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Toxic Gas Suppressor Using IOT

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ABSTRACT

Nowadays, pollution has become a greatest threat in the world. In old age culture the cause for pollution was very less compared to the present Digital Era. The major cause for the increase of pollution in 20th century is due urbanization and a sudden hike for vehicles which replaced bicycle and horse saw cars and on the other hand industries also have their part in polluting the air and water, which cause great impact on human health. Studies show that health related issues like neurological system, stress disorder, respiratory tract are all caused due to the presence of toxic gas in the atmosphere. In rural areas the toxic gases are produced due to the improper disposal of water and human waste, collected in gutters whereas in urban its due to the electronic wastes, deforestation and industries. The burning of coal in Thermal power plants and mixing of chemicals in textile industries produce poisonous gases which are not safe for living organisms. This reminds us about the Bhopal gas tragedy in 1984, where many died due to the increase in release of toxic gases and it also affected the public causing severe change in climate. To overcome these problems and avoid the fatal rating our paper toxic gas suppressor using IOT, with buzzer helps us to prevent such disasters by giving an alert at the initial stage.

Keywords : Pollution - Bhopal disaster- climate change-health disorder.
Technical Keywords : Suppressor- IOT- Toxic Gas-Buzzer

I. INTRODUCTION

In today's scenario pollution plays a very vital role in rural areas. Most of the industries are located in rural areas due to more land spaces and official laws. People in rural areas get affected due to the emission of toxic gases from industries, as these people are illiterate they doesn't have the basic knowledge that these gases are bad to their health in addition to it there is no proper hospital facility due to this death rate is increasing in rural areas compared to cities. For example, if we consider a paper industry they produce both air and water pollution at greater levels, as the major needs for paper industry is water and pulp. Solid and water waste from paper industry mixes with running water which in turn gets polluted. Pulp is the major cause for Air pollution because it is obtained by cutting down the trees which in turn affects the climatic conditions. Similarly textile, chemical industries and mines produce various toxic gases which can be reduced using the toxic gas suppressors. Keeping an eye on living things and WHO (world health organization), which stresses on the safety and health consciousness inside an industry the paper 'Toxic Gas Suppressor using IOT' is published to save both public and people working in plants by displaying the graphical format of various gases as shown in the Fig.1, inside the plant using MQ4 sensor at the initial stages, and prevent great disasters in future.

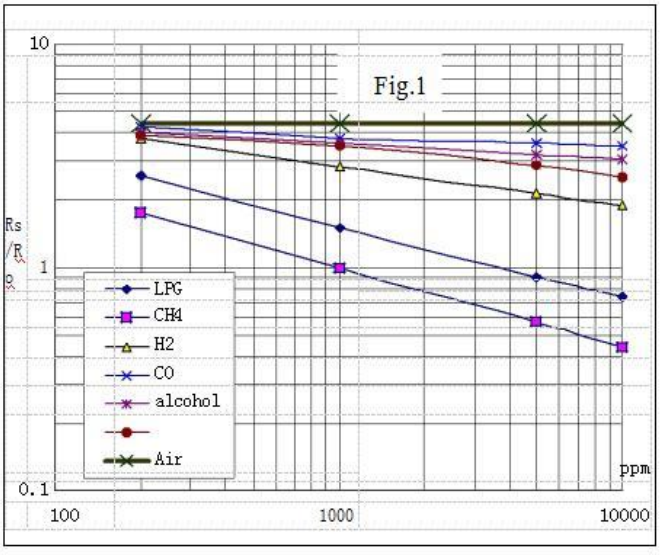

Figure 1. Sensitivity characteristics of various gases in MQ4 sensor.

II. METHODS AND MATERIAL

A. Litrature Review

In olden days people working under mines, and other toxic gas production industries were given protective suits, electric safety lamps, goggles, smoke helmets, flame safety lamps, safety rooms etc which helped them only after accidents[2]. The goal of occupational safety is to provide a safe and healthy workspace [4], keeping this in mind and to prevent the accident the pre alert is given to the workers about the various gas levels inside the plant in case of any emergency, using GSM technology. 8051 Microcontrollers played a vital role due to its various advantages.GSM technology is used by most of the countries and SMS is sent via digital encryption technique, its data rate is about 14.4kpbs [1]. Later due to the availability of 3G and 4G network in 20th century IOT came into existence. PIC is used in proposed system to overcome the disadvantages of 8051, like the power consumption and instruction per cycle. Wi-Fi concentrator can be used which is not possible in GSM to increase the efficiency compared to the GSM. Some of the limitations in GSM based toxic gas suppressor using 8051 are [1][3(ii)]

1) Pin design in 8051 is Complex.
2) Data rate in GSM is only 14.4 kbps.
3) Erecting towers was a major task.
4) Less speed and more cost.

B. Proposed System

In IOT data rate is 384kbps [1] PIC 16F877A and the IOT is used in place of ARM and AURDINO though it is the latest version of PIC because of considering the cost, simplicity, speed and efficiency as the major factor. The main objective of this system is to reduce the death rate and inform remote master in case of emergency.

1. Block Diagram Description

Our proposed model consists of a microcontroller, RS232, Communication module, Bluetooth module, Actuator, Toxic gas sensor, toxic gas suppressor, Alarm, Mobile phone (Wi-Fi), as shown in fig.2 The microcontroller continuously monitors the atmospheric air, using the gas sensor, the gas sensor detects toxic gases and it provides the analog output. The same is been fed to the microcontroller ADC section and we get the digital value ,using these values micro controller detects the presence of toxic gas and triggers the alarm, based on the gas intensity the gas will be suppressed by turning on the suppressor. The status of the atmospheric air is been communicated to the remote master via the Wi-Fi technology. The master may be a mobile phone or a computer. The user can also see the gas intensity and temperature value using a 16x2 LCD display. The microcontroller section is powered by a power supply section unit.

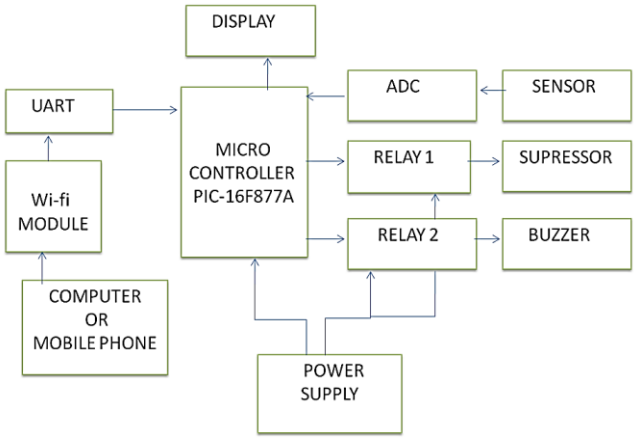

Figure 2. Block diagram of user interatactive toxic gas suppressor system.

2. Operation

1) *PIC Microcontroller (16F877A):* The PIC contains an ALU, which does arithmetic and logic operations, the RAM, which is also called the "register-file", the program EEPROM (Flash Memory), the data EEPROM, and the "W" register. The ALU, the RAM, the "W" register, and the data EEPROM each manipulate and hold 8-bit-wide data, which ranges in value from zero to 255 (or, in hexadecimal, from 0x00 to 0xFF). The program EEPROM (Flash Memory) works with 14-bit-wide words and contains each of the user's instructions. The PIC16F877`s internal architecture is shown in Fig.3. It is not uncommon for microcontrollers to have different sizes of data memory and program memory (in the PIC: 8-bits for data and 14-bits for program words). More than that, the key is that the data and program memories occupy separate spaces. This allows access to each at the same time. The PIC's program EEPROM (Flash Memory) has addresses that range from zero to 8191(0x1FFF). The user's program occupies this memory space.

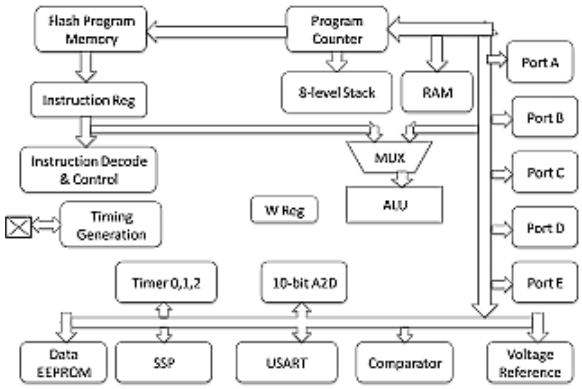

Figure 3. Architecture of 16F877a

2) MQ4 Gas sensor: Structure of MQ-4 gas sensor is shown in fig.4,the sensor is composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-4 have 6 pin, 4 of them are used to fetch signals, and other 2 are used for providing heating current. Resistance value of MQ-4 is difference to various kinds and various concentration gases. When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence.

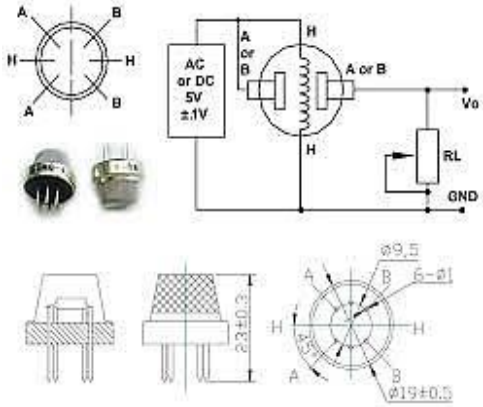

Figure 4. The MQ4 gas sensor.

3) WI-FI MODULE (ESP 8266): It is an impressive, low cost Wi-Fi module suitable for adding Wi-Fi functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone Wi-Fi connected device just add power.

The feature list is impressive and includes**:**

- ✓ 802.11 b/g/n protocol
- ✓ Wi-Fi Direct (P2P), soft-AP
- ✓ Integrated TCP/IP protocol stack

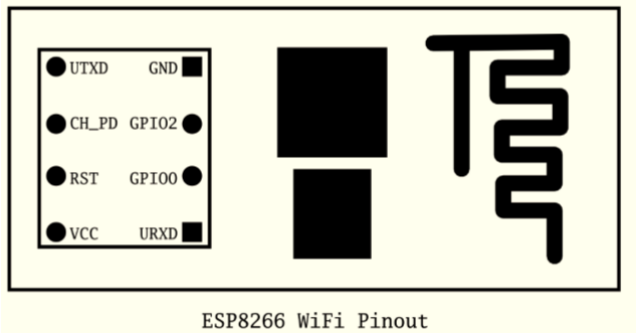

Figure 5. Pin out configuration of ESP8266

The hardware connections required to connect to the ESP8266 module are fairly straight-forward but there are a couple of important items to note related to power. The ESP8266 requires 3.3V power–do not power it with 5 volts. The ESP8266 needs to communicate via serial at 3.3V and does not have 5V tolerant inputs, so you need level conversion to communicate with a 5V microcontroller like most Arduinos use. One end of ESP8266 is connected to mobile phone or computer and the other end of ESP8266 is connected to the Universal Asynchronous Receiver and Transmitter for transmitting and receiving purposes.

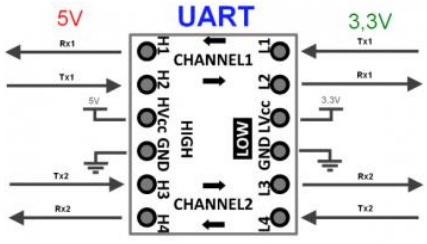

Figure 6. UART Pin Configuration

4) POWER SUPPLY CIRCUIT DIAGRAM (LM7805): The power supply circuit diagram with LM7805 as shown in fig.7.

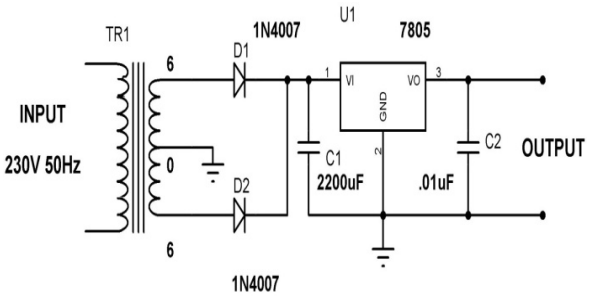

Figure 7. Power supply circuit diagram

5) RELAY: Relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. In general, the point of a relay is to use a small amount of power in the electromagnet.

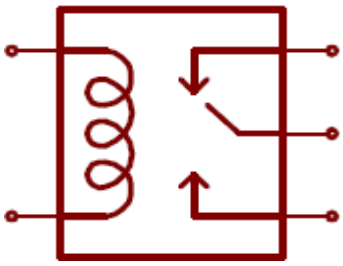

Figure 8. Relay Circuit

The input circuit is switched off and no current flows through it until something (sensor) turns it on. The output circuit is also switched off.

III. FUTURE WORK

The same network can interfaced using internet via cloud computing so that the system can be accessed by anyone around the world.

IV. CONCLUSION

By implementing the above system, which provides information about various gas levels we can save life of many people working in the industry and plant largely. IOT platform is used here, which provide the status of toxicity level to both remote master and the person working onsite.

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