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GSM Based Health Monitoring of Critical Equipments

Ramakrishna G[1], Shashidhar Kasthala[1], G.K.D. Prasanna Venkatesan[2]
[1]Indian Naval Academy, Ezhimala, Kerala, India
[2]SNS College of Engineering, Coimbatore, Tamilnadu, Kerala

ABSTRACT

Maintaining the continuity and reliability of critical equipments is of utmost importance. Failure of these critical equipments may incur huge financial losses due to non productivity and may also risk the life of the personnel working in the vicinity. These Critical equipments need to be continually monitored for initiating suitable preventive measures. In this paper, the health monitoring of such critical equipments is discussed. The equipment is monitored for temperature, humidity, gas, water logging and short circuit current and the data is continuously transmitted to the control room using the GSM technology.

Keywords: Arduino, Gas sensor, Current Sensor, Temperature And Humidity Sensor

I. INTRODUCTION

In General, every industry has to identify its critical equipment and should also take up special measures in maintaining them. Any sort of discontinuity or damage to the critical equipment can be lethal to the future of the organisation. This is applicable to every production based industries, marine based industries and software companies. Even the hospitals need to maintain the critical equipment to avoid any discontinuity in the medical services to the patients [1][2][3].

However, it sometimes may not be easy for the personnel to physically monitor every parameter of the equipment. When it comes to a larger organisation, the complexity may further increase to monitor each and every parameter of all the equipments[4][5].

In the recent past, researchers have worked out on numerous methodologies to monitor the equipment or devices. The concept of conditional monitoring is applicable to a range of issues. This includes equipment, personnel and even the animal and plant life [6][7].

Another dimension of this the medium used to communicate the monitored information to the remote control centre. It also involves the commands passed in return to the equipment for further action [8][9]. The different types of medium used to communicate between the equipment and the control centre are coaxial cable, Ethernet cable, optical fibre cable, power line communication etc [10][11][12].

Though various communication medium as been worked out till date, it is not easy to conclude the superiority of a method. Every medium has its own advantages and limitations [13[14]. The Ethernet cable may be of limited use if the control room and equipment are not in the same location or atleast in the nearest building. Power line communication is also not easy if the two locations are not placed to the same feeder [15][16].

One advantage of using GSM module is the reach. The distance between the control room and the equipment does not matter [17]. In fact, multiple nodes can be connected very smoothly i.e, monitoring devices of different equipments can simultaneously contact the control room and the control room can contact the maintenance personnel at the same time.

In this paper, a module is developed to continuously monitor the critical equipments. For this, multiple sensors are connected to the sensitive equipment and the information is transmitted to the control unit. This will reduce the efforts of the maintenance personnel and will also increase the efficiency of the workforce.

The subsequent sections of the paper as organised as follows: In the section II, the working principle of the monitoring system is explained through the system architecture. In the section III, the hardware

implementation of the system and the components involved are presented. In the final section, the future scope of this system and alternative methods to implement the monitoring techniques are discussed.

II. SYSTEM ARCHITECTURE

The reliability of any system depends upon effectiveness of the methodology used to maintain it. Any organisation will have a large number of equipments operating, but only a few of them will be identified as critical equipments. The categorization of critical equipments is based on the operational procedures followed in that industry and nevertheless these equipments are given highest priority.

The primary component in health monitoring of any system is the sensors as shown in Figure 1. These sensors should identify any sort of abnormalities in the system. In certain cases, the sensors should communicate between each other to confirm the deviation from normal conditions.

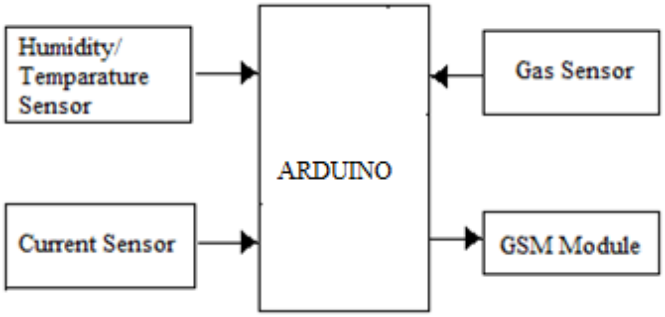

Figure 1. Block Diagram

In this system, the critical equipments are equipped with humidity sensor, temperature sensor, gas sensor and current sensor. If the equipment is exposed to excessive heat, the temperature sensor and humidity sensor will activate.

The equipment is connected with sensors that can detect the gas or smoke leakage in the vicinity of the equipment. An early prediction of gas leakage is absolutely necessary for the safety of the personnel and the equipment.

The information received from the sensors is processed by the arduino and is communicated through the GSM module. This GSM module passes the information to the control centre for initiating further action.

III. HARDWARE IMPLEMENTATION

The communication between the various components of the system is explained in the flow chart shown in Figure 2. Once the system is activated with the sensors, the equipment is monitored continuously.

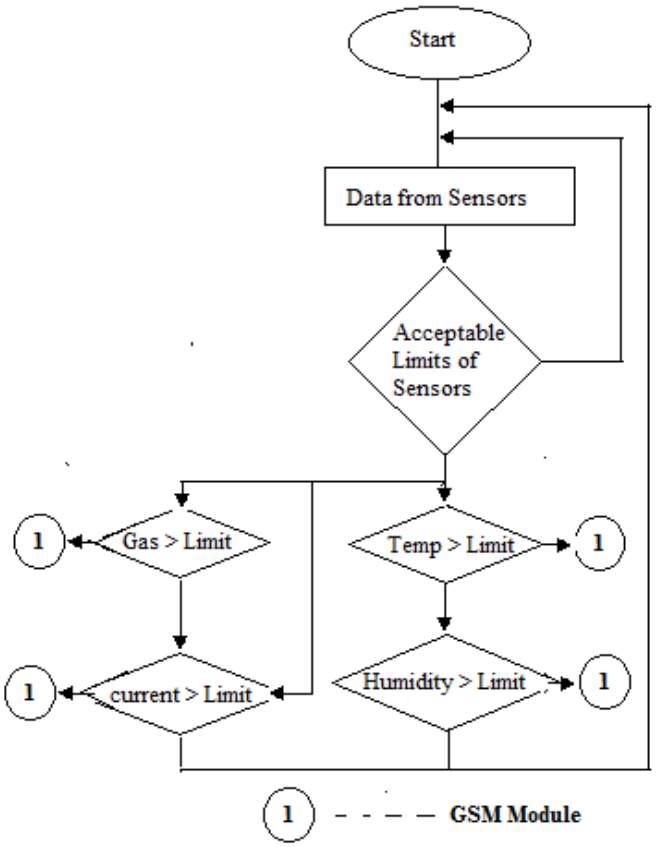

Figure 2. Flow Chart

The monitored information is compared with the limits set to the device. If the temperature is beyond the set limit, then the humidity is also compared. If the humidity is also beyond the limit, then the information is passed to the control room through the GSM module.

If any gas leakage is detected, the information is sent. But simultaneously, the current is also sensed. Any leakage of current in the vicinity of the equipment may aggravate the situation. The current is as such monitored continuously.

The components used in monitoring the health of the critical system are discussed below.

A. Gas Sensor

The Gas sensor used in this system is MQ2 type Gas sensor as shown in Figure 3. The sensitivity and the response time of this sensor are widely appreciated and can be adjusted by a potentiometer. This is the commonly used sensor to detect the gas leakage in home and industries. It is best suited for detecting the leakage of LPG gas, alcohol, propane gas, smoke etc [18].

Figure 3. Gas Sensor

B. Temperature and Humidity Sensor

The sensor used for temperature and humidity analysis is RHT03. It is a combinational sensor of both temperature and humidity. It is cost effective and does not require additional components [19]. It is well calibrated device and is commonly used.

Figure 4. Temperature and Humidity Sensor

C. Current Sensor

The sensor used to measure current in this system is ACS712. It is a cost effective device and has huge industrial and commercial applications. It is a fully equipped linear current sensor based on Hall Effect [20][21]. Due to Hall Effect, the current flowing near through the copper coil generates a magnetic field and converts into voltage. If any abnormality in the current, the voltage will go beyond the set limits and thus trigger.

Figure 5. Current Sensor

D. Arduino with GSM module

The GSM Modem is connected to a PCB with different types of output say arduino taken from the board and RS232 Output to interface directly with a PC. The board will also have pins or provisions to attach mic and speaker, to take out +5V or other values of power and ground connections. These types of provisions vary with different modules [22].

IV. RESULTS AND DISCUSSION

The monitoring of critical equipment cannot be limited to certain type of sensors. For a more accurate and reliable system, the number of sensors need to be increased and so the interaction between them.
The communication between the sensor and the control room also cannot be limited to a certain type of medium. Based upon the requirements and the constraints of the system, a single type of medium or a combination of medium can be used. For example, a combination of GSM with power line communication can be used. GSM can provide the reach between two nodes and power line communication can penetrate even into the area where GSM signals are found to be weak.

V. REFERENCES

[1]. Babysen R, Manikandan P and G.K.D.Prasanna Venkatesan, "Various Indoor OFDM Optical Wireless Communication Systems and Performance Characteristics," Vol. 3, No. 5, 2014.
[2]. Krishnapriya, Shashidhar kasthala, "Identification of Cable Faults Onboard Ship using Power Line Communication.," International Journal of Advanced

Research in Computer Science, Vol. 8, No.3, pp. 70-73.

[3]. S. Saranya, A.Vijay, G.K.D.Prasanna Venkatesan. ,"A Hybrid Communication Infrastructure Power System Using Effective Sensor Network", International Journal of Research in Engineering and Advanced Technology, Volume 2, Issue 2, Apr-May, 2014.

[4]. Shashidhar Kasthala, GKD Prasanna Venkatesan, "Estimation of MIMO Power Line Communication Channel Capacity using Multi-Conductor Transmission Line Theory," IEEE International Conference on Applied and Theoretical Computing and Communication Technology.

[5]. Shashidhar Kasthala, GKD Prasanna Venkatesan, A Amudha, "MIMO PLC Channel Modelling on Indian Residential Networks" International Journal of Applied Engineering Research, Vol. 12, No. 14, 2017.

[6]. S. Ramya, GKD Prasanna Venkatesan, "Study of various transmission schemes of MIMO systems," International Journal of Emerging Trends in Engineering and Development, Vol. 2, No. 3, 2013.

[7]. Banupriya.R, R.R.Jegan and G.K.D.Prasanna Venkatesan,"Disseminating For Concurrent Wireless Data And Power Transfer Using MIMO",International Journal of Research in Engineering & Advanced Technology, Vol. 2, No.2, 2014.

[8]. V Ravichandran, GKD PrasannaVenkatesan, R Rani, "CDMA coding techniques for interconnect between ip cores," IOSR Journal of Engineering, Vol. 2, No. 9, 2012, pp. 84-90.

[9]. GKD Prasanna Venkatesan, VC Ravichandran, "Performance Analysis of Dynamic Sub-Carrier Allocation Technique for Adaptive Modulation based MC-CDMA System", International Journal of Computer Science and Network Security, VOL.7 No.2, February 2007, pp. 201-204.

[10]. GKD Prasanna Venkatesan, VC Ravichandran, "Performance analysis of MC-CDMA for wide band channels," Information technology journal, VOl 6. No. 2, 2007, pp. 267-270.

[11]. J Kirubakaran, GKD Prasanna Venkatesan, "Performance Analysis of MIMO based ASTM-OFDM System for Indoor Communication," International Journal of Advanced Engineering Technology, Vol. 8, No. 2, 2016, pp. 662-666.

[12]. V Ravichandran, GKD Prasanna Venkatesan, "CDMA Technique with Inter-process Communication," Research Journal of Applied Sciences, Engineering and Technology, Vol. 7, No. 8, 2014.

[13]. G.K.D.Prasanna Venkatesan J.Kirubakaran, "Performance analysis of MIMO systems using CDMA for 4G Wireless Communication," International Journal of Applied Engineering Research, Vol 10, No. 41, 2015.

[14]. Shashidhar Kasthala, GKD Prasanna Venkatesan, "Evaluation of Channel Modeling Techniques for Indoor Power Line Communication", International Conference on Advanced Computing and Intelligent Engineering, Bubhaneshwar, Dec 2016.

[15]. Shashidhar Kasthala, GKD Prasanna Venkatesan, Experimental Verification of Distributed Parameters on Indian Residential Networks for Power Line Communication," International Journal of Engineering & Technology, Vol. 8, No. 6, 2012.

[16]. Shashidhar Kasthala, GKD Prasanna Venkatesan, A Amudha, "Design and Development of Protective Coupling Interface for Characterizing the Residential Broadband PLC Channel," Journal of Advanced Research in Dynamical and Control Systems, 9(2), 2017

[17]. Shashidhar Kasthala, Krishnapriya and Saka Rajitha, "An Efficient Photo Voltaic System for Onboard Ship Applications," International Journal of Engineering Research and Applications, Vol 6. No. 2, pp 75-81, 2016.

[18]. Shashidhar Kasthala, "Reactive Power Management in Industries: An analysis," International Journal of Emerging Technology and Advanced Engineering, Vol. 3, No. 11, 2013.

[19]. Shashidhar Kasthala and Saka Rajitha, "Power Consumption Pattern in Residential Buildings: A Case Study," International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 4, No. 4, 2015.

[20]. Shashidhar Kasthala and Saka Rajitha, "Ethernet based Monitoring and Controlling of Real time Security Parameters," International Conference on Innovations in Electrical & Electronics Engineering, Hyderabad, 2015

[21]. Shashidhar Kasthala and Saka Rajitha,"Non Intrusive Monitoring of Electrical Cables in Ship Power Systems," The Journl of CPRI, Vol 12. N0. 4, 2016.

[22]. V Ravichandran and GKD Prasanna Venkatesan, "Performance analysis of MC-CDMA for wide band channels," Information technology journal, VOl 6. No. 2, 2007, pp. 267-270.