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Bluetooth Low Energy Technology in Sports

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Abstract

Bluetooth low energy or Bluetooth LE, marketed as Bluetooth Smart, is a wireless personal area network technology designed and marketed by the Bluetooth Special Interest Group aimed at novel applications in the healthcare, fitness, security, and home entertainment industries. Compared to Classic Bluetooth, Bluetooth Smart is intended to provide considerably low power consumption and cost while maintaining a similar communication range. Borrowing from the original Bluetooth specification, the Bluetooth SIG defines several profiles — specifications for how a device works in a particular application — for low energy devices. Manufacturers are expected to implement the appropriate specifications for their device in order to ensure compatibility. Technology remains in the forefront, as gadgets grow ever more user-friendly, compact and sophisticated. Many use their phones for training with fitness apps, so everyone needs to protect it from sweat and impact. With the help of these technology ,I am going to design a simple device which is having features like shock absorber ,water proof ,dust proof , user friendly, adoptable to all operating system. The proposed project is to calibrate the heart rate, temperature, acceleration, (x,y,z) position, speed of the various players. From that data, it is helpful to analysis the performance players.

Keywords: Bluetooth Low Energy Technology, Health Monitoring App.

Introduction

Bluetooth low energy or Bluetooth LE, marketed as Bluetooth Smart, is a wireless personal area network technology designed and marketed by the Bluetooth Special Interest Group aimed at novel applications in the healthcare, fitness, security, and home entertainment industries[1]. Compared to Classic Bluetooth, Bluetooth Smart is intended to provide considerably reduced power consumption and cost while maintaining a similar communication range. Bluetooth Smart was originally introduced under the name Wibree by Nokia in 2006. It was merged into the main Bluetooth standard in 2010 with the adoption of the Bluetooth Core Specification Version 4.0.Mobile operating systems including iOS, Android, Windows Phone and BlackBerry, as well as OS X, Linux, and Windows 8, natively support Bluetooth Smart[2]. The Bluetooth SIG predicts more than 90 percent of Bluetooth-enabled smart phones will support Bluetooth Smart by 2018.Bluetooth Smart goes beyond being simply power-friendly because it uses dramatically less power than other wireless technologies[4][7]. It is application- friendly because it costs less and offers flexible development architecture for creating applications for Bluetooth smart sensors. This allows the developers to bring everyday objects like heart -rate monitors ,toothbrushes and shoes into the connected world and have them communicate with applications reside on the Bluetooth smart compatible smart phones, tablets or similar devices those consumers already.

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Figure 1. Bluetooth Logo

Methodology

Bluetooth Low Energy technology is a wireless technology allowing electronic devices to perform short range wireless communication between each other[3]. Traditionally Classical Bluetooth technology, it supports only to the Apple iOS software. But here we are going to implement of supporting to all OS operating system. By this it reduces the cost and becomes as a user friendly technological tool[5]. For this we had designed the prototype and android app as follows. This prototype includes, Heart rate monitor, Heart beat sensor, Accelerometer, Bluetooth, RS232, Temperature sensor.

RS232 Cable Communication

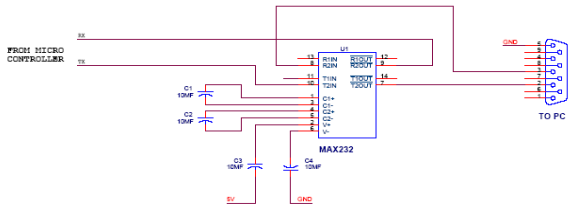

Figure II. Circuit diagram of RS232 cable communication

In telecommunications, **RS-232** is a standard for serial binary data interconnection between a *DTE* (Data terminal equipment) and a *DCE* (Data Circuit-terminating Equipment). It is commonly used in computer serial ports. In this circuit the microcontroller transmitter pin is connected in the MAX232 T2IN pin which converts input 5v TTL/CMOS level to RS232 level[6]. Then T2OUT pin is connected to reviver pin of 9 pin D type serial connector which is directly connected to PC. In PC the transmitting data is given to R2IN of MAX232 through transmitting pin of 9 pin D type connector which converts the RS232 level to 5v TTL/CMOS level. The R2OUT pin is connected to receiver pin of the microcontroller. Likewise the data is transmitted and received between the microcontroller and PC or other device vice versa[8].

Figure III. RS232 cable communication

Thermistor

A thermistor is a type of resistor whose resistance varies with temperature. The word is a portmanteau of *thermal* and *resistor*. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting over current protectors, and self-regulating heating elements[8]. A temperature-sensitive resistor is called a thermistor**.** There are several different types:

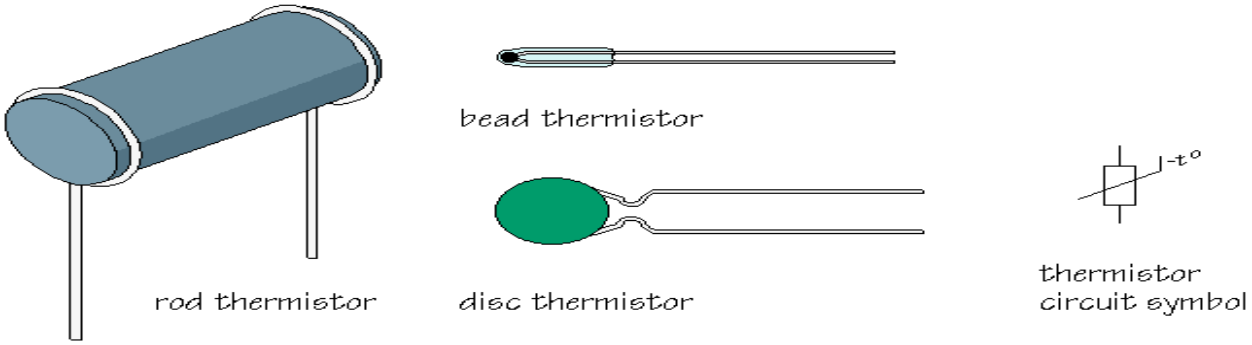

Figure IV. Types of Thermistor

Here we are using bead thermistor, when the player touch this thermistor (before /after the practise) it will indicate the temperature simultaneously.

Heart beat sensor

A device for holding a heartbeat sensor in a relatively fixed relationship with respect to the end of a user's fingertip. More particularly, a device is disclosed wherein a single sheet of resilient material is formed into a base portion for holding the heartbeat sensor and three resilient bands that extend upwardly there from[7]. The bands are adapted to grip the user's fingertip. In one

embodiment of the invention, the bands and base portion define a U-shaped channel of constant cross-sectional area. In this embodiment a holding structure for the heartbeat sensor is wedge-shaped, the wedge-shaped holding structure being adapted to be held by the base portion so that the cross-sectional area defined by each band and the wedge-shaped holding structure decreases along the longitudinal length of the base portion. In another embodiment of the invention, each band defines a smaller cross-sectional area with respect to the base portion. Thus both embodiments result in more pressure being applied to the sensor at the portion of the user's fingertip closest to the end.

Figure V. Heart beat sensor in fingertip

Heart rate is a term used to describe the frequency of the cardiac cycle. It is considered one of the four vital signs. Usually it is calculated as the number of contractions (heart beats) of the heart in one minute and expressed as "beats per minute" (bpm). See "Heart" for information on embryo fetal heart rates. The heart beats up to 120 times per minute in childhood. When resting, the adult human heart beats at about 70 bpm (males) and 75 bpm (females), but this rate varies among people. However, the reference range is normally between 60 bpm (if less termed bradycardia) and 100 bpm (if greater, termed tachycardia)[8].

Acccelerometer

An accelerometer is a device that measures proper acceleration, the acceleration experienced relative to freefall. Single- and multi-axis models are available to detect magnitude and direction of the acceleration as a vector quantity, and can be used to sense orientation, acceleration, vibration shock, and falling[8]. Micro machined accelerometers are increasingly present in portable electronic devices and video game controllers, to detect the position of the device or provide for game input.

Results and Discussion

When the power supply is on the prototype starts to function, the Bluetooth should be ON in mobile as well as in the PC. In order to calculate the heart rate, the sensor is connected to fingertip, it will indicates whether is normal or abnormal, here we set as range from 70to140bpm. Then the Thermistor will indicates the temperature of his/her. And simultaneously the position of the player is displayed. Here with the help of Bluetooth low energy technology, all the information of the players/ athletes data are collected and monitored in the above fig 3.1 android app as well as in the display of prototype circuit board. The Lab view software is used to monitor the database of players. These data are transferred from circuit board to mobile/PC with the help of Bluetooth Low Energy technology. Then the data are collected and monitored in the android app as well as in the display of prototype circuit board. The Lab view software is used to monitor the database of players.

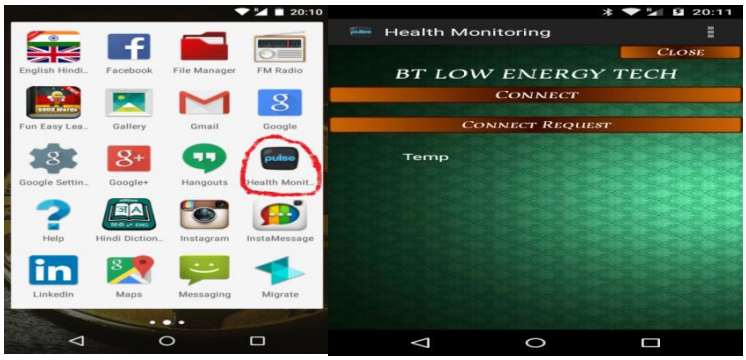

Figure VI. Image of android app –Pulse Health Monitoring

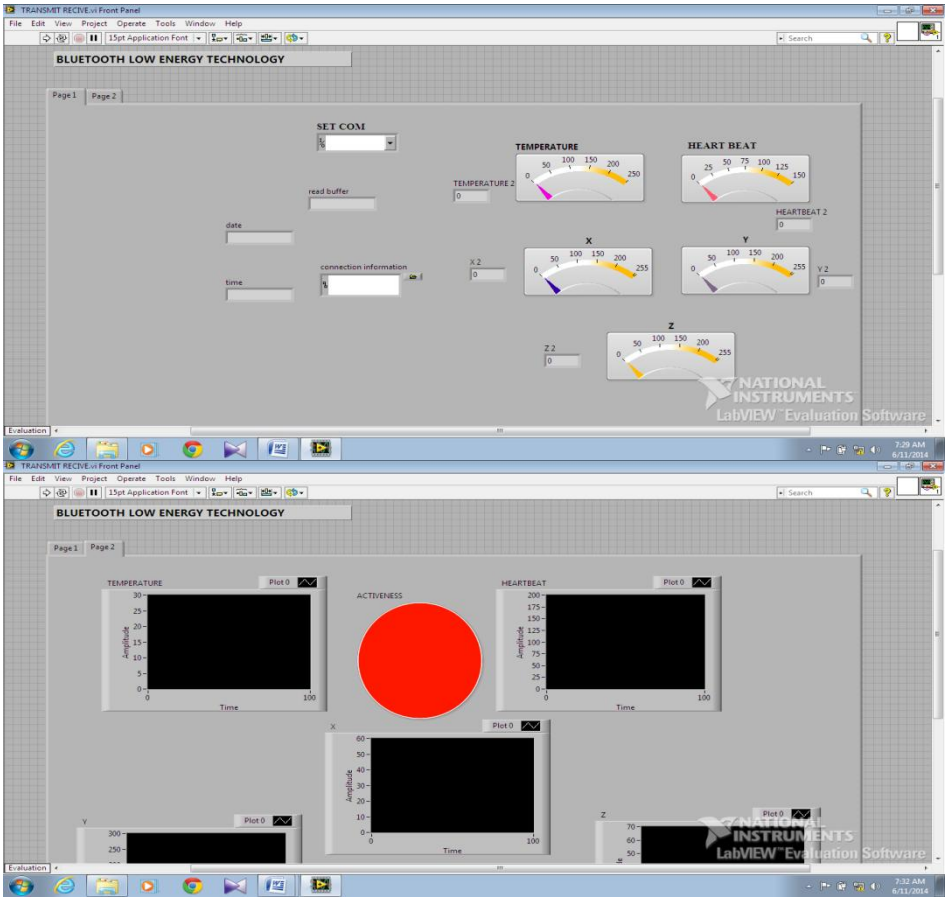

Figure VII. Lab view of Bluetooth Low Energy Technology-page 1, page 2

Conclusion

It is well proved from the data and results obtained that it will helpful for the coaches as well as the athletes in order to enhance the performance. Future scope with these techniques, many device can be designed like wrist band, heart rate monitor belt, etc which is to be supported to all operating system with low power consumption.

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