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An Analysis on Monitoring and Control of Real Time Systems

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***Abstract*-Oneofthemost challenging scenarios facedintheprocess industry is the need of constant monitoring and controlling of parameters under hazardous conditions.In-depth analysis of various control techniques used for monitoring and controlling the real time parameters of Process Industries has been done in this paper.As the processesare highly critical so they need to be run at the appropriate temperature, humidity, pressure etc continuously. Various control methods are being explored and analyzed based on merits or demerit for their suitability. Microcontroller and PIC based Control system,PLC Controller, SCADA based Automation System,Fuzzy Controller etc are the various control methods which has been investigated in this paper.Our paper is presenting a review and analysis of various advanced controls and optimization solutions and in this study, we found that Arduino based control system is the most suitable approach for various process application.**

***Keywords*-Arduino, SCADA, PIC, PLC,Fuzzy.**

I. INTRODUCTION

The Access of Real-Time Data is quite a herculean task. With the advancement in technology, many methods have come up for obtaining these Real Time Data. There are pros and cons of every method which is used for finding thesedata.

The development of an efficient parameter monitoring system requires the use of adata acquisition system,the analysis of several parameters that are monitored (temperature, humidity, light etc) and a real-time notification system in case of condition failure.The objective is to develop a flexible and robust intelligent systemby keeping it as simple aspossible.

Now a day's control of parameter is used in industries and can be used in variety of applications available.The main of function of control action is to a maintain a particular parameter which changes due to some chemical reaction and environmental parameters [1-3].In this context, lot of research work has been explored and presented in next section.

II. LITERATUREREVIEW

Lots of research work has been done for monitoring the real time parameters and controlling strategies in process industries such asMicrocontroller and PIC based Control system, PLC Controller; SCADA based Automation System, Fuzzy Controller etc.

Microcontroller based system is one of the most popular among various techniques. Instead of usage of a separate microprocessor and other components separately, we can economically operate the device by using microcontroller. Md. BelayatHossain[4] has discussed the Queue Control in banks, retail stores etc. Unique numbers are assigned tocustomer and service is processed accordingly.Ahmed Salih[5] describesAutomatic Railway Gate and Crossing Control using microcontroller and magnetic sensor.

Rashidi[6] describes Car Monitoring using Bluetooth security system. In this the whole system under consideration can be accessed by the Bluetooth of the mobile phone.Zairi Ismael Rizman[7] has discussedAutomatic Temperature Control Systemfor Smart Electric Fan. Microcontroller based system has certain constraints. Its software development is much more expensive aswell as difficult to implement. Although it is economical as compared to the usage of a separate microprocessor but it had issues with software development and powerconsumption.

A Programmable Logic Controller (PLC) is a industrial computer control system used for monitoring the processes in industries, for e.gautomation of electromechanical processes, manufacturing lines oil industries etc.M.GIoannides [8] describes implementation of monitoring and control system for the induction motor basedPLC controller.PLC correlates the operational parameters to the speed requested by the user and monitors the system during normal operation and under trip conditions.Irmak[9]has discussed real time monitoring and controlling of an elevator based on PLC.MinggangZheng[10]formulated a control strategy to control the temperature of blast furnace by regulating water spray.D.V. PushpaLatha[11]has explained the measurement of temperature and is then controlled using Programmable Logic Controller (PLC).Advantage of using PLC control system is its ability to change and make the same copy of the operation while it communicates and collects the important information.However,PLC based control system poses certain limitations too. Extra effortis required to connect

Wires in assembly lines. It is a tedious task to find the error in PLC based control system as compared to other control systems.

Supervisory control and data acquisition(SCADA) is used todescribe a system where both data acquisition and supervisory control are performed. AdityaGoel[12] has formulated a control strategy to control temperature, pressure, humidity etc. for real time monitoring of remotely situated DAQ.EnginOzdemir[13]describes Mobile phone based SCADA for industrial automation.This paper explained that operator can visualize and modify the plantparameters using his mobile phone, without reaching the site. In this way maintenance costs are reduced andproductivity is increased.However, SCADA based system has certain restrictions. It is rather more expensive than other control techniques.It is difficult to install and maintain the SCADA based Control Technique. There is no systematic approach to acquiring data from the plant devices – if two operators require the same-data.

Fuzzy logic based control systems are also gaining popularity now-a-days. The quality and performance can be improved using fuzzy logic Control Strategy due to well-known merits of soft computing techniques. The fuzzy logic is a soft computing method; whichcan help in many complex control techniques.Pekka [14] introduces a fuzzy logic controller for temperature control of the superheated steam. This paper describes the usefulness of self-tuningmethods that modifies the scaling factor of FLC output as well as the membership functions of fuzzy rule set. Malki A Heider [15] describes a fuzzy PI controller and its application in the control for boilers.It is very popular in automation based control system.A. Hossain[16] has formulated a strategy for monitoring and controlling of a real-time industrial process using dynamic model control technology.A dynamic model could provide early signal to detect deterioration ofcertain equipment,animated control of an industrial process, and tuning of certain control devices under real-time process dynamics.J.W Shin [17] has discussed a patient monitoring system using fuzzy information. This paperoffers not only the real-time monitoring information but also the references of a patient's ECG waveform and a past recorded data.Thistype of control system is very close to the way human thinks and approaches than traditional logical system.Basically it provides an approximate picture of the real world.Hence, the basic part of Fuzzy logic controller is set of basic rules, which have a dual concept of fuzzy implication, and compositional rules of inference. It converts the control strategy, which is based on the knowledge of expert into an automation based control solutions. However, it poses certain limitations too. It is difficult to estimate membership functions and there are several ways of interpretingrules.

In the recent years, the technological advancements have given us many new control techniques.This paper investigates an alternative approach through Arduinosystem for parameters analysis and monitoring.Georgitzikis[18] expanded the Arduino capabilities by adding an 802.15.4 wireless module, in order to expose its functionality as a Web of Things node.There is a description of the necessary steps to make a heterogeneous network interoperate and the implementation of a network stack for the 4 most representative hardware platforms, as used by the relevant research community (Arduino, SunSPOT, TelosB, iSense).These types of control systems have certain unique advantages.Arduino is open source hardware. Hence, we can develop any applications according to our requirement.The Arduino hardware platform has the power and reset circuitry setup as well as circuitry to program with the microcontroller over USB. In this context, lot of proposed work has been explored and presented in next section.

III. PROPOSEDWORK

In this paper, the main emphasis is given on real time parameter monitoring and controlling. The data acquisition is obtained through the MATLAB, simply through programming, without using of the tool box and Simulink. Hence this would be more user friendly and would be cheaper way of obtaining real time data acquisition.

Arduino system consists of an ARDUINO board and PC. It has a user interface realized under the MATLAB and a Microsoft OUTLOOK.The real-time alert is sent to the decision making factorsvia Internet.

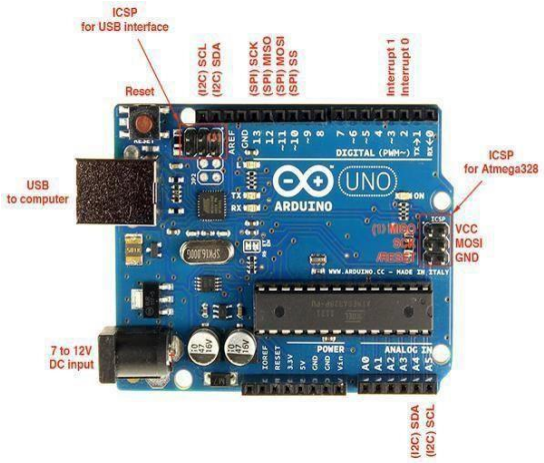

Fig 1.Arduino Board

The Arduino Uno which has been used in this project, is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which we can use 6 pins as PWM outputs), 6 analog inputs, a ceramic resonator of 16MHz, a USB connection, a power jack, and a reset button. In our project we have use ARDUINO UNO because, it has an advantage of being open source, because of which any user can debug it easily. It has an easy USB interface. This board is cheap and easy to find so if any fault arises in thisboard.

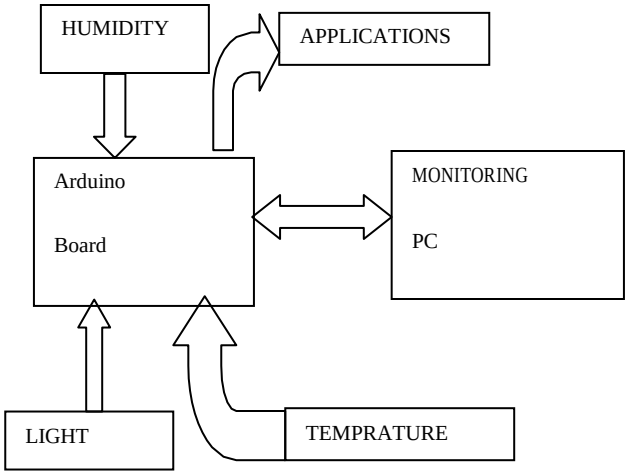

Fig 2.Block diagram of Monitoring and controlling

On the other hand the automation is obtained with the help of Arduino Uno and MATLAB, by interfacing the HR202 (humidity sensor) and LM35 (temperature sensor), LDR (light sensor) with the Arduino.

Fig 3. Temperature Sensor(LM35)

Fig 4. Humidity Sensor(HR202)

Fig .5 Light Dependent Resistor

In this proposed work, sensors used are shown in fig. 3, 4, 5. Results of these sensors are appealing. Hence, real time data time data can be extracted and monitored in a very efficient manner.

CONCLUSION

In this paper rigorous analysis and review on various control techniques such as Microcontroller, PIC, PLC, SCADA, Fuzzy etc. has been done.The attempted work thus, presents that Arduino based controller is the best and optimal solution for controlling the parameters of a control room in process industry. Several researchers have implemented Arduinologic on robotics but it has not yet been implemented in controlling the parameters of a control room in industry. Practical implementation of Arduino controller for control unit in a typical industry can have certain bottlenecks. However, it seems it is the best possible method as compared to conventional methods.Arduinoboards are relatively inexpensive compared to other microcontroller platforms. It is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well.

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