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Gas Leakage Detection based on IoT using Raspberry Pi

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Abstract: This paper presents the growth in the industrial monitoring system's design using Internet of Things (IoT). The main aim of our project is to post the sensor captured information into cloud using Thing speak cloud services. The sensor used for the development of this system is MQ-135 which detects the leakage of gas at any atmospheric condition. In this system, Raspberry pi plays an important role such that all the components are interfaced to it. This avails the observer to notice the changes from anywhere in the world. We place a buzzer and an LCD display to alert the observer near the workplace. The requirement of a gas detection system is not only to monitor the surroundings continuously but also needs to prevent the further leakage of gas in the environment to minimize the chances of fire. Thus user can take immediate action upon leakage occurs to prevent the conditions becoming worst.
Keywords: Internet of Things (IoT), Raspberry pi, leakage detection, cloud.

I. INTRODUCTION

In this paper we are introducing a gas detection system which definitely exceeds the performance of the previously existing systems. In the proposed method we make use of Raspberry pi as a control system, MQ-135 gas sensors, an alarm and an LCD display. The output of the information captured by the sensors is posted into cloud using Internet of Things(IoT) with the help of Thing speak cloud services. The Internet of Things (IoT) can be described as connecting everyday objects like smart phones, TVs, sensors and actuators to the Internet where devices are intelligently linked together enabling new forms of communication between things and people and between things themselves. Building IoT has advanced significantly in the last couple of years since it has added a new dimension to the world of information and communication technologies. Thing speak is an Open source data platform and API for the Internet of Things. The Internet of Things provides access to a broad range of embedded devices and web services. Thing speak enables you to collect, store, analyze, visualize, and act on data from sensors or actuators, such as Arduino, Raspberry pi.

A. Motivation

There are many methodologies to detect the leakage of gas over pipelines. But they are not able to serve over long length of the pipeline. So, detection becomes difficult and it needs time to identify the leakage. The existing methodologies may cause severe consequences. To avoid these effects the system methodology should be updated. Then only it's possible to reduce the fire accidents. So, we modified the existing system by extending the number of sensors used in previous designs. This technique works effectively and helps us to identify the leakage easily with the help of IoT. It also allows the user to control and monitor irrespective of the location of the user.

II. PROPOSOED METHODOLOGY

The proposed methodology consists of the block diagram, flowchart, and complete overview of the system designed.

A. Block Diagram

The block diagram of the every system will indicates the specific interfacing modules to be connected.

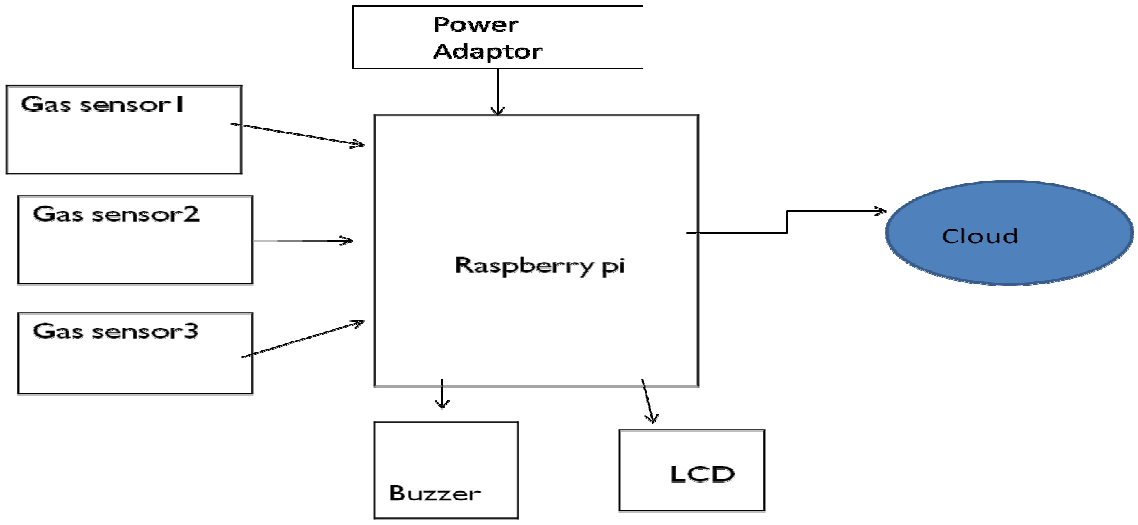

Fig. 1. Block diagram

B. Flowchar

The flow chart is a design flow or an algorithm which indicates complete process.

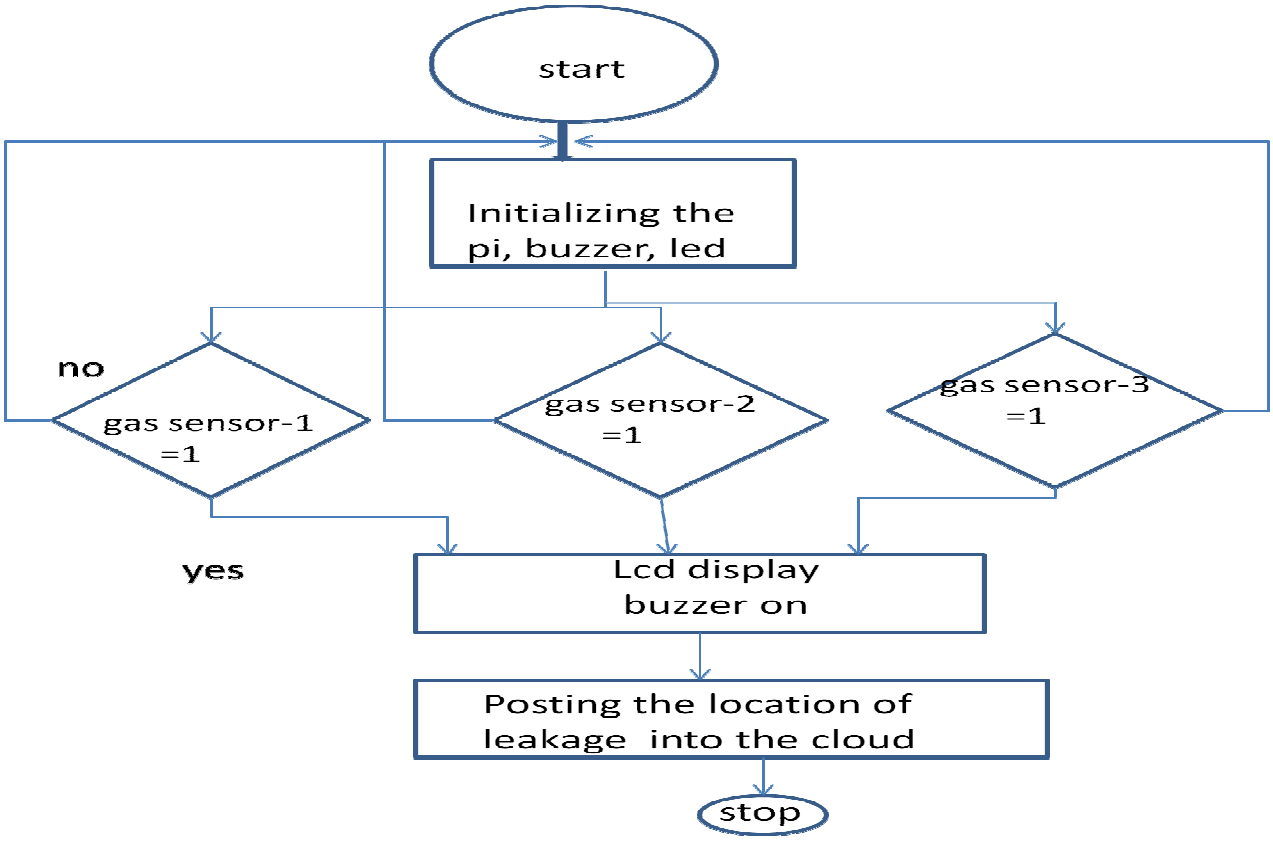

Fig. 2. Flowchart

C. Working

Gas leakage detection is the process of identifying potentially hazardous gas leaks by sensors. These sensors usually employ an audible buzzer to alert people when a dangerous gas has been detected. This detection can be achieved by using the three gas sensors(MQ-135) which are interfaced to the Raspberry pi. Whenever the sensor detects gas, a voltage is generated in it and is given as input to raspberry pi. The buzzer sounds when the gas has been detected. An LCD display will indicate the leakage by displaying

the number of sensor at which the leakage occurs. This information is kept in cloud using IoT. The entire working of the system can be achieved by executing a python code and by installing the required sensor libraries.

III. COMPONENTS

A. *Raspberry Pi*

Fig.3. Raspberry pi

The Raspberry Pi 3 Model B is the third generation Raspberry Pi . This powerful credit-card sized single board computer can be used for many applications. The Raspberry Pi's popular board format brings you a more powerful processer, 10 times faster than the first generation Raspberry pi. Additionally it adds wireless LAN and Bluetooth connectivity making it the ideal solution for specific designs. 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). The Data will be stored in micro SDHC slot and power capacity ranges from 1.5w to 6.5w. The setting up of Raspberry Pi consists of selecting raspbian OS from noobs package.

B. *GAS SENSOR(MQ-135)*

Fig. 4. Gas sensor(MQ-135)

MQ-135 gas sensor has high sensitivity to ammonia gas, sulfide, benzene series steam, also can monitor smoke and other toxic gases well. It can detect kinds of toxic gases and is a kind of low-cost sensor for kinds of applications. It has good sensitivity to toxic gas in wide range, and has advantages such as long lifespan, low cost and simple drive circuit. MQ-135 gas sensor is widely used in domestic gas alarm, industrial gas alarm and portable gas detector. MQ-135 gas sensor made with SnO_2 which has lower conductivity in clean air.

C. *Lcd Display*

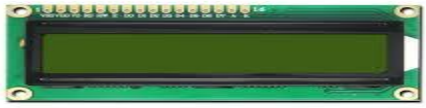

Fig. 5. LCD Display

A liquid crystal display(LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to display the characters. The display consists of two rows and 6 columns. The pins used in LCD are register select(RS), enable(E), VCC, VSS, read/write(R/W), and data pins.

D. Buzzer:

Fig. 6. Buzzer

A buzzer or a beeper is an audio signaling device which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

IV. RESULTS AND DISCUSSION

Here the three sensors are assigned to three charts in the channel of thing speak. The required sensor's chart is obtained by adding the write API key of the channel to the execution command. The figure below shows the experimental setup of the system. The setup gives brief information about the interfacing of components to the Raspberry pi. We promise you that the designed methodology will definitely satisfies the user's requirements. It gives the indication in less time compared to the previous methods.

Fig.7. Experimental setup

The figures below depicts the output readings of three gas sensors. If the sensor detects the gas it shows '1' on the chart assigned to it otherwise it shows '0'.

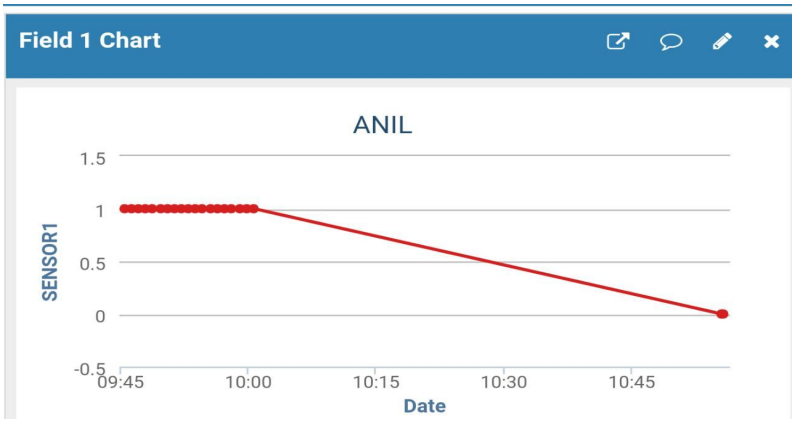

Fig. 8. Output of gas sensor1

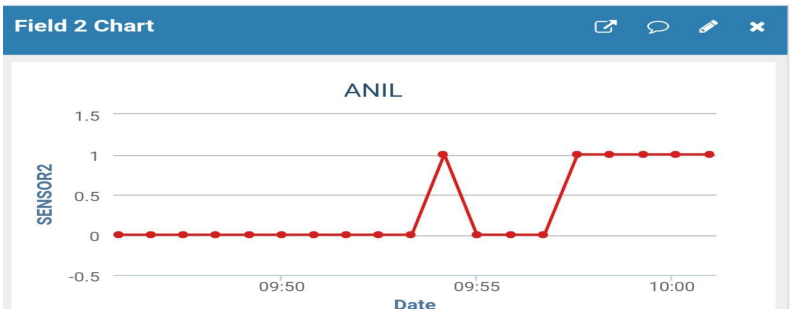

Fig. 9. Output of gas sensor2

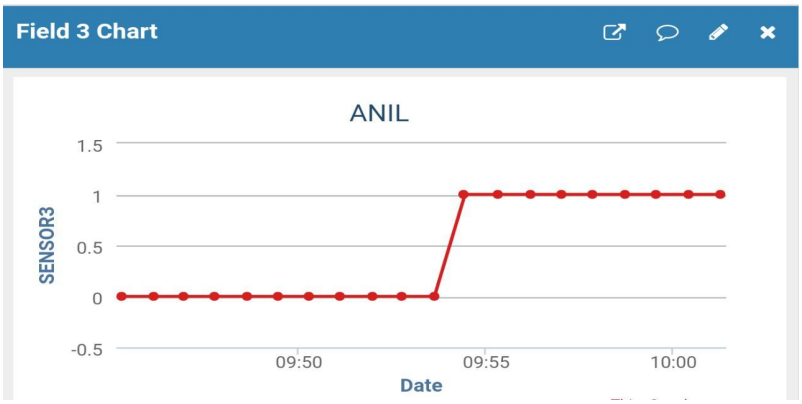

Fig.10. Output of gas sensor3

V. CONCLUSION & FUTURE SCOPE

Our method will detect the leakage of gas by indicating via buzzer and LCD display. This real time 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 environmental conditions and controller collects the data from sensor and those updated sensor values are written by python coding in particular file. Depending upon the captured data, the necessary action will be carried out. It has more scope to employ it in different applications such that it will give more effective outcome.

VI. ACKNOWLEDGEMENT

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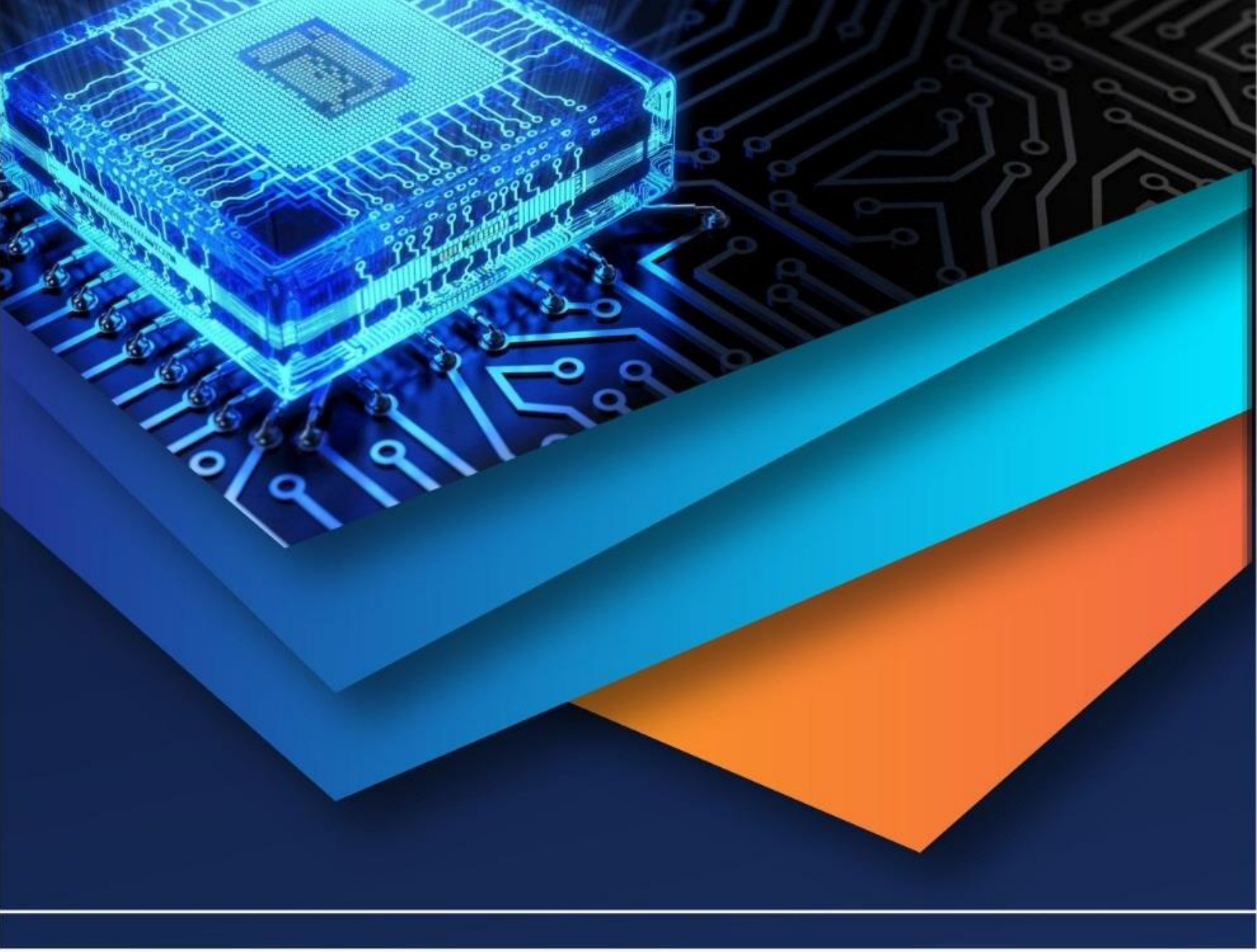

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