

EXECUTION FOR REMOTE SENSOR SYSTEM FOR ESP 8266 LINUX PAULING BUILT WEB-SERVER

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Abstract—This Project proposes an advanced system for process management via a credit card sized single board computer called raspberry pi based multi parameter monitoring hardware system designed using RS232 and microcontroller that measures and controls various global parameters. The system comprises of a single master and multiple slaves with wireless mode of communication and a raspberry pi system that can either operate on windows or Linux operating system. The parameters that can be tracked are current, voltage, temperature, light intensity and water level. The hardware design is done with the surface mount devices (SMD) on a double layer printed circuit board (PCB) to reduced the size and improve the power efficiency. The various interesting features are field device communication via USB-OTG enabled Android devices, on field firm ware update without any specific hardware and remote monitoring and control.

Keywords: *ESP8266, Wireless Sensor Network, Internet of Things, Embedded Linux Web-Server, Wi-Fi*

I. INTRODUCTION

- AI. Embedded systems are designed to do some specific task, rather than be a general-purpose computer for multiple tasks. Some also have real time performance constraints that must be met, for reason such as safety and usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce costs.
- III. An embedded system is not always a separate block - very often it is physically built-in to the device it is controlling. The software written for embedded systems is often called firmware, and is stored in read-only memory or flash convector chips rather than a disk drive. It often runs with limited computer hardware resources: small or no keyboard, screen, and little memo Wireless communication has become an important feature for commercial products and a popular research topic within the last ten years. There are now more mobile phone subscriptions than wired-line subscriptions. Lately, one area of commercial interest has been low-cost, low-power, and short-distance wireless communication used for \personal wireless networks." Technology advancements are providing smaller and more cost effective devices for integrating computational processing, wireless communication, and a host of other functionalities. These embedded communications devices will be integrated into applications ranging from homeland security to industry automation and monitoring. They will also enable custom tailored engineering solutions, creating a revolutionary way of disseminating and

Processing information. With new technologies and devices come new business activities, and the need for employees in these technological areas. Engineers who have knowledge of embedded systems and wireless communications will be in high demand. Unfortunately, there are few adorable environments available for development and classroom use, so students often do not learn about these technologies during hands-on l exercises The communication mediums were twisted pair, optical fiber, infrared, and generally wireless radio

[1].Comparison between Wi-Fi and ZigBee is given in Table

TABLE I
WI-FI & ZIGBEE COMPARISON

	Wi-Fi	ZigBee
Range	50-100 meter	10-100 meter
Data Rate	11 & 54 Mbps	20,40 & 250 Kbps
Topology	point to Point	Ad-hoc,peer to peer,star,mesh
Working Frequency	2.4-5 GHz	2.4 GHz
Complexity	High	Low
Power Consumption	High	Very Low

In this proposed WSN (Wireless Sensor Network) is consists Wi-Fi for node to server communication. Each node mainly consist an ESP8266 Wi-Fi module to communicate with a main server. Raspberry Pi embedded Linux board is used as a network main server. The function of the Raspberry Pi server is to begin the communication with apporportioned end device nodes through the Wi-Fi cordless communication protocol, Raspberry Pi periodically collects the data from sensor node to the MySQL database. Raspberry Pi analyzes the received data and take action according to data result. Raspberry Pi server has an Ethernet interface for Network and Internet access to run web-server, Hence Raspberry Pi transferring data from node to server and server to node over Wi-Fi network, and user can observe the sensor data and control the Wireless Sensor Network from web browser remotely anywhere.

II. DESIGN AND IMPLEMENTATION

From a literature survey most of the existing Wireless sensor network are developed on RF and ZigBee, Network which was build using Wi-Fi is very costly. RF based Wireless sensor Network has its range indefinite quantity, so RF based Wireless sensor network is suitable for small area. And ZigBee is working on IEEE 802.15.4 protocol and used cluster based Network topology to transmit a data from Wireless Node to base station. In cluster base network topology formation of cluster is depends on the happening of an event. So it will take more time to send data from sensor node to base station. Simple block diagram representation of Wireless Sensor Network is shown in figure 1.

In this wireless Network system protocol used is IEEE 802.11n, which provides multicasting facility. Communication speed is relatively more than IEEE 802.15.4 ZigBee network. The projected system is divided into three stages such that the lowest stage is the wireless sensor node, the mediate level is the main server controller, and the top level is a supervisory node.

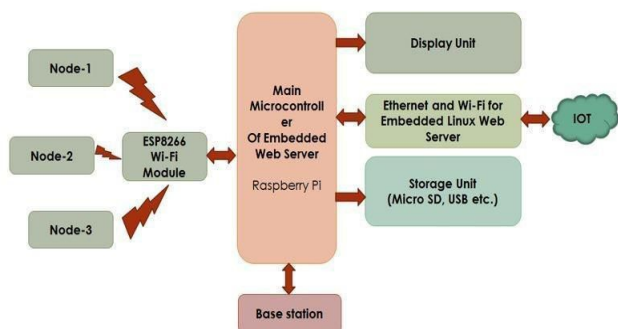


Fig. 1. Block diagram of WSN system

Proposed system is handle all possible system failure. The supervisor node can handle the entire control of the system if any error occurred during data transmission.

If transmission between any wireless node and Base station having some trouble, that sensed data will be stored on node memory or it will be transferred to other neighbor node and from neighbor node this sensed data will be transferred to base station. So, this types of mechanism avoid all type of tolerance in Wireless sensor Network. All sensors in a network are configured such a way to improve the latency of a Wireless sensor Network.

We are using Raspberry Pi Linux board to develop Embedded Web Server based on Linux operating system. It will provide a muscular networking mechanism over comfortable range of Wireless sensor areas over Internet. Raspberry pi is used as a main system server which control the Wireless sensor control. ESP8266 Wi-Fi module is used to transmit the detected sensor data is transmitted to the base station using the Wi-Fi 802.11b and then transmit that data to the end user by Raspberry Pi Ethernet port or ESP8266 module. It can also send command from end user to node to control the node operation.

III. EMBEDDED WEB-SERVER AND DATA BASE

The Embedded Web Server Technology is most evolving engineering science for Internet of Things. Embedded Web Server is designed the database based on MySQL, which is establish on Raspberry Pi Linux board .our developed web page for monitoring and handling wireless sensor system through network or Internet is shown in figure 2.

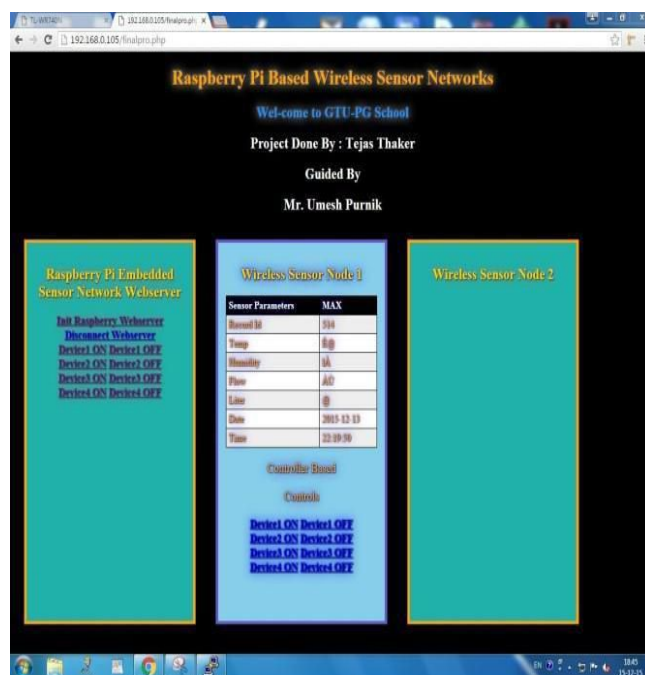


Fig. 2. Linux Webpage

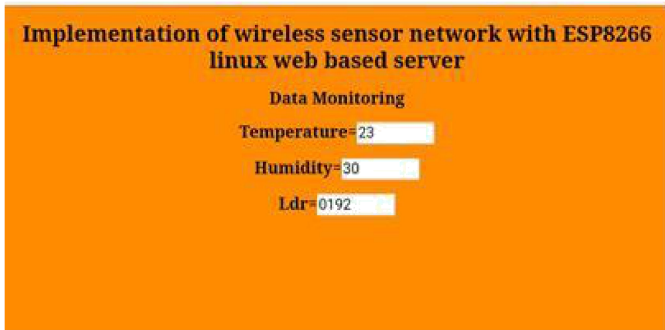


Fig. 3. Output result

IV. METHODOLOGY

The system should be able to acquire data from remote areas, store and should be in a position to reproduce the data whenever demanded by the client at the other end. DS1820 is the sensor used for acquiring temperature. There is even a provision for controlling an electronic component from the client end which is demonstrated by controlling an LED. The methodology is such that, there are temperature sensors and LED in the remote area, which are connected to the Raspberry pi module which acts as a Mini-computer in this case. This will be continuously monitoring the sensors and storing it in the database using SQL which is a light weight Database Management System. Since data is stored at a very high frequency, like lot of unnecessary data is stored continuously in the Memory leading to filling up of memory space. To avoid this undesired event Cron Job is used, which is basically a job scheduler in UNIX like operating System. This helps in scheduling and updating of data in database at a fixed time interval that can be decided by the user. So every five minutes (as defined by user) the Cron job automatically executes the program and stores temperature values in the database.

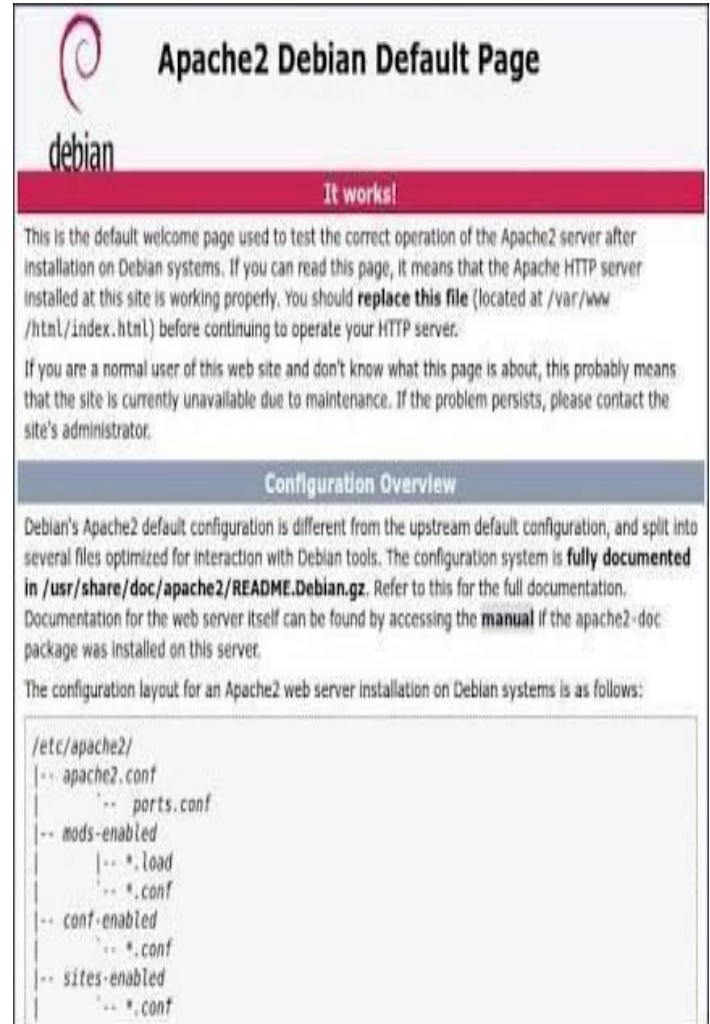
V. RASPBERRY PI WSN LINUX SERVER

Raspberry Pi is a tiny, effectual, affordable computer Board. This credit card-sized computer with many performances and affordable, it is perfect platform for interfacing with many devices. Raspberry pi acts as a base station which connects to sensor nodes by ESP8266 Wi-Fi communication protocol and clients. For wireless connection and multi-hop networking communications protocol, we used 802.11n.



Fig. 4. Raspberry Pi 2

Which is also known as Apache HTTP Server. Apache server provide online distribution facility of website service using HTTP (Hyper Text Transfer Protocol). It is widely popular web server for different operating systems such as Linux, UNIX, Windows, Solaris, Mac OS X, Novell NetWare, etc. Apache2 version was used in this project for creating web server. After installing Apache web server on Raspberry Pi, we can test the Apache server using test HTML file. Browse the default test web page on the Raspberry or using Web Browser, Web page appear as shown in figure 4.



A. Features of Raspberry Pi 2

We use Raspberry pi 2 Model B. Raspberry Pi comes with Mounting Points and 1 GB of RAM and ARM 7, 1GHz powerful processor. Raspberry pi has integrated Video core 4 Graphics GPU with capable of playing Full 1080p HD Videos with HDMI Video Output. it also contains 4 USB Ports with maximum current rating of 1.2A. Raspberry Pi 2 Board operated on 1.8 mA and 5v power supply. Micro SD Flash Memory Card Slot is given for OS porting.

B. Raspbian

We are using Raspbian wheezy Linux operating to establish a Wireless sensor network system using Raspberry Pi. Raspbian is an open source operating system, which is based on debian optimized for

the raspberry pi board. It is Linux kernel based operating system. At the first startup of Raspbian OS system configure menu appear which shown in figure 5.

C. Apache

For developing an Embedded Web-Server for WSN system we are installing Apache Web-server on Raspberry Pi board,

D. SSH (Secure shell)

SSH provide a remotely gain access of the command terminal of Raspbian OS from other system on the same network. SSH provide only command line access, not the full Raspbian desktop. Using VNC we can get full remote desktop access of Raspbian OS. SSH server can be enable or disable from raspi-config menu, which is appear by "sudo raspi-config". Raspberry configuration menu is shown in figure.

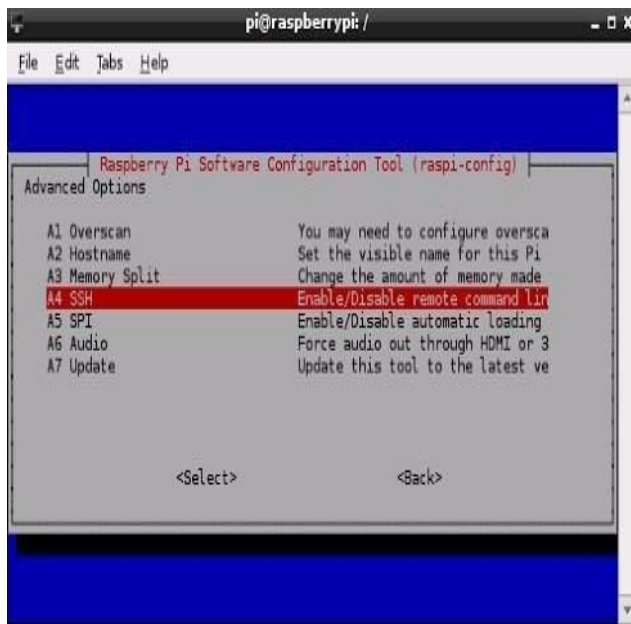


Fig. 5. Apache HTML test web page

E. PHP

The Hypertext preprocessor (PHP) is a scripting language designed for web development. PHP code is integrated by a web server with a PHP processor module which generates the resulting web page. PHP is basically used for developing web based software applications and also to manage database, Dynamic.

VI. WIFI FRAME STRUCTURE

The presented algorithm for Wi-Fi in the wireless nodes to validate the improvement efficiency. In the actual transmission process, there are two cases of data loss, one is continuous loss and another is discrete loss. The constant data loss undoubtedly has a bigger effect on the robustness communication than the discrete one. Proposed Wi-Fi algorithm can avoid continuous data loss during transmission. If any node failed to communicate with server than it will send its data to neighbor

node and neighbor node will send this data to server. In the implementation of Wi-Fi frame the algorithm, channels data are packed together and sent to the base station. Figure 6 shows the details of a Wi-Fi frame.

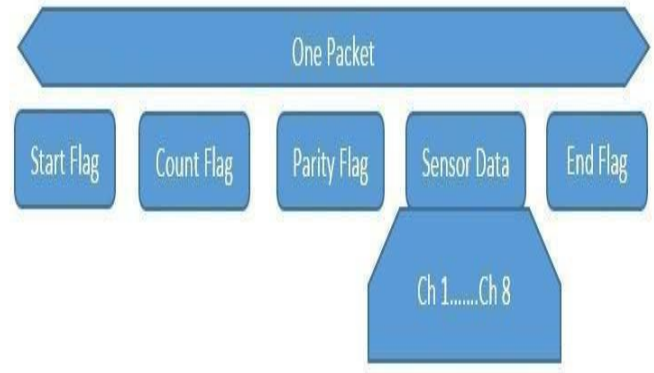


Fig. 6. Wi-Fi Frame Algorithm

VII. WIFI MODULE ESP8266

We are also considered a cost of a designed Wireless network, here we use Low cost and energy efficient ESP8266 Wi-Fi module for developing a Wireless Sensor Network. ESP8266 module configure such a way to provide high performance, high integration performance. Power saving operation algorithm for ESP8266 is shown in figure 7.

Power down logic and advance power management provide an energy efficient Wi-Fi based wireless sensor network. ESP8266 consumes 60uA in deep sleep mode with RTC clock still running and less than 1 mA to stay connected to the access point. Cost and performance parameter comparison of ESP8266 module with Arduino shield and RN-131C is shown in Table II.

The comparison is not exhaustive, but it still appears to show ESP8266 solutions support most features than price competing modules. There are however, case where competing solutions have an edge, for example if you need an Arduino shield, although ESP8622 can be programmed with the Arduino IDE, and some ESP8266 based shields are available, but probably not as well supported as the ones from Sparkfun and Adafruit. Mike also considers Arduino shields and CC3000 to have better software support and documentation, although he acknowledges ESP8266 community has help narrowing the gap.

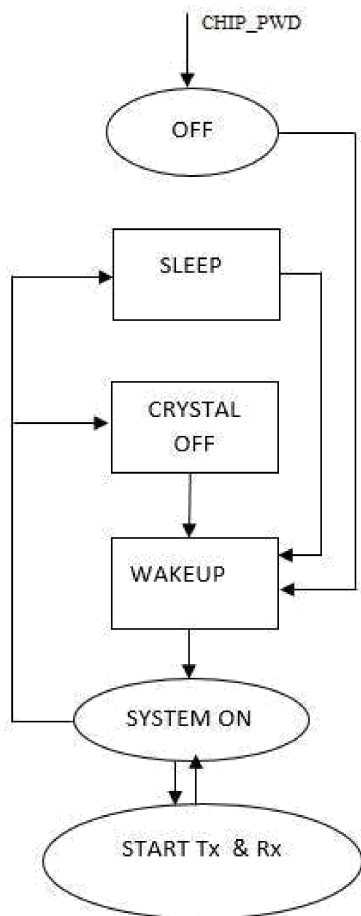


Fig. 7. Wi-Fi Frame algorithm

TABLE II
 WI-FI MODULE COMPARISON

	RN-131c	Arduino shield	ESP8266
Wi-Fi Standard	802.11 b/g	802.11 b/g	802.11 b/g/n
Packet	TCP & UDP	TCP & UDP	TCP & UDP
Mode	Client-Server	Client-Server	Client-Server
Transmit Current	210 mA	210mA	215mA
Programmable Controller	No	Yes	Yes
Cost	\$69.95	\$84.95	\$2.75

VIII. CONCLUSION

In this proposed design, we have introduced the event of a Wi-Fi based Wireless Sensor Network management exploitation using Linux board Raspberry pi and Internet of Things technology using ESP8266 Wi-Fi module. The system is suitable for real time Wireless sensors monitoring and for remotely controlling the Sensor network and improve the latency compare to ZigBee and RF based sensor network. The proposed system may be employed in many fields like home and Building automation and Industrial automation. Now a days Wi-Fi network is easily available in all fields like Office Building and Industrial Building so proposed wireless sensor network easily controlled using any Wi-Fi network.it is not possible to overcome all the current issues in a single system, but proposed system can avoid any type of failure in node to server communication.

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