

# A Wearable Cuff-Less System For Continuous Monitoring Of Blood Pressure And ECG Using Android Technology

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*Abstract—In order to improve the way of data collection and workflow of vital signs measurement in hospital, Continuous monitoring of Blood Pressure (BP) has a significant value for Cardiovascular Diseases (CVDs), but the conventional BP apparatus are commonly Cuff-based, which becomes a great hindrance for long term BP measurement particularly during night. this paper proposed a android based vital signs data collection and information system. This system comprises a database server, PC, and wireless devices such as blood pressure monitor, infrared thermometer and ECG measurment. The Tablet PC and wireless devices are put on a cart to serve as a mobile nursing information system unit. All of the devices have Bluetooth interface, therefore they can communicate with the Tablet PC via Bluetooth. Moreover, the designed user interface on Tablet PC can inspect patients' information and upload the collected vital signs data to a database server. The system has a pilot trial in hospital, and the results show the system can reduce the time of data transcription. Besides, the benefits of this system are also including: (1) eliminating the error rate caused by hand written, (2) providing real-time vital signs data recording and access, (3) speeding up the overall process of nursing documentation.*

*Key words: LPC2148, Sensors, Bluetooth, Mat lab, android.*

## I. Introduction

In general the way to record vital signs data is recording vital signs data on the paper by handwritten, and then transcribed these vital signs data to an information system by typing on a computer. Duplicate to record vital signs data by handwritten and typing to transcribe the data into information system not only increase workload of nurses but also waste the direct care time for providing to patients. Furthermore, it may cause recording error during handwritten and could also cause error by typing vital signs on the computer. Because of these reasons it may lead misdiagnose. There has a study proposed a clinical documentation system with a Tablet PC affixed to the vital signs monitor to achieve machine to computer clinical documentation. Nurses can transcribe vital signs data from measuring device to Tablet PC immediately. The data can be stored into database information system without handwritten and hence shorter the time delay for providing data on information system. Although the result of this study has lower error rate and shorter medical records transcribed delay time, the process of typing values into Tablet PC could still have errors [6]. Because of the vital signs data still can't direct input from a measuring device to the information system, it is means that human involved is still needed. If the vital signs data can direct input from a measuring device to the information system, then it can reduce the error rate and delay time. Therefore, nurses can spend more time on direct care of patient. In this paper The Purpose of the project is BP measurement devices are mainly cuff based, it

discomfort due to the inflation of cuff during measurement. So an old process is unsuitable for long-term BP monitoring, especially in night time. So we introducing new technique PTT(Pulse transit time) can be readily derived from electrocardiogram (ECG) and photoplethysmogram (PPG) by wearable devices PTT within 24 h or overnight in an out-of-laboratory daily life setting. Therefore, this study aims to investigate whether PTT can be a surrogate of 24-h BP in an unattended environment. It provides a very practical solution for ambulatory BP monitoring.

## II. The Hardware System

**Micro controller:** This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

**ARM7TDMI:** ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

**Liquid-crystal display (LCD)** is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

## III. Design of Proposed Hardware

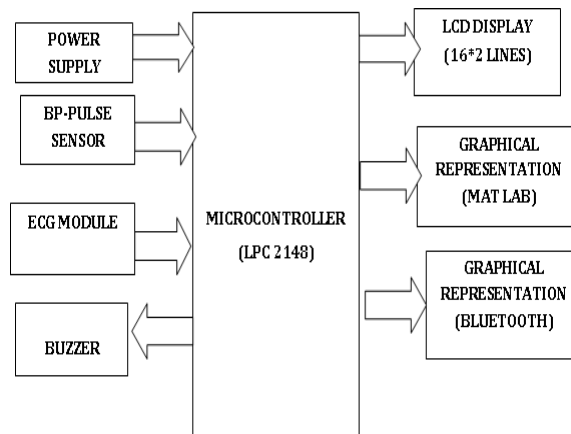


Fig. 1. Block Diagram

In this paper, we use the state-of-the-art mobile technologies to design a Tablet PC based vital signs data collection and information system. Fig. 1 shows the system architecture, which is consisted of three units, database server and graphic user interface (GUI) unit, mobile nursing system unit and ward unit. Patient's information and vital signs history record is stored in the database on server. When nurses make routine measurement, they just need to push the mobile nursing system unit to ward to measure patient's vital signs. shows the mobile nursing system unit, which is equipped with the PC, pulse sensor, ECG sensor on a cart and data will send to the PC as well as mobile.

## IV. Board Hardware Resources Features

Technologies used in our project to get effective data of a patient health details are:

### Pulse sensor

Pulse sensor is also called as Heart Beat Sensor. This heart beat sensor is designed to give digital output of heart beat when a finger is placed inside it. When the heart detector is working, the top-most LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

### ECG:

The ECG sensor measures electrical potentials produced by the heart (Electro-cardiogram). These small voltages are measured at the skin of the wrists and elbow through electrodes. The ECG sensor can also be used to measure the electrical potentials generated by muscle cells when these cells contract and relax (Electromyogram). For safety reasons the sensor uses an optical coupler to avoid any direct electrical contact between the person whose ECG is measured and the measurement interface or computer. The ECG sensor is delivered together with a package of 100 electrode patches.



Fig2. ECG Sensor

### Bluetooth:

HC Serial Bluetooth product consists of Bluetooth serial interface module and Bluetooth adapter. Bluetooth serial module is used for converting serial port to Bluetooth. This module has two modes: master and slaver device. The device named after even number is defined to be master or slaver when out of factory and can't be changed to the other mode. But for the device named after odd number, users can set the work mode (master or slaver) of the device by AT commands.

HC-06 Specifically includes:

Master device: HC-06-M, M=Master

Slaver device: HC-06-S, S=Slave

The main function of Bluetooth serial module is replacing the serial port line, such as:

One connects to Bluetooth master device while the other one connects to slaver device. Their connection can be built once the pair is made. This Bluetooth connection is equivalently liked to a serial port line connection including RXD, TXD

signals. And they can communicate with each other.

1. When MCU has Bluetooth slave module, it can communicate with Bluetooth adapter of computer and smart phones.
2. The Bluetooth devices in the market mostly are slave devices, such as Bluetooth printer, Bluetooth GPS. So, we can use master module to make pair and communicate with them.
3. Bluetooth serial module's operation doesn't need driver, and can communicate with the other Bluetooth device. But communication between two Bluetooth modules requires two conditions:
  - i) The communication must be between master and slave.
  - ii) The password must be correct.

### V. CONCLUSION

We used the project an armband-based wearable device was developed for long-term BP measurement based on PTT method. 24-h take-home study was conducted to evaluate the accuracy of this device. In this we used MATLAB based PC and wireless measuring devices to build vital signs data collection and information system. This system has been used in hospital for a pilot trial. Results show the system can reduce the time of data transcription and eliminate the error caused by handwritten on paper.

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