

# E-Portable Wristband Health Monitoring System Using Lilyypad

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**Abstract:** This work describes the implementation of portable health monitoring system using Lilyypad Arduino microcontroller and HC-05 Bluetooth module. The system is developed to monitor the real-time heart rate and body temperature of a patient remotely. The components used in this work are pulse sensor to pick up the rate of heart beat signal and Lilyypad temperature sensor to detect body temperature from the patient. The signals sensed by the Lilyypad are transferred to the Bluetooth module where it transmits the measured data wirelessly to the Android mobile. The system design is portable, cost wise it is low and it has no complications. This system gives clear information about how the conventional health system had been replaced by portable ones. This work is useful for the transmission of signals over wide range of distance and also provides a simple monitoring process.

**Keywords**— Heart rate, Temperature, Lilyypad, Bluetooth module, Wireless.

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## I. INTRODUCTION

Recently, risking of health factors is a major threat to the people. In this mechanic life, they did not spend any time to take care of their health. As a result, most of the people have suffered many health problems like cardiac arrest, cholesterol, blood pressure, stress etc. even if they go to hospital for medical checkup it will be a waste of time to them. Therefore, it is an urgent in the near future for health care sectors or hospitals to develop an advanced and practical related technology which can be used by any sort of people. In order, to keep the track of their records and daily events essentially regular monitoring of the patient must be ensured. However, with rapidly aging people these have great pressure to the challenging events on the unhealthy society by taking the reviews of past 10 years people don't have good healthy diet and they did not practice meditation to keep them relax. Poor medication leads to increase in the stress level. Technology improvements in health care sectors and hospitals are highly desirable to meet the needs of giant group. In the meantime, E-textile based wearable has been recognized as an evolution of modern era it was started in the beginning of year 2004. This type of technology provides this possibility to connect or fabricate sensors in dresses and other garments. These types of wearable can be wearing easily and this also be connected to connectivity like Bluetooth and WI-FI and can be accessed easily. Various wearable are exploring this domain which can unlock new era of wearable as a part of wearable in which Lilyypad is fabricated and it plays major role in connecting with sensors which can be connected by using strings or metal threads or by means of connecting wires. Lilyypad can be used in any kind of applications like blinking of led, movement of robotic arm, displaying words in LED screen etc. Some researchers try to implement Lilyypad in health care-based applications using pulse sensor which detect the heart rate of a human being by means of LED if the lead glows high the heartbeat of a person in normal if it blinks low heartbeat of a person is abnormal. Some researchers found that E- wearable can be used in advanced technologies in field of health care and also it can be implemented with functional textiles where utilized to produce sensor zed garment for physical monitoring of a person, where ECG signals are successfully recorded and fabricated using sensing elements. Arduino are used to connect the hardware's and upload the programs to get the output. Today, wireless network provide mobile telemedicine which allows patients to engage with their daily routines while they are monitored continuously anytime, anywhere and in any place. In this paper they have done the basic health care monitoring system using the Internet of Things (IOT). Here the Health is monitored using the Radio Frequency Identification (RFID) technology is used to extract the information of the health rate [1]. They have used wireless body area network (WBAN) and a server at home. The WBAN sensors monitor the heart rate and physical activity to the home server [2]. The patient health is continuously monitored and the acquired data is transmitted using Wi-Fi wireless sensor networks. If any disturbances

occur to the patient, the signals are sent to the medical officials [3].Heart rate is measured using the fingertip and Arduino system. Here the photophelthysmography (PPG) [4].This type of network is not suitable for high distance transmission of signals. Hence this work is useful for the transmission of signals over a minimum range of distance and also provides a simple monitoring process.

## II. LITERATURE REVIEW

Some researches study related to the health monitoring system by using different approaches are wireless body area networks (WBAN), Bluetooth, Wi-Fi, raspberry pi, Internet of Things (IOT) and Arduino etc are briefly presented here ( Bishop 2006; Pekkanen 2010; Yang and Mantysalo 2012 ;Krigslund 2013; Sai Kiran 2017 ).

Chris et al (2004) developed a wearable health monitoring system by utilizing the wireless body area network (WBAN) technology. This technology consists of multiple sensor nodes and it is capable of sampling in processing and communicating vital signs such as heart rate, blood pressure, oxygen saturation by placing tiny patches in parts of the body. The signals from the tiny patches is transmitted to WBAN technology and global positioning system is used to receive the signals from WBAN from GPRS it passes the signal to emergency care unit and hospitals.

Bin et al (2012) observed the electronic cardio gram (ECG) waveform by using Bluetooth with low energy wireless system in mobile phones. Bluetooth technology has a great impact of transmitting echo signals easily using GATE traffic approach the heart rate of a person can be digitally seen in Android mobile phones by using this gate approach.

Geng et al (2014) developed an Internet of Thing (IOT) platform based on integration of intelligent patching using unobtrusive bio-sensor and intelligent medicine box. The biosensors are placed in human body where it senses the bio signals and sends to I-medical box. The weighing sensor used in medicine box to receive the signals. The received signals from medicine box is get transmitted to cloud network.

Rakesh et al (2017) analyzed the micro electro mechanical system (MEMS) accelerometers by implementing on gloves with Lilypad. RF transmitter is used to receive the sound waves in order to pass the received waves to deaf and mute people using hand gestures.

From the literature review, it is observed that the most of the health monitoring system focused on Internet of Things (IoT), Raspberry pi and Wi-Fi module. Health monitoring systems are quite reasonable and the usage of sensors such as piezo resistive sensor, bio sensor and pill camera have some of the disadvantages like low signal transmission, improper waveform and network delay etc. Therefore, in this work to avoid such type of problems, Lilypad is used as controller which is inbuilt with external power source and heart rate sensor is used to produce electrocardiogram pulses and Lilypad temperature sensor is used to measure the body temperature and by using heart rate and Bluetooth module used as a transmission medium to view parameters in Android application.

## III. EXPERIMENTAL DETAILS

The components used in this work are Lilypad Arduino, Pulse sensor, Lilypad temperature sensor and HC-05 Bluetooth module. Table 1 shows the components used in the health monitoring system.

Table 1. Description of Components

COMPONENTS	MODEL	REQUIREMENTS	WORKING
Arduino Lilypad	DEV-13342	2	To store the programs
Pulse sensor	M212	1	For sensing the heartbeat

Temperature sensor	MCP9700	1	For sensing the temperature
Bluetooth module	HC-05	1	To send or receive the data

#### IV. METHODOLOGY

Figure 1 shows the block diagram of health monitoring system. The system mainly includes six parts Lilypad USB powered by external battery, LilypadArduino in which Bluetooth module is connected. Pulse sensor and Lilypad temperature sensor are connected to the Lilypad USB. The program which has been designed and it is fed into the Lilypad USB using FTDI cable. The function of the system is to sense the signal, send and receive the signals, and display the signal digitally. Figure 1 illustrates the block diagram of the system in which external power supply is given to Lilypad USB pulse sensor is connected to digital pin and the temperature sensor is connected to analog pin. Positive and negative pins of the Lilypad USB are connected to Lilypad. In Lilypad USB the pulse signals and body temperature reading has been sensed. This signal from Lilypad USB has been sent to the Lilypad Arduino in which Bluetooth module is connected, where the function of Bluetooth module is to receive the signal from Lilypad in which the signals had been transmitted wirelessly to Android mobile application.

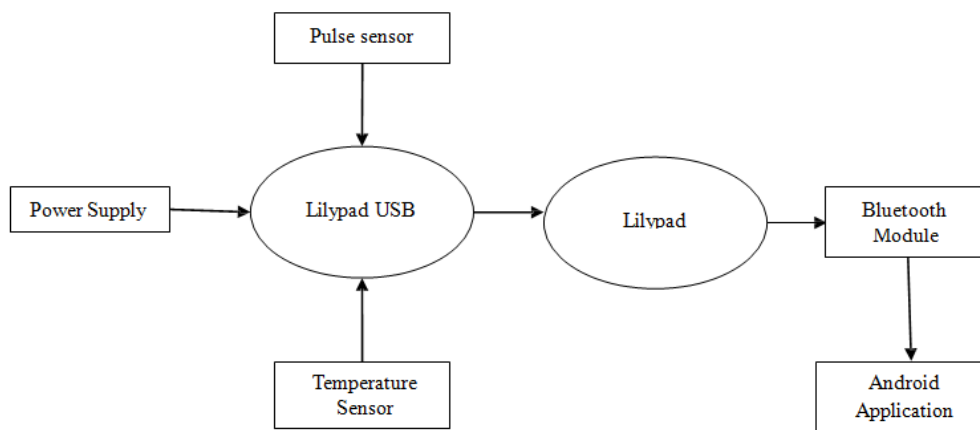


Fig. 1: Block diagram of health monitoring system

#### V. DESIGN AND SIMULATION

Health monitoring system is carried using Arduino programming and with the help of Massachusetts Institute of Technology(MIT) APP inventor and APP was developed.

##### 5.1 APP DEVELOPMENT: HEART RATE

Open a new screen in App Inventor and name it as screen1. First, we need to set up some buttons to find and connect to our Arduino over Bluetooth. Figure 2 shows the graphical output on Android mobile in heart rate. Drag a canvas from the Layout drawer in the Palette and add text box button below to it. Then pick a vertical arrangement 1 and inside that vertical arrangement 1 place the horizontal arrangement layout. Below the horizontal arrangement layout place the list picker button and name it as connect. Add two labels label 1, label 2 and ensure that label 1 should be visible and other should be in-visible. After that place another label and name it as disconnected in that same arrangement pick another

label from layout and name it as diesand also pick the label 4 and make it invisible. After that place a button in the page layout and name it as btn-disonnect it disconnects the Bluetooth.Add another label1 make it invisible. Below that place two buttons and name it as btn-start and btn-stop they are used to get readings from the pulse sensor and below at place two labels and make them invisible. Now take the table arrangement from the layout and draw two columns and two rows in it and name it x axis time and axis amplitude theny–amplitude, these will give the time duration of pulses. Below that place to horizontal arrangement add one label and three buttons make the label invisible and button as graph color, save and exit, then insert non-visible icons Bluetooth, tiny, clock, three notifies storing the pulse waveform. The heart rate systolic and diastolic normal values are 120/80. Three stages are there, stage 1 systolic and diastolic rate is 130/89. It is called hypertension. Stage 2 systolic and diastolic rate is 150/99.The Final stage systolic and diastolic rate is 180/120.It is called hypertensive crisis. This is very dangers consult your doctor immediately.

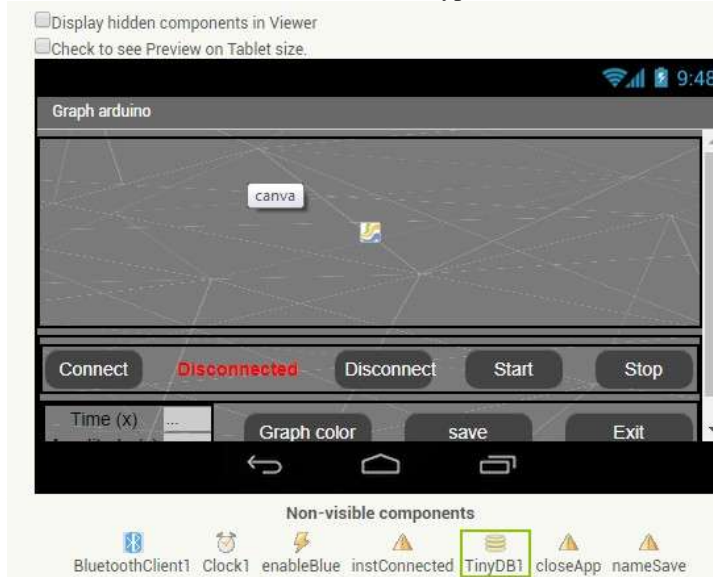


Fig. 2: Graphical heart rate output screen

Open a screen in app inventor and name it as screen 1. Add a label make it invisible and below that place the non- visible components like Bluetooth client, tiny,clock and activity starter for displaying and storing the

temperaturreadings. The empty screen will open below that empty screen places a list picker icon which is used to select Bluetoothdevice. The human body temperature normal range is (36.5–37.5°C). The temperatures are measured in Celsius °C. The body temperature above the normal temperature is called hypothermia. The body temperature below the normal temperature is called low body temperature.

The temperature sensor senses the body temperature and send to the App. In the temperature App, it will read the sensor value and display readings to the user. Figure 3 represents the flow diagram of health monitoring system. The following steps are used in health monitoring system.

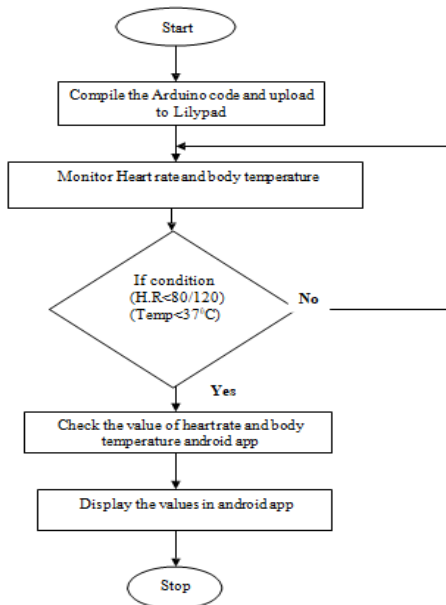


Fig. 3: Flow diagram of health monitoring system

This system only requires a minimum power source to operate it. At the same time, it should provide accurate results than conventional health care systems. It is good flexibility and high reliability. The major assumption from this system is to avoid the health risk. The designed system can be easily used by wearing it in hand. The material used is here spandex type this used to regulate the blood flow smoothly and prevent thrombocytosis. Due to its portability it can be taken anywhere and it also used by anyone. The pulse sensor output pin is A3. The Lilypad output pin is A2. Figure 4 shows the photograph of E-portable health monitoring system. The programs are fed into the Lilypad and compile the program, if no error exists an output signal send to a mobile app via a Bluetooth module.



Fig. 4: Photograph of health monitoring system

Figure 5 shows the output signal of the heartbeat. The output from pulse sensor will go to the Arduino LilyPad. The output will be in the form of the X-axis and Y-axis with respect to time and frequency. The time will be increasing in all time, but the frequency is varied in terms of breathing. The breathing is normal systolic and diastolic value is 120/80. When the breathing is changed the heart problems are accord. The output of body temperature represents the values in Celsius. The normal temperature is 37°C. When the climate is changed the body temperature also gets changed. The normal temperature range varies from men, women and childhood.

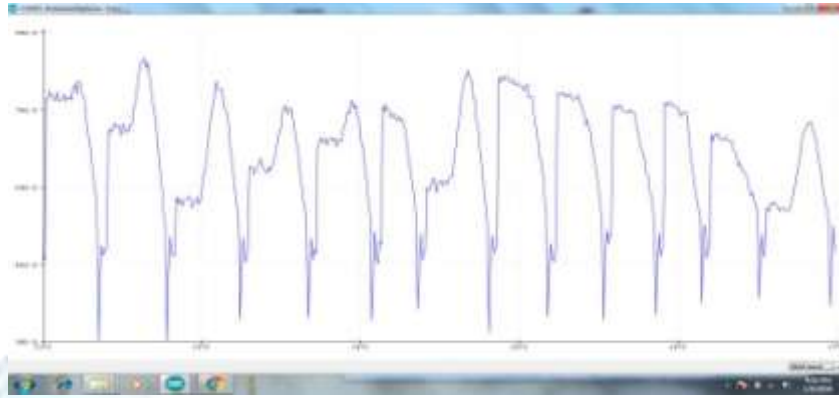


Fig. 5: Heart rate output signal

## CONCLUSION

In this work, e-portable wrist band health monitoring system is developed using LilyPad. The heart rate and body temperature are measured by using pulse sensor, LilyPad temperature sensor and LilyPad Arduino. This work is useful for the transmission of signals over a minimum range of distance and also provides a simple monitoring process. Hence, the further improvements can be made for our system by implementing it using the Internet of Things (IoT) and then the output will be of good in its transmission system by using the Internet of things.

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