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Industrial Monitoring using IoT

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ABSTRACT: This paper presents the development of industrial monitoring system that monitors the environment conditions in an indoor space at remote location using the concept of IoT. In this system, sensors like temperature sensor, humidity sensor and gas sensor are used and data collected from the sensor will be available remotely through webpages and can view the data anywhere in the world and decisions will be taken based upon the measurement. SMS alert will be sent to the specific person in any emergency situation which contains collected values from the sensor. The communication between the system's components is performed using the existent wireless infrastructure based on the IEEE 802.11 b/g standards**.**

KEYWORDS: Raspberry Pi, wireless communication, remote access, sensors, dc motor, buzzer.

I.INTRODUCTION

This paper deals with monitoring the industry's environmental condition and generates an Alert/Alarm and also take intelligent decisions using concept of IOT. Temperature Sensor is used to gather the temperature level in an indoor space and Humidity sensor is to detect the moisture level in air and Gas sensor is to detect the LPG leakage. After the information is collected from sensor, it will be updated in webpages and SMS alert will be sent to specific people in an organisation.

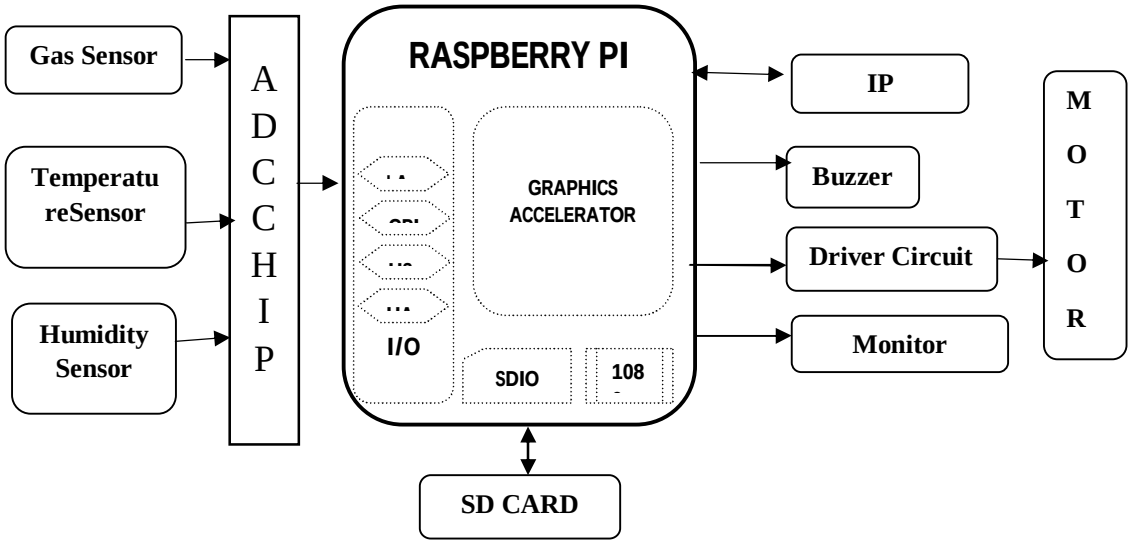

FIG 1. THE COMPLETE SYSTEM ARCHITECTURE OF MONITORING SYSTEM

The fig 1 shows the complete architecture of monitoring system. Three sensors are used in this system i.e. temperature sensor, humidity sensor and gas sensor. These sensors are connected to the ADC chip to convert an analog

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signal to digital signal and these data will be collected by the Raspberry Pi. All the sensors will be assigned a threshold value. Once the threshold value is reached or goes beyond it, buzzer will be activated and SMS alert will be sent to the particular person. The data collected will be available in webpage and can be accessed anywhere else. Webpage has a control system and it will run the motor as well stop the motor.

A.RASPBERRY PI

The **Raspberry Pi** is a small single-board mini-computer developed by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries**.**Referring to fig 2, Raspberry Pi has a Broadcom System On-Chip (SOC) which includes an ARM compatible central processing unit (CPU) and an On-chip Graphic Processing Unit(GPU). CPU speed ranges from 700 MHz to 1.2 GHz for the Pi 3 and on board memory range from 256 MB to 1 GB RAM. Secure Digital (SD) cards are used to store the operating system and program memory in either the SDHC or MicroSDHC sizes. Most boards have between one and four USB slots, HDMI and composite video output, and a 3.5 mm phone jack for audio. Lower level output is provided by a number of GPIO pins which support common protocols like I²C. The B-models have an 8P8C Ethernet port and the Pi 3 has on board Wi-Fi 802.11n and Bluetooth.

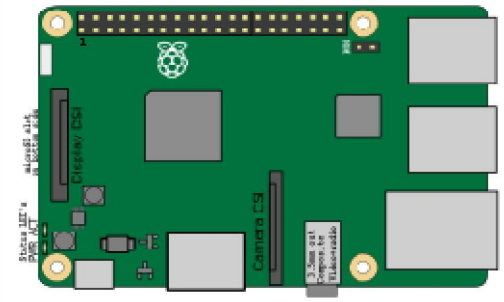

FIG 2. RASPBERRY PI 3

B. TEMPERATURE SENSOR

The temperature sensor used in our project is LM35 which is shown in fig 3.The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in ^{o}C). Temperature sensor sends data as an analog signal. Since Raspberry Pi accepts only digital data, ADC chip is used and sensor will be connected to it to convert the analog into digital signal. LM35 measures the temperature more accurate than the other sensors and it also generates high output voltage.

FIG 3. LM35 TEMPERATURE SENSOR

B.GAS SENSOR

Gas sensor is used to detect the LPG leakage in an indoor environment. The sensor can also sense iso-butane, propane, LNG and cigarette smoke. It can be integrated to any alarm devices to generate an alarm if a gas leakage is being detected. It provides a digital data since it uses a comparator IC. In our project, we detect only whether the gas is

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leaked or not. Once the gas is detected, an buzzer will be activated in turn an SMS alert will be sent to the specific person and motor will be run from anywhere by accessing a webpage. Fig 4 shows the gas sensor.

FIG 4.GAS SENSOR

C.HUMIDITY SENSOR

Humidity Sensor is used to detect the moisture level in an air. It is required in many industries especially in food production industry where moisture level needs to be monitored in order to avoid fungus formation. In medical applications, humidity control is required for respiratory equipments, sterilizers, incubators, pharmaceutical processing, and biological products. For domestic applications, humidity control is required for living environment in buildings, cooking control for microwave ovens, etc. In all such applications and many others, humidity sensors are employed to provide an indication of the moisture levels in the environment. Below Fig 5 represents the humidity sensor.

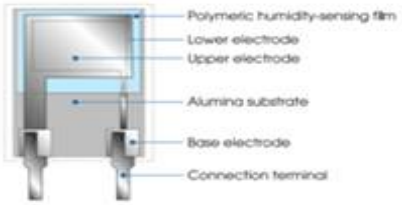

FIG 5.HUMIDITY SENSOR

E.DC MOTOR

The DC motor has two basic parts: the rotating part is called the armature and the stationary part that includes coils of wire called the field coils. The stationary part is also called the stator. The armature is made of coils of wire wrapped around the core, and the core has an extended shaft that rotates on bearings. You should also notice that the ends of each coil of wire on the armature are terminated at one end of the armature. The termination points are called the commutator, and this is where the brushes make electrical contact to bring electrical current from the stationary part to the rotating part of the machine. The coils that are mounted inside the stator are called field coils and they may be connected in series or parallel with each other to create changes of torque in the motor. You will find the size of wire in these coils and the number of turns of wire in the coil will depend on the effect that is trying to be achieved.

II.RELATED WORK

The literature contains a large number of efforts for developing monitoring solutions that benefit from the advantages provided by wireless sensing technology. Reference [1] presents an energy efficient wireless sensor network communications based on computational intelligent data fusion for environmental monitoring which uses an ultrasonic sensor to detect the water level to provide prevention from flood. Reference [2] presents an integrated sensing systems for real-time indoor air quality monitoring which uses a humidity sensor to detect the level of seven gases, ozone (O_3), particulate matter, carbon monoxide (CO), nitrogen oxides (NO_2), sulfur dioxide (SO_2), volatile organic compound, and carbon dioxide (CO_2). Reference [3] presents a quantification of individual gases/odors using

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dynamic responses of gas sensor array with ASM feature technique which uses a gas sensor to detect the gas leakage. Reference [4] presents automated irrigation system using a wireless sensor network and GPRSmodule was developed to optimize water use for agricultural crops. The system has a distributed wireless network of soil-moisture and temperature sensors placed in the root zone of the plants.

III.INTERFACING BETWEEN RASPBERRY PI AND SENSORS

Sensors like temperature sensor, humidity sensor and gas sensor are connected to the ADC chip. Then ADC chip is connected to the Raspberry Pi's 40 GPIO pins. External keyboard and mouse is connected to the Raspberry Pi through USB cable to the USB port. External monitor is connected to the Raspberry Pi through HDMI cable and VGA connector. Since monitor doesn't has a VGA port, HDMI cable is used for the connection. SD card is loaded into the Raspberry Pi which is being booted with Raspbian Jessie OS. 5V power supply is provided to the Raspberry Pi.DC motor and buzzer are directly connected to the Raspberry Pi. Fig 6 shows the pin representation of Raspberry Pi.

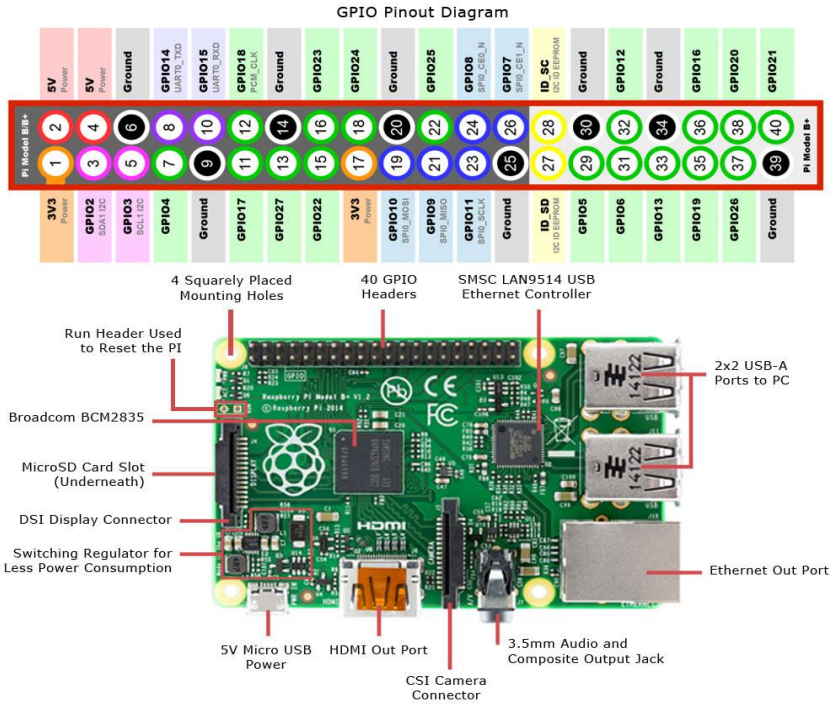

FIG 6. PIN DIAGRAM OF RASPBERRY PI

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IV.FLOW CHART REPRESENTATION

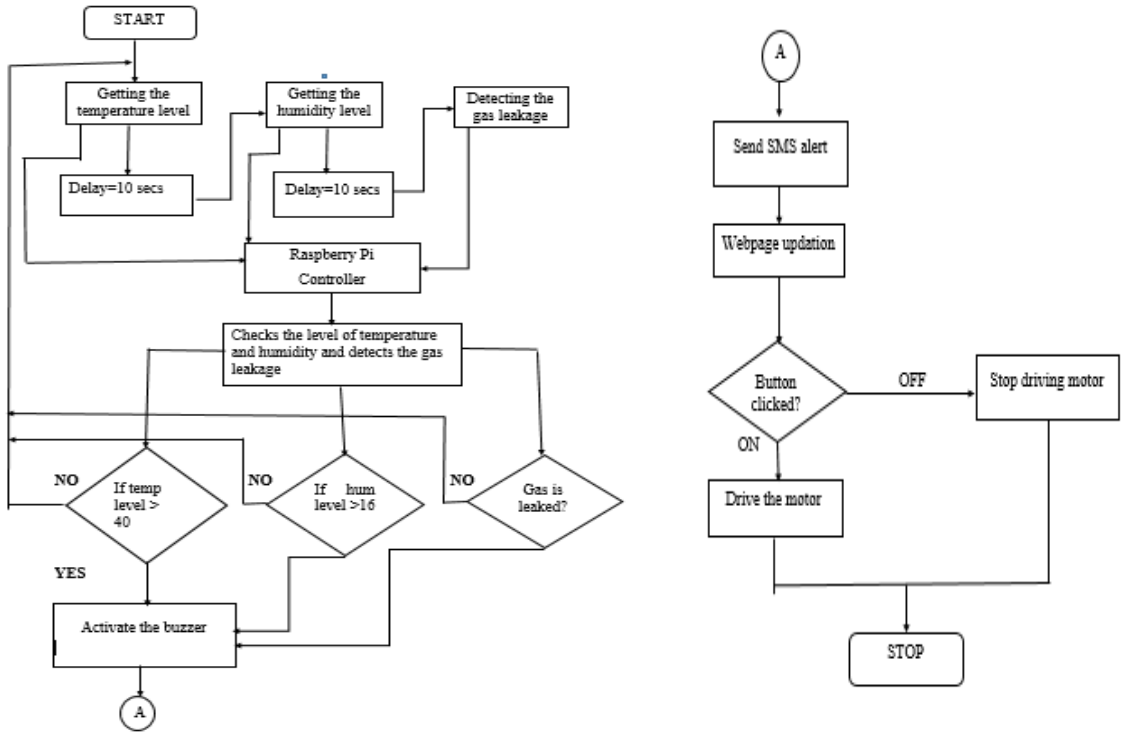

FIG 7.FLOW DIAGRAM OF THE SYSTEM

Fig 7 shows the flow diagram of the system. Initially the temperature value will be collected from temperature sensor and data will be send to Raspberry Pi. After 10 seconds the moisture value will be collected and send to Raspberry Pi and the same process is done for gas sensor.

This process is repeated until a user stops the program execution. If temperature level and humidity level reaches or goes beyond 40 and 16 respectively, buzzer will be activated. Buzzer will also be activated if gas leakage is detected. And also SMS alert will be send to the specific group of people in an industry which contains the data collected from sensors. The data will be updated periodically in webpage which has a control over the motor i.e. motor will be ON or OFF by clicking the respective buttons in webpage.

V.RESULTS

COLLECTING THE TEMPERATURE AND MOISTURE LEVEL

In our project, Raspberry Pi is programmed using python. First module is to gather the moisture level from the Humidity sensor and it will be displayed in command prompt which is shown in fig 8A. Similarly the second module collects the temperature level from temperature sensor and displays it in the command prompt See fig 8B.

Next step is detecting the gas leakage using gas sensor and result will be displayed in the command prompt which is shown in fig 8C. After collecting all the data from sensors, they will be updated in webpage and SMS alert will be sent to the specific group of people which is shown in fig 8D.

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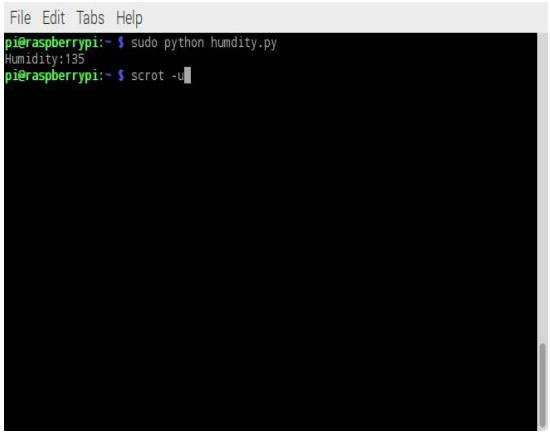


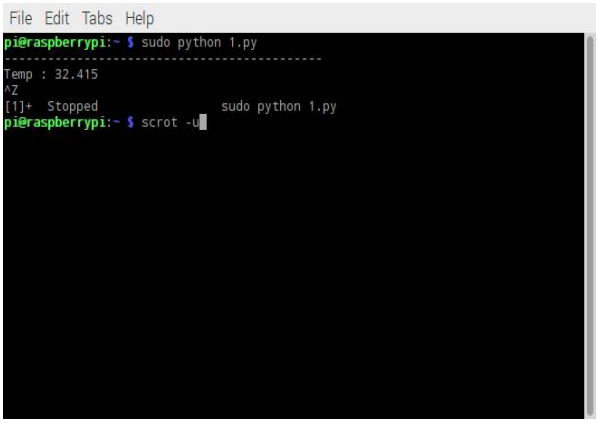
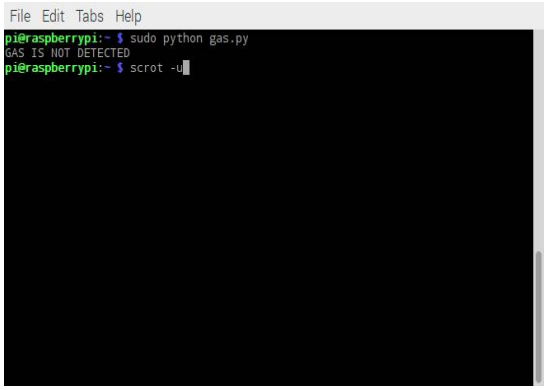


FIG8A AND 8B COLLECTING THE TEMPERATURE AND MOISTURE LEVEL



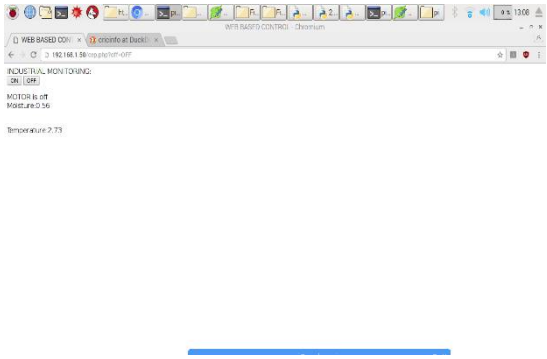


FIG 8C DETECTING GAS LEAKAGE

FIG 8D WEBPAGE UPDATION

.VI.CONCLUSION

The industrial monitoring system is designed especially to solve the cost effective, accuracy and transparency problems in a highly secured approach. This system is more effective than the existing system, since it uses an advanced controller for monitoring the environmental conditions and controller collects the data from sensor and those updated sensor values are written by the Python coding in particular text file. Using PHP coding the value is read and updated in webpage. Based upon the collected value, the respective action will be carried out.

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