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IOT Based Gas Detector with Alerting System

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ABSTRACT: Gas leaks are a major problem in industrial, residential, and gas-fired vehicles. Leaks if not visible can cause explosions and cause serious damage to health and environment. The standard leak detection system uses local alarms to alert. In this paper, we propose a leak detection method where leak information is sent to the first responders via wireless media. This ensures immediate prevention actions even when people are not on site. The detection system uses FPGA to detect leaks and automatically initiates an alert call via GSM. The prototype of the gas leak detection system was developed and tested with LPG (Liquefied Petroleum Gas). Test results show that the system is able to detect leaks in less than a minute.

KEYWORDS: MQ-4 Gas sensor, Gas leakage detection, Buzzer, Arduino.

I. INTRODUCTION

Gas leak detection systems are an important part of the safety system, providing a first line of defense against potential gas leak disasters. It detects gas leaks and activates the warning system to activate safety measures. Some leaks are too small to be smelled or odorless but some of them but some of them are very big, so it is a very important step needed to install a gas leak system. Exposure to breathing on the LPG can lead to organ dysfunction, eye irritation and respiratory tract, drowsiness, hallucinations and a feeling of excitement, LPG inhalation inhibits the central nervous system as it has a narcotic effect, fainting, drowsiness, lightheadedness. , cyanosis, cardiopulmonary arrest, and sudden death are the most feared problems However LPG does not have a significant toxicologically significant effect but, by ingesting oxygen in the atmosphere, carbon monoxide will produce toxins. Extremely combustible gases can ignite this gas even when the lights are switched on if there is an invisible leak from the cylinder leading to dangerous heat eventually and death.[1]

Gas consumption in both industrial and residential areas is constantly increasing. Gas is widely used in energy production and as a process requirement in the manufacturing industry. Paper [5] shows a system that works to detect gas levels, monitor and control the system based on a leaky LPG leak. The system includes a suitable DC engine powered by a DC relay that used to automatically control the stove button. The [5] system was suitable for automatic cylinder reservation by comparing gas level with the normal cylinder weight. The effect of gas leaks can be dangerous no matter how much the leak. Leakage of gas leading to deadly heat has become a major problem in homes and other areas where domestic gas is purified and used. Gas leaks lead to a variety of risks that lead to financial losses as well as injuries and loss of life. Factors to consider during Gas acquisition options Gas detection, location detector, gas flow, and alarm management. What gas discovery is needed? Are toxic gases or volatile organic compounds (VOC)? A single gas detector cannot detect other gases. Therefore, during system design, gas type is the first information a designer must know. The task is to design a system that detects gas leaks and notifies these detectors via SMS and display mode, the system is a smart system, as it does not cause a problem by sounding the alarm continuously but the alarm stops sounding when the gas is fixed. the atmosphere after the leak goes below the set point. This activity will reduce the losses caused by the explosion due to gas leaks and improve health safety. Gas leaks are a major problem in the industrial sector, gas-powered vehicles such as CNG, LPG vehicles. One of the best ways to prevent the risk of gas leaks is to install a gas leak detection kit in high-risk areas. The aim of this project is to introduce a design that can automatically detect gas leaks in high-risk areas. In particular the gas sensor used has high sensitivity to propane (C3H8) and butane (C4H10). The gas leak system contains a GSM (Global System for mobile communication) module, which warns by sending SMS. This project provides a way to design both software and hardware. There are various portfolios of gas detection systems available in the market, but it is important to know which specific identification system meets the requirement.

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II. PROPOSED SYSTEM

We have come up with these existing and above discussed technology. Here we have adapted new technology IOT (Internet of Things) to get fastest notification of gas leakage with the help of GSM - 900A module. We will also use an application under the IOT technology to get fastest response from the module. For the application we will be using BLYNK - IOT which will help us to create a good UI (user interface) to display the temperature and humidity level and it will also display the gas level which will be detected using the MQ - 4 gas detector sensor. The other module and things which are used in this paper is GSM module, 16x2 LCD for indication, a buzzer to notify local peoples and MQ 4 gas sensor module to sense the gas leakage.[3] The main advantage of this paper is that it can determine the leakage and send the data over to an application, where it can be monitored and corrective actions can be taken. If appropriate measures are taken quickly after it is reported over the IOT, it can help in saving the loss of lives and property.

III. LITERATURE REVIEW

A number of revisions on the topic of gas leak detection strategies were made in the past or as a section of research papers / technical reports on a specific method for detecting leaks and other gas-related topics. [2] resenting the formation and implementation of economic gas leak detector. They have given rise to many problems with previous gas leaks machines. Tell them that several measurements have been made of the gas leak detection design system such as IEEE, BS 5730, and IEC. In this work, UK safety standards are recommended accepted. The proposed alarm system is highly targeted to detect LPG leaks, which are very commonly used in residential and commercial areas. Work in [4] proposes an automatic detection device, this device works to stop gas leaks in high-risk areas. The system developed by LPG (Liquefied Petroleum Gas) is a gas sensor that enters the sensor values of the microcontroller unit, the values are compared to the set values and based on the comparison result, the LED alarm and buzzer will work. In addition to the above, the system [4] is able to create SMS messages via GSM to notify the customer of a particular cell phone.

The system not only detects the presence of gas (gas leak), but also the amount of air leakage, and appropriately raises the appropriate sound watch alarm. The purpose of the program is to obtain LPG gases such as propane and butane. UK approved level Butane is 600 ppm more than that which is considered high quality and poses a risk. The proposed system ensures continuous monitoring of gas levels. When the gas level rises above a standard threshold level of 400 ppm butane (LPG), the system starts issuing early warning alarms by 100ms interval, which means low gas leakage. When the leak level rises to 575 ppm butane (LPG), the system activates heavy sound alarms for 50ms warning passengers to run safety.

The components we have used are as follows:

1. DHT-11: -

DHT11 in Fig. 1 and is a basic, inexpensive digital sensor and moisture sensor. It uses a capacitive humidity sensor and a thermistor to measure ambient air, and generates digital signal output per data pin (no analog input pins required). Easy to use, but requires careful time to recover data. The only downside to this sensor is that you can only get new data on it once every 2 seconds.

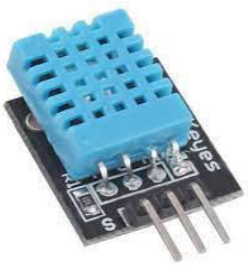

Fig. 1 Image for DHT – 11 Sensor.

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2. Node MCU (ESP 8826): -

Arduino Company has begun working on developing a new microcontroller recently. This effort was made with the construction of a new MCU and popularly known as the ESP8266 Node MCU module. The module has been neglected by AVR processors and has been used sparingly like the Arduino MCU. Therefore, the module operates based on Arduino IDE C ++ compiler. New specifications have been added to the ESP8266 module to reduce the number of parts and shields needed to perform a specific task. The company has developed this new MCU in relation to the Arduino Uno board manager and the SAM spine. The term 'Core' was given to a group of software units needed to integrate Arduino C ++ heads using the MCU language. The new Arduino module is considered an integrated design due to the development of the Arduino core under the rule of ESP8266 Wi-Fi spread over the GitHub ESP8266 core web page. MCU is assigned to be one of the most popular learning software platforms for the combination of ESP8266 and NodeMCU firmware. The module shown in Fig. 2 works under the supervision of 802.11n and 802.11b networks. This means it can work as an Access Point AP, a Wi-Fi channel or both a channel and an AP together.

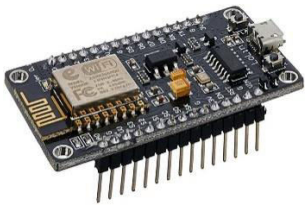

Fig. 2 Image for Node MCU (ESP 8826).

3. MQ-4 Gas Sensor: -

This is the MQ4 gas detection module (Fig. 3) that is widely used to investigate gas spills in a particular area of this sensor module. It is mainly used to judge torture. Mainly sees LPG, coal etc. Contains 6 anchors, 4 anchors are used to detect signals in the event of a crash. The other 2 pins are not used. The four anchors are Digital output, Analog output, VCC and GND. VCC contains power available between (2.5V to 5.0V).

Fig. 3 Image for MQ-4 Gas Detector Sensor.

4. GSM 900A Module (Fig. 4): -

The SIM900A is a complete Quad-band GSM / GPRS Module that delivers GSM / GPRS 850/900/1800 / 1900MHz voice function, SMS and low power data. This GSM modem can accept any GSM network operator SIM card and act as a mobile phone with a unique phone number. The advantage of using this display on the bulletin board using the GSM SIM900A modem is that you can use its RS232 port to connect and upgrade embedded applications. Apps such as SMS control, data transfer, remote control and logging can be easily upgraded. The modem can be connected to the PC serial port directly or from any micro-controller. It can be used to send and receive SMS or to make / receive voice calls. It can also be used in GPRS mode to connect to the Internet and perform many data entry and control programs. This GSM modem is a very flexible plug and plays quad band GSM modem for direct integration and simplicity AT commands are the commands used to control the modem. AT is a summary of Attention. Every command line starts with "AT" or "at". That is why modem commands are called AT commands. Many commands used to control cable dialing modems, such as ATD (Dial), ATA (Response), ATH (Hook control) and ATO (Back to online data mode), are also supported by GSM / GPRS modems. and cell phones. In addition to the standard AT command set, GSM / GPRS modems and mobile phones support an AT command command-specific GSM technology, which includes SMS-related commands such as AT + CMGS (Send SMS message), AT + CMSS (Send SMS message from archive), AT + CMGL (Include SMS messages) and AT + CMGR (Read SMS messages).

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Fig. 4 Image for GSM 900A module

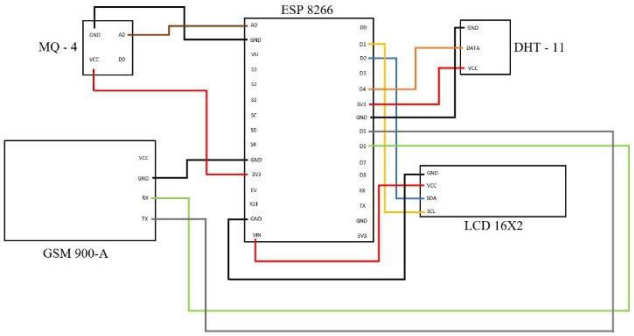

Fig. 5 Circuit diagram for gas detector

In Fig. 5 we can see all the connections made with ESP 8266 NodeMCU, MQ-4 sensor, LCD 16X2, DHT – 11 and GSM 900 – A modules. This connection has helped us in making a proper working model.

IV. OBJECTIVE

The main purpose of our project is that it should reduce the risk of fire and / or explosion and to prevent serious property damage, crop disruption, injury, and loss of life. Another consideration is the toxicity (ultimately health risk) caused by a gas leak containing both toxic and flammable substances. The purpose of the gas detection system is clearly stated at the beginning of the project to ensure that risk analysis, equipment selection and installation of the detector are consistent with the reason for the installation of the system. These parameters will vary depending on the location of the plant involved. The system can only be used for alarm in a liquid gas storage area because there are no ignition sources and the area is far from other processes. Elsewhere, the goal may be to initiate process shutdown and to activate pumping systems to reduce emissions. Part of the whole project should include procedures that address the steps that the technicians must take when the gas detection system is alarmed. This should include the actions will take place at the various alarm levels, the steps to be taken at specific plant areas, and what the condition of the plant (closure, normal, irritability) has to do with these actions.

V. FUTURE SCOPE

Overall, software and hardware parts of the systems have been developed and tested by introducing a small amount of LPG near gas sensor module. The authors of this paper are currently working to include multi functions with this device. One of the notable future functions of this system is to add a sub system where wastage of gas and the uses of gas can be monitored using this system. The system is flexible as a greater number of sensors and relays can be added to it according to the whole LPG supply setup in those premises. The author is adding more software based intelligent functions with this system. This is an automatic gas detection, control and alert system. In future this system will have a feature where it can notify the emergency services if any accidents happen. A web-based app for real time monitoring also will be added. In the user app for this system many smart features will be added. The overall features will make the system safer for the users. The system will be optimized for use in many places like the car, the home, industries and

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many other places. After designing the final prototype with smart multifunctional features, the system will be implemented in real life scenarios as a pilot project. A survey will be done soon before using the system and another one will be done after implementing the system to discover the KPI. Summarizing all the results, finding and analyzing a research article will be done and author has plans to submit it to the MDPI sensors journal for review. In the future paper the features of this final product will be compared with the available gas detector systems presented in the future.

VI. CONCLUSIONS

Finally, we conclude in recent households, the use of LPG is taking a big troll. From the use of cylinder up to the use of petroleum pipelines. The biggest threat in using this technology is security. And our project will prove to be boom for households and industries. A wide variety of leak detecting techniques is available for gas pipelines. Some techniques have been improved since their first proposal and some new ones were designed as a result of advances in sensor manufacturing and computing power. However, each detection method comes with its advantages and disadvantages. Leak detection techniques in each category share some advantages and disadvantages. For example, all external techniques which involve detection done from outside the pipeline by visual observation or portable detectors are able to detect very small leaks and the leak location, but the detection time is very long. Methods based on the mathematical model of the pipe have good results at high flow rates while at low flow rates a mass balance-based detection system would be more suitable. Hybrid systems benefiting from the real-time detection capability of a software-based method and the high localization accuracy of a hardware-based technique, along with other specific advantages of both approaches, seem to be the future trend in gas leak detection. Selecting from the wide variety of commercial solutions available is ultimately an action that has to be taken after assessing the needs of the system in which gas leak detection is needed.

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