

Data Collector by Using Wireless Technologies IEEE 802.15.4 and Bluetooth

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Abstract: In this paper we have shown a system based on Bluetooth and ZigBee for hospital environment applications. This system provides an easy way to monitor the patient's health condition. We have used advanced technical methods to design the system like ZigBee, Bluetooth and ARM9. ARM9 processor requires significantly less transistors than other micro controllers. This reduces the cost, heat producing by the circuit. We have used Pulse sensor, Temperature Sensor, ECG signal for the health monitoring of the patient. Finally we have designed a system by using the wireless technologies to monitor an individual's health.

Key Words : ZigBee, Bluetooth, Pulse sensor, ECG Signal, Temperature sensor, ARM9, Micro controller.

INTRODUCTION

Mobile communication devices can be essential in the healthcare environment for good patient management. However, the electromagnetic interference produced by such equipment may have the potential to affect medical devices. These mobile communication devices are designed to achieve multiple purposes but mostly are focused on voice and short messaging services [1] [2]. Wireless technology has the benefit of improving data mobility, using different protocols such as WiFi, Bluetooth, ZigBee. In the medical field, many studies introduced body sensor networks for health care applications [3] [4].

The main disadvantage in the hospital environments is that time taking for the doctors to check the patient individually. Our proposed design finds a solution for this problem. By using various sensors and modern wireless technologies we have designed a system for the patients monitoring. When comparing all the wireless technologies, ZigBee technology is a low data rate, low power consumption, low cost; wireless networking protocol targeted towards automation and remote

Wireless Parameter	Bluetooth	Wi-Fi	ZigBee
Frequency band	2.4 GHz	2.4 GHz	2.4 GHz
Physical/MAC layers	IEEE 802.15.1	IEEE 802.11b	IEEE 802.15.4
Range	9 m	75 to 99 m	Indoors: up to 30 m Outdoors (line of sight): up to 100 m
Current consumption	60 mA (Tx mode)	400 mA (Tx mode) 30 mA (Standby mode)	25-35 mA (Tx mode) 7 mA (Standby mode)
Raw data rate	1 Mbps	11 Mbps	250 Kbps
Protocol stack size	250 KB	1 MB	33 KB 4 KB (for limited function end devices)
Typical network join time	>3 sec	variable, 1 sec typically	30 ms typically
Interference avoidance method	FHSS (frequency-hopping spread spectrum)	DSSS (direct-sequence spread spectrum)	DSSS (direct-sequence spread spectrum)
Minimum quiet bandwidth required	15 MHz (dynamic)	22 MHz (static)	3 MHz (static)
Maximum number of nodes per network	7	32 per access point	64 K
Number of channels	19	13	16

Table 1 Comparison of wireless network standards

control applications. The table 1 shows the advantages of ZigBee over other wireless networks [5].

In this paper we introduce a new technique to monitor the patients condition which is based on ARM9 micro controller. This paper is scheduled as First it discusses about the proposed design and the techniques involved in it. Next it shows about the ARM9 micro controller. Section iii illustrates about the ZigBee module next section discusses about results and Section v concludes the paper.

PROPOSED DESIGN

The proposed data collector system contains three sections. The first section contains all the body sensor networks and the values are given to the micro controller. The microcontroller sends the data by using the blue tooth module to the second section that is display section. The display section displays the values and sends the data to the central server to store the data by using ZigBee wireless modules. In the third section central server receive the data and stores the values.

A. Data collection section

This section contains all the sensors at which we have to collect the data. The Figure 2 shows the data collector section. In our proposed design we are collecting the data of body temperature, pulse calculation and ECG signal values. These three values from the sensors are given to the micro controller. Micro controller reads the values of the sensors and it will send the data to the display section.

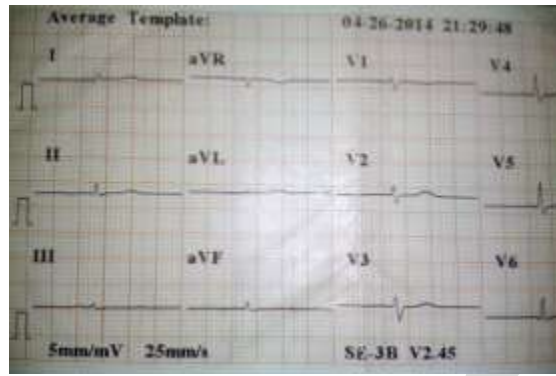
Body sensor networks improve the patient monitoring system with the help of modern technology. This can be done by various wearable sensors equipped with wireless capabilities [3] [4]. Figure 1 shows the various body sensor networks used. Figure 1 (a) shows the temperature sensor, figure 1(b) shows the pulse sensor figure (c) shows the ECG signal transmitted to the micro controller. Figure 2 shows the block diagram for the section 1 which collects the whole data from the sensors.



(a)



(b)



(c)

Figure 1 Various body sensor networks

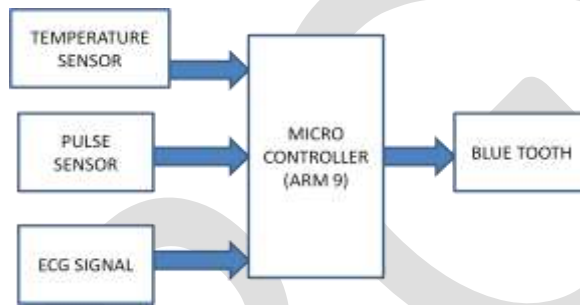


Figure 2 Block diagram for section 1

B. Display section

Display section receives the values of the various values from the section 1 which is transmitted by using blue tooth module. Figure 3 represents the block diagram for the display section. It contains blue tooth module to receive the signals and ZigBee modules for transmitting the values.

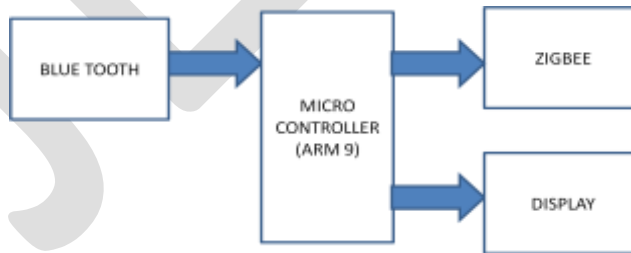


Figure 3 Block diagram for the display section

C. Central server section

Central server section receives the values and stores the values of the particular patient. Figure 4 shows the block diagram for the central server system.

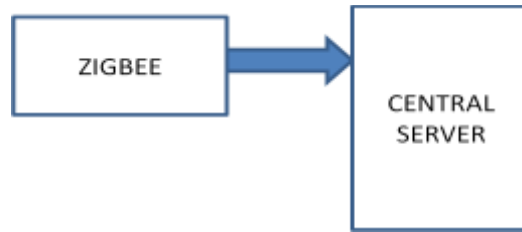


Figure 4 Block diagram for the Central server section.

ARM9 MICRO CONTROLLER

ARM9 micro controller due to its high performance, low power consumption gained their interest in processor field. ARM is one of the most licensed and thus widespread processor cores in the world. Used especially in portable devices due to low power consumption and reasonable Performance [6]. The figure 5 shows the Hardware architecture of ARM9 micro controller.



Figure 5 ARM9 hard ware structure

ZIGBEE and IEEE802.15.4

ZigBee technology is a low data rate, low power consumption, low cost, wireless networking protocol targeted towards automation and remote control applications. IEEE 802.15.4 committee started working on a low data rate standard a short while later. Then the ZigBee Alliance and the IEEE decided to join forces and ZigBee is the commercial name for this technology. ZigBee is expected to provide low cost and low power connectivity for equipment that needs battery life as long as several months to several years but does not require data transfer rates as high as those enabled by Bluetooth. In addition, ZigBee can be implemented in mesh networks larger than is possible with Bluetooth. ZigBee compliant wireless devices are expected to transmit 10-100 meters, depending on the RF environment and the power output consumption required for a given application, and will operate in the RF worldwide (2.4GHz global, 915MHz Americas or 868 MHz Europe). The data rate is 250kbps at 2.4GHz, 40kbps at 915MHz and 20kbps at 868MHz. IEEE and ZigBee Alliance have been working closely to specify the entire protocol stack. IEEE 802.15.4 focuses on the specification of the lower two layers of the protocol(physical and data link layer).

On the other hand, ZigBee Alliance aims to provide the upper layers of the protocol stack(from network to the application layer) for interoperable data networking, security services and a range of wireless home and building control solutions, provide interoperability compliance testing, marketing of the standard, advanced engineering for the evolution of the standard. This will assure consumers to buy products from different manufacturers with confidence that the products will work together. IEEE 802.15.4 is now detailing the specification of PHY and MAC by offering building blocks for different types of networking known as "star, mesh, and cluster tree". Network routing schemes are designed to ensure power conservation, and low latency through guaranteed timeslots. A unique feature of ZigBee network layer is communication redundancy eliminating "single point of failure" in mesh networks. Key features of PHY include energy and link quality detection, clear channel assessment for improved coexistence with other wireless networks [7].



Figure 6 ZigBee module

RESULTS

The design is implemented in embedded c programming and executed the output with keil uvision. The below figure 7 shows the kiel c51 compiler. The designed system is very useful for the hospital environments. The system is also used advanced ARM9 micro controller, Blue tooth modules in the first section, ZigBee modules in the second section for the hardware implementation.

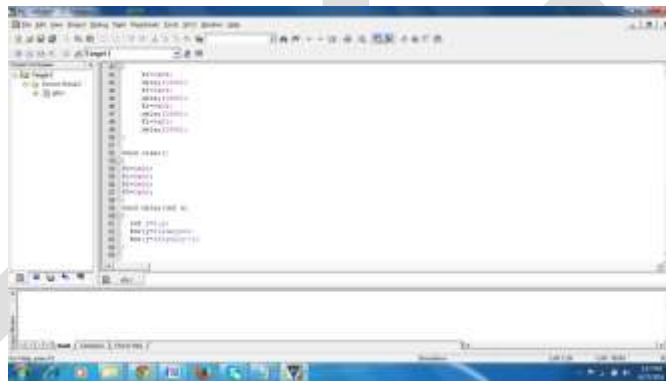


Figure 7 Kiel c51 compiler

CONCLUSION

We have designed a system which is useful in the hospitals by using Bluetooth and zigbee modules. In this proposed system we have used pulse sensor, temperature sensor and ECG signals. This system is an advancement over the ordinary wireless networks. The system also stores the data at time for the further usage. This system can also be implement with WIFI in the future.

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