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Industrial Safety Automation Using Iot

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***Abstract*—This paper illustrates a precarious environment monitoring and control for this monitoring information concerning safety and security. The proposed system uses a combination sensor network with a system architecture and concept implementation, which are described mainly for an industrial safety monitoring scenario. The information is gathered by the deployed sensor network with focus on five main conditions: temperature, fire, gas leakage and mobile detection. This paper also enables an easy to use user interface and the accessibility of data through standards-based web server technologies.**

***Index Terms*— Automation, Sensors, IoT, Safety, Industry.**

I. INTRODUCTION

The environmental care has become one of the prime concerns for almost every country in the last decades. Even though the number of industrial accident has been increasing in the last few decades, the current scenarios in the industry have not improved. They tend to be more a dangerous environment rather than a safe one even with a wide range of modern technologies. Recently the current industries have been demanding sophisticated instrumentation for monitoring and control of environmental risk parameters in the danger-prone areas. Human safety and property losses are the essential to maintain a balance between industry and industrial environments.
Five main components are the reasons for an accident to occur: the fire, gas leakage, radiation, over voltage and high temperature. An industrial accident usually occurs individually to the above mentioned factors or as the result of their combined effects. In this paper propose, combining the virtual monitoring technology with hazardous risk management together, a wireless multi-sensory monitoring system of hazardous site environment. GPRS and GSM wireless sensor network architecture is adopted and based on virtual instrument technology, Virtual instrumentation environment. In this paper we propose a combination of the real time monitoring technology with the sensors to keep a time to time track of the various factors which are recognised to cause an accident on site. In addition to this, GPRS and GSM wireless sensor network architecture are adopted. The function of real-time monitoring is to provide remote-distance hazardous parameters information, display the data, analyze, identify when the parameters cross threshold, provide warning in case of an accident.

II. LITERATURE SURVEY

In the past few years, keeping abreast with most of the industrial accidents that occur in dangerous environment which have very bad consequences with respect to life, property and environment is a very arduous task. Safety in such environment and security in case of any mishap can be most important for humanitarian, legal, and financial reasons. Real time monitoring is mainly required in such cases as it just

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takes matters of seconds for the situation to go from bad to worse if no actions are taken. The main factors responsible for the accidents was analysed and understood. The purpose of the paper was mainly to improve the existing design considerations and focus on improving key areas such as: methodology used, being aware of the environment in real-time and placement of the sensor. This paper surveys the needs associated with monitoring and long term solution for the problem existing from few decades now. Upcoming sensor technologies are studied to identify which particular technology is suitable in monitoring factors which were recognised earlier. Automation is given primary focus in this paper as it in the primary innovative requirement in the industries in the twenty first century.

III. SYSTEM OVERVIEW

A. Block Diagram

The system comprises of a base station and a Wireless sensor node. An ARM 7 microcontroller acts as a base station. Temperature, Fire, Mobile radiation and gas leakage sensors with associated signal conditioners attached to ARM 7 32 bit controller. Fig. 1 shows the block diagram of the system. In this project we are measuring the vital parameters. Any leakage of poisonous gases can be detected and if temperature is increased beyond certain limit it will intimate the concerned person. Similarly, if fire accidents occur then it will intimate to the owner through GPRS which commonly called IOT protocol along with a message through GSM. If over voltage occurs we can cut off the power to the base station .In addition to this we use a buzzer and a display for intimating the other workers about the accidents.

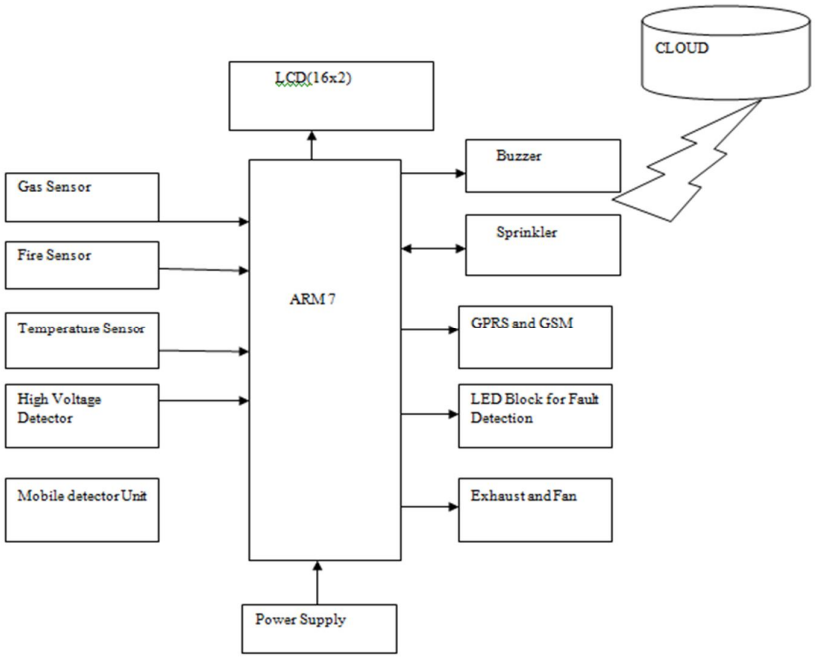

Fig 1: Block Diagram Of The System

B. Hardware Description

ARM7 LPC2148: The ARM7 Controller constitutes the main part of the embedded system. Advanced RISC Machines (ARM) is categorized under the Reduced Instruction Set Computer (RISC) architecture. The controller model used in the project is the LPC2148 model. The main characteristic being real time emulation and embedded trace support with an embedded high speed flash memory. The controller processes the incoming data from the sensors and displays the necessary information on the LCD display.

Temparature Sensor: The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C).It can measure temperature more

accurately than a using a thermistor. The sensor circuitry is sealed and not subject to oxidation. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. The LM35 has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/°C.

Gas Sensor: The analog Smoke/LPG/CO Gas Sensor (MQ2) module utilizes an MQ-2 as the sensitive component and has a protection resistor and an adjustable resistor on board. The MQ-2 gas sensor is sensitive to LPG, i-butane, propane, methane, alcohol, Hydrogen and smoke. It could be used in gas leakage detecting equipments in family and industry. The resistance of the sensitive component changes as the concentration of the target gas changes.

Fire Sensors: Flame sensor is the most sensitive to ordinary light that is why its reaction is generally used as flame alarm purposes. This module can detect flame or wavelength in 760 nm to 1100 nm range of light source. The sensor and flame should keep a certain distance to avoid high temperature damage to the sensor. If the flame is bigger, test it with farther distance. The detection distance is up to 100 cm.The detection angle is 60 degrees so the flame spectrum is especially sensitive. The Flame sensor can output digital or analog signal. It can be used as a flame alarm or in fire fighting robots.

Mobile Detector Unit: The mobile detector unit can sense the presence of an activated mobile phone from a distance of one meter. The circuit can detect both incoming and outgoing calls, SMS and video transmission, even if the mobile is kept in silent mode. The transmission frequency of the mobile phones ranges from 0.9 to 3GHz with a wavelength of 3.3 to 10cm. A 0.22uF disk capacitor is used to capture the RF signals from the mobile phone. The op amp IC CA3130 is used in the circuit as a current to voltage converter. The transistor BC548 is used to increase the voltage level. The IC 555 is used in monostable multivibrator mode to drive the piezo buzzer.

Exhaust and Fan: It is a wiring mechanism used for the circulation of air. It works on the principles of a DC motor. Any leakage of gases is drawn out by the exhaust to the outside. Similarly the fan is used to bring the temperature down if it goes beyond a particular threshold value.

GPRS and GSM: The GSM net is used by a cell phone to provide wireless communications that need connectivity rather than high data rates. GSM modem can be controlled by a standard set of AT (Attention) commands. In this project GSM modem is used for communicating with the user and controller. It sends a message to the user whenever the sensor value is high. General Packet Radio Service (GPRS) is a packet oriented mobile data service on the 2G and 3G cellular communication system's global system for mobile communications (GSM). The GPRS is used to connect the WIFI module to the cloud storage using IOT.

Sprinkler and Buzzer: The sprinkler is a device that is triggered on whenever fire is detected to diffuse the fire. The sprinkler used in the project is required to be immersed in water. As long as the fire sensor is detection the flame, the sprinkler keeps running. The buzzer however will be triggered by every sensor when something is detected. The main purpose of the buzzer is to intimate to the owner about the accident.

LCD (Liquid Crystal Display): An electronics display module which has a variety of applications. A 16X2 LCD module is used in the project which is used to display room temperature, light intensity, concentration of gases and presence of a person in the room. The 4 bit data lines send the information to the LCD.

C. Software Description

- The GSM gets initialized and sends a message to the owner about proper initialization.
- The LCD and UART get initialized.
- The ADC is used to monitor the sensors continuously.
- When the temperature is sensed to be above 35 degree Celsius, controller sends a message to the user and it is displayed on the LCD along with a buzzer. The fan is simultaneously turned ON to bring down the temperature to ambient condition.
- When gas leakage is detected in the industry, the exhaust fan is turned ON and a message is sent to the user through the GSM system along with warning message on the LCD and buzzer.
- When the flame sensor detects fire, the controller first displays the warning on the LCD followed by a buzzer, turning ON the sprinkler and finally a message to the owner via GSM system.
- The mobile detector unit is a separate unit and will start buzzing as soon as any mobile radiation is detected and will continue to buzz until the phone is turned off.
- Whenever the voltage inside the circuit goes higher than 12V, over voltage message is displayed on the LCD followed by the buzzer. Finally, a message is sent to the owner using the GSM system.

D. IOT Platform

A web page is used to provide a suitable interface between the user and the Industrial Safety Automation System. A particular IP address is provided for the particular industry and this IP does not change as it is hosted on Amazon Web Server. The screenshot in Figure 1 depicts the login page as seen on the user's laptop. Only after authentication is an individual allowed access to check the condition of the industry. The screenshot shown in Figure 2 is the home screen that is displayed once login is successful. This contains the different columns representing different data. This is continuously updated every second and keeps track of previous data too.

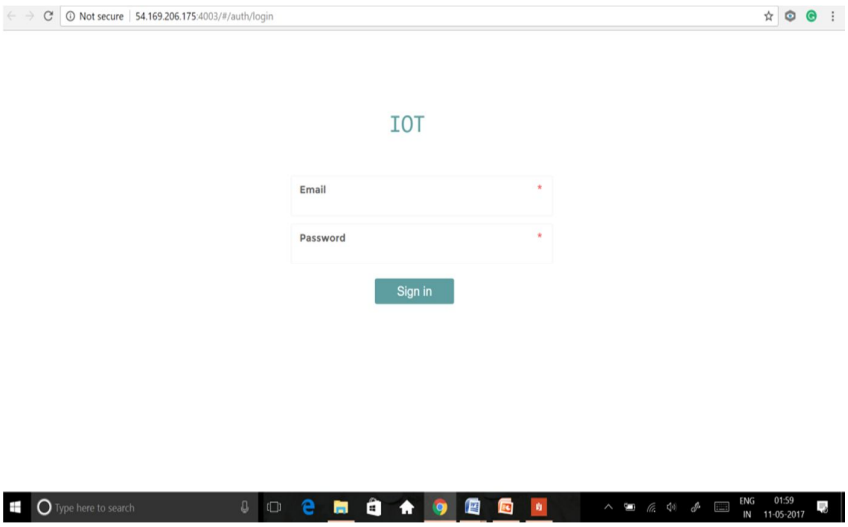

Fig 2: Login Page To The IOT

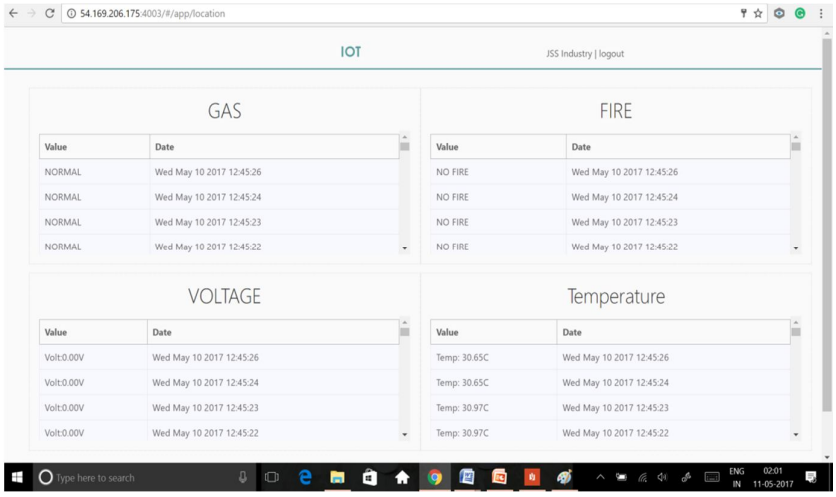

Fig 3. Real time IOT based industry monitoring

IV. RESULTS

The implemented system was tested efficiently and tested for proper working. The initialization of the GSM and working of the sensors were verified. Messages were obtained after each alert and corresponding data uploaded on to the cloud storage. The buzzer and sprinkler also worked efficiently.

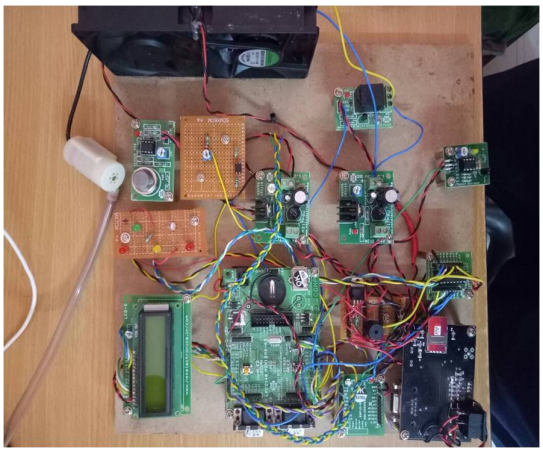

Fig 4. Proposed System

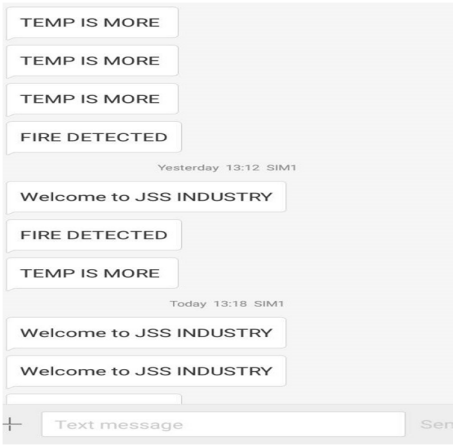

Fig 5. Messages received via GSM

V. CONCLUSION

Industrial Safety Automation using IOT has been implemented successfully. We have successfully integrated the house and its appliances to the digital world. The project is cost effective and can be easily implemented for other real time applications. It can be realised with the usage of less power. This project is secure and user friendly and can be employed by the government in large scale to help industries too. By automating an industry, a safe working environment can be created with the available advanced mechanism and the entire system integrated into one network. The industry is substantially safe from fire accidents, voltage fluctuations and gas leakage.

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