Wi-Fi based Health Monitoring System using Lilypad

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Abstract

This work describes the implementation of health monitoring system using Lilypad Arduino microcontroller and ESP8266 Wi-Fi 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 Lilypad temperature sensor to detect body temperature from the patient. The signals sensed by the Lilypad are transferred to the Wi-Fi 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 This system gives clear information about how the conventional health system had been replaced by portable ones.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, Lilypad, Wi-Fi Module

I. INTRODUCTION

In this paper, we developed the WI-FI based health monitoring system using Lilypad. Wi-Fi is famous for low cost, low power consumption and flexible network topology. After power ON, the total monitoring system the program is loaded in to the microcontroller. Using hyper link terminal in the PC the data from each sensor is perceived. And the received data of a patient at rest room is transmitted to the doctor using WI-FI works with no physical wired link between sender and receiver by using radio frequency technology (RFT), a frequency within the electromagnetic spectrum related with radio wave broadcast. When a radio wave current is delivered to an antenna, an Electro Magnetic (EM) field is formed that then is able to propagate through space. In continuous health monitoring the proactive analysis is mainly constrained due to the unavailability of the patient under omnipresent observing. The major reasons for this scenario are the user is non-static (thereby user crosses the range of connectivity) and life time of the node. To deal with this problem we propose a system design for multi parametric remote health observing, which can be joined ubiquitously and consumes less energy. We have observed over the last ten years a proliferation of wireless technology that has now develop into omnipresent. Given the scarce availability of Radio Frequency spectrum, many of these technologies are obliged to use the same unlicensed frequency groups. A space suit outfitted with sensors is the noticeable conduit for measuring and transferring information about astronaut health. In order to avoid this scenario, one result is to reduce the amount of data that is to be transmitted. In continuous ECG monitoring relevance's the data require will not be transferred continuously which will increase load on the network. In the obtainable architectures for data logger and transmission architectures, the traditional continuous transmission of data was used, which leads to most power utilization and increase in the communication network traffic. In this proposed system, we propose design architecture for multi parametric continuous health monitoring which can deal with the matters discussed above. We strongly believe that the proposed design can discover potential applications in continuous health observing where the patient wants to be under stable monitoring. This can also be used in applications which necessitate uninterrupted connectivity such as habitat observing and civil structures scrutinizing.

II. LITERATURE REVIEW

Some researches study related to the health monitoring system by using different approaches are Wireless body area Wi-Fi Module, ZigBee, raspberry pi, Internet of Things (IOT) and Bluetooth etc are briefly presented here.

Manisha Shelar et al (2013) to developed Wireless Patient Health Monitoring System by utilities of wireless monitoring the body temperature and heart rate microcontroller based system for wireless heartbeat and temperature monitoring using ZigBee. The Transmitter will acquire values of physical parameters and will perform digital conversion of them for further processing. This digital data is then transmitted into air using ZigBee by the μC.

Jorge Gomez et al (2016) to developed Patient Monitoring System Based on Internet of Things (IOT) platform based on integration of intelligent patching using un obtrusive bio-sensor and intelligent medicine box. His aim of this article is to develop an architecture based on ontology capable of monitoring the health and workout routine recommendations to patients with chronic diseases

G.Vijaya Lakshmi et al (2016) observed that Health Monitoring System Using Wi-Fi as a Communication Medium on ARM7. All sensor data are transferred within a group of WI-FI wireless module. Wi-Fi is famous for low cost, low power consumption and flexible network topology. And the received data of a patient at rest room is transmitted to the doctor using WI-FI.

Pravin Zaware et al (2014) analyzed the Wi-Fi based Monitoring and Controlling of Embedded System. Monitoring is on-line real-time monitoring based on the machine status controlled the field equipment's. If user wants to operate the equipment he/she will operate from Wi-Fi based device like Phone, Tablet, Laptop or any desktop pc having Wi-Fi utility.

From the literature review, it is observed most of the health monitoring system focused on Internet of Things (IoT), Raspberry pi and Wi-Fi module. Health monitoring system is quite reasonable and the usage of sensors such as, 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. Here WI-FI 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.*
WI-FI module	*ESP8266*	*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, Lilypad Arduino in which WI-FI 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. The signal from Lilypad USB has been sent to the Lilypad Arduino in which WI-FI module is connected. Where the function of WI-FI module is to receive the signal from Lilypad in which the signals had been transmitted wirelessly to Android mobile application.

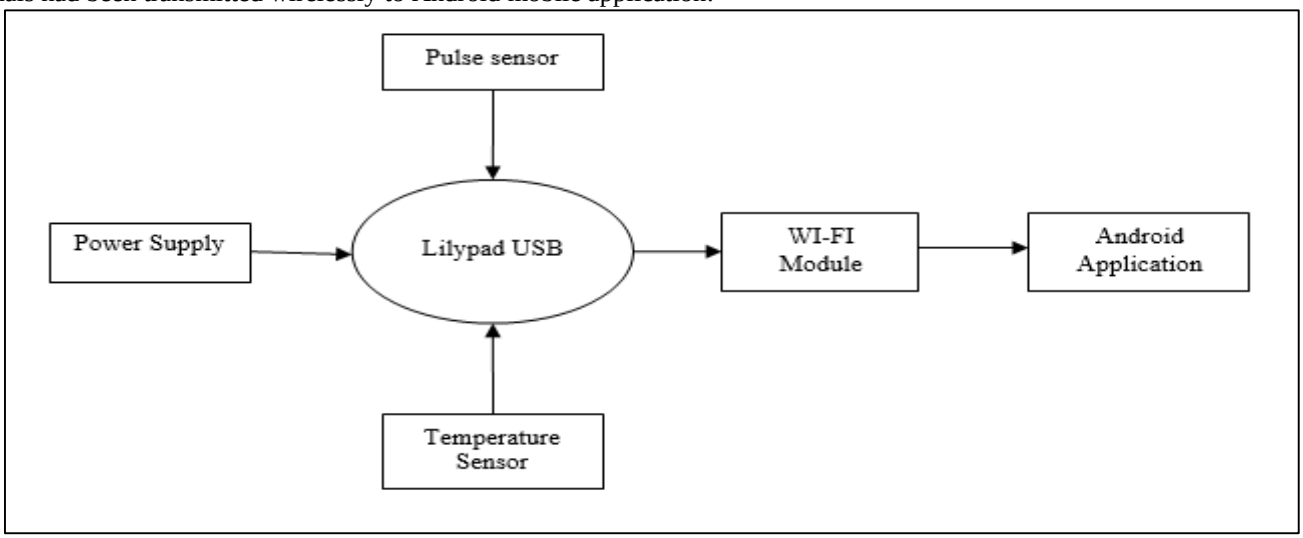

Fig. 1: shows the block diagram of health monitoring system

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.

A. App Development: Heart Rate

Open a new screen in App Inventor and name it screen1. First, we need to set up some buttons to find and connect to our Arduino over WI-FI. 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 places another label and names 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 those place a button in the page layout and name it as btn-disonnect it disconnects the WI-FI. 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-time then y–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 Wi-Fi, 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.

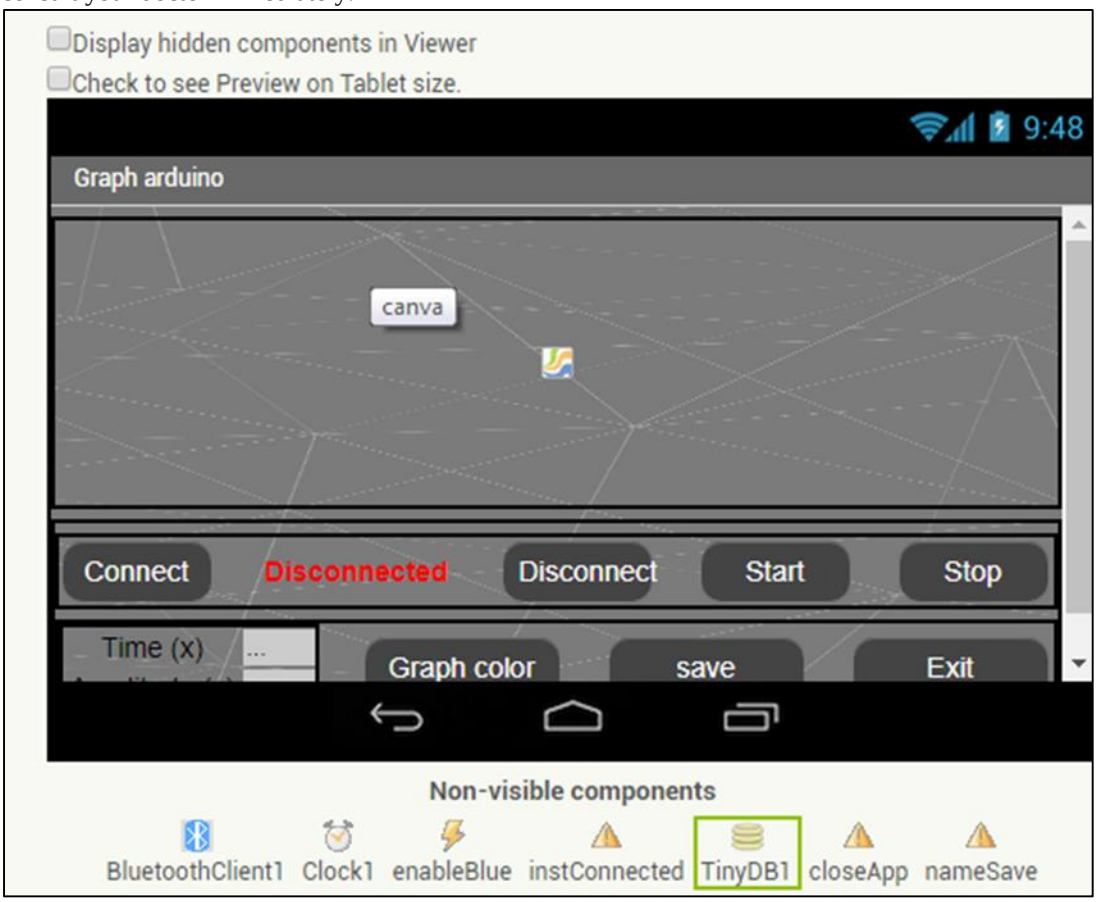

Fig. 2: Graphical heart rate output screen

B. App Development: Temperature

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 temperature readings. The empty screen will open below that empty screen places a list picker icon which is used to select Bluetooth devices. Figure 3 shows the temperature android app screen. The human body temperature normal range is (36.5–37.5°C). The temperatures are measured in Celsius 0C. The body temperature above the normal temperature is called hypothermia. The body temperature below the normal temperature is called low body temperature.

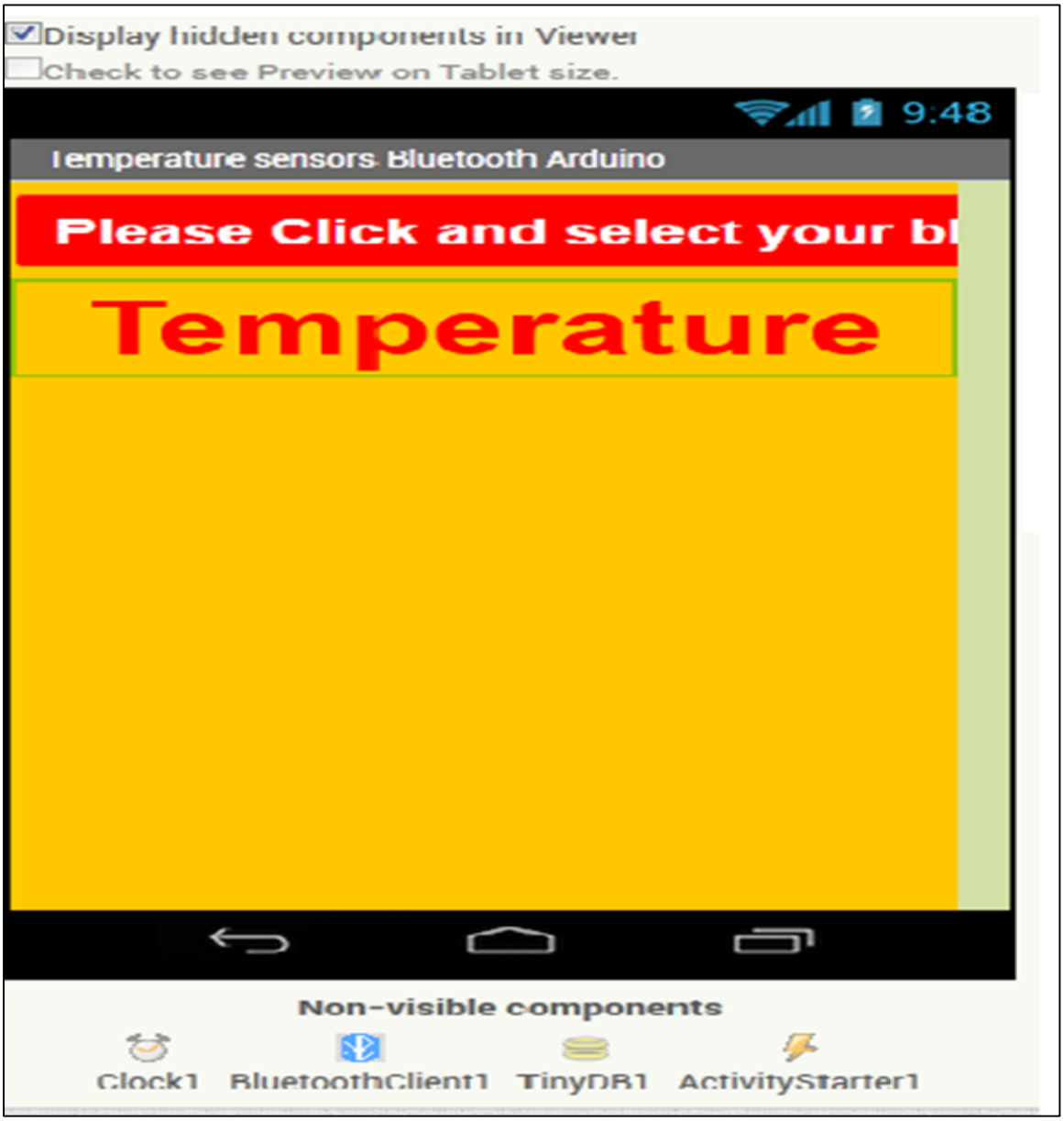

Fig. 3: Temperature output screen

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 4 represents the flow diagram of health monitoring system. The following steps are used in health monitoring system.

Step 1: Start to connect the hardware components.
Step 2: Compile the Arduino code to Lilypad.
Step 3: No error upload program to Lilypad.
Step 4: Sensor sense the reading and send to WI-FI module.
Step 5: WI-FI send the readings to android mobile.
Step 6: Finally, we see the output to mobile screen.

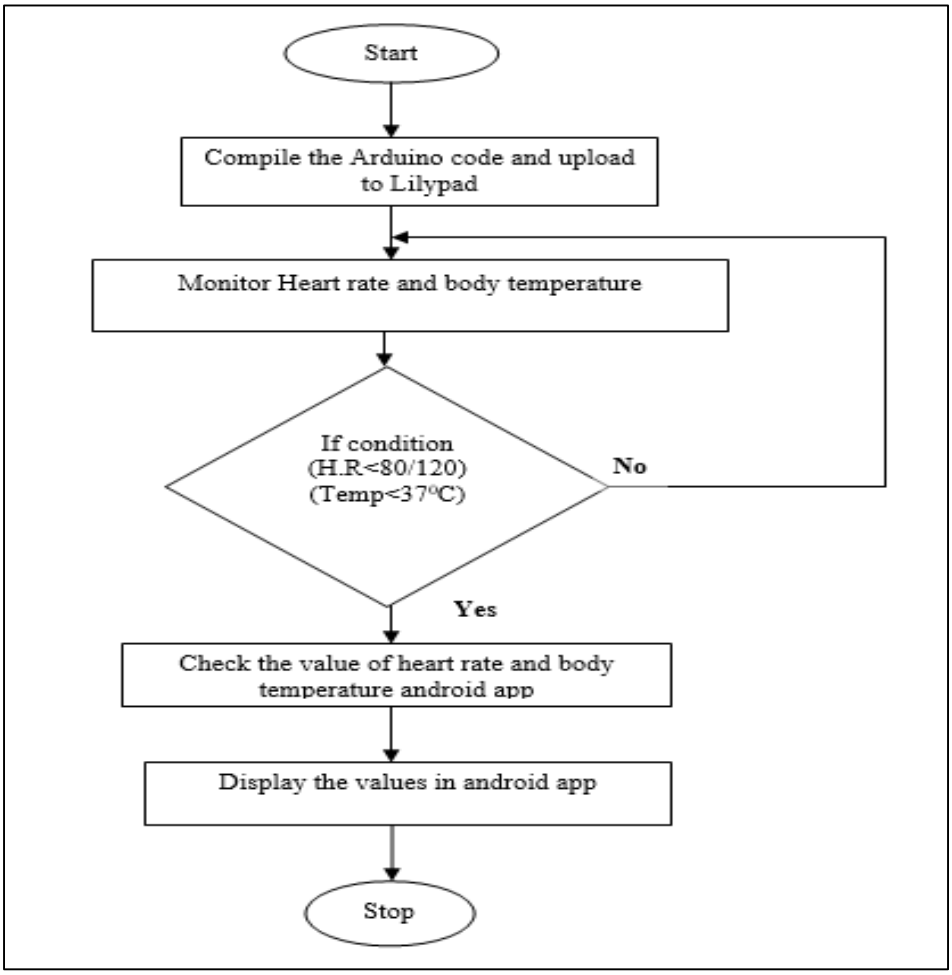

Fig. 4: Flow diagram of health monitoring system

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 thrombcysis. 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.

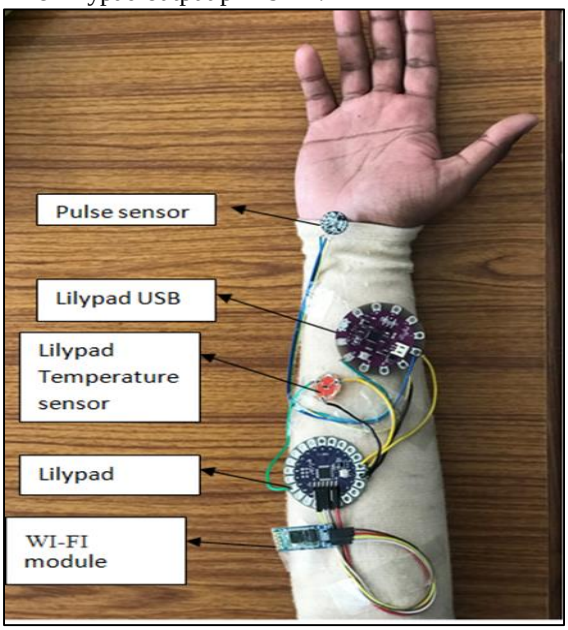

Fig. 5: Photograph of health monitoring system

Figure 5 shows the photograph of WI-FI based health monitoring system. The programs is fed into the Lilypad and Compile the program, if no error exists an output signal send to a mobile app via a WI-FI module.

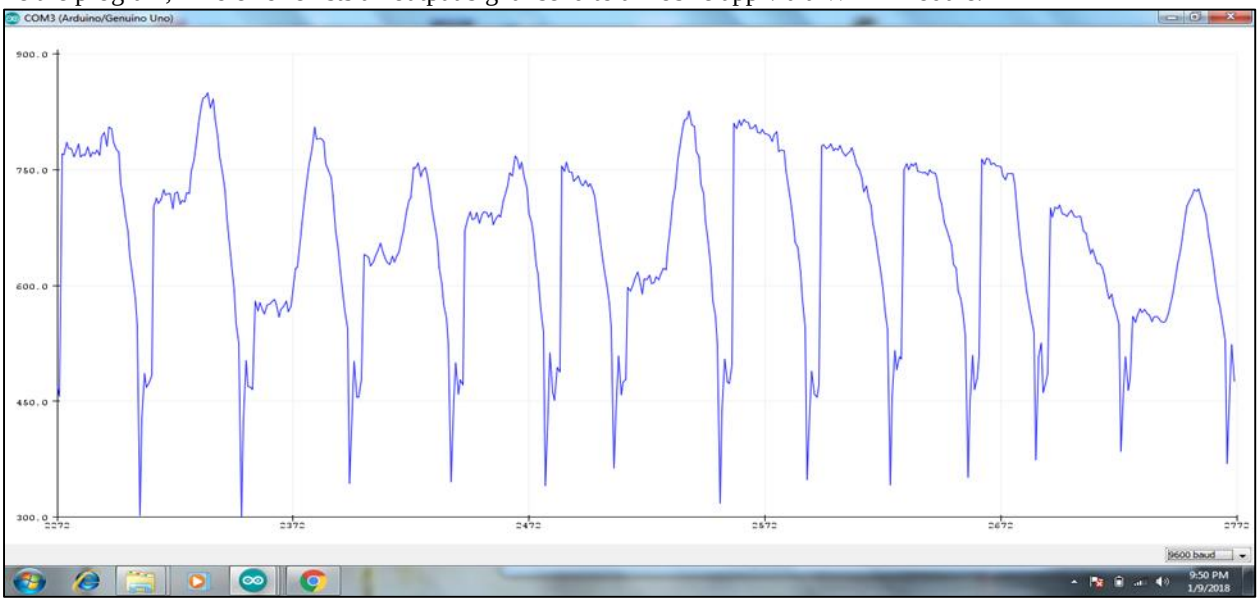

Fig. 6: Heart rate output signal

Figure 6 shows the output signal of the heartbeat. The output is get from pulse sensor in Arduino Lilypad. The X-axis and Y-axis are with respect to time and frequency. The time is increased 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.

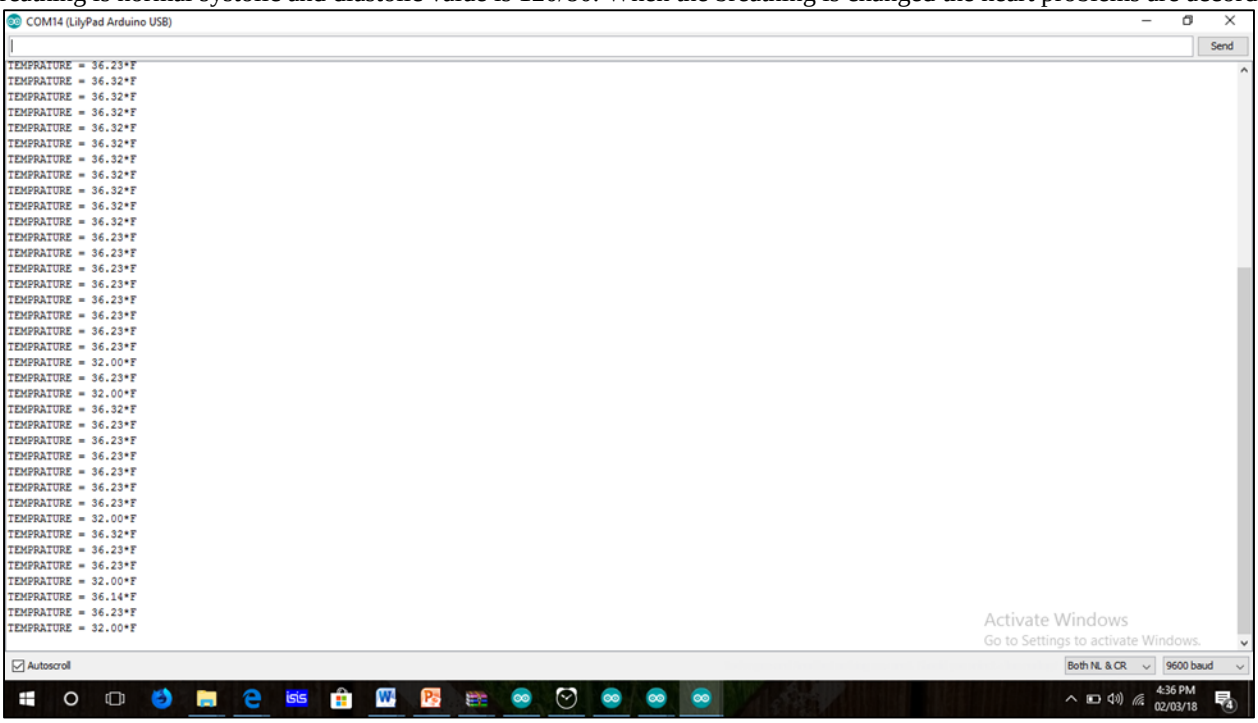

Fig. 7: Temperature output value

Figure 7shows the output of body temperature. It represents the values in Celsius. The normal temperature is 37^0C. When the climate is changed the body temperature also gets changed. The normal temperature range varies from men, women and childhood.

VI. CONCLUSION

In this work, WI-FI based 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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