Monitoring of Air and Water Quality

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***Abstract*— Air and water are the important natural resources which need constant quality monitoring for ensuring its safe use.[2] In this proposed project the constant monitoring of the quality of air and water is done. This is possible in real time through various sensors.[4] The project is based on Arduino platform. The Arduino IDE software scripts are developed in order to take the values from the sensors and upload to the local storage database.[1] This system can keep a strict check on the pollution in air and water resources and be able to provide an environment for safe drinking and breathing.[4]**

I. INTRODUCTION

Natural resources are the resources that occur within the environment in their natural form. Different kinds of natural resources are light, soil, natural gases, minerals, forest and timber etc. Air and water are the major abiotic factors in the environment and are used in almost all activities of life support systems.

As the rapid development of the society and numerous human activities are speeded up, the contamination of air and water resources occur. So that it is necessary to identify any changes in these parameters from time-to-time to make sure its safety in real time.[4]

The application of sensor technologies in various fields includes environmental monitoring, indoor climate control, surveillance, medical diagnostics, disaster management, emergency response, and gathering sensing information in hospitable locations. Sensor technology allows creation of low-cost air and water quality monitoring systems, which helps in the reduction of installation costs, quick and easy configuration.[5]

The proposed system employs use of multiple sensors to measure the quality of air and water in real time for effective action, and is economical, accurate, and required less manpower.[4][16]

II. PROPOSED SYSTEM

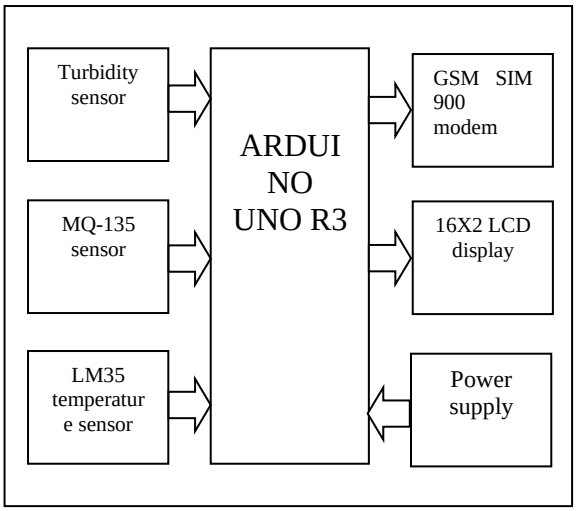

Fig 1: Block diagram of the proposed system

The block diagram of the proposed system is show in Figure 1 which consists of Arduino UNO-R3 operating at 5V provided by the power supply. The MQ-135 gas sensor, LM35 temperature sensor and turbidity sensor are interfaced with the Arduino UNO-R3 to measure harmful content in air and water. The MQ135 air sensor is used to measure different kinds of gases like NH3, NOx, Alcohol, Benzene, smoke etc. The LM35 temperature sensor is used to measure the temperature of air in the environment. The turbidity sensor is used to measure the transparency of the solution. The sensed data is stored onto the Arduino. SIM800L modem is used to connect with internet via 4G/GPRS which is used as data transfer application. The end user receives the message according to the value of the sensor and it is displayed on the 16X2 LCD display.

III. IMPLEMENTATION

A. Hardware

1. Arduino ATmega328P

Arduino UNO is a microcontroller board which is based on the ATmega328 .It consists of 6 analog pins,14 digital I/0 pins(from those 6 can be used as a PWM outputs),ceramic resonator frequency of 16MHz, a USB connector, a power jack, an ICSP header, and a reset button. This board

contains everything required to support the microcontroller; The board is powered by simply connecting it to a computer using a USB cable or by AC-to-DC adapter or battery. The Uno differs from all preceding boards as it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. The Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground.

2. Turbidity sensor

The turbidity sensor detects water quality by measuring the levels of turbidity. It uses light to detect suspended particles in water by measuring the light transmittance and scattering rate, which changes with the amount of total suspended solids (TSS) in water. As the TSS increases, the liquid turbidity level increases.

3. Temperature sensor

LM35 is a device used for measuring temperature which is having an analog output voltage proportional to the temperature. Which provides output voltage in Centigrade (Celsius). It doesn't requires any external calibration circuitry. It has an sensitivity of 10 mV/degree Celsius. This device has an advantage over linear temperature sensors calibrated in kelvin , if the user is not required to subtract a large constant value from the output to obtain convenient Centigrade scaling.

4. MQ-135 gas sensor

The MQ-135 is a air quality sensor they are used in air quality control equipments measurements for building/offices ,and they are suitable for detecting of CO , NH3, acetone, alcohol,Benzene,smoke,CO2 ,etc.

The Detection Range for NH3 is 10-300ppm, for Benzene 10-1000ppm, for Alcohol 10-300ppm

5. 16X2 LCD display

This is an LCD Display designed for E-blocks. It is a 16 character and 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected the E-Block I/O ports. The LCD display required the data in a serial format which is detailed in the user guide below. The display also requires a 5V power supply. The 5V is generated from the E-blocks Multi programmer or a 5V fixed regulated power supply.

6. SIM900 GPRS Module

This is a quad-band GSM/GPRS module, which is works on frequencies like GSM850MHz, EGSM900MHz, DCS1800 MHz and PCS1900MHz. It features like GPRS multi-slot class 12/10 and this supports the GPRS coding schemes like CS-1,CS-2 and CS-4.

7. Software

The proposed system is developed using Embedded C language script in Arduino IDE compiler to get the values from each sensors with the help of Arduino UNOR3 micro controller.[1]

The values can be read from the sensors and the programming is constructed to check compilation errors using Arduino IDE and developed without compilation errors.

IV. EXPERIMENTAL RESULTS

A . *Simulation work*

The programming for each sensor will be written in Arduino IDE with the help of Embedded C for the perfect calculations from the sensor readings which helps to build an efficient system without compilation errors.[1]

The simulation work of the project is done by using ISIS simulation tool software Proteus. The project proposal with all the interconnections are done in the Proteus and also checked for the working of the circuit with the simulation feature. This methodology gives a broad outlook of how the proposed project will work with simulated inputs and outputs by correcting the possible errors which can be occur in the real time hardware working of the project.[1]

The Arduino IDE sensor programming is used to create an HEX file from the written code Embedded C program. First Open Proteus constructed circuit and then click on Arduino processor and then upload the HEX file.[1] Then the sensor monitoring readings can be visualized by the 16X2 LCD display.

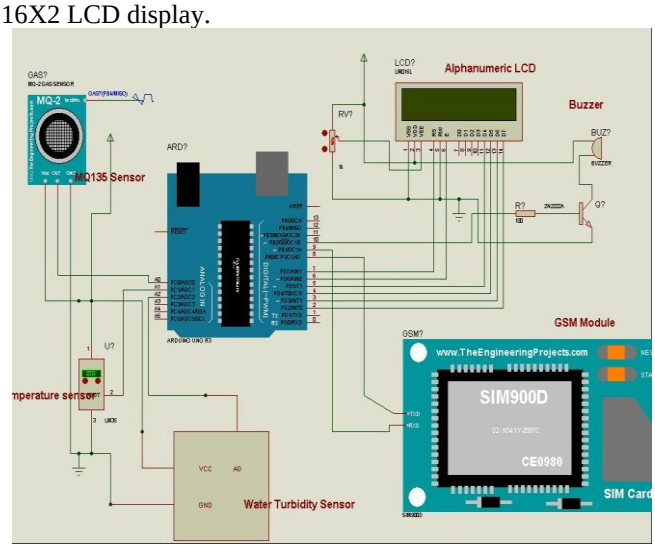

Fig 2: Simulation circuit diagram

The simulation results is as shown in the figure 3.

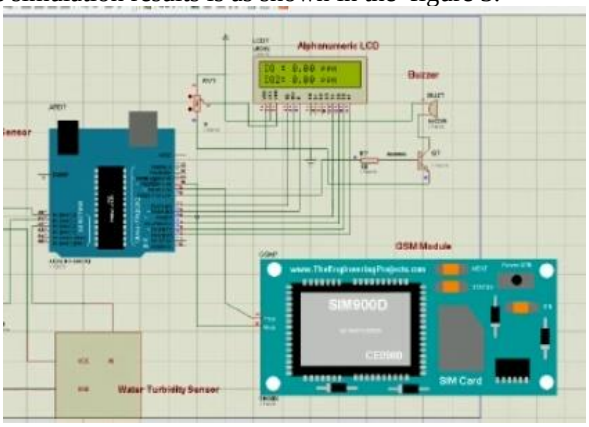

Fig 3 : Simulation results displayed on 16X2 LCD display

B . ***Hardware***

The proposed system with all the sensors are interfaced with Arduino board is as shown in the figure 4. The necessary programming is dumped into developed hardware kit for monitoring the values and the same is displayed on 16X2 LCD. Also the message alert notification can be sent to the user phone via GSM module. [1]

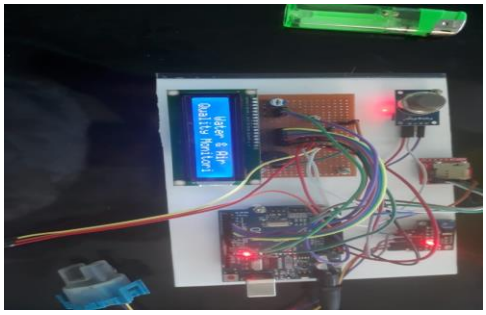

Fig 4 : Hardware connections

The information about the air and water quality displayed on 16X2 LCD is shown in figure 5.

Fig 5 : Results on LCD Display

The message alert notification sent to the user phone via GSM module is as shown in the figure 6.

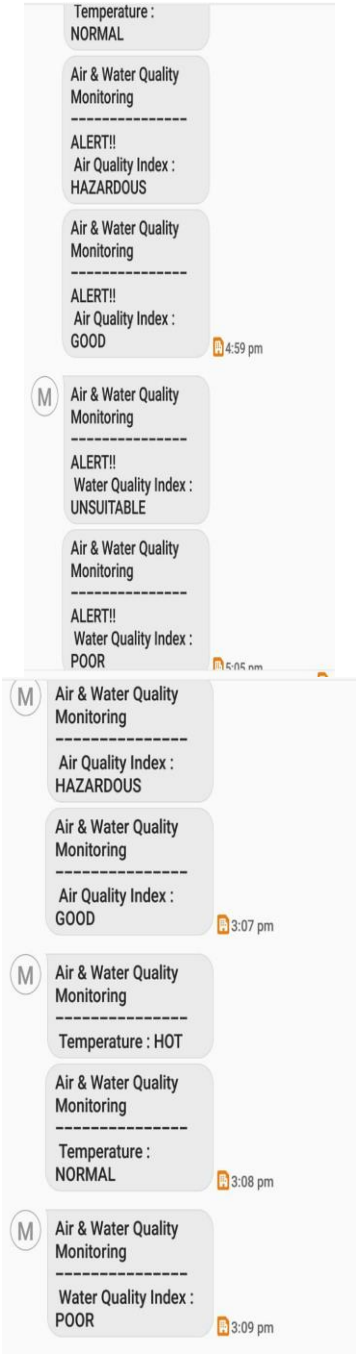

Fig 6 : Message alert notification

V. CONCLUSION AND FUTURE WORK

The method of air and water quality monitoring using sensors is implemented in a cost effective, easy to install way. The real time data of field is obtained instead of traditional methods.

Other type of sensors can be used to determine various other parameters.

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