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DESIGN A MOBILE GAS SENSING SYSTEM USING ARDUINO UNO WITH RECORDING AND MONITORING DATA

Ammar Yaseen Burjes
Department of physics, College of science, University of Mosul/ Iraq
ammaryaseen@uomosul.edu.iq

Ghader Salim Aziz
Department of physics, College of science, University of Mosul/ Iraq
Ghadersalim167@gmail.com

Haneafa Yahya Najm
Department of Medical instruments, Engineering Technical College/ Mosul, Engineering Technology, Northern Technical University/ Iraq
haneafa.najem@ntu.edu.iq

Abstract
This work intends to design and implement of a mobile system for gas detector and measuring the data of (relative humidity H%, temperature in Celsius &Fahrenheit) which can be used in homes or in the workplace such as laboratories. Specifically, this paper aims to answer how to design a prototype (software and hardware) for gas detection and its performance in terms of detecting both liquefied petroleum gas (LPG) and smoke, through the use of the MQ2 sensor, as well as measuring the humidity and temperature in (^{o}C, ^{o}F) by using the DHT11, through the connecting them with the Arduino UNO. The results of this work were display through serial monitor by Arduino window & at the same time it is displayed on the LCD screen, meaning the presence of a gas is detected or no gas is detected “Its alarm system by buzzer and red led”, in addition to displaying the value of temperature and humidity (^{o}C, ^{o}F, H%). Also, through the programming process, the results of this work are displayed and stored on the Excel program which are (date, time, ^{o}C, ^{o}F, H%, ratio of gas detecting ppm), and on same time recorded data on a memory card which added portable device. The executing cost is ($17) which is very cheap.

Keywords: PC, Arduino, DHT11, MQ2, Uno, LCD.

1. Introduction

There are many functions for MQ2 gas sensor and DHT11 sensor by forming them with Arduino on a process of practical research that can be used through the following literature. In 2020 Arun Kumar designed the system employed to solve the problem of food spoilage by using Arduino Uno, MQ2 sensor, DHT11and Moisture sensor, with the sensor assistance to identify the spoilage by continuous sensing, in the case the food is spoilage will be send an alert message [1]. The researcher designed and implemented a system of cigarette smoke to detect the dangerous gases, the tools used are Uno board, a series of gas sensor MQ_n (n=2,7,9,135) the data obtained from these sensors are collected and sent wireless to Raspberry by (ESP-8266 ESP01) [2]. The researchers of [3] worked on developed device to check the temperature & humidity by using DHT11 sensor also checking the ratio of gas in the sewage pipelines by using series of gas sensor, and display the data on the LCD (16x2) and PC, then the data is sent wireless to the person responsible for avoiding a rise in gases ratio. The component of UNO, MQ2 and nRF21 wireless transceiver module and other electronic accessories are used to design system for detection, monitoring and measurement the hazardous or toxic gas in home[4]. The researcher [5] worked to designed gas detection by using Arduino UNO, MQ2 and buzzer, which we can use it to detect LPG and CNG in home or restaurant. A group of researchers has worked an extrapolation of a qualitative estimate of air quality at (USTP), through their use of MQ2 and UNO board where they worked on the preliminary development and testing the MQ2 sensor to monitor air quality in university laboratories where they concluded it is preliminary in nature and needing improvement [6]. Arduino board with IDE, DHT11, MQ2 & MQ135 along with the other attachments to complete the requirements of this work, it was used to design an integrated system for monitoring air quality and purity through the IOT cloud [7].The researchers [8] are designed the system for fire detection and alarm, by using DHT11, MQ6 as Input signal then from UNO MCU which process the received data then displays the results as the Output on the buzzer, LCD and mobile. LabVIEW which are using as a method for calibrating of gas sensor, the techniques used to assess the calibration are linear regression and the analysis of sample. The hardware using in this article are DHT22, MQ2 sensor, MEGA board, XBees1and BME680 [9]. ZigBee module, Arduino MEGA, MQ2 sensor and DHT(11& 22)which are used by the[10] [11] to analysis the parameter of environmental. The simple detector for gas leak which are designed from the researcher [12] by using board of UNO, MQ6 sensor and display the result on the LCD, which is used to alarm the leakage of LPG gas for stakeholders.

2. Methodology and Components

The proposed of prototype having two parts Software and Hardware which is based on the electrical engineering and physical application. The program consists of "Arduino IDE" to programming the parts of this design after that some programing commands the Excel was linked with the development environment of the Arduino to show & records the (Date, Time, Temp ^{o}C, Temp ^{o}F, Hum%, ratio of gas detecting ppm).The principle of operation of any advanced device with high sensitive depends essential on the (MCU) that controls the performance of the device. The MCU embedded on Arduino board was used as the main hardware component which will process the collected data (INPUT) that received from the MQ2 and DHT11sensors also the OUTPUT data "green led & red led with buzzer). The Hardware as shown in Fig.1 (a & b) which consists of the following components are classified in the following:

1. Plastic box has properties of waterproof & shock resistant we used to install all experimental elements.
2. the breadboard has medium size, which is put in the box & through it all the component is connecte to each other.
3. Red led & Buzzer used as output for alarm with gas detected condition, another Green led indicated to system is run and no gas detected, and two resistance (220 ohm) connected with the two led to protect them.
4. (ac-dc) Adapter or Power bank or mobile charger adapter if the system is used as a portable.
5. LCD (20 x 4) connected with module (I2C) "It means needed only 4 pins which are "SDA, SCL, VCC and GND" and fixed on the surface plastic box.
6. Micro SD card to records the received data with external memory, it is connected with (VCC, GND, MOSI, MISO, CLK and CS)
7. MQ2 it is one of type of Gas sensor who using to detect the smoke and LPG, the sensor has four pins (VCC, GND, digital and an analog pins), and work on five volt and it is capable to operate with many MCU [13] and [14]
8. DHT11 sensor which is senses the changes of humidity and temperature Surrounding, it has low power and small size, possesses sensitivity to temp. (0 to 50 ^{o}C), Hum. (20-80%) and (3-5v) Operating voltage, which connected to (VCC, GND and digital pin 2) [15] & [16].
9.The main board used for this system is Arduino Uno ATmega328P, which consist of "6 analog Pins, 14 digital Pins, VCC(3,5V) and GND", the choice of this board due to it can be setup easily and cheap and programed through USB[17] [18]& [19]. After fixing all parts, we connect to the appropriate points with each other as in Fig:1 (a&b).

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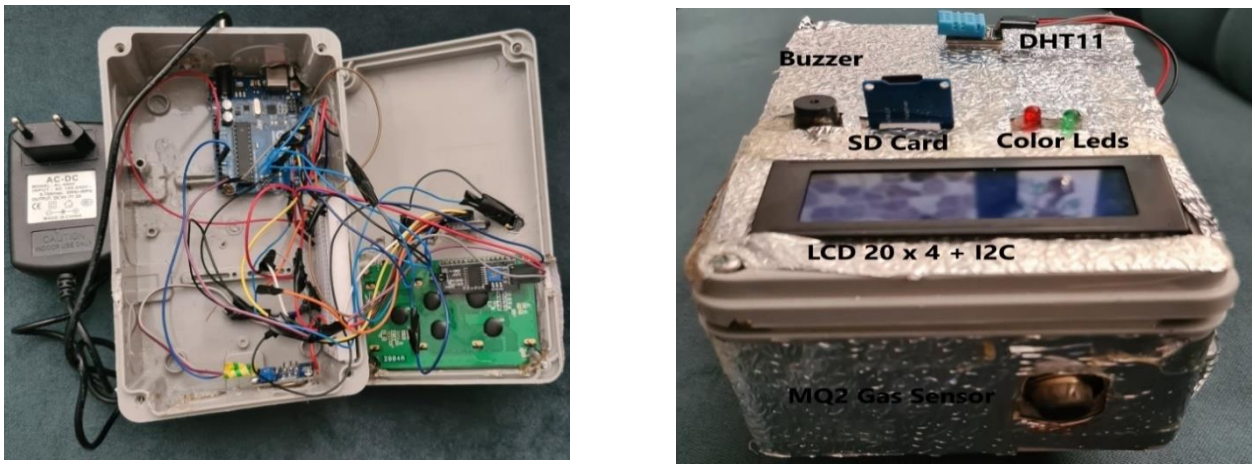
10.Fig.2 shows the final diagram of the designed system which drawing by Fritzing program.



a **b**

Fig:1 The Hardware (a) Internal components, (b) Package the system

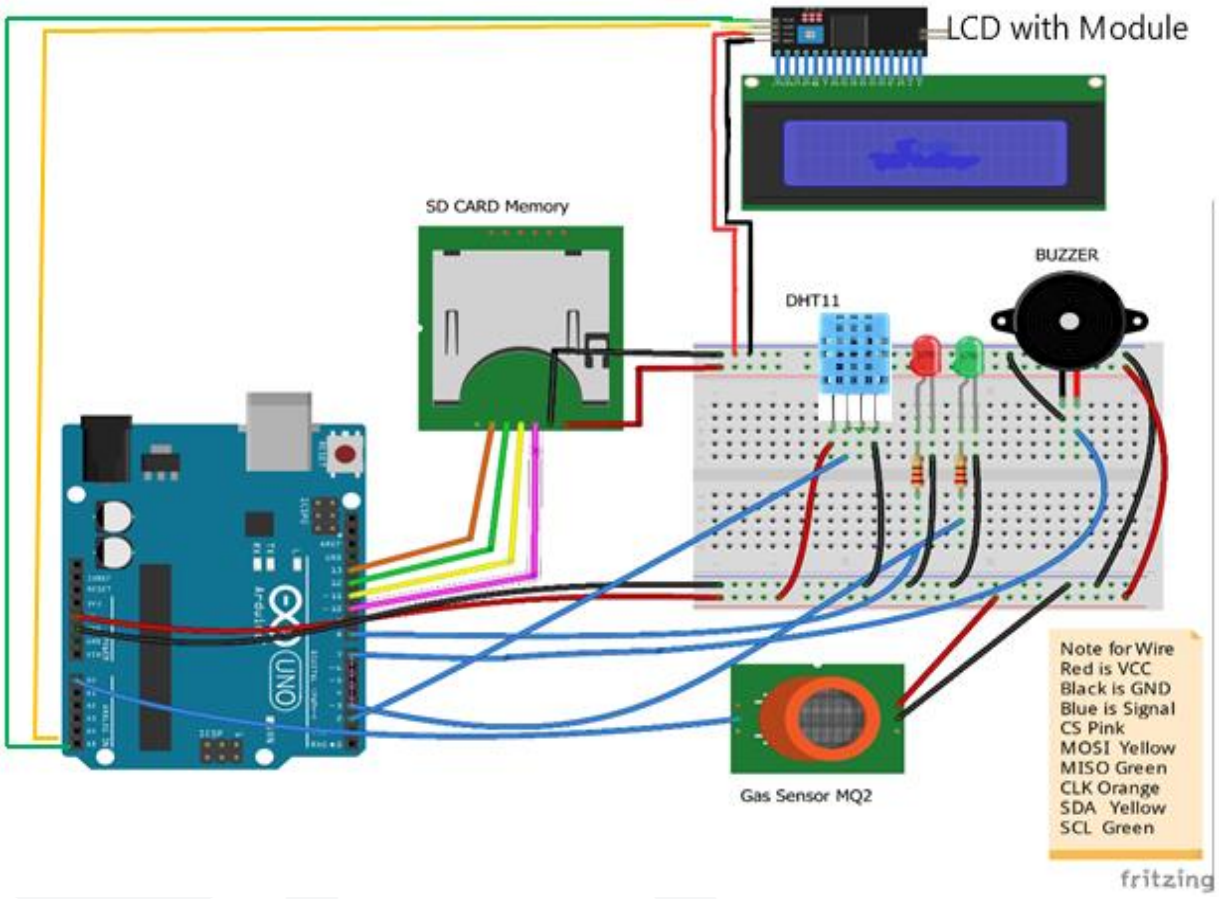


Fig:2 Final designed system

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3. Result and Discussion

The MQ2sensor usually used to measure or detect the gas leakage as (LPG, smoke, Co). The varying of relative Humidity and Temperature of the environment are measured by the DHT11 sensor which has a digital signal output, after the uploading software and when connected to the power source through an adapter, the Arduino UNO & MCU work like a conditional switch and then through the software commands we will see.

First: as shown in Fig:3 (a & b) displays on the LCD a welcome message (calibrating, done, sensor active and the name of the researchers).

Second: through Fig:4 we notice the work of the designed system, where the green led will light up, and we will see in the LCD a reading that there is No Gas Detected, as well as the temperature in the values of (^oC & ^oF) and the relative H %.

Third: from the Fig:5 (a& b) we did two tests (a) a small amount of gas from the Gas Lighter and (b) Incense we notice in both cases that the red led lights up with sound from buzzer (alarm) and the LCD displays the Gas is Detected with displaying the values of Temp. in (^oC & ^oF) and Hum. " which indicates the success of the work of this system", at the same time the data displays on the serial monitor and recorded on the micro SD card, and through some programing commands the required data were displays and recorded on the Excel program by using PLXDAQ program if we would need to calculate many readings for a long time (date, time, ^oF, ^oC , H%, ratio of gas detecting ppm), this is the desired purpose of this work.

a **b**

Fig:3 (a & b) welcome messages

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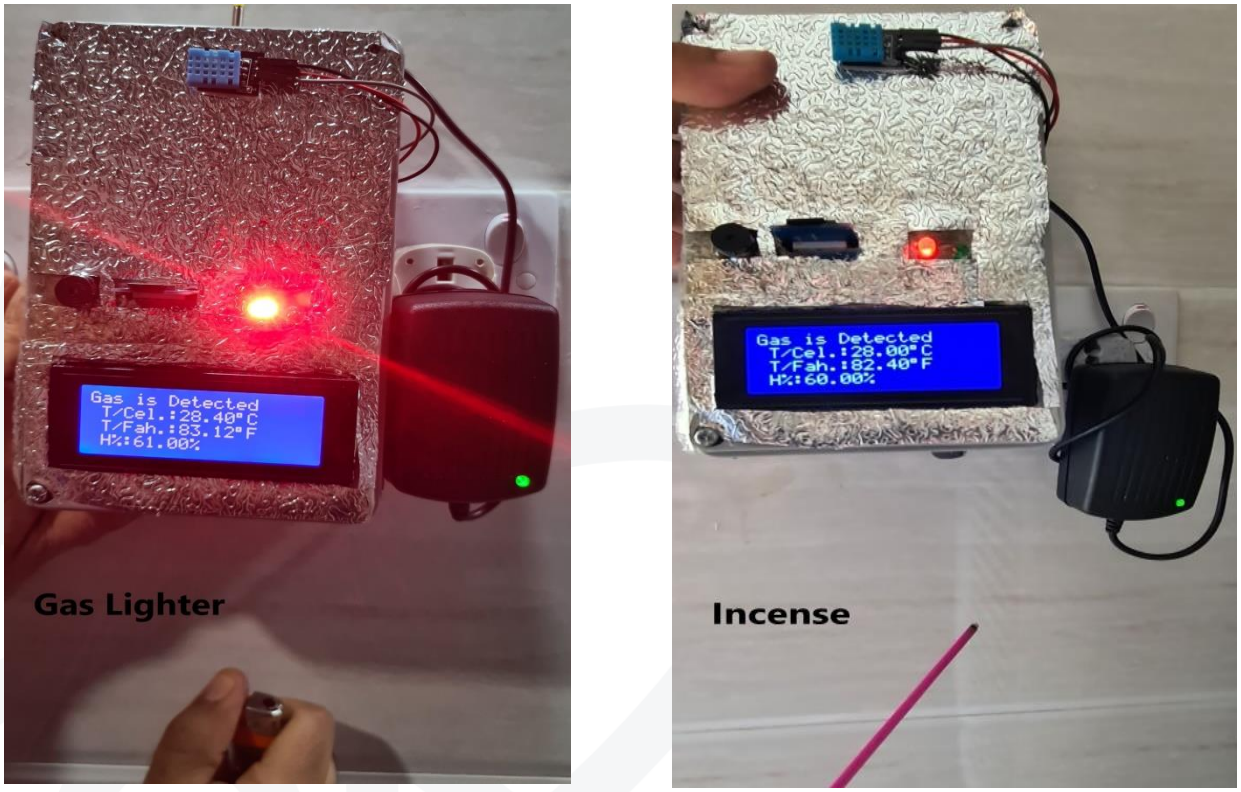
Fig:4 Work of the Designed System



a **b**

Fig:5 The system Testing (a) Test of Gas Lighter (b) Test of Incense

Conclusion

In this paper, we present the execute and design the hardware for a mobile gas detector with alarm and monitoring the temperature in (^{o}C & ^{o}F) and the (relative humidity %) with an Arduino Uno. The proposer was tested many times and can be

relied upon to achieve the project objective, the test cases proved reliability, accuracy, efficiency and durability for our not expensive (cost of design $17), also easy to maintain and used the system whereas it is possible connect it to the power source through a phone charger or power bank or an (ac-dc) adapter. As well as displaying and recording the obtained data from the designed device in more than one way was successfully achieved in (PC with serial monitor, LCD, SD Card and Excel data base). The mechanism of work is shown in flowchart Fig:6.

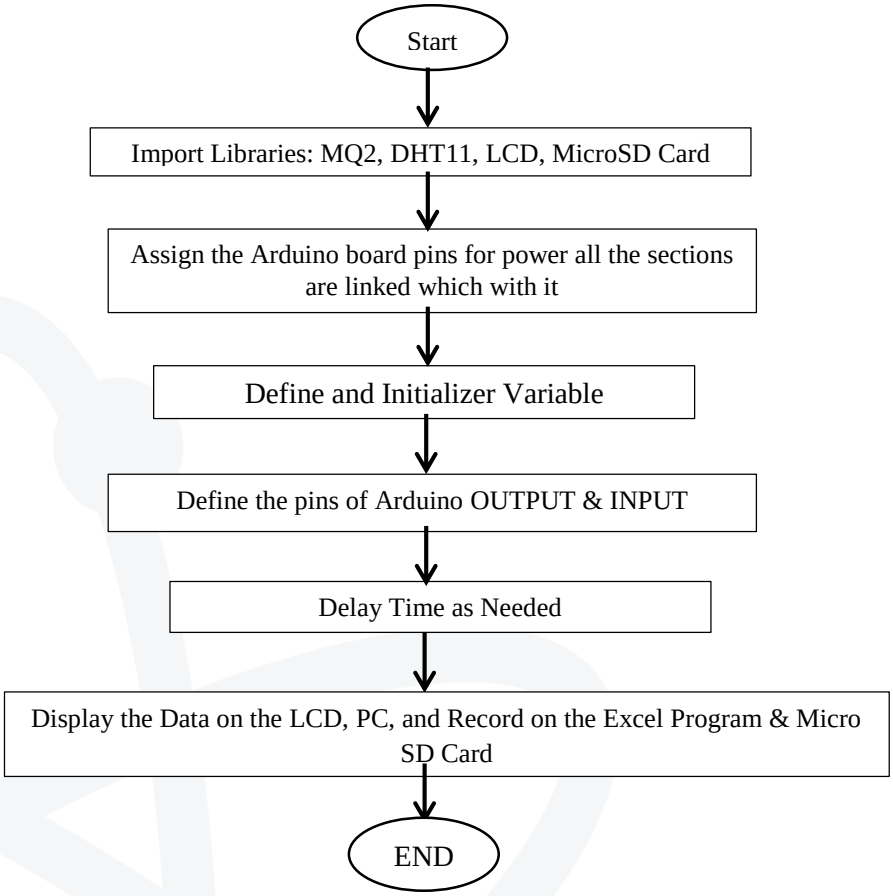


Fig.6: The Flowchart of the system

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