International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

ADAPTIVE CYBER PHYSICAL SYSTEM FOR MONITORING ENVIRONMENTAL STATUS

M.ANIL KUMAR, KARTHIK KUMAR

PG Scholar Dept of ECE, Balaji Institute of Technology & Science

Assistant Professor Dept of ECE, Balaji Institute of Technology & Science

Abstract - CYBER PHYSICAL SYSTEMS(CPS) represents a new generation of digital systems,where cyber entities and physical devices cooperate towards a set of common goals.This paper presents that the CPS monitors the environmental conditions in real time.The communication between the systems componenets is performed by using IEEE 802.11 b/g standards .It provides a possibility of logging into the system from anywhere in the world with the device connected to the internet.
key words - Cyber physical system(cps),sensors,Internet Of Things(IOT),wireless communication,wi-fi

I. INTRODUCTION

The importance of environmental monitoring p l a y s a v i t a l r o l e . This is the field where wireless sensor networks (WSNs) have been first used, their primary purpose consisting in the observation of the physical world and the recording of physical quantities characterizing it . CPSs composed of interconnected clusters of process- ing elements and large-scale wired and wireless networks of sensors and actuators gathering data about and acting upon the environment[1] . These newly appeared systems have a lot of similarities with the Internet of Things (IoT), an enabler of ubiquitous sensing, that envisions a world in which many billions of Internet-connected objects or things, with sensing, communication, computing, and potentially actuating capabilities, will coexist, allowing an uninterrupted connection between people and.

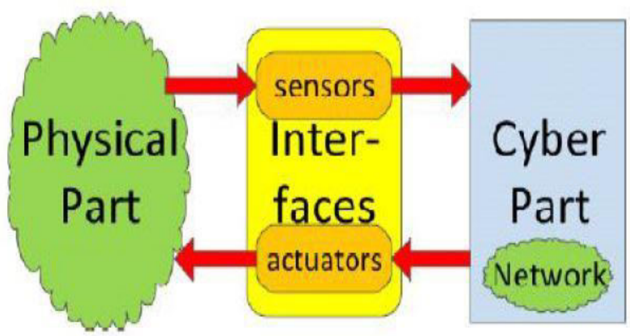

Fig 1: cyber physical system

The paper proposed a real-time Cyber-Physical system for environmental monitoring based on WSNs and cloud computing. The architecture is designed according CPSs paradigm, and restful API are used to distribute sensor data for upper application. In this paper, we propose a method to tag time stamp with sensor data. Even under the poor network condition, the system senses environment without data missing. We

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

implemented and test the system and it works very well. But the control of the sensor hub is relatively centralized. That is not so good for device management when numbers of devices are connected into the system .A distributed strategy will be developed in the future work. The environment monitoring system (EMS) consists of three layers: physical sensing layer, data transport layer, data management layer. Generally, sensors and sensor hub which collects sensor data and transfer them to the upper layer make up of physical sensing layer. And the main function for data transport layer is to forward sensor data to the specified destination. The last layer is in the cloud, composed of a data processor and a knowledge base. Data from physical sensing layer can be analyzed due to the strong computation ability of cloud computing. Also, there are abundant restful API (application programming interfaces) are provided by management layer based on users' demand. The proposed architecture provide convenient management with devices since all the information of devices are stored into database in the cloud. Even under the poor condition of network, data produced by sensors can be saved in local storage, making it enough time for user to settle the network problem with no affecting on the environment monitoring.

II. RELATED WORK

Reference [2] presents an automated irrigation system based on a distributed wireless network of soil moisture and temperature sensors that achieves water savings of 90% compared with traditional implementations. Sentinella is a smart monitoring solution for the assessment of possible causes of power inefficiency at the photovoltaic panel level based on WSNs [3]. However, most of the proposed solutions are based on the IEEE 802.15.4 standard and ZigBee applications, and they rely on gateways when the data has to be sent to the Internet [4]–[6]. Furthermore, in this case, additional applications have to be developed for encapsulating the data in Internet protocols, such as user datagram protocol (UDP) or transmission control protocol (TCP). Another promising technology providing high power efficiency is Bluetooth Low Energy (BLE), which was first introduced in 2010 with the goal of expanding the use of Bluetooth to power-constrained devices such as wireless sensors [7]. Therefore, the use of Wi-Fi sensors, as the ones in the system presented in this paper, which connect directly to the existing IEEE 802.11 b/g infrastructure seems to be a better, more straightforward, and less expensive solution. This is beneficial especially for applications deployed in indoor spaces or urban areas, where there is a high probability that access points are present. The main contribution of this paper, a continuation of [8] and [9], consists in the development of a reli- able, stand-alone, low-cost, and low-power scalable system, with reduced total cost of ownership (TCO), allowing the remote visualization of environmental and ambient data in places where IEEE 802.11 b/g network coverage exists. Reference [8] presents a complete solution for temperature and relative humidity monitoring using low-power wireless devices, allowing a battery lifetime of 2 years when a 20-min measurement cycle is used. . Here, a data viewer and data processing application, running on a personal com- puter, is included. This provides functionalities for alarming the user by e-mail or SMS A cloud-based Cyber-Physical system for environmental monitoring[2] consists of three layers: (I) the bottom layer, physical one, collecting data from sensor, (II) the middle layer which is consist of data and knowledge, (III) the top layer, namely application layer, provide users with service. This architecture takes real-time performance requirement into consideration. The transmitted data represented

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

as hexadecimal values and no time including the data. However, in the poor network condition, such as the network is not so stable, some of data may dismiss. Thus, it has bad influence on providing real-time service. What's worse, some of history data can't be acquired. Another disadvantage for the architecture is that it is lack of device management, it is not feasible to configure device with manual operation.

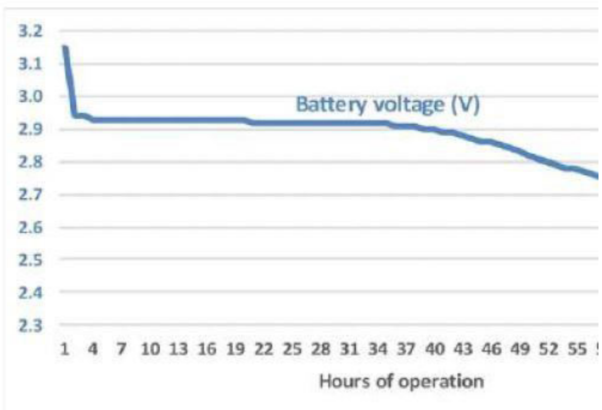

Fig 2: battery discharge curve for 10s measure cycle

In this paper, we introduce a novel architecture with a better data model and device management in the cloud. The sensor hub transmit data to the data proxy only if it shakes hand with data proxy. In the meantime, the information from the cloud are send to sensor hub to control the device and tag timestamp with sensor data. The proposed CPS architecture is presented in Figure 3.

Fig3: Cyber-Physical System for environmental Monitoring.

II. SYSTEM ARCHITECTURE

A. General Overview

A graphical representation of the entire CPS used for monitoring the environment in indoor or outdoor spaces,where IEEE 802.11 b/g network coverage exists, is presented in Fig. 3The two main system components consist of the following.

1. Wi-Fi Sensors

Low-power wireless sensors based on the programmable system-on-chip3 (PSoC 3) device [11] and on the RN-131C/G wireless local area network (WLAN) module.

2. IoT Platform

A BeagleBone Black embedded computer [12] running the server application.

B. IoT Platform

The IoT platform is, in fact, a BeagleBone Black single- board computer based on the ARM Cortex-A8 processor running at 1 GHz [12]. This choice was motivated by the reliable stand-alone low-cost platform,low power consumption is targeted. .A server application runs on the IoT platform. This listens to the UDP port, interprets the messages received from the sensors, and saves the data in a database in the device's internal memory or on a microSD card. A Web server is installed on the platform for providing access to the data requested by authenticated users for further analysis.

1. UDP Port Listener and Message Interpreter

This com-ponent is in charge of listening the UDP port to which the sensors transmit the packets containing the measurement data.The data received are stored into a buffer and processed for being saved in a database. A benchmark program was written to compute the average processing time for each received message. This includes message interpretation and data saving into the database. An average period of 1.5 ms was observed for each data

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

packet that was received and saved on the local memory.

2. **Database:**

The SQLite[13] software library was chosen for storing the data received from the Wi-Fi sensors in a data- base

3. Web Server

An open source licensed small memory footprint Web server, namely, lighttpd,[14] was installed on the IoT platform for remote data visualization shown below.

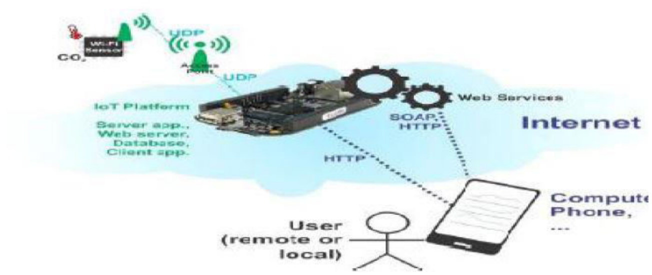

Fig4: Monitoring application.

CONCLUSION AND FUTURESCOPE:

The development of a CPS, which monitors environmental parameters based on the existent IEEE 802.11 infrastructure,was presented. It employs sensors measuring the ambient or the environment, which send messages to an IoT platform using UDP. The system provides the possibility of logging data where Wi-Fi network coverage exists, can be used in a wide range of monitoring applications. In future we can enhance the reliability and security of the proposed system. In the proposed a real-time Cyber-Physical system for environmental monitoring based on WSNs and cloud computing [10] the sensor hub is relatively centralized. That is not so good for device management when numbers of devices are connected into the system .A distributed strategy will be developed in the future work.

REFERENCES

[1] S. Gao et al., "A cross-domain recommendation model for cyber- physical systems," IEEE Trans.Emerg. Topics Comput., vol. 1, no. 2, pp. 384– 393, Dec. 2013.

[2] J. Gutierrez, J. F. Villa-Medina, A. Nieto-Garibay, and M. Porta-Gandara, "Automated irrigation system using a wireless sensor network and GPRS module," IEEE Trans. Instrum Meas., vol .63, no. 1, pp. 166–176, Jan. 2014.

[3] B. Ando, S. Baglio, A. Pistorio, G. M. Tina, and C. Ventura, "Sentinella: Smart monitoring of photovoltaic systems at panel level," IEEE Trans. Instrum. Meas., vol. 64, no. 8, pp. 2188–2199, Aug. 2015.

[4] J. P. Amaro, R. Cortesao, J. Landeck, and F. J. T. E. Ferreira, "Harvested power wireless sensor network solution for disaggregated current esti- mation in large buildings," IEEE Trans. Instrum. Meas., vol. 64, no. 7, pp. 1847–1857, Jul. 2015.

[5] H.-C. Lee, Y.-C. Chang, and Y.-S. Huang, "A reliable wireless sensor system for monitoring mechanical wearout of parts," IEEE Trans. Instrum. Meas., vol. 63, no. 10, pp. 2488–2497, Oct. 2014.

[6] L. Hou and N. W. Bergmann, "Novel industrial wireless sensor networks for machine condition monitoring and fault diagnosis," IEEE Trans. Instrum. Meas., vol. 61, no. 10, pp. 2787–2798, Oct. 2012.