INDUSTRIAL PARAMETER MONITORING AND FAULT DETECTION FOR SAFETY USING IOT

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***Abstract*—** Automation has changed the way we live. There were tasks that used to take a lot of our time and efforts that are now being done by machines. But it can proven to be cursed some time when it crosses their operating limits, hence monitoring and controlling is called as a heart of industrial parameter. Industrial parameter monitoring is the process of real time monitoring of parameters and its control using programming. This project presents the implementation of real time embedded system for industrial automation applications. Recently, PLCs have dominated industrial automation implementations but however, they do present some challenges especially in meeting real time constraints due to its centralized control and cyclically scanned program execution mechanisms. This project proposes a practical way to precisly monitor physical parameter like voltage, current, temperature, humidity and light intensity for the safety of industrial processes and its monitoing using IoT.

***Keywords*—** *Industrial Automation, Internet of Things, ARM7, Sensor, Parameter Monitoring.*

I. INTRODUCTION

The end of the 20th century has brought important new trends in all industries particularly in terms of engineering. The main consequences to apparel manufacturing have been a constant increase of individual production orders, product and materials variety and much smaller order quantities. This fact posed new requirements on the production systems and equipment: both have to be flexible and reliable. In the case of the equipment, this means that quicker set-up times are required whenever process changes and that quality assurance has to be much more efficient. Managing this situation with the traditional machine set-up and process planning methods is difficult. Better control and predictability of the processes are required.

Automation is essential and well proposed system in 21st century. The industrial world is facing many technological changes which increased the urgent demand for the premium quality products and services that can only be supplied by a high level of productivity. This requirement needs process engineering systems, automated manufacturing, and industrial automation. Hence, industrial automation plays a key role in solving the requirements of companies. On the other hand, many people losing their lives in industrial accidents due to presence of black holes while implementation of automation in industries. When we talk about industrial automation is all about working smarter, faster, and proficiently we need to monitor some critical parameters like temperature, voltage, current, humidity, pressure etc. This is one of the most upcoming issues in the industrial sectors. If the parameters are not monitored and controlled properly due to unavoidable manual error, it leads to a harmful situation. Sometimes, if this control process may not handle properly, it results in occurrence of major accidents. With the embedded technology, it is very easy to overcome the greater issues in industrial automation monitoring and controlling. Embedded System is the combination of both Hardware and Software. Embedded system allows the flexibility to user to design the automation system with greater power efficiency. The operations performing in industries are very fast and they are not possible to monitor for normal human eye. Hence, various types of sensors can be used for monitoring purpose which is available in market. Embedded system allows interfacing these sensors using computer program for greater efficiency and fault detection capability, which also ensure the safety of industry premises. Embedded system also allows interfacing of internet with hardware using IoT and IoT provide the flexibility to monitor and detect faults present in system from remote location using "User Name" and "Password".

II. RELATED WORK

The concept of industrial automation was first introduced by Jacques de Vaucanson and he was invented first automated loom. [4] Author does the survey on implementation of real time system for industrial automation. In this paper author explain how the PLCs are dominated industrial automation implementation but the use of PLC system requires more cost for implementation. [3] Author does the survey on recent trends and application of an embedded system. In this paper author explained what embedded system is and how it can be applicable for industrial solutions. About all the microprocessor and microcontrollers are manufactured using automated process and as it can be easily programmed with high level language, they are very popular in industry. [2] Author does the survey on Internet of Things from market perspective. In this paper author states that Internet of Things is dynamic global information consisting of internet connected objects that are becoming the integral component of Internet. This survey is intended to serve as a guideline and conceptual framework for context-aware product development and research in IoT paradigm. [19] Author does the survey on data acquisition system. This paper is about how the data acquisition system

has been used in various applications in the world. Data acquisition is a collection of data. The data might be collected from local objects or from remote location using sensors for the monitoring on which processing can be done further. [6] Author introduced the emerging trends of embedded system for industrial automation. In this paper author states that, embedded system is a combination of computer technology and electronic hardware which is designed for strict application system on function, reliability, cost, volume and power. Author had provided a detailed view of embedded processor for industrial use. [17] The importance of Real Time Industrial Monitoring System is given by author and also proposed how we can monitor process using RFID in this paper. [9] The importance of ARM microcontroller and its scope in industry is given by author in this paper. The rapid development of the field of industrial process control and the fast popularization of embedded ARM processor; it has been a trend that ARM processor can substitute the single-chip to realize data acquisition and control.

III. HARDWARE DESCRIPTION

The implementation of system shown in fig. 1 consists of LPC 2148 ARM7, Wi-Fi Module, Power Supply and Sensors.

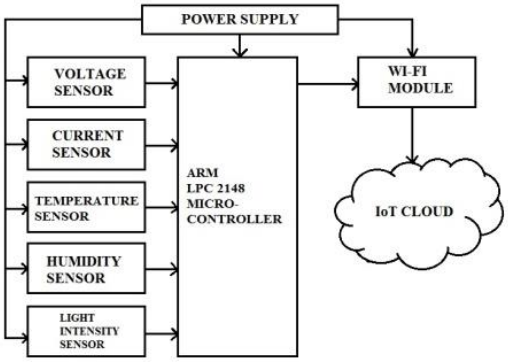

Figure 1 Block Diagram of Industrial Parameter Monitoring

A. LPC2148 ARM7 Microcontroller: The LPC2148 microcontrollers are based on a 32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory of 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate.

B. ESP8266 Wi-Fi Module: The ESP8266 Arduino compatible module is a low-cost Wi-Fi chip with Full TCP/IP capability. It has a Microcontroller Unit (MCU) integrated which gives the possibility to control I/O digital pins via simple and pseudo-code like programming language. ESP8266 Wi-Fi Module comes with PCB trace antenna which has very good coverage.

C. LM35 Temperature Sensor: The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature.

D. DHT11 Humidity Sensor: The DHT11 is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).

E. LDR: It is a light dependent resistor, works on photo conductivity principal. Photo conductivity is an optical phenomenon in which the materials conductivity is increased when light is absorbed by the material. Here it is use in this project for detection of light intensity.

F. Potentiometer: A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor. Potentiometer is used to demonstrate the change in voltage and current in this project.

IV. WORKING ALGORITHM

The system will perform operation in following steps:

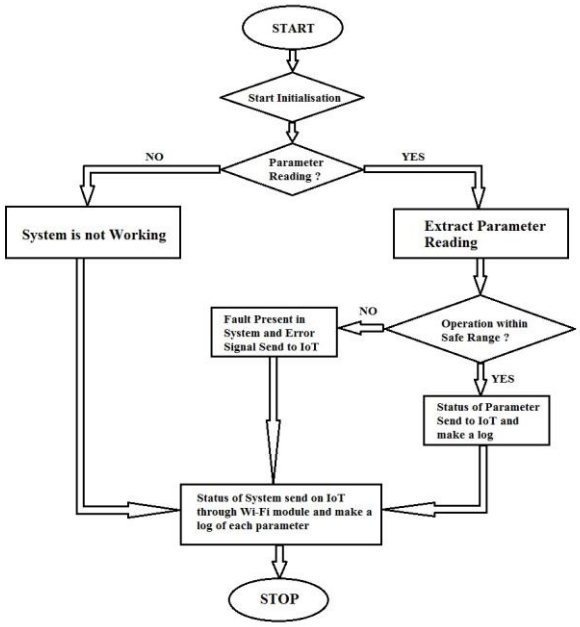

Figure 2 Flowchart of Industrial Parameter Monitoring

1. Turn ON the Power Supply to turn the hardware ON.
2. The initialisation program will starts executing, once hardware gets turn ON.
3. Sensor will start monitoring after initialising the program, and supply their output to LPC 2148 ARM microcontroller.
4. LPC 2148 ARM microcontroller will process the received data and it will be updated in LOG Page created on internet for online monitoring.
5. The program will continuously monitor the status of parameter under monitoring. System will generate the alert if malfunctioning is detected in it and turn OFF the system in case of any malfunction present in it.

This system also provides us the facility to monitor its status using internet from any remote location.

V. EXPERIMENTAL RESULTS

Figures show the results of industrial parameter monitoring using sensors. Images are showing algorithm of the project. Fig. 3 is an experimental setup without power connections.

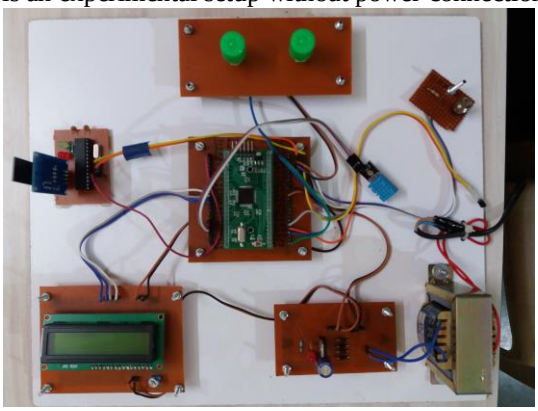

Figure 3

Fig. 4 is an experimental setup with power connections.

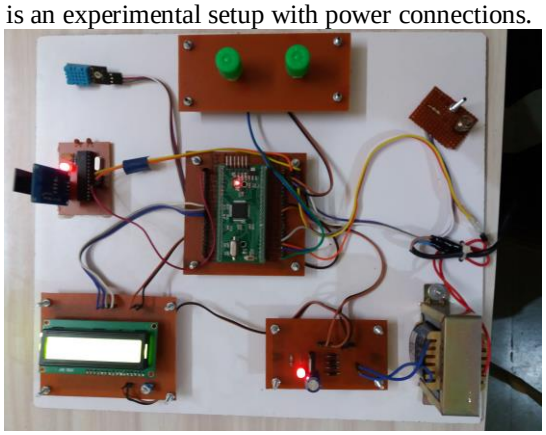

Figure 4

Fig. 5 is showing the initializing process.

Figure 5

Fig. 6 is showing the result of system after initialization, monitoring parameter and collecting their values.

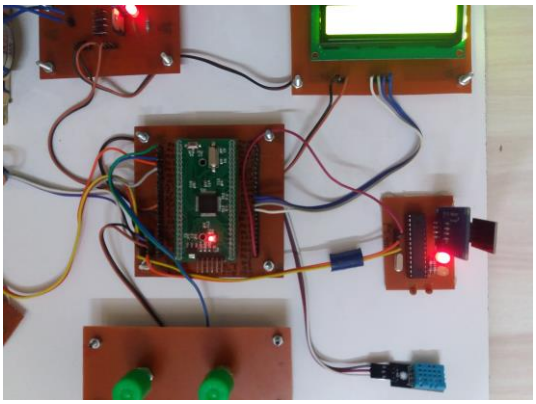

Figure 6

Fig. 7 is showing the result after the data is collected, updated in system and uploading on Website.

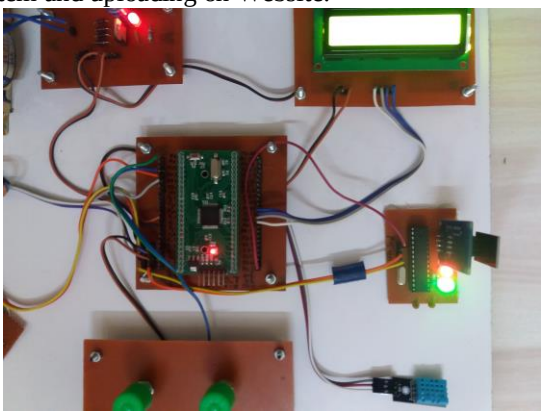

Figure 7

Fig. 8 is showing the result of parameter monitoring on LCD which will be continuously updated in every 2 seconds.

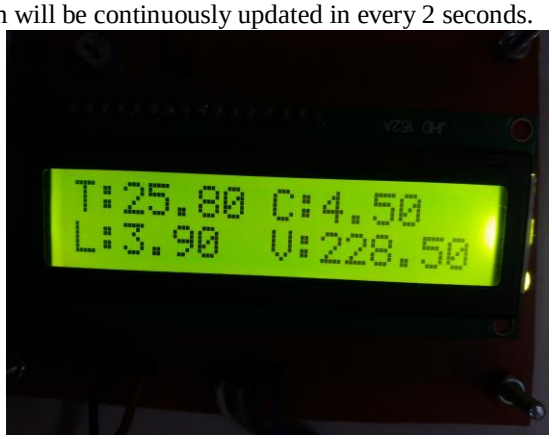

Figure 8

Fig. 9 is showing the result of parameter monitoring updated on website, which can be monitor online using user id and password.

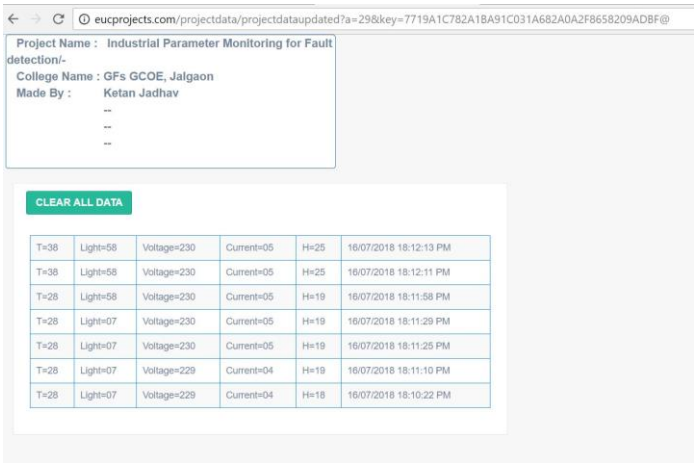

Figure 9 Online Log

VI. CONCLUSION

We have implemented system for Industrial Parameter Monitoring and Fault Detection for safety using IoT. The algorithm design is successfully monitoring the physical industrial parameters. We have also test our algorithm for faults and found that it successfully generating alert in response of faults. We have also monitor a log sheet of our system on internet using user id and password. Hence we can conclude that our system can provide safety to industrial processes.

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