WLAN INTERFACE WITH BEAGLEBONE BLACK

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Abstract— An embedded system is a computer system designed for specific control functions within a larger system, often with real-time computing constraints But when networking technology is combined with it, the scope of embedded systems would be further more. Here wlan interface with beaglebone black is presented. That can be used for industrial monitoring system. In h/w design beaglebone black, netgear wna 1100 wlan adepter is used. Sensors are interfaced with beaglebone black. Parameters like ldr, temperature, humidity, gas are measured and transmitted to PC through tcp/ip socket programing. The received values in PC is real time values that are coming from beaglebone black. So by giving aIP address to both server and client can sensor's data can transmite through beaglebone black to pc. In industry single ARM board acts as data acquisition and control system and as bone script a web server also, so the system is less compact with less complexity.

Keywords: Beaglebone Black,Netgear WNA WLAN Adepters,Angstrom linux,real time data acquisition and control system.

I. I INTRODUCTION

The arrival of internet increase the communication to village to village..When the embedded device are provided with internet access, it is of no doubt that demand will rise due to the remote accessing capability of the devices. The paper includes complete implementation of a socket programming with arm cortex A-8 beaglebone black. ARM cortex A-8 beaglebone black is multipurpose board which contains wlan interface. Sensors are connected to ARM board.Ldr, Temp, Gas, Humidity, pressure, motion, speed are must often measured parameters. Some electronic circuits, chemical reactions, biological processes perform best with in limited temperature, humidity range. It is also necessary to measure gas in environment. These parameters are mostly used in power plants, chemical industry, hospital, medicine Production Company. In this paper embedded systems and Internet technology are combined to form a new technology - the Embedded Internet Technology, which developed with the popularization of computer network technology in recent years. The heart of communication is TCP/IP protocol. Network communication is performed by the IEEE 802.11 Wlan standard. It is the most modern technology of embedded systems. Since ARM processor has fast execution capability and Wlan standard can provide internet access with reasonable speed, this system is suitable for enhancing security in industrial conditions by remotely monitoring various industrial appliances.

II. SYSTEM DESIGN

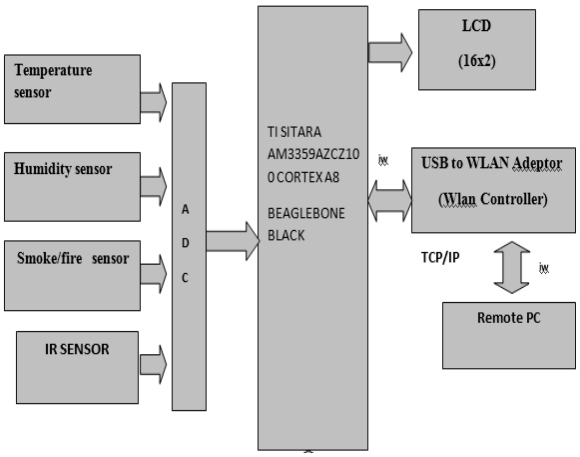

Fig.1: embedded data acquisition module

As shown in Fig.1 Embedded system is a single chip implementation of the WLAN networking standard. It consists of two primary elements communicating with each other: i) a server consisting of an ARM processor with an WLAN controller and ii) a client computer which is connected to controller through Wlan adepter. The client computer sends/receives data to/from the beaglebone black using TCP/IP packets. The client has to enter IP address to access with the server. This request is taken by the operating system and given to the WLAN controller of the client system. The WLAN controller sends the request to the router that processes and checks for the system connected to the network with the particular IP address. If the IP address entered is correct and matches to that of the server, a request is sent to the WLAN controller of the server and a session is established and a TCP/IP connection is establishes and the server starts sending the sensor's data to the client.

III. BEAGLEBONE BLACK

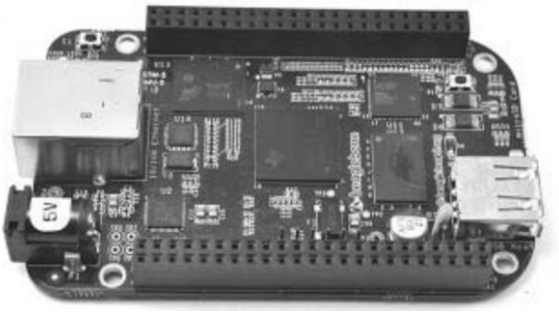

Fig.2: beaglebone black

The Beaglebone Black has 1Ghz ARM based cpu,512 MB of RAM,2 GB on board storage.The BeagleBone Black has on-board flash storage, with Ångström Linux pre-installed, making it fully ready to go,

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straight from the box. Ångström Linux is not a particularly popular distribution, and the makers of the BeagleBone Black also provide a micro-SD card slot on the underside of the board, which can be used either to boot directly onto an operating system installed on a micro SD card, or with the press of a button, to upload a disk image from the micro SD card directly into the 2 GB on-board storage. Ångström is fast and small and will allow the BeagleBone Black to boot and establish a network connection in about 10 seconds, compared with 20 or 30 seconds for a Raspberry Pi running Raspbian.Angstrom(Default),Ubuntu,Android,ArchLinux,Gentoo,Minix,Risc OS are supported to Beaglebone Black.It has 65 gpio pins.It has some peripherals like 1 USB Host,1 Mini USB client,1 10/100 Mbps Ethernet.Beaglebone Black supports resolution 1280*1024,1280*720 all at 16 bit.

IV. WLAN ADEPTER

WLAN a networking technology allowing the connection of computers without any wires and cables.This detector supports 64/128/256-bit WEP data encryption that protects your wirelessnetwork from eavesdropping. It also supports WPA (Wi-Fi Protected Access) and WPA2 that combines IEEE 802.1x and TKIP (Temporal Key Integrity Protocol) technologies. Client users are required to authorize before accessing to APs or AP Routers, and the data transmitted in the network is encrypted/decrypted by a dynamically changed secret key. This adapter has built-in AES engine which ensure the highest degree of security and authenticity for digital information and it is the most advanced solution defined by IEEE 802.11i for the security in the wireless network.

Fig.3: netgear wna 1100 wlan adepter

This paper used iw nl802.11 tool for connect beaglebone to pc. nl80211 is the new 802.11 netlink interface public header. Together with cfg80211 it is intended to replace Wireless-Extensions. nl80211 and cfg80211 are still under development.

For installing iw tool in your pc some building requirements should be there.

(1) libnl >= libnl1
(2) libnl-dev >= libnl-dev-1
(3) pkg-config .

In this paper there are some commands to connect beaglebone black and other pc after interfacing wlan adepters perfectly.

(1) Iw dev wlan0 link
(2) Iw dev wlan0 scan
(3) Iw dev wlan0 set type ibss
(4) Iw dev wlan0 connect your_essid
(5) Iw dev wlan0 set power_save on

V. TCP/IP SOCKET PROGRAMING

A socket is the mechanism that most popular operating systems provide to give programs access to the network. It allows messages to be sent and received between applications (unrelated processes) on different networked machines.

There are a few steps involved in using sockets:

(1) Create the socket
(2) Identify the socket
(3) On the server, wait for an incoming connection
(4) On the client, connect to the server's socket
(5) Send and receive messages
(6) Read and write messages
(7) Close the socket

A. Server sudo code

```
Listenfd=socket(AF_INET,SOCK_STREAM,0);
Memset(&serv_addr,'0',sizeof(serv_addr));
Memset (sendBuff,'0',sizeof(sendBuff));
Confd=accept(listenfd(struct sockadd r*)NULL,NULL);
printf("<Querry received>\n");
if(in=popen(python Readsensor.py" "r"));
{
Perror("error occurred \n");
Exit(1)
}
```

B. Client pseudo code

```
While ((n=read(sockfd,recvBuff,sizeof(recvBuff)-1)));
{
recvBuff[n]=0;
printf("sensor data is : ");
}
If (fputs(recvBuff,stdout)==EOF
{
Printf("\n Read error\n");
}
```

VI. OUTPUT

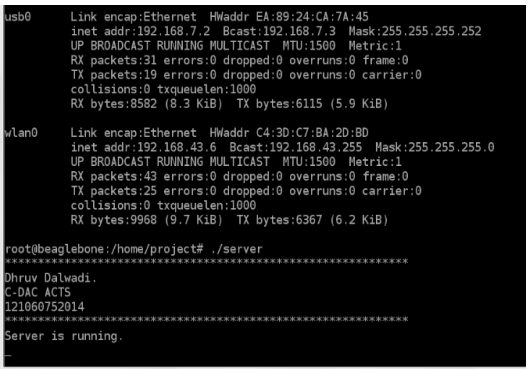

Fig.4: wlan interface

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```
root@beaglebone:/home/project# python TestSensor.py
python: can't open file 'TestSensor.py': [Errno 2] No such file or directory
root@beaglebone:/home/project# python testSensor.py
Reading         Volts
0.876667        1.578000
0.869444        1.565000
0.865000        1.557000
0.878333        1.581000
0.888889        1.600000
0.880556        1.585000
0.869444        1.565000
0.855000        1.539000
0.870556        1.567000
```

Fig.5: LDR Sensor data

```
**********************************************************
Dhruv Dalwadi.
C-DAC ACTS
121060752014
**********************************************************
Server is running.
<Query recieved.>
Sensor data is : 1.574000
_
```

Fig.6: runing server

```
linux-coaw:/home/dhruv/Desktop/project # ping 192.168.43.6
PING 192.168.43.6 (192.168.43.6) 56(84) bytes of data.
64 bytes from 192.168.43.6: icmp_seq=1 ttl=64 time=2009 ms
64 bytes from 192.168.43.6: icmp_seq=2 ttl=64 time=1001 ms
64 bytes from 192.168.43.6: icmp_seq=3 ttl=64 time=1.87 ms
64 bytes from 192.168.43.6: icmp_seq=4 ttl=64 time=9.57 ms
64 bytes from 192.168.43.6: icmp_seq=5 ttl=64 time=9.20 ms
^C
--- 192.168.43.6 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4013ms
rtt min/avg/max/mdev = 1.873/606.370/2009.208/800.331 ms, pipe 2
linux-coaw:/home/dhruv/Desktop/project # ./client 192.168.43.6
Sensor data is :1.574000
linux-coaw:/home/dhruv/Desktop/project #
```

Fig.7: running client

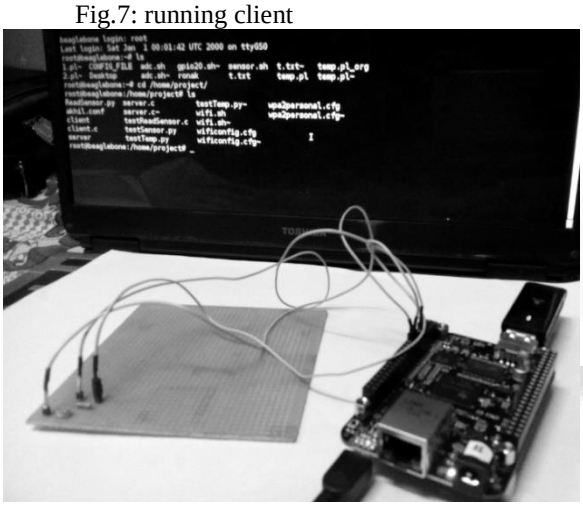

Fig.8: ldr connection through Beaglebone

VII. CONCLUSION

Wlan Interface with Beaglebone Black is a new method to monitor a environment which designed here for the prototype By using ARM Cortex A-8, the embedded system becomes highly precise and gives better performance over traditional 8/16-bit Microcontrollers. . It supports online-supervision and control not only within Private Network (LAN) but also in Public Network (Internet) The whole system has low-cost, good openness and portability, and is easy to maintain and upgrade. It is possible to interface different kind of sensors with these modules and make various applications. So it can monitor embedded system operation state through Internet, achieving network monitoring purposes. Hence for our future we make the system for industrial, domestic environment monitoring, for Ocean environment monitoring, Educational Institution, electric power, petroleum.

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