A Wireless Safety System for Detecting Gas Leakage in Air Conditioner

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Abstract — In this paper, we'll keep an eye on the air conditioner's gas leaking. Frequently, a minor gas leak can cause a gas concentration to grow up explosively over time. A small amount of explosive gas combined with fire can cause significant damage to our homes and loved ones' lives if this gas leak is not discovered in time. By the usage of sensor helps to keeps an eye on gas leaks in the air conditioner. Gas presence in a space can be determined with a gas sensor. The microcontroller for this paper, an Arduino UNO, is utilized to process the sensor input. When a gas leak is discovered, the system alerts the user by sending an SMS through the GSM module and playing a buzzer sound.

Keywords—Use of Arduino UNO, Gas sensor, and GSM

1 Introduction

Many people have placed air conditioners in their homes, allowing them to enjoy comfortable nighttime sleeping in temperature-controlled spaces. The most recent models use R410-A as a refrigerant. The CFC gases used by all coolants pose a number of risks to people. After use, it must be disposed of correctly in a manner that doesn't harm the environment. It's very likely that your aircon is comes out if your aircon isn't chilling your space as effectively as it once did or if your copper coils suddenly become overcooled. The compressor in your machine may suffer permanent harm as a result of the air conditioner leaking issue. Additionally, it can result in a rise in your electricity usage. And the greatest factor is the grave threat to human life. When an air conditioner leaks coolant, the liquid quickly turns to gas. Gas leaks may be caused by a variety of things, including the copper condenser coil within the air conditioner corroding. Corrosion has long been a challenge for the HVAC business. Protecting homes and industrial equipment from corrosion is challenging but not impossible. The most frequent type of corrosion that damages air conditioning units and causes these leaks is pitting corrosion. Today, MQ 2 sensors are used to check for the hazardous gas. Many lives have been saved by using technology to detect gas leaks and send out alerts.
2 Literature survey

An article on the R290 leakage and risk reduction in a split-type home aircon was proposed in [1]. This essay discusses the well-known hydrocarbon compound R290 (propane), however because of its explosive and flammable properties, it must be used with caution. In actuality, R290 is a refrigerant with outstanding thermodynamic qualities and a low global warming potential. However, it challenging use this type of aircon (R290). Study provides a unique method of replacing a solenoid close to the valve in order for minimize fire threat through slowing at which smoke escapes. Method employs a model to look at how important variables affect the distribution of gas in the space leaking from the indoor unit, in addition to number of tests for confirmation. Experiments were also used to validate the new methodology. The results showed that the area that is most likely to catch fire is right beneath the leak, and that there is only a risk present at the fast phase. Additionally, enormous noise produced by the R290 leakage might be used to evaluate the flammable risks.

The paper on outflow and concentration distribution of harmful gas in the automotive aircon was proposed in [2]. This essay discusses how R290, a natural refrigerant, is currently being explored as a potential R134a replacement in automotive air conditioning (MAC) systems. The use of R290, an A3 class refrigerant, presents the greatest challenge due to its explosive and combustible properties. This research tries to explain dispersion of gas under various outflow situations. Findings indicated about the system's leaking cause danger. Because gas flow into the area in this instance, environment's R290 concentration exceeded limit. The engine compartment leak R290 distribution was found to be primarily influenced by three variables: pressure, hole size, and wind. When hole and wind dropped, peak R290 and the amount of time the gas concentration was above limit, also increased. Furthermore, a lower level indicated that the concentration climbed more slowly sustained above the LFL for a longer period of time than under a high-pressure scenario.

The interior leakage test for R290 split type room air conditioner was proposed in [3]. This paper discusses how choosing different refrigerants for the aircon business had become a serious concern in recent years. Flammable refrigerants are one of the potential solutions, according to the research. R-290 (propane), in particular, has a strong chance of being the preferred fluid for the upcoming generation of aircon due to its exceptional thermo-physical and environmental characteristics. However, because of its flammability and the ensuing safety worries, its use is restricted. Through analyzing the impacts of specific variables of leaked gas into a space, the concerns of using gases are tested in this research. Different conditions result in the leak of gas. The findings evaluated in light of the RAC safety standard criteria, and it is concluded that the requirements may need to be verified in greater detail for wall type RAC.

Study on failure instances involving refrigerant gas leakage in automobile air conditioning systems [4]. This essay will examine and investigate instances for harmful failure on vehicle aircon. In the instance, the aircon ran continuously while the system's gas was leaking. Due to a lack of lubrication, the piston was failed. In the second illustration, it was determined whether gas is leaking from the aircon to the pressured condenser toward the aircon. In third instance, it was discovered that the condenser's internal refrigerant gas had been secretly leaking via a fracture created by the condenser's concave fins. As a result, air conditioning should maintain the air by lowering temperature of the vehicle carefully monitor to ensure that the refrigerant gas does not leak.
The detection of gas leaks in air conditioner cooling systems was the focus of supervised machine learning developed in [5]. This paper helps to provide an evaluation for gas leak system to be implement in the aircon production which in order to increase demand in products. Cycles of testing with the product, the industrial setting, and an infrared thermographic camera—charged with obtaining image of the gas leaked specific area — were conducted to evaluate the suggested remedy. On the basis of temperature datasets, algorithms were trained to categorize areas based on the results. The greatest prediction performance came from the regression logistic approach, demonstrating that "Gas leakage" areas can be found in automatic decision-making in an industrial environment.

3 Proposed methodology

The Arduino UNO ATMEGA 328P microcontroller, which is connected to the MQ 2 gas sensor, GSM module, LCD and GSM module is used in the proposed system.

![Proposed system](image)

**Fig. 1.** Proposed system

An illustration of a block diagram for a gas leakage detecting system can be found in block figure 1 above. Lethal gas leaks from air conditioners can be found thanks to the gas leakage detecting system. The microcontroller for this paper, an Arduino UNO, is utilized to process the sensor input. In the event that a gas leak is discovered, the system notifies the user by buzzing and sending an SMS over the GSM module. Each and every person who are having air conditioner at their house or work places should able to check the condition and working status periodically. If it doesn’t happen then it may show danger situation. By this case the leakage of gas can be detected using a system developed with an inbuilt alert system and sensing the gas leakage with the presence of gas sensor. The figure 2 shows the flowchart of the system explain about the gas leakage detection system. Initialize the modules by giving power input. In initial stage of process, the GSM will activate by using cellular SIM which has been inserted into a module. And then microcontroller starts the process. If GSM module detects the signal and it will send an initiate message to mobile.
Then sensor starts to check the gas present in room space. This will monitor periodically, if there is a presence of gas inside in room space then it enables the system to be activated. The alert message will send to the user handset, it will be initiate using a GSM module and for an additional note the alarm will begins using buzzer.

4 Connection diagram

![Connection diagram](image)

**Fig. 3.** Interfacing Arduino UNO with GSM
Figure 3 links the Transmitter of the Arduino to the Receiver of the GSM. Connect ground to the GSM module's ground. By removing $GPGGA$ string from the GPS module's data and sending necessary information to the GSM, the Arduino can read coordinates. Data is received by the GSM module and sent to the cellphone number entered in the Arduino.

![Interfacing Arduino UNO with MQ2 Gas Sensor](image)

**Fig. 4.** Interfacing Arduino UNO with MQ2 Gas Sensor

Figure 4 explains the connection of Arduino 5V power supply attached to the power supply pin (VCC). Join the Arduino's ground and the gas sensor's ground pin. Connect the Arduino's analog or digital output pin to the appropriate pin. The output readings from the gas sensor are sent to the Arduino after it has read the input values in ppm.

### 5 Result and Discussions

The proposed technology shows how to detect gas leaks in air conditioners. Here, a gas sensor is used to find the gas leak. The following parts are used to create the gas leakage detection system: a MQ 2, an UNO, display, an alarm, and communication module, all of which are connected to a breadboard.

![Gas leakage detector- Prototype](image)

**Fig. 5.** Gas leakage detector- Prototype
The gas leakage detector prototype is depicted in the figure 5 above. where the linked LCD display module will show the system's status, including status of the system is on or off. The module is linked and assists in facilitating mobile connection with the user.

![Image of LCD display showing system status](image)

**Fig. 6.** Message sent to user

The message that is relied to the phone is shown in figure 6 above. With the aid of a GSM, which can send information with the mobile via communication, the system initially provides the user a status update. It sends the message "Air Quality is Normal" to the user's mobile device. Security system is not in use.

![Image of a gas sensor detecting smoke](image)

**Fig. 7.** Alert alarm using Buzzer

Figure 7 above illustrates a gas sensor detecting smoke. A linked gas sensor detects smoke, and it sends the information to a microcontroller, which processes it and emits a buzzer.
sound as an alarm. LED starts to shine. And the linked LCD display shows the sending status.

![Image of alert message](image)

**Fig. 8.** Alert message sent to user

Figure 8 above depicts the user-sent alarm message. "Air Quality is Normal" is the alarm message. Using a module that can send message with a tower, the message "Security system OFF" delivered to given number.

## 6 Conclusion

The proposed technology shows how to detect gas leaks in air conditioners. Here, a gas sensor is used to find the gas leak. The condenser coil may develop cracks and holes as a result of air conditioner wear and tear. The gaps and perforations could allow the gas to escape. This can cause an air conditioner short circuit, start a fire, and release poisonous carbon monoxide gas, which has no flavor or color. This type of causes, the harmful smoke is recognized by MQ 2 sensor, and a buzzer-activated alarm begins to ring and a led begins to glow.

## References


