

A Study on: Wireless Sensing Network (WSN) gas leakage detection system with IOT

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Abstract:- There have been many incidents such as explosions and fires due to gas leaks. Such occurrences can have dangerous effects if the leak is not detected early. The wireless detection network based gas leak detection system is a project that can detect the gas leak in the environment and send data to the cloud via the MCU node. The Internet of Things (IoT) is the network of "things" that physical things can communicate through sensors, electronics, software, and connectivity. These systems do not require human interaction and the same happens with the IOT based gas detection system, it does not require human attention. The WSN-based gas leak detection system detects the gas using a gas sensor. The gas sensor interface to the MCU node is implemented in this project. The signal from this sensor is sent to the node microcontroller (ESP8266). The microcontroller is connected to a cloud and a buzzer. WSN-based leak detection is implemented using an ESP8266 chip. This is a WiFi module used to connect microcontrollers to the Wi-Fi network, make TCP / IP connections, and send data. The data collected by these sensors is sent to the cloud. The MCU node then sends the data to a cloud. Once the gas leak is detected, the buzzer will be turned on and the result will be displayed in the cloud. The prerequisite for this GLP project for gas leak detection and intelligent warning is that the WLAN module is connected to a WLAN hotspot or access point.

Keywords: - IOT, MQTT, Node-MCU, MQ4

I. INTRODUCTION

The Wireless Sensor Networks (WSNs) are an important technology for monitoring and control of several process systems and can provide sensor measurements at high precision, low-cost and

low-power consumption with the advancements in wireless communication, microelectronics and computer technology. Wireless sensor networks show their strength in a variety of applications.

A WSN is a system that includes radiofrequency trans-receivers, sensors, microcontrollers and energy sources. Wireless technology provides installation flexibility for sensors, increases the robustness of the network and reduces complexity and maintenance costs. Most wireless

sensor network systems have signal conditioning and processing units installed at the sensor locations and transmit signals in series. As a result, the capture of noise becomes a less important problem. In addition, since it is a wireless transmission, a WSN system in the field is less subject to being damaged by animal and the machinery, while the reliability of the transmission could be improved.

The main objective of the work is designing gas detecting that self-organizing, self-configuring, and self-healing which enable uninterrupted, in filed sensing, measurement, and control. If the gas sensor detects the leakage gas then the location of leakage gas is immediately updated to the clouds. Our efforts are to design and develop a reliable smart wireless gas sensing system, utilizing the Node-MCU board.

WSN is a wireless Ad-hoc multi-hop network which consists wireless sensor node and sink as the main data receiver like figure 1[5]. Environmental information collected by sensor nodes is routed from the ad hoc network to the sink node, where the data can be analysed and aggregated. From the background explanation above, then we can propose this research goal is to create a tool. A tool for wireless detection and prevention system.

The research is still underway when this paper is made. This research hopefully will answer the problems of explosion prevention system concept which still have a gap. Also hopefully this will help leakage detection problems.

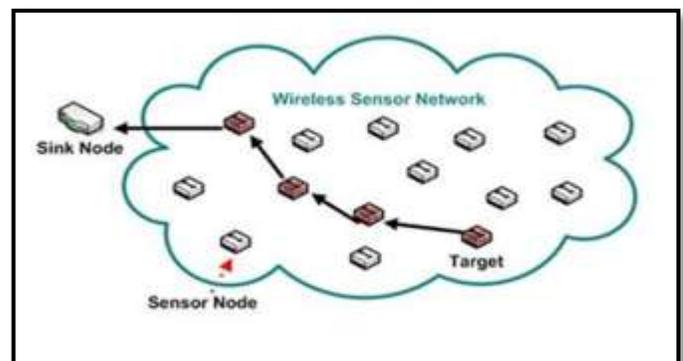


Fig.1 Wireless Sensor Network System. [6]

II. LITERATURE SURVEY

“Reference [1]” Prof. Pradeep Khatua [1] When a gas leak occurs at a particular location, the Raspberry-pi immediately reads and sends the data to the cloud over wireless communications such as WI-FI. The application warns with an indicator when a gas leak occurs, and we can also control the robot’s movements via Wi-Fi. Previous mobile robots are based on heterogeneous technologies such as GSM, GPS, Internet etc. However, the main disadvantage of these prototypes was the lack of communication in certain areas. Due to the rapid developments and the enormous technological changes, we have many techniques to eliminate previous problems. Wireless communication protocols play a crucial role in current trends. Bluetooth, Wi-Fi, ZigBee, etc., we use one of the best features of the smartphone, that is, Bluetooth technology for controlling and monitoring the parameters controlled by a robotic robot. The proposed prototype represents a mobile mini-robot capable of detecting gas. [2] They introduce the importance of Internet of Things (IoT) technology for industry, politics and engineering.

This technology is included in a wide range of networked products, systems and applications

Sensors that use the advances in computing power, miniaturization of electronics, and network connectivity to deliver new capabilities. The large-scale implementation of IoT devices promises to change many aspects of our lifestyle.

For consumers, new IoT products, such as Internet-enabled devices, home automation components and energy management devices, bring us to a vision of the "smart home" that offers greater security and energy efficiency. IoT systems such as connected vehicles, intelligent transport systems and embedded sensors in roads and bridges bring us closer to the idea of "smart cities", which help to minimize congestion and energy consumption. IoT technology provides the ability to transform agriculture, industry and power generation and distribution by increasing the availability of information along the value chain of production using networked sensors. [3] In this article, we looked at MQTT. MQTT: Message Queue Telemetry Transport (MQTT) is an extremely lightweight, simple protocol for publishing / subscribing to news. This is designed specifically for low-bandwidth, high-latency networks, which are unreliable and limited devices. It complies with design principles such as the minimum bandwidth of the network, meets the resource requirements of the device and allows easy telemetry transport. [4] In this system, we examine how gas has traditionally been captured and how it has been overcome. Natural gas such as liquefied petroleum gas (LPG) is widely used in industry. Of course, it is possible that the gases can

be filtered and that the system must be monitored in real time. This article describes the design and development of a wireless gas leak monitoring system using Arduino and XBee. The system is configured in star topology with devices and sensors, and then controls all devices through a gateway node to the XBee network and takes security measures to protect against serious risks.

The proposed system uses XBee as a wireless device, sensors and Arduino controllers, which not only increases system performance but also provides security measures. In fact, work has been done with the Arduinonano plate, the gas sensor MQ-2 / MQ-6, XBee and a GSM module. The sensor is characterized by excellent sensitivity combined with fast response time and low cost Arduino GSM protection automatically sends a gas leak message to the authorized person or family member.

III. PROPOSED METHODOLOGY

The overview of the proposed methodology is shown in Figure

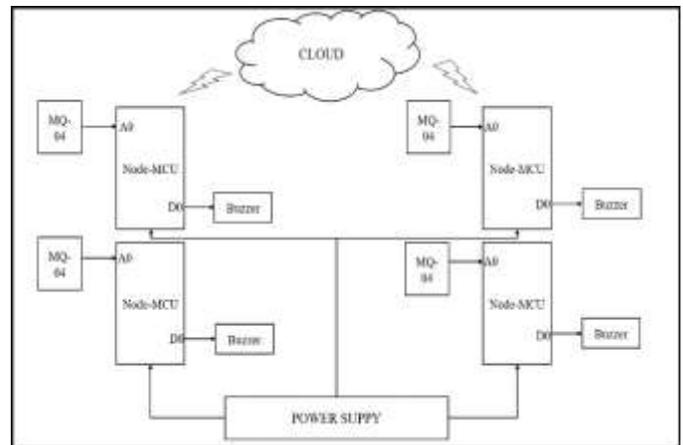


Figure 2. Block diagram of the proposed WSN for Gas Leakage Detection

The block diagram of the proposed system is as shown below in Fig-2. Here, the signal voltage from gas sensor is given to the Node MCU Board wherein the Node MCU board have the inbuilt Wi-Fi module which is used to communicate with cloud. When the gas sensor detects the presence of leakage gas, it will send an analog signal to the A0 pin of Node MCU board. Node MCU have also inbuilt ADC which will convert analog signal into the digital form. Converted data of gas sensor is then transmitted to the cloud through Wi-Fi module of Node MCU board. Also location of the leakage gas is updated to the cloud for understanding where and how much amount of gas is leak.

A. Node MCU:

Node When exploring the functionality with the ESP8266 chip, the Node MCU firmware is delivered with the development board ESP8266 / kit ESP8266; H. The Node MCU Development Board. Because Node MCU is an open source platform, your hardware design can be edited, modified and created. The Node MCU development kit / board consists of an ESP8266 Wi-Fi enabled chip. The ESP8266 is a low cost WLAN chip developed by Express si Systems with TCP / IP protocol. For more information about ESP8266, see the Wi-Fi module ESP8266. Version 2 (V2) is available for the node's MCU development kit, i. H. The Node MCU Development Board v1.0 (Version 2), which is usually supplied in black PCB color. / Fig.3 Node MCU Development Board / Kit v0.9 (Version 1) [5]

Sensor MQ-4: The sensors of the MQ series use a small heater inside with an electrochemical sensor to measure different types of gas combinations They can be calibrated, but this requires a known concentration of measured gas or gases. For industrial purposes, the calibrations are carried out in specialized laboratories with probes and precise tests. In our case, we test it as it comes from the manufacturer, without additional adjustments or calibrations.

The main idea before ordering this type of sensor was to build a self-built alarm sensor that would produce alarming sounds or lights if someone forgot about the stove or my little boy learned to play with the stove switches or if my installation Gas has a leak. To achieve this, I wanted a methane gas that was easy to use and also compatible with the Arduino platform..



Fig.3 Node MCU Development Board/kit v0.9 (Version1) [5]

B. MQ-4 Sensor:

The manufacturer says that the MQ4 sensor can easily detect methane / natural gas with a sensitivity of 300 to 10,000 ppm, the cost is very low and can be easily connected Arduino boards. / Fig.4 MQ-4 sensor [7] The MQ4 model must be supplied with stable 5V and requires at least 150 mA according to the cleaning of the data sheet

in order for it to work properly.

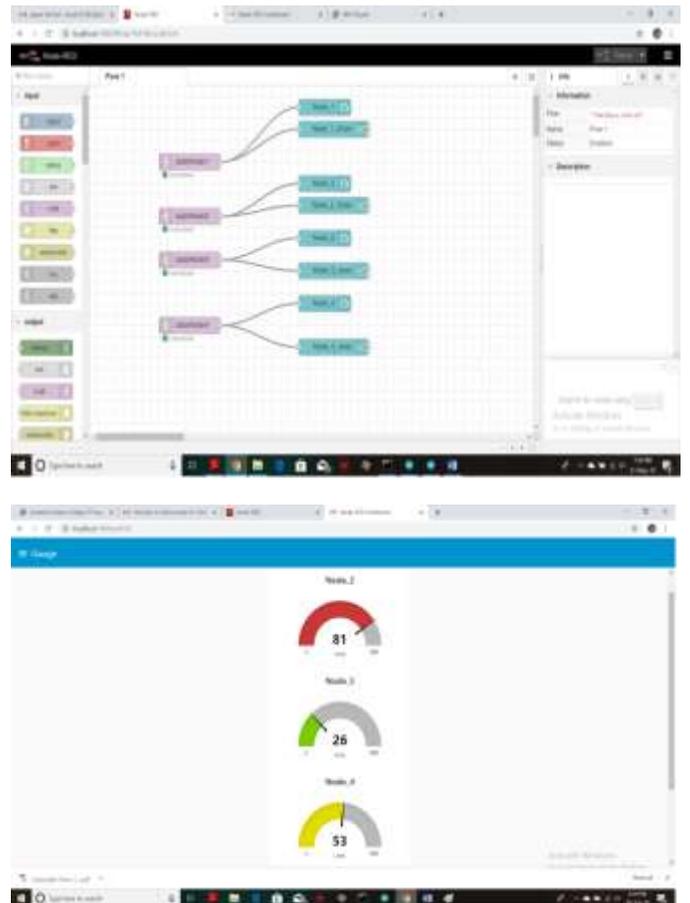
Even before obtaining stable measurements, this model requires at least 1 minute to warm up. Note that the term "preheat" is used in some data sheets. This means that some versions take between 12 and 24 hours to burn on the sensor. Only then do you receive consistent data.

Even devices of this type, which have internal heating, are very sensitive to environmental influences, such as humidity or humidity.



Fig.4 MQ-4 sensor [7]

IV. RESULTS



V. CONCLUSION

This system provides a comprehensive overview of existing and emerging work on gas leakage source detection and tracking of continuous objects with WSNs. We have highlighted the inherent features of the various well known gas diffusion models using localization and tracking algorithms with the advancement in sensing technologies, the gas source localization techniques are discussed from the view of precision, robustness, and energy consumption issues.

As the detection characteristics of nodes directly affect the localization and tracking estimation, the choice of sensor is much more crucial than the choice of the optimization algorithms in real environment. As a localization of continuous object and boundary tracking become serious issue in large scale industrial area as well as environment, in depth research on the development of localization and tracking technology is expected to become fundamental task with several new problems to solve and challenges to overcome in factory automation, fault diagnosis, surveillance, and gas consumption monitoring systems

VI. REFERENCES

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