Iot Based Air and Noise Pollution Monitoring In Urban and Rural Areas, Important Zones Like Schools and Hospitals in Real Time

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***Abstract*-Today's major environmental & public issue is air pollution. According to the report of World Health Organization (WHO), air pollution is significant risk factor for multiple health conditions including skin & eye infection, irritation of nose, throat & eyes. It also causes serious conditions like heart disease, lung cancer difficulty in breathing & many. Parking management is also main public issue in most of metropolitan cities and that is also the reason of many problems. The main objective of project is by using various sensors, GSM/GPRS module and Cloud/server to design an efficient and remote system to monitoring the level of various pollutants causing pollution and to minimize the effect of these parameters without affecting the natural environment and provide live updates to avoid conflicts.**

Index-terms-Intertnet Of Things, Things, RFID, WIFI, ZigBee, Smartphones, Pedometer, Web Of Things(WOB), M2M, Sensors

I. INTRODUCTION

The speed of multiplication operation is of great importance in digital signal processing as well as in the general purpose processors today. In the past multiplication was generally implemented via a sequence of addition, subtraction, and shift operations. Multiplication can be considered as a series of repeated additions. The number to be added is the multiplicand, the number of times that it is added is the multiplier, and the result is the product. Eachstep of addition generates a partial product. In most computers, the operand usually contains the same number of bits. When the operands are interpreted as integers, the product is generally twice the length of operands in order to preserve the information content. This repeated addition method that is suggested by the arithmetic definition is slow that it is almost always replaced by an algorithm that makes use of positional representation. It is possible to The

Internet of Things (loT) is a new concept which has attracted the attention of both academia and industry. Internet of Things (loT) is implemented as a network of interconnected objects, each of which can be addressed using unique id and communicates based on standard communication protocols.

Today's one of the major public health & environmental concern is air pollution and now a day's parking management also the main issue in cities. According to the 2014 report of World Health Organization (WHO), due to air pollution in 2012 caused the deaths of around 7 million people worldwide. And according to blacksmith institute world's worst polluted places report indoor air pollution and urban air quality are listed as two of the world's worst toxic pollution problem in 2008. It also causes serious conditions like heart disease, lung cancer, pneumonia, bronchitis, difficulty in breathing & many more.

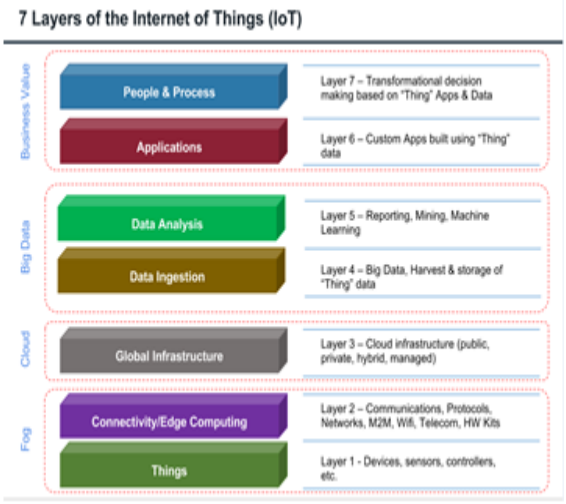
In an urban environment, traffic conditions have a large effect on the quality of the outdoor air, as vehicle emissions are a major source of urban pollution. Figures from the National Atmospheric Emissions Inventory for the INDIA indicate that road transport emissions are possible for the following percentages of total emissions in the INDIA:

- Carbon Monoxide (CO): 43%,
- Nitrogen Oxides: 32%,
- Particulates: 21%.

In this project the pollution level at each sensor node can be provided to server by using GSM/GPRS system or we can display the pollution level information on large display close to square. People generally more than one alternate path to reach some destination; if person knows the pollution

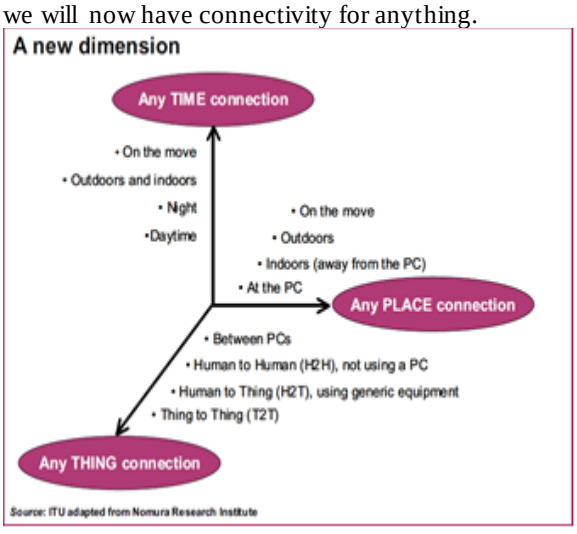
information in advance he can follow safe path & simultaneously pollution can also control.

At each sensor node, the sensors such has smoke sensor, noise sensor and RFID reader are interfaced with single microcontroller to read the pollution level from each vehicle on road, each vehicle will be provided with Unique number (RFID) , the sensors value will be uploaded to server/cloud for every instant of time so that the user can know the pollution level at any time using internet.



IOT VALUE CHAIN

From any time, any place connectivity for anyone, we will now have connectivity for anything.

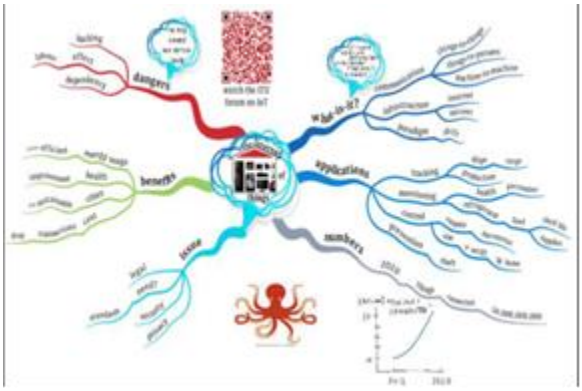


FEATURES OF IOT

The features of IOT we can mention as Network of Physical Objects, embedded systems with electronics, software, sensors.

Enable objects to exchange data with manufacturer, operator, other devices through network infrastructure. Univocally identifiable and addressable objects. Artificial Intelligence,Architecture, Geo-Localization, Size Considerations, allow remote control.

Direct integration computer + physical world. As a result: automation in all fields.



TECHNOLOGIES OF IOT

The following technologies are key once in IoT..RFID, WiFi IEEE 802.11, Barcode e QR Code, ZigBee IEEE 802.15.4, Sensors and Smartphones, 50-100 Trillion object, each person carries 1000-5000 trackable objects, computer manage and inventory objects and people.convergence of data from IoT into applications, web-of-things.

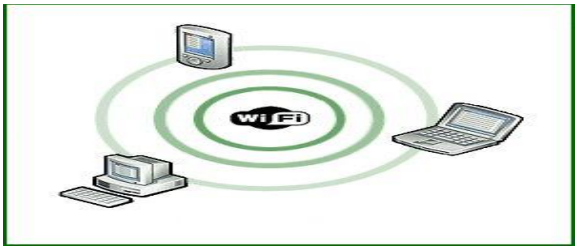
RFID

We have seen this is Widely used in Transport and Logistics which is easy to deploy: RFID tags and RFID readers.

Where in the communication range and the frequency depends on the type of technology [1].

WIFI

The wifi technology is Very common now days and Widely used both in indoor and outdoor environments for General purpose which is Low cost and Highly interoperable.Some times Maybe not a good solution in some special conditions



BARCODE E QR CODE

This technology is condidered to be Low cost and without having any technological difficulties as several devices can read a barcode. Many a times it is Starting point for more complex systems. For example: price comparison [4].

ZIGBEE

Onemore option to easy deploy which comes with Low cost, Very long battery life. We can deploy large number of nodes (up to 64770). Can be used globally which is secured and Ideal for WPAN and mesh networks. Which provides wide spread support for multiple network topologies [9].

SENSORS AND SMARTPHONES

In the near future almost everybody will probably have a smartphone. A smartphone isn't just a mobile phone that has access to the Internet. The iPhone has a lot of different types of sensors.

Sensors are the magic of IoT.

The ability to detect changes in the physical status of things is essential for recording changes in the environment. Wireless sensor technology play a pivotal role in bridging the gap between the physical and virtual worlds, and enabling things to respond to changes in their physical environment. Sensors collect data from their environment, generating information and raising awareness about context. Sensor Market includes : Micro-electromechanical systems (MEMS) - based sensors, optical sensors, ambient light sensors, gesture sensors, proximity sensors, touch sensors, fingerprint sensors and more Example: sensors in an electronic jacket can collect information about changes in external temperature and the parameters of the jacket can be adjusted accordingly.

WEB OF THINGS

To achieve IoT we need a universal protocol to combine several heterogeneous devices.

This protocol should be: simple, lightweight, loosely-coupled, scalable, flexible and standard. Sounds like the WEB.

Several technologies and protocols already available and widely accepted by the community: HTTP, TCP, IPV6, XML, JSON, RSS, ATOM, REST, WS-*, URI, etc.

URI to make the objects easily identifiable and addressable, XML, WS-* and REST to allow the objects to expose their features and to communicate with external or centralized services, Simpler mashup, Objects (things) are the resources, Ontologies for knowledge representation (information collected by the objects, etc.) [3][10].

II. LITERATURE SURVEY

Some of the existing instruments for air pollution monitoring are Fourier transform infrared (FTIR) instruments, gas chromatographs, and mass spectrometers. These instruments provide fairly accurate and selective gas readings. The existing monitoring system largely uses smart transducer interface module (STIM) with semiconductor gas sensors, which uses the 1451.2 standard. STIM was found to an efficient monitoring system but for the power requirements and ability to expand for large deployment. Some of the implemented systems are:

A) In 2014, Dan Stefan Tudose, Traian Alexandru Patrascu, Andrei Voinescu, Razvan Tataroiu, Nicolae Tapus et al. [1] proposed an environmental air pollution monitoring system that measures CO2, NO2, CO, HC & NH4 concentration using mobile sensors in urban environment. The acquired information about air pollution in surroundings is then stored on central on-line repository system periodically. It uses a wireless GSM modem connection for transferring data to a central computer. Also, the application can share the data publicly by displaying it on a dedicated web site.

B) In 2012, Amnesh Goel, Sukanya Ray, Prateek Agrawal, Nidhi Chandra et al. [4] proposed a wireless sensor network to monitor air pollution levels of various pollutants due to environment

changes. A wireless network is comprises of large number of sensors modes.

This system proposes a method which mainly focuses on longer sustain time period of sensor network by effectively managing energy in sensor network, effectively processing of collected information and less overhead in transferring information between various sensor nodes.

C) In 2013, Wenhu Wang, Yifeng Yuan, Zhihao Ling et al. [5], in order to comply with requirements of oil and gas industry, an air quality monitoring system was proposed based on ZigBee wireless sensing technology. It uses ZigBee wireless network to send results to the monitoring centre so that, if some abnormal situations happens, a quick warning will be generated to remind staff.

D) John I Curries, Graham Capper proposed how Road Traffic is responsible to the Pollution and its Effect on the Environment. The monitoring period was chosen to cover a period of street closures and hence attempt to isolate some of the traffic related pollutants. Traffic flow information was available for the area, from which traffic emission data was used to test an integrated model for street canyon pollution.

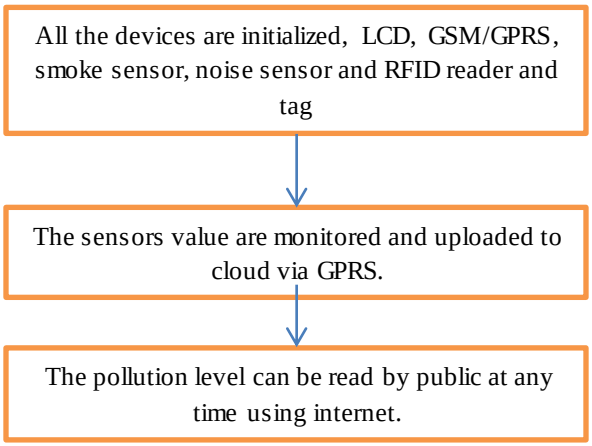
FEATURES

- Monitoring the pollution level by means of smoke and noise sensor.
- Uploading the sensor value from every sensor node placed at different regions to server/cloud.

III. PROBLEM DEFINITION (EXISTING SYSTEM)

With the increasing number of automobiles, especially in some metropolis, such as Europe and America, it is very impending to resolve the problem of air pollution resulting from automobile exhaust gas. In Europe, air pollution has reached levels judged as hazardous to human health. To fight this problem, the motor emissions standards have been established and promoted in many developed countries for many years. Furthermore, some improved measures in vehicle engines or the quality of gasoline have also been developed by researchers. However, these methods seem not to solve radically the emissions pollution problems. The motor emissions standard is very difficult to implement in real-life. Although government forces all cars for testing or examining periodically as the local standard, the actual vehicle on-road emissions are usually much higher than those which are measured during the emission inspections.

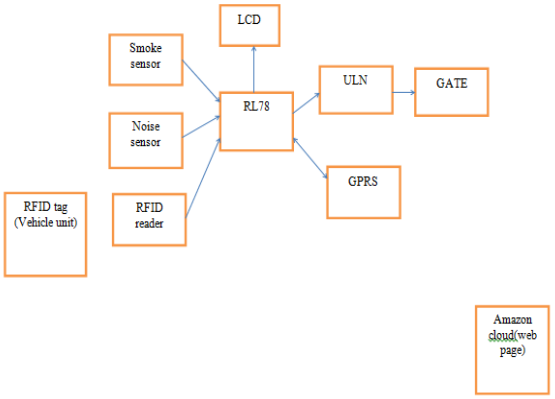
METHODOLOGY



SYSTEM ARCHITECTURE

R5F100LEA microcontroller from Renesas RL78 series which is a 16-bit microcontroller is used to implement this project. Microcontroller acts as the heart of this project, which controls the whole system. It contains of Flash ROM 64KB, RAM 4KB and Data Flash 4KB, and it has High speed on-chip oscillator, Self-reprogrammable under software control, 58 GPIO's, 3 UART's, Simplified I2C, 10 bit resolution ADC, 28 Interrupt Sources, ISP programming support etc.

BLOCK DIAGRAM



DESCRIPTION

Many embedded systems have substantially different designs according to their functions and utilities. In this project design, structured modular design concept is adopted and the system is mainly composed of a single microcontroller, smoke sensor,

RFID reader and tag, noise sensor, stepper motor, ULN stepper motor driver and GSM/GPRS.

The microcontroller located at the centre of the block diagram forms the control unit of the entire project. Embedded within the microcontroller is a program that helps the microcontroller to take action based on the inputs provided by the output of the sensors.

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IV. COMPONENTS USED HARDWARE'S USED

- Microcontroller RL78
- LCD
- GSM/GPRS
- RFID reader and tag
- Smoke sensor
- Noise sensor
- Stepper motor driver
- Stepper motor

SOFTWARE'S USED

- Cubesuite+
- Renesas flash programmer
- Embedded c
- Dotnet

APPLICATION

- This system is very promising to use in various industrial areas where air pollution level is high.
- System also used in near the hospitals where pollution (air, noise) & traffic problems are is most harmful to the patients.
- In Weather forecast department, so they can give information about the rainfall and effect of rainfall on traffic in particular area.

ADVANTAGES

- Due to use of various sensors it is easy to detect or to measure the (air, noise) pollution in the city.
- It can be easily mounted at any particular area.

FUTURE WORK

- By using GPS module which is connected to the vehicles then we get information about traffic and pollution where vehicle can travel. i.e. by using GPS we can cover wide area information.
- The performance and remotely the pollution monitoring and control system can further be improved by implementing sensors for detecting dust, noise, smoke and other parameters, thereby improving the industrial and natural environment.

CONCLUSION

The project is designed using structured modeling and is able to provide the desired results. It can be successfully implemented as a Real Time system with certain modifications.

Science is discovering or creating major breakthrough in various fields, and hence technology keeps changing from time to time. Going further, most of the units can be fabricated on a single along with microcontroller thus making the system compact thereby making the existing system more effective. To make the system applicable for real time purposes components with greater range needs to be implemented.

V. THE FUTURE OF IOT

World sensor networks, Home automation and domotics, Daily life (traffic monitoring, shopping, etc.), Tracking and shipping of goods, Health, Unpredictable developments... [7].

There are three core sectors of the IoT :

enterprise, home, and government. With the Enterprise Internet of Things (EIoT) being the largest of the three. By 2019, the EIoT sector is estimated to account for nearly 40% or 9.1 billion devices Size considerations, The Internet of objects would encode 50 to 100 trillion objects, and be able to follow the movement of those objects. Human beings in surveyed urban environments are each surrounded by 1000 to 5000 trackable objects Space considerations, Internet of Things, things are able to take actions on their own initiative, this human-centric mediation role is eliminated, and the time-space context that we as humans take for granted must be given a central

role in this information ecosystem. Just as standards play a key role in the Internet and the Web, geospatial standards will play a key role in the Internet of Things.Criticism and controversies, While many technologists tout the Internet of Things as a step towards a better world, scholars and social observers have doubts about the promises of the ubiquitous computing revolution, Privacy, autonomy and control [7].The technology already influences our moral decision making, which in turns affects human agency, privacy and autonomy. He cautions against viewing technology merely as a human tool and advocates instead to consider it as an active agent.

Some have expressed concern regarding the impact of IoT on consumer privacy, saying that "There are some people in the commercial space who say, 'Oh, big data — well, let's collect everything, keep it around forever, we'll pay for somebody to think about security later.' The question is whether we want to have some sort of policy framework in place to limit that.You aren't just going to lose your privacy, you're going to have to watch the very concept of privacy be rewritten under your nose

Technology roadmap

50-100 Trillion objects, each person carries 1000-5000 trackable objects. Computer manage and inventory objects and people. Transform daily life,bottom up,Convergence of data from IoT into applications, web-of-things

REFERENCES

[1] Kevin Ashton: That 'Internet of Things' Thing. In: RFID Journal, 22. July 2009. Abgerufen am 8. April 2011.

[2] Dave Evans. (2011, July 15). Cisco: Over 50 billions of devices connected to Internet [Online]. Available: http://blogs.cisco.com/news/the-internet-of-things-infographic/

[3] Vlad Trifa. (2011, June 10) HomeWeb and Android at Home – challenges? [Online]. Available: http://www.webofthings.com/2011/06/10/homeweb-and-android-at-home-challenges/

[4] *Denso-Wave. (2011, October 03)*. QR code: [Online]. Available: https://en.wikipedia.org/wiki/QR_code

[5] Jon Fingas. (2012, August 01). AutoBot [Online]. Available: http://www.mavizon.com/mavia#meet-mavia, http://www.engadget.com/2012/08/01/mavizon-mavia-tracker-reaches-pre-order-at-last/

[6] Matthew Lacey, Helena Lisachuk, Andreas Giannopoulos, & Alberto Ogura. (2015, September 15). IoT for Shipping [Online]. Available: http://dupress.com/articles/internet-of-things-iot-in-shipping-industry/

[7] Ericsson. (2010, june 20)Social Web of Things [Online]. Available: http://www.ericsson.com/thinkingahead/idea/110217_social_network_for_you_1968920151_c

[8] Freedomotic. (2015, April 15). FreeDom - Open Source Home Automation [Online]. Available: http://freedom.disi.unitn.it/, http://www.avsforum.com/forum/162-home-automation/1329017-freedom-open-source-home-automation.html

[9] Smart homes. (2016, April 29). ZigBee Alliance [Online]. Available: http://www.zigbee.org/Ominique Guinard. (2011, December 01) Web of Things [Online]. Available: http://webofthings.org/2011/12/01/

[10] phd-web-of-things-app-archi/ Zanella, Andrea; Bui, Nicola; Castellani, Angelo; Vangelista, Lorenzo & Zorzi, Michele. "Internet of Things for Smart Cities". IEEE Internet of Things Journal, VOL. 1, NO. 1, FEBRUARY 2014.

[11] Wikipedia. (2015, June 26). Internet of Things [Online]. Available: https://en.wikipedia.org/wiki/Internet_of_Things

[12] India: State of the environment document, "Air pollution special reference to Vehicular pollution in urban areas"

[13] Dr. B. Sengupta, "Vehicular pollution control in India technical and non-technical measure policies

[14] N. Kularatna and B. H. Sudantha, "An environmental air pollution monitoring system based on the IEEE 1451 standard for low cost requirements, IEEE Sensors J., vol. 8, pp. 415–422, Apr. 2008.

[15] F. Tsow, E Forzani, A. Rai, R. Wang, R. Tsui, S. Mastroianni, C. Knobbe, A. J. Gandolfi, and N. J. Tao, "A wearable and wireless sensor system for real-time monitoring of toxic environmental volatile organic compounds," IEEE Sensors J., vol. 9, pp. 1734–1740, Dec. 2009.

[16] Y. J. Jung, Y. K. Lee, D. G. Lee, K. H. Ryu, and S. Nittel,"Air pollution monitoring system based on geosensor network," in Proc. IEEE Int. Geoscience Remote Sensing Symp., 2008, vol. 3, pp. 1370–1373.