

Design and Implementation of Wireless Handheld Device For Android Cell Phone

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Abstract

This paper investigates a portable system for remote monitoring of cardiac activity. In this paper we present a low cost, handheld device with wireless transmission for real time ECG acquisition so that we can archive and visualize both in a mobile phone and a PC. With the recent advance in technology, we create small sized wireless ECG system capable of transmitting ECG signal via Bluetooth technology to laptop and mobile phone.

Keyword: Wireless, ECG, Bluetooth, Android OS, Eclipse.

1. Introduction

Cardiac arrest [1] is having major contribution to sudden and unexpected death rate in the modern stress filled lifestyle around the globe. A system that warns the person about disease earlier automatically will be a boon to the society. This can be achieved by adding advances in wireless technology to the existing patient monitoring system. The World Health Organization (WHO) has given an estimate; cardiovascular disease kills almost million people around each year along with twenty million people at a risk of sudden heart failure. From these lives can often be saved if proper care and cardiac surgery. So the need for advice on first hand medical attention and promotion of good health by patient monitoring and follow-up becomes inevitable. So patients are at risk require that their cardiac health to be monitored frequently.

Telemedicine [2] is considered to be part of the inevitable future of the modern practice of medicine. Wireless communication is used between mobile users and they are becoming increasingly popular due to the advancements in computer and wireless technologies. Implementation of wireless technology in the existing Electrocardiogram (ECG) monitoring system eliminates the physical constraints imposed by hard-wired link and allows users to conduct own check up at anytime anywhere. The use of mobile phone has been recognized as important tool for telemedicine as it has become a commercially available household article. It is possible to detect the onset of a heart attack and eliminate patient error. So we present a portable wireless device for ECG measurements. The goal is to provide early heart attack detection so that the patient

will be given medical attention within the first few critical hours, so that we can greatly improve chances of survival.

Bluetooth [3] offers several advantages such as low cost, low EM interferences, less power consumption, security of the data, length of the transmitter and it is capable of generate small piconet of some devices. Bluetooth is used in portable, small computers and mobile phones and also used in a great number of wearable devices like mobile phones wireless headsets. The ZigBee [4] standard offers capabilities especially in term of power consumption, number of connected devices but, currently, it is not as widespread as Bluetooth. So this paper describes system with a low cost, portable with wireless transmission capabilities for the acquisition, processing, storing and visualization of ECG in real time of the electrical activity of the heart to a mobile phone, a PC and in PDA.

Wireless ECG Monitoring System [5] is used in a system that would be used without compromising functionality or quality. So we replace the leads which are used in normal ECG Monitoring system with a wireless technology. Electrocardiogram (ECG) is useful diagnostic tool and it is immediately available for accessing the probability of cardiac events. So many of studies have focused in the design of a highly intelligent, easy to use, personal portable device for the early detection and interpretation of ECG.

Wireless technology replaces cables and allows increased patient mobility for decades through ambulatory patient monitors. This wireless technology in the existing ECG monitoring system eliminates the physical constraints imposed by hard-wired link and allows users to conduct own check up at anytime anywhere. Mobile phone has been recognized as a possible tool for telemedicine as it has become a commercially available household article. We use wireless technology inside a hospital, where several electrical devices using long wires and cables. An ECG [6] Monitor which ideally has 12 cables connected to a patient and it could potentially be implemented as a wireless system. An ECG reading shows most accurate data which is used to determine a patient's heart condition.

2. System Model

2.1 Designed System

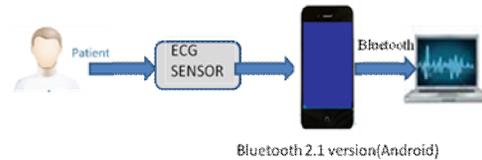


Fig. 1: Block diagram

From the above block diagram, we have three important modules a) ECG sensor, b) Android mobile phone c) Bluetooth. By using ECG sensor we can measure ECG from patient's body on mobile phone & we get ECG waveform on mobile phone and by using Bluetooth technology we can transmit ECG to PC. The application running on the mobile terminal runs on any mobile phone equipped with Bluetooth. Its user interface allows communications with other devices, and we can receive cardiac signals and can visualize real-time data signal.

2.2 Bluetooth Wireless Link

Bluetooth Network [3] can provide point to point connection or point to multipoint connections. In point to multipoint connections, several Bluetooth units share the same channels, two or more units sharing the same channels form a Piconet. Bluetooth™ is an emerging short-range RF wireless voice and data communication technology expected to spread widely in a couple of years. This technology eliminates the need for cables to connect portable computers, mobile phones and other devices to each other from all different manufacturers. Bluetooth technology has many properties like voice and data applications without the need to apply for permission to run in the 2.4 to 2.485GHz band, operating range from 10m or 100m can be penetrate solid objects as compared to other wireless technologies

2.3 Electrocardiograms (ECG)

ECG [6] is a non-invasive recording produced by an electrocardiographic device. The meaning of the word is derived from the Greek electro, as it is electrical activity, cardio, heart. An ECG is the recording of the heart's electrical potential versus time [3]. So ECG is simply an electrical recording of the heart.

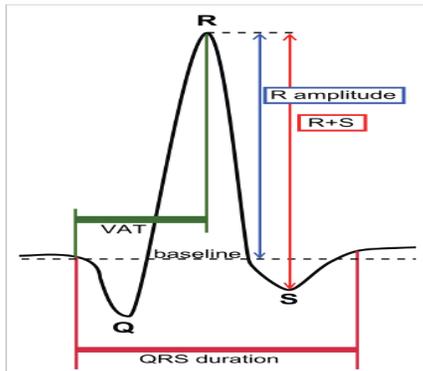


Fig. 2: ECG Waveform

Waves and intervals are Schematic representation of normal ECG Animation of a normal ECG wave. A typical ECG tracing of the cardiac cycle (heartbeat) consists of waves like a P wave, a QRS wave, a T wave, and a U wave which is normally visible in 50 to 75% of ECGs. The baseline voltage of the electrocardiogram is known as the isoelectric line. Typically this is measured as the portion of the tracing following the T wave and preceding the next P wave.

2.4 Android Operating System

Android OS [20] is a Linux based operating system. It is targeted for mobile, smart phone and tablet devices. It is characterized by openness and explicit features that enable developers to take full advantage of features of the hardware devices. Android is basically a software Environment which includes a Linux based OS, different application frame-works; end user applications, integrated multimedia support, Different libraries, and more. Tools and different APIS that are used for developing mobile apps are provided through the android SDK. The Android platform as part of the most widely used operating systems on smart phones and hand held tablet devices is important target for mobile application developers and hardware manufacturers. Different Platforms available today which include Apple iOS, RIM Blackberry, Symbian, and Android [5].

The Java programming language, Eclipse [8] and the android Software development Kit (SDK) are used as the development tools and environment. Eclipse IDE is selected for the development as it offers direct invoking of tools that are used for developing applications through the eclipse Android Development Tools (ADT)

plug-in. Android contains a set of C and C++ libraries that are responsible for performance optimization and efficiency.

Dalvik Virtual Machine is special virtual machine used to run Java based applications. Dalvik having its own byte code format which is different from Java byte code. So we cannot directly run Java class files on Android; we need to get converted in the Dalvik byte code format.

API Level is an integer value that uniquely identifies the framework API revision offered by a version of the Android platform. The Android platform provides a different framework API that applications can use to interact with the underlying Android system. The following table specifies the API Level supported by each version of the Android platform.

Platform Version	API Level
Android 2.3	9
Android 2.2	8
Android 2.1	7
Android 2.0.1	6
Android 2.0	5
Android 1.6	4
Android 1.5	3
Android 1.1	2
Android 1.0	1

Table 1: API levels

3. Implementation

3.1 Eclipse Software

The Eclipse Platform [19] is designed for building integrated development environments (IDEs) that can be used to create applications as diverse as web sites, embedded Java programs, C++ programs, and Enterprise JavaBeans. Many software developers spend their workday in an integrated development environment (IDE). For many Java developers, Eclipse (IDE) is a choice. Commonly cited reasons for using Eclipse include rich Java Development Tools (JDT) support and a plug-in architecture that allows tight integration of third-party functionality. Figure 3 shows the top 10 of the 42 views shipped with the default

Eclipse distribution based on the percentage of developers who made at least one selection in each of the views. The 10 views are used for display purpose

- the code’s static structure (Package Explorer and Outline),
- runtime and debug information (Console, Variables, Debug, and Breakpoints),
- search results (Search),

Many developers used the first seven views.

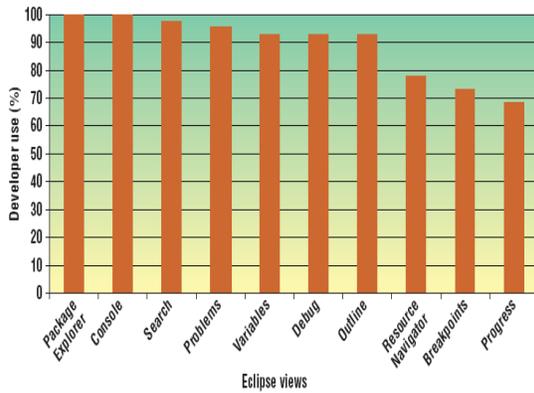


Fig.3: Top 10 Views of Eclipse

Figure 4 shows the Eclipse development environment, which is used for display and manipulating information in views. The Package Explorer view i.e. window A, for instance, displays information about the Java code’s package, class, and member structure. Window B in figure 4 shows a Java editor.

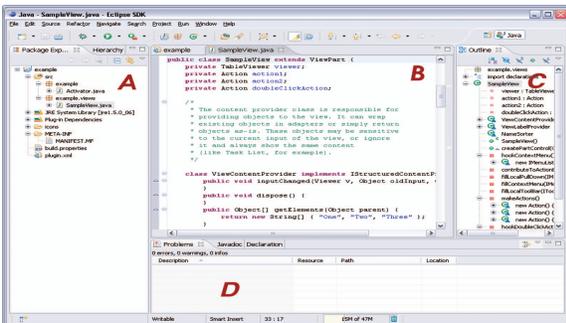


Fig. 4: Editor Window

We can create layout via drag and drop or via XML (Extensible Markup Language) source code using android editor. Android support layout manager like

linear layout, Relative layout, Grid layout, Frame layout.

Linear Layout having single column or row depending on the android orientation attributes. Different values for this attribute are horizontal and vertical, horizontal is the default value. Relative Layout allows positioning the widget relative to each other. This allows for complex layouts. Grid Layout separates its drawing area into: rows, columns, and cells. Frame layout is a layout manager which draws all elements on top of each other.

3.2 Algorithm for developing Android Application

Steps

- i) Android applications are primarily written in the Java programming language in eclipse software.
- ii) The Java source files are converted to Java class files by the Java compiler.
- iii) The Android SDK contains a tool called dx which converts Java class files into a .dex (Dalvik Executable) file.
- iv) The .dex file and the resources of an Android project, like images and XML files. They are packed into an .apk (Android Package) file.
- v) So finally whole Android application (.apk file) will be created and deployed.

3.3 ECG Capturing

We can read ECG [19] in mobile phone using ECG sensor .The Android multimedia framework includes support for capturing and encoding a variety of common ECG formats, so that we can easily integrate ECG into our applications.

4. Result

In this paper, we got a result for capturing ECG by using ECG sensor in mobile phone.



Fig. 5: Ecg Waveform in mobile phone

5. Footnotes

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