

Implementations Paper: Monitoring Of Air Pollution Using Wireless Sensor Network

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ABSTRACT: Air pollution monitoring is extremely important as air pollution has a direct impact on human health and environment. In this paper we are the introduce the wireless sensor network system for participatory air pollution monitoring. The traditional monitoring air quality system are controlled by the Pollution Control Department is extremely expensive. Analytical measuring equipment are costly, time and power consuming. In contrast to traditional air pollution monitoring stations, we are present the design, implementation, and evaluation of the low power, low cost WSN based Air Pollution Monitoring System which is provides real time monitoring of polluted materials at proper locations by using distributed or real time air pollution monitoring systems.

Technical keyword: GPS, Microcontrollers systems, Air pollution, wireless mobile networks.

1. INTRODUCTION:

Air pollution is a gas released in a big enough quantity to harm the health of people or animals, kill plants damage some other aspect of the environment.

Top-ten gases in air pollution:

Any gas could qualify as pollution if it is a reached a high enough concentration to do harm.

1. Sulfur dioxide: Coal and other fuels are often impure and contain sulfur as well as carbon-based compounds. Coal-fired power plants are the world's biggest source of sulfur-dioxide air pollution, which is contributes to the smog, acid rain, and health problems i.e lung disease.

2. Carbon monoxide: It is spews out in car exhausts and it can also build up to dangerous levels inside your home if you have a poorly maintained gas boiler, stove, or fuel-burning appliance.

3. Carbon dioxide: carbon dioxide is also a greenhouse gas released by engines and power plants.

4. Nitrogen oxides: Nitrogen dioxide (NO₂) and nitrogen oxide (NO) are pollutants produced as an indirect result of combustion, when nitrogen and oxygen from the air react together. Nitrogen oxide pollution comes from vehicle engines and power plants, and plays an important role in the formation of acid rain, ozone and smog.

5. Volatile organic compounds (VOCs): These carbon-based chemicals evaporate are easily at ordinary temperatures and pressures, so they readily become gases.. They are also a form of air pollution: they are re believed to have long-term effects on people's health and they also play the role in the formation of ozone and smog.

6. Particulates: These are the sooty deposits in air pollution that can be cause the breathing difficulties. Particulates of different sizes are often referred to by the letters PM followed by a number, so PM10 means soot particles of less than 10 microns.

7. Ozone: it is also as called trioxygen, this is a type of oxygen gas molecules are made from three oxygen atoms joined together instead of just the two atoms in conventional oxygen (O₂). In the stratosphere a band of ozone protects us by screening out harmful ultraviolet radiation beaming down from the Sun. At ground level, it is a toxic pollutant that can be damage health.

8. Chlorofluorocarbons (CFCs): Once thought to be harmless, these gases are widely used in refrigerators and aerosol canes until it was discovered that they are damaged Earth's ozone layer.

9. Unburned hydrocarbons: Petroleum and other fuels are made of organic compounds is based on the chains of carbon and hydrogen atoms.

10. Lead and heavy metals: Lead and other toxic like heavy metals can be spread into the air either as toxic compounds or as aerosols from incinerator smokestacks.

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Causes of air pollution:

- Traffic
- Power plants
- Industrial plants and factories

Effects does air pollution:

- Agricultural effects
- Human health

2. EXISTING SYSTEM:

The main pollutant from environment are the oxides of carbon and nitrogen which can be detect easily these day with the help of semiconductor gases sensor. The existing system air pollution detection and indicates the environment pollution using GPS-GPRS. So Pollution Control Office easily detect large pollution area.

3. PROBLEM STATEMENT:

Low cost wireless sensor network(WSN) based on Air Pollution Monitoring System which is provides real time monitoring of the polluted materials at proper locations by using distributed air pollution monitoring systems.

4. PROPOSED SYSTEM:

In this proposed system wireless sensor network air pollution monitoring system (WAPMS) comprises of sensor array nodes and the communications system which is allows to the data reach a server. The sensor nodes gather data autonomously and the data network is used to pass data to the one or more base stations, which is forward to the sensor network server. The system send commands to the nodes in order to fetch data, and also allows the nodes to send data out autonomously.

5. SYSTEM REQUIREMENT:

A) Domain: Android and wireless sensor network

B) Software Interfaces:

Language: JDK1.8, ADT ,Eclipse, Xampp
 Server, Assembly language
 Operating System : Windows/ Android
 Front End : Java
 Back End : MySql
 Data Base : My Sql

6. SYSTEM ARCHITECTURE:

In block diagram divided into two major blocks are namely: Pollution monitoring Server (Pollution- Server) and Mobile Data Acquisition Unit (Mobile- DAQ).In

Mobile Data Acquisition Unit include sensors array, single chip microcontroller, GPS and GPRS modem. The Mobile Data Acquisition Unit is also connected to a GPS module and a GPRS- Modem.

Each of these components is described in the following.

a. Sensors:

The sensor array consists of three air pollutions sensors like as including SO2, NO2, and CO.

b. GPS Module:

GPS mean **Global Positioning System**. The Global Positioning System is the space-based navigation system that is provide location and time information in all weather conditions, anywhere or near the Earth where there is an line of sight to four or more GPS satellites. The GPS modem is interfaced with the microcontroller.

c. GPRS-Modem:

GPRS means **General packet radio service**. GPRS is a packet oriented mobile data service are used in 2G and 3G cellular communication systems for GSM. GPRS use typically charged based on volume data transferred, contrasting with circuit switched data, which is usually to the billed per minute of connection time.

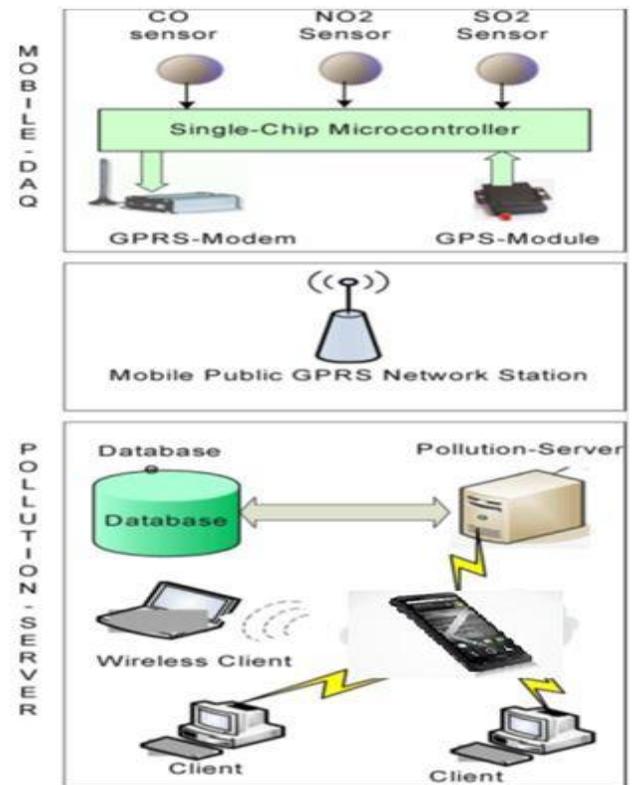


Figure No.1 Block Diagram

d. Single-Chip Microcontroller:

The microcontroller is a single-chip device that has to the rich built-in the resources for digital input/output ports, 16 channels, 8/10 bits A(analog)-to-D(digital) converter, 8 input/output interrupt-driven timers, SPI communication ports and two RS-232 serial communication ports.

e. Pollution-Server:

The Pollution-Server is connects to the GPRS-Modem via TCP/IP through the Internet and public mobile network. The Pollution-Server is standard personal computer with access to the Internet.

Workflow of System

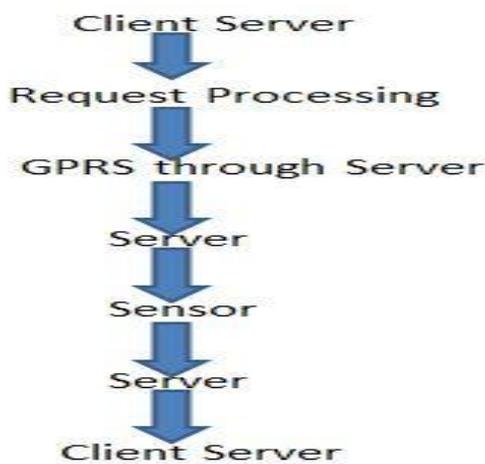


Figure No.1 Workflow Diagram

7. MATHEMATICAL MODEL:

Let s be the set $S=\{C, S, G, Db, W,P, F,M\}$

Where,

C is a set of the clients - C1, C2, C3.....Cn belongs to C.

S is the server machine which is the responsible to getting clients process information.

Db is database for storing the values collected by Sensors

G is the GPS-Module who has transferred collected information from Sensors to the server machine S.

W is the third party client network managed by the administrator functions like as following-

P is the set of processes - P1, P2, P3.....Pn belongs to P.

F is the set of files - F1, F2, F3.....Fn belongs to F.

Operations:

Process list :

Process pl= Demon tool(client machine, all requested value) Db=add pl(pl,cid)

f=Get created files on sensors(cid,fname,path,contents)
 [Y/N]=GPS Module(cid,process name,pid)
 M=Create message(cid,M)
 S=checks the recent values, if values are old then
 Server(S) Zend request through GPS (G)

8. ALGORITHM & FLOWCHART:

- a. Sensor Nodes is sense, collect and transmit data to the Cluster Head.
- b. The Cluster Head is collects data and performs two computational operations.
- c. The result can be obtained by computational operation is transmitted to the Sink.
- d. The Sink collects the data and forwards to the Database, which sends the data to Application.

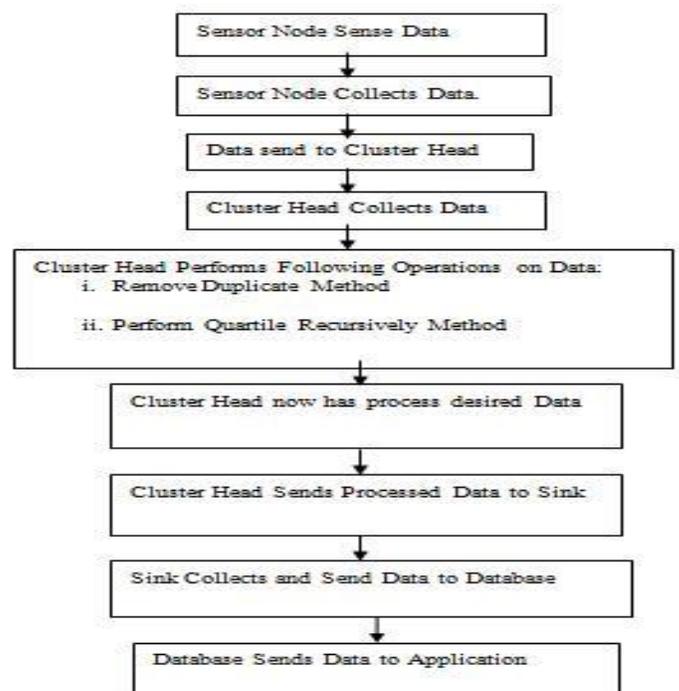


Figure No.1 Flowchart

10. ADVANTAGES:

- Sensors are easily available.
- Simple, compact and Easy to handle.
- Sensors have long life time and less cost.
- Simple Drive circuit.
- Real Time system.
- Output is visual.
- Update continous of changes in percentage of air quality.
- It avoid lot of wiring.

11. APPLICATIONS:

Some daily life applications which are used

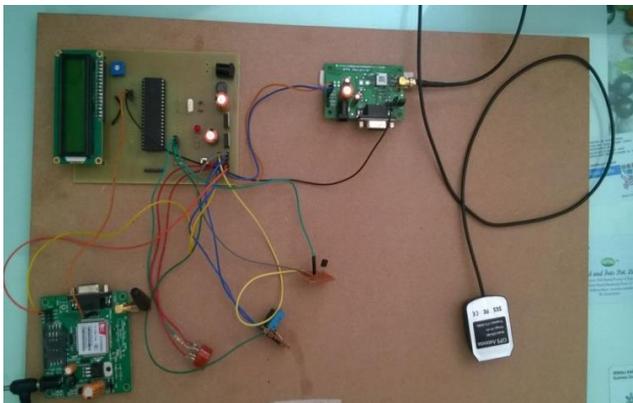
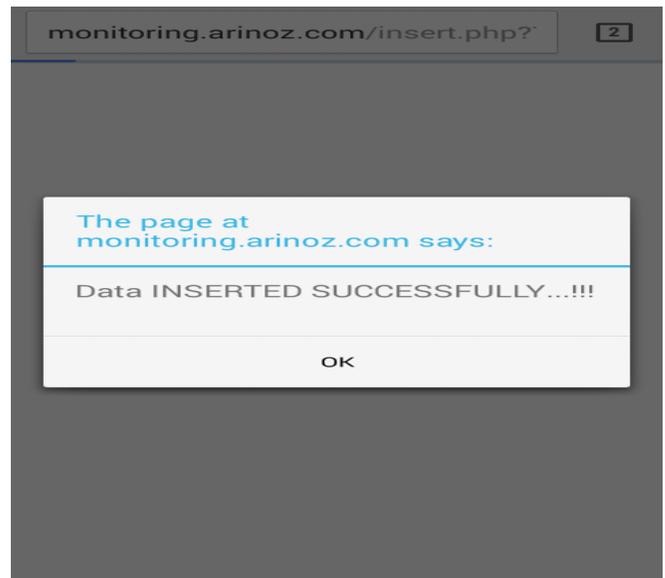
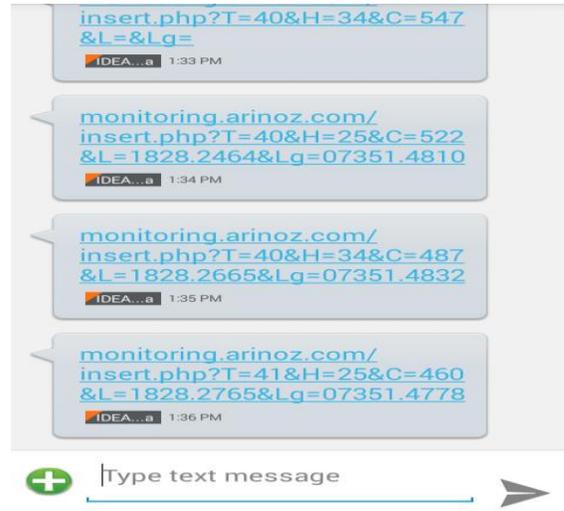
- Environmental monitoring
- Indoor climate control
- Surveillance

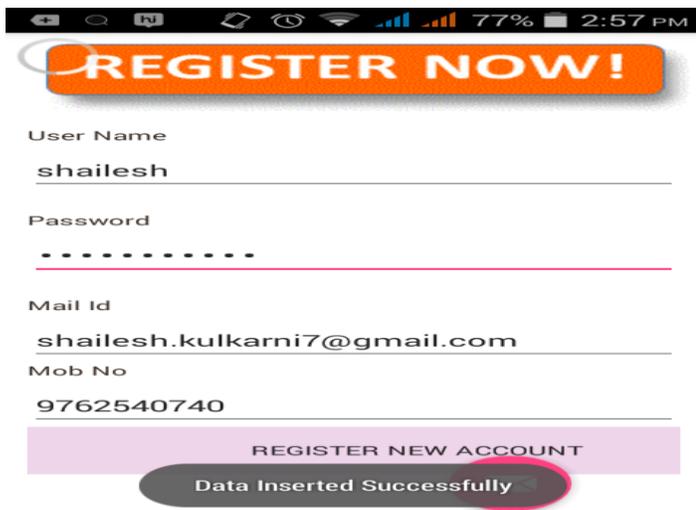
12. CONCLUSION:

Thus the several parameters like as gas and purity of water level are monitor continuously and the standard level exceeds a message is sent to the owner as a warning and even in the case of failure in the measure and message is sent to the pollution control board. Thus the environment is saved from the several hazards of pollution.

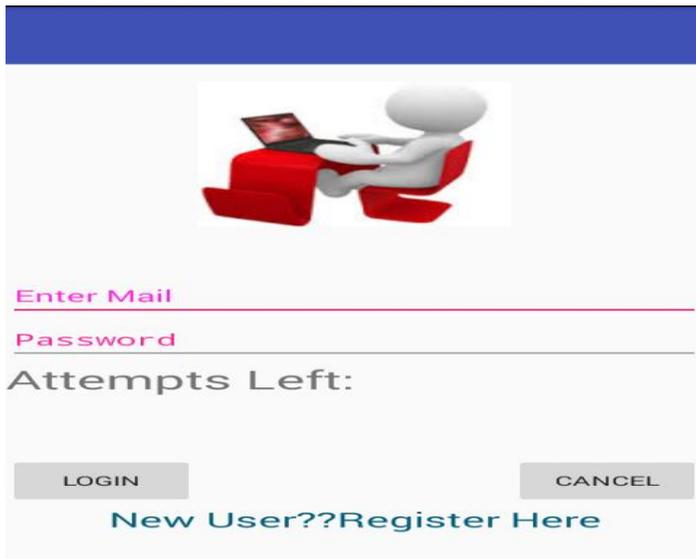
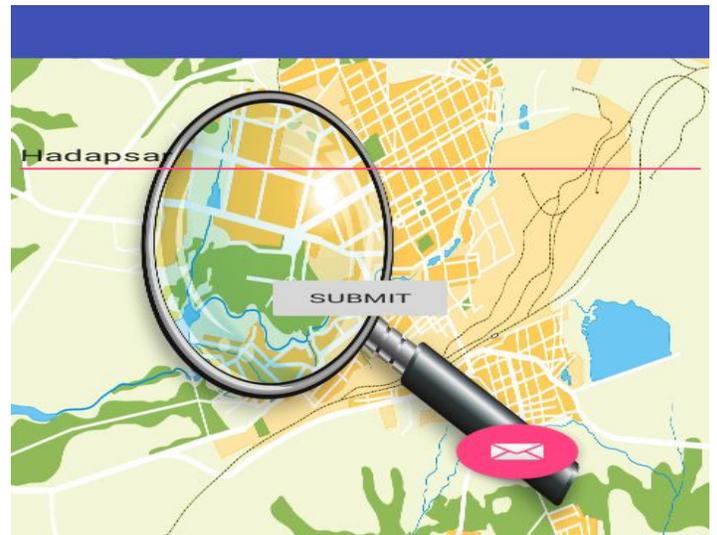
13. IMPLEMENTAION:

Android software development is the process by which is new applications created for the Android operating system. The first part of project are login page. This system contains an android app which can any one install in Android phone. Following are the step by step snap shots of working of this android app.

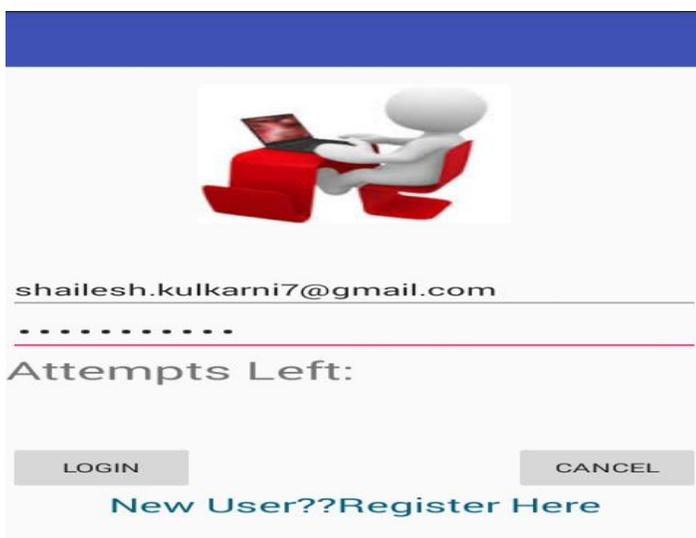




A mobile application registration screen. At the top, there is a status bar showing 77% battery and 2:57 PM. Below it is a large orange button that says "REGISTER NOW!". The form contains the following fields: "User Name" with the value "shailesh", "Password" with a masked input ".....", "Mail Id" with the value "shailesh.kulkarni7@gmail.com", and "Mob No" with the value "9762540740". Below the form is a pink button labeled "REGISTER NEW ACCOUNT". At the bottom, a dark grey button says "Data Inserted Successfully".



A mobile application login screen. At the top, there is a status bar showing 76% battery and 2:59 PM. Below it is a blue header with a menu icon, a search icon, a notification bell with "16", and a user profile picture. The main title is "Monitoring Of Air Pollution Using WSn". Below the title is a map of Maharashtra, India, with a red pin over Pune. A tooltip over the pin shows "CO2-545%, Hum-25%, Temp-40%". The map also shows other cities like Mumbai, Surat, and Goa. Below the map are "Map" and "Satellite" buttons. At the bottom, there is a "LOGIN" button, a "CANCEL" button, and a link "New User??Register Here".



A mobile application login screen, identical to the one above. It features a status bar, a blue header with navigation icons, the title "Monitoring Of Air Pollution Using WSn", a map of Maharashtra with a red pin over Pune and a tooltip showing "CO2-545%, Hum-25%, Temp-40%", and a "LOGIN" button, a "CANCEL" button, and a link "New User??Register Here".

14. REFERENCES:

- [1]GPRS-Modem Technology. [Online].
- [2] J. Liu, "Calibration of a Wireless Sensor Board for Measuring Air Pollution," University of New South Wales, Sydney, Australia, Tech. Rep., 2012"

[3] Air Quality Index, UAE, Dubai Municipality city.

[4] Muhammad Adeel Pasha, Steven Derrien, Olivier Senti
eys, "A Complete Design- Flow for the Generation of Ultra Low-Power WSN Node Architectures Based on Micro-Taskin)

[5] N. Kularatna and B. H. Sudantha, "An environmental air pollution monitoring system based on the IEEE 1451 standard for low cost requirements of ssystem,"27Monitoring Of Air Pollution using Wireless

Sensor Network IEEE Sensors J., vol. 8, pp. 415-422, Apr. 2008.

[6]Hardas Bhalchandra M, Asutkar G.M., Dr..Kulat K. D,(2009)"Environmental Monitoring Using Wireless Sensors: A Simulation Approach", First International Conference on Emerging Trends in Engineering and Technology

[7]Atmel Corporation. ATmega 128L 8-bit AVR Low-Power MCU.

[8]Air pollution monitoring data of Nagpur city available at accessed during July, 2011.