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An Android based Wireless ECG Monitoring System for Cardiac Arrthymia

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Abstract: A WBAN is an integration of Wireless Sensor Networks (WSNs) to connect various WBAN Biomedical Wireless Sensors (BWSs) located inside and outside of the human body to collect and transmit vital signals. Wireless Body Area Network (WBAN) is emerging by leaps and bound due to tremendous evolutions in sensors and wireless communication technologies. For The WBAN technology improvisation, researchers are mainly concentrating on technical parameters of health monitoring to make it interactive and real time based. The collected biomedical data is send to the hospitals and medical centres for therapeutic, diagnostic analysis and treatment. An electrocardiogram (ECG), a non- invasive mechanism, is widely used to establish medical diagnosis of heart diseases in health care systems. This paper presents a microcontroller ARM7 based health monitoring system intended to monitor and to early detect situations when heart rate and blood oxygen level are out of their safe ranges. The main objective of this proposal is to prevent emergency situations by informing the patient to take actions before patient's health condition get worse leading to emergency medical care. This system employs a programmable ARM7 for confab the bio-signal to determine the condition of heart. If any abnormalities are discovered from patient's heart parameters, the system sends alarm to the doctor. The system ensures wireless transmission of ECG signal to the Medical Server (doctor's PC) through Bluetooth and Android platform. This endows doctor to have visual description of patient's ECG on Medical Server and if critical condition exists, system will send alert messages to the doctor on his mobile phone even if doctor is away from Medical server. The experimental result shows that the device is compact, cheap, user friendly and useful.

I. INTRODUCTION

A. The phenomenal industrial and economic growth is leading to complex and demanding day to day life, which causes nervousness, anxiety, and disturbance in many people. Because of these stress inducing parameters major adult illnesses is a cardiovascular diseases instead of infectious diseases, which exponentially increase the medical cost. In recent years, the telemedicine information system has become more and more essential.

B. Especially the intelligent systems are employed in healthcare that leads to not only provide a better health care monitoring but to save the medical cost as well.

C. Heart disease has become common disease in today's world and still remains as a threat to human health.

D. Measuring of the bio-signals from patients is a very important factor when it comes to diagnosis of heart disease. Among the various devices for measuring and detecting heart disease, ECG is preferred due to its precision, convenience, and low cost, even-though there are various alternatives are available.

E. The communication industry is growing very fast. This advancement has made it possible for many devices in the health care to use and work in conjunction with some telecommunication devices. Now ECG monitors products for instant are using technologies such as smart phones, and Wi-Fi, internet solutions, bluetooth for their display and analysis. However, these devices and their communication protocols have hurdles like: (1) required electrodes to be attached on chest to detect the ECG tracing, (2) High cost, (3) Delay in detecting / analysing ECG trace, (4) High power consumption. etc . Many advances and the transformation that has occurred in the field of mobile and telecommunications have led to the development of mobile data services over cellular mobile systems, giving support and making it easy for the development of new applications.

II. HARDWARE REQUIREMENTS

A. Signal Controlling Unit

The ECG acts as a signal sensor which is amplified by an instrumentation amplifier of high gain as amplitude of original raw ECG signal is very small. IC AD624 is low noise amplifier and high precision instrumentation amplifier. Due to all these properties it is ideal for use in high resolution data acquisition system.

B. Power Supply

In medical devices regulated power supply is desired for effective functioning. This system utilises a battery of 12V. Additional regulated power supply is also provided.LM1117 is a voltage regulator at low dropout voltage of 1.2V, with 800mA of load current.

C. Microcontroller

The ARM7 TDMI-S is a general purpose 32 bit microprocessor, consumes very low power and offers high performance. ARM7 incorporates pipeline technique where processing and memory system can operate simultaneously while an instruction is being executed, decoding the successor and fetch the third instruction from memory.

D. Flash Program Memory

The LPC 2148 has 512 KB flash memory which stores both code and data. Flash memory programming can be done in many ways. It may be done by In System Programming (ISP) via serial port.

E. Android

Android is open source mobile operating system developed by Google based on Linux Kernel. This operating system is adapted by several smart phone manufacturers. The base of the entire operating system is formed by an android java application and is able to make use of the majority of device's functionality. Included support for the Bluetooth network stack with the android platforms allows exchange of data wirelessly with other Bluetooth devices.

III. SOFTWARE REQUIREMENTS

A. GSM

Gsm is a digital mobile telephony system that is widely used in Europe and other parts of the world .gsm uses a varaiation of time division multiple access and is most widely used of the three digital wirless telephony technologies.

B. Features

1) Improved spectrum efficiency
2) International roaming
3) Support for new services
4) SIM phone book management
5) Fixed dialing
6) Real time clock with alarm management, high quality speed.
7) *Keil Software:* The micro vision IDE combines project management, run time environment, built facilities, source code editing, and program debugging in a single powerful environment .Micro vision is easy to use and accelerates your embedded software development Keil software leading developer of embedded system software makes ANSI C compiler, debuggers, linkers, simulators, integrated environment and evaluation for 8051,ARM7Keil software implemented the first c compiler for 8051 microcontroller.

IV. PROPOSED SYSTEM

A. WBSN (Wearable Body Sensor Network)

It is a network of wearable and embedded biosensors on patient's body. In proposed system we have taken ECG sensors AD624 which sense the electrical impulses from patient's body, then the signal is processed by microcontroller ARM7 which acts as a central controller of WBSN whereas PPHS can be communicated by the central controller using Bluetooth.

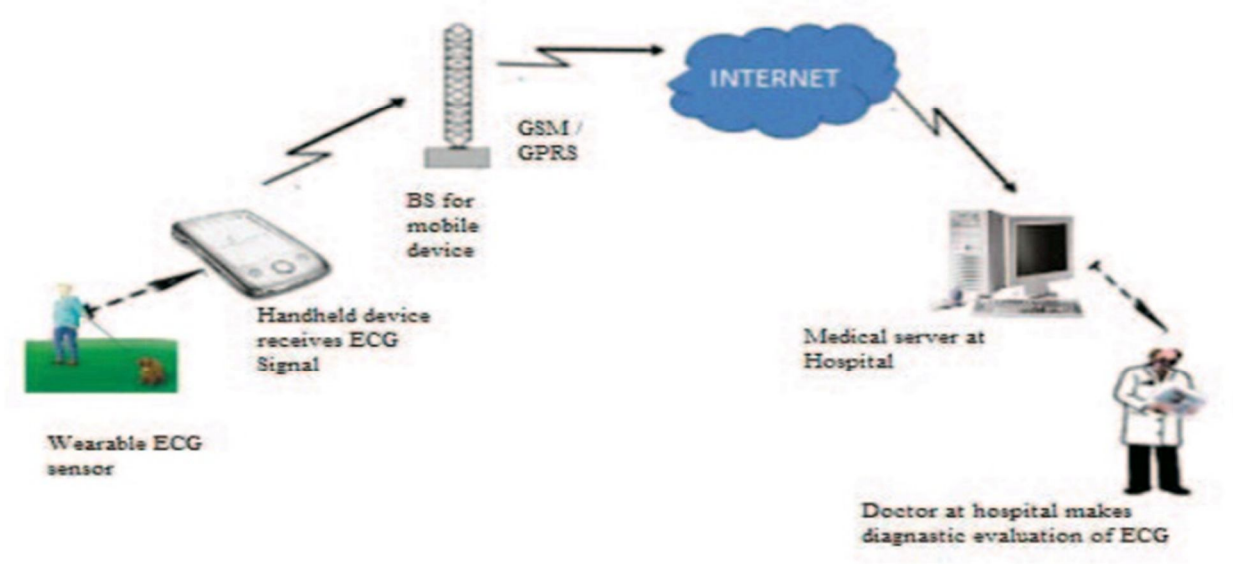
B. PPHS (Patient's Personal Home Server)

In proposed system android mobile device is used as a PPHS which will collects real time ECG data from WBSN and forward this data to the Medical Server (MS) using GPRS. PPHS is designed smart to decide whether to forward this information to MS or not. Thus PPHS will acts as a service requester and MS as a service provider.

C. MS (Medical Server)

receives real time ECG data from PPHS. The doctor can analysed the ECG waveforms continuously or at periodic intervals and if required he can check the previous records as well which helps in comparing the abnormalities in heart activity at various time. If some abnormalities are observed, doctors can send immediate messages or can advise the patient with necessary comments and at the same time if some patient is at high risk can inform the ambulatory services and keep ready the medical assistance.

V. BLOCK DIAGRAM



A. ECG Waveform on Medical Server

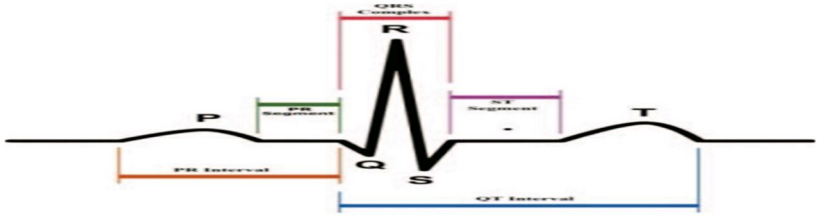


Figure 5: ECG waveform on Medical Server.

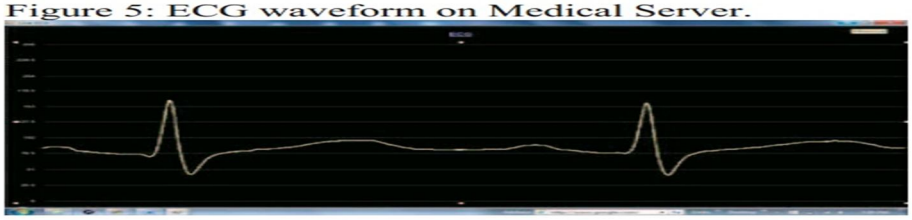
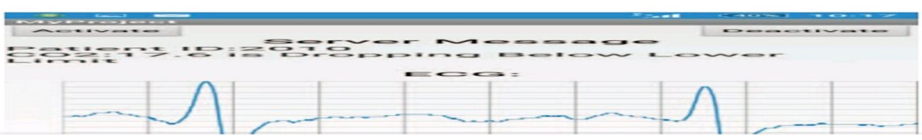


Figure 6: ECG waveform on Doctor's Mobile.



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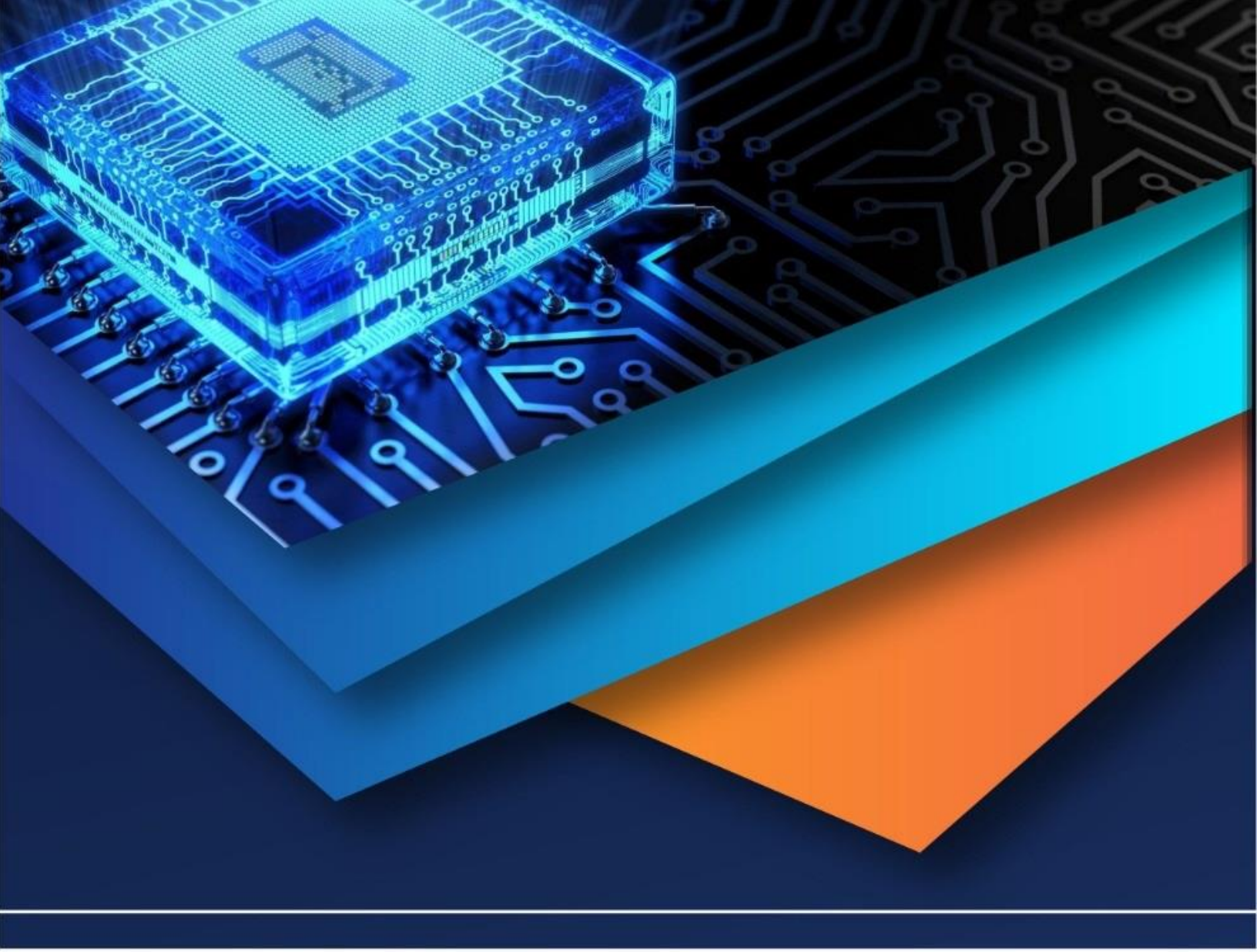
VI. CONCLUSION

The proposed wireless ECG monitoring system including WBSN use microcontroller ARM7 to process the ECG signal and with the help of GSM patient's android mobile device can transmit these signals to Medical server through GPRS where medical practitioner can make diagnostic evaluation of real time and recorded ECG signal. The proposed wireless ECG monitoring system is small in size, light weight, precise, low cost and consumes low power. The patient's doesn't need to get hospitalized if he/she suggested under observation for few days. Patient's bio-signals are captured even at home, if he is wearing that device his real time signals have been transmitted to the hospital using android mobile device and at Medical server side doctor can fixed the ECG related parameters with some threshold and if it exceeds the upper and lower limit, doctors will be informed with auto generated messages and in turn medical practitioner advise the patients with possible treatment and actions. In addition the proposed system is also able to monitor ECG signal on medical server along with doctor's personal mobile. Even if the doctor is mobile he can analysed the patient's ECG and can advise the treatment.



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