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Smart Sensors for Industrial Monitoring in IOT Environment

[1]S.ARAVINTH, [2]S.K.MANIKANDAN

[1]Master of Engineering, Embedded System and Technologies (EEE), Velalar College of Engineering and Technology, Erode, India,
[2]Assistant Professsor (Sr.Gr), EEE, Velalar College of Engineering and Technology, Erode, India

Abstract: **Increased levels of particulate matter (PM) in the atmosphere have contributed to an increase in mortality and morbidity in communities and are the main contributing factor for respiratory health problems in the population. Currently, Concentrations are sparsely monitored; for instance, a region of over 2200 square kilometers surrounding Melbourne in Victoria, Australia, is monitored using ten sensor stations. This paper proposes to improve the estimation of PM concentration by complementing the existing high-precision but expensive PM devices with low-cost lower precision PM sensor nodes. Our evaluation reveals that local PM estimation accuracies improve with higher densities of low-precision sensor nodes. Our analysis examines the impact of the precision of the lost-cost sensors on the overall estimation accuracy.**

Keywords: **Sensor nodes, Enterprise information systems Internet of Things.**

I. INTRODUCTION

Environmental issues such as climate change have received much attention in recent years, and environmental monitoring, modeling, and management enable us to gain a deeper understanding of natural environmental processes. Environmental monitoring and management is a broad area focusing on using scientific and engineering principles to improve environmental conditions. How to effectively monitor, model, and manage environmental processes is a critical task for both scientists and engineers.

The rapid development and wide application of environmental informatics has significantly improved environmental monitoring, management efficiency, and effectiveness. However, both the DSSs and enterprise information systems (EISs) (or IEISs) were implemented to help locate and analyze environmental problems rather than to solve any environmental problems in reality.

In the last decade, the Internet of Things (IoT), a concept describing how the Internet extends into people's everyday lives through a wireless network of uniquely identifiable objects is predicted to be able to promote the entire process of environmental monitoring, modeling, and management, as well as to support sustainable decision-making. This project focuses on the IoT application in the new generation of environmental informatics, and provides a new paradigm for environmental monitoring and management in the future.

Wireless Sensor Networks (WSN):

A Wireless sensor network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and soon.

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a ZigBee transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

Sensing and the digital data harvest:

The recent developments in technology capabilities across each of the core processes involved in sensing and monitoring—data collection, infrastructure connectivity, and data mining and analysis. It also looks at how sensing and monitoring processes are evolving in ways that no longer require human intervention, using the communications infrastructure of the internet through the 'internet of things' and machine-to-machine communications using mobile and internet-based technologies.

Collecting data:

Sensors are fundamental elements of all machines that gather data, require feedback for their operation or are required to provide a Human Machine Interface (HMI). Purpose-specific sensors that are observable by instruments have been developed to enhance the scope and range of measurements. Electronic sensors based on semiconductor devices have been integrated with computers and communications networks to provide useful information-gathering solutions.

The application of monitoring plays an important role in collecting sufficient relevant information to achieve the desired outcomes of the process. Some monitoring systems are required to make observations from multiple remote and dispersed sensors that in turn require a single communications network path to transport individual sensor data to a point of aggregation and analysis. Where multiple sensors are concentrated over a smaller area, an underlying sensor–mesh network may be used to aggregate data prior to data transport over a communications network. The frequency and accuracy of sensor observations may also determine monitoring system design and particularly the proportion of resources that are sensor-, communications- and analysis-based.

II. TECHNICAL DESCRIPTION

Sensors require a network of interconnecting infrastructure to communicate and process the information required for services and monitoring applications. The availability of fixed-access and wireless mobile networks has guided the evolution of sensing by providing bidirectional connectivity for associated monitoring and control. Third-party integrators dominate systems development to provide novel and fragmented solutions across different industry sectors. These solutions tend to be dedicated, proprietary in nature and lacking interoperability.

Sensor network: comprising sensors and an independent power source such as a battery or solar source

USN access network: intermediary or 'sink nodes' collecting information from a group of sensors and facilitating communication with a control centre or external entities

Network infrastructure: likely to be based on a next-generation network (NGN)

The Internet of Things:

More data originates from the operation of deployed sensors that have minimal human intervention than from user interfaces to equipment and peripheral devices such as keyboards. Using the communications infrastructure of the internet, widely distributed sensors and actuators form an electronic ecosystem known as the 'internet of things'. Emerging areas of activities for the internet of things can be cast into two broad categories:

1) Data information and analysis

2) Automation and control

As technology and networks link more things, increasing volumes of information and improved data analysis is available for decision-making. For example, embedded mobile devices can track location information and usage behaviors to provide information that allows for more cost-effective management of assets. Data monitoring of environments and infrastructure can also result in information to enhance situational awareness of weather, traffic and buildings. Long-range analytics can also be applied to historical sensor data to assist in planning, marketing and investment. In retail, historical data may be used to profile purchase choices and directly market similar products. In health care, long-term continuous monitoring may provide better diagnosis and subsequent treatment not otherwise identified.

The automation and control category generally uses sensor data derived from a particular process and subsequent analysis in feedback loops to modify and improve that process. This can be as simple as water irrigation in response to soil moisture sensors. The key objective is process optimization, whether it is for quality, time and waste reduction, energy efficiency or human intervention. More complex autonomous systems involve real-time sensing of unpredictable conditions and require instantaneous autonomous responses.

III. PROPOSED WORK

This project introduces a novel IIS that combines Internet of Things (IoT), Cloud Computing, Geo-informatics [remote sensing (RS), geographical information system (GIS)], and e-Science for environmental monitoring and management, with a study on regional climate change and its ecological effects. Multi-sensors and web services were used to collect data and other information for the perception layer; both public networks and private networks were used to access and transport mass data and other information in the network layer.

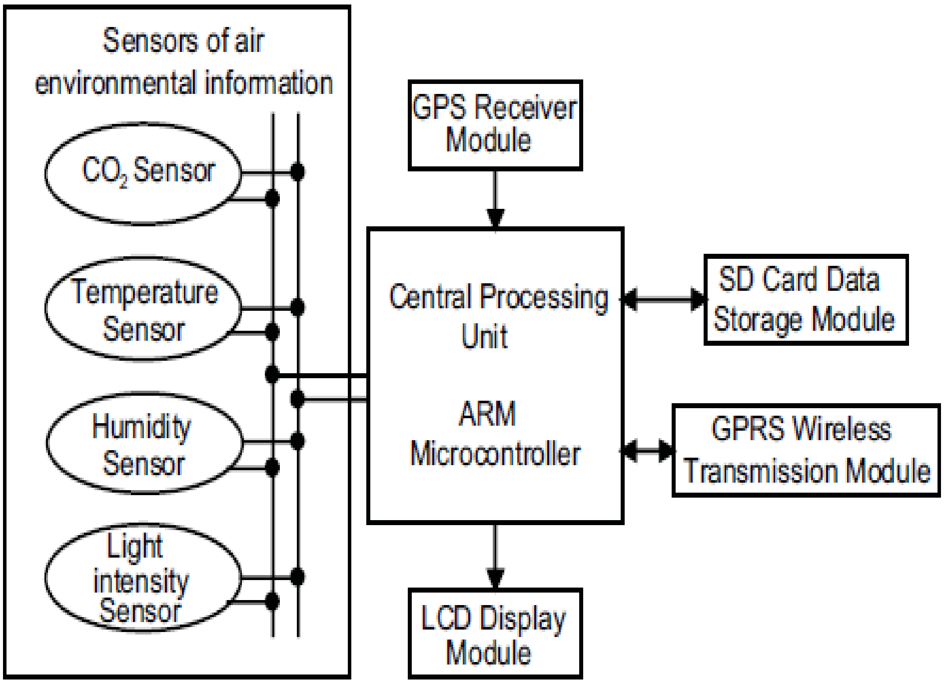

Fig.1. Block diagram of proposed method

A carbon dioxide sensor or CO2 sensor is an instrument for the measurement of carbon dioxide gas. The most common principles for CO2 sensors are infrared gas sensors (NDIR) and chemical gas sensors. Measuring carbon dioxide is important in monitoring indoor air quality, the function of the lungs in the form of a capnograph device, and many industrial processes. NDIR sensors are spectroscopic sensors to detect CO2 in a gaseous environment by its characteristic absorption. The key components are an infrared source, a light tube, an interference (wavelength) filter, and an infrared detector. The gas is pumped or diffuses into the light tube and the electronics measures the absorption of the characteristic wavelength of light.

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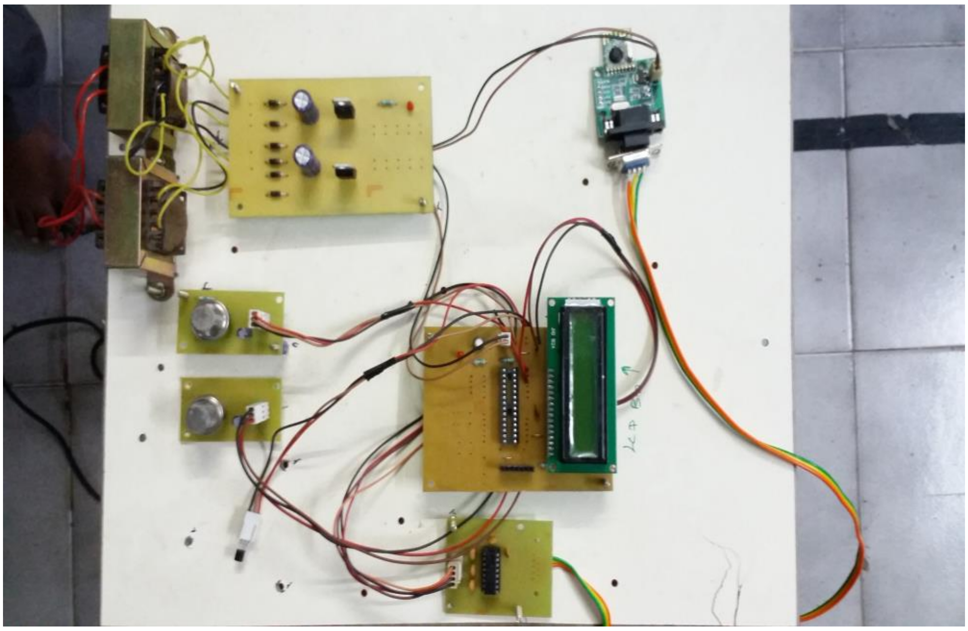
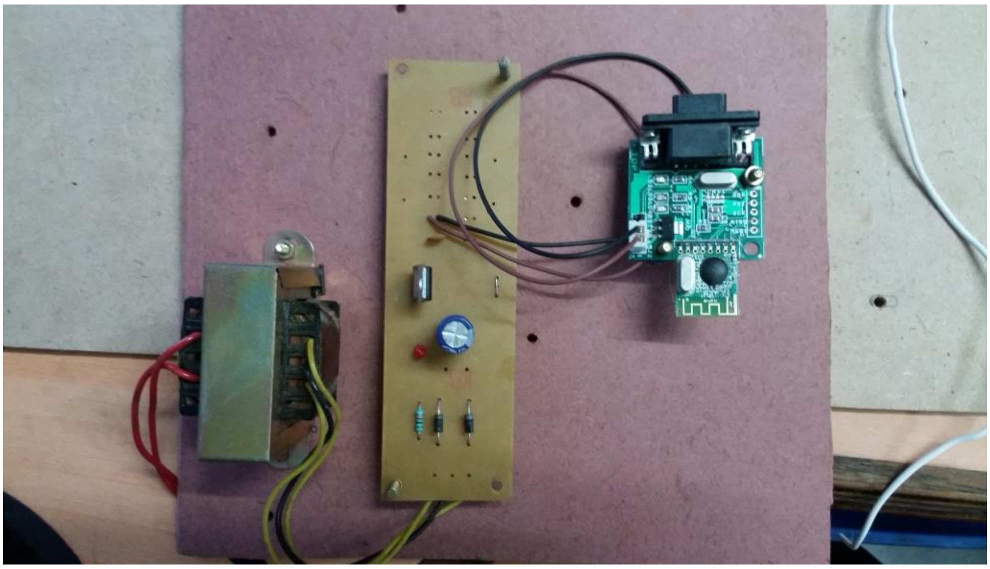
Hardware Implementation:

Transmitter module:



Receiver module:



NDIR sensors are most often used for measuring carbon dioxide.[1] The best of these have sensitivities of 20–50 PPM. Typical NDIR sensors cost in the (US) $100 to $1000 range. New developments include using microelectromechanical systems to bring down the costs of this sensor and to create smaller devices (for example for use in air conditioning applications). NDIR CO2 sensors are also used for dissolved CO2 for applications such as beverage carbonation, pharmaceutical fermentation and CO2 sequestration applications. In this case they are mated to an ATR (attenuated total reflection) optic and measure the gas in situ. Another method (Henry's Law) can be also be used to measure the amount of dissolved CO2 in a liquid, if the amount of foreign gases is insignificant. A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other.

IV. EXPERIMENTAL RESULTS

The simulation helps us to develop a prototype which is used for temperature, CO2, NH4 sensors, sensor output is given as a input to controller it examines the value with the maximum limit if the sense value is less than maximum means it is showing as normal.

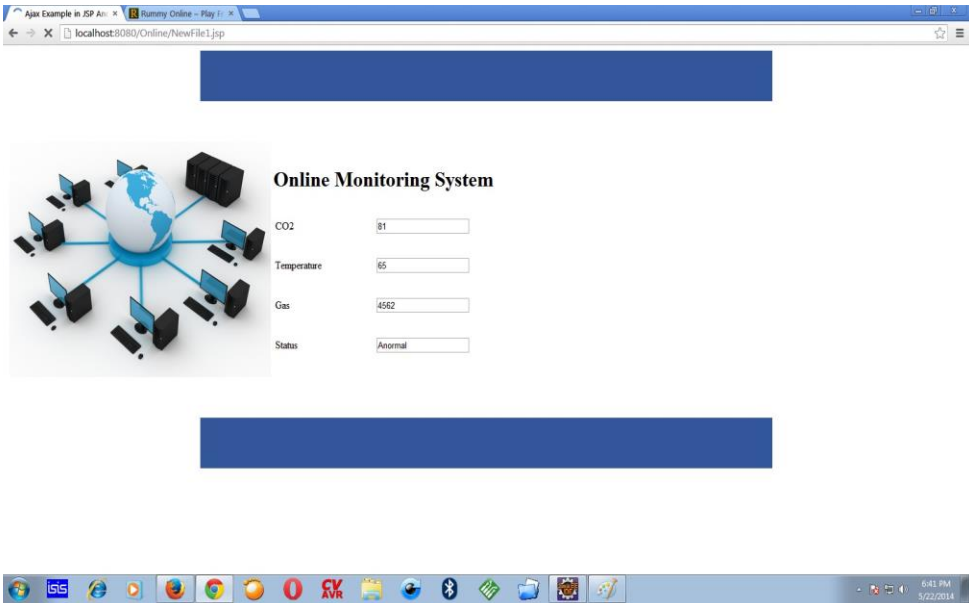
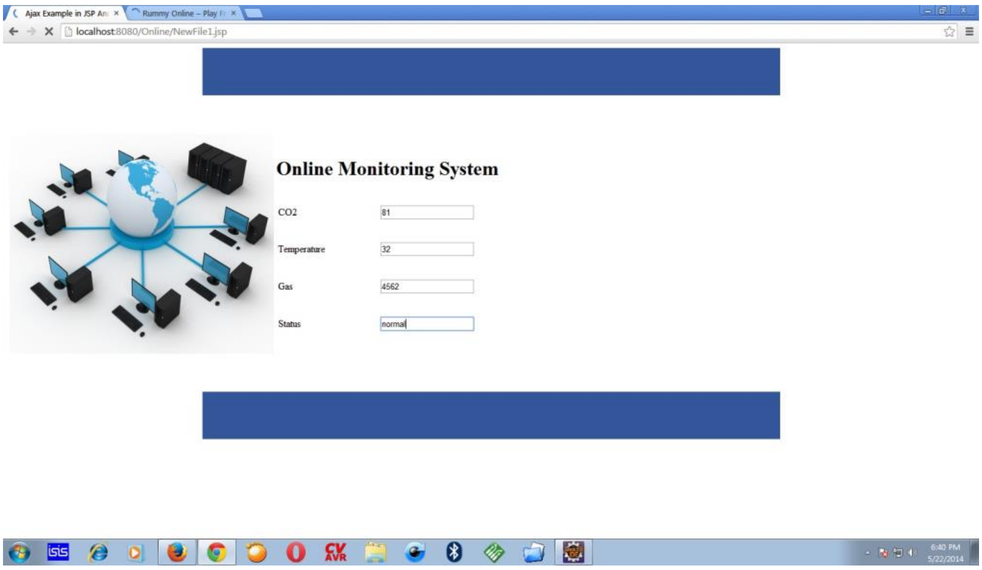


Fig.2. Simulation Output

The sense value is periodically displayed in LCD as well as it is sent to clients through internet of WI-FI. If any of these three values become higher than the maximum limit controller will show Abnormal value is sensed in particular sensor.



Here the temperature sensor value exceeds the limit so the controller shows abnormal temperature in the LCD and also makes the motor connected with the controller to run.

V. CONCULUTION

In this project making use reconfigurable smart sensors for industrial WSN in IoT environment. The system can collects data intelligently; it is very suitable for real-time and effective requirement of high speed data acquisition in IoT environment. The application of smart sensor and IoT greatly simplifies the design of peripheral circuit, and makes the whole system more flexible and extensible. The CO2, temperature, Methane sensors suitable for monitoring in order to realize remote real-time acquisition of multivariate information for Climate and environmental Changes.

In future, the Implementation of functions sensing, storing, organizing, processing, sharing of data and other information, configurations factors such as security and reliability will be considered. web services were used to collect data and other information; both public networks and private networks were used to access and transport mass data and other information in the network layer. The other parameters such as jitter and bandwidth can also be taken to improve the performance even better.

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