Industrial Automation using Microcontroller

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***Abstract*--- This paper mainly focuses on monitoring and controlling of Industrial Appliances remotely when the user is away from the place. Micro- controller is the core component of this project. Objective of this project is to avoid number of accidents, human errors, and for manual safety. As Human errors and manual safety systems lead to increase in industrial accidents, So here we are proposing a micro controller based industrial automation system that detects Smoke, Temperature, Fire, Alcohol, LPG Gas etc, to keep track of accidents, accordingly it on/off various load such as cooling fan, exhaust fan, water sprinkler and also it gives the information about detection to the supervisor through LCD Display. This paper includes the study of various electronic devices using sensors.**

Keywords–Industrial Automation, Smoke detection, Alcohol detection, LPG detection, Temperature and fire detection, Microcontroller.

I. INTRODUCTION

Security is primary concern everywhere and for everyone. Every person wants his industry to be secured. This project describes a security system that can monitor an industry. This is a simple and useful security system. Here our application uses Micro controller as its controller. A Gas sensor is present to avoid leakage of liquid petroleum gas intimated with buzzer alert and simultaneously on the exhaust fan and switch off the lights automatically. This is very dangerous to human being present in the industry as it can cause fire. Secondly a smoke as well as alcohol sensor is present to detect if any person is smoking inside the industry or any drunken persons entering in the industry as it gives probability of improper handling of equipment as well as it may cause risk of fire intimated with buzzer. A fire sensor is also present for protection against fire hazard and is intimated with buzzer alert and also water sprinkler gets on. A temperature sensor is also present at this end to find out increase in temperature and switch on cooling fans to cool the room. In this way security is provided through all aspects.

II. PROBLEM STATEMENT

Technology has advanced so much in the last decade or two that it has made life more efficient and comfortable. The comfort of being able to take control of devices from one particular location has become imperative as it saves a lot of time and effort. Also human errors may lead to accidents and hazards. It also helps in avoiding wastage of power. Therefore, it arises a need to do so in a systematic manner which we have tried to implement it with our system. The system we have proposed is an extended approach to automating a control system.

III. SYSTEM DESCRIPTION

Micro controller is the core component of this project**.** It is interfaced with Alcohol detector, Smoke detector, LPG sensor, Fire sensor and Temperature sensor. If any accident happens or any abnormal condition arises, the sensor of particular field activates and gives signal to microcontroller, and it starts executing according to the program which is fed in it. Different types of sensors such as MQ2, MQ3 and MQ6 are being used for protection against Smoke, Alcohol, LPG Gas etc., alcohol sensor (MQ3) and smoke sensor (MQ2) are used if any drunken persons entering in the industry or any person is smoking inside the industry then it detects and gives the signal to the microcontroller and according to a program it sends signal to relay driver IC to on the buzzer and also to display it on LCD thereby drawing attention of supervisor. LPG detector (MQ6) is used to detect any presence of liquid petroleum gas leakage in the industry. When leakage is detected, microcontroller performs same function as earlier and will turn on exhaust fan to forced leakage gas out to atmosphere and also automatically switch off all the lights in the industry as it may cause fire.

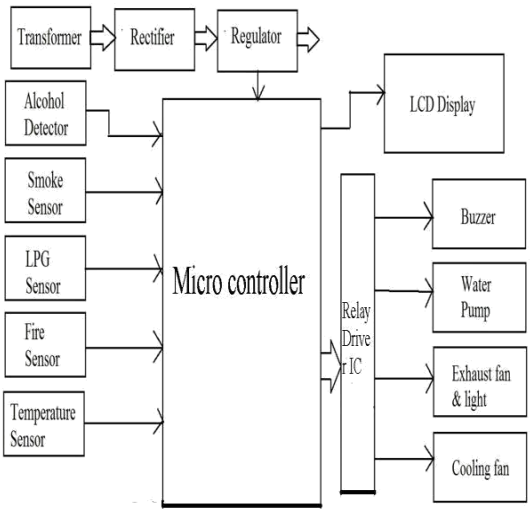

Fig.1 Block diagram

If the temperature of a machine or environment goes above a certain level, or if it crosses the limit, it is an indication of a malfunction, hence temperature sensor is used. It senses when temperature of zone exceeds and will give signal to microcontroller which is an important device and will turn on cooling fans which simultaneously controls the temperature of particular zone and will be displayed by using LCD. Fire detector is used to detect burning in a particular zone. It will sense the flame and will give signal to microcontroller and according to program it will turn on the buzzer and water sprinkler simultaneously.

IV. MICRO CONTROLLER

Micro-Controller is a small computer on a single integrated circuit. In modern technology, it is a System on a chip. A microcontroller contains one or more CPUs along with memory and programmable input-Output peripherals. There are two types of Microcontroller in use today; One is Embedded Microcontroller and Other is External Memory Microcontroller. External memory microcontroller is used when extra memory is required, therefore need can fulfilled by allowing the connection of external memory during the work as a separate ROM (RAM) which will make the work simpler and sophisticated. But in project hence memory required is within 8kb we are using embedded microcontroller.

Here we are using Atmel AT89S52 microcontroller. It is a powerful micro controller which provides a cost-effective and highly-flexible solution to many embedded control applications. An embedded microcontroller is a chip which has a computer processor with all its support function, memory and input- output interfacing built into device.

Following are some features of AT89S52 Microcontroller [4]:

- Compatible with MCS-51 products
- 8k bytes of in-system programmable flash memory
- Fully static operation from 0 Hz to 33 MHz
- Three- level program memory lock 256 x 8-bit Internal RAM
- 4.0 to 5.5V operating range
- 32 programmable I/O lines
- 8 interrupt sources
- Three 16-bit Timer/Counters
- Low power idle and power -down modes

V. METHODOLOGY

In this paper there are two parts. They are the Protection system and the Load controlling system [1]. In the protection system we use various sensors such as alcohol, smoke detector sensor, LPG gas detector sensor, temperature sensor, fire detector sensor. In the load controlling system we use relay to on or off the load such as fan, water pump, etc. Each part of our paper has been discussed in details.

A. Alcohol/Smoke/LPG Gas Detection Unit:

The heart of this unit is a Sensor devices [1]. MQ3 is an Alcohol sensor which is suitable for detecting alcohol concentration from the breath, just like a breathalyzer. It has a high sensitivity and fast response time. Sensitive materials of MQ-3gas sensor is SnO2, which with lower conductivity in clean air. This sensor can be used to detect alcohol with different concentration, it is with low cost and suitable for different application.

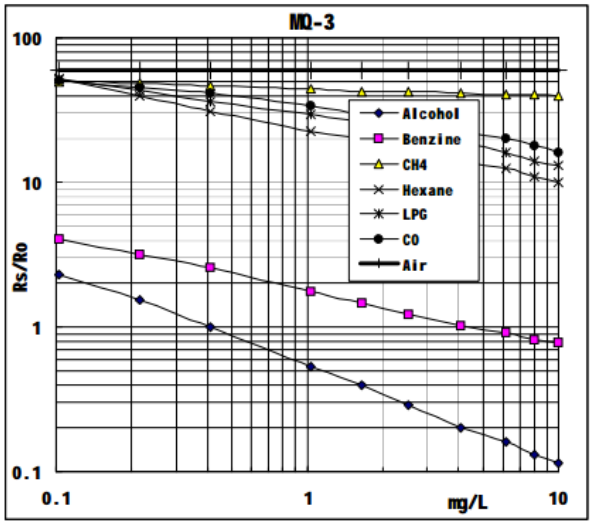

Fig.2 MQ-3

For Smoke detection smoke sensor MQ-2 is used. Main feature of this sensor is that it is not only sensitive to smoke, but also to flammable gas. The Output pin of it gives the voltage reading at output, which is proportional to the amount of smoke that the sensor is exposed to. MQ6 is a Liquefied Petroleum Gas (LPG) sensor. It is suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. It can sense LPG gas concentrations anywhere from 200 to 10000ppm.

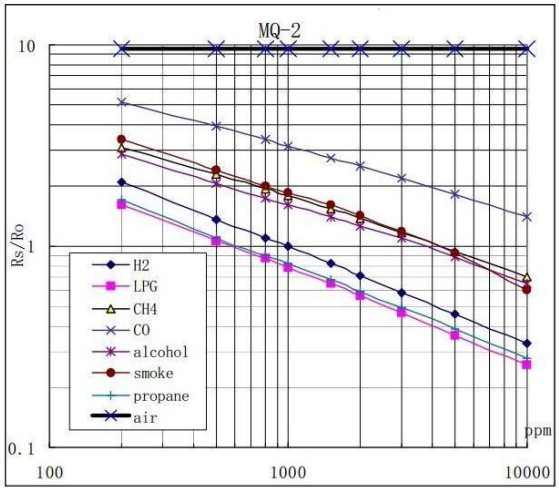

Fig.3 MQ-2

B. Temperature Sensing Unit:

The core functionality of the DS18B20 is its direct-to digital temperature sensor. DS18B20 requires no external components and its power supply range is 3.0 to 5.5V. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a microcontroller. Terminal 1 of sensor is connected to ground, supply is given to terminal number 3, and Output terminal is 2. The resolution of the temperature sensor is 9, 10, 11, and 12 bits, corresponding to increments of 0.5°C, 0.25°C, 0.125°C, and 0.0625°C, respectively., When the particular temperature reaches the reference value then the signal is set to the input pin of the microcontroller[1].

An application of DS18B20 includes thermostatic controls, industrial systems, consumer products, thermometers, or any thermally sensitive system.

C. Fire Detection Unit:

This detection unit has been used to detect flame in the corresponding room. Flame sensor is a Zener diode N4148. A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. Responses to a detected flame depend on the installation, and includes sounding an alarm, At first we set the detecting range of sensor using variable resistor. It works on the principles of the thermal triggering when the particular fire i.e., temperature is reached, the electrons in the junction of zener diode will start moving. i.e., will become free, the zener diode voltage will breakdown and then starting conducting When fire has been detected by the sensor then the signal is given to the microcontroller[1].

These device types have an enduring popularity in low current applications. A flame detector can often respond faster and more accurately than a smoke or heat detector.

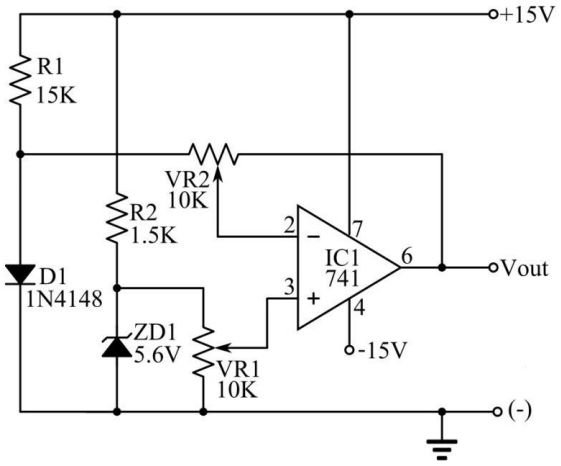

Fig.4 Circuit diagram

D. Load Controlling Unit:

In this paper the first and foremost priority unit is load control which has been interfaced with microcontroller [1]. We can control each and every load individually; We can turn on or off every load by giving signal from microcontroller.

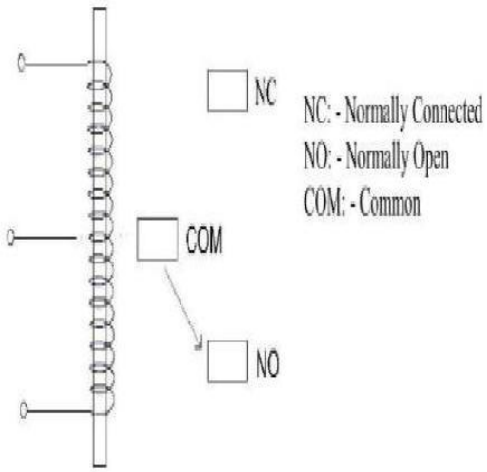

Fig.5 Relay Coil[4]

The relay driver is an coil with three contacts-Normally Connected (NC), Normally Open (NO), and Common (COM). It is used to isolate both the controlling and the controlled devices [4]. When microcontroller gives signal to the output pin then the relay coil gets magnetized and it attracts the moving contacts. Now the moving contact leaves from its initial position (NC) normally closed terminal which is a fixed terminal and establishes the connection with a new terminal which is indicated as a normally open terminal (NO).

VI. CONCLUSION

The project we have undertaken has helped us to gain a better perspective on various aspects related to our course of study as well as practical knowledge of electronic equipment and communication.

The extensive capabilities of this system are what make it so interesting. From the convenience of a micro-controller, a user is able to control industrial accidents, human errors and for manual safety. This makes it possible for the user that there are less accidents taking place in industry and people's life or company growth is not in risk anymore. The end product will have a simplistic design making it easy for users so that they can interact. This will be essential because of the wide range of technical knowledge that industries have.

VII. FUTURE ASPECTS

The future implications of this project are very great by considering the amount of time and resources it saves. The project we have undertaken can be used as a reference or as a base for realizing a scheme to be implemented in other projects of greater level such as temperature updates, device synchronization, etc. The project itself can be modified to achieve a home automation system which will then create a platform for user to interface between himself and his household.

In future the system will be small box combining the micro-controller and GSM module. The hardware will be self contained and it cannot be prone to electric failure. This module will have its own encapsulated UPS and charging system.

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