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Gas Leakage Detection, Prediction & Alert System Using Raspberry Pi & Cloud Computing

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Abstract - *Gas leakage is a common problem in various places, including residential properties, industries, manufacturing facilities, and gas stations. For example, LPG (Liquified Petroleum Gas) is a highly combustible gas which can lead to building fire, suffocation or an explosion. Methane explosions, which occur when a buildup of methane gas, a by-product of coal, comes into touch with a heat source, are highly prevalent in coal mines. This can lead to coal mine fire and severe life damage. One of the preventive methods to stop this kind of dangerous accidents associated with gas leakage is to install gas leakage detection systems at vulnerable places. The aim of this IoT project is to build a model that can automatically detect, alert and minimize the chances of calamity. The gas sensor which is used in the model detects any type of gas leakage. Once the sensor detects any leakage, it will send the data to the raspberry pi from there it will be uploaded to the cloud. On cloud the sensor data will be analyzed to determine the severity of the situation and actions will be performed accordingly. If the situation is detected as low (no leakage) no action is performed and the device continuously collects the sensor data. If the situation is detected as high (Leakage), then all the concerned persons are notified via MQTT dashboard app, buzzer will go off and the relay is turned on to perform preventive operations. Our model also predicts the air quality index of the surrounding based on the sensor data using Machine Learning algorithm. With the help of this model, we are able to achieve our aim and we are able to reduce the damage as much as possible.*

Key Words: **LPG; Raspberry Pi; IoT; Gas Sensor, MQTT App;**

1. INTRODUCTION

There are many different types of gases that play a vital role in human life, and some of these gases are odourless and colourless, therefore they are not detectable by human senses. The majority of people lack sufficient knowledge of how to handle gas-powered products, making gas detection challenging in real life. Gas leaking causes serious accidents in everyday life.

LPG is the most common gas used in households and industries. LPG consists of gasses like propane and butane. These gases are highly combustible. LPG gas is also used as propellant, fuel and as a refrigerant. When the leak occurs, it may cause an explosion. The death rate due to LPG gas leakage and their explosion has increased. Therefore, the leakage should be controlled to protect people from danger.

In past accidents like the Bhopal gas tragedy on December 1984 more than 3000 people were killed when methyl isocyanate was leaked out. Andhra Pradesh's Nagaram The line became rusted in June 2014, resulting in a gas leak, a blast at the Gas Authority of India Limited's plant, and the deaths of 29 persons. So, to protect people from this hazardous disaster we need to upgrade the technologies.

Sensors are crucial part in our model. There are various types of gas sensors such as MQ2, MQ5 which are used to detect different types of gas in the surrounding.

Our proposed methodology is utilized to identify gas leaks and send out alert messages to those who need to know. It can also be used to determine how much gas is present in the environment and communicate that information to the user. This system sounds an alarm when a gas level exceeds a preset threshold and also performs preventive maintenance.

2. RELATED WORK

[1] Subramanian M Athish developed a model to detect gas leakage with push notification feature. The system using a lighter that releases a gas we want to detect and for this he is using MQ5 sensor. As the gas is leaked the

Buzzer light is turned on and notification from push bullet is send to the user.

[2] According to the author of this paper, LPG is commonly used as a fuel in homes, companies, and automobiles. The United States Bureau of Mines investigated gas in 1910, initially developed by Dr. Walter Snelling, to see if there was any explanation why it dispersed so quickly, and discovered that the vanishing gases were propane, butane, and other light hydrocarbons. Both LPG and gaseous petrol are natural friendly and may be easily distinguished. These gases are usually stored in pressured steel chambers in a fluid frame, where they dissolve at normal temperatures. LPG is heavier as a result of the air correlation; it flows down the floor and settles into cosy depression regions, making it difficult to disperse.

[3] According to Chaitali Bagwe, GSM is an extension of the internet notion. GSM refers to the use of the internet to connect multiple physical devices. Sensors are wired together in a physical device. The data collected was sent across the internet from one device to another. Using the GSM principle, the author created a novel gas alert system

[4] Rohan Chandra Pandey used the internet to create a new method for gas notifications. This system was designed to detect harmful levels of LPG gas and send an alarm to the user. This system displays the value on the LCD panel. The buzzer goes off when the gas level reaches the threshold value, and the ARM board sends an email to the user via the internet.

[5] Gas leakage and gas sensing, according to Anandhakrishnan S, is a difficult issue in today's world. The majority of the gases are very combustible. The goal of this planned method was to prevent unwelcome kitchen difficulties. This technology was primarily used to detect gas levels and send individuals SMS alert messages. Gas wastage in the home and industry was also tracked using infrared sensors.

3. MOTIVATION AND PROBLEM STATEMENT

Gas leaks cause a variety of consequences, including financial loss and human life. The environment has a critical impact in human health issues in everyday life. Fire, suffocation, and explosion risks are all determined by physical attributes like as flammability and toxicity. The number of people killed by gas cylinder explosions has been rising in recent years.

These are some of the model's specific problem statements:

• Gas leaks have a variety of consequences, including financial losses as well as human life.

• Inhaling leaked gas in an inside space, like your home may end up in an exceedingly lack of oxygen within the air and cause hypoxia.

• Leaked fossil fuel mostly methane may be a powerful gas. it's a big contributor to global climate change and also contribute into smog which causes asthma and other respiratory problems.

4. OBJECTIVES

1. To build a prototype that can detect the gas leakage and measure the humidity and temperature which will be uploaded on the cloud for cloud computation.

2. To determine the level of gas leakage and alert the concerned person depending upon the gas leakage via MQTT Dashboard.

3. To perform preventive operations and to predict the upcoming gas leakage based on previous data using Machine Learning Algorithm.

5. TOOLS USED

5.1 HARDWARE COMPONENTS:

- Raspberry Pi
- Gas Sensor (MQ2, MQ5)
- Temperature and Humidity Sensor (DHT 11)
- Relay
- Buzzer

5.2 SOFTWARE COMPONENTS:

- Raspbian OS
- VNC Viewer
- Advanced Information Processing Scanner
- HiveMQ Broker
- MQTT Dashboard

6. BLOCK DIAGRAM

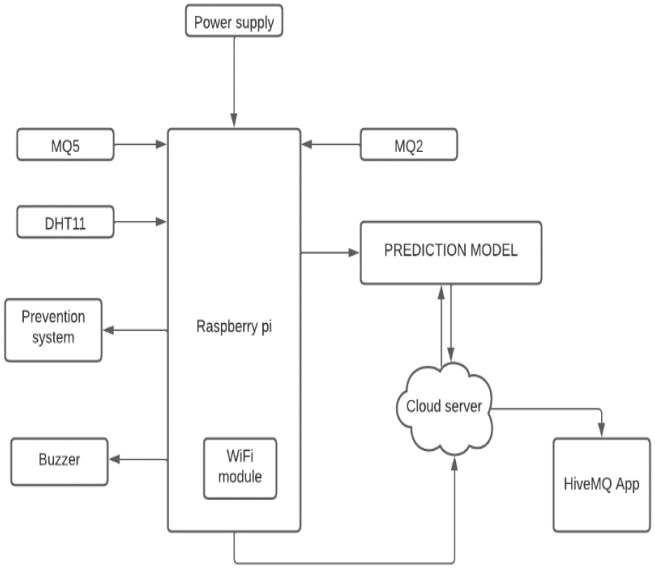

Fig-1: Block-diagram of the proposed methodology

7. METHODOLOGY

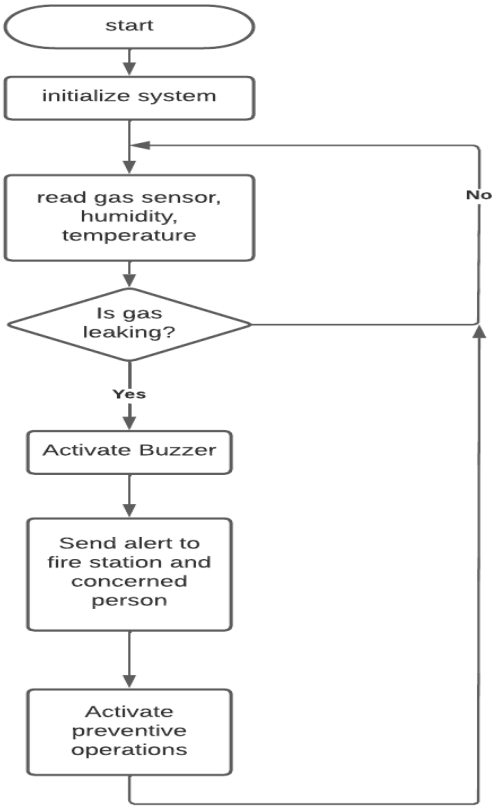

Fig-2: Flow-chart of the model

This is the methodology we used in our model:

1. First the system is turned on and the gas sensor start reading the gas concentration

2. System then determine if the gas leakage is there or not.

3. If the gas is not leaking then it continues to read the data.

4. If the gas is leaking then it determines the severity of the gas leakage.

5. If the severity is of high level system will start the buzzer and alert the concerned person and start the preventive operation.

6. Air quality is also predicted with the help of data on cloud server and prediction model and is displayed on the MQTT dashboard app.

7. It will keep on reading the data using gas sensor.

8. RESULTS

When Gas Leakage is not present:

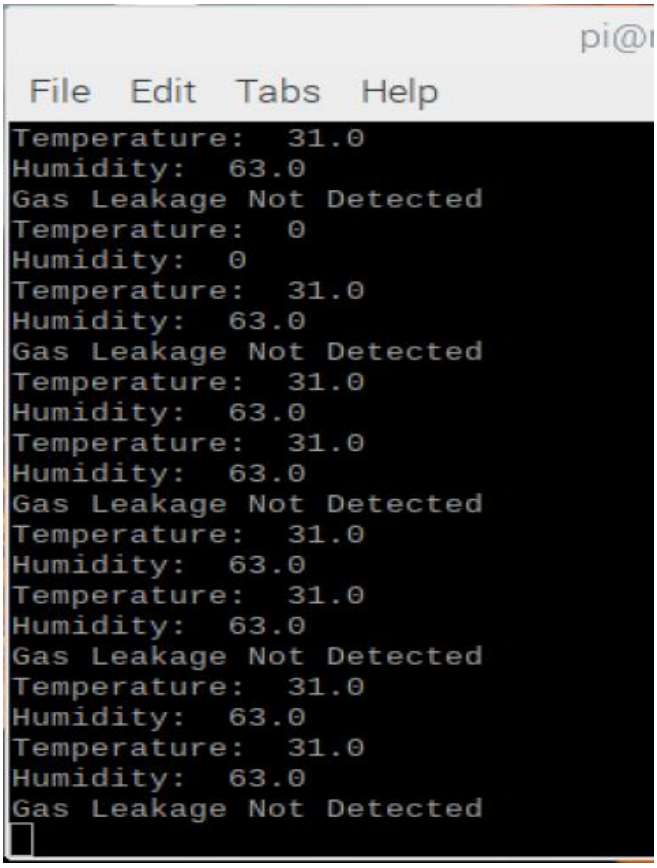

Fig-3 : Real Time Data

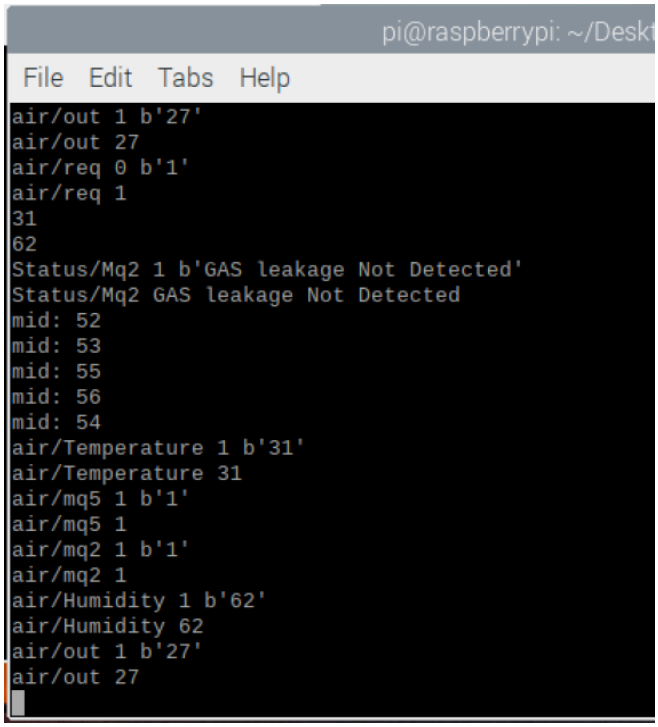

Fig-4 : Fetched Data

When Gas Leakage is present:

Fig-5 : Real Time Data

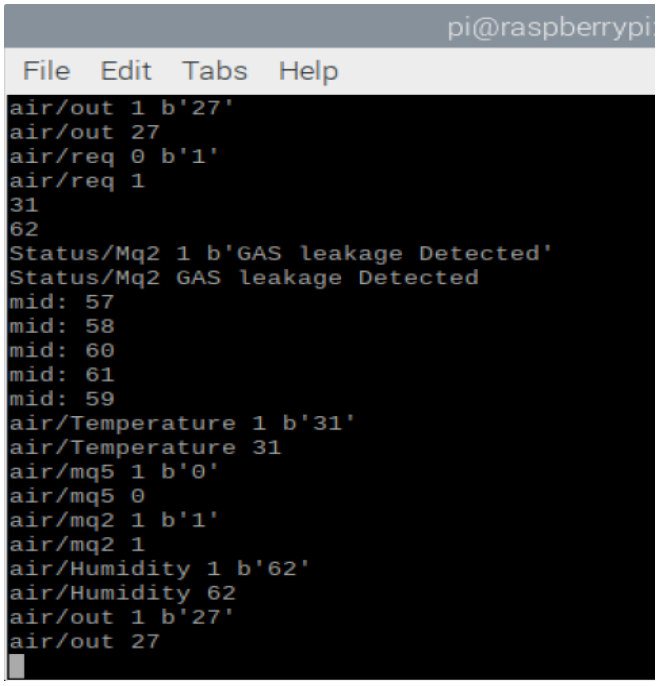

Fig-6 : Fetched Data

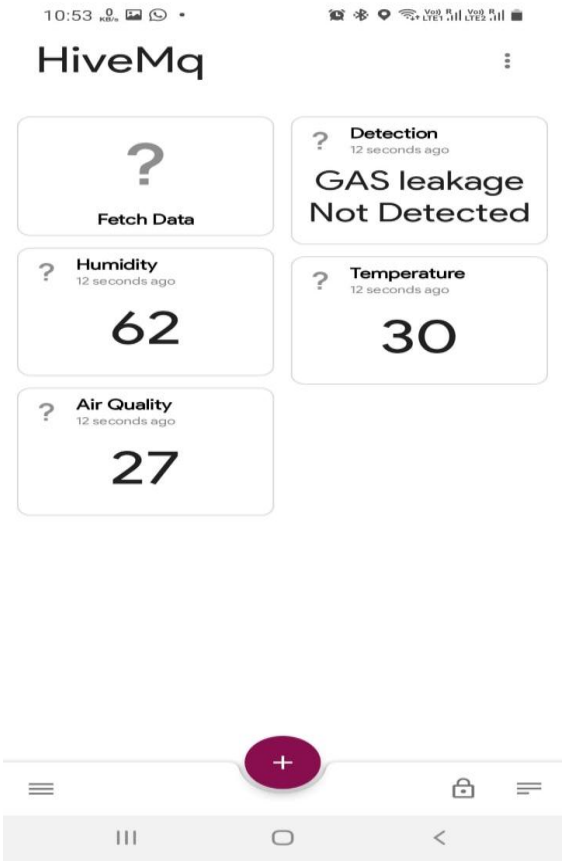

Fig-7 : MQTT Dashboard (Gas Leakage not present)

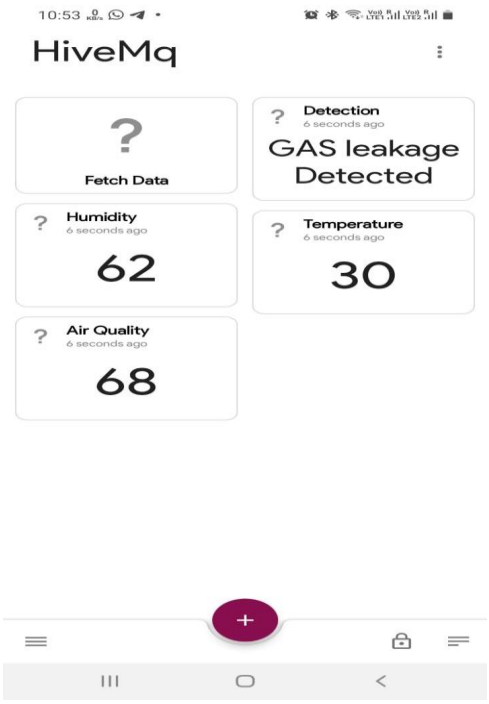

Fig-8 : MQTT Dashboard (Gas Leakage present)

9. CONCLUSION

In terms of safety, the proposed gas leakage detector looks promising. During the development of this prototype, the goal was to create a revolution in the field of safety against the leaking of hazardous and toxic gas in order to reduce and thereby eliminate any significant or minor hazard caused by gas leakage. The proposed method demonstrates how a gas leak can be detected and the harm caused by it controlled. Once a gas leak has been identified by the sensor, an alert has been sent to the appropriate person, who will take appropriate preventive action. One of the most important benefit is that the data can be accessed from anywhere around the globe. The model is very much reliable and secure as MQTT protocol is being used for communication between raspberry pi board and user i.e MQTT dashboard mobile application. Relay has been added in the model to perform different preventive operations as per requirement such as switching on the ventilation fan.

10. REFERENCES

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