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Design of Toxic Gases Detector using MQ 2 and MQ 135 Sensor for Military Soldiers to Survive in a Contaminated Zone with a Protective Mask

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ABSTRACT:The safety plays a major role in today's world and it is necessary that good safety systems are to be implemented for military people. The industries are the main objective for the increase of toxic and hazardous gases for environment. Hence the demand for accurate sensor was increasing. It is necessary to detect low concentrations of toxic and hazardous gases in the gases medium. The automated detection and alerting system over the automated method offers quick response time and the emergency detection which leads to faster diffusion of any critical situation.

KEYWORDS:Sensor, hazardous gases, toxic, alerting system.

I. INTRODUCTION

The increase in the development of technology and the human race have failed to take care about the surrounding where everyone lives in. The environment has been polluted and thereby reducing the quality of the surrounding. There are several aspects of pollution in that air pollution acts as the serious aspect. Hence there is a growing demand for the environmental pollution monitoring and control systems. These gases have to be monitored such that increase in the normal level of them could be known and proper precaution measures can be taken. Hence embedded system will be designed with the help of microcontroller for the detection of harmful gases which will help to save the human lives.

II. LITERATURE REVIEW

[1] F. Tsow, E. Forzani, A. Rai, R. Wang, R. Tsui, S. Mastroianni, C. Knobbe, A. J. Gandolf, and N. j. Tao, "A wearable and wireless sensor system for real-time monitoring of toxic environmental volatile organic compounds" Intelligent Residential Security Alarm and Remote Control System Based On Single Chip Computer", the project focuses on, Intelligent residential burglar alarm, emergency alarm, fire alarm, toxic gas leakage remote automatic sound alarm and remote control system, which is based on 89c51 single chip computer. The system can perform an automatic alarm, which calls the police hotline number automatically. It can also be a voice alarm and shows alarm occurred address. This intelligent security system can be used control the electrical power remotely through telephone.

[2] Ioan Lita, Ion Bogdan Cioc and Daniel Alexandru Visan, "A New Approach of Automatic Localization System Using GPS and GSM/GPRS Transmission" 2016. This paper focuses on, a low-cost automotive localization system using GPS and GSM-SMS services, which provides the position of the vehicle on the driver's or owner's mobile phone as a short message (SMS) on his request. The system can be interconnected with the car alarm system which alerts the owner, on his mobile phone, about the events that occurs with his car when it is parked. The system is composed by a GPS receiver, a microcontroller and a GSM phone. In additional the system can be settled for acquiring and transmitting the information, whenever requested about automobile status and alerts the user about the vehicle



started engine. The system can be used as a low-cost solution for automobile position localizing as well as in car tracking system application.

[3] **Chen Peijiang and Jiang Xuehuan, “Design and implementation of Remote Monitoring System Based on GSM” 2018.** This project focuses on the wireless monitoring system, because the wireless remote monitoring system has more and more application, a remote monitoring system based on SMS through GSM. Based on the overall architecture of the system, the hardware and software architecture of the system is designed. In this system, the remote signal is transmitted through GSM network. The system includes two parts which are the monitoring centre and the remote monitoring station. The monitoring centre consists of a computer and a TC35 communication module for GSM. The computer and the TC35 are connected by RS232. The remote monitoring station consist of a TC35 communication module for GSM, a MSP430F149 MCU, a display unit, sensors and a data gathering and processing unit. The software for the monitoring center and the remote monitoring station were designed using VB

[4] **S. Rappert and R. Müller, “Odor compounds in waste gas emissions from agricultural operations and food industries,”.** Rappert et al proposed the odor emissions data available from agricultural and pharmaceutical industries via an analysis of odor issues, smell recognition and measurement, and the identification of the factors and processes leading to odor exposures.

[5] **D. Gutmacher, C. Foelml, W. Vollenweider, U. Hofer, and J. Wöllenstein, “Comparison of gas sensor technologies for fire gas detection,”** Gutmacher et al proposed A range of low-capacity gas detectors for fire detecting applications to contrast their efficiency. The test fire situations assessed gas sensitive trigger effect transistors, metal oxide detectors (MOSs) and electrical and chemical cells (EC). In comparison we also concentrated on the dissemination behavior of various gas materials in space and time besides the analysis of the efficiency of the sensors.

III. PROPOSED SYSTEM

In proposed method the AVR microcontroller is used for controlling the device. The 12V input power supply given to the Regulator 7805 is used for regulating 12V to 5V. The LCD display is used for displaying the sensor information. The MQ-2 sensor is used for the detection of toxic gases. The MQ-135 sensor is used for detect the ammonium nitrate gas in environment. If the gas is detected the sound indication will be activated with the help of buzzer. Relay is used for activating the oxygen motor. The carbon filter papers are interfaced with mask for purifying the toxic gas. When the toxic gas is detected, the microcontroller transmits the signal to android application thus the application is paired with the help of MAC address and receives the signal through the GCM communication for sending the SMS alert to control room.

IV. BLOCK DIAGRAM

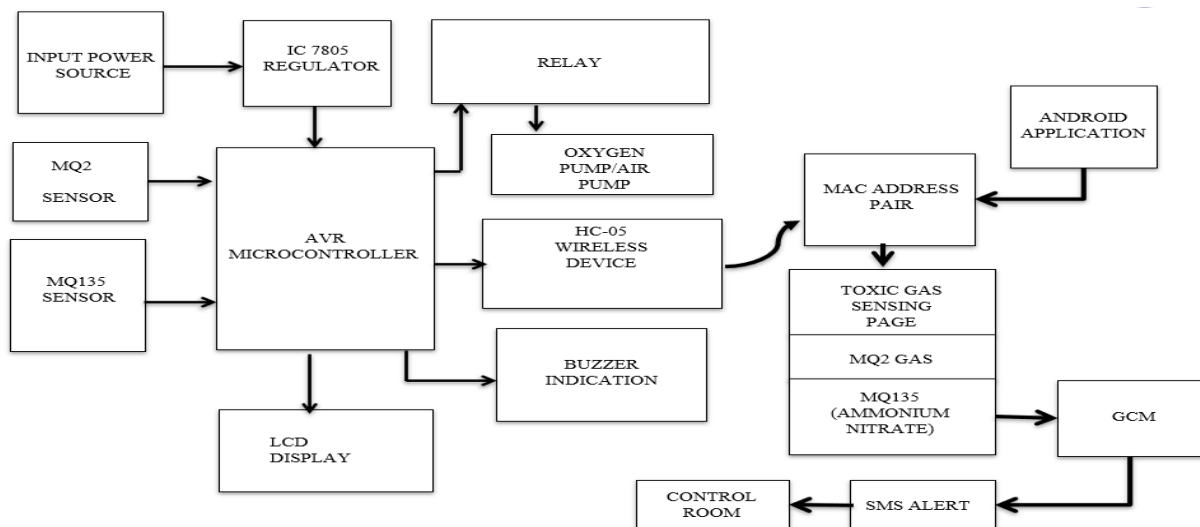


Figure 1: Block Diagram



V. WORKINGMETHODOLOGY

A.AVR Microcontroller

The AVR microcontrollers are advanced RISC architecture which consist of thirty-two x eight-bit general purpose operating registers. In one single clock cycle, the input is taken from the two general purpose registers and it transmitted to ALU to carry out the requested operation, and it transfers the result to the arbitrary register. The ALU will perform arithmetic in addition as logical operations over the inputs from the register or between the register and a constant. Single register operations taking a complement also executed in ALU. The AVR is mainly followed by Harvard Architecture format within which the processor is equipped with separate memories and the buses for Program and also the information data. Hence while an instruction is being executed, the next instruction will be pre-fetched from the program memory.

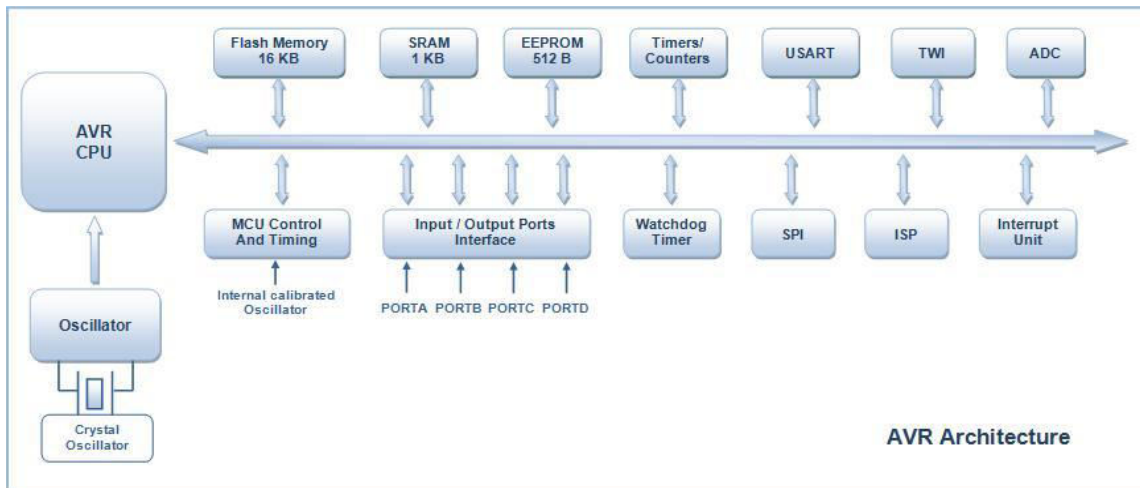


Figure 2: AVR architecture

B.LCD Display

The LCD screen is more energy efficient and can be disposed more safely than the CRT. It has low electrical power consumption which enables it to use in battery-powered equipment. It is an electronically modulated device which is made up of any number of segments filled with liquid crystals and arrayed in front of a light source(backlight) or reflector to produce images in color or monochrome. Liquid crystals were first discovered in 1888. A liquid Crystal Display (LCD) is a small low-cost display and it is easy to interface with a micro-controller because of an embedded controller (the black blob on the back of the board). The controller is a standard across several displays (hd-44780), in which the several microcontrollers have libraries that make displaying messages as easy as single line of code.



Figure 3: LCD display



C. Buzzer

A buzzer is an efficient component which helps in the way of sound system. It is very small and compact two pin structure and it can be easily used on breadboard, Perf Board and also on PCBs. Hence this is widely used component in most electronic application. The buzzer can be used by powering it with a DC power supply ranging from 4V to 9V. A normal 9V battery also be used, but it is recommended to use a regulated +5V or +6V DC supply.

D. MQ-2 Sensor

An MQ2 detector is a device which is helpful to detect the presence of various gases within an area, which acts as a safety system. This kind of gas detector is used to detect a gas leak and interface with a control system hence this process will be automatically shut down. The gas detector will sound as an alarm to the operators in the area where the leak is occurring, these leads giving them the opportunity to leave the area.

E. MQ-135 Sensor

An MQ-135 gas detector is used to sense the gases like ammonia nitrate, oxygen, alcohols, aromatic compounds, sulfide and smoke. The operating voltage of this type of gas sensor is from 2.5V to 5.0V. The MQ-135 gas sensor due to its lower conductivity it cleans the air as a gas sensing material.

F. HC-05 Wireless device

The HC-05 is a Wireless device which was designed for showing the shortest range of wireless data communication between two microcontrollers. Thus, the module works on Wireless device 2.0 communication protocol and hence it will be act as slave device.

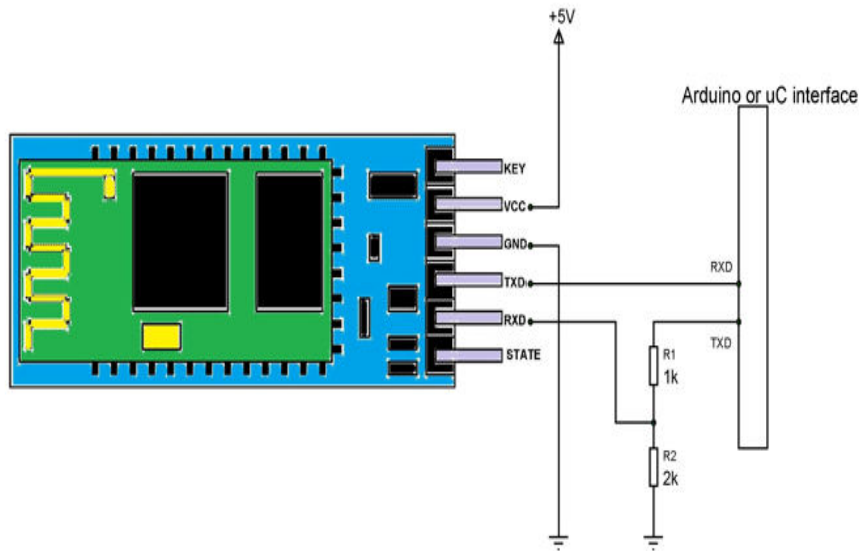


Figure 4: HC-05 Wireless device

VI. CIRCUIT DIAGRAM

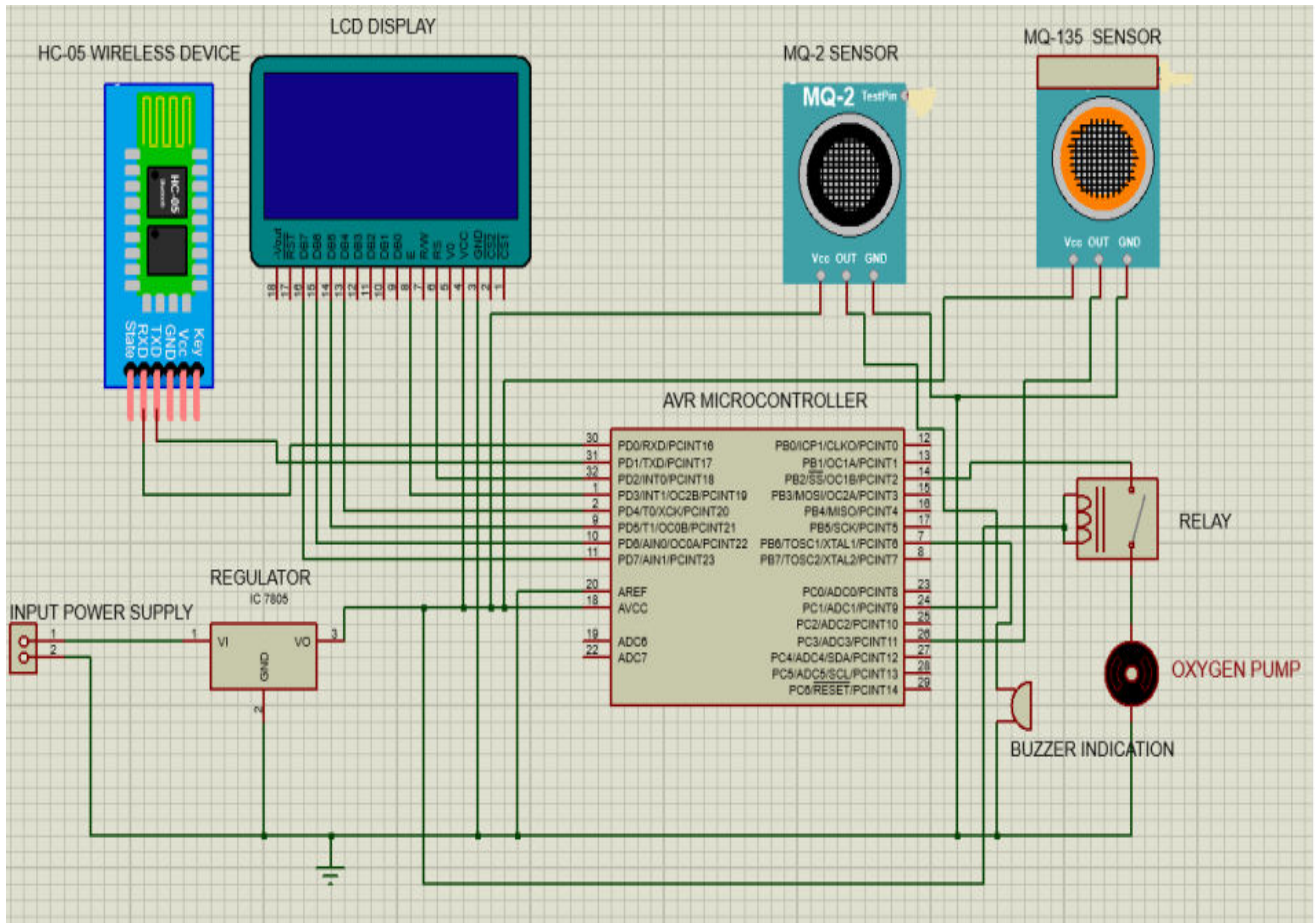


Figure 5: Circuit Diagram.

VII. WORKING METHODOLOGY

12v Power Supply is given to the regulator in the AVR microcontroller for voltage regulating 12V to 5V then 5V supply is given to relay. Relay is activated (ON) and it activates the oxygen pump/air pump it measures the oxygen level in liquid or gas. The MQ-2 and MQ-135 sensors are used to detect the hazardous gas like toxic gases and Ammonium nitrate and later it will be displayed in LCD screen. If the hazardous gas is detected the buzzer indication will activate. HC-05 wireless device/Bluetooth sends MAC address output to the android application. It alerts the control room by sending the google cloud message (GCM) of representing that toxic gas is detected.

VIII. OUTPUT

A prototype model for harmful gas detection has been implemented, here only two gases are detected toxic gas and ammonium nitrate gas have been detected for demo purpose. The MQ2 and MQ135 are the sensors the critical level of these should be known, and then this system can be implemented for detecting various gases either in domestic area such as places like educational institutions, residential and industrial areas which avoids endangering of human lives. This system provides quick response rate and the diffusion of critical situation can be made faster than the manual methods. Hence successfully implemented to save the life of the soldiers.

IX. HARDWARE OUTPUT

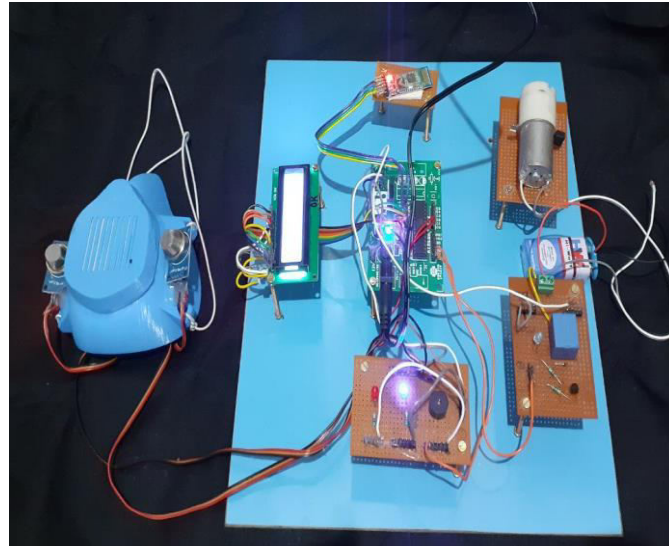


Figure 6 : Hardware output

X.RESULT AND CONCLUSION

A prototype model for harmful gas detection has been implemented, here only two gases are detected toxic gas and ammonium nitrate gas have been detected for demo purpose. The MQ2 and MQ135 are the sensors the critical level of these should be known, and then this system can be implemented for detecting various gases either in domestic area such as places like educational institutions, residential and industrial areas which avoids endangering of human lives. This system provides quick response rate and the diffusion of critical situation can be made faster than the manual methods. Hence successfully implemented to save the life of the soldiers.



Figure 7: Detection of ammonium gas



Figure 8: Detection of toxic gas

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