IoT Based Environment Monitoring Using Wireless Sensor Network

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Abstract – The system of physical object devices, vehicles, buildings and other items embedded with sensors, electronics, software and network connectivity that enables these objects to collect and exchange data, this is called IoT. IoT is expected to generate large amounts of data from diverse locations. IoT is one of the platforms for today's smart city and smart energy management systems. Wireless Sensor Network (WSN) is used to monitor environmental conditions such as sound, pressure, temperature etc. The application requirements are long lifetime, low cost, fast deployment, low maintenance; high number of sensors and high quality of service are considered in the specification. Wireless Sensor Networks (WSN) has been employed to collect data about physical phenomenon in various applications such as habitat monitoring. The Internet of Things (IoTs) can be described as connecting everyday objects like smart-phones, Internet TVs, sensors and actuators to the Internet where the devices are intelligently linked together enabling new forms of communication between things and people, and between things themselves.

Index Terms – wireless sensor networks, Raspberry pi, Zigbee, Sensor node, Sensors.

1. INTRODUCTION

The diversity and quantity of chemicals released into the environment has risen dramatically in recent years. These emissions and their impacts are varied and usually complex. This causes serious concerns about their adverse effects on the ecosystem and on human health. The legacy of land and groundwater contaminated by human activities affects quality of life. Increasing regulatory and economic requirements to monitor and treat pollution in the environment have created a pressing need for reliable, cost-effective monitoring of contaminating compounds in water, soil and sediments. For example, the Integrated Prevention and Pollution Control (IPPC) Directive, 1996; the Landfill Directive, 1999; the Water Framework Directive, 2000 etc. New low-cost effective tools are needed for monitoring pollution and detecting trends over time. Recent advances in wireless communications and electronics have enabled the development of low-cost, low-power, multifunctional sensor nodes that are small in size and communicate untethered in short distances. These tiny and generally simple sensor nodes consist of sensing units, data processing, and communicating components [1], [2], [3]. A large number of such nodes deployed over large areas can collaborate with each.

Fig.1 Concept of IoT in Environment Monitoring

Wireless sensor network (WSN) [1] is a low cost, low power wireless network made up of thousands of smart sensor nodes which monitor physical or environmental conditions, such as temperature, pressure, moisture, etc. at different area or different location. The Internet of Things (IoT) is an emerging key technology for future industries, and environmental monitoring. The Internet of Things (IoTs) can be described as connecting everyday objects like smart-phones, Internet TVs, sensors and actuators to the Internet where the devices are intelligently linked together enabling new forms of

communication between things and people, and between things themselves. Building IoTs has advanced significantly in the last couple of years since it has added a new dimension to the world of information and communication technologies.

2. RELATED WORK

2.1 Wireless Sensor Network:

The figure 4 shows design of sensor node. The main components of a sensor node are a microcontroller, transceiver, external memory, power source and one or more sensors. The controller performs tasks, processes data and controls the functionality of other components in the sensor node.

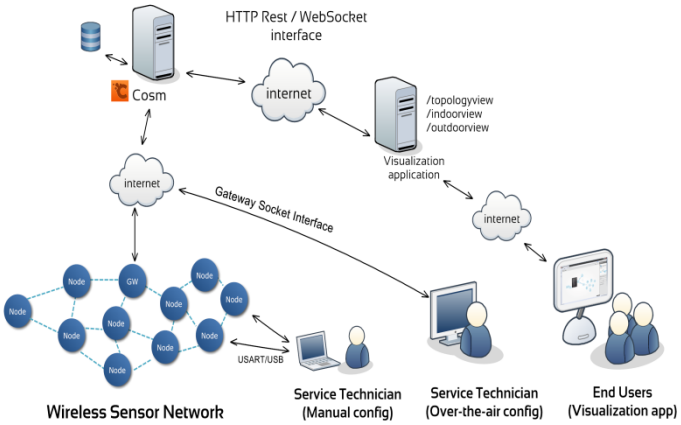

Fig.2 Architecture of WSN

While the most common controller is a microcontroller, other alternatives that can be used as a controller are: a general-purpose desktop microprocessor, digital signal processors, FPGAs and ASICs. A microcontroller is often used in many embedded systems such as sensor nodes because of its low cost, flexibility to connect to other devices, ease of programming, and low power consumption. Transceiver Sensor nodes often make use of ISM band, which gives free radio, spectrum allocation and global availability. The possible choices of wireless transmission media are radio frequency (RF), optical communication (laser) and infrared. Radio frequency-based communication is the most relevant that fits most of the WSN applications. WSNs tend to use license-free communication frequencies: 173, 433, 868, and 915 MHz; and 2.4 GHz.

2.2 Internet of Things:

The Internet of things (stylized Internet of Things or IoT) is the internetworking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society. "The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention.

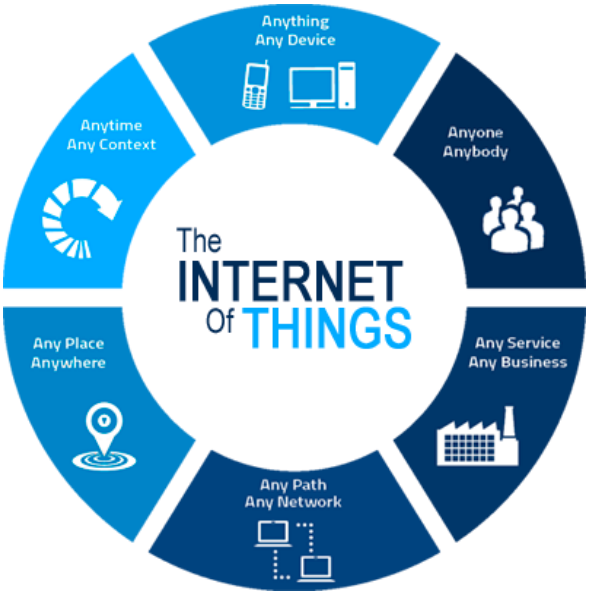

Fig.3 Internet of Things

Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. the vision of the Internet of things has evolved due to a convergence of multiple technologies, including ubiquitous wireless communication, real-time analytics, machine learning, commodity sensors, and embedded systems.

3. PORPOSED MODELLING

Sensor node is a major part in this system it is responsible for information or sensor data. Raspberry pi manages multiple sensor nodes. Design and Implementation of Environment monitoring system using Raspberry-Pi which contains interfacing with various sensors (temperature, Humidity, CO2, Vibration). Real time data will be collected by all the sensors and will be fetched by the Webserver. the gateway node of wireless sensor network, that is raspberry pi (base station) consist of database server and web server in one single-board computer hardware platform, it reduces the cost and complexity of deployment. Sensor node sense the data from the sensor and that data receives the end tag, end tag search the nearest router if router in its range it immediately sends the data to the router, next router to coordinator, here

coordinator is directly communicating with the base station. Base station sends all data to the cloud or Ethernet (Database server). The WSN is built using a coordinator node and several sensor nodes, a workstation and a database.

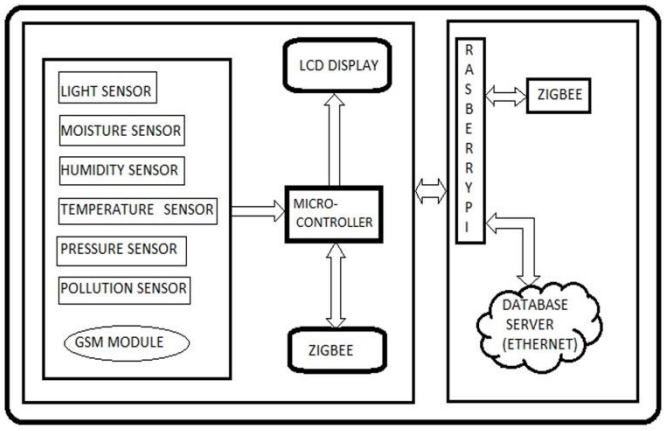

Fig.4 Block diagram of Proposed System

4. RESULTS AND DISCUSSIONS

In wireless sensor network, there are three types of devices: coordinator, router and end tags shows in figure 8. Open source data platform for the Internet of Things provides access to a broad range of embedded devices and web services. So, here one XBee is configured as a coordinator, which is connected with the raspberry pi using UART protocol shows in figure 9,10. Here sensor node is configured as router (R1and R2) and end tag(E52), it will send its real-time data to the nearest router. There is only one coordinator in the network, which communicates with the base station (raspberry pi).

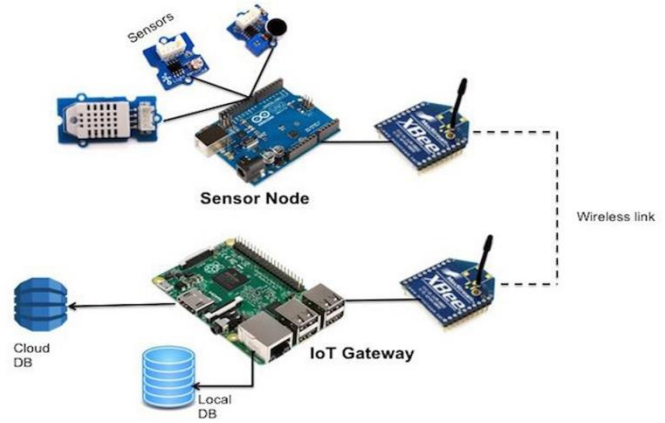

Fig.5 System Design

5. CONCLUSION

Sensor networks have two significant differences from traditional networks, namely nodes have limited processing capability and power and a sensor network may consists of a huge number of nodes. As a result, the traditional layer architecture may not be appropriate since it is designed to support generality, rather than simplicity. As a result, a new architecture is needed which will also help us handle the huge volume of measurement data that the network can generate. This paper designs a wireless sensor network system using Raspberry Pi as a base station, XBee as a networking protocol, sensor node as combination of sensors, controller and zigbee. Hence, we can create sensor-logging application, location-tracking applications, and a social network of things with status updates, so that you could have your location parameter control itself based on your current location. One major advantage of the system lies in the integration of the gateway node of wireless sensor network, database server, and web server into one single compact, low-power, credit-card-sized computer Raspberry Pi, which can be easily configured to run without monitor, keyboard, and mouse. Such a system is very useful in many environmental monitoring and data collection.

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