PROJECT REPORT

Gas Leakage Monitoring and Alerting System

(Department of Electronics and Communication Engineering)

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TABLE OF CONTENTS :

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 tobe integrated with the cooker. The technology includes ultrasonicsensors that determine if the cooker is being utilized for cooking purposes or not. If it is discovered that the cooker is not in use, thesystem 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 beginsto 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 peruser 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.

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 energyand 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 gassensor. 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.

Objective :-

The design of a sensor-based automatic gas leakage detectorwith 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 theatmosphere, but also wastage of gases will hurt our economy. Theneed for ensuring safety in workplaces is expected to be the
key driving force for the market over the coming years.

Problem Formulation:-

Gas leakage is nothing but the leak of any gaseous molecule from astove, or a pipeline, or cylinder etc. This can occur either purposefully or even unintendedly. As we are aware that these kindsof 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 leakageinclude 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 humanbeings 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 detectany kind of gas, fume, leak, smoke etc. However harmful and dangerous it can be, the detector could be attached with certainparameters that could help to prevent the issue.

List of Components :-

S.No.	Name of the Component	Quantity
1.	Arduino UNO R3	1
2.	Breadboard	1
3.	LED	2
4.	Resistor	5
5.	Piezo	1

6.	Gas Sensor	1
7.	LCD 16*2	1

Arduino UNO R3 :-

Arduino Uno R3 is one kind of ATmega328P based microcontrollerboard. It includes the whole thing required to hold up the microcontroller; just attach it to a PC with the help of a USB cable, and give the supply using AC-DC adapter or a battery to get started.The term Uno means “one” in the language of “Italian” and was selected for marking the release of Arduino’s IDE 1.0 software. The R3 Arduino Uno is the 3rd as well as most recent modification of the Arduino Uno. Arduino board and IDE software are the
reference versions of Arduino and currently progressed to new releases.

The Uno-board is the primary in a sequence of USB-Arduino Board,& the reference model designed for the Arduino platform.

Breadboard :-

A breadboard is a widely used tool to design and test circuit.
You do not need to solder wires and components to make a circuitwhile using a bread board. It is easier to mount components & reuse them. Since, components are not soldered you can change your circuit design at any point without any hassle. It consist of an

array of conductive metal clips encased in a box made of white ABSplastic, where each clip is insulated with another clips. There are a number of holes on the plastic box, arranged in a particular fashion.A typical bread board layout consists of two types of region also called strips. Bus strips and socket strips. Bus strips are usually used to provide power supply to the circuit. It consists of two columns, one for power voltage and other for ground. Socket stripsare used to hold most of the components in a circuit. Generally it consists of two sections each with 5 rows and 64 columns. Every column is electrically connected from inside.

LED :-

LED (Light Emitting Diode) is an optoelectronic device which works on the principle of electro-luminance. Electro-luminance isthe property of the material to convert electrical energy into lightenergy and later it radiates this light energy. In the same way, thesemiconductor in LED emits light under the influence of electric field. The symbol of LED is formed by merging the symbol of P-NJunction diode and outward arrows. These outward arrows symbolise the light radiated by the light emitting diode.

Resistor :-

A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current inelectrical circuits.

Piezo :-

A piezo is a device that generates a voltage when force is applied or becomes deformed when voltage is supplied.

Gas Sensor :-

A gas sensor is a device which detects the presence or concentration of gases in the atmosphere. Based on the concentration of the gas the sensor produces a corresponding potential difference by changing the resistance of the material inside the sensor, which can be measured as output voltage. Basedon this voltage value the type and concentration of the gas can beestimated.

LCD 16*2 :-

16×2 LCD is one kind of electronic device used to display the message and data. The term LCD full form is Liquid Crystal Display.The display is named 16×2 LCD because it has 16 Columns and 2 Rows. it can be displayed (16×2=32) 32 characters in total and eachcharacter will be made of 5×8 Pixel Dots. These displays are mainlybased on multi-segment light-emitting diodes. There are a lot of combinations of display available in the market like 8×1, 8×2, 10×2,16×1, etc. but the 16×2 LCD is widely used. These LCD modules are low cost, and programmer-friendly, therefore, is used in various DIY circuits, devices, and embedded projects.

Project Design & Planning :-
IDEATION PHASE

A system was designed to identify and measure methane gas in the zones of flammable gas stockpile sites. The device measuresthe air and water quality, including every parameter that can have deviation as the result of gas leakage in the water or air. The sensors measure the amount of CH4 and CO2 gas in the air while the temperature, pH, and electrical conductivity of the water are monitored. The device is controlled by an Arduino UNO microcontroller that transmits measured data to the database on Raspberry Pi 3. Different advancements in pipeline leakage detection were put forward. This includes acoustic emission, optic fiber sensor, ground penetrating radar, Vapour sampling and infrared thermography.
A system with sensors are connected to arduino for data collection and it uses LabVIEW as the GUI (graphical user interface).
A detailed sensor list for flammable toxic and combustible gases and their possible advantages and disadvantages has been compared. One such example is the SB-95 sensor, which detects sequentially the variation on the methane and carbon monoxide gasconcentration and modifies its resistance accordingly. The variationin the filament resistivity is transmitted as a voltage variation on theload resistor. At the same time, metal oxide sensors have a long

response time and even longer recovery time.

These sensors need to extract the gas by making a hole into the pipe for the gas concentration measurement. Making holes cancause danger such as leakage or explosion of the toxic gas.

On the other hand, ultrasonic sensors are free from the above disadvantages for the measurement of gas concentration with fastresponse time and the device is compact and inexpensive too.

A detailed study of health issues related to gases like hydrogen sulphide, Carbon monoxide and methane has been done. Activationof optical alarms and buzzers when the sensed values of SB-95 sensor goes above the threshold along with the working of the sensor is explained in detail. Table gives a reference about the sources and flammable limits of Hydrocarbons and Hydrogen Sulphide gas.Even though the sources of leaks of both the types of gases are common, the lower range of flammability of hydrocarbons are less than hydrogen sulphide which makes

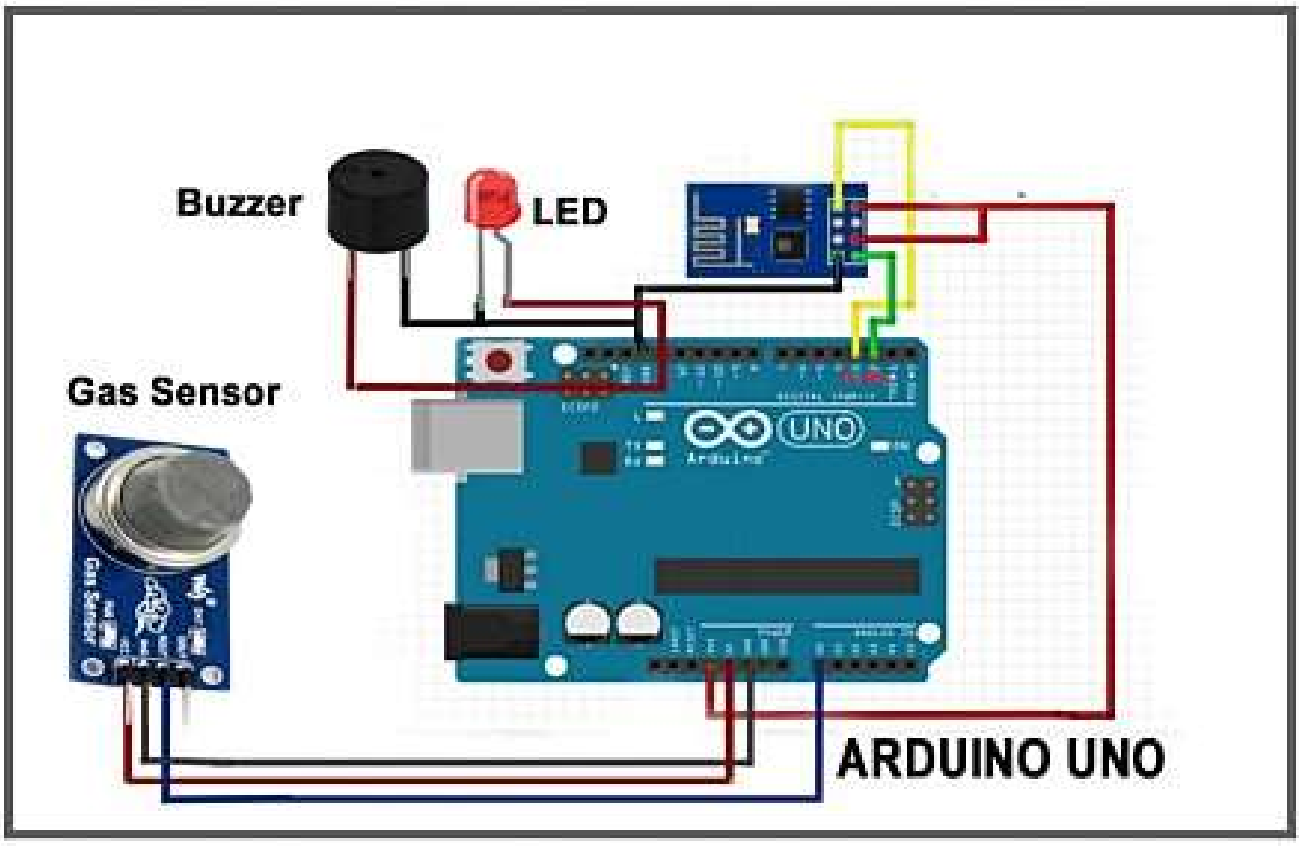
their leaks vulnerable to explosions. At the same time the toxicity of hydrogen sulphide is seen as 50ppm which can really cause lots ofhealth issues in humans and continuous exposure may even lead todeath.

● Ideation :-

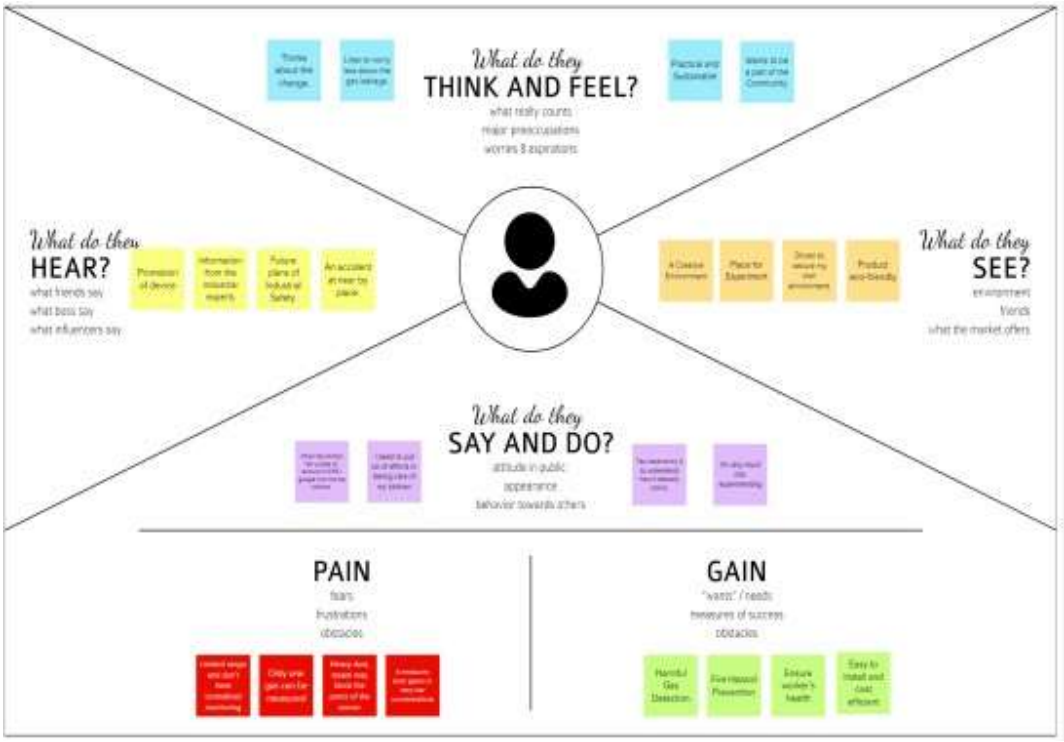
System consists of gas detector sensors, Arduino board, ESP8266 and Cloud server. One Society authority person can register the all flat member user to our system. Society admin canadd the details of per flat user such as user name, mobile number,

per user flat sensor details information. Society admin can configure the threshold value of each sensor. System hardware canbe deployed on each flat. Sensors can sense the value per time.

System can send the values to cloud server. Server can Check thatthe sensor values was existed the threshold value. If sensor value can cross the limit the server can send the command to hardware for buzzing the alarm.



EMPATHY MAP;



Project Design Phase I :-

PROPOSED SOLUTION

1. Problem Statement

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 anyleakage of gas in their surroundings so that they can work efficiently on major crises rather thanworrying about monitoring or leakage of gas, this will indeed reduce the manpower of that industry and create a peaceful environment.

2. Idea / Solution

Workers who are engaged with a busy industries packedwith 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 sothat 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 apeaceful environment.

3. Novelty / uniqueness

Even though there are many existing solutions for this problem they failed to satisfy the needs of customer. Some of the solutions are only detecting some particulargases 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 thereis a small leak of gases.

4. Social Impact / Customer satisfication

Our solution will be very helpful for theworkers and the society which isassociated or located nearby theindustries. Our solution will prevent great disasters like Bhopal Gas Tragedy so thatso many lives can be saved. Through thisproject the workers mental pressure willbe reduced so that they can concentrate
on other works or by relaxing them.

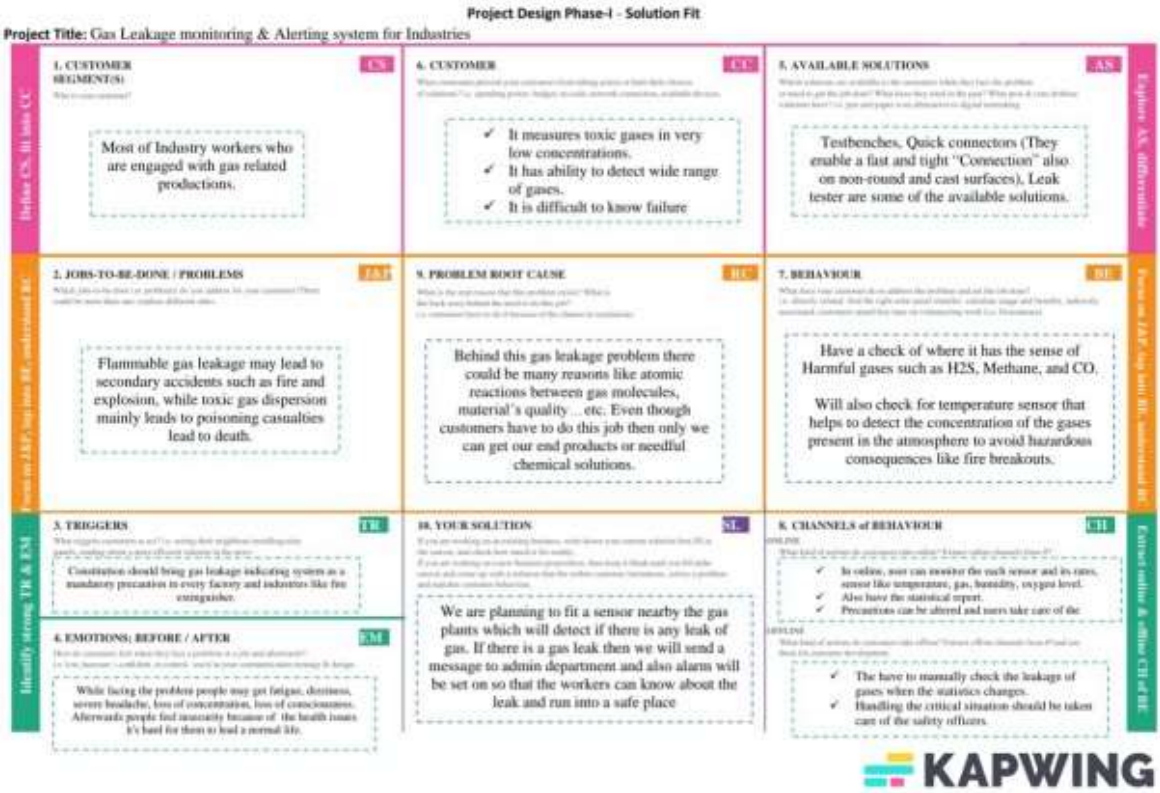
5. Business Model/(Revenue Model)

The main target of our solution is Industries so we have planned to visit industries and explain them about the benefits of our products. So that they canaware of the importanceof this solutionand use it.

6. Scalability of theSolution

Our solution can be integrated for furtherfuture use becausethe solution we haveprovided will be lay on the basic or initial stage of any upgraded version.

PROPOSED SOLUTION FIT:

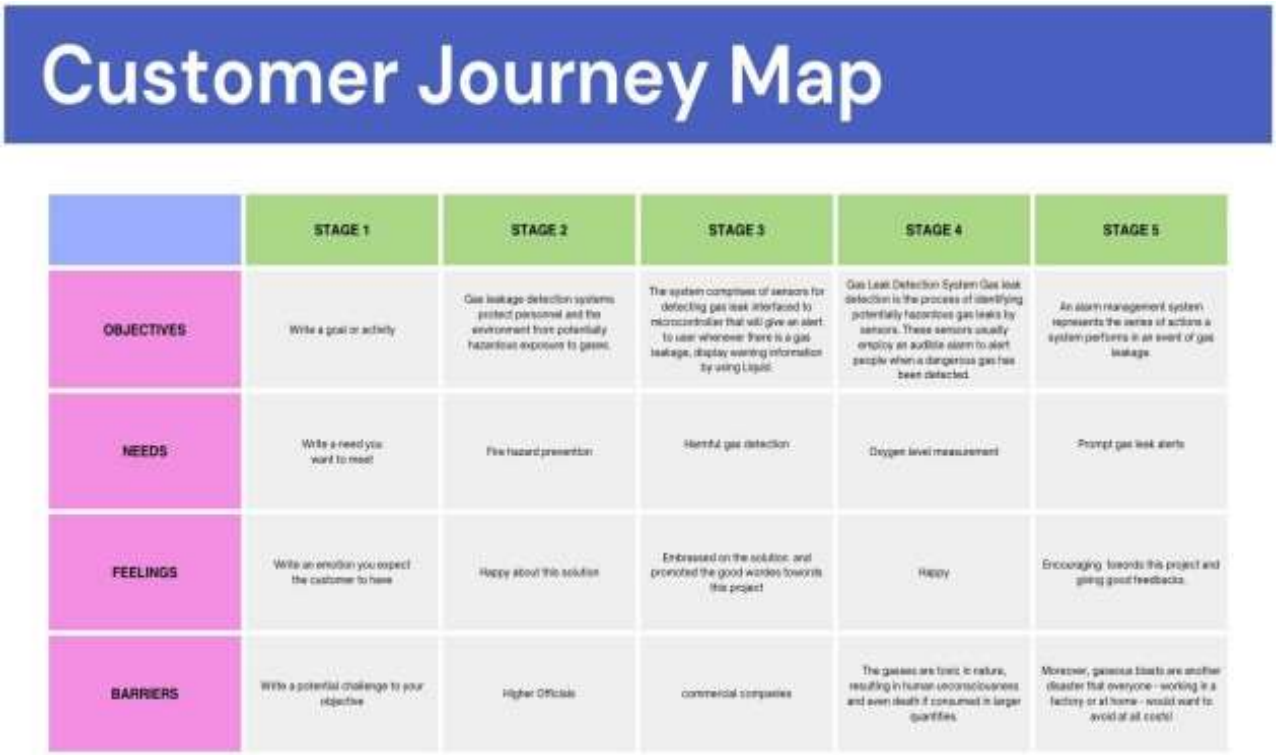


● Solution Architecture :-

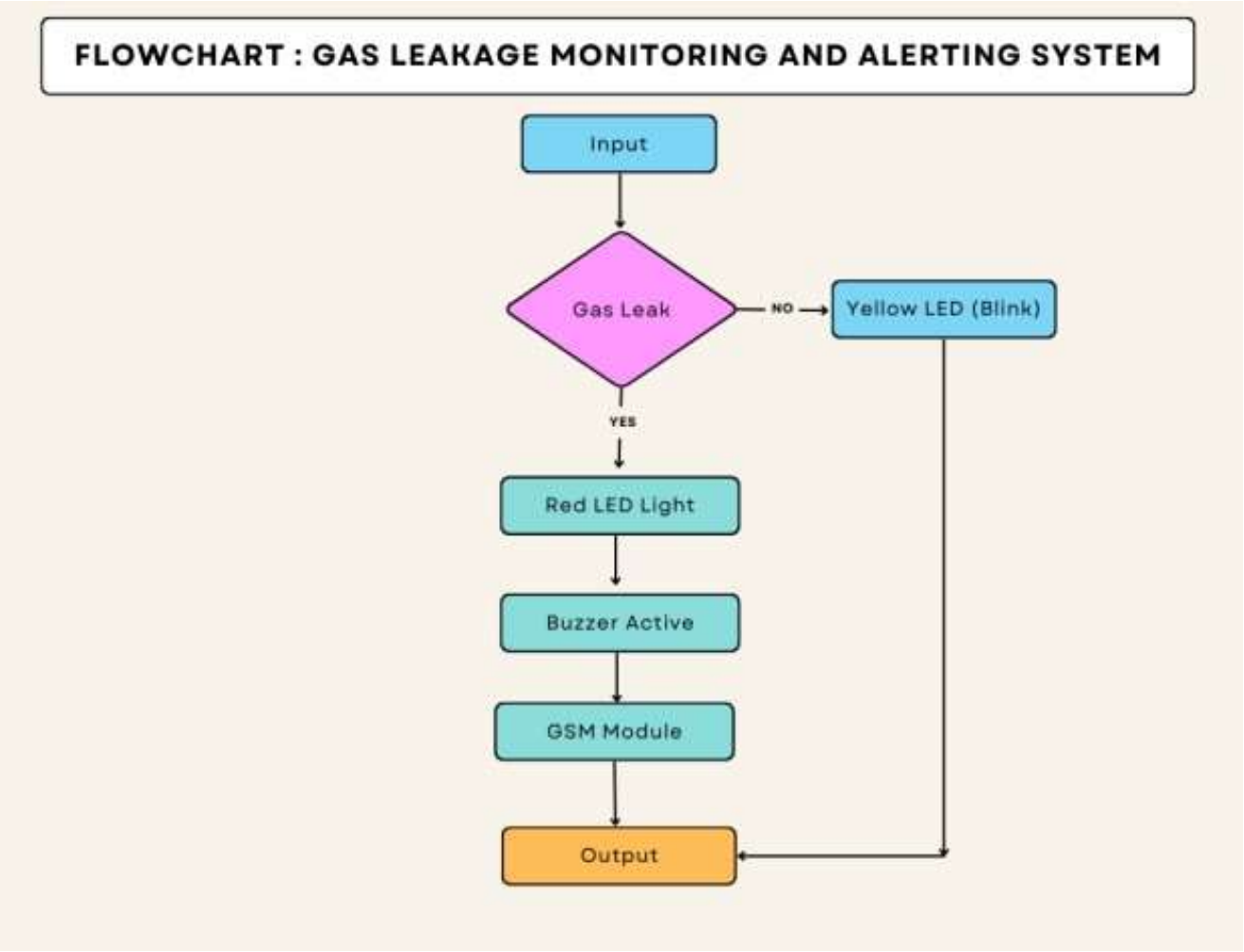
The system can be taken as a small attempt in connecting the existing primary gas detection methods to a mobile platform integratedwith IoT platforms. The gases are sensed in an area of 1m radius of therover and the sensor output datas are continuouslytransferred to the localserver. The accuracy of MQ sensors are notupto the mark thus stray gasesare also detected which creates anamount of error in the outputs of thesensors, especially in case of methane. Further the availability and storageof toxic gases like hydrogen sulphide also creates problems for testing the assembled hardware.

Project Design Phase II :-

● Customer Journey Map :-



● Data Flow Diagram :-

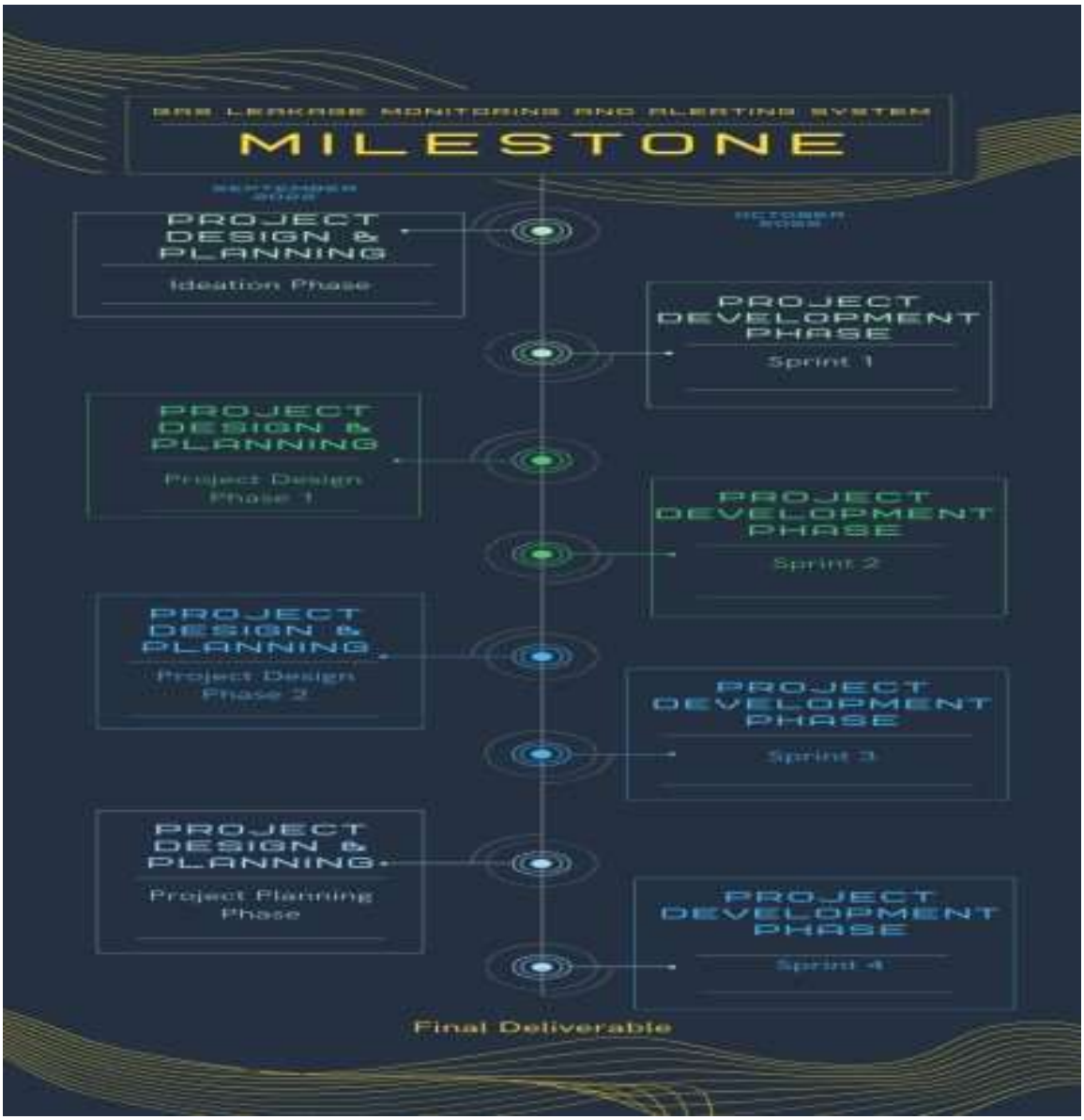


● Functional Requirements :-

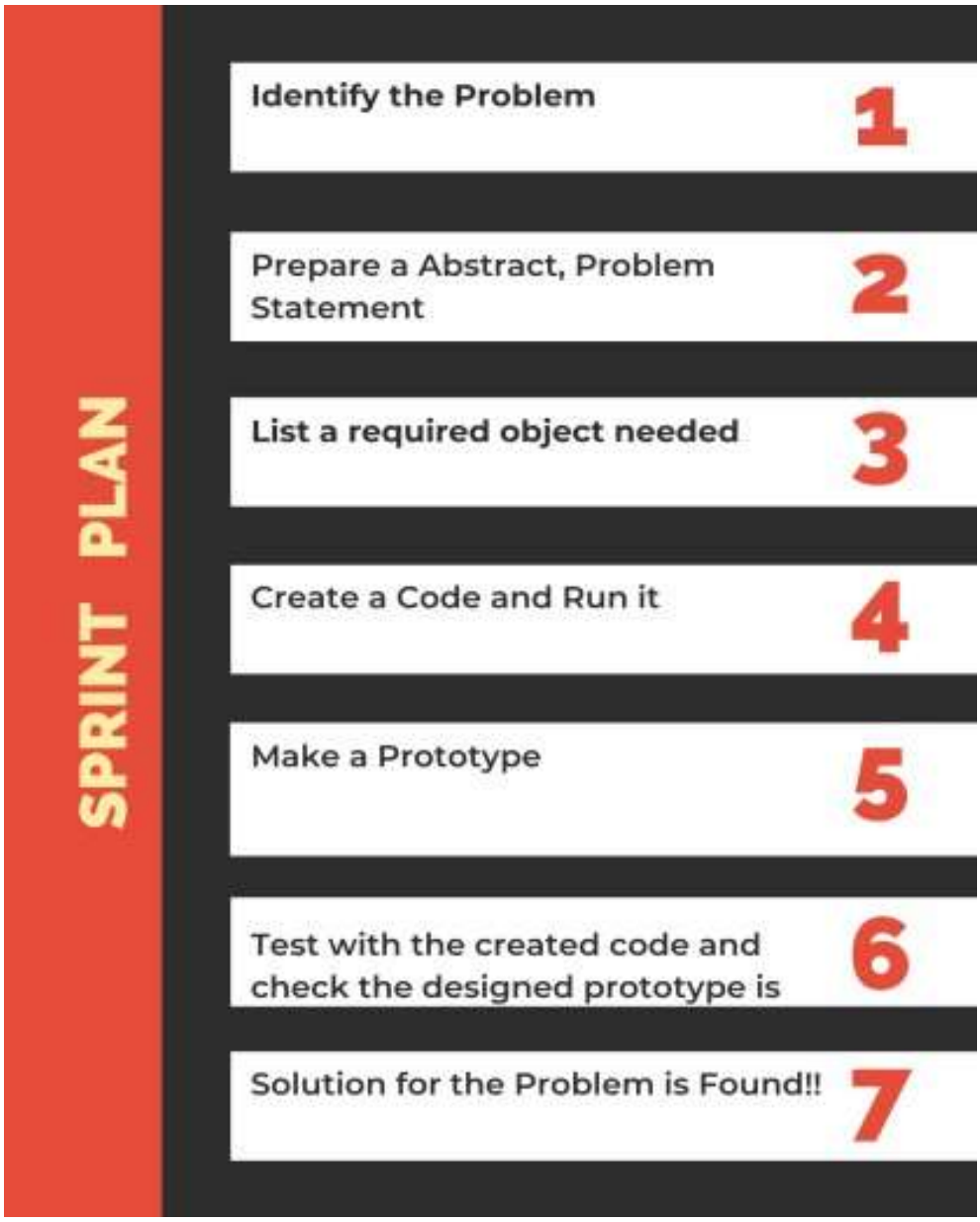
Business Requirements	User Requirements	Product Requirements
The said system can be deployed in homes, hotels, factory units, LPG cylinder storage areas, and so on. The main advantage of this IoT and Arduino-based application is that it can determine the leakage and send the data over to a site. It can be monitored, and preventive measures can be taken to avoid any disaster.	The gas leakage detection system can be optimized for detecting toxic gasses along with upgrading them with smoke and fire detectors to identify the presence of smoke and fire. Ensuring worker safety is important but making using of the right technology is even more vit	Detecting gasses is necessary regardless of your business role or individual purpose. Certain technologies at play make such IoT devices what they are, and if you want to indulge in IoT application development, you must know what they are and what purpose they can fulfill

Project Planning :-

- Milestone and Activity List :-



- Sprint Delivery Plan :-



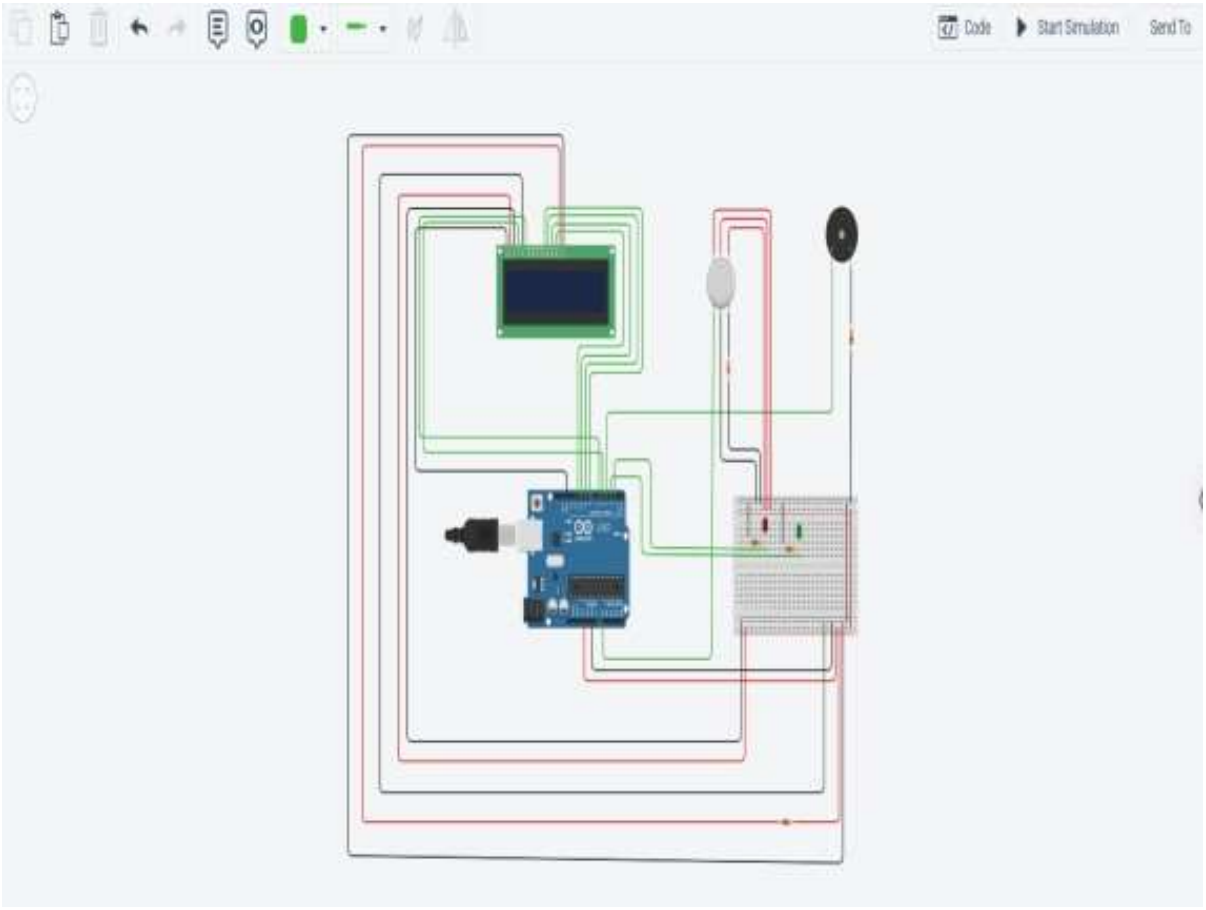
Arduino UNO (Atmega-328) is the main unit of the system which performs the following tasks. A signal conditioning of the Arduino UNO isdone by output signal of the sensor, provided input to Arduino. Thedetection results displayed on LCD. Indicates the people of danger in workplace, factory, home. Buzzer activity with beep(siren) sound is made. Alsosend alert SMS to the in charge of the plant whose number is saved in SIMcard by using GSM modem.The SMS received depends upon the leak ofgas in the detection area of the sensor.

Solution Statement :-

The system can be taken as a small attempt in connecting theexisting primary gas detection methods to a mobile platform integratedwith IoT platforms. The gases are sensed in an area of 1m radius of therover and the sensor output datas are continuouslytransferred to the localserver. The accuracy of sensors are not uptothe mark thus stray gases arealso detected which creates an amount of error in the outputs of thesensors, especially in case of methane. Further the availability and storageof toxic gases like hydrogen sulphide also creates problems for testing the assembled hardware. As the system operates outside the pipeline,thecomplication of system maintenance and material selection of the systemin case of corrosive gases is reduced. Thus the system

at this stage can only be used as a primary indicator of leakageinside a plant.

Circuit Diagram :-



Project Development Phase :-

- Sprint :-

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(5,6,8,9,10,11);int
redled = 2;
int greenled = 3;
int buzzer = 4;
int sensor = A0;
int sensorThresh = 400;
void setup()
{
pinMode(redled, OUTPUT);
pinMode(greenled,OUTPUT);
pinMode(buzzer,OUTPUT);
pinMode(sensor,INPUT);
Serial.begin(9600);
lcd.begin(16,2);
}
void loop()
{
int analogValue = analogRead(sensor);
Serial.print(analogValue); if(analogValue>sensorThresh)
{
digitalWrite(redled,HIGH);
digitalWrite(greenled,LOW);
```

```
tone(buzzer,1000,10000);
lcd.clear(); lcd.setCursor(0,1);
lcd.print("ALERT");
delay(1000);
lcd.clear();
lcd.setCursor(0,1);
lcd.print("EVACUATE");
delay(1000);
}
else
{
digitalWrite(greenled,HIGH);
digitalWrite(redled,LOW);
noTone(buzzer);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("SAFE");
delay(1000); lcd.clear();
lcd.setCursor(0,1);
lcd.print("ALL CLEAR");
delay(1000);
}
}
```

Conclusion :-

After this project performance, can conclude that detection of theLPG gas leakage is incredible in the project system.Applicable usefully inthe industrial and domestic purpose. In danger situations we are able tosave the life by using this system.

An alert is indicated by the GSM module.A sensor node senses gaslike CO2, oxygen, propane. The estimated range of transmission and consumption of power is obtained. The simpleprocedures and Arduino UNO Micro controller area used to build the sensor.

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