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Weather Monitoring Using Raspberry Pi Viva Web Application

Jeethuri Vasantha[1] & S Mahaboob Basha[2]
[1]M-Tech Dept of ECE, Geethanjali Engineering College NANNUR-V, KURNOOL-DIST
Mail Id :- manasajoshnaarthi@gmail.com
[2]Associate ProfessorDept ECE, Geethanjali Engineering College NANNUR-V, KURNOOL-DIST
Mail Id:- Syedmahaboob45@gmail.com

Abstract

For last few years, challenges of monitoring and control of distant environmental parameters accurately has emerged as new field of research. The concept of Internet of Things (IOT) is also emerging very fast where everything around us comes with an internet connectivity for monitoring and control. Monitoring the environmental parameters and initiating a control action from internet is also part of this concept. In our proposed work, we design an environment monitoring system, capable of monitoring and control of environmental parameters like temperature, pressure and humidity. Also, we focus on design of a low cost system that is capable of not only remotely monitoring the environment variables like temperature, pressure and humidity but also initiates some control action like switching devices ON/OFF from the internet. This system uses Wireless sensor Networks for sensing the environment parameters in the area under supervision. Sensors Node has been designed to measure the temperature, pressure and humidity. The Control node has been designed to initiate the control action. The Central Monitoring is based on ARM11 raspberry pi board.

Keywords: Raspberry pi, WSN, Zigbee, AVR, python, CMU

1. Introduction

Environment monitoring system is a system that is capable of measuring several environmental parameters like temperature, humidity, pressure, illumination and quantity of gasses like LPG etc. These parameters are important in many applications like in industry, smart homes Greenhouse [2] and weather forecasting. Advanced Environment monitoring systems offer many features like remote access to the measurement data and also can initiate some control action from distant location. These systems use Wireless sensor Networks for sensing the environment parameters. Wireless Sensor Network (WSN) has sensors to sense the physical parameters and they are interconnected wirelessly to exchange information. They have a central monitoring system that is connected to the internet to access the data remotely. Several sensors are equipped in each remote location to

measure environmental parameters and these measurements are sent to the central office for storage and analysis purpose. In addition, the central office can give command to remote location for output control execution.

These features offer a way to maintain condition and allow obtaining caution on occurrence of any abnormal conditions like parameters exceeding. A WSN allows deployment of number of sensor nodes which configure themselves depending upon the network topology and neighborhood situation. After sensing their physical environment and processing the obtained data locally, nodes communicate their data (or an extract)towards a network sink, where data is further processed andmade available for readout. As transmitted data should find thebest route towards its destination automatically, the networkcan be remotely controlled and therefore be handled as onelarge measurement instrument. Some systems also offer theremote logging facilities that are the parameters can be storedat regular intervals at the remote server so that they can bereferred any time.

2. Related Work

Sheikh Ferdoush , Xinrong Li, "Wireless Sensor Network System Design using Raspberry Pi and arduino for Environmental Monitoring Applications" [1]. This paper represent design of wireless sensor network is developed using open source hardware platform called Raspberry Pi .This system is low cost and scalable in terms of sensor types and the number of sensor nodes. The 802.15.4 RF transceivers and zigbee protocol modules are used for wireless sensing, actuation system and capable of forming a complex mesh network structure on its own without intervention from user applications program running on the microcontroller. A brief description of sensors network and cyber physical system has focused on the development of enabling the technologies by addressing a lot of technical challenges such as multi hop routing, communication abstractions and operating system(OS),semantic abstractions and storing of data. Nattapolkaewmard, SaiymenSaiyod," Sensor Data Collection and Irrigation Control on Vegetable Crop using Smart Phone"[2]. The main purpose of this paper is to find a better way controlling an irrigation system with automatic system manual control by smart phone and provide long term sustainable solution for automation of agriculture.

Agricultural automation has several methods to getting data from vegetable crop like sensor for environmental measurement and developed portable measurement technology it includes sensors like soil moisture sensor, air humidity sensors, and air temperature sensors, for collecting different environmental data. The

smart forming technique is used for environmental measurements and water management is that it is important plant growth. In addition, environmentalmeasurement using wireless sensor network and water management technology is simpler, cheaper and low cost. However measured and collected environment data from sensor to manage vegetable crop including water level, air temperature and air humidity were not enough for making the intelligence decision. G. V. Satyanarayana, SD. Mazaruddin [3] proposed a design to implement remote monitoring of agriculture system. ZigBee is used for wireless communication.

Environmental parameters like temperature, moisture and humidity is measured with this design. This system also has a GPS system to identify the location of field. Solar power is selected to address the power constraints. CC2430 chips are used for ZigBee standard. The system uses Samsung S3C2440 based on ARM 920T core at Central Monitoring Station which supports embedded operating systems like Linux, VxWorks. This design includes SIM100-E GSM/GPRS module for messages transmission. Web data server is used for accessing the information about climate variations. At the end user point service program has written to access servers to obtain latest data from anywhere over the world. The implemented system is tested in 800square meters field. They have also implemented GUI application to allow the uses to access the data and configure the system and track the location of the farm field using GPS system. Yiming Zhou @.al., "A Wireless Design of Low Cost Irrigation System using ZigBee Technology"[4] . In irrigation system instead of using conventional wired system, the wireless design made the system easy installation and maintenance using wireless sensor or actuator node and portable controller, acting as the end device and coordinator in zigbee WSN respectively, which reduces labour saving and water saving in irrigation.

This system consists of portable controller, a wireless sensor node, a weather station and wireless actuators. The sensor node collects the temperature and air humidity parameters, whereas the nearby weather station monitors the information, a portable controller it gets the sensor data and actuator node are used to control the pump and electromagnetic valves, these sensor node and actuator node senses a end devices. GoranHorvatet @.al., "Real time WSN Communication for Access Control Applications"[5]. In this paper the analysis of WSN real time QOS ability for the application of access control communication network was presented in respect to the existing WSN based on ZigBee communication protocol andXBee WSN module. These WSN transmit the data and

return the acknowledge and rating QOS matrices was proposed based on round trip time (RTT) parameter and various other parameter, the distance between end node and cluster head is analyzed in XBee WSN modules.

3. Implementation

3.1 Design of sensor node:

In this work, we choose AVR core microcontrollerATMEGA324PA as main control chip of the sensor node.This chip is a high performance, low power AVR 8 bitmicrocontroller. This chip has a 32 KB in system selfprogrammable flash program memory, 1KB EEPROM,2KB internal SRAM, two 16 bit timer, programmablewatchdog timer,8 channel 10-bit ADC, master/slaveinterface and 32 programmable I/O lines, so it is possible toconnect a number of sensors sensor node board. The blockdiagram of sensor node is shown in figure 1.

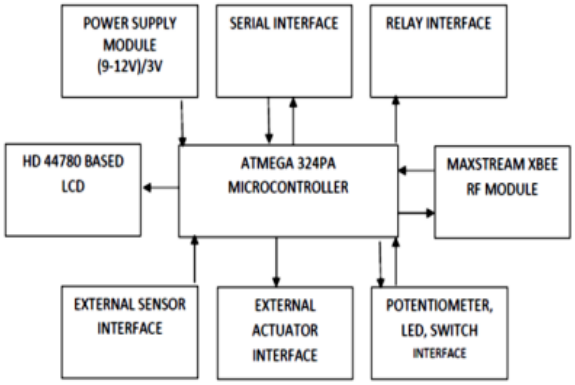

Fig 1: Block Diagram of Sensor Node.

ZigBee devices are particularly suitable for fast prototypingfor wireless sensor network applications. It is possible tobuild complex mesh network using these devices. We haveto develop application both at base station and sensor nodesto use some advanced features of ZigBee. We can connectnumber of sensors to the sensor node. The XBee module S2is connected to sensor node board as shown in figure. TheXBee module encapsulates 802.15.4 RF transceivers andZigBee protocol stacks, and it can be easilyintegrated intoany microcontroller or microprocessor systems such asRaspberry Pi through UART serial communicationinterface. The connection between controller of sensor nodeand XBee is shown in figure 2. The XBee module isconfigured as a router on the sensor nodes. Router can relaymessages in a tree or mesh network and Coordinator has thecapability to control the entire network. The XBee modulecan be configured into three types of devices: coordinator,router, and end device. Coordinator has the capability tocontrol and initiates the entire network. Router can relaymessages in a tree or mesh network topologies. End devicecan only communicate with the coordinator or the router.There can be only one coordinator in a network; the numberof router or end device is not limited.

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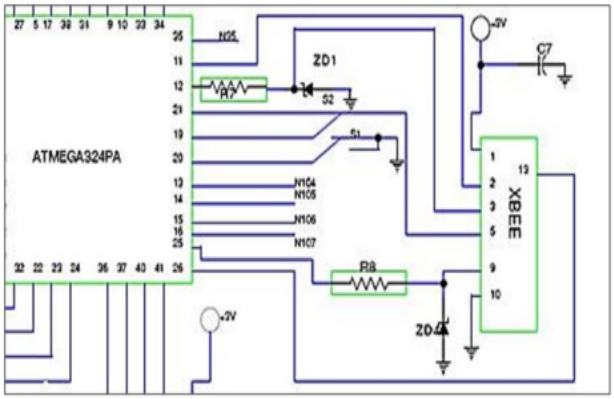

Fig 2: Connection between Controller of Sensor Node andXBee.

4. Experimental Work

Fig 3: System Experimental Result-1.

Fig 4: System Experimental Result-2.

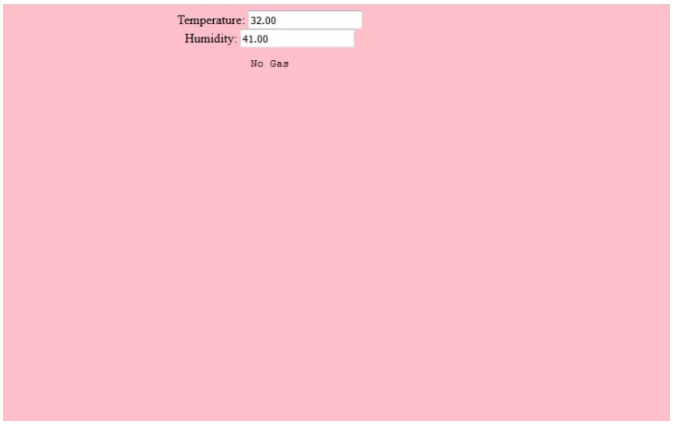

Fig 5: System Experimental Result-3.

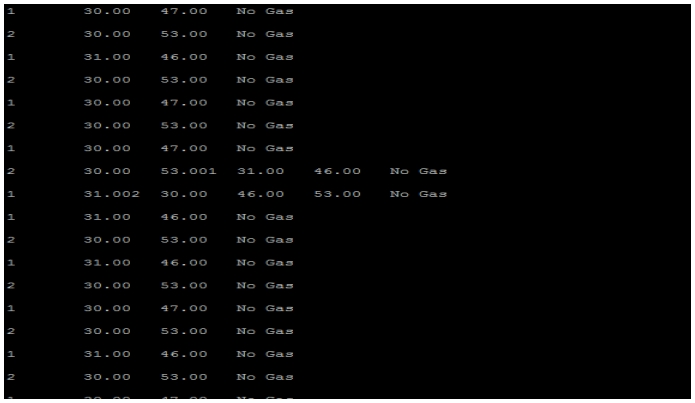

Fig 6: System Experimental Result-4.

5. Conclusion

This paper designs a wireless sensor network system usingsensor node, Raspberry Pi as a base station, XBee as anetworking protocol, and a number of open-source softwarepackages.

Comparing with collection and forwardinginformation or data of traditional base station (gateway),this system has low-cost, low power consumption, compact,scalable, easy to deploy, and easy to maintain. One majoradvantage of the system lies in the integration of thegateway node of wireless sensor network, database server,and web server into one single compact, low-power, creditcard-sized computer Raspberry Pi, which can be easilyconfigured to run without monitor, keyboard, and mouse. In addition, this system allows us to use it with implementedsensor networks using different hardware platforms. Such asystem is very useful in many environmental monitoringand data collection.

6. References

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