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RTU Based Power Station Equipments Condition Reporting System

Rahatullah Khan[1], A.V.Sakhare[2]
M.E (ESC), CSE Department, G.H.Raisoni College of Engg, M.S, INDIA1[1],
Asst.Professor, CSE Department, G.H.Raisoni College of Engg, M.S, INDIA[2],
rahat600@gmail.com1,apekshasakhare@raisonimail.net2

Abstract:- In this present approach, a dedicated microcontroller based hardware unit (DHU) has been developed to continuously measure the parameters of the power plant such as voltage, current, speed of turbine, vibration, pressure, temperature ,carbon monoxide, LPG and other gasses of the different unit of the power plant. There are some system which needs continuous monitoring to keep plant in healthy condition. In this monitoring system each equipment is connected to microcontroller which is also connected to a Global System for Mobile Communication (GSM) modem. The preliminary level of fault or abnormality in operation of each component is diagnosed by the microcontroller and the fault or abnormalities details are reported to the pre-assigned operator through an SMS service. In extreme case, the plant gets automatically gets shut down, and if any operator or concerned person can handle the situation by just sending the SMS through his cell phone.

Index Terms: GSM, Microcontroller, SMS service.

1. INTRODUCTION

Now-a-days, wireless and mobile communication is becoming the major tool that can be used to provide the information to the operator or concerned authority for their supervisory control. The present approach has been made to apply the advantages of wireless communication and embedded technology towards power plant and substation equipments condition monitoring and abnormality detection and reporting. This work describes the development of a supervisory automated reporting system for remote condition based monitoring and primary level control of different equipments to enhance the overall power station performance.

Electrical equipments including turbine, boiler, transformer installed in different locations in a power system, are needed to be monitored and controlled for healthy operation and smooth running for the power plant. The convergence of wireless communication technology and the embedded controller technology with the different transducers makes these supervisory systems more reliable, flexible, and much efficient as well as cost effective than wire line deployment.

Among different parameters of alternator, monitoring of output voltage, load current, temperature of boiler, turbine speed etc. are most important for early detection of any incipient fault. Speed and winding current estimation is helpful to determine the mechanical stresses like bearing failure or shaft failure, turn to turn short circuit, cracked/broken rotor. In this context real time condition monitoring and control has become an essential issue.

2. MATERIALS & METHODOLOGY

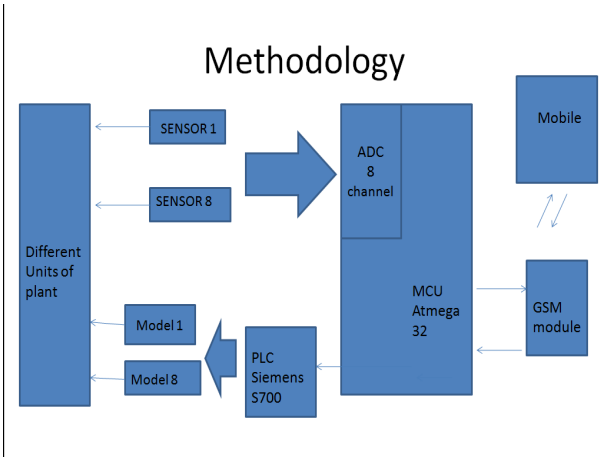

Fig 1. Block Diagram

In power station different equipment operating, each equipment is associated with a Dedicated Hardware Unit (DHU) is developed using PLC and microcontroller for monitoring the system parameters like instantaneous voltage, current, temperature, frequency and speed of alternator and transformer in a power plant for data acquisition to measure different parameters. All such units are interfaced with any remote mobile station through GSM technology. A preliminary level of abnormal running condition is detected by the DHU when the measured parameter exceeds beyond their set or limiting values. At this stage, the DHU generates a message and sends it to the pre-assigned operator in form of SMS through GSM modem. Realizing the criticalness of the SMS or in case of an emergency situation the operator/the

receiver of this SMS will be able to turn off this particular machine by sending another SMS from his/her mobile to that DHU. Hence the total work can be divided into two parts – where the development of microcontroller based DHU for different parameters measurement with some emergency control as first part and the development of GSM modem based SMS service system as second part.

2.1 Microcontroller for data Acquisition

In each DHU, the microcontroller is interfaced with different sensors like potential transformer (PT), current transformer (CT) or hall sensor (HS) used for current sensing, proximity sensor (PS), temperature sensor through proper hardware circuitry in order to measure the applied voltage, flow of current, speed and temperature of the alternator or transformer or any other equipments. The microcontroller is connected to the GSM Modem through the level converter MAX 232.
The firmware is designed in such a way that it is able to detect preliminary abnormal situations like over voltage, under voltage, over current, over load, short circuit current, over speed, overheating, single phasing etc. The fault or abnormal conditions are also classified into different levels or priorities. Depending upon the priority of the type of abnormal conditions the DHU decides its action. In case of highest priority abnormal conditions the machine will be isolated from supply. Once a fault of such kind is initiated, other than taking the preliminary action the DHU also dictates the GSM modem to communicate the abnormality along with its type, as occurred in the system, by generating a fault respective SMS.
On receiving the SMS, the person or the operator at Mobile unit and/or central control Station will take a decision and send it through an SMS. Any message received by the GSM modem will be sent to the microcontroller for its decoding and proper action.

2.2 GSM modem interfacing with microcontroller

The GSM modem (i-300 GSM Modem. It supports GSM 07.07, 07.05 and SIMCOM enhanced AT commands) is built with a COM port with RS232 protocol based interfacing facility. Hence the microcontroller is connected with the modem using 9600, N, 8, 1 protocol after the necessary hardware interfacing for proper TTL to RS 232 level conversion. As the modem works on AT command sets, following AT commands are to be sent to the modem in order to execute the SMS services.
First the microcontroller has to send "AT" command word. A response "ok" is returned from the GSM modem. The microcontroller sends another query by sending "AT+CPIN?" to get the PIN (Personal Identification Number).If the SIM card is ready for the use, the response "+CPIN: READY" is returned. After this, following AT commands are to be sent for the required SMS services.

For the configuration of the GSM modem in text mode of SMS the AT Command AT+CMGF = 1 is to be sent. In order to send the SMS, the desired mobile number is to be sent with "AT+CMGS=+91xxxxxxxxxx"AT Command. The desired message, containing a maximum of 160 characters, is to be constructed and to be sent to the modem. After then the ASCII code for 'CTRL+Z' character is also to be sent to the modem in order to transmit the message to mobile phone +91xxxxxxxxxx.
In a similar way, any message received by the GSM modem will be sent to the microcontroller for its decoding and proper action.

2.3 Cell phone or GSM modem at the control station

The Hand held Mobile station may be of any mobile unit who can roam around but still have the facility to monitor the status of the motor through SMS services with the corresponding DHU. In extreme case or for any emergency situations this station can stop the motor from its running through a return SMS. At the same time the operator at the central control station can be instructed for the due course of action based on the SMS from the DHU. The DHU can also send the same SMS to the central control station where a PC based monitoring, and reporting system is installed. On receiving the SMS from DHU or getting instruction from the hand held station the operator at the central control station performs the required task through a return SMS to the DHU. The PC software has the capability to store this communications for future analysis. A GSM modem is thus installed at the central control station in order to have the SMS communication with the
DHU and it is connected with the PC through its COM port. The SIM numbers of the hand held station as well as the central station must be pre-loaded to the DHU.

2.4 Parameters Measurements

Temperature
Motor speed
Voltage
Current
Pressure
Carbon monoxide
CNG
LPG

A website will develop for maintaining a data base. In data base the overall performance will be stored via dedicated GSM module. Whichever the changes happens in the model such as changing of temperature, RPM, voltage, current and pressure will be stored in data base. Whatever the command given from the master will also stored in data base.

3. CONCLUSION

The possible contribution of the project to bridge the gap between healthy and faulty mode of operations from a centralized control room. It is a humble approach to diagnose the machine running conditions with an intelligent program within a microcontroller based dedicated system.
The uniqueness of the proposed system is that the abnormal running conditions of electric equipments installed at different geographical locations in a plant are detected, diagnosed and reported to any mobile and /or central control station.

REFERENCES

[1] Sumana Chowdhuri,Jitendranath Bera "GSM based Condition Reporting System", 2012 Third International Conference on Emerging Applications of Information Technology (EAIT).

[2] P.Komeswarakul, "Remote Terminal Unit for Automatic Dam Monitoring System Using a Microcontroller" SICE Annual Conference 2011.

[3] Hong-Chan Chang, "Design and Implementation of Remote Terminal Unit for Feeder Automation System with High Performance Microcontroller" 978-1-4244-8756-1/11/$26.00_c 2011 IEEE.

[4] Syed Misbahuddin, "Fault Tolerant Remote Terminal Units (RTUs) in SCADA Systems" 978-1-4244-6622-1/10/$26.00 ©2010 IEEE.

[5] M. M. Ahmed, "Power Line Carrier (PLC) Based Communication System for Distribution Automation System" 2nd IEEE International Conference on Power and Energy (PECon 08), December 1-3, 2008, Johor Baharu, Malaysia.

[6] V.K.Chandna, "Innovation in the Design of RTU and Migration to IED"978-1-4244-1762-9/08/$25.00 02008 IEEE