DESIGN AND IMPLEMENTATION OF IOT BASED INDUSTRIAL SCADA SYSTEM

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ABSTRACT

Number of accidents happens in the industry are increased in great extent. These accidents are mainly caused due to system or machinery failure or due to irregular irresponsible monitoring and controlling of the system. Such accidents become Hazardous for human life working with that environment. To avoid such accidents happened due to system error we have to control the system parameter automatically. The system proposed in this paper gives advance solution for the monitoring and controlling of the industrial machine parameter from anywhere, anytime by using internet.

Internet of things(IOT) is rapidly increasing technology. IOT is the network of physical objects or things embedded with electronic software, sensors, and network connectivity which enables these objects to collect and exchange data. In this project, we are developing a system which will automatically monitor the industrial applications and generate Alerts/Alarms or take intelligent decisions using concept of IOT. Safety from Temperature, Smoke and fire are the most important requirements of home and industries security system for people. A traditional security system gives the signals in terms of alarm.

Keywords— IOT (Internet of Things), Arduino UNO, Arduino Software, ESP32, SCADA (Supervisory Control& Data Acquisition).

1.INTRODUCTION

Internet of Things (IoT) is a network in which all physical objects are connected to internet through network devices or routers and exchange data. IoT allows objects to be controlled remotely across existing network infrastructure. It mollifies human effort and enables easy access to physical devices. It also has autonomous control feature by which any device can control without human interaction. The versatility of IoT has become very popular in recent years because of its low power embedded system, cloud computing, availability of big data networking condition. IoT can be any device with any kind of built-in-sensors with the ability to collect and transfer data.

An industrial safety system is a counter measure crucial in any hazardous plants such as oil and gas, nuclear plants. They are used to protect human, plant and environment in case

the process goes beyond the control margin. Mechanical Engineering is primarily concerned with industries and their applications. This prototype will benefit the above requirements. The best way of preventing accidents is to be aware of your surroundings. 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.

2.PROPOSED METHOD:

As shown in figure.1 in this project a design and implementation of sensor based security system with an IOT environment has been presented, which will resolve various security issues like Temperature, fire and Gas detection etc. Therefore continuous monitoring of the home/industry is possible. The system is cost effective, reliable and has low power consumption. In this method we collected real time sensor information using sensors. Temperature sensor, Humidity sensor senses real tome information of temperature, humidity and gas.

These signals are sent to ESP 32using analog to digital converter ADC. Controller manipulates this information and according to given program and conditions it switches relays using ULN2003. These relays are connected to output parameters respectively sprinkler, artificial cooler. The website is burnt into ESP32, information collected by the sensors is sent on website. Also from website we can control the output parameters by switching relays off and on. Some of the details for implementing Internet TCP/IP end point connections, with comparisons to more traditional methods will be looked at and related to examples for weather monitoring systems and sensors. A global network of networks consisting of millions of private, public, academic, business, and government networks, that are linked by a broad array of communications and network technologies, all using the standard Internet protocol suite (TCP/IP).

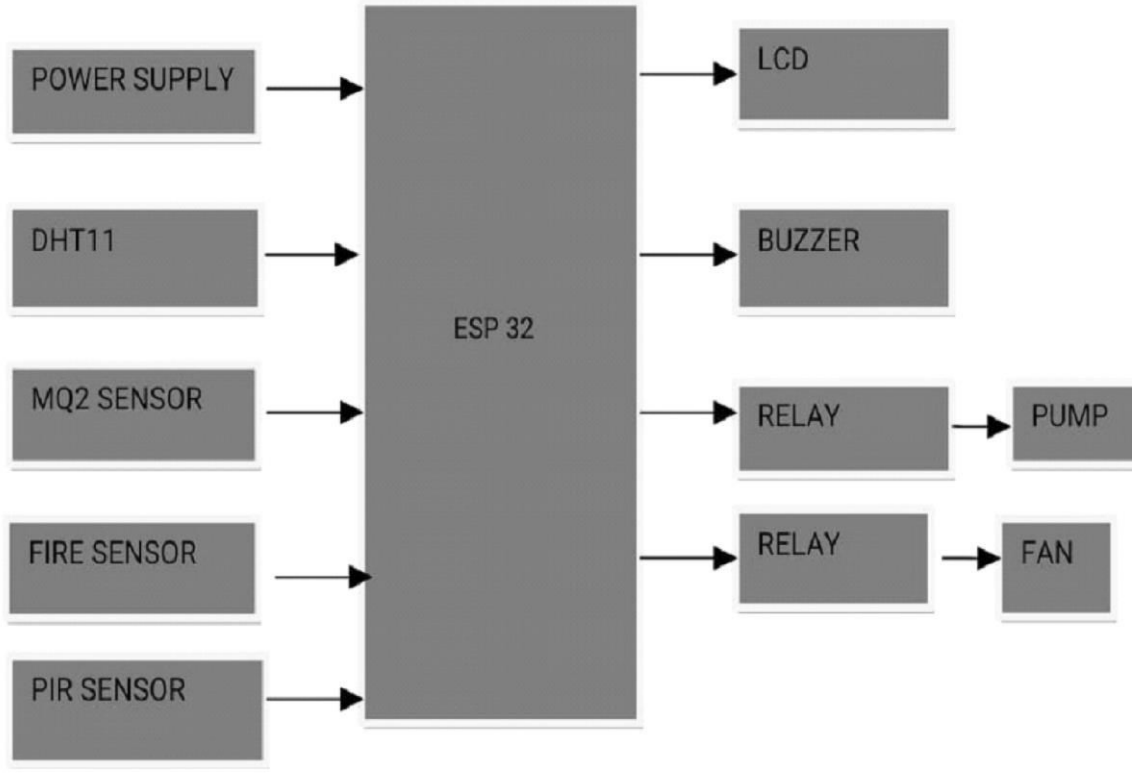

Fig. 1. Block Diagram of Proposed Method

In this project we are supposed to design and implementation of sensor based security system with an IOT environment has been presented. which will resolve various security issues like Temperature, fire humidity and smoke detection etc. Therefore continuous monitoring of the home/industry is possible, The system is cost effective, reliable and has low power consumption. In this method we collected real time sensor information using sensors. Temperature sensor, Humidity sensor senses real tome information of temperature, humidity and smoke. These signals are sent to Arduino UNO using analog to digital converter ADC. Controller manipulates this information and according to given program and conditions it switches relays using ULN2003. These relays are connected to output parameters respectively sprinkler, artificial cooler. The website is burnt into esp32, information collected by the sensors is sent on website. Also from website we can control the output parameters by switching relays off and on. Some of the details for implementing Internet TCP/IP end point connections, with comparisons to more traditional methods will be looked at and related to examples for weather monitoring systems and sensors.

You can use this board in your hardware design (as it takes care of the complex RF section of the PCB) and make a development board or a breakout board or even a commercial product. This is what third-party module manufacturers do. They take the ESP-WROOM-32 Module, design a break-out board based on this module with user friendly pins, USB Port, RESET and BOOT switches etc.

2.1 Arduino UNO

The Arduino UNO is a micro-controller board based on the ATmega328 as shown in Figure 2.

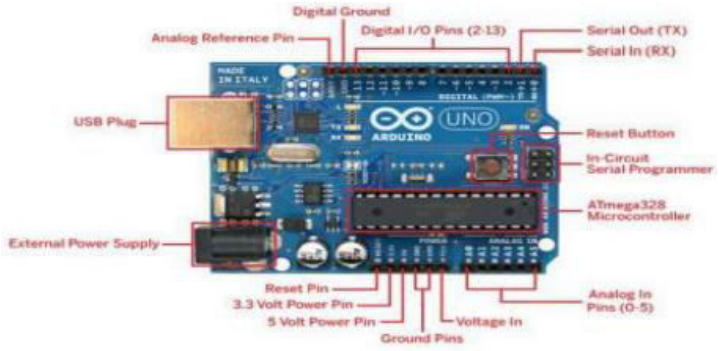

Figure.2.Arduino UNO

It has fourteen digital input/output pins (of which six of it can be used as PWM outputs), six analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the micro-controller; it can simply connect to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

2.2 Liquid Crystal Display (LCD)

As shown in figure.3 Liquid Crystal Display (LCD) is an electronic display module or screen and has a wide range of applications. It is very basic and very commonly used in many devices and circuits. LCD can display sixteen characters per line and a second line on the screen (16x2). The LCD will be displayed in a matrix of 5x7 pixels.

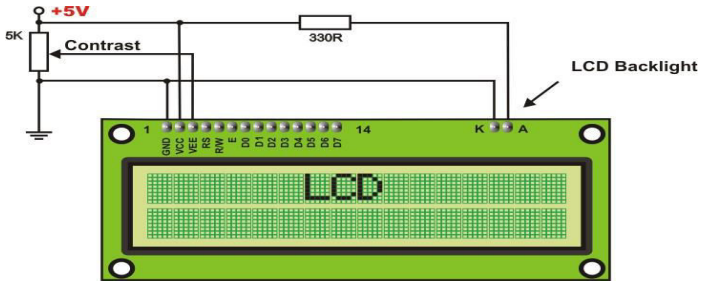

Fig.3.LCD Display

2.3 Smoke Sensor :

A smoke detector is a device that detects smoke, typically as an indicator of fire. Commercial, industrial, and mass residential devices issue a signal to a fire alarm system, while household detectors, known as smoke alarms, generally issue a local audible and/or visual alarm from the detector itself as shown in figure.4

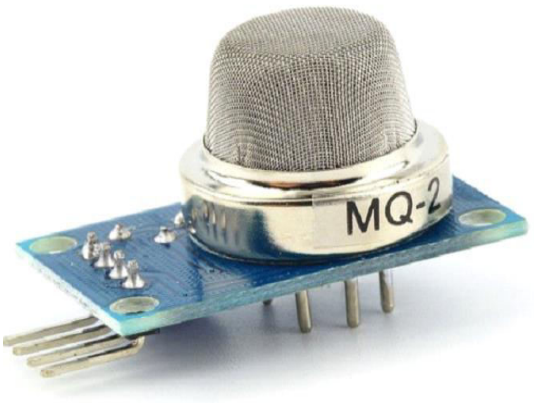

Fig.4.Smoke sensor

2.4 Humidity Sensor :

Humidity Sensor is one of the most important devices that has been widely in consumer, industrial, biomedical, and environmental etc. applications for measuring and monitoring Humidity.Humidity is defined as the amount of water present in the surrounding air. This water content in the air is a key factor in the wellness of mankind as shown in figure.5

But if the temperature is 100C and the humidity is high i.e. the water content of air is high, then we will feel quite uncomfortable. Humidity is also a major sensitive devices and high voltage devices environment that is suitable for the device factor for operating sensitive equipment like electronics, industrial equipment, electrostatic. Sensing and controlling humidity in our homes and offices is important as higher humidity conditions will affect the blood flow. Other areas include cooking, indoor plantation etc

Fig.5.DTH-11 Sensor

2.5 Flame Sensor:

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, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and

activating a fire suppression system. There are different types of flame detection methods. Some of them are: Ultraviolet detector, near IR array detector, infrared (IR) detector, Infrared thermal cameras, UV/IR detector etc.

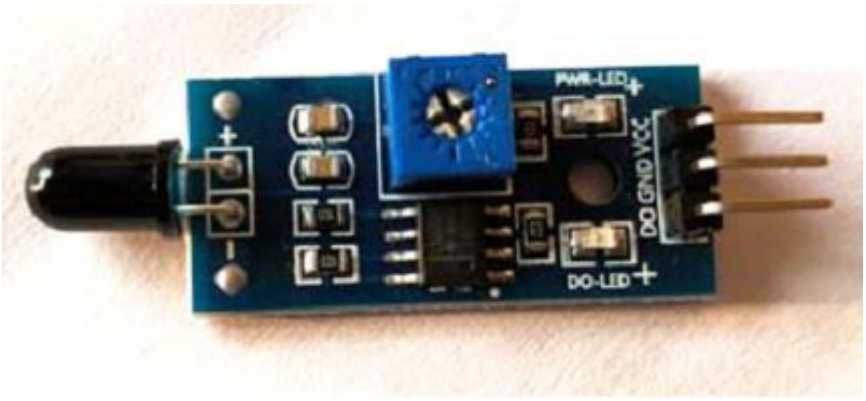

Fig.6.Flame Sensor

When fire burns it emits a small amount of Infra-red light, this light will be received by the Photodiode (IR receiver) on the sensor module as shown in figure.6.

2.6 PIR Sensor :

PIR sensors allow you to sense motion. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. Now, the big question is that how it will detect the human activities? Do not worry, this tutorial will guide you about the PIR sensor working principle as shown figure.7

- Pin1 corresponds to the drain terminal of the device, which connected to the positive supply 5V DC.
- Pin2 corresponds to the source terminal of the device, which connects to the ground terminal via a 100 K or 47K resistor.

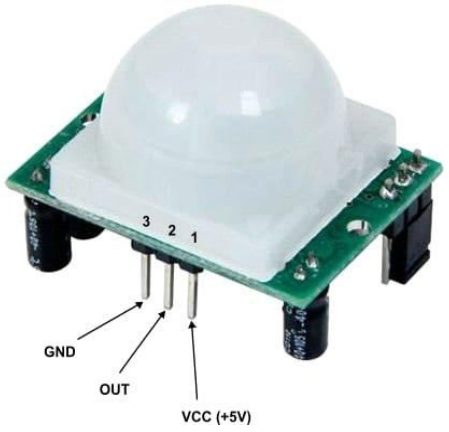

Fig.7.PIR Sensor

2.7 Applications :

1) This small scale project can be implemented in many houses, buildings and industries with minimum cost and resources.

2) This system is useful for farmers in water irrigation and on/off pump from any place.

2.8 Advantages:

- The implemented overall system is user friendly.
- Time required for working of system is less.
- The system implemented to reduce manpower.
- Low cost
- High Reliability
- Multipurpose system
- Prevent the disaster due to DAM overflow

2.9 Brushless Submersible Water Pump:

As shown in figure.8 shows this Brushless Submersible Pump is a low-cost, small- size Submersible Pump. It can take up to 240 litres per hour with a very low current consumption of 300mA. Just connect the tube pipe to the motor outlet, submerge it in water, and power it.

2.10 Buzzer:

As shown in figure.9 shows an audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main

function of this is to convert the signal from audio to sound.

Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren

Fig.9. Buzzer

The **pin configuration of the buzzer** is shown below. It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-'symbol or short terminal and it is connected to the GND terminal.

2.11 Cooling Fan:

Fig.10. Cooling Fan

As shown in figure.10 shows this is a miniature-size exhaust cooling fan. This fan is as small as your palm. Its working voltage is 5V DC. It can work with a simple 5V battery without any difficulty. The body of the fan is built from a combination of resin and plastic material.

The combination provides strength and insulation to the fan. Due to its manufacturing, It is light in weight and strong enough to bear some falls on the ground.

So if you are looking for a perfect combination of strength and insulation in a single fan

3.HARDWARE:

As shown in figure.8 we are monitoring the weather conditions in the greenhouse and make the information visible anywhere in the world. The technology behind this is Internet of Things (IOT), which is an advanced and efficient solution for connecting the things to the internet and to connect the entire world of things in a network.It shows the block diagram of internet of things based industrial SCADA system. It mainly consists of sensors, Arduino UNO, LCD display, along with Wi-Fi module and controlling device such as fan/heater. This system is used to monitor and control the various parameters of the industrial operational process such as temperature, pressure, speed etc.

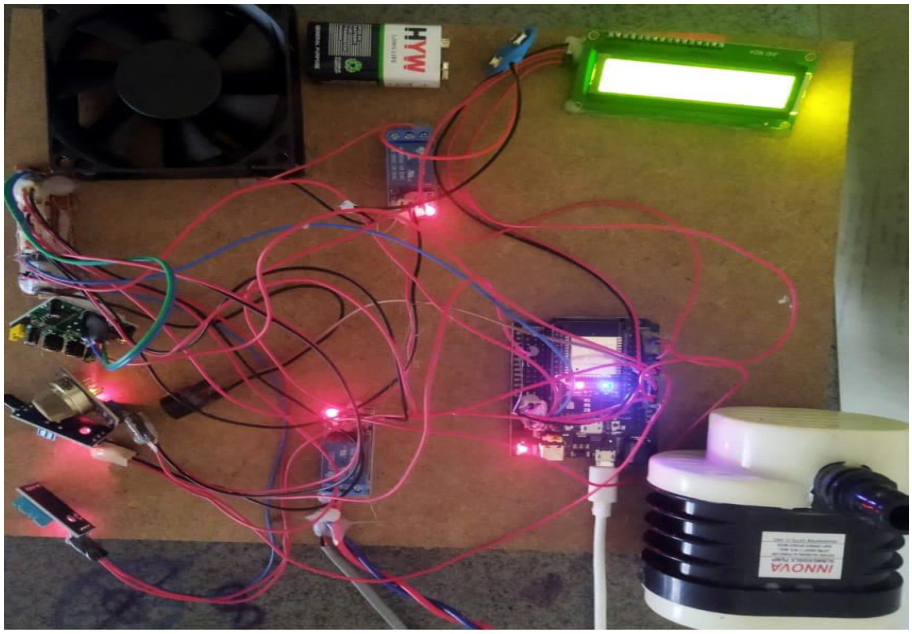

Fig.8.Hardware Prototype

Arduino UNO is the heart of the system. Arduino UNO uses ATMEGA 328 as a microcontroller. Power supply is used to power up the various devices used in the system. For this purpose we require analog to digital converter. ATMEGA328 has inbuilt ADC which convert sensors analog data into digital form ant that digital data will be read by the microcontroller.

ESP32 is used as Wi-Fi module. It is used to send the temperature data to the webpage. It also receives the controlling instructions from the webpage and given to the microcontroller. ESp8266 requires power supply of 3.3V. Webpage/mobile app is used to monitor and control the process from anywhere, anytime.

4.RESULTS:

Once the power supply is on all the devices get powered up. Temperature sensors detect the current temperature and send it to the analog to digital converter of Arduino UNO. Here we use LM35 as a temperature sensor which has operating range in between -550C to 1550C. LM35 generates 10mV per change in degree change in temperature. ADC has a 10 bit resolution. Hence it has 1024 steps. If we use such steps then full scale voltage goes to 10.24V but it is not accepted by the microcontroller of Arduino. Hence we have to convert it. For 10 bit ADC steps are in the range of 0 to 1023. 1V=1/1023 = 977.51 microvolt For 5V= 0.0048875 volts Hence we have to multiply each incoming temperature by factor 0.0048875 volts to get actual temperature. Once we get actual temperature then that will display on LCD and web server results display as shown in figure.9

Fig.9.Web Server result

5.FUTURE SCOPE:

The proposed system consists of two WIFI modules, as a future implementation we will implement a common server for recording the parameters and controlling the system. The other necessary updating is the implementation of chemical sensor. Chemical sensors can be used to measure the PH and chemical components in soil. Advantages of the proposed system: GUI, wireless, vast controlling and monitoring.

6.CONCLUSION:

To implement this need to deploy the sensor devices in the greenhouse for collecting the data and analysis. By deploying sensor devices in the industry, we can bring the environment into real life i.e. it can interact with other objects through the network. Then the collected data and analysis results will be available to the end user through the Wi-Fi. The smart way to monitor parameters and an efficient, low cost embedded system is presented with different models in this paper. In the proposed architecture functions of different

modules were discussed. The temperature and humidity monitoring system with Internet of Things (IOT) concept experimentally tested for monitoring two parameters. It also sent the sensor parameters to the cloud (Google Spread Sheets). This data will be helpful for future analysis and it can be easily shared to other end users.

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