PLC based data logger for monitoring and controlling various environmental parameters

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Abstract
With the advancement of technology, the processes are becoming more and more complex. Due to this increase in complexity, for efficient analysis of process the number of parameters required for data acquisition also increases. Data Acquisition is simply the gathering of information about a system or process. This paper presents the design and development of automatic monitoring and controlling system based on Programmable logic controller. The monitoring system enables the monitoring of different parameters in any environment. Such a system can consist of sensors which are used to monitor parameters of interest. The sensors measure the different parameters and give the output in the form of analog or digital value. The acquired data from all the sensors is given to the input ports of the PLC MicroLogix 1400. If the parameters are not in the proper range, they are controlled by fan, bulb and buzzer which are connected to the output ports of PLC MicroLogix 1400.

Keywords: Programmable logic controller (PLC), MicroLogix 1400, Environment

Introduction
Data logging and recording is a very commonly used measurement application. A data logger is an electronic instrument that records various measurements at particular set intervals over a period of time. Such measurements can be current, temperature, voltage, humidity, displacement, flow, strain, differential pressure, light intensity, soil moisture, or any other parameters. The data loggers are small, battery powered devices having an internal microprocessor, data storage device and one or more sensors. Data loggers can be displayed outdoors, indoors and also underwater and can collect the data up to months at a time. The environmental consultants, building managers, energy auditors, research scientists and many other professionals rely on data loggers because of their low cost, ease of use, reliability and time-stamped data. Data loggers are the valuable devices for anyone want to continuously monitor the conditions without having to be on site.

The proposed automatic monitoring and controlling system is an integrated device that is very much essential in industries and in experimental setup to monitor the different parameters. The monitoring and controlling of different parameters using PLC are very much important in industries and research related experiments.

The proposed project involves two basic modules. One is monitoring of parameters

and another is controlling of parameters. In the first module, different sensors can measure the data which are connected to the PLC. Second module involves the controlling of these parameters using relays.

Problem statement

The collection of information about the changes in different parameters in the environment is very important. Such parameters changes continuously in the environment which is not suitable for the better operation and it can cause the effect on the operation of machines and other devices in an industry. Hence the monitoring and controlling of these parameters is important.

The data logger for automatic monitoring and controlling system consists of PLC MicroLogix 1400, multiple sensors, control devices and the computer. The system has the ability to perform the data acquisition on temperature, humidity, light intensity, smoke and LPG present in the environment. The measured parameters which are in analog form are given to the PLC. The PLC have Direct digital convert facility which converts the analog values into digital values and these values are also stored in excel file. If measured parameters are not in the proper range then the control devices like fan and bulb are automatically switched on by exciting the relays to keep the parameters in the required range. If there is smoke present in the air, the buzzer will make the sound. The excel file is created in the PLC to store the data at regular intervals.
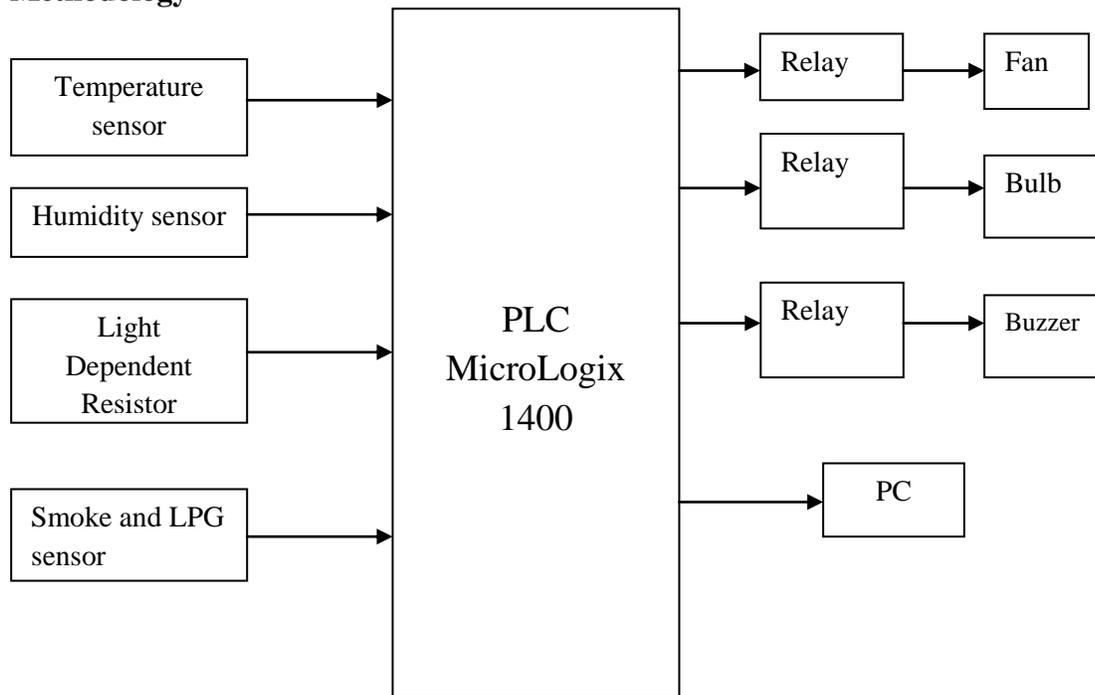
Methodology

Fig. 3.1 Block diagram of the project

Hardware Requirements
Temperature sensor
Temperature measurement sensor is used to measure the temperature present in the environment. It gives the output in the form of voltage. The temperature sensor used here is LM35.

Humidity sensor
Humidity measurement sensor is used to measure the humidity present in the environment. It works on the principle of relative humidity and gives the output in the form of voltage. The humidity sensor used here is HSM 20G.

Gas Sensor
Smoke and liquid petroleum gas measurement sensor is used to measure the amount of smoke and LPG present in the air. The sensor used for the system is MQ-2.

LDR
The light dependent resistor is used to measure the amount of light intensity in the environment. LDR is a light-controlled variable resistor and resistance decreases due to increase in intensity of light. Resistance increases with decrease in the light intensity.

PLC Controller
Programmable logic controller is a special form of controller which usually accepts the data in any format and control the machine and process. PLC uses its programmable memory to store the instructions and special functions which includes on/off control, timing, counting, arithmetic and data handling. Unlike general purpose computer PLC is designed for multiple inputs and outputs arrangements. Each sensor which is interfaced with body is directly given to the controller without any analog to digital converters since PLC have the application of direct digital converter (DDC) in it. PLC is a best example for hard real time system since output results must be generated in response to input conditions within stipulated time.

There are five basic components in PLC system, such as PLC processor or controller, I/O (Input/output) modules, Chassis or backplane, power supply and programming software that runs in a PC in addition to these PLC have SDcard slot to store the large amount of data for further analysis and PLC also consist of network interface. The PLC used in this project is MicroLogix 1400.

Relay
Relay is an electromechanical or electronical switch that opens and closes the circuits. The function of relay is to control one circuit by opening or closing the contacts in other circuit. If relay is not energized there will be an open contact because relay contact is normally open. If relay contact is normally closed, then there will be closed contact. When an electrical current is applied to the contact, there will be change in their state.

Software Requirement
CCW vesion-6
Ladder logic programming
RS-Linx
RS-Emulator

Results
The value of temperature, humidity, light intensity and smoke present in the environment are stored in the programmable memory of PLC at regular intervals. If these parameters are not in the proper range, it also displays weather these parameters are high or low. If temperature or humidity is high, then the fan will be turned on and if the light intensity is low, bulb will be on. If there is a presence of smoke, then buzzer will be on. On/off of the fan, bulb and buzzer will also be displayed in the excel sheet.

Conclusion

The different parameters which are present in the environment such as temperature, humidity, light intensity and gas are measured by the LM35 sensor, HSM-20G sensor, LDR and gas sensor respectively. When temperature and humidity are high, fan will be on. When light intensity is low, bulb will be on. If gas is detected, buzzer will be on. These parameters are monitored and controlled by Programmable Logic controller automatically. The measured data is also stored in excel sheet displayed on the computer. The system can also be enhanced by using GSM modem to send the data immediately over the long distance. The different sensors such as CO_2 sensor, accelerometer sensor, soil moisture sensor, oxygen sensor etc. can also be included in the system.

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