Realization of Automated Industrial Pollution Control System using LabVIEW

Isha Gupta & Rashpinder Kaur

Abstract—
Several applications of pollution controlling systems are in industries. The control of the parameters which causes pollution in the natural environment and industrial pattern is a great experiment and has inward interest for industries especially in chemical industry, paper making industries, Sugar manufacturing industries, water treatment industries and granule mills. The major objective of this paper is to design a well-organized and distant system to control the parameters causing pollution and to decrease the effect of these parameters without affecting the natural environment. In this research designed a system to monitor, read, and control pollution parameters and to alert pollution control authorities when any of these factors goes higher than industrial standards. GSM and LabVIEW will robotically monitor and control when there is a pollution disturbing the industrial environment. The system is design using LabVIEW software. The system monitor level of level of CO gas released during industrial process, pH in industry effluents, and humidity in industry and environment temperature of the machineries. With the design of GSM, the signals are efficiently transferred and the conduct is made accurate and effective. Thus through this paper controlling of pollution and the data is transferred through SMS. LabVIEW is influential and multipurpose programming language for functioning and controlling the pollution monitor system and GSM is suitable for interactive surroundings for transferring signal.

Index Terms **—LabVIEW, GSM, Humidity, pH, CO, temperature, microcontroller (p89v51rd2).**

I. INTRODUCTION

Industries are the biggest workplace all over the world, also there is large number of workers involved and most of them are working as a machine operator. Due to the increasing demands for system performance, production quality as well as economic operation, modern technical processes are becoming more complicated and the automation for such systems are therefore radically increasing. There are many technical systems developed for industrial environment some monitors machine process, other monitor and control machine parameters such as speed, temperature, production, environment etc. Therefore, the control and monitoring of multifarious process is a great challenge, because of unavailability of adequate quantitative knowledge about the process. On the contrary to model-based approaches, data-driven control and process monitoring methods make use of the data obtained from the existing process, dimensions to describe various complex behaviors, thus they have formed an efficient substitute for control and monitoring issues with complex industrial applications.

Recently science has advanced for the construction of small and low cost sensors which have become technically and economically possible. The Industrialization has blown up the degree of automation and together it has also enlarged the pollution by releasing the pollutants in environment especially in industrial surrounding. Therefore there must be a system which can monitor and be in charge of controlling the industrial pollution. The terms monitoring and measurement are normally puzzled and used synonymously. The process of industrial quality measurement is an estimate of the industrial eminence in relation to standard quality which is set by pollution control board. Particularly the attention should be given to the factors which can affect human health and the natural environment system itself. Environmental quality measurement is to define the condition of water, to provide system for detecting and to provide the information through which the cause of pollution can be established.

Industrial monitoring is the collection of group information at different work place in industries at regular intervals of time so as to provide the group of data which can be used to describe present situation. As a result of the difficulty in parameters huge variation originate between dissimilar industries. In the same way, the result to industrial impact is also extremely irregular. The main cause for the measurement of the quality of the industrial atmosphere is to verify whether the defined industrial quality is suitable for proposed operation or not. Distant Monitoring, Control and intellectual safeguarding is one of the most significant criteria for maximizing the production and system accessibility. The use of monitoring has also evolved to find out trends in the quality of the water, air and soil environment and how they are affected by the discharge of pollutant, and by waste handling procedure. More recently, monitoring has been undertaken to guesstimate nutrient or pollutant fluxes discharged into rivers, ground waters, lakes, oceans and soil or across international boundaries. Nevertheless, it should be noted that industrial ecological environment quality is very dependent on neighboring situation.

In the recent scenario, there has evolved much interest towards remote monitoring and control in the field of the industrialization. A new rush forward of expansion will come through new Wireless technology [1], construction at the lowest cost for worldwide circulation, and fast time-to-market. Much interest has grown towards the

wireless communication [2] especially in the industrial sector for the automation at the same time to enhance the safety and security standards. There is a huge advantage for industries to take up the wireless communication for the control the systems for the industrial sector. Due to the complication for factors to decisive the industrial qualities also the large variation in parameter originates in different industries at same time. Equally, the response to industrial impacts is also extremely variable [11]. A Wireless Industrial Automation communication system, at the current time, presents a combination of consistent and proprietary technology is going on.

II. SYSTEM DESIGN

The paper proposed consists of P89V51rd2 microcontroller, temperature sensor (LM 35), Ph sensor humidity sensor (SY-HS-220) and a carbon monoxide sensor. All these sensors are connected to P89V51rd2 microcontroller, is the main processing and controlling unit of the system. The sensors sense different parameters and provide data to microcontroller for processing. From the obtained data from the sensors the program controls the fan and motor to achieve the system requirements, send the SMS through the GSM module to controller room and the whole system in monitor through LabVIEW. LCD is used to display the data obtained currently from the sensors. System structural design is composed of microcontroller based system board.

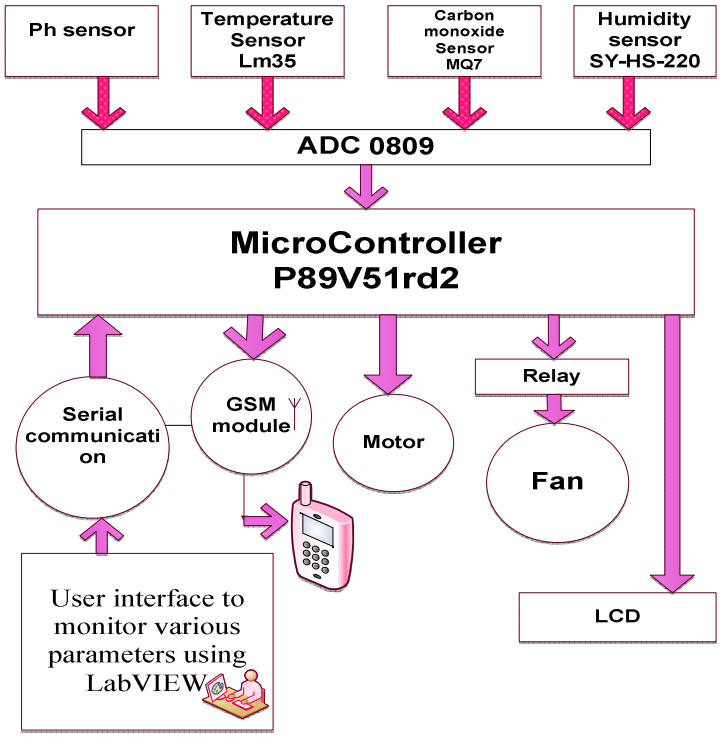

Fig. 1: Block diagram

System architecture is composed of Micro Controller based system board The hardware and software of the industrial pollution monitoring and control of temperature, CO, Ph , humidity and GSM module is shown in figure 2.

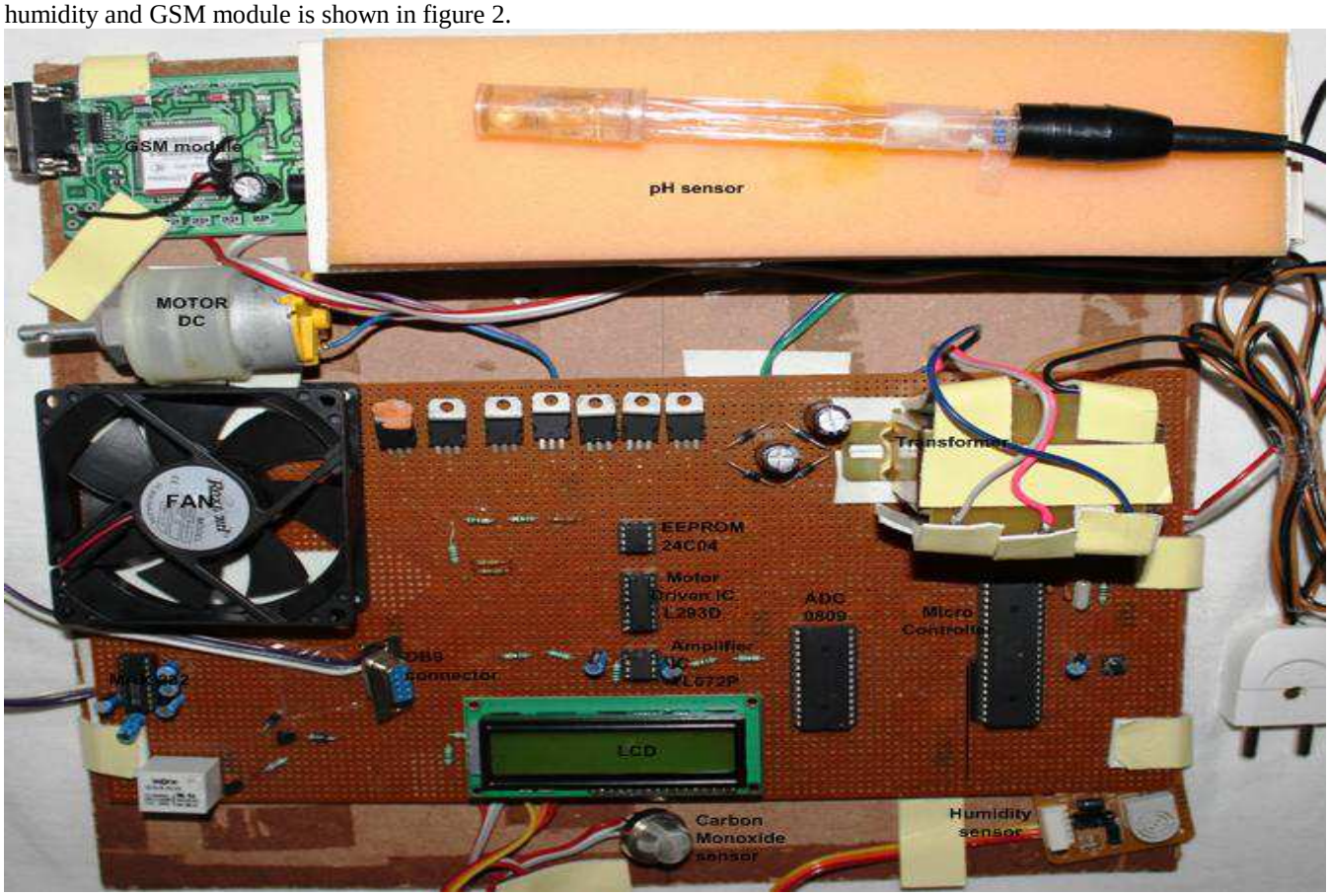

Fig. 2: Circuit Design

III. SYSTEM OPERATION

Initially the threshold value for various sensor in the circuit are set according to the process being followed in industry using LabVIEW software. Then the hardware come into role. When the sensor are sensing the value of the parameters will be shown on the LCD screen

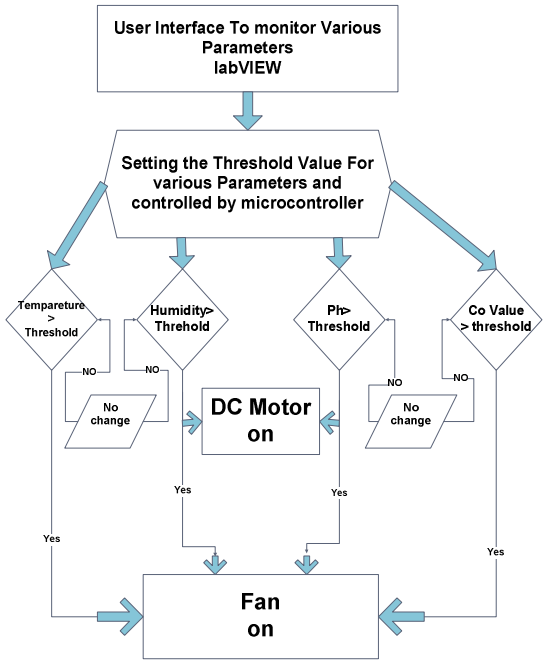

Fig. 3: Flow chart of system

The temperature sensor first sense the change in the environment temperature. The output from the sensor is analog output so it is fed to ADC to convert the analog to digital signal and this digital signal is passed to microcontroller for further processing. If temperature sensed has the value above the threshold value fan will be ON automatically and the SMS is send to controller room through the GSM module. When the temperature reached below the threshold value fan will stop automatically. In this way temperature is controlled.

Similarly humidity (to sense water vapor in air) in the environment can be controlled. If the sensed value is above the threshold value set FAN will be ON by the microcontroller automatically and side by side SMS in send to controller room through GSM module. In this way humidity is controlled.

If the pH value is not in range the motor will be ON to spray the liquid (as per need)and at the same time SMS will send to controller room through GSM module so the value reach in range the motor will automatically OFF, by this the pH value is maintained.

If the value of carbon monoxide in not below the threshold value set the fan will be ON by the micro controller automatically and the SMS is send to controller room through GSM module. When the gas is in range the fan will be stopped automatically.

IV. SOFTWARE DESIGN

The virtual instrument (VI) for setting the threshold value for various sensors is design in LabVIEW software. In this various functional blocks are used to perform the operation. Firstly the visa tool is used for serial communication, which is used to initialize the serial port specified by VISA resource name.

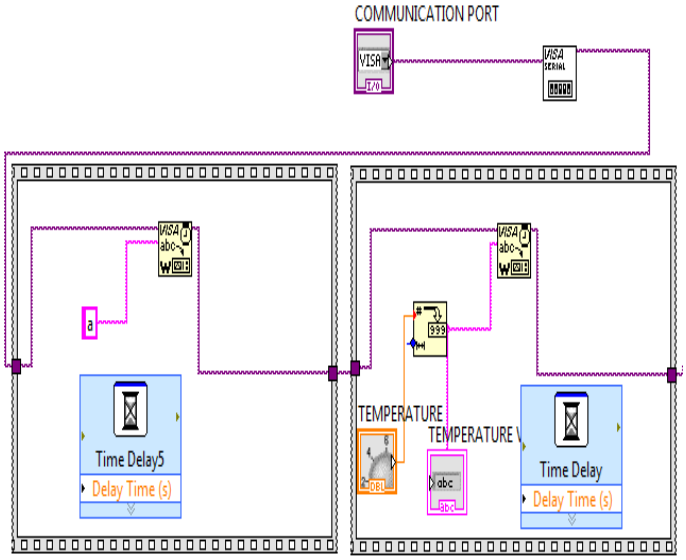

Fig. 4: Block diagram in VI

VISA resource name input to manually select the order. The out from the VISA tool that is VISA resource name out is connected to stack sequence.

Stack sequence consist of one or more frames that execute sequentially. The frames is use to create sequence locals to pass data between frames. Then the output of stack sequence is connected to VISA write which writes the data from data buffer to the device. Time delay is given as process can take some time to process so the time delay is given to insert delay in VI. The output of the VISA write is connected to proceeding stack sequence.

In this stack sequence there is VISA write whose input which is connected number to decimal string functional block it converts number to a string of decimal digit to at least width character wide to this input functional block a knob attached through which the threshold is set according to the operation. The output of the number to decimal string is connected to the input of VISA write. Again the out of the VISA write is connected to proceeding stack sequence. The time is also introduced as the process being done in this stack sequence will take time to process so time delay is given to complete the process accurately. The same stack sequence are repeated for four parameters which are being calculated in this paper

The same stack sequences are repeated for four parameters which are being calculated in this paper for pollution control in industry. The front panel window has the controlling knobs through which the values are controlled for different parameters.

V. RESULT AND SIMULATION

Here the microcontroller is programmed to read the digital value of temperature, humidity, pH and carbon monoxide which is stored in external storage device EEPROM. Data is displayed i.e. the current condition of the industrial environment will be shown on LCD by programming the microcontroller. Through the DB9 to USB connector it can communicate with the LabVIEW module in the computer. In LabVIEW the temperature, humidity, carbon monoxide and pH point is set and the set point is read by microcontroller accordingly the microcontroller function whether fan and motor to be ON or OFF. The GSM module is connected to microcontroller to send the SMS when condition is not proper to the controller room.

The threshold set through the LabVIEW software as shown In fig is

Temperature……. 5ºc
Humidity……...23%RH
pH lower……....0
pH higher……...7
Carbon monoxide….2ppm

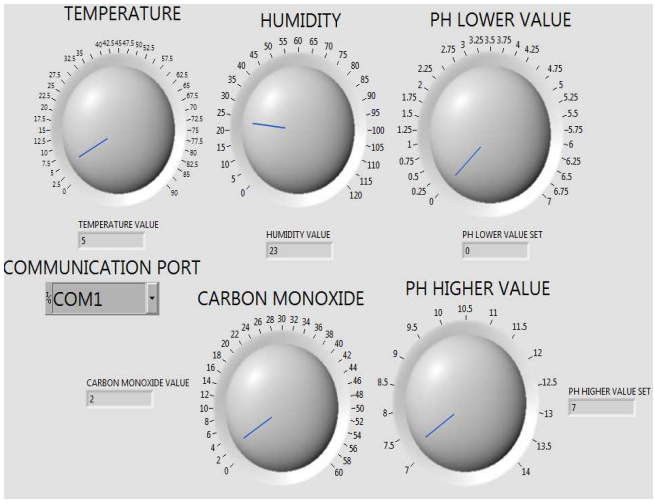

Fig. 5: Front panel window running

But the LCD show the current value of the industrial atmosphere as shown in fig 6.

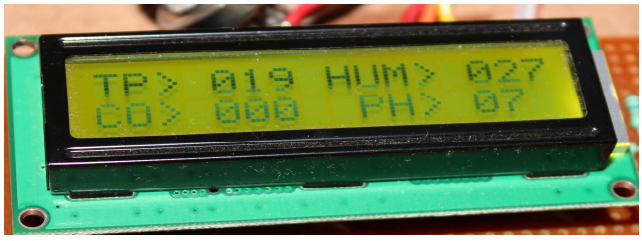

Fig. 6: LCD

The values of the parameters are high as shown on LCD so the SMS is send to the controller authority to update with the values of the parameters which are not in range.

VI. CONCLUSION

The field of pollution monitoring and control is very wide. In this system, an attempt is made to minimize the problem of cost, to monitor and control various parameters which will help in reducing industrial pollution. The regular inspections can be done by the utility of GSM (Global system of mobile communication) technology. The software model for device control automation is developed in LabVIEW through which the according to the need in industry the value of various parameters can be select. The user can observe the parameters readings taken from the workplace and control them.

VII. APPLICATIONS

- It is used to remotely control pH level and soil moisture as well as temperature irrigation system.
- It can be applicable in distant checking of the entire industrial environment in petro chemical industries.
- Further it is also used to regulate the pollution parameters through sensors hence reducing the manual labor.
- Its application can also be applied in chemical industrial to control the deterioration of natural environment.

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