PROJECT BASED LEARNING DESIGN AND DEVELOPMENT OF IOT SOLUTION FOR REAL TIME CHALLENGES

TITTLE: SMART LPG MONITORNING AND SAFETY SYSTEM

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PROBLEM STATEMENT:

Traditional LPG (Liquefied Petroleum Gas) cylinders used in households and small businesses lack real-time monitoring and automated safety mechanisms. Users are often unaware of low gas levels, leading to sudden service interruptions. Additionally, undetected gas leaks pose serious fire and health hazards, potentially leading to fatal accidents and property damage. There is a need for an intelligent system that can continuously monitor gas levels, detect leaks, and instantly alert users to ensure timely refilling and enhanced safety.

OBJECTIVE:

To design a system that:

- Monitors the remaining LPG gas level in a cylinder.
- Detects gas leakage using an MQ gas sensor.
- Automatically turns off the gas regulator using a servo motor durning leakage.
- Continuously display the gas percentage and status on I2C LCD.

PROPOSED SOLUTION:

The Smart LPG Monitoring and Safety System uses sensors and a microcontroller to monitor gas levels and detect leaks in real time. It alerts users through mobile notifications or alarms when gas is low or a leak is detected. An automatic shut-off valve can stop gas flow during emergencies. The system ensures safety, prevents accidents, and helps users track gas usage efficiently.

PROPOSED SYSTEM DETIALS:

The Smart LPG Monitoring and Safety System is an IoT-based solution that uses a gas sensor to detect leaks and a load cell to monitor gas levels in real time. A microcontroller processes the data and sends alerts to users via Wi-Fi or GSM when a leak is detected or gas is low. It includes a buzzer and LED indicators for local alerts, and may feature an automatic shut-off valve for emergencies. The system enhances safety, prevents accidents, and ensures timely refilling in homes and businesses**.**

COMPONENTS AND ITS FUNCTIONS:

1.Arduino Uno

Function: Acts as the central processing unit of the system. It receives data from all connected sensors, processes the information, and sends commands to the output devices (e.g., servo motor, buzzer, display).

2.HX711 Load Cell

Function: Amplifies the low-voltage signal from the load cell to a readable level for the Arduino. It converts the sensor's analog output into digital data that the microcontroller can process.

3.Load Cell Sensor

Function: Measures the weight of the LPG cylinder. The load cell detects small changes in weight as the gas is consumed and sends the information to the HX711 module. This data is used to estimate the remaining gas level.

4.MQ-2 or MQ-6 Gas Sensor

Function: Detects the presence of gases like LPG, smoke, or methane in the air. When gas concentration exceeds a predefined threshold, it triggers an alarm to alert the user of a possible leak or hazardous gas presence.

5. Servo Motor (SG90 or MG90S)

Function: Controls the gas shut-off valve in the system. In case a gas leak is detected, the servo motor can be used to close the valve and stop the gas flow, ensuring safety by preventing further leakage**.**

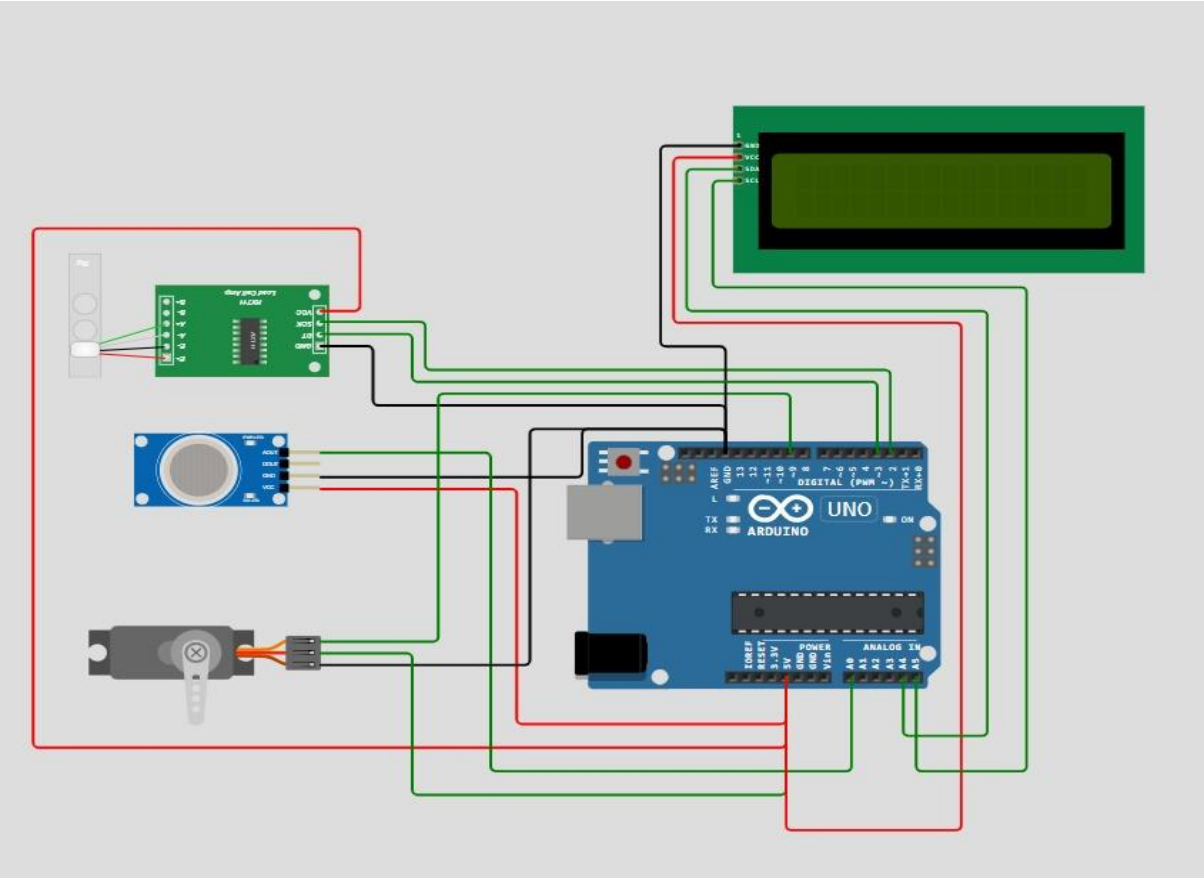
6.I2C LCD Display (16x2)

Function: Provides real-time data on the gas level and leakage status. It displays key information like the remaining gas percentage, alerts on low gas levels, and status indicators for any detected gas leakage. The I2C interface ensures easy wiring with fewer pins required for communication**.**

RESOURCES REQUIRED:

- Arduino Uno
- Load Cell Sensor
- HX711 Load Cell Amplifier Module
- MQ-2 or MQ-6 Gas Sensor
- Servo Motor (SG90 or MG90S)
- I2C LCD Display (16x2)
- Buzzer
- Power Supply (15V Adapter or Battery)
- Jumper Wires
- Bread Board
- Gas Cylinder (for testing purposes)

CIRCUIT DIAGRAM:



PROJECTIVE OUTCOME:

The Smart LPG Monitoring and Safety System will enhance safety by detecting gas leaks and monitoring LPG levels in real-time. The system will automate gas level tracking, reducing the chances of running out unexpectedly and preventing accidents. It will also feature an optional remote monitoring interface for added convenience. The solution is cost-effective, scalable, and easy to deploy, offering long-term benefits in safety, efficiency, and convenience.

🛠️ APPLICATION IN REAL-TIME SCENARIOS:

1. 🏠 Domestic Kitchens:
Ensures safe usage of LPG in homes by detecting leaks and alerting residents to prevent fire hazards and gas-related accidents.

2. 🍽️ Restaurants & Hotels:
Provides continuous gas level monitoring in high-usage environments, preventing service disruptions and enhancing kitchen safety.

3. 🏭 Small-Scale Industries:
Used in workshops or factories where LPG is used for heating, welding, or manufacturing—minimizing risks of gas explosions.

4. 🏫 Educational Institutions (Labs):
Helps monitor LPG usage in science labs, ensuring student and staff safety.

5. 🚚 LPG Distribution & Delivery:
Integrated into LPG supply chains to track cylinder usage and leakage during transportation and storage.

6. 🏢 Apartment Complexes & Hostels:
Monitors centralized LPG supplies, alerts building management of leaks or low gas levels, and improves emergency response.