Implementation of IoT based EMS using LoRa Technology

[1]M. Zahir Ahmed, Lecturer in Physics, Osmania College (A), Kurnool
[2]Shaik Abdul Muneer, Lecturer in Physics, Osmania College (A), Kurnool
[3]Talat Parveen, Lecturer in Physics, KVR Govt. College for Women (A), Kurnool
[4]D.Vijaya Pushpa mani, Assistant Prof. of Physics Rayalaseema University, Kurnool

***Abstract*: Remote device management and data access are made simple with web interfaces and mobile apps, information such as hourly and daily averages is automatically computed, data can also be exported to external programs to perform more sophisticated statistical analysis. Internet of Things (IoT) which has rapidly developed covering hundreds of applications in the civil, health, military and agriculture areas. Eurotech environmental monitoring systems are designed to provide a scalable, efficient and compact solution that integrates multiple sensors in a single, easy to deploy unit. These compact, easy to install environment monitor systems collect and analyze air quality parameters, electromagnetic fields, ionizing radiation levels and sound pollution. With the trend going on in ubiquitous computing, everything is going to be connected to the Internet and its data will be used for various progressive purposes, creating not only information from it, but also knowledge and even wisdom. In this paper, we have reported an effective implementation for Internet of Things used for monitoring and controlling regular domestic conditions by means of low cost ubiquitous sensing system. 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. In devising controls for emission of pollutants, scientists and engineers have developed strategies for monitoring the environmental pollution problems. Environmental monitoring1T 1Tdescribes the processes and activities that need to take place to monitor the quality of the environment**.

***Keywords:* Internet of Things (IoT), WSN, Energy Management, XBEE, Environment**

I. Introduction:

The description about the integrated network architecture and the interconnecting mechanisms for reliable measurement of parameters by smart sensors and transmission of data via Internet is being presented [1]. The healthcare and pharmaceutical industry has one of the most complex and highly regulated supply chains systems. Ensuring the safety, quality and timely delivery of products can be a life or death concern. The costs associated with these efforts are rising and it's becoming harder to proactively monitor the supply chain without innovation and technology. rfxcel addresses these supply chain challenges with its investment into IoT technology for the Environmental Monitoring Software.

Fig.1: IoT connectivity with Environment

The as shown in Fig.1 environmental sensing system is also able to corresponding loads based on the decisions taken by remote user or server. The longitudinal learning system is able to provide self-control mechanism for better operations of the devices in monitoring stage[2]. Along with the environmental conditions system is also able to provide home security based on alarms input. The IoT has a large role to play in future smart cities.

II. Sensor node communication:

Sensor-enabled devices can help monitor the environmental impact of cities, collect details about sewers, air quality, and garbage. Such devices can also help monitor woods, rivers, lakes, and oceans. The novelty of the system is the Internet working mechanisms, which are practicable to integrate with co-modules like intelligent home monitoring systems for wellness determination of inhabitants. The system incorporates XBee for communication between Wireless Sensing Nodes and Gateway as shown in Fig 2.

Internet of Things (IoT) is an ideal emerging technology to influence the internet and communication technologies. Communications in the LoRa IOT Home Environment Monitoring System is currently one-way from the remote station to the gateway; that is, the gateway is always receiving and does not transmit, and the remote stations periodically transmit but receivers are never enabled. As the LoRa wireless links have proven to be very reliable in a home environment, the complications that come with implementing a two-way protocol in the system did not seem warranted[3]. Remote stations send updates asynchronously at intervals of approximately ten minutes. The transmissions are very short, so the probability of transmissions from two stations colliding is very low.

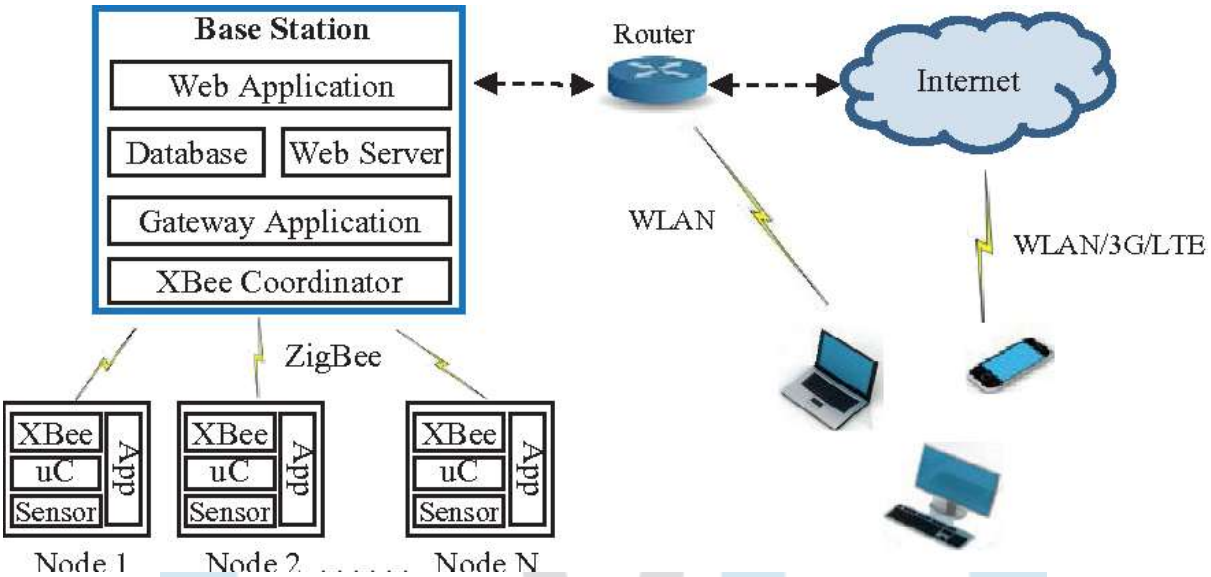

Fig:2. Sensor node communication using IoT

Simply "Internet of Things" connects living and non living "things" through "internet". Traditionally in the object oriented paradigm everything in the world is considered as an object, but in the IoT paradigm everything in the world is considered as a smart object, and allows them to communicate each other through the internet technologies by physically or virtually. IoT allows people and things to be connected Anytime, Anyplace, with anything and anyone, by using ideally in any path/network and any service[4].

This is a community-led air quality sensing network that allows anyone to collect very high resolution readings of NO_2 and CO concentrations outside of their home. Sensor networks are also being deployed in tunnels to monitor air flow, visibility, and a range of gases (CO, CO_2, NO_2, O_2, SH_2 and PM-10). sensor networks measure temperature, humidity and similar parameters on highways to qualify them as 'smart roads'.

2.1.LoRa Technology:
LoRa is a long-range, low-power, low-bitrate, wireless telecommunications system, promoted as an infrastructure solution for the Internet of Things: end-devices use LoRa across a single wireless hop to communicate to gateway(s), connected to the Internet and which act as transparent bridges and relay messages between these end-devices and a central network server. This paper provides an overview of LoRa and an in-depth analysis of its functional components. The physical and data link layer performance is evaluated by field tests and simulations.
Another range of protocols and technologies has emerged to fulfill the communication requirements of the IoT: Low-Power Wide Area Networks (LPWAN). Colloquially speaking, an LPWAN is supposed to be to the IoT what WiFi was to consumer networking: offering radio coverage over a (very) large area by way of base stations and adapting transmission rates, transmission power, modulation, duty cycles, etc., such that end-devices incur a very low energy consumption due to their being connected.

III. Environmental Sensing System:

At a fraction of the volume of a traditional environmental monitoring station, Eurotech systems are suitable both for fixed and mobile installations. In modern greenhouses, several measurement points are required to trace down the local climate parameters in different parts of a large scale greenhouse in order to ensure proper operation of the greenhouse automation system. Cabling would make the measurement system expensive, vulnerable and also difficult to relocate once installed. This paper presents a WSN prototype consisting of MicaZ nodes which are used to measure greenhouses' temperature, light, pressure and humidity. Measurement data have been shared with the help of IoT. With this system farmers can control their greenhouse from their mobile phones or computers which have internet connection. Environmental monitoring is a broad application for the Internet of Things. It involves everything from monitoring levels of ozone in a meat packing facility to monitoring national forests for smoke[5]. Using IoT environment sensors for these various applications can take an otherwise highly labor-intensive process and make it simple and efficient. Air quality is of great importance for human health and life expectancy.
3.1.Waspmote:

Waspmote along with the gas sensors board allows monitoring the following parameters to determine the quality of air we breathe.

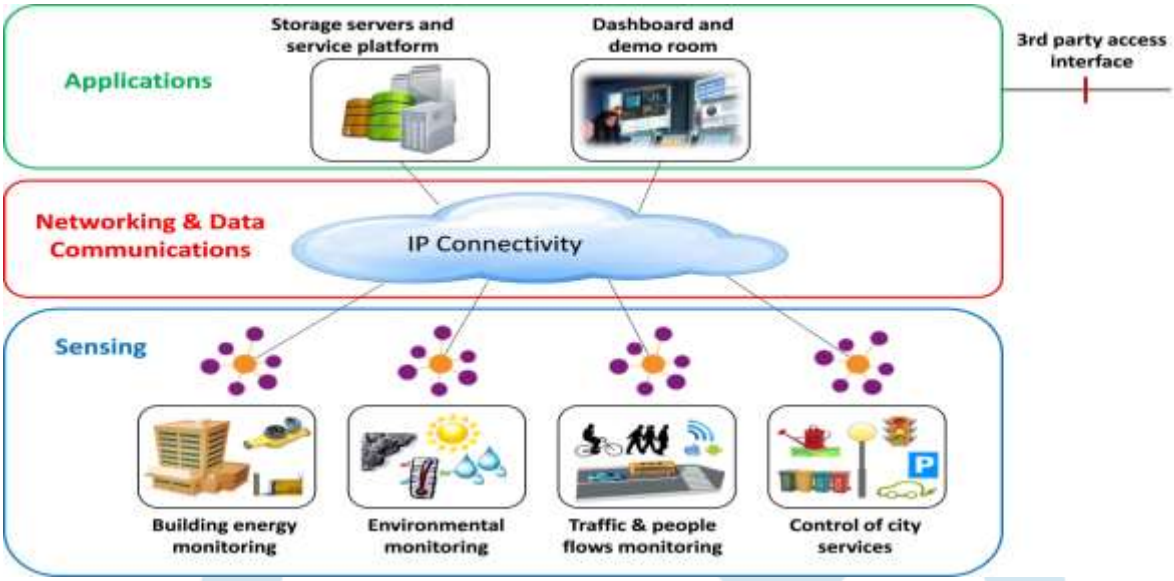

Fig.3.Environment monitoring

It becomes crucial to monitor atmospheric dust in the air of cities. In connection with the development of mobile networks and low-cost sensory agents, it has become possible to create inexpensive environmental monitoring systems. The paper presents results of studies on the system monitoring dust concentration in city air in Fig3. The system consists of moving IoT agents placed on vehicles (taxies, busses, private cars) and measure the dust concentration. Agents, using a wireless connection, are sending the data to the recording server. The server application collects the data and visualises them on the map in a certain colour, depending on the dust concentration in the air and the values acceptable by standards[6]. The system architecture, the algorithm of measurements and the agent-server data exchange protocol were presented in the article, as well as the example of data visualisation.

IV. Environmental Monitoring Software (IoT)

Fig: 4. Software based Environment monitoring

Based on the latest IoT (Internet of Things) technology, rfxcel enables live monitoring of products in the supply chain. With this technology, companies can now take corrective action in real time instead of discovering the issue after it is too late. The real-time nature of rfxcel Environmental Monitoring provides the opportunity for cost savings and competitive differentiations. rfxcel Environmental Monitoring provides a rich set of monitoring capabilities to track a diverse set of industry needs. Examples of this include not only temperature monitoring but also: Geo-Fencing to ensure that shipments do not deviate from predetermined routes or shipping/receiving locations.

4.1. Data Collection

This software fig 4. Manages sensing, measurements, light data filtering, light data security, and aggregation of data. It uses certain protocols to aid sensors in connecting with real-time, machine-to-machine networks. Then it collects data from multiple devices and distributes it in accordance with settings. It also works in reverse by distributing data over devices. The system eventually transmits all collected data to a central server [7].

4.2. Device Integration

Software supporting integration binds (dependent relationships) all system devices to create the body of the IoT system. It ensures the necessary cooperation and stable networking between devices. These applications are the defining software technology of the

IoT network because without them, it is not an IoT system. They manage the various applications, protocols, and limitations of each device to allow communication.

4.3. Real-Time Analytics

These applications take data or input from various devices and convert it into viable actions or clear patterns for human analysis. They analyze information based on various settings and designs in order to perform automation-related tasks or provide the data required by industry[8].

4.4. Internet Accessible Dashboard

Fig:5. Environment monitoring Dash board

V. Conclusion:

Many environmental trends are so complex, that they are difficult to conceptualize. The basic operations include remote management and control of domestic devices such as electric lamp; water heater etc., unobtrusive monitoring of domestic utilizations and providing ambient intelligence to reduce the energy consumption through IoT technology are the key functions of the developed system[9,10]. This will support and reschedule the inhabitant operating time according to the energy demand and supply. Also safety aspects such door open, lockers will also monitored and alarms will be raised. Averting environmental pollution is one of the tedious tasks since the humans are responsible for this hazardous nature which poses threat to whole world. And we are responsible to eradicate pollution problems. The measured parameters from the sensors are continuously updated and is thus viewed by the user using the EMS(Environmental Monitoring System) application. Thus the data is directly accessed and is purely independent of third parties.

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