

Smart Fire Prevention System

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ABSTRACT: As the world develops, there has been a drastic change to the use of LPG gas in both the rural and urban areas. The most common problem we face in our day to day life is the explosion of LPG gas cylinders. This gas explosion happens primarily due to the accumulated gases in a kitchen environment. Precious lives can be saved if the leakage is detected and explosion is prevented in advance. This project proposes a leakage detection system and exhaust system for letting gases out of a kitchen environment. This module is equipped with a GSM module to provide alert signals to the house resident in case of a leakage or explosion. We use a MQ-2 gas sensor to detect the gas leakage and the signal is sent to an Atmega328P microcontroller, further the controller controls an exhaust fan and a door. The alert messages are sent to a user by means of GSM which can be viewed from an application. The app provides an alert message by using angular JS. The AT commands are used to transmit the control message from the microcontroller via a GSM module. The GSM SIM900A module is used for the purpose of transmission of data. The Relay is used for controlling the motor and exhaust system.

I. INTRODUCTION

Gas leakages are a common problem in households and industries. Unlike a traditional gas leakage alarm system which only senses a leakage and sounds an alarm, the idea behind our solution is to automatically turn on the exhaust fan and opens the window as soon as a gas leakage is detected. In addition to this, a message is sent to an authorized person informing him about the leakage. For detecting dangerous and flammable gas leakage, a gas sensor is used which detects natural gas, LPG and coal gas. This can easily be incorporated into an alarm unit to sound an alarm. GSM AT command set for sending and receiving SMS and getting modem status with the help of GSM modem. Depending

upon the gas sensor output, the microcontroller can send message to the authorized person. Block diagram is shown in fig 1.

BLOCK DIAGRAM

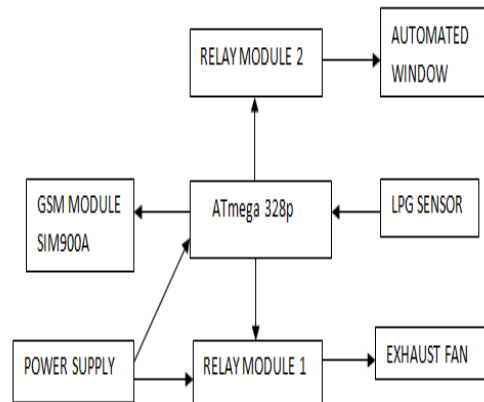


Fig.1.Block Diagram

II. PROPOSED METHOD

1. USER INTERFACE

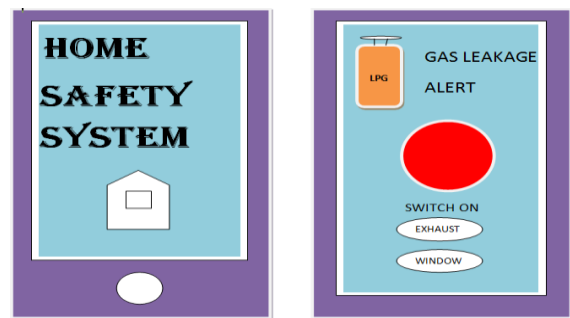


Fig.2.User interface with web application

2. ATMEGA328p MICROCONTROLLER

The ATmega328P is an 8-bit, 32KB Flash, microcontroller, part of the mega AVR MCUs series, developed by Atmel. The microcontroller provides a delicate balance between performance and balance.

This is the Pico Power version of the standard ATmega328 version which allows it to operate under lower voltage and power requirements, as low as 1.62V. The microcontroller came into public not ability when it was selected to be the microcontroller of choice in the Arduino single-board microcontroller. ATmega 328p microcontroller is shown in fig.3.



Fig.3. Atmega328p microcontroller

3. MQ-2 GAS SENSOR

The MQ series of gas sensors use a small heater inside with an electro-chemical sensor. They are sensitive for a range of gasses and are used indoors at room temperature.

They can be calibrated more or less (see the section about "Load-resistor" and "Burn-in") but a known concentration of the measured gas or gases is needed for that. The output is an analog signal and can be read with an analog input of the Arduino.

This sensor module utilizes an MQ-2 as the sensitive component and has a protection resistor and an adjustable resistor on board. The MQ-2 gas sensor is sensitive to LPG, i-butane, propane, methane, alcohol, Hydrogen and smoke. It could be used in gas leakage detecting equipments in family and industry. The resistance of the sensitive component changes as the concentration of the target gas changes. The fig.4 shows the MQ-2 gas sensor.



Fig.4. MQ-2 Sensor

3.1. FEATURES:

- Continuous Analog output
- 3-pin interlock connector
- Low cost and compact size

4. GSM MODULE SIM900A

This is an ultra-compact and reliable wireless module. The SIM900A is a complete Dual-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900A delivers GSM/GPRS 900/1800MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mmx24mmx3mm, SIM900A can fit in almost all the space requirements in user applications, especially for slim and compact demand of design. GSM module SIM900A is shown in fig.5.



Fig.5. GSM Module SIM900A

4.1. HARDWARE AND SOFTWARE USED:

- SIM 900A Module
- Arduino UNO
- Arduino IDE (1.0.6V)

4.2. AT COMMANDS FOR GSM:

AT commands for GSM is given below

AT Press ENTER	Checking the Operation and Connection of GSM Shield. This would print OK which signifies of working connection and operation of the GSM shield.
ATD+(country code)mobile number; Press	Making a Voice Call

ENTER.	
ATH Press ENTER.	Disconnecting the Active Call
ATA Press ENTER	Receiving the Call
AT+CMGF=1 Press ENTER	For sending SMS in text Mode
AT+CMGS="mobile number" Press ENTER	Once the AT commands is given ' >' prompt will be displayed on the screen. Type the message to be sent via SMS. After this, Press CTRL+Z to send the SMS. If the SMS sending is successful, "OK" will be displayed along with the message number.
AT+CMGF = 1 Press ENTER	For reading SMS in the text mode
AT+CMGR = num	Number (num.) is the message index number stored in the SIM card. For new SMS, URC will be received on the screen as + CMTI: SM 'num'. After this AT+CMGR=1 Press ENTER. This displays the message on the screen along with sender details, number and timing too.

5. EXHAUST FAN

An exhaust fan is a fan which is used to control the interior environment by venting out unwanted odors, particulates, smoke, moisture, and other contaminants which may be present in the air. Exhaust fans can also be integrated into a heating and cooling system. Common locations for exhaust fans include bathrooms and kitchens, and these fans are usually very easy to install, so they can be situated in many other locations as well. For installation, people do need a few tools, and they must be comfortable working with electricity to wire the fan in place. Exhaust fan shown in fig 6.



Fig.6. Exhaust fan

A classic use for an exhaust fan is in an environment like a kitchen or a bathroom. These fans can also be useful in garages and workshops to ventilate the space. Since these areas can sometimes acquire strong smells and people may work with potentially dangerous chemicals in them, exhaust fans can be used for comfort and safety. An exhaust fan is especially important when people are working with things like solvents, which are not healthy or safe to inhale. Likewise, it is important to vent fumes from paints, varnishes, and similar types of treatments.

6. RELAY MODULE

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch. Relays are used where it is necessary to control a circuit by a separate low-power signal, or to be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers, they repeated the signal coming in from one circuit and re-transmitted it on another circuit. A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults in modern electric power systems these functions are performed by digital instruments still called "relays". Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts.

The circuit diagram of relay module is shown in fig.7.



Fig.7. Relay

7. INTERNET OF THINGS

The internet of things (IoT) is the internet working of physical devices, vehicles, buildings are embedded with electronics, software, sensor, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society. The IoT allows objects to be sensed and/or controlled remotely across existing infrastructure, resulting in improved efficiency, accuracy and economic benefit. It is used in technologies such as smart homes, intelligent transportation and smart cities, when IoT is augmented with sensors and actuators. IoT connectivity is shown in fig.8.



Fig.8.IoT Connectivity

8. WI-FI BASED INTRANET

Wi-Fi or WiFi is a technology that allows electronic devices to connect to a wireless LAN (WLAN) network, mainly using the 2.4 gigahertz (12 cm) UHF and 5 gigahertz (6 cm) SHF ISM radio bands.

A WLAN is usually password protected, but may open, which allows any device within its range to access the resources of the WLAN network. The Wi-Fi Alliance defines Wi-Fi as any "wireless local area network" (WLAN) product based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11

standards. "Wi-Fi" is a trademark of the Wi-Fi Alliance. The "Wi-Fi Certified" trademark can only be used by Wi-Fi products that successfully complete Wi-Fi Alliance interoperability certification testing. Devices which can use Wi-Fi technology include personal computers, video-game consoles, smart phones, digital cameras, tablet computers, digital audio players and modern printers. Wi-Fi compatible devices can connect to the Internet via a WLAN network and a wireless access point. Such an access point (or hotspot) has a range of about 20 meters (66 feet) indoors and a greater range outdoors. Hotspot coverage can be as small as a single room with walls that block radio waves, or as large as many square kilometers achieved by using multiple overlapping access points. Depiction of a device sending information wirelessly to another device, both connected to the local network, in order to print a document. Wi-Fi is less secure than wired connections, such as Ethernet, precisely because an intruder does not need a physical connection. Web pages that use TLS are secure, but unencrypted Internet access can easily be detected by intruders. Because of this, Wi-Fi has adopted various encryption technologies. The early encryption WEP proved easy to break. Higher quality protocols (WPA, WPA2) were added later. An optional feature added in 2007, called Wi-Fi Protected Setup (WPS), had a serious flaw that allowed an attacker to recover the router's password.[3] The Wi-Fi Alliance has since updated its test plan and certification program to ensure all newly certified devices resist attacks.

III. SOFTWARE DEVELOPMENT

1. WEB APPLICATION DEVELOPMENT USING ANGULAR:

Angular JS is a very powerful JavaScript Framework. It is used in Single Page Application (SPA) projects. It extends HTML DOM with additional attributes and makes it more responsive to user actions. AngularJS is open source, completely free, and used by thousands of developers around the world.

2. MVC ARCHITECTURE IN SOFTWARE DEVELOPMENT:

Model View Controller or MVC as it is popularly called, is a software design pattern for

developing web applications. MVC is popular because it isolates the application logic from the user interface layer and supports separation of concerns. The controller receives all requests for the application and then works with the model to prepare any data needed by the view. The view then uses the data prepared by the controller to generate a final presentable response.

A Model View Controller pattern is made up of the following three parts –

- **Model** – It is the lowest level of the pattern responsible for maintaining data.
- **View** – It is responsible for displaying all or a portion of the data to the user.
- **Controller** – It is a software Code that controls the interactions between the Model and View as shown in fig 9

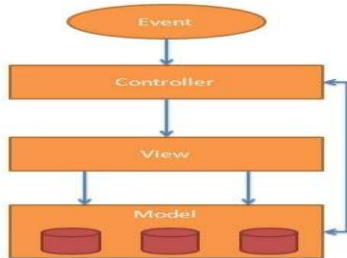


Fig.9. MVC Architecture

3. CORDOVA FOR CONVERTING WEB TEMPLATES IN TO APPS:

Apache Cordova (formerly Phone Gap) is a popular mobile application development framework originally created by Nitobi, it is an open source software. It enables software programmers to build applications for mobile devices using CSS3, HTML5, and JavaScript instead of relying on platform-specific APIs like those in Android, IOS, or Windows Phone. It extends the features of HTML and JavaScript to work with the device. The resulting applications are hybrid, meaning that they are neither truly native mobile application nor purely Web-based (because they are not just Web apps, but are packaged as apps for distribution and have access to native device APIs). Mixing native and hybrid code snippets has

been possible since version 1.9. fig 10 shows the conversion of web template to web app.

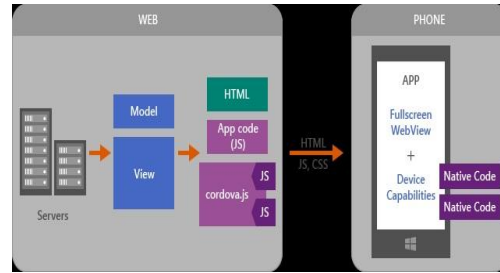


Fig.10. Conversion from Web Template to Web App

4. OPEN SOURCE IOT SERVER-THINGSPEAK.COM:

ThingSpeak is an Internet of Things (IoT) platform that lets you collect and store sensor data in the cloud and develop IoT applications. The ThingSpeakIoT platform provides apps that let you analyze and visualize your data in MATLAB, and then act on the data. Sensor data can be sent to ThingSpeak from Arduino, Raspberry Pi, Beagle Bone Black, and other hardware.

5. THINGSPEAK:

The Internet of Things (IoT) provides access to a broad range of embedded devices and web services. ThingSpeak is an IoT platform that enables you to collect, store, analyze, visualize, and act on data from sensors or actuators. For example, with ThingSpeak you can create sensor-logging applications, location-tracking applications, and a social network of things with status updates, so that you could have your home thermostat control itself based on your current location. It serves as a bridge connecting edge node devices such as temperature and pressure sensors to collect data and data exploratory analysis software to analyze data. The typical ThingSpeak workflow lets you:

- Create a Channel and collect data
- Analyze and Visualize the data
- Act on the data using any of several Apps.

IV. CONCLUSION

Everyone in metrocities, rural and urban area household use LPG gas provided by government and private facilities. LPG gas detection systems are available but prevention system to save people are not available. Other systems provide alert alone in case of LPG gas detection but our system provide safety by means of exhaust fan and window opening system action other than alert. This project overcomes the disadvantage which exists in other systems.

This project uses a specialised mobile application which alerts its user with help of a message popup when there is a leakage of gas. This app is user friendly which is used by all people. This helps in preventing explosions and saves multiple lives.

V. RESULT

Nowadays most households use LPG gas provided by Government and Private facilities. There are many gas leakage detection techniques but this system is a gas leakage prevention technique and an alert system using a specialized mobile application.

The gas leakage prevention technique works in a way such that a sensor detects the leakage of gas in any closed environment and safety measures by means of exhaust fans and window opening systems. Once a leakage is detected a message is sent using a mobile app namely AJAX. In this application, GSM is used as a mode to send a message to the programmed mobile number.

Unlike other systems which only detects the gas leakage and sends an alerts system this system detects the gas leakage, sends an alert message and also turns on the exhaust fan and also opens the windows to prevent the fire explosion which may occur

VI. REFERENCE

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