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GAS LEAKAGE MONITORING AND ALERTING SYSTEM FOR INDUSTRIES

ABSTRACT:

Leakage of any kind of gas has been a concern in recent years, whether it is in a residential setting, a business, a cafe, or a canteen. In this paper development of an IoT based gas wastage monitoring, leakage detecting and alerting system is proposed. This paper elaborates design such an intelligent system that will help save gas and smartly prevent accidents. The system needs to be integrated with the cooker. The technology includes ultrasonic sensors that determine if the cooker is being utilized for cooking purposes or not. If it is discovered that the cooker is not in use, the system uses an automatic switching off mechanism to cut off the gas supply. The moment gas leakage will probably be recognized, users will be informed via SMS through GSM, and so that user can solve the issue as soon as possible. The system will monitor flame and fire through flame sensor. When a fire is detected, the buzzer begins to sound. Aside from that, the system also has a cloud storage capability. The usage of gas for each user each day may be tracked with the aid of this cloud storage solution. At the end of the day, this procedure will assist in detecting per user natural gas usage. The system has been tested and it is able to monitor gas wastage, leakage and send a SMS to the user. The resulting performance indicated its effectiveness toward saving a significant portion of the wasted gas in domestic.

1.INTRODUCTION:

Now a days the home safety detection system plays the important role for the security of people. Since all the people from the home goes to work on daily bases,

it makes impossible to check on the appliances available at home specially LPG gas cylinder, wired circuits, Etc. Since last three years there is a tremendous hike in the demands of liquefied petroleum gas (LPG) and natural gas. To meet this access amount of demand for energy and replace oil or coal due to their environmental disadvantage, LPG and natural gas are preferred. These gases are mostly used on large scale in industry, heating, home appliances and motor fuel. So as to track this leakage gas, the system includes MQ6 gas sensor. This sensor senses the amount of leak gas present in the surrounding atmosphere. Through this, explosion or getting affected by the leakage of gas could be avoided.

1.1 project overview

The design of a sensor-based automatic gas leakage detector with an alert and control system has been proposed. This is an affordable, less power using, lightweight, portable, safe, user friendly, efficient, multi featured and simple system device for detecting gas. Gas leakage detection will not only provide us with significance in the health department but it will also lead to raise our economy, because when gas leaks it not only contaminates the atmosphere, but also wastage of gases will hurt our economy. The need for ensuring safety in workplaces is expected to be the key driving force for the market over the coming years.

1.2 purpose

Huge industries, especially oil refineries are severely exposed to harmful explosions and human risks even with a slightest of the gas leak. Moreover, the expenses due to gas leakages are enormous. This ranges from the production loss in food industries to the infrastructure losses by flammable gas leaks including the healthcare costs to treat the patients injured by gas poisoning. In the USA alone, the treatment costs linked to carbon monoxide intoxication is over \$1.3 billion and the death losses due to this are over 2000 per year. Hence, advanced level gas sensors or gas monitoring systems help the manufacturers to procure accurate and real-time information regarding accidental gas leaks.

2.LITERATURE SURVEY

Whenever there is an occurrence of gas leakage in a particular place the robot immediately read and sends the data to android mobile through wireless communication like Bluetooth. We develop an android application for android based smartphones which can receive data from robot directly through Bluetooth. The application warns with an indication whenever there is an occurrence of gas leakage and we can also control the robot movements via Bluetooth by using text commands as well as voice commands. The previous mobile robots are based on heterogeneous technologies like GSM, GPS, internet based etc., but the main disadvantage of those prototypes were the absence of communication in particular areas. So, with the rapid developments and tremendous changes in technology we have lots of techniques to eradicate previous problems. Wireless communication protocols play a vital role in present trends. Bluetooth, WI-Fi, Zigbee etc., we use one of the best feature of smartphone, i.e., the Bluetooth technology to control and monitor parameters driven by a robot

2.1 existing problem

Gas leakage is nothing but the leak of any gaseous molecule from a stove, or a pipeline, or cylinder etc. This can occur either purposefully or even unintendedly. As we are aware that these kinds of leaks are dangerous to our health, and when it becomes explosive it could cause great danger to the people, home, workplace, industry and the environment. Few of the major incidents that took place due to gas leakage include the Bhopal Disaster and the Vizag Gas leak. The Bhopal disaster is known to be the worst industrial accident ever. Approximately 45 tons of Methyl Isocyanate was leaked from this insecticide plant. Methyl Isocyanate is an organic compound and a chemical that could come from the carbamate pesticides. This colorless, poisonous and flammable liquid is something that human beings have to be away from. Vizag Gas leak was a resultant of the escape of styrene that were unattended for a long period. This colorless oily liquid can spread in fumes. So, a detector must be made in such a way that could detect any kind of gas, fume, leak, smoke etc.

2.2 references

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- [2]. C.Selvapriya, S.Sathyaprabha, M.Abdulrahim,” LPG leakage monitoring and multilevel alerting system”, published in 2013.
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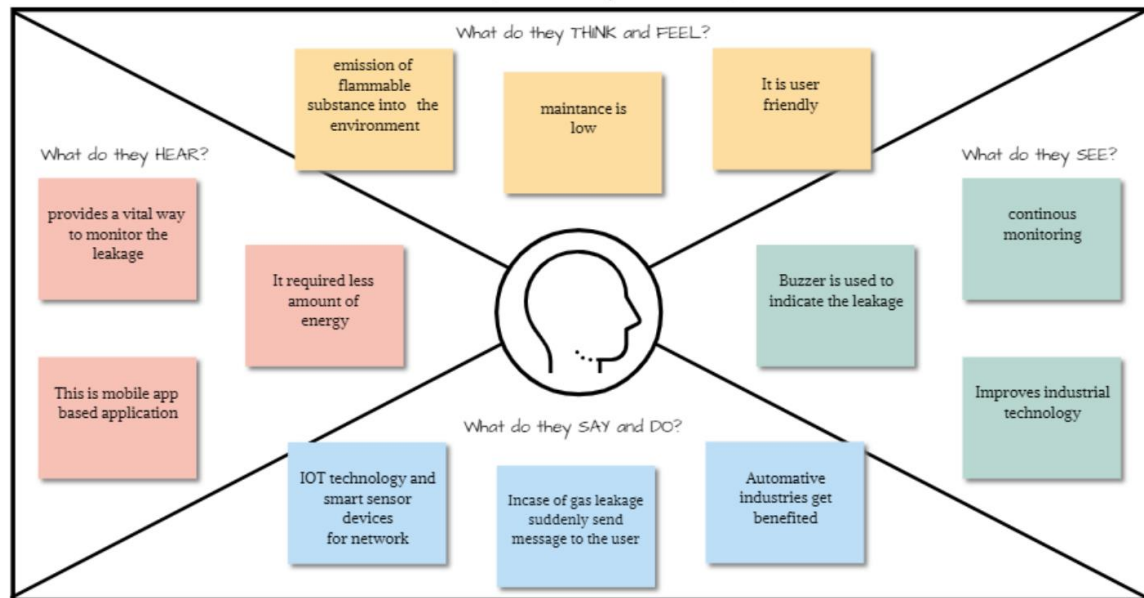
2.3 problem statement definition

The leakage of gases only can be detected by human nearby and if there are no human nearby, it cannot be detected. But sometimes it cannot be detected by human that has a low sense of smell. Thus, this system will help to detect the presence of gas leakage.

Furthermore, gas leakage can cause fire that will lead to serious injury or death and it also can destroy human properties. This system was developed by using IoT to give real-time response to the user and the nearest fire station.

3.IDEATION AND PROPOSED SOLUTION

3.1 Empathy map canvas



3.2 Ideation and brainstorming

The leakage of LPG gas is detected by the MQ6 gas sensor. The analog output from the gas sensor is given to the micro controller, which converts it into digital form using its in-built ADC. It consists of predefined instruction set. Based on this, the exhaust fan is switched on. So, the concentration of gas inside the room gets decreased. Then, the stepper motors are rotated for closing the knob of the cylinder and the main power supply. Because of this process, the leakage of gas the flow of current are stopped. The relay is switched to off the power supply of the house. The buzzer produces an alarm to indicate the gas leakage.

3.3 Proposed Solution

S. No	Parameter	Description
1.	Problem Statement (Problem to be solved)	Liquid Petroleum Gas (LPG) is a highly flammable chemical that consists of mixture of propane and butane. LPG is used for cooking at home, restaurant, and certain use for industry. They have certain weaknesses that make the gas leakage occur. The leakage of gases only can be detected by human nearby and if there are no human nearby, it cannot be detected. But sometimes it cannot be detected by human that has a low sense of smell. Thus, this system will help to detect the presence of gas leakage.
2.	Idea / Solution description	Workers who are engaged with a busy industries packed with gas either harmful or harmless needs a way to monitor their gas pipelines continuously and detect early if there is any leakage of gas in their surroundings so that they can work efficiently on major crises rather than worrying about monitoring or leakage of gas, this will indeed reduce the manpower of that industry and create a peaceful environment.
3.	Novelty / Uniqueness	Some of the solutions are only detecting some particular gases where some others failed to alert the main department and other solutions are with some delays. Our solution not only notify the industry person but also notify the fire fighters so that can take control over the situation and our solution will alert the workers even there is a small leak of gases.
4.	Social Impact / Customer Satisfaction	Through this project the workers mental pressure will be reduced so that they can concentrate on other works or by relaxing them

3.4 Proposed Solution Fit

Define CS, fit into CL Focus on PR, tap into BE, understand RC	1. CUSTOMER SEGMENT(S) <small>CS</small> <i>The levels of gases are detected, can help to prevent an explosion or can help to prevent worker injury or exposure to toxic gases.</i>	6. CUSTOMER LIMITATIONS <small>CL</small> <small>EG. BUDGET, DEVICES</small> <ul style="list-style-type: none"> Poor stability greater environmental impact 	5. AVAILABLE SOLUTIONS <small>PLUSES & MINUSES</small> <ul style="list-style-type: none"> Test Benches Leak Tester Quick Connectors 	Explore AS, differentiate Focus on PR, tap into BE, understand RC
	2. PROBLEMS / PAINS <small>+ ITS FREQUENCY</small> <i>Leakage of gaseous product from a pipeline or other containment into any area where the gas should not be present. Gas leaks can be hazardous to health as well as the environment</i>	9. PROBLEM ROOT / CAUSE <small>PR</small> <i>The root cause / problem for the gas leakage is due to atomic reactions between gas molecules, material quality and etc.,</i>	7. BEHAVIOR <small>+ ITS INTENSITY</small> <i>It senses the harmful gases,</i> <ul style="list-style-type: none"> H₂S Methane CO <i>It will check temperature sensor,</i> <ul style="list-style-type: none"> Detect the concentration of gases Avoids hazardous consequences like fire breakouts 	
Identify strong TR & EM	3. TRIGGERS TO ACT <small>TR</small> <i>Gas leakage system acts as a mandatory precaution in every aspects for example, Fire extinguishers in factories, industries</i>	10. YOUR SOLUTION <small>SL</small> <ul style="list-style-type: none"> We can fix sensor near gas plants It detects and alerts the leakage of gas It sends a message to admin 	8. CHANNELS of BEHAVIOR <small>ONLINE</small> Through online the industry can be continuously monitors the gas leakage <small>OFFLINE</small> In offline mode the alerting system.	Extract online & offline CH of BE
	4. EMOTIONS <small>BEFORE / AFTER</small> <small>EM</small> <i>Gas leakage is hazardous to people and its hard for them to lead a normal life. Symptoms are fatigue, dizziness, loss of consciousness and concentration.</i>	<i>Alarm alerts the workers around</i>		

4.REQUIREMENT ANALYSIS

4.1 Functional Requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User convenience	Through message notification we can easily get data of gas level and in case of gas leakage, it can directly send notification to nearby hospitals and police station
FR-2	User visibility	Gas level can be monitored by users if there is any leakage and they will be receiving alert notification.
FR-3	User reception	The notification for the gas level and leakage can be send through messages.
FR-4	User understanding	User can monitor the level of gas with help of the data. If there is an increase in gas level then the alerts will be given
FR-5	User performance	When the user gets notified ,they could turn on the water sprinkler or exhaust fan.

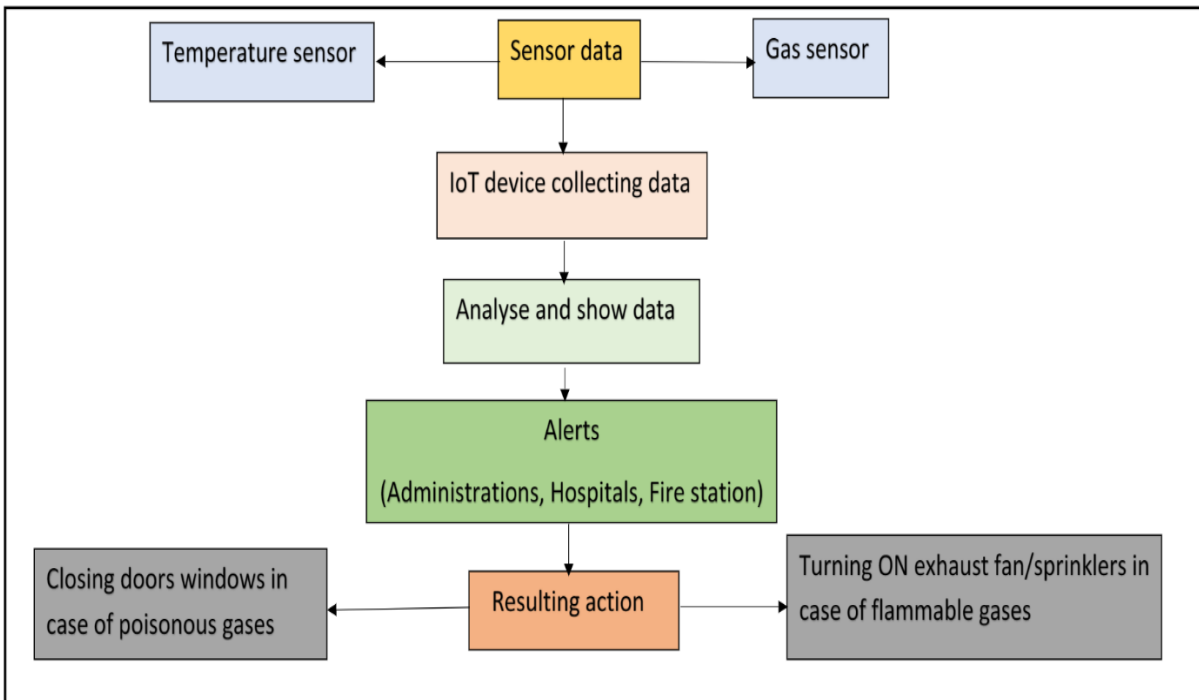
4.2 Non-Functional Requirement

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	It updates data periodically and protects the workers in industries.
NFR-2	Security	In case of emergency alerts, industrial properties and human beings are protected from fire accidents.
NFR-3	Reliability	It will provide most accurate information and have Capacity to recognize the hazardous gas which is true or not.
NFR-4	Performance	During fire, water sprinklers and exhaust fans are used .
NFR-5	Availability	It can be accessed both day and night.
NFR-6	Scalability	Once the sensor got fails it can be easily replaced.

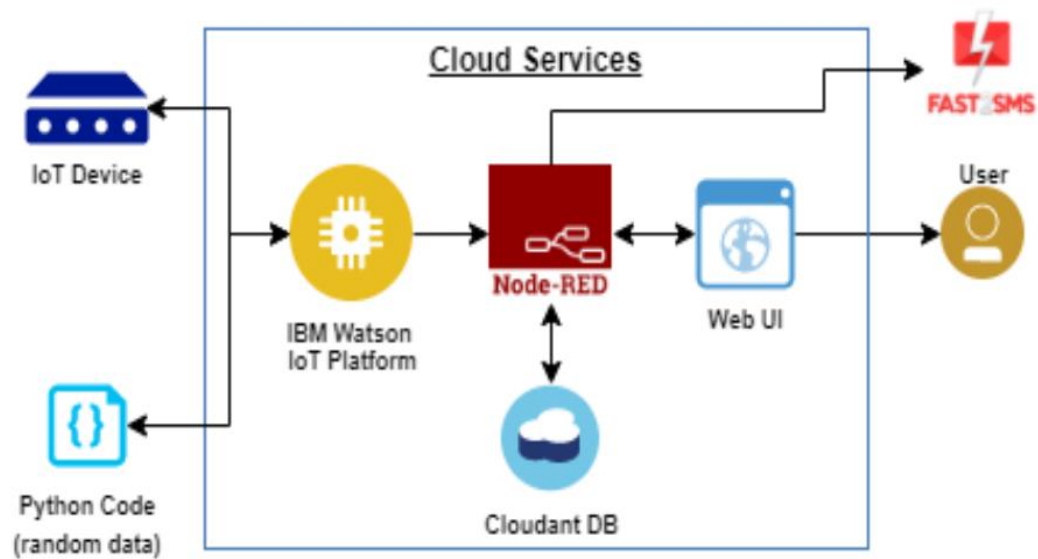
5.PROJECT DESIGN

project design includes data flow daigram,solutional architecture for the project based on IoT that gives a proposed solution for respective problem statement.

5.1 Data Flow Diagram



5.2 Solution and Technical Architecture



5.3 User Stories

	STAGE 1	STAGE 2	STAGE 3	STAGE4	STAGE5
OBJECTIVES	Write a goal or activity	This system alerts the user from the environmental exposure to the harmful gases	Sensor alerts the micro-controller while the gas got leakage and by displaying warning information	Major process is detecting the environmental exposure of hazardous gas	Detection and alerting are the main role in gas leakage monitoring and thus gives information
NEEDS	Write a need that you want to meet	Hazardous gas leakage	Fire hazard preventing	Gas level monitoring	Prompts leakage alerts
FEELINGS	Write an emotion that you expect from the customer	Feeling safe and found best ever solution	Complexity for the usage is very less	Happy and excited	Encourage the solution and giving good feed backs
BARRIER	Write the worst challenges faced by gas leakage	Higher officials in industries	Company managements	Government towards this implementation	Harmful gases that may cause unconsciousness to the people

6.ADVANTAGES & DISADVANTAGES

Advantages:

- Get real-time alerts about the gaseous presence in the atmosphere
- Prevent fire hazards and explosions
- Supervise gas concentration levels
- Ensure worker's health
- Real-time updates about leakages
- Cost-effective installation
- Data analytics for improved decisions
- Measure oxygen level accuracy
- Get immediate gas leak alerts

Disadvantages:

- It requires air or oxygen to work
- It gets reacted due to heating of wire.
- It can be poisoned by lead, chlorine and silicon

- It is affected due to ambient light interference.

7.CONCLUSION

After this project performance, can conclude that detection of the LPG gas leakage is incredible in the project system. Applicable usefully in the industrial and domestic purpose. In danger situations we are able to save the life by using this system. An alert is indicated by the GSM module. A sensor node senses gas like CO₂, oxygen, propane. The estimated range of transmission and consumption of power is obtained. The simple procedures and Arduino UNO Micro controller area used to build the sensor.

8.FUTURE SCOPE

Major cities of India are pushing Smart Home application, gas monitoring system is a part of Smart Home application. Enhancing Industrial Safety using IoT. IoT turns drone into gas detection sensor. Another major future scope could be including a Automatic Shut-off device which will turn off the gas supply whenever it will detect any gas leakage. This system can be implemented in Industries, Hotels and wherever the LPG cylinders are used. This system can be used in industries involving applications such as Furnace, Boilers, Gas welding, Gas cutting, Steel Plants, Metallurgical industries, Food processing Industries, Glass Industries, Plastic industries, Pharmaceuticals, Aerosol manufacturing. As hospitals require to provide maximum possible safety to patients, this system can be used to keep track of all the cylinders used in it. Some of the cylinders used are Oxygen cylinder, Carbon dioxide cylinder, Nitrous oxide cylinder. As many students are naïve the risk of causing accidents is high. Hence, our system can also be used in schools, colleges. Many colleges have well established labs including chemistry lab and pharmaceutical labs where gas burners are used. Plenty of medical equipment requires gas cylinders.

9.APPENDIX

Github link:

<https://github.com/IBM-EPBL/IBM-Project-9825-1659076872.git>