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IoT Based Environmental Parameter Monitoring Using Machine Learning Approach-A Review

Madhuri Kashid[1],Sudha Surwase[2],Kailash Karande[3]

[1]Research scholar (M.Tech), Department of Electronics Engineering,SKN Sinhgad College Of Engineering ,Pandharpur (MH.) 413304. Email: madhurikashid.ingole@gmail.com

[2]Assistant Professor, Department of Electronics Engineering,SKN Sinhgad College Of Engineering ,Pandharpur (MH.) 413304. Email: sudha.surwase@sknscoe.ac.in

[3]Principal,SKN Sinhgad College Of Engineering ,Pandharpur (MH.) 413304. Email: principal@sknscoe.ac.in

A B S T R A C T

Today environment monitoring becomes important for humans to ensure a safe and wealthy life. Monitoring requirements are extremely different, depending on the environment, leading to specially appointed usage that needs adaptability. The proposed system describes an implementation of Internet of Thing network that can be adjusted to various applications and also inserts the adaptability required to be conveyed and updated without necessity of arranging complex infrastructures. The solution is based on small autonomous wireless sensor nodes, small wireless receivers connected to the Internet, and a cloud architecture which provides data storage and delivery to remote clients. The solution permits supervisors on-site not only to monitor the current situation by using their smart-phones but also to monitor remote sites through the Internet. All measurements are stored at different levels to guarantee a safe back-trace and to access data stored in case of network failure or unavailability. The proposed system is useful in measuring the temperature, humidity etc. The prediction of this parameter is by using the Machine learning methods which include the methods like Regressions, Classification etc . The data pre-processing is needed to clean the data by means of error value, validation of data etc . Machine learning models are very powerful and accurate to work on the predictions of the datasets.

Keywords: IoT, Machine learning, Node MCU, Temperature Sensor, humidity Sensor, pressure sensor, Think speak cloud.

1. Introduction

The environmental care has become one of the biggest concerns for almost every country in the last few years. Even though the industrialization level has been increasing without any control in the last decades, the current situation is clearly changing towards more environmentally friendly solutions. Water and air quality are essential to maintain the equilibrium between human development and a healthy environment. It is also important to notice that by means of looking for a more efficient production in factories both pollution and consumption of natural resources can be decreased. Processes, such as boiling, drying, binding, and so forth, are being carried out by almost every kind of the current factories. Those processes are responsible of a great amount of gas emissions and polluted water discharges. Although the majority of the factories have their own sewage plants, it is crucial to measure the quality of the waste water that is being poured into the public sewer. In reality, clean air is a basic requirement for daily life. Air pollution affects human health and considered as a major serious problem globally, especially in countries where gas and oil industries are ubiquitous. According to the United States Environmental Protection Agency (USEPA), the air quality is characterized by measuring certain gases that affect the human health, which are: carbon monoxide (CO),ground-level ozone (O3), and hydrogen sulfide (H2S).

The main intention of environmental monitoring is not only to gather data from a number of locations, but also to provide the information required by scientists, planners, and policy-makers, to enable those making decisions on managing and improving the environment, in addition to presenting helpful information to end-users. There are huge efforts are carried out to improve the air quality in both environments: indoors and outdoors. Habitat and environmental monitoring represent an important class of sensor network applications. Recent advances in low-power wireless network technology have

Madhuri Kashid
E-mail address: madhurikashid.ingole@gmail.com

created the technical conditions to build multi-functional tiny sensor devices, which can be used to sense and observe physical phenomena. Wireless Sensor Networks (WSNs) are currently an active research area due to their wide range applications including military, medical, environmental monitoring, safety, and civilian. Many environmental monitoring examples of WSNs are already presented in the literature and developed for different purposes

1.1. Problem Statement

Environmental monitoring system needs some technical requirements such as high level of system integration, performance, reliability, productivity, accuracy, robustness, flexibility etc. and WSN technology provides reliable solution. Since IoT technology introduced a low-cost, low-power featured hardware and data can be recorded plotted via web server.

Now days the environmental monitoring is most essential thing for human being. The recorded data from IoT server will be used in standard prediction algorithm to predict now casting of present weather situation. The machine learning approach is useful to do these things.

1.2. Objectives

1. To establish communication between sensing unit and processor, processor and communication module.
2. To monitor environmental conditions like temperature, humidity.
3. To update the monitored current environmental condition along with sensor value on the Thing speak cloud.

1.3. Scope

The IoT system offers instant notification in real–time. Hence the temperature monitoring system allows company to track the environmental parameter on secure web/mobile-based platform. Eliminates redundant task like taking manual readings, thus saving time and elevating quick decision making. The system Can be used in Industries where short distance communication is required. Device can controlled more comfortably.

2. Methodology

2.1 . Block Diagram:

IoT is currently an active research area due to its wide range applications including military, medical, environmental monitoring, safety, and civilian. Many environmental monitoring examples of WSNs are already presented in the literature and developed for different purposes.

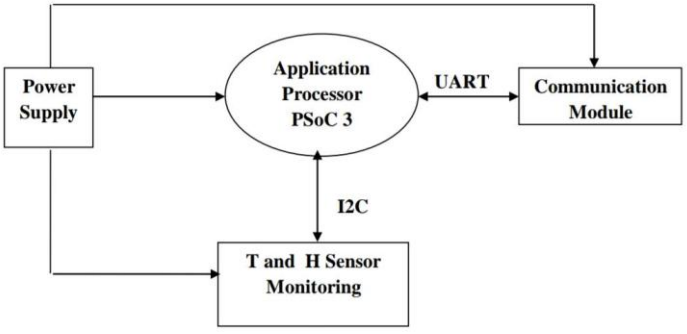

Fig. 1 - Block Diagram [12]

The two sensors that communicate using Wi-Fi technology are based on the same hardware, the difference between the two consisting in the protocol that was used, namely UDP or HTTP. The generic architecture of the devices based on Wi-Fi technology is presented in Fig .1. It consists of the application processor, programmable system on chip microcontroller (PSoC 3) produced by Cypress Semiconductor, temperature and humidity sensor all powered by using a battery . The choice of using a separate application processor removes the possibility of interfering with the communication stack. Therefore, the processor in the developed devices is in charge with performing all the actions for the proper operation of the device, namely, power management, acquisition of data from the sensing unit, and communication. For transmitting the data to a base station, a serial link between the PSoC 3 device and the communication module, and an API (application programming interface), called WiFly, and are used. The motivation for selecting the wireless module consists in its low-power operation, providing 4 μA during sleep and short 210 mA pulses during transmission. The development of other cheaper wireless modules based on the IEEE 802.11 set of standards, such as the ESP8266 from Express if, will multiply the range of possible solutions. However, with a current larger than 20 μA in deep sleep mode, newer approaches for achieving power efficiency in the designs using it will have to be investigated.

2.2 . Environmental Monitoring System Based on UDP Communication

Fig. 2 - Environmental Monitoring System based on UDP Communication [12]

UDP-based cyber-physical system for monitoring the temperature and humidity in the environment or ambient in this advantage of the existing IEEE 802.11 infrastructure for sending measurement information to a cloud-based server platform and provides the possibility of visualizing the data from every device with an Internet connection. In fig 2 Using UDP allows the low-power operation of the Wi-Fi sensors, because of its connectionless nature. Furthermore, this protocol provides lower packet sizes, increased speeds and low latency, compared to TCP/IP. All these come at a price, namely, a loss in transmission reliability, because there is no acknowledge message received for the packets being sent. The server platform can reside in the Think speak cloud , or can be an UDP listener running on a computer, that can interpret the received data, store them in a database, and provide the possibility of visualizing and processing them according to the user's needs, through a Web server .

2.3.Server Selection

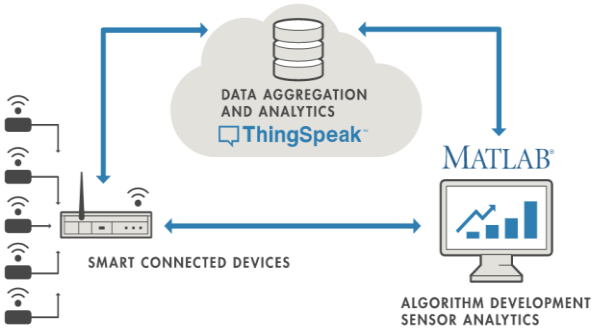

Fig. 3 - Think Speak Server Operation [13]

Internet of Things (IoT) describes an emerging trend where a large number of embedded devices (things) are connected to the Internet. In fig.3 ,these connected devices communicate with people and other things and often provide sensor data to cloud storage and cloud computing resources where the data is processed and analyzed to gain important insights. Cheap cloud computing power and increased device connectivity is enabling this trend.
IoT solutions are built for many vertical applications such as environmental monitoring and control, health monitoring, vehicle fleet monitoring, industrial monitoring and control, and home automation.

3. Conclusion

Environmental monitoring is a tricky activity as the environmental conditions can easily change from point to point even at small distances. The technique is used to monitor the environmental conditions at remote locations effectively because of reduction in power consumption, size, flexibility, IoT access etc. The system can extended to have observations at different locations with smallest distance between them.

4. Future Scope

We can extend this system to have monitoring of various other parameters like gas, air quality .It will be helpful to get the predictions of all these observations. We can also predict the weather condition from monitored parameter. we can able to implement this system such a way that, if we can programme web server to get the live predictions for all these parameters .It is also possible that we can use deep learning algorithms with machine learning models to get the more precise results.

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