Environment Monitoring using IOT

Introduction

This paper presents the implementation and results of an environmental monitoring system that is *cost effective* and which can be deployed in numbers across the city. The project here aims to blur the line between the two and give a single system which can be deployed on any scale as the user intends to.

Proposed System

The system consists of *sensor networks, control and processing unit and a web server* which can store data and provide necessary tools for analysis. The base of the system is built up using an *Arduino UNO board* which provide control and processing with the help of ATmega 328 microcontroller. The sensor networks consist of various *sensors* to sense key environmental parameters such as temperature, humidity, air pollution and rain. The Arduino directly communicate with the individual sensor and collects necessary data. Once data are available, it performs a series of processes and transfers the data to the server *via GSM modem*. The sensors that are configured and are used for monitoring real time data of the environment are *DHT11 (Temperature & Humidity Sensor), MQ135 (gas sensor), KG004 (rain drop sensor) module and RES-0276 light dependent resistor (LDR).* The microcontroller interacts with the modem of the GSM module when the temperature range is exceeded and sends SMS (Temperature Exceeded) to the programmed phone number and the *message displayed on the receiving phone*

Hardware

Arduino UNO R3 board- Arduino Uno R3 is one kind of ATmega328P based microcontroller board. Operating Voltage of the Arduino is 5V. The communication protocols of an Arduino Uno include SPI, I2C, and *UART serial communication***.**

Sensors –

- *DHT-11 Humidity sensor and Temperature sensor* - DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high performance microcontroller, *offering excellent quality, fast response, anti- interference ability and cost-effectiveness*. The single-wire serial interface makes system integration quick and easy. Its a small sized*, low power consumption* and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. *The component is 4-pin single row pin package.*

- *Gas sensor (MQ-135)*- The MQ-135 Gas sensors are used in *air quality control equipments* and are suitable for detecting or measuring of NH3, NOx, Alcohol, Benzene, Smoke, CO2. The MQ-135 sensor module comes with a Digital Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas..

- *Raindrop sensor KG-004*- Raindrop Sensor is a tool used *for sensing rain*. It consists of two modules, a **rain board** that detects the rain and a **control module**, which compares the analog value, and converts it to a digital value. Interfacing the raindrop sensor with a microcontroller like 8051, *Arduino, or PIC* is simple

Liquid Crystal Display- Liquid Crystal Display (LCD) is a *flat panel display, electronic visual display* or video display that uses the light modulating properties of liquid crystals. It are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. The operation of the 8 character LCD is connected in *4-bit mode that is ASCII cod*es are fed to it in two stages (high nibble then low nibble).

GSM modem- It accepts *a SIM card*, and operates over a subscription to a mobile operator, just like a mobile phone. GSM is a cellular network, which means that cell phones connect to it by searching for cells in the immediate vicinity. GSM networks operate in a number of different carrier frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands.

Workflow for system design

The Hardware is divided into six sections: Power supply, Temperature sensor, Microcontroller, Liquid crystal display (LCD), Buzzer, GSM module while the software program was written in C language. The code was written in such a way that it embeds the High and Low sensitivity of the sensor, the buzzing unit, Light emitting diode (LED), LCD and the programmed GSM module.

The designed device signals when a specific temperatur has been exceeded from that of the room temperature or it sense the rain or C02 level is exceeded then a specific value it reports by sending a message from the device to the programmed GSM number, buzz from the buzzer and display from the LCD while providing warnings at programmed values settings. The detailed operation of the system is stated in the following steps as follows:

Step 1: The environmental monitoring device operates in such a way that when the power is supplied to the designed system, the sensor senses the temperature/rain/humidity/CO2 (lets say temperature) of the environment in an analogue form. The programmed microcontroller converts the analogue input to a digital form to be used by the control unit for necessary data flow. The liquid crystal display (LCD) helps in displaying the measured temperature in degree centigrade.

Step 2: A case where the temperature range that has been programmed in the microcontroller (for low temperature ≤-10ºC and for high temperature ≥30ºC) was exceeded is observed. The reading on the LCD display is 34.99ºc which is above the specific range of 30ºc for this work. The LED notifies with the light.

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Step 4: For this given ranges the buzzer gives an audio signal or sound output to alert the personnel in charge.

Step 5: The microcontroller interacts with the modem of the GSM module when the temperature range is exceeded and sends SMS (Temperature Exceeded) to the programmed phone number. The message displayed on the receiving phone.

Conclusion

In this paper, we have presented the design, implementation and testing of a low cost IoT based environment monitoring system. Paper gives us detailed monitoring of various parameters of the environment using an IoT based system and remotely accessing the data through the internet. The data received during the experiments and the analysis proves that such IoT based platform is reliable for environment parameter monitoring. Apart from its low cost and low power, it provides operational efficiency and flexibility than traditional wired methods. The system occupies very less space and hence can be installed anywhere.

Thank you,

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