

LP Gas Leakage Monitoring System

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Abstract

The significance of a fire alarm system in maintaining and monitoring the safety of all types of surroundings and circumstances is critical. However, many existing fire alarm systems are well-known for their utility, yet they can be produced at a high cost. As a result, it is out of reach for low-income individuals. The major goal of this project is to create a low-cost fire control system. The detecting system, monitoring system, and appliance system are the three primary systems in the project. The detecting system functions as both a fire and a smoke detector.

The GSM is used for sending SMS services, buzzer for alarming, servos for automatic lockdown of doors in emergency exits, motor pump fire extinguishing foam to stop the fire, and GPS module to indicate the location where the fire occurred for the fire extinguishing vehicle are all components of the appliance system. The microcontroller is in responsible for the total system.

The system can detect smoke, flame, heat, and other elements detected by the detector, followed by a monitoring system that displays smoke, light, flame, heat, and other elements at that level. Finally, the main Buzzer activates and sends SMS when the sensors from each level are independently triggered. The control panel LCD display then displays which areas are damaged and which are safe. Then it activates the emergency exit servo motor for escape and the water pump motor for fire suppression in the affected zone.

1. Description

This system functions as a self-contained embedded system. It's a completely self-contained unit. It accepts digital or analog inputs through its input ports, calibrates, transforms, and processes the data, and then sends the results to an attached output device, which either displays data or controls and drives the attached devices. For example, these devices may use the Global System for Mobile Communication (GSM) and short message service (SMS) to transmit data from the building to the owners' mobile phones. As a result, by employing GSM technology to send immediate alert notification messages to owners or the fire brigade, it is easier to control fire damage. Microcontrollers will control variables such as temperature and smoke level. Each of these parameters is monitored by a sensor that is calibrated to a specified range; if the sensor detects a change in that range, the system will take the necessary action, and the user will receive a daily report through SMS.

1.1 Objectives

- To indicate the location where the fire is occurred.
- To prevent fire and smoke.
- To sound the alarm if fire occurs.
- To run the emergency EXIT servo motor and control the fire by supplying water to the remote area by motor pump.

2. Requirements

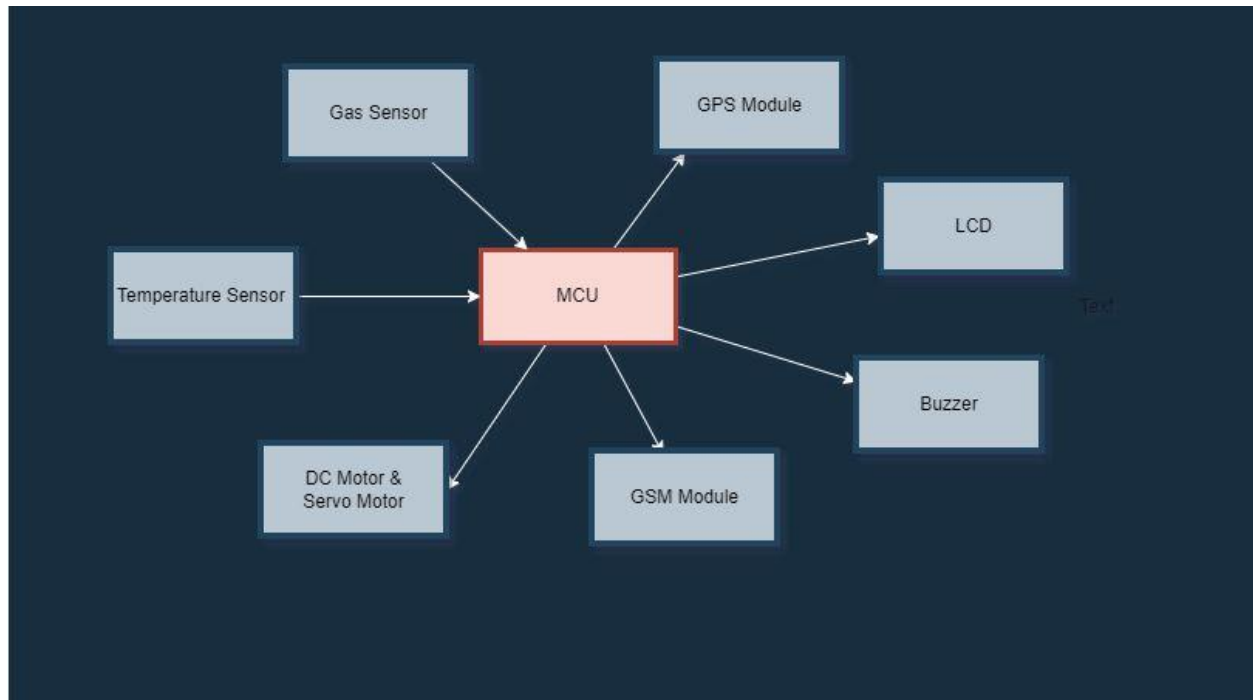
2.1 High Level Requirements

ID	Title	Description
HLL_01	Gas Sensor	It shall sense the gas leakage
HLL_02	LCD	It shall display the message
HLL_03	Temperature Sensor	It shall measure the room temperature
HLL_04	Servo motor	It shall spray water on fire
HLL_05	GSM Module	It shall send a message to fire extinguisher when the fire takes place
HLL_06	Buzzer	It shall notify the neighbors that the fire or gas leakage taken place

2.2 Low Level Requirements

ID	Title	Descript
LLR_1.1	Gas Leakage	Home appliances that generates heat or gas such as stove, water heater
LLR_3.1	Fire Detection	This can be caused by gas leakage in room

3. Block Diagram



3.1 Components required:

3.1.1 ATmega328P Microcontroller

This microcontroller is a low-power CMOS (Complementary Metal Oxide Semiconductor) 8-bit microcontroller based on the AVR enhanced RISC (Reduced Instruction Set Computer) architecture. The powerful execution of instructions in a single clock cycle leads to the achievement of 1 MIPS per MHz throughputs allowing the designer to optimize power consumption versus processing speed.

3.1.2 Sensor

3.1.2.1 Temperature Sensor

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

3.1.2.2 Smoke Sensor

The MQ-2 smoke sensor reports smoke by the voltage level that it outputs. The more smoke there is, the greater the voltage that it outputs. Conversely, the less smoke that it is exposed to, the less voltage it outputs. The MQ-2 also has a built-in potentiometer to adjust the sensitivity to smoke. By adjusting the potentiometer, you can change how sensitive it is to smoke, so it's a form of calibrating it to adjust how much voltage it will put out in relation to the smoke it is exposed to.

3.1.3 Actuators

3.1.3.1 DC Motor

A DC motor is a mechanically commutated electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore the current in the rotor is switched by the commutator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque.

3.1.3.2 Servo motor

Inside a servo motor, there are a small DC motor, potentiometer, and a control circuit. The motor is attached by gears to the control wheel. The motor rotates, the potentiometer's resistance changes, so the control circuit can precisely regulate how much movement there is and in which direction. The servo motor in this project operates on 6V.

3.1.3.3 Buzzer

For alarm purposes a lot of electric bells, alarms and buzzers are available in the market that has got different prices and uses. The buzzer being used in this project is a 5-12 V buzzer and has got enough alarm sound to be used in a fire alarm system. Louder buzzer would have been even better but then their operating voltages are high as we had a supply of maximum up to 12V available with us on the board

3.1.4 Communication modules

3.1.4.1 GPS Module

GPS or Global Positioning System is a satellite navigation system that furnishes location and time information in all climate conditions to the user. GPS is used for navigation in planes, ships, cars and trucks also. The system gives critical abilities to military and civilian users around the globe.

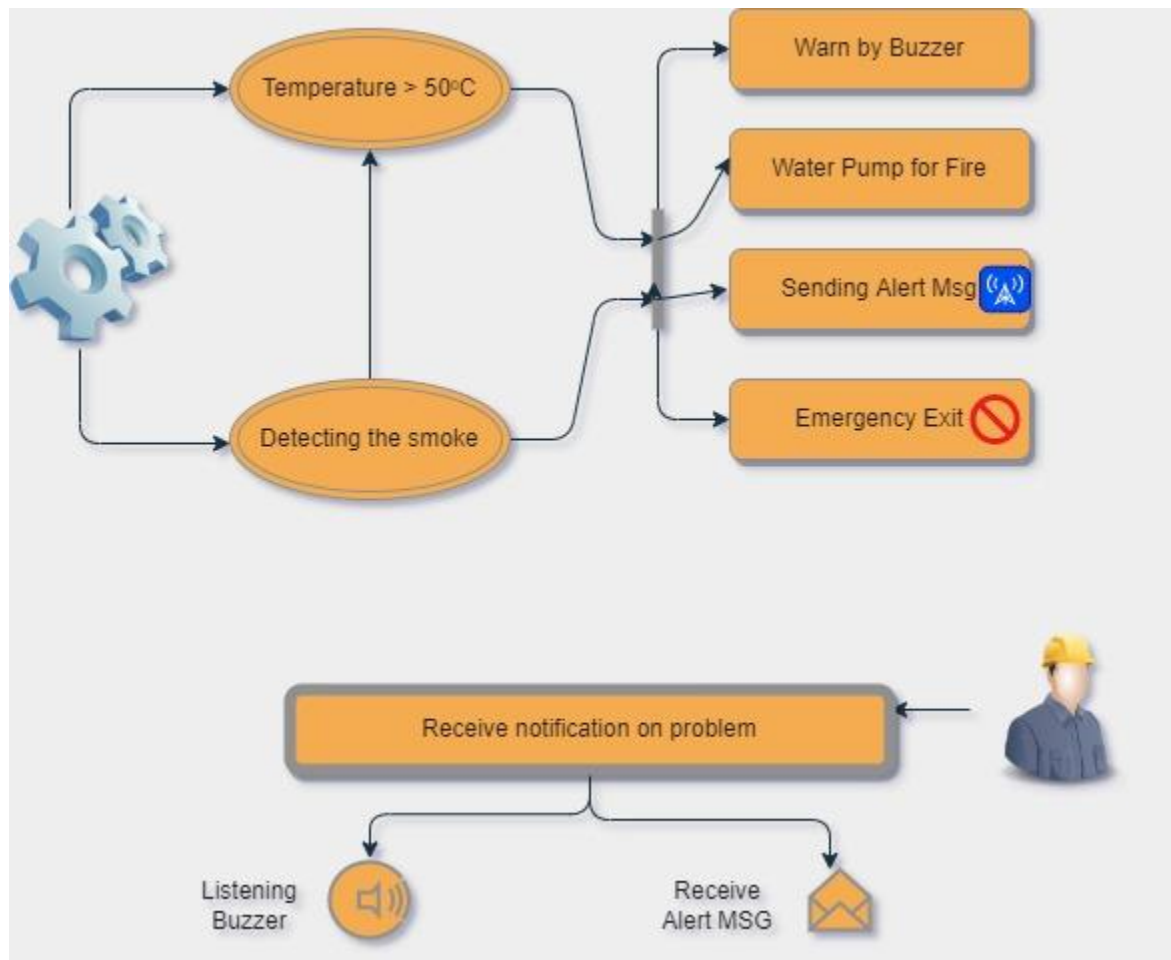
3.1.4.2 GSM Module

The acronym GSM is presently understood to mean Global System for Mobile Communications. We chose the SIM 900A because that our country Ethiopia support the SIM 900 2G network. It requires SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification.

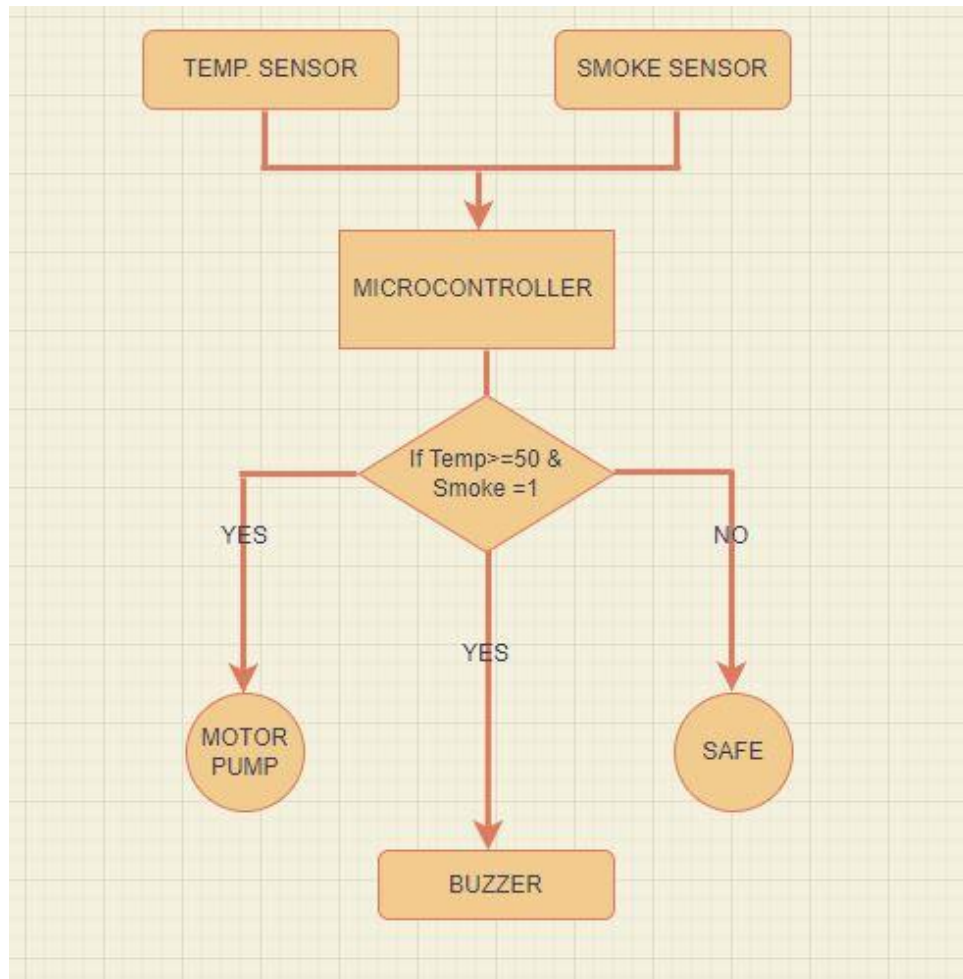
3.1.5 LCD

A Liquid Crystal Display commonly abbreviated as LCD is basically a display unit built using *Liquid Crystal technology*. When we build real life/real world electronics based projects, we need a medium/device to display output values and messages. Liquid Crystal Displays comes in different size specifications. Out of all available LCD modules in market, the most commonly used one is 16×2LCD Module which can display 32 ASCII characters in 2 lines (16 characters in 1 line).

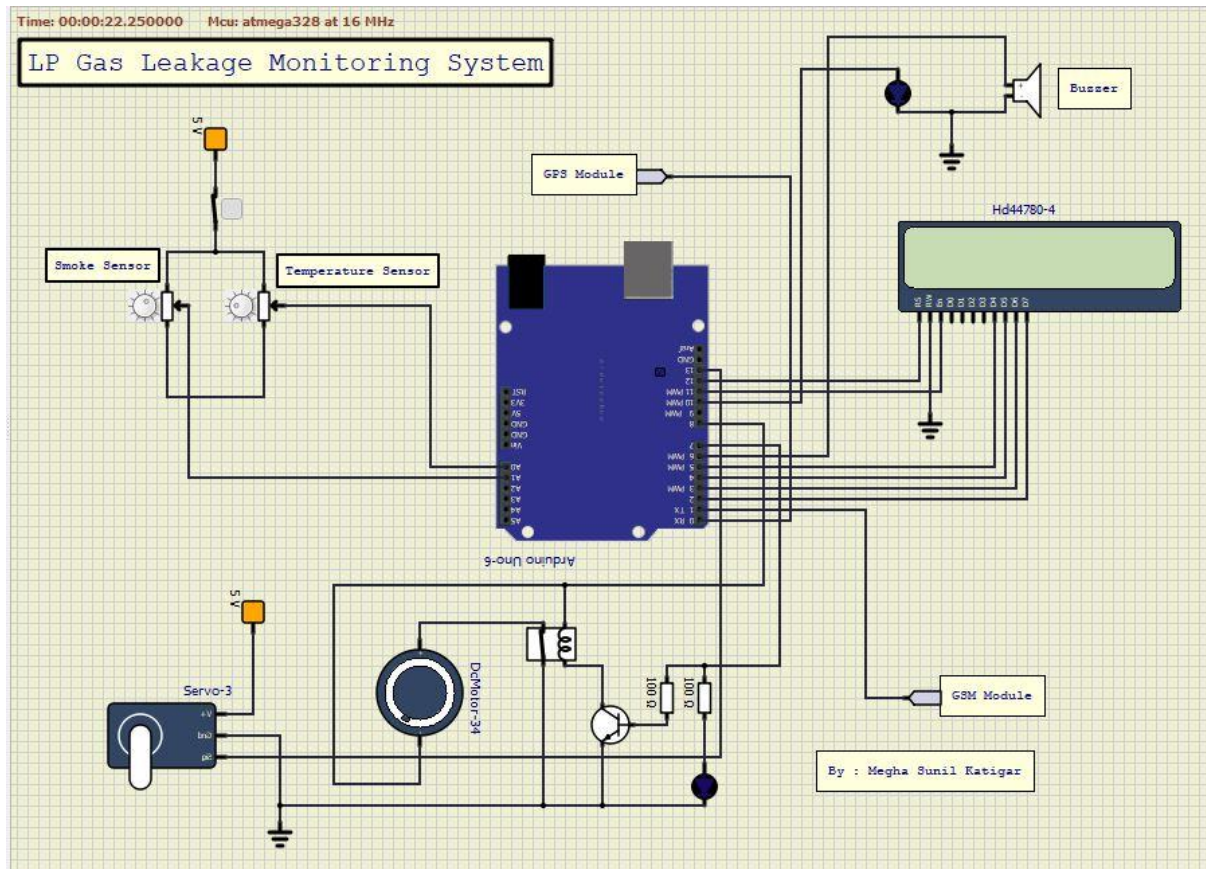
4. Behavioral diagram



5. Flow Chart



6. Schematic Diagram



7. Test Plan

7.1 High Level Test Plan

Test ID	Title	Input Value	Expected O/P	Actual O/P	Status (✓ PASS/ ✗ FAIL)
01	Gas Sensing	Detection of smoke	Shall turn ON the buzzer	Shall turn ON the buzzer	✓
02	Temperature measurement	50° C	Shall turn on the Servo & DC motor	Shall turn ON the Servo & Dc motor	✓
03	Main Switch	OFF(0)	Shall display "NO FIRE ALL SAFE" on LCD	Shall display "NO FIRE ALL SAFE" on LCD	✓
04	Main Switch	ON(1)	Shall display "Sending MSG" on LCD	Shall display "NO FIRE ALL SAFE" on LCD	✓

7.2 Low level Test Plan

Test ID	Title	Input Value	Expected O/P	Actual O/P	Status(✓ PASS/ ✗ FAIL)
01	Displaying the message on LCD	NO FIRE ALL SAFE	NO FIRE ALL SAFE	NO FIRE ALL SAFE	✓
02	Servo Motor	0V	Motor is OFF	Motor is OFF	✓
03	Servo Motor	5V	Motor is ON	Motor is ON	✓
04	DC Motor	5v	Anticlockwise rotation	Anticlockwise Rotation	✓

8. Application

- 1) Home
- 2) Factories
- 3) Industries
- 4) Apartments
- 5) Malls

9. Future Scope

The project can be extended by increasing the number of sensors used along with an increase in the number of installation places. The remote management of electronic devices can also be extended with the use of different real electronic devices. Using DC motor control automatically turns off the knob of the cylinder. So continuously monitoring the level of the LPG present in the cylinder using weight sensor and automatically books the cylinder using a GSM module.

References

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