

Intelligent Pollution Monitoring Using GSM

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Abstract: Pollution affects the health of the living beings; in order to reduce it we must detect the pollutant in particular areas. The aim of our project is to detect the pollutants by using sensors, which will detect the pollutants of air, water and human interference in the restricted areas and to give an alert message to the controller. If the controller doesn't take any proper action to reduce the pollutants level within the given duration then the alert message will be send to the CPCB (Central Pollution Control Board) through the GSM. The values are captured by the sensors and it will be specified to the Arduino Board furthermore the data are send out wireless by using Zigbee module. If the threshold value is exceeded, GSM will automatically send a message to the controller.

Keywords: Arduino Board, GSM Modem, Sensors, Zigbee module, Control Board.

1. INTRODUCTION

Pollution is the introduction into the natural environment of contaminants that cause adverse changes. Pollutants are pollution components that can be foreign substances / energies or contaminants that occur naturally. Due to the rapid development of the world's industrialization and urbanization process, environmental pollution in most cities is now a major problem. So the pollution monitoring is needed in order to provide useful information about the pollutants to the control board to take appropriate measures to mitigate the negative impact whenever it is necessary. Various types of pollution exist, such as air pollution and water pollution. Pollution is essentially appropriate for industrial growth ; urbanization and the increasing use of synthetic organic substances have severe effects on fresh water bodies as well as poor impacts. Human beings suffer from breathing, coughing and worsening of existing respiratory and cardiac conditions due to air pollutants. In order to sense these pollutants different sensors are used for air pollution for the measurement of carbon monoxide, smoke, NH₃, NO_x, alcohol, Benzene gases. The quality of the water can also be judged by turbidity, conductivity and pH meter. To save aquatic animals, the temperature sensor is used to calculate the water temperature. For human interference, till now there is only a law has been enforced to prevent human intervention in restricted areas which is not sufficient. For sensing humans in prohibited areas of inactive infrared sensor (PIR sensor) is used which is an

electronic sensor that determines infrared (IR) light transmit from objects in its field of view. The values from different sensors is given to the arduino board and an alert message is given to the controller and if proper measurement is not taken by the controller the alert message will be given to the CPCB board trough GSM modem. For transmission and reception we use Zigbee module.

2. BACKGROUND

In this module different types of sensors are used for detecting air and water pollution. For detecting toxic gases like carbon-monoxide, LPG, combustibile gases MQ 7 and MQ 135 sensors are used. The GSM module is used to give a message to the controller or CPCB. Zigbee is used to transmit and receive data over long distances via transient data through a network of transitional devices to reach more distant devices. The water pollution is monitored by measuring clearance of the water, resistivity of the water and the pH meter is also used to sense the alkaline and acidity of the water because water is a main source of energy for all the human beings. Till now there is only a law has been implemented to prevent humans in a prohibited areas but it is not sufficient. In this module the human intervention is prevented by using PIR sensor which measures the infrared light radiating from the humans. All the values from the sensors will be in the analog values and it is digitized by the Atmel microcontroller and this

microcontroller gives an alert message to the controller or CPCB when the value exceeds the threshold values.

3. OPERATION

Air pollution

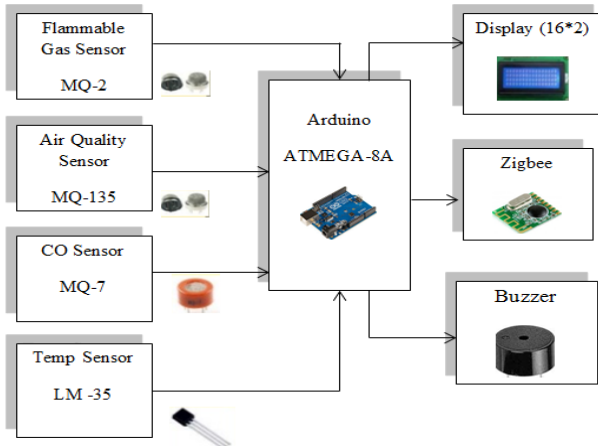


Figure 3.1 Block diagram of air pollution

As shown in the figure 3.1 the MQ-2 sensor is used to monitor the flammable gases. It is highly susceptible to LPG, Propane and Hydrogen, Methane and other fuel steam. The MQ7 gas sensor has a high Carbon Monoxide sensitivity. It makes detection by the technique of cycle high and low temperature, and detects CO when low temperature. The gas sensor MQ135 is highly sensitive to Ammonia, Benzene steam, smoke and other harmful gases as well as Sulfide. These sensors are of low cost and suitable for different application.

Water pollution

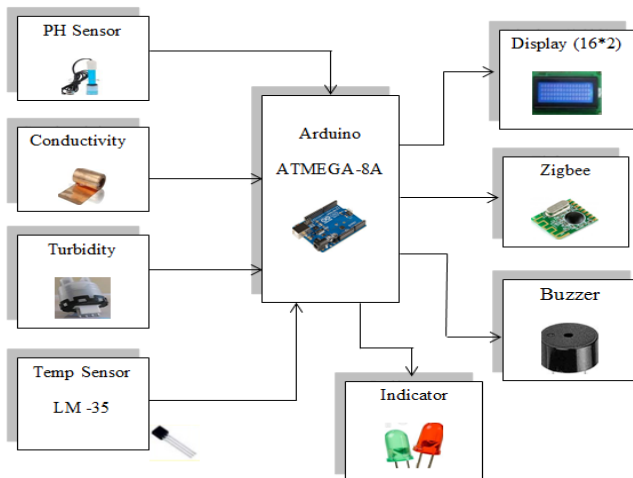


Figure 3.2 Block diagram of water pollution

The pH sensor is used to measure the alkalinity of water, as shown in the figure 3.2. Even if the water will be clear, but it contains some metal particles in it and it can be measured by conductivity is used to measure the resistivity of the water. The water clearance is measured by turbidity and the temperature sensor is used to measure the water temperature, whether or not it is high.

Human interference

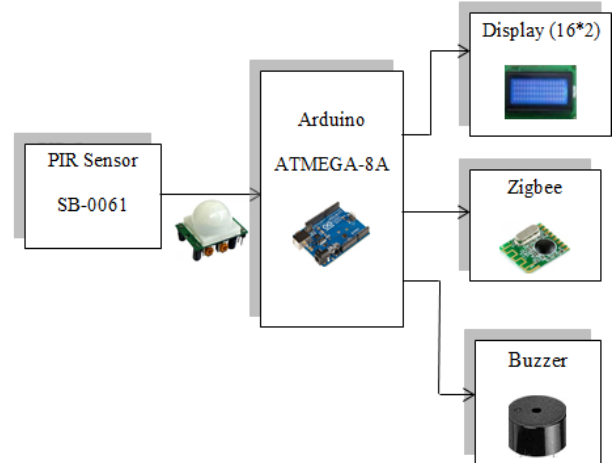


Figure 3.3 Block diagram of human interference

As shown in the figure 3.3 PIR sensor is used to measure the infrared light radiating from the human. PIR Sensor works with only 3.3V. The sensor obtains 10 to 12 seconds to cause an additional interrupt and the range is between 2m and 3m. They are small, cheap, low - power, easy to use and don't wear out.

Arduino Board

Arduino is a prototyping platform for open - source electronics based on flexible, easy - to - use hardware and software. An Arduino hardware board with a microprocessor and pins for communication with physical objects input/output (I/O). The board is typically powered by USB or an external power supply, which allows additional hardware and sensors to be powered.

It features the following hardware:

- Communication: Serial USB cable.
- Power supply: positive 2.1mm positive jack.
- 5V (max. 1A) and 3.3V (max. 50mA) available through on-board regulators.
- 32kB of flash memory

The microcontroller compares the value sensed by the sensors with the threshold values and if the value exceeds the threshold value microcontroller will send an alert message to the controller through GSM. GSM is a wireless network technology based on TDMA. To identify the user's account, the GSM modem uses a SIM card. If a GSM modem is connected to a computer, the computer can communicate over the mobile network using the GSM modem. For mobile internet connectivity, GSM modems are most often used. Many can also be used to send and receive SMS. GSM networks currently operate on frequency bands of 850MHz, 900MHz, 1800MHz and 1900MHz. Devices supporting all four bands are called quad bands, with those supporting three or two bands named tri bands and dual bands.

Zigbee

For transmission and reception, Zigbee is used. Zigbee devices can transmit data over long distances via a mesh network of intermediate devices to contact more distant devices. The specification for a collection of high-level communication protocols for the creation of personal area networks from small and low-power digital radios. Zigbee is based on the standard IEEE 802.15.4. Even if its low power consumption limits transmission from a line of sight of 10 to 100 meters depending on the power output and environmental features.

As shown in the figure 1.4 the output from various modules are received by central Zigbee module. If the value exceeds the threshold value it switch over to GSM. The GSM module intimates an alert signal to the controller and CPCB board.

4. CONCLUSION

In this project different types of sensors are used to monitor the pollutants. The parameters like gas level and purity of water level are monitored continuously; if the standard value exceeds a limit then an alert message is sent to the controller. If the controller does not take preventive action, the message is sent via GSM to the CPCB board.

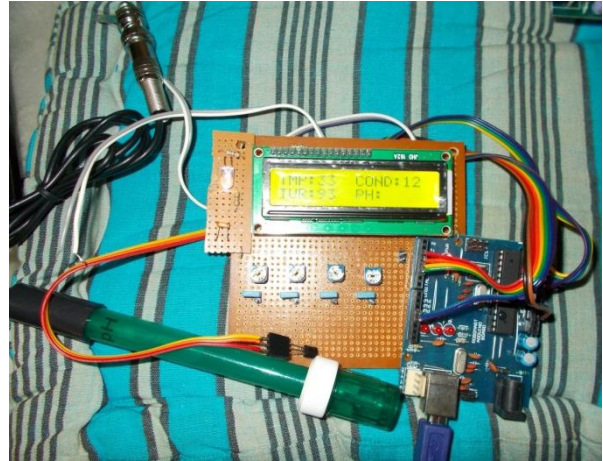
The sensors used in this proposed project are of low cost and can be used for different types of applications. This project can be implemented in places like homes, Industries and shops etc. Simply we can change the values in the program and can be used in future. The pollution can be

monitored in different sites by more number of sensor nodes and base station. So the earth is saved from various pollution hazards.

5. RESULTS

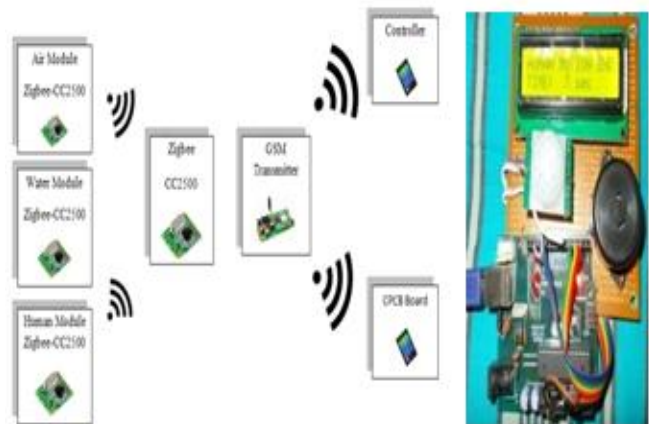
Water pollution

The output of the water pollution is shown in the LCD



Human interference

The output of the human interference is shown in the LCD



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