IoT Enabled Environmental Monitoring System

D. Lokesh[1], N. Manavalan[2], R. Santhosh[3], M. R. Mahalakshmi[4]
[1,2,3]*Student, Dept. of Electronics and Communication Engg., Sri Muthukumaran Inst. of Tech., Chennai, India*
[4]*Asst. Prof., Dept. of Electronics and Communication Engg., Sri Muthukumaran Inst. of Tech., Chennai, India*

***Abstract*: In recent decades, the science and engineering professions have been heavily influenced by their responsibilities to the society. This responsibility has been directed towards the protection of public health and welfare. protection of environment is also a forefront responsibility and hence there is need to monitor it. The existing system in this paper uses separate devices and sensors to monitor the environmental parameters and condition. This may be tedious in case of monitoring a numbers of environmental surroundings and it is also not portable. The proposed system overcome the drawback of previous system by displaying all the parameter needed for accessing the environment as a single device and it is also easily portable. Updating real time data over cloud servers and giving alert over emergency messaging system.**

***Keywords*: Emergency messages, Real Time data, Environment condition**

1. Introduction

Monitoring environment condition is very important in daily life. During disaster, a large number of people were trapped by changing environment condition. The recent changes in climate have increased the importance of environmental monitoring, making it a topical and highly active research area. This field is based on remote sensing and on wireless sensor networks for gathering data about the environment. five different IoT-based wireless sensors for environmental and ambient monitoring. Using GSM and Web app to intimate people about real time changes in environmental condition. Giving alert message over phone with corresponding data after reaching particular threshold.

2. Objective

Our main objective of the system is to provide Environmental Monitoring system and Real time changes in climatic condition under affordable cost. Providing real time changes in environmental condition over cloud severs in graphical representation and sending SMS alert over GSM module for peoples.

3. Literature survey

Internet of Things (IoT) for building Smart Home System: International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) I-SMAC 2017) This application is used for sensing the smart home environment for healthy living and can also be used for security. This application is used for optical detection, ionization, and air sampling technique. It is capable of raising alert to nearby fire station in case of fire and smoke and to user via email/SMS informing them about health risks.

Environment Monitoring System for Agricultural Application Based on Wireless Sensor Network: Seventh International Conference on Information Science and Technology Da Nang, Vietnam; April 16-19, 2017. It features a temperature and complex with a calibrated digital signal output. It is small size, low-cost and produced under the exclusive digital-signal- collecting-technique and sensing technology that enable DHT21 is high reliability and excellent long term stability.

Proactive Marine Information System for Environmental Monitoring: INSPIRE – EU, "Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)", March 14, 2007. A main component of the MIS is the model for the provision of real - time and dynamic risk maps. This designed model relies on the available heterogeneous data integrated into the MIS, by aggregating these sources ranging from maritime traffic density to water quality parameters sensed by electronic noses. The aggregation goal is to bring a visual information through a single quantitative parameter for each point in the area of interest. The so called risk map provides a quick yet effective way to have an outlook of the situation in the monitored area.

An Integrated System for Regional Environmental Monitoring and Management Based on Internet of Things:D. Miorandi, S. Sicari, F. De Pellegrini, and I. Chlamtac, "Internet of things: Vision, applications and research challenges," Ad Hoc Netw., vol. 10, no. 7, pp. 1497–1516, 2012. The IoT refers to uniquely identifiable objects and their virtual representations in an Internet-like structure. The term "Internet of Things" was first used by Kevin Ashton in 1999, and became popular through the Auto-ID Center and related market analysis publications. RFID tags, sensors, actuators, and mobile phones are often seen as prerequisites for the IoT. Key technologies of IoT include RFID technology, sensor network and detection technology, Internet technology, intelli- gent computing technology, and so on. However, technical challenges must be tackled before these systems can be widely applied.

A Study on Indoor/Outdoor Concentration of Particulate Matter in Rural Residential Houses in India David. D. Massey. Aditi Kulshrestha School of Chemical Sciences, Department of

International Journal of Research in Engineering, Science and Management
Volume-2, Issue-3, March-2019
www.ijresm.com | ISSN (Online): 2581-5792

Chemistry, St. John's College Ajay Taneja Department of Chemistry, Institute of Basic Science, Dr. B.R. Ambedkar University DOI 10.1109/ICECS.2009.45 Year of Issue:2009 IEEE. Indoor air quality (IAQ) is a matter of public concern these days whereas air pollution is normally monitored outdoors as required under national air quality strategies. In Consequence, much less is known about air pollution levels indoors. As about 70% of the Indian population lives in villages in rural areas this study attempt to provide information about the present IAQ based upon particulate matter concentrations in rural resident's homes of Agra regi (the city of Taj Mahal). Samples were collected during March- 2008 to arch-2009 in the indoors and outdoors of five rural homes having different indoor and outdoor kitchen configurations using Grimm aerosol spectrometer model no: 1.109. The mean concentration of PM10, PM2.5 and PM1.0 were 217.75±66.62μgm-3, 156.87±66.76μgm-3, and 94.01± 37.87μgm-3 indoors, whereas 187.86±41.01μgm-3, 127.94±34.65μgm-3, 80.64±18.47μgm-3 outdoors respectively. Concentration of PM10 and PM2.5 has been compared with prescribed WHO standards and were found to be much higher. Significant Spatial as well as seasonal variations of particulate pollutants were also obtained.

4. Block diagram

A. Transmitting section

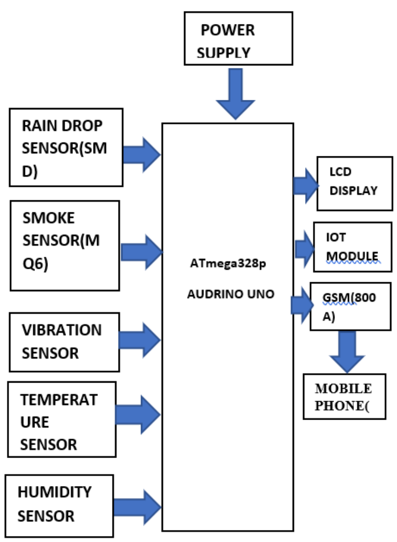

Fig. 1. Block diagram of transmitting section

The transmitter section which placed in a home which consist of a Rain drop sensor, Smoke sensor, Vibration sensor, Temperature sensor and Humidity sensor with the help of Arduino uno Atmega328p. The Arduino receives the data send by sensor via serial peripheral interface. The sensors detect changes of environment. The data will store automatically in the Internet of Things and send message to the particular person.

B. Receiver section

Fig. 2. Block diagram of Receiver section

The receiver section to monitor the environment user consists of a PC or laptop or a smart phone with highly speed internet connection. By typing the http://(thinkspeek):port number then the streaming data can be viewed from any web browser.

5. Methodology

As the effects of global warming are spreading globally, the world population encounters one of the most important social and scientific phenomena-changing the parameters of the environment due to pollution. Any conducted action requires precise and accurate measuring of the environmental parameters at several dozens of thousands points deployed around the world. Since financially, as well as practically, it is impossible to create such a large number of measuring stations which would network all over the planet, it is obvious that some alternative solutions must be found. A new measuring system is developed and measuring methods for remote measurement of environmental parameters are implemented. This system can be implemented as a stationary or mobile measuring station. The working hypothesis is based on the use of statistical analysis of measurement data. It leads to the possibility of reducing the number of sensors at measure station, as based on the monitoring of one value-gas concentration (the concentration of carbon monoxide) can be estimated values of other gas (the concentration of nitrogen — dioxide) in the case that they originate from the same source. Using prediction and regression models — interpolation and extrapolation have shown the possibility to reduce the number of measuring stations. Also, based on a mathematical model (ARMA) estimation of concentrations of gases based on previous measurements is shown.

6. Components

A. Arduino UNO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board -- you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

Fig. 3. Arduino Uno

Table 1
Versions of Arduino

Name	Processor	Digital I/O with PWM (pins)
Arduino Duemilanove (2009)	ATmega168, ATmega328P (ATmega328 for newer version)	6
Arduino Mega	ATmega1280	14
	ATmega168 (Pro uses ATMega328)	6

B. Arduino components

- *Power (USB / Barrel Jack):* Every Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply (like this) that is terminated in a barrel jack. In the picture above the USB connection is labeled (1) and the barrel jack is labeled. The USB connection is also how you will load code onto your Arduino board. More on how to program with Arduino can be found in our Installing and Programming Arduino tutorial.
- *Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF):* The pins on your Arduino are the places where you connect wires to construct a circuit (probably in conjuction with a breadboard and some wire. They usually have black plastic 'headers' that allow you to just plug a wire right into the board. The Arduino has several different kinds of pins, each of which is labeled on the board and used for different functions.
- *GND:* Short for 'Ground'. There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- *5V & 3.3V:* As you might guess, the 5V pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.
- *Analog (6):* The area of pins under the 'Analog In' label (A0 through A5 on the UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read. Digital: Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).
- *PWM:* You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). We have a tutorial on PWM, but for now, think of these pins as being able to simulate analog output (like fading an LED in and out).
- *AREF:* Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.
- *Reset Button:* Just like the original Nintendo, the Arduino has a reset button. Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn't repeat, but you want to test it multiple times. Unlike the original Nintendo however, blowing on the Arduino doesn't usually fix any problems.
- *Power LED Indicator:* Just beneath and to the right of the word "UNO" on your circuit board, there's a tiny LED next to the word 'ON' . This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong. Time to re-check your circuit!
- *TX RX LEDs:* TX is short for transmit, RX is short for receive. These markings appear quite a bit in electronics to indicate the pins responsible for serial communication. In our case, there are two places on the Arduino UNO where TX and RX appear -- once by digital pins 0 and 1, and a second time next to the TX and RX indicator LEDs. These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we're loading a new program onto the board).
- *Main IC:* The black thing with all the metal legs is an IC, or Integrated Circuit. Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type, but is usually from the ATmega line of IC's from the ATMEL company. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software. This information can usually be found in writing on the top side of the IC. If you want to know more about

the difference between various IC's, reading the datasheets is often a good idea.

- *Voltage Regulator:* The voltage regulator is not actually something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it's for. The voltage regulator does exactly what it says -- it controls the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extra voltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts.

C. *Vibration sensor*

A piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal. Piezo electric sensors have proven to be versatile tools for the measurement of various processes. They are used for quality assurance, process control and for research and development in many different industries. Although the piezoelectric effect was discovered by Curie in 1880, it was only in the 1950s that the piezoelectric effect started to be used for industrial sensing applications. Since then, this measuring principle has been increasingly used and can be regarded as a mature technology with an outstanding inherent reliability.

Fig. 4. Vibration sensor

D. *Raindrop sensor*

Water sensor brick is designed for water detection, which can be widely used in sensing the rainfall, water level, even the liquate leakage. The brick is mainly comprised of three parts: An electronic brick connector, a 1 MΩ resistor, and several lines of bare conducting wires. This sensor works by having a series of exposed traces connected to ground and interlaced between the grounded traces are the sense traces. The sensor traces have a weak pull-up resistor of 1 MΩ. The resistor will pull the sensor trace value high until a drop of water shorts the sensor trace to the grounded trace. Believe it or not this circuit will work with the digital I/O pins of your Arduino or you can use it with the analog pins to detect the amount of water induced contact between the grounded and sensor traces. This item can judge the water level through with a series of exposed parallel wires stitch to measure the water droplet/water size . This item can easily change the water size to analog signal, and output analog value can directly be used in the program function, then to achieve the function of water level alarm. This item has low power consumption, and high sensitivity, which are the biggest characteristics of this module.

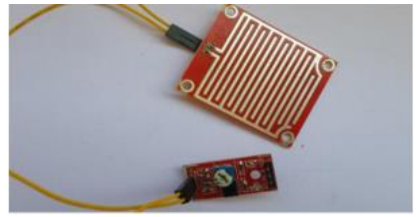

Fig. 5. Raindrop sensor

E. *Gas sensor*

Gas sensor measures the concentration of gas in its vicinity. Gas sensor interacts with a gas to measure its concentration. Each gas has a unique breakdown voltage i.e. the electric field at which it is ionized. Sensor identifies gases by measuring these voltages. The concentration of the gas can be determined by measuring the current discharge in the device. Sensitive material of MQ-6 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exists, the sensor's conductivity is higher along with the gas concentration rising. Please use simple electro circuit, Convert change of conductivity to correspond output signal of gas concentration.MQ-6 gas sensor has high sensitivity to Propane, Butane and LPG, also response to Natural gas. The sensor could be used to detect different combustible gas, especially Methane, it is with low cost and suitable for different application.

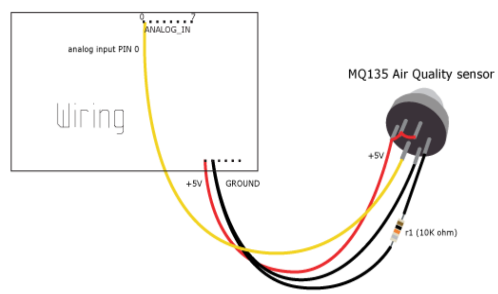

Fig. 6. Gas sensor

F. *Temperature sensor*

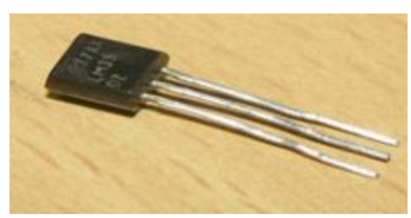

Fig. 7. Temperature sensor

The measurement of temperature is one of the fundamental requirements for environmental control, as well as certain chemical, electrical and mechanical controls. Many different types of temperature sensors are commercially available, and the type of temperature sensor that will be used in any particular application will depend on several factors. For example, cost, space constraints, durability, and accuracy of the temperature sensor are all considerations that typically need to be taken into account.

Various types of temperature sensors are known including liquid-in-glass (LIG) thermometers, bimetallic thermometers, resistance thermometers, thermocouples, and radiometers. Depending upon the temperature to be measured, the required accuracy of the measurement, and other factors such as durability or cost, one type of temperature sensor may be preferable over another.

7. Advantages

- Five different sensors are embedded into a single kit
- Environmental conditions can be assessed by a remote user at a longer distance
- Can be monitor over a continuous range of time through graphical analysis

8. Future scope

With increasing rapid changes in global climate it is inevitable to avoid or ignore environment. Hence there arises the need to continuously monitor changes occurring in livelihood. This system will serve the cost

9. Conclusion

This system is individually designed for working in a small localized space. The user will able to receive environmental updates in real time. Thus would be able to undertake safety precaution in case of any abnormalities. This system provides a practical way to monitor local environmental changes.

References

[1] Albert M. C. Souza and Jose R. A. Amazonas" A Novel smart home application using an internet of things middle"2010 International conference on image analysis and singnal processing, IEEE, June 2013.
[2] Can Nguyen, Tien Cao-Hoang "Environment Monitoring system for Agricultural Application Based on wireless sensor network" Seventh International Conference on Information science and technology, April 16-19, IEEE, 2017.
[3] Davide D. Massey and Aditi Kulsprestha, "A Study on Indoor/outdoor concentration of particular matter in rural residential houses", Institute of Basic Science, Dr. B. R. Ambedkar University, IEEE, 2005
[4] David Moroni, Gabriele Pieri, Ovidio Salvetti, and Macro Tampucii, "Proactive marine Information System for Environment Science and Technology," ISTI, IEEE, 2015.