

Smart Gas Outflow Detection and Safety Circumstance System Using Cloud Technology

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Abstract

The project aim is to design and develop a cloud connected smart LPG gas cylinder platform, acting as a safety device for detecting LPG gas drip at minimum levels to avoid any credible incidents. It is also capable of detect fire exists in the area and level of the gas in order to provide real time monitoring and alert over Cloud server. If an aberrant condition is detected, the device gives an alert to the smartphone app of the user and also sends an alert e-mail to other authorities. In addition to this upon detecting a gas leakage or a fire breakout, the device automatically takes safety precautionary measures, like gas valve closing, ventilation opening, fire sprinkler activation and home electrical power supply cut-off. The device connects to the internet via Wi-Fi and thus increasing the mobility of the platform within the premises of the house. A Wi-Fi capable ARM Cortex-M4 Launchpad is used to execute the system. This device proposes a complete, low-cost, powerful and accessible way of real-time tracking and distant control of gas leakages and preventive mechanisms in household and industrial areas.

Keywords: Wi-Fi, Cloud, ARM Cortex-M4, LPG

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1. Introduction

The LPG is generally utilized as a bit of homes, associations and in autos as animates. Both LPG and oil gas are characteristic merciful they can be seen. These gases are regularly secured in menaced steel barrels perfectly healthy and poured at standard temperatures. With closeness of air LPG is heavier as requirements are it advance along the floor furthermore closed in low focuses which make it hard to disperse. LPG is a mix of significant butane and beneficial propane having both transfuse and unstirred hydrocarbons. LPG promoted in India might be extended by Indian Standard Code IS-4576 and the test systems by IS-1448 [1]. Characteristics of this perilous gas combine (a) vapor weight: The weight inside a LPG stockpiling vessel/chamber will be corresponding to the vapor weight relating to the temperature of LPG in the farthest point vessel [2]. The vapor weight is liable to temperature and besides on the degree of blend of hydrocarbons; (b) Floatability: LPG has a detonative degree of 1.8% to 9.5% volume of gas in air. This is obviously right than other fundamental vaporous powers; (c) Oxidization: The begin response of LPG more unmistakable the volume of things in added to the headway of warmth [3]. LPG needs up to 50 times its own particular total of air for whole oxidization; (d) Odor: LPG has just a delicatened acknowledge, and in this way, it is depended upon to affiliation some odorant, so that any present gas can vapor organize, in any case, furcated when in higher fixations in light of the case that it unsettles oxygen; (e) Toxicity: LPG despite the way that gently terrible, is not hurtful it can have a veritable impact in the event that they turned out. Impacts: LPG may spill as a gas or a fluid. In the event that the fluid streams it will fastly disseminate and make a for all intents and purposes wide surge of gas which will spot to the ground, as it is heavier than air. LPG vapors can cleanse for more segments forward to the ground and can floak in channels or whirlwind storm cellars Cylinders can crease if exist in a fire [4]. The success appulse this critical gas can have freezing effects the skin and it can respond as a gag at high center interests. Spill has a risky impact to the thriving so that the hydrocarbons and assorted chemicals of the LPG go to long rest. It is like way causes bothered respiratory tract, nose and eyes. The contraption is proposed for use in family success where machines and warmers that utilization fluid oil gas (LPG) might be a wellspring of hazard. The structure may be utilized for different locales in the business or plants that rely on upon LPG in their execution.

2. Existing System

LPG gas is comprehensively used as a piece of industry, warming, and home machines and even as motor fuel. Notwithstanding the way that LPG gas is ecological, it can make a veritable peril if they stream [5]. The spillage can realize suffocation and impact. In this way the spillage of gasses has bolster more energy for late years especially in range of prosperity, industry and condition. Family prosperity is transforming into a troublesome issue due to the advancement of LPG gas for warming and home machines. Generally steaming is done using LPG, and over portion of the warmers uses LPG [6]. As needs be fire scenes from gas spillage augment each and every day. The amount of disasters consistently keeps extending.

3. Overall System Design

Cloud connected Gas Leakage Detection system block diagram as shown in figure 1.

This project needs capable microcontroller with Internet source. So we are implementing CC3200, a single chip Wi-Fi microcontroller from Texas Instruments. It includes a high performance ARM Cortex-M4 processor subsystem running at 80 MHz and a Wi-Fi subsystem. The Wi-Fi subsystem consists of a dedicated ARM MCU, an 802.11b/g/n radio, baseband, and MAC with powerful crypto engine for fast, secure Internet connection. CC3200 chip supports Station, Access Point and Wi-Fi Direct modes. It also supports WPA2 personal and enterprise security and WPS 2.0. Multiple provisioning methods are supported including Smartconfig, AP mode and WPS. It contains embedded TCP/IP stack and numerous IP's for easy web approach. It consumes very low power and can run for more than a year from a single coin-cell battery.

Features of system hardware

a) Live-Monitoring and Control

The smartphone app can show the amount of LPG gas remaining, present room temperature other device status. These data are updated every few seconds providing real-time live monitoring. In addition to this, the actuators connected on the device can be controlled from the smartphone app giving additional benefits for the user.

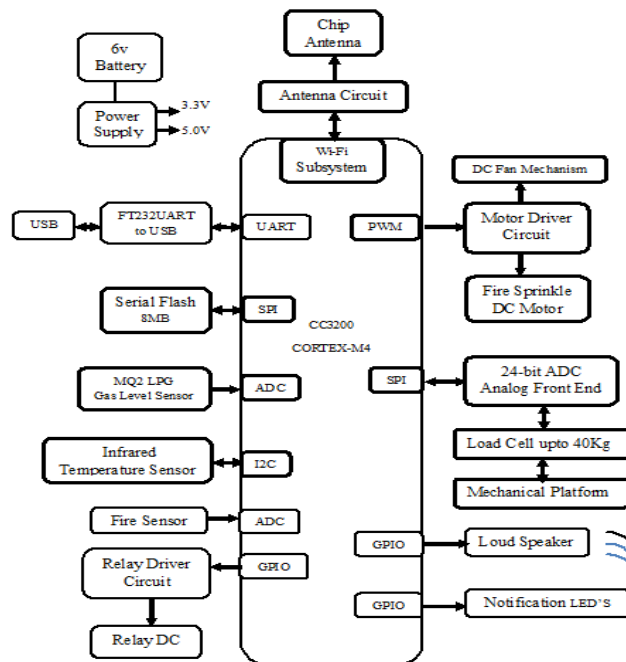


Figure 1. Gas Exhalation Monitoring and Safety Provision system

b) On-Demand Automatic Reordering Facility

If the device is configured in automatic reordering mode, whenever the gas level comes below a certain threshold, the device automatically sends a gas cylinder requesting e-mail to the gas vendor or gas distributor. The user must save the e-mail address of the gas distributor before enabling this feature.

c) Low Weight Alert

Every time when a new gas cylinder is delivered, the user must press a button on the device which starts the process of measuring the weight of the cylinder and if it detects low weight cylinder, which means a low fuel content, it will immediately alert the user smartphone app about this as well as send an e-mail alert to the gas agency company to register this case. This is a useful application in finding and avoiding a low weight gas cylinder at the time of delivery.

d) Actuators

A servo motor is used to control the gas valve position, whereas DC fan motor mechanism acts like a ventilation/exhaust fan [4]. Another DC electrical motor will do the work of a fire sprinkler motor. All these motors are controlled using appropriate PWM signal generation. An AC relay circuitry is used cut-off the mains electrical supply.

e) Local Audio Alarm

A loud beep alarm sound is generated intermittently to alert the neighbouring people.

f) Device User Interface

Notification LED's are used to intimate Wi-Fi provisioning and cloud server connection status.

g) IoT Cloud – Blynk

The cloud is responsible for authorizes the hardware device and the smartphone app. It enables the communication between the smartphone app and the hardware device to handles all the data translation and data management between them [2]. There are many cloud platforms available. In our case, we are going to implement Blynk server and Blynk app for its connectivity and simplicity. The connection to the internet is based on Wi-Fi [3]. The project hardware has to be registered with the Blynk server shown in Figure [2]. An authentication token is issued by the server while creating the project. This token will be used as a unique identifier that allows connecting the hardware to the smartphone app. The cloud is capable of managing all forms of communication, between device to device, device to server and server to web application over internet. The Blynk server contains a custom protocol for this communication and also the Blynk library supported to handle that communications.

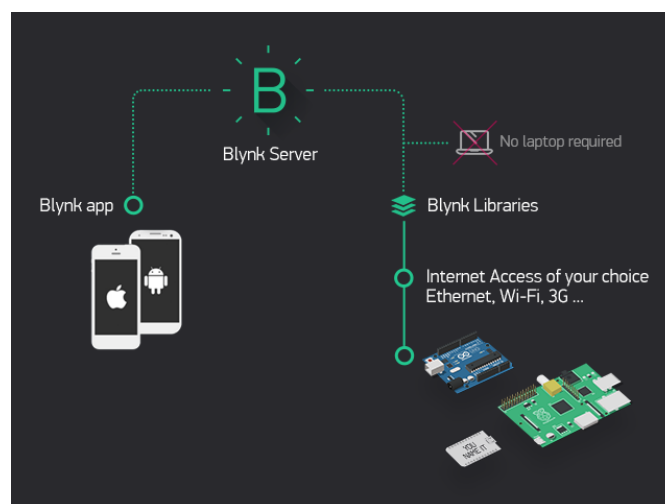


Figure 2. Blynk-Cloud Platform

h) Smartphone App – Blynk

The smartphone app shown in Figure [3] gives necessary permission to the user to track and supervising the device from a remote place. The smartphone GUI is created using Blynk app that is always present for download for both Android and iOS. Blynk is a smartphone app that allows the developer to create a custom UI according to the application fulfillment. It leverages the resources of a smartphone and provides a set of widgets that helps to create the custom user interface.



Figure 3. Blynk App

4. System Software Design

The Software consolidated with Gas Leakage Detection System uses Energia which is an open Source electronic prototyping stage with the target to pass on the Wiring and Arduino structure to the Texas Instruments [8]. Structure writing computer programs is made out of embedded c tongue and application program. The application is mainly orchestrated into two ranges which are interface and correspondence with Blynk, Gas Leakage Detection coding [7] and prosperity protection estimation and control coding.

5. Results

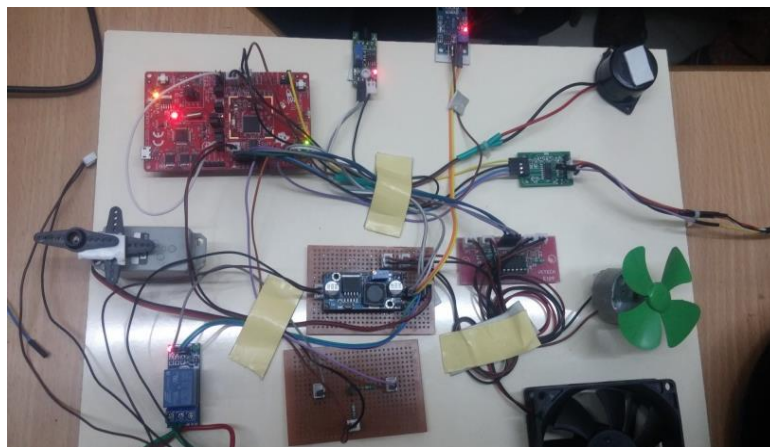


Figure 4. Overall Hardware Setup

In figure 4 shows the overall hardware setup and connections in corresponding port pins.

6. Conclusion

LPG is a flammable gas, which can make a danger. In this way it is important that the properties and safe treatment of LPG are appreciated and associated in the neighborhood and business/mechanical conditions. So we developed a model of a customized system that consistently screens the gas spillage status with the help of the sensors. This data is made available on cloud through steady reinforce over the web. Gas sensor identifies the gas spillage and makes cautious strides thusly in the house. It moreover rebooks at whatever point the gas level gets low through email. Here using this thought one can live with no fear of dangers and reduce the time due to modified rebooking.

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