

Industrial Parameters Monitoring System based on Embedded Web Server

D. M. Chandwadkar, Chavan Shweta Ashok, S. P. Ugale

Abstract: *The main aim of this paper is to deal with remote monitoring of various physical parameters of an electrical device via web-based application. This system facilitate user to monitor the real-time data from across the globe as the whole data is made available through pre-designed website. Real-time monitoring of electrical parameters is needed beside the high performance and precision of measurements with the development of modern industry towards networking. The main objectives of paper are to access the real-time data on global scale, to reduce the cost of visit & maintenance and finally to improve quality as well as throughput of production. All the physical parameters of an electronic device such as temperature, current, gas flow, viscosity etc. will be monitor independently. Microcontroller is used for the interconnection of all sensors and all collected information will be send to the web page using GSM facility. This real-time monitoring system definitely offers user for hassle free data accession. For high precision, repeatability of real-time data monitoring system has been done. This concept is helpful in industrial sectors for real time monitoring.*

Index Terms: *Embedded system, Global System for Mobile communication (GSM), Internet of Things (IoT), Real-time monitoring*

I. INTRODUCTION

To achieve the industry goals, 'Industry Standards' must be maintained which are related to standard functioning and carrying out of operations in their respective fields [1]. Industry standard assist global as well as domestic competitiveness. It is crucial tool for developing and meeting industry goals. To achieve the said goals today's manufacturers must do more with less. Improve the quality throughput and reduced overheads. Important is proactively detect and react to the problems before they escalate. Learn from the process and use this knowledge to improve further. These are the key parameters of the successful industry and this could be possible when there is accurate communication between machine and manufacturer. This type of precise communication is possible with help of real-time monitoring system. This system offers users to continuously monitor the process and gather real-time information regarding reliability, accessibility and maintainability of the equipment. Further, not only this information is collected it is share quickly and precisely in respect to achieve the high production goal. This monitoring facility offers solution which is not only powerful but also cost-effective in

comparison with Supervisory Control and Data Acquisition (SCADA) [2]. Web based real-time monitoring system comprises of embedded system, Global System for Mobile communication (GSM) network and requisite sensors. This sensor reads/measures the physical quantity and converts them into the digital output. The embedded module is located at device site. The purpose of it is to acquire, process, display, and transmit the parameters to the GSM modem. Real-time data monitoring system is quite user friendly and playing an important role in the area of remote data access. In particular, this type of application is more appropriate where there are uses of various parameters of electrical/electronic instrument. These type instruments may have different dependent/independent parameters such as, temperature, current, voltage, humidity etc. [3]. One of the significant advantages of real-time monitoring is its remote access through web page. From anywhere across the globe we can access and monitor the information available through website. In most cases, it may happen that often human visits are not possible to monitor parameters of an industry base electrical instrument. The reason may be due to huge cost per visit, bad weather conditions, danger wildlife, issue of safety etc. To overcome this problem, global access of real-time data via web site is possible. Recently, with the help of one of the popular era of Internet of Things (IoT) live data updates to web page could be possible and user can access it until the internet connectivity is available [2]. Now a days, the technology has improved to such extend where unmanned monitoring system could be designed and developed. In addition to this, man power cost required for the accession of machine data and as well as frequent visits for configuration and maintenance could be definitely reduced which is quite important aspect as per as industry concern. In present research work, real-time data monitoring system is designed and developed and web-based data accession of said system is also possible globally.

II. CURRENT RESEARCH STATUS

Data collection, transmission, processing, automatic dissemination are the basic functions of real-time monitoring system. Wang et. al. in year 2012 proposed idea of landslide remote monitoring [4]. The significance of landslide monitoring system is to prevent disaster. The author Mahadevan studied real-time monitoring of parallel systems [5]. Monitoring of distribution transformer is reported by Sharma et.al. [6]. According to him the system is capable of detection of all operating parameters, operation and sends the information to

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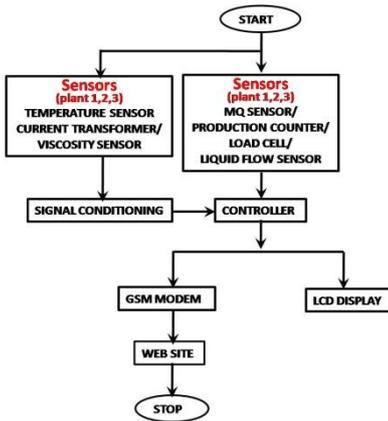
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monitor centre. Das et. al. [7] developed cost effective heart beat and temperature wireless monitoring system. Physical parameters such as temperature, current, voltage and power can be measured continuously with the help of monitoring system [3]. Daigavane et.al. has proposed IoT based monitoring system for water quality testing [8]. A unique monitoring methodology which provides various details of battery in real-time such as, acid level, voltage, charging status, current and remaining battery back-up has been developed by Rauniyar et.al. in year 2017 [9]. Very recently (2018), Figueiras and his group designed and developed the real-time monitoring system for road traffic [10].

The proposed use of present real-time monitoring system is in sugarcane industry. As per as liquid is concern viscosity measurement is quite important issue. If the viscosity of the intermediate product is not precise or appropriate, then it directly affects the quality of final product. For the purpose of measurement of flow rate of sugarcane juice liquid flow sensor is used in present study. As a part of safety issue in industry toxic or explosive gas sensors are used. MQ6 sensor is used for sensing of LPG, iso-butane and propane. Further, remote monitoring of real-time results/database will be made available to users by uploading the same over GSM module. The aim of LCD display is to show the calibrated result at the industry site.

III. METHODOLOGY

Flowchart



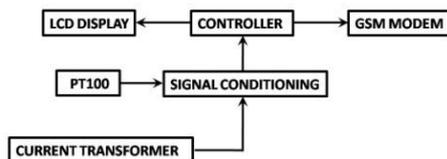
Explanation of methodology

In this case, real-time data monitoring is possible for three plants such as plant 1, plant 2 and plant 3. Each plant has its own logic, aim and application. In all plants, programmed microcontroller is used which is capable to look all the electronic operations.

A. Plant 1:

Plant 1 has two inputs i.e. current and temperature. Current sensor is used to calibrate the current of the equipment in the industry. Temperature sensor is used to measure the temperature of the boiler. The signals from the current and temperature sensors will send for signal conditioning.

PLANT 1

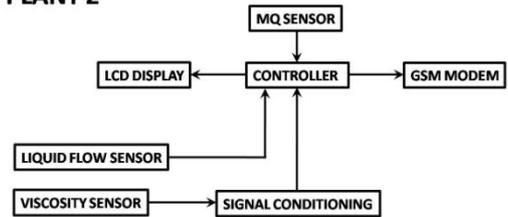


A final

accurate signal is then pass to controller. Further, remote monitoring of real-time results/database will be made available to users by uploading the same over GSM module. The aim of Liquid Crystal Display (LCD) display is to show the calibrated result at the industry site.

B. Plant 2:

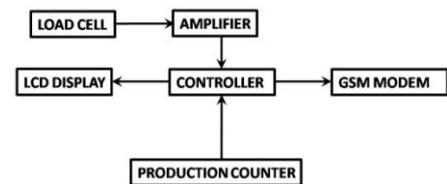
PLANT 2



C. Plant 3:

To measure the weight of final product in the industry load cell is used in this real-time monitoring system. The data signal from load cell is received by controller via HX711 amplifier. Infrared sensor is used at production counter for accurate counting of the final product. All the signals will be send to controller for necessary action. Further, remote monitoring of real-time results/database will be made available to users by uploading the same over GSM module. The aim of LCD display is to show the calibrated result at the industry site.

PLANT 3



D. Microcontroller Unit:

The important role of microcontroller is to look the operations of electronic peripherals. Behaviour of microcontroller is as similar to tiny computer which is located on hardware of electronics. In present case, PIC18F452 microcontroller is used to control the various operations. PIC18F452 features a 'C' compiler friendly development environment. In addition, PIC18F452 microcontroller has 256 bytes of EEPROM with self programming.

E. GSM Module:

For the purpose of data communication across the globe SIM800C is chosen in our case. Data uploading into web server will be possible through the GSM module and with available network service users could access the same on global scale. Frequency bands of SIM800C are Quad-band: GSM 850, EGSM900, DCS 1800, PCS 1900. The present module can search 04 frequency bands automatically.

F. Temperature Sensor:

PT100 Platinum resistance temperature sensor is used in present study. The sensor has -200°C to 850°C temperature calibration range.

G. Current Sensor:

For the purpose of current calibration 5/1A PCB mounted current transformer is used.

H. Viscosity Sensor:

As the present project has direct application in sugarcane industry various properties of materials involved has to be investigated. In the said context measurement of glueyness property of the sugarcane juice is important. For this purpose viscosity sensor is used.

I. Load Cell:

5 kg straight bar load cell with HX711 amplifier module is used in present study. Operating temperature range is -20°C to $+85^{\circ}\text{C}$. HX711 has output rate of 10 Hz or 80 Hz.

J. Production Counter:

Production counter is the E18-D50NK infrared obstacle avoidance proximity sensor. The device is working on the principle of photoelectric sensor which can transmit and receive Infrared rays. This sensor has advantage of long detection, small interference of visible light and easy to assemble. The sensor range is 3-50 cm with operating temperature range of -25°C to $+55^{\circ}\text{C}$.

K. Gas Sensor:

MQ6 is used as LPG gas sensor in present study. It has high sensitivity to LPG, iso-butane, propane and methane. 100-10,000 ppm is the detection range which is quite remarkable. It has fast response time of < 10 sec.

L. Liquid flow sensor:

YF-S201 sensor is used in this project for the measurement of liquid flow meter. This sensor is supposed to be fixed in between the container and liquid line. It's working temperature range is -25 to $+80^{\circ}\text{C}$

IV. RESULTS

For the sake of testing of the device, investigations of various sensor parameters and their transfer of corresponding signals have been done. For the results, different measurements are classified in to 1) Temperature and current, 2) Gas flow, liquid flow and viscosity, 3) Counter and weight. Below is the image of hardware (Fig. 1) of plant which indicating the sensors, LCD display, microcontroller and other electronic components.

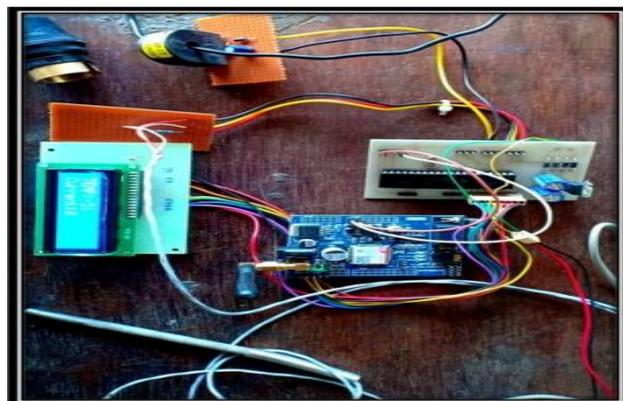


Fig. 1 Hardware of the plant with LCD display.

A. Temperature and current:

Fig. 2 (a) shows the LCD readings of temperature and current. These measurements were recorded as the test reading for the sake of observation. As the present project focuses on the industry application, one can also apply the temperature sensor to the boiler. The measured data is accessible through web site as shown in Fig. 2 (b).



Fig. 2 (a) LCD sensor with (b) Snapshot of web page depicting reading of temperature and current.

B. Gas, liquid flow and viscosity:

The aforesaid sensors are quite important as per as the sugar industry concerns. The Fig. 3 shows the sensor results of gas detection for Methane, sugarcane juice (as an example) flow rate and finally, viscosity of the liquid (ex. sugarcane juice) is measured by the viscosity sensor. The actual measured physical parameters are shown in Fig. 3 (a) and (b).

Fig. 3 (a) Real time results shown in LCD display and (b)



Pre-designed web page depicting observation of gas, viscosity and liquid flow rate.

C. Counter and weight:

At the end of the reaction process, measurement of weight of the final product with high precision is also important. Following diagram (Fig. 4) is showing sensor results of weight and counter. When the final objects (products) reaches in front of counter sensor it detects the object as well as counts the total number. Access of aforesaid sensors is achieved through LCD display as well as pre-designed website (as shown in Fig. 4 (a) and (b)).



Fig 4. (a) Real time results shown in LCD display and (b) Counter and weight sensors indicating the observed reading in real time on website.

I. TABLE showing results of plant 1, plant 2 and plant 3

Sr.No.	Parameters	Plant 1	Plant 2	Plant 3
1	Temperature (°C)	16		
2	Current (mA)	22		
3	Gas level (%)		29	
4	Flow rate (ltr/hr)		4	
5	Viscosity (%)		58	
6	Counts (Nos)			89
7	Weight (gm)			100

V. CONCLUSIONS

The idea behind the present system was to facilitate the user for unmanned and remote access of the real time data. The present system was designed by bearing the all critical and important issues in our mind required for smooth operation of the industry. The said system is capable of measuring physical parameters of electrical device such as system self temperature, self current, self liquid flow etc. In addition to this, the given real time data is also sent to pre-designed web page and is accessible on global scale. Overall, in our observations and measurements the system is found to be quite remarkable in terms of accurate and web based real time data access. We believe that the present project work will be definitely hassle free, less time consuming, more effective and economical and will also add significant contribution in this field. The present system is advantageous than the direct onsite observation system which is used in most of the industry.

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