives the signals from mobile phone and sends to the microcontroller.

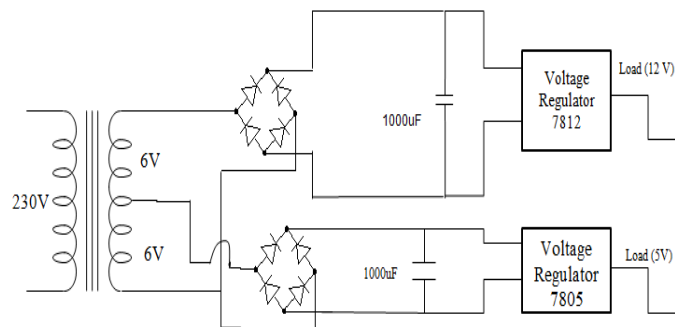
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A) Power Supply Unit



First the 230v ac supply is converted into 12v ac without changing its frequency using a 230/12v center tapped step down transformer. This 12v ac is converted into equivalent dc voltage using a bridge rectifier. Similarly a 6v is got from the center tapped transformer and is rectified by the bridge rectifier to get dc voltage of equivalent magnitude. Practically we cannot get the exact input voltage magnitude as output so we have introduced a voltage regulator. This voltage regulator maintains the output at a constant value even though the input to the voltage regulator varies. This constant output voltage from the regulator ICs can be given to the devices like microcontrollers, LCD display, LED display and other ICs based on their requirement.

B) RS232

In telecommunications, RS-232 is a standard for serial communication transmission of data. It formally defines the signals connecting between a DTE (data terminal equipment) such as a computer terminal, and a DCE (data circuit-

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terminating equipment, originally defined as data communication equipment), such as a modem. The RS-232 standard is commonly used in computerserial ports. The standard defines the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pinout of connectors.

C) 8051 microcontroller

The most popular general purpose microcontrollers in use today are Intel 8051 microcontroller. The Intel 8051 is an 8-bit microcontroller which means that most available operations are limited to 8 bits. There are 3 basic "sizes" of the 8051: Short, Standard, and Extended. The Short and Standard chips are often available in DIP (dual in-line package) form, but the Extended 8051 models often have a different form factor, and are not "drop-in compatible". All these things are called 8051 because they can all be programmed using 8051 assembly language.

D) Features of 8051

- 4 KB on chip program memory.
- 128 bytes on chip data memory(RAM)
- 4 register banks.
- 128 user defined software flags.
- 8-bit data bus
- 16-bit address bus
- 16 bit timers (usually 2, but may have more, or less).
- 3 internal and 2 external interrupts.
- Bit as well as byte addressable RAM area of 16 bytes.
- Four 8-bit ports, (short models have two 8-bit ports).
- 16-bit program counter and data pointer.
- 1 Microsecond instruction cycle with 12 MHz Crystal

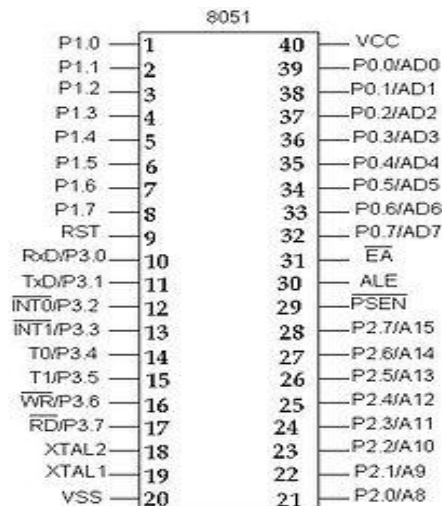


Figure 1:8051 Pin diagram

VIII.WORKING OF THE SYSTEM

Every data regarding the wind mill is collected by the SCADA system. This SCADA system is connected with the microcontroller unit through the IC MAX232. We have used two microcontrollers in the proposed system. These microcontrollers are also connected with the mobile device through modem and antenna arrangement. Apart from these the microcontroller is also connected with an EPROM. We have used a GSM modem which can be mainly used for

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messaging purpose. This modem can accommodate any SIM like Aircel, Airtel, BSNL etc.,. Whenever a message is received by the microcontroller from any mobile, First it will check the mobile number whether the mobile number has the permission to access the SCADA system. The mobile numbers which can access the SCADA system has been stored in the EPROM. If the number has the permission to access the system only then the received SMS will be analyzed. According to the received SMS signals will be generated and will be sent to the SCADA system. Based on the received signal SCADA system reacts.

IX. HARDWARE MODEL

The original proposed system was done and the model is shown below. For the better understanding of the system we have connected a model wind mill. As per the block diagram of the transceiver system connections has been made. A prototype model of SCADA system has been connected with the transceiver system which has stored some predefined values.



X .EXPERIMENTAL RESULTS

The system has been connected according to the block diagram. Some predetermined values regarding the parameters of windmill such as grid voltage, frequency, generating voltage etc, have been stored in the SCADA system. Using the authorized mobile, the stored values from the SCADA system was retrieved successfully by giving recognized commands via SMS. Some fault have been generated in the prototype model and checked for the fault messages generated by the system.

Command	Received Information
WIND COND	Generating voltage ,Frequency, Power, Gear position
WIND GRID	Grid voltage, frequency
WIND STOP	Stopping messages
WIND DDST	Acknowledgement messages For starting
(During Fault)	Fault messages

Table 1: Result description



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Sent SMS	Received SMS
WIND COND	FREE WHEELING ..G2 0 0 0 0 0 0 S- 0,0R-0/0000 Z- 50.1 HB- OT- OB -298C -000000 Y-2 72 R 212V 0A S 213V 0A T 215V 0A W- O
WIND GRID	GRID Details are R 212 v 0A 0KW S 213V 0A 0 KW T 215 V 0A 49.9 HZ COS PHI 1.00
WIND STOP	STOP COMMAND issued
WIND DDST	Safe! Control room is closed
(During Fault)	INTERFERNCE/POWER FAILURE

Table 2: Experimental result

For the command 'WIND COND' we get information like generating voltages of three phases, generated power, oil temperature etc.,. Similarly we get the grid condition through the command 'WIND GRID'. 'WIND DDST' command is used to manually turn on the wind mill. The wind mill can be turned off manually through the command 'WIND STOP'.

XI.CONCLUSION

A SCADA system integrated with mobile phone for windmill monitoring system has been proposed. It enables the authorized users to monitor the windmill from remote distance. Since the project deals with remote monitoring it drastically reduces the man power needed and also the charges incurred due to maintenance when compared to conventional monitoring methods. Whenever any faults occur in the windmill, a message will be sent to the authorized mobile immediately. This leads to reassessment and readjustment of repair time thus reducing the mean time to receive the attention of the workers. It also leads to efficient usage of labours at all circumstances. This project is well secure since only the authorized personnel can access the system. The authorization can be modified by changing the stored mobile number in the EPROM. This project holds well where SCADA system has been employed for monitoring in any generating plants. This system can also be extended in the form of android application.

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