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DETECTION AND PREVENTION OF DOMESTIC GAS LEAKAGE USING MSP430 MICRO CONTROLLER

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ABSTRACT

Conventional cooking methods like cooking on wood stoves and kerosene stokes is a tedious process. These methods not only effect environment, but also damages peoples' health. So, domestic gas cylinders came into the use. With the use of domestic gas cylinders cooking became easy and cooking time is also reduced. But there are also ill effects of using these cylinders. Leakage of domestic gas is not only fatal to human and animal life but also causes huge property loss. Therefore, detection and necessary measures are to be taken to prevent fatal accidents. In this paper, we are going to discuss about detection and prevention of domestic gas leakage using MSP430 micro controller.

KEYWORDS: Domestic gas, leakage, MSP430 micro controller, GSM, GPS.

INTRODUCTION

Domestic gas primarily consists of hydrocarbons like methane, butane and propane. These gases help in producing required heat and flame for cooking. How does the gas leakage occur? Gas leaks can mainly occur from defective rubber tubing, faulty regulator connections and improper handling of gas appliances. Apart from these leaving the cooking items unattended can cause the food to spill over, which in turn blocks the burner and causes gas leak. Domestic gas is highly flammable under pressure. There could be two main kinds of health hazards associated with a gas leak – Due to inhalation of the gas or due to explosion of the gas if there is a source of ignition.
This project is helpful in detecting the gas leakage and prevents the cause of severe accidents.

MAIN CONCEPT

The main theme of our project is:

- The Leaked gas is detected using a Gas sensor.
- Mains are turned off
- A Buzzer is made to ring.
- A voice call is made to the owner.
- Anti-Inflammatory gas is spread over place
- GPS Location is shared via SMS to the nearby Fire Station.

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BLOCK DIAGRAM

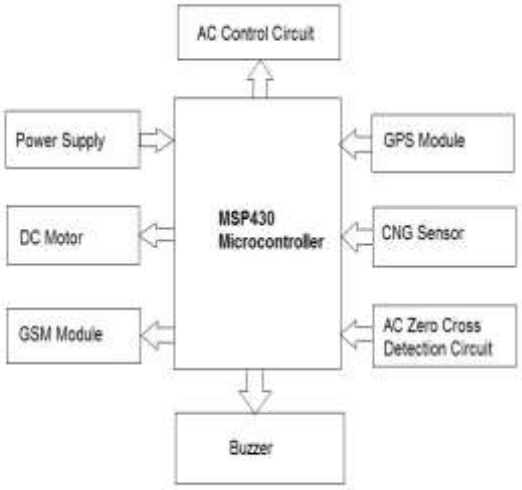

Fig. 1 Block Diagram

COMPONENETS USED

- MSP430 micro controller
- Gas Sensor
- GSM
- GPS
- ZCD and AC control circuit

MSP430 Micro controller:
MSP430 is a mixed-signal microcontroller from Texas Instruments. It is built around a 16-bit CPU and it is designed for low cost, specifically low power consumption embedded applications. The micro controller consists of several peripherals like timers, ADCs, DACs etc.

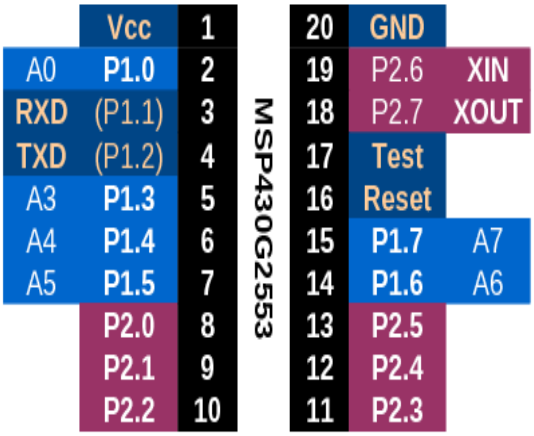

Fig. 2 Pin Diagram of MSP430G2553

There are several series in this microcontroller. In specific, we use MSP430G2553.
G – Designed for medical instrumentation.
2 – Generation of device.
5 – Model within that generation.
53 – Amount of the memory on the device.

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Specifications of the Microcontroller:
Non- Volatile memory: 16KB
RAM: 512 Bytes
Frequency: 16 MHz
Voltage levels: 1.8V (min), 3.6V (max)
GPIO: 20

It consists of two ports and each port has eight pins. Port1 is used for reading and sending analog data while port2 is used for digital data.

Programming on the micro controller is done with the help of an open source software called Energia IDE. Energia supports many TI processors (MSP430), primarily those available in the Launch pad development ecosystem.

Gas Sensor:
The gas sensor MQ-5 is made of a sensitive material SnO2, which has low conductivity in pure air. This sensor is highly sensitive and also its response time is less. The sensor gives output in the form of analog resistance. The driving circuit is simple; it consists of heater coil powered with 5V, a load resistance, and the output is connected to an ADC. MQ-5 can be used to detect domestic gas concentrations ranging from 300 to 10000ppm.

MQ-5 gas sensor has high sensitivity to methane and propane, also to Butane. It has low cost and is suitable for different application.
Characters:
* High sensitivity to Natural gas
* Long life and low cost
* Simple drive circuit

Fig. 3 MQ5 Gas Sensor

GSM:
GSM stands for Global System For Mobile Communication. GSM is an architecture used for mobile communication in most of the countries. In our project, we are interfacing GSM module with MSP430 for sending SMS to the user to inform about the gas leakage. In order to send SMS, GSM use AT commands.

AT is the abbreviation of ATtention. These command lines start with "AT" or "at". So these modem commands are called as AT commands.

The GSM module we are using is SIM900. It operates at a frequency of 900MHz. Some of the AT commands used in SIM900 are:
TO CHECK THE MODEM:
AT
OK
TO CHANGE SMS SENDING MODE:

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AT+CMGF=1
OK
TO SEND NEW SMS:
AT+CMGS=" MOBILE NO."
<MESSAGE
{CTRL+Z}

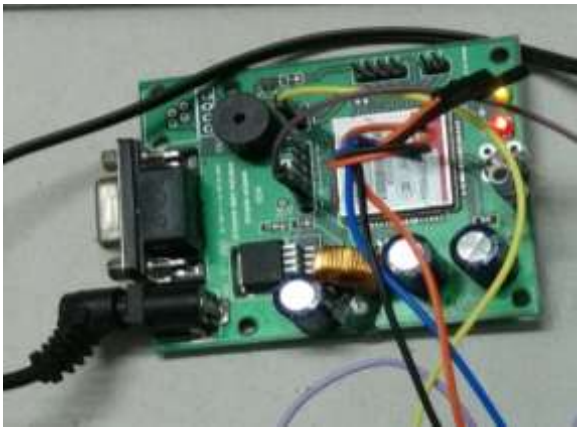

Fig. 4 GSM Module – SIM900

GPS:

The Global Positioning System was developed by American Department of Defense (DoD) in 1978 (but project was commissioned in 1973) as a continuation program for the TRANSIT System (The US-Satellite Navigation System) and one of the actual the-then working Global Navigation Satellite Systems (GNSS). The GPS receiver monitors multiple satellites and solves equations to determine the precise position of the receiver and its deviation from true time. At a minimum, four satellites must be in view of the receiver for it to compute four unknown quantities (three position coordinates and clock deviation from satellite time).

- The principle of GPS is "triangulation" from satellites.
- To "triangulate," a GPS receiver measures distance by calculating the travel time of radio signals.
- To measure travel time, GPS needs very accurate timing which it achieves with some tricks.
- Along with distance, exact positions of the satellites in the space. Higher orbits and careful monitoring is essential for this process.
- Finally, the delays in the signal as it travels through the atmosphere are to be corrected.

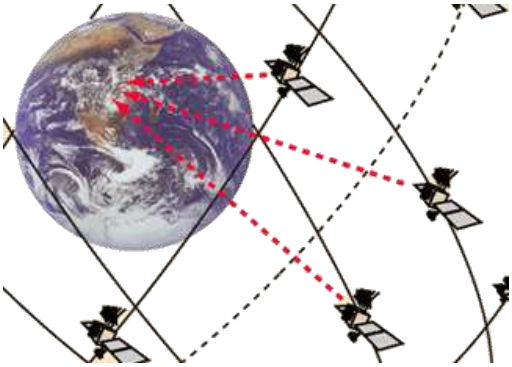

Fig. 5 GPS triangulation

GPS data is transmitted in the form of a sentence that is specified by National Marine Electronics Association (NMEA). Each sentence begins with a '$' and ends with a carriage return/line feed sequence.

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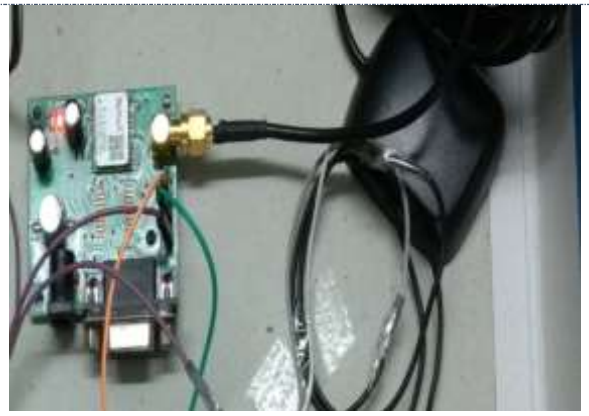

Fig. 6 GPS Module with receiver

ZCD & AC Control Circuit:

A zero-crossing detector or ZCD is a one type of voltage comparator. It is used to detect a sine wave transition from positive to negative that coincides when the signal crosses the zero-voltage condition. We use ZCD to detect any fluctuations in the voltages levels.

The AC control circuit is most commonly used for switching and power control of AC systems. One such device is the triac. It can be switched ONs by either a positive or negative Gate pulse, regardless of the polarity of the AC supply at that time.

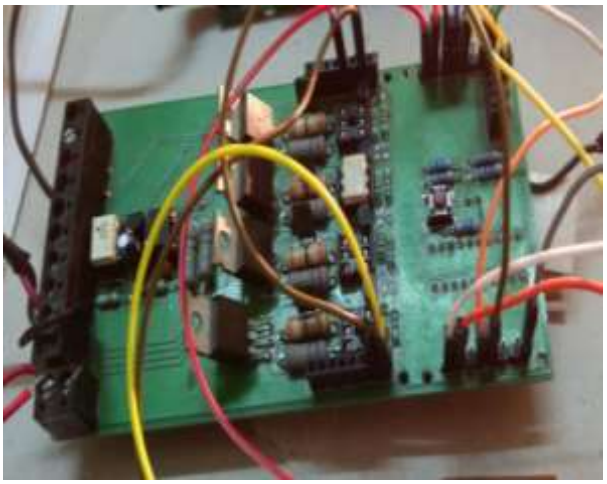

Fig. 7 ZCD & AC Control Circuit

WORKING

The gas sensor checks if there is any gas leakage in the location. The sensor constantly sends analog signals to the micro controller. The micro controller checks whether received values are greater than the threshold. If the leakage is detected (i.e. sensor value is greater than the threshold) the DC motor starts so that the anti-inflammatory gas is spread over the place so that the domestic gas concentration can be restricted to some extent. Later the mains are turned off to prevent electric short circuit. The user is intimated about the gas leakage through a message. An SMS is sent to the nearby fire station along with the GPS location.

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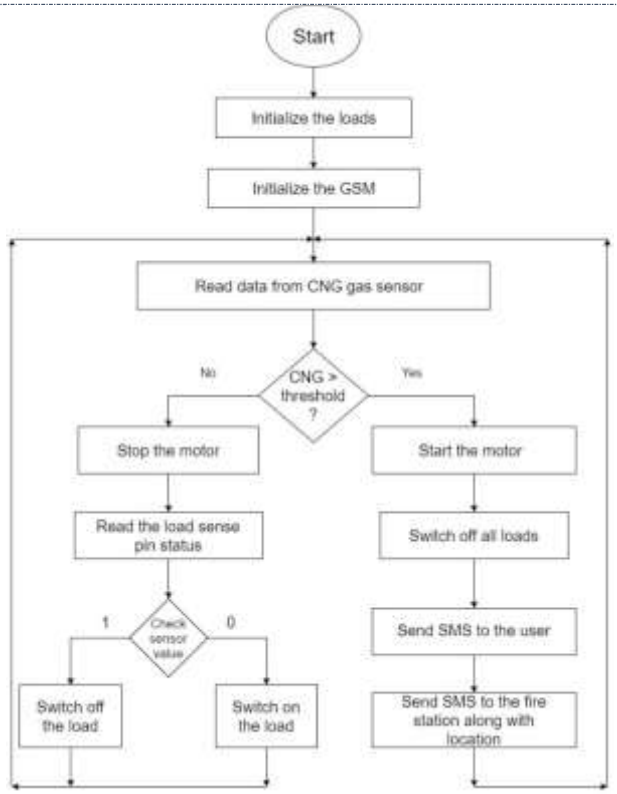

Fig. 8 Flowchart

If the sensor value is not greater than the threshold (i.e. no gas leakage) the gas sensor keeps on reading the values and is sent to the micro controller.

RESULTS

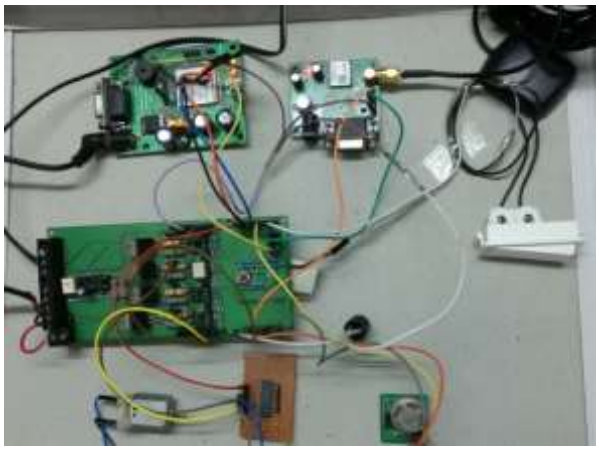

Fig. 9 Resulting Kit

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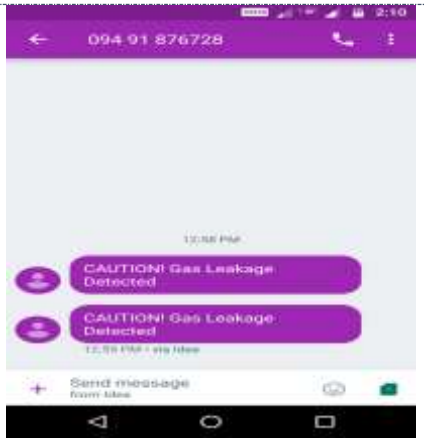

Fig. 10 Message sent to the user using GSM

Fig. 11 Data received by the GPS Receiver

CONCLUSION

This device is less in cost and consumes less power hence; it can be affordable by all classes of people. By using device domestic gas leakage tragedies can be controlled to major extent. Further, it can be used in areas where accidents are caused mainly due to gas leakage.

REFERENCES

[1] http://mecrisp.sourceforge.net/connections.htm
[2] https://www.pololu.com/file/0J311/MQ4.pdf
[3] https://www.pantechsolutions.net/blog/basic-at-commands-for-sim900a-gsmgprs-module/
[4] https://en.wikipedia.org/wiki/Global_Positioning_System
[5] http://freenmea.net/docs
[6] https://www.elprocus.com/zero-crossing-detector-circuit-and-working/
[7] http://www.electronics-tutorials.ws/power/triac.html