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The Effective Methodology For Iot Based Weather Monitoring System

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Abstract

Monitoring the meticulous weather conditions requires large data requirements for many applications such as agricultural, atmospheric nature etc. The process for making this large data to read and record for further and forecasting applications with minimal errors needs more attention to the design engineers. Also, it is very imperative to minimise the human participations to reduce the data errors plays a vital role in day to day life. Presently, data loggers are using in most applications and identified the considerable disadvantages such as break down and malfunctions in operations. In view of this authors are attempted to develop an advanced solution system for monitoring the meticulous weather condition. In order to make the proposed system in to an advanced and efficient solution, Internet of Things (IoT) is one of the key leading technology is used. The Internet of Things technology performs the operations of connecting the things to the internet and to connect the entire world of things in a network. The present work is developed an automated system which monitors the weather system automatically and makes the data read and recording for future applications. The proposed system is developed to collect humidity and gas data automatically. Also, the proposed system stores the recorded data according to current and previous data and shows the results in graphical manner.

1. Introduction

Weather parameters such as temperature, pressure, wind velocity, humidity etc. are the key parameters for several needs in day to day human life. These parameters involves significant forecasting results on different service applications such as agriculture, environmental impacts etc. Recent years dictates that, sophisticated results on weather monitoring system made human lives in safe side [1] [2]. Improper monitoring errors results in step in to hazardous situations of environment surrounding to living organisms. Therefore, the collection of these parameters data and storing, monitoring of data with minimal human errors is most important task to the design engineers. In order to overcome many engineers are used various software applications, microcontrollers, sensors, data loggers etc. [3] Recent advanced technologies supports the monitoring of these weather parameters in online and transferring the recorded data in online with minimal data errors. Identification and developing a suitable software solution to monitoring the weather parameters in online and transferring the recorded data in online with minimal data errors is much need to present day to day life. Internet of Things (IoT), is the most efficient and advanced software technology which supports to monitor and store the recorded data in online [4] [5]. Hence, authors are concentrated to develop a advanced and efficient system solution using combinations of sensors microcontrollers for weather monitoring system automatically in online with minimal errors. The proposed work aims to smart weather reporting system over the internet [6]. Also, the proposed system allows for reporting the weather parameters over the internet and allows the people to check the weather condition status in online directly without the need of a weather forecasting agency. System uses temperature, humidity, sound as well as CO sensor to monitor weather and provides live reporting of the weather statistics. The system constantly monitors humidity using humidity sensor and also for CO [7]. The system constantly transmits this data to the Adriano microcontroller, which now processes this data and keeps on transmitting it to the online web server over a Wi-Fi connection and to PC [8]. This data is live updated to be viewed on the online server system. Also system allows user to activate alerts for meticulous instances and also allows for the system to provide activation alerts to users for crossed set values of weather parameters. This authenticates that, the proposed developed system of IoT based

weather reporting system provides an efficient internet based weather reporting system for users. Therefore, this paper presents the proposed advanced and efficient solution system which supports the automatic online monitoring system [9].

2. Existing System

In recent years, many monitoring systems are designed for pollution monitoring systems with considering different environmental parameters taken in to account. Existing system models [10] [11] uses the zigbee based wireless sensor networks for monitoring the physical and environmental conditions with thousands of application in different fields. RFID [12]is a type of storing and retrieving data through electromagnetic transmission for RF based compatible integrated circuit. Usually, it is used to label and track items in supermarkets and manufacturing industries. RFID system consists of two major components one is tags and others is readers. A tag has an identification (ID) number and a memory that stores additional data such as manufacturer, product type, and environmental factors such as temperature, humidity, etc. The other one, reader is able to read and/or write data to tags via wireless transmissions. In a typical RFID application, tags are attached or embedded into objects that are in need of identification or tracking. RFID [13] tags may be classified into three major categories in view of its power source and they are active tags, passive tags, and semi passive (semi-active) tags respectively.

Mobile phones or smart phones that are enabled with sensors may have impact on socio-economical way including how the mobile technology was to be used for environmental protection, sensing and to influence just-in-time information to make immediate movements and environmental friendly actions [14]. Mobile phone sensors are deployed and used on urban areas for monitoring and it was categorized into two major classes, one is participatory sensing where user is directly involved and other one is opportunistic sensing where user is not involved, but its limitation includes power and static information processing or mobility restrictions respectively. A wireless sensor network consists of many inexpensive wireless sensors, which are capable of collecting, storing, processing environmental information, and communicating with neighbouring nodes. In past, it is observed that the sensors are connected with wire lines. The access method of WSN gateway [15] node is convenient due to data receiving data from WSN through the gateway at any stipulated time and place and the gateway acts as the parameter in this type of operations. Network coordinator in charge of node authentication, message buffering where you can collect, process, analyze, and present your measured data. The model comprises with wireless sensor network management consists of end device, router, gateway node and management monitoring centre. End device is responsible for collecting wireless sensor network data, and sending them to parent node, then data are sent to gateway node from parent node directly or by router. After receiving data from wireless sensor network, gateway node extracts data after analyzing and packaging them into ethernet format data and allows sending data to the server [17].

A server is an instance of a computer program that accepts and responds to requests made by another program named as client [18]. Less formally, any device that runs on server software can be considered as server as well. Servers are used to manage network resources [19] [20]. The services or information in the servers are provided through the Internet that are connected through lan and made available for users via smart phones, web browser or other web browser devices to make the system more intelligent, adaptable and efficient.

3. Disadvantages of Existing System

a) It requires the knowledge for the system to owner to respond zigbee compliant devices.
b) It is not secure like wifi type based secured system.
c) Replacement cost will be high in view of any problem occurs in zigbee compliant home appliances.
d) Like other wireless systems, zigbee based communication is prone to attack from unauthorized people.

e) The coverage is limited and hence cannot be used as outdoor wireless communication system. It can be used in indoor wireless applications.

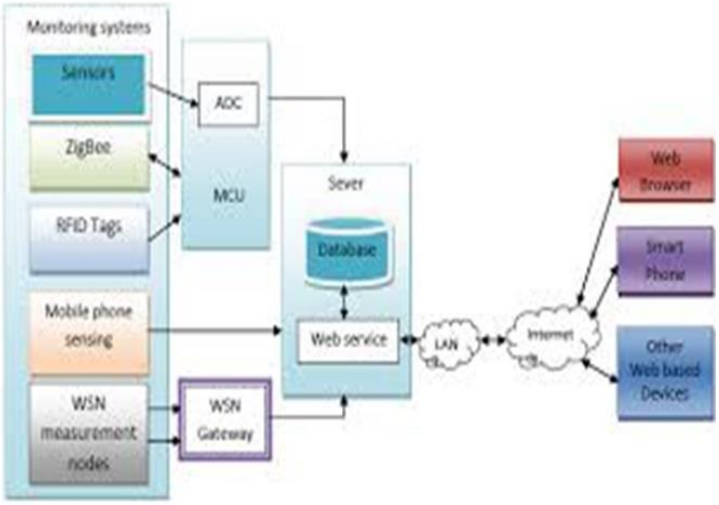

Figure 1. Existing Model

4. Proposed System

The proposed system uses the IoT technique based embedded device for monitoring humidity, pressure, and CO levels in the atmosphere to make the environment intelligent or interactive with the objects through wireless communication. The proposed model is further adaptable and distributive in nature to monitor the environmental parameters. The proposed architecture was discussed in a four - tier modules with the functions of each individual module developed for noise and air pollution monitoring. The tier 1 module is designed for environment in support of sensor devices. In tier 2 module, sensor data acquisition and decision making process was developed in tier 3 and lastly intelligence for environment was designed in tier 4 modules respectively. Here, the tier 1 module provides information about the parameters under the region which is to be monitored for noise and air pollution control. In continuation tier 2 module deals with the sensor devices with suitable characteristics, features and each of these sensor devices are operated and controlled based on their sensitivity as well as the range of sensing. In between tier 2 and tier 3 modules, necessary sensing and controlling actions will be considered depending on the conditions, such as fixing the threshold value, periodicity of sensing, messages (alarm or buzzer or LED) etc.

Based on the data analysis performed in between tier 2 and tier 3 and also from previous experiences the parameter threshold values during critical situations or normal working conditions are determined. Tier 3 describes about the data acquisition from sensor devices and also includes the decision making. Which specify the condition the data is representing which parameter in the proposed model. Lastly, tier 4 module deals with the intelligent environment. This performs the action of identifying the variations in the sensor data and fixes the threshold value depending on the identified level of CO. In this module 4 sensed data will be processed, stored in the cloud i.e.in to the google spread sheets and also it will show a trend of the sensed parameters with respect to the specified values. The end users can browse the data using mobile phones, PCs etc.

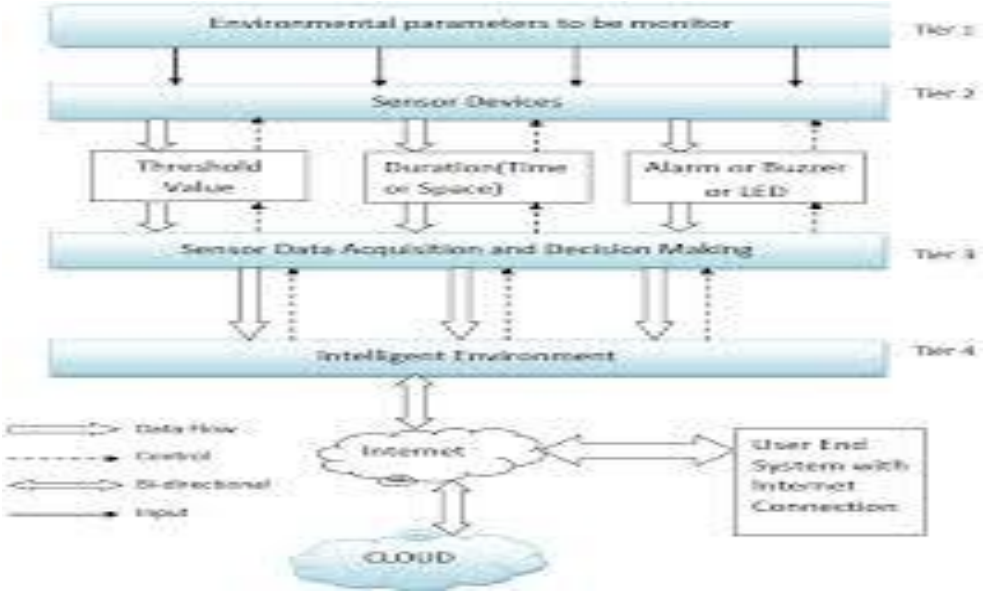

Figure 2. Proposed Systems

5. Applications of Embedded System

In recent days, it is observed that the variety of information about these embedded controllers in many places. The ongoing computer operations such as compose of mails or create a document or analyze the database is known as the standard desktop computer. These desktop computers are manufactured to serve many purposes and applications. It is needed to install the relevant software to get the required processing facility. So, desktop type computers can do many things. In contrast, embedded controllers carry out a specific task of work for which they are designed. Most of the time, engineers design these embedded controllers with a specific goal in mind

a) Military and aerospace software applications

From in-orbit embedded systems, jumbo jets, vital battlefield networks, designers of mission-critical aerospace and defence systems requiring real-time performance, scalability, and high-availability facilities consistently turn to the Lynx OS® RTOS and the LynxOS-178 RTOS for software certification to DO-178B. Rich in system resources and networking services, Lynx OS provides an off-the-shelf software platform with hard real-time response backed by powerful distributed computing (CORBA), high reliability, software certification, and long-term support options.

b) Electronics applications and consumer devices

In wireless appliance revolution, web-enabled navigation systems, radios, personal communication devices, phones and PDAs all benefit from the cost-effective dependability, proven stability and full product life-cycle support opportunities associated with blue cat embedded linux. Also, for makers in low-cost consumer electronic devices who wish to integrate the lynx OS real-time operating system into their products, the proposed system offers special MSRP-based pricing to reduce royal fees to a negligible portion of the device's MSRP.

6. Literature Survey

Firstly the survey was conducted on standard technologies to establish a standard sensor network [1] [2] [3] [4]. Studies are continued on choosing the suitable standard sensors. It should be suitable in all aspects like economic and technological [5]. After reviewing this, the next choice to be made on about the

communication method to be used depending upon the range of communication which will provide and decided to make use of ESP8266 WIFI module [6].
The next concern was to select a microcontroller that would match the other system requirements. As a result, ARDUINO UNO [7], which is low power microcontroller and works with only 2.0V to 5.5 V was chosen. Study went on choosing the suitable wireless technology [8]. It should be suitable in all aspects like economic as well as technological.

Through the weather monitoring system collected [9] the information about humidity and temperature and according to current and previous data it can produce the results in graphical manner in the system. After reviewing many literatures [10] [11], authors are observed that lack papers on monitoring of the combination of temperature, lighting and humidity in single integrated system and need in actuators to modify these settings also. In addition to this, it is observed that, one literature was observed and found that literature discussed monitoring these three environmental conditions [12]. However, there was no mentioning on containing actuators to modify the system. This perturbs that, an idea ignited to design a system that can sense the main components that formulates the weather and can be able to forecast the weather without human error [13] [14]. Ancient weather forecasting methods usually relied on observed patterns of events, also termed pattern recognition [15]. For example, might be observed that if the sunset was particularly red, the following day often brought fair weather. This experience accumulated over the generations to produce weather lore [16].

7. System Testing

The IoT testing is a type of testing to check IoT devices. Today all are need to deliver better and faster services for their applications. There is a huge demand observed to access, create, use and share data from any device. The thrust is to provide the greater insight and control, over various interconnected IOT devices. Hence, IOT testing framework is important.

1) Usability Testing:
There are so many devices of different shape and form factors are used by the users. Moreover, the perception also varies from user to user. That's why checking usability of the system is very important in IoT testing.

2) Compatibility Testing:
There are lot of devices which can be connected though the IoT system. These devices have varied software and hardware configuration. Therefore, the possible combination is huge. As a result, checking the compatibility in IOT system is important.

3) Reliability and Scalability Testing:
Reliability and scalability is important for building an IoT test environment which involves simulation of sensors by utilizing virtualization tools and technologies.

4) Data Integrity Testing:
It's important to check the data integrity in IoT testing as it involves large amount of data and its application.

5) Security testing:
In IoT environment, there are many users are accessing a massive amount of data. Thus, it is important to validate user via authentication, have data privacy controls as part of security test.

Conclusion

In keeping view of the embedded devices in the environment for monitoring enables self protection (i.e., smart environment) to the environment. To implement this, need in deploy the sensor devices in the environment for collecting the data and analysis. Also, deploying sensor devices in the environment, it can bring the environment into real life i.e. it can interact with other objects through the network. Then the collected data and analysis results will be available to the end user through the Wi-Fi. The smart way

to monitor environment and an efficient, low cost embedded system is presented with different models in this paper.

In the proposed architecture functions of different modules were discussed. The air pollution monitoring system with Internet of Things (IoT) concept experimentally tested for monitoring two parameters. It also sent the sensor parameters to the cloud (Google Spread Sheets). This data will be helpful for future analysis and it can be easily shared to other end users. This model can be further expanded to monitor the developing cities and industrial zones for pollution monitoring. To protect the public health from pollution, this model provides an efficient and low cost solution for continuous monitoring of environment.

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