International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 9 (2018) pp. 7205-7209

Health Monitoring Wrist Band

Jenifer Amla.L[1], Abinaya Vaishnavi.D[2], Swathi Rehka.R[3] , Sathees Kumar.S[4] ,

Professor[1], Scholars[2,3,4.]
Department of Electrical and Electronics Engineering,
Sri Ramakrishna Institute of Technology Coimbatore, Tamil Nadu-641010, India.

Abstract

The competing and complex health need of every individual requires keen attention and monitoring. Nowadays, it becomes a challenge where continuous monitoring is needed, but virtually there is no time to do it. It is a fact that there is an essential need for the health assessment tools and technology to address these concerns in a cost effective manner. Even though there are devices available in the market to monitor the health parameters, monetary discomfort for an average individual is to be taken care. The main objective of this project is to economically design and develop a wearable health [1]monitoring glove which measures essential parameters like body temperature, heart rate, respiratory rate, pulse, fall detection and alarm system for patients who are suffering from diseases like Down syndrome etc., the data collected will be stored for future reference[2][3][7].

Keywords: Health monitoring, Medical Instrumentation, Sensors, Wearable electronics, Wrist band.

INTRODUCTION

Wearable technology have widely been used for spans as hearing supports, pacemakers and other medical devices that are common in the social order. In recent years most of the electronic gadgets are wearable, which are not primarily designed as one but have been reformed based on customer requirements. Even GPS connected wearable is also available in the market nowadays which is considered to be a useful innovation. These wearables are worn by the consumer in which relevant information of the user is displayed. The glove is used to monitor respiratory rate, heart rate, temperature and for fall detection[18] of the patient. The signal acquisition module is then connected to a personal computer that displays the results of the signal processing analysis and gives accurate feedback to the user. This system measures a number of parameters using one device. Most importantly, all the measurements which are to be made are non-invasive.

PROBLEM STATEMENT

Children with genetic disorder, premature children and bed-ridden elderly face a great difficulty of frequent visits and prolonged stay in the hospitals. Monitoring their unstable vitals is yet another challenge.

ROLE OF SENSORS

Sensors play a vital role in wearable electronics and continue to become smaller and more sophisticated. There are number of sensors that can be used in wearable technology. An accelerometer is a sensor that can trail the movement of a moving system, direction and speed. Other commonly sensors are pressure, temperature, compasses, GPS, gyroscopes and humidity sensor. Sensors used in medical applications can be used to measure and monitor blood flow, pulse, blood pressure, blood oxygen levels, muscle movement, body fat and body weight. The widely held healthcare wearable is the fitness and sport activity trackers. Most smart phones already have built-in apps for tracking the steps of an individual. They also measure the pulse rate of a person and generate the results as graph or chart. As they are designed to be user-friendly, smart clothes and gloves respond well to the end users for health monitoring[6][7].

EASE OF USE

To ensure continuous monitoring data log is maintained and for safety an alarm has been set, that buzzes in case of any abnormalities in the measured parameters. The methods that we have introduced for the measurement of parameters are totally pain free and are easy to be handled by the patients and others. Since the biometric data is monitored continuously, frequent visits to the hospital can be avoided. The bed ridden people can be easily taken care even at home. Children who are prone to certain genital disorder require frequent monitoring. This can be totally reduced with the help of this device. They are cost efficient and reliable.

SOCIAL BENEFITS

The wearable health monitoring glove is very useful for the patients who do not have stable health condition. When the people are bed ridden, the glove is used to monitor and check their vitals without having the trouble of moving them to the hospital and better health management[11][12]. Children who are born with certain genital disorder are very unstable with certain medical parameters like blood pressure which make them slow and prevent them from the society to avoid unexpected breakdown or collapse. These children can be left free wearing the glove so that they can be monitored with the help of the data log anywhere. They reduce the medical expenditure to a great extent.

METHODOLOGY

This project has a great advantage over the available commercial product and is comparatively economical. They can be easily operated and are more comfortable to the user.

A. Block Diagram

The block diagram of the proposed model is shown below in Fig .1. It consists of all the parameters that are going to be measured such as body temperature, respiratory rate, heart rate and pulse. It also gives us how the data is going to be collected in the data log through IoT.

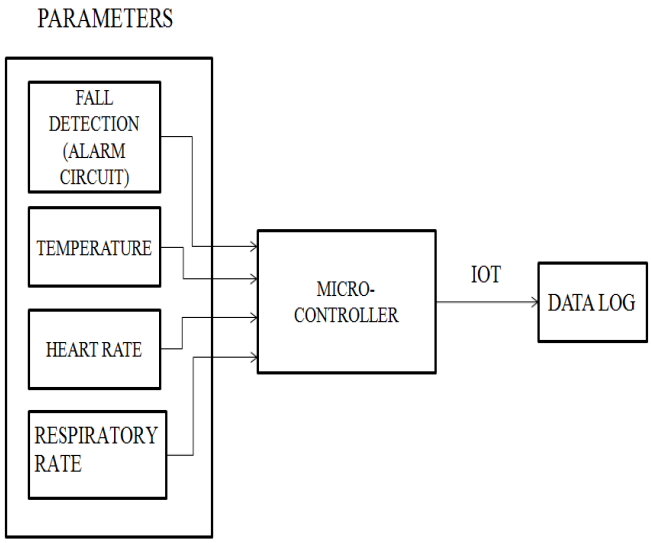

Figure 1. Block Diagram of the Proposed Model

B. Flow Diagram

The flow diagram (Fig.2) gives the overall view of the working of the proposed system and the arrangements made in the glove for the data log.

(a)Sensor Circuit design

A sensor PCB is designed to house the temperature sensor, accelerometer, pressure sensor, pulse wave sensor, pulse oximeter and optical sensor[12][21].

(b)Microcontroller Programming

The microcontroller is programmed to collect the data from the individual sensors and feed them to the Wi-Fi module

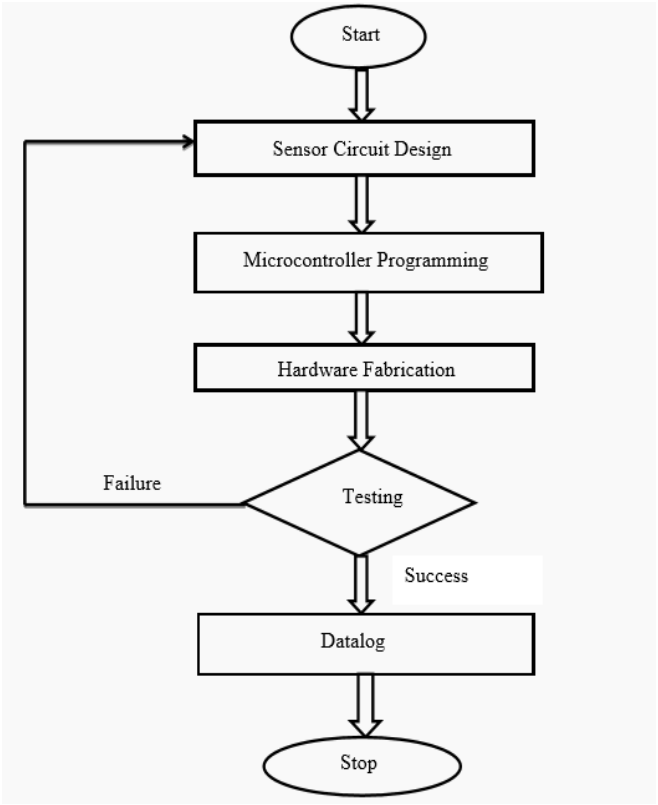

Figure 2. Flow Diagram of the Proposed Model

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(c)Hardware Fabrication

The sensor and microcontroller unit are fabricated on a PCB. This setup is mounted on a glove made up of a conducting fabric which can be worn by the patient.

(d)Testing

This device is tested on a patient to check its functioning compared with other products in the market.

(e)Data log

The physiological parameters are continuously monitored and stored into a database or cloud and are used at times of need.

PROJECT IMPLEMENTATION

A. Positioning Of Sensors

The positioning of the sensors on the glove is done as shown in Fig.3.The pulse and heart rate sensor is placed on the middle finger, pulse oximeter on the index finger, temperature sensor behind the palm and alarm circuit and fall sensor on the wrist.

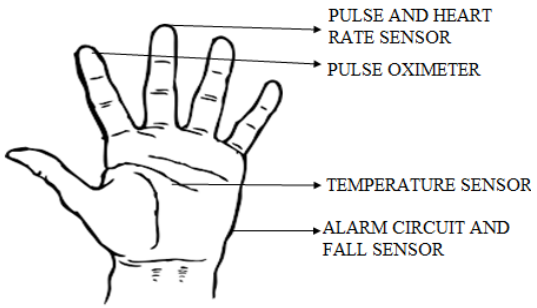

Figure 3. Positioning of sensors

B. Temperature Sensor

A temperature sensor is used for the measurement of body temperature. A thermistor is used as a temperature sensor. A thermistor is a kind of resistor dependent on temperature. A thermistor is a temperature-sensing element composed of sintered semiconductor material which exhibits a large change in resistance proportional to a small change in temperature. Thermistors usually have a negative temperature coefficient which means the resistance of the thermistor decreases as the temperature increases[12][24]. Thermistors are of two types

- NTC (Negative Temperature Coefficient) in which increase in temperature causes decrease in resistance. It is often used as a temperature sensor or as an in rush current limiter
- PTC (Positive Temperature Coefficient) in which increase in temperature causes increase in resistance and is used for over current protections.

An NTC 10K thermistor is used as temperature sensor.

Figure 4. A 10K Thermistor

C. Heart Beat & Pulse Sensor

Heart beat and pulse rate sensor is used to monitor heartbeats. It is usually worn on the finger or earlobe and can be connected to Arduino via cables. It is also loaded with an open-source program to display heart rate The side of the sensor with heart logo makes contact with the skin and on the other side is a small circular hole through which an LED glows. A small square is present right under the LED which is an ambient light sensor, exactly like the one used in cell phones, tablets and laptops to adjust the screen brightness in different light conditions. The remaining parts of the sensor are mounted behind this setup.

Figure 5. Heart Beat and Pulse Sensor

D. Fall Sensor

GY-61 DXL335 accelerometer is used as fall sensor. It is a based on ADXL335 integrated circuit. It consumes less power and has very low noise and has a full sensing range of +/-3g. It is capable of measuring both static acceleration in tilt-sensing applications and dynamic acceleration due to vibration, motion or shock. A buzzer is provided along with the sensor to indicate the onset of fall.

Figure 6. GY-61 accelerometer

E. Hardware Setup

The entire hardware setup is shown in Fig.7.The hardware setup includes other components such as a Wi-Fi module, alarm circuit and arduiono uno.

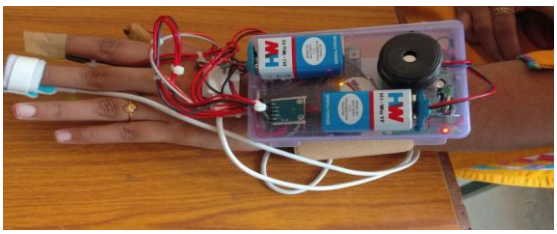

Figure 7. Hardware Setup

Figure 8. Entire Product in Glove

RESULTS AND DISCUSSION

The sensors are interfaced with the Arduino Uno and with the help of Arduino and Wi-Fi module the data from the sensors are monitored continuously through Internet oh Things (IoT). The sensor data is monitored continuously and the datalog is updated every minute.

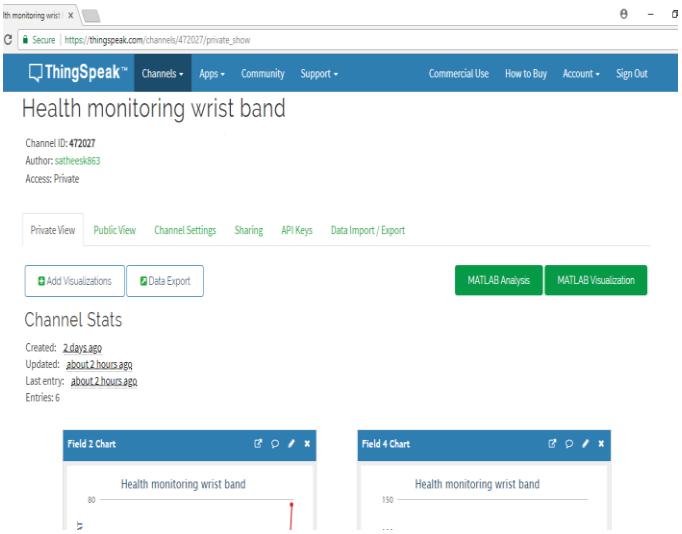

Figure 9. Data Monitor via IoT

The data is monitored through IoT in Thingsspeak.com .The various sensor data are displayed in the form of field charts. Each sensor data is displayed in a separate field chart. There are totally four field charts. The four field charts show temperature, heart rate, respiratory rate and fall.The various field charts are shown below.

The normal human body temperature would range between 92.7–99.5 °F in an average. The temperature is normal and updated in the log continuously.

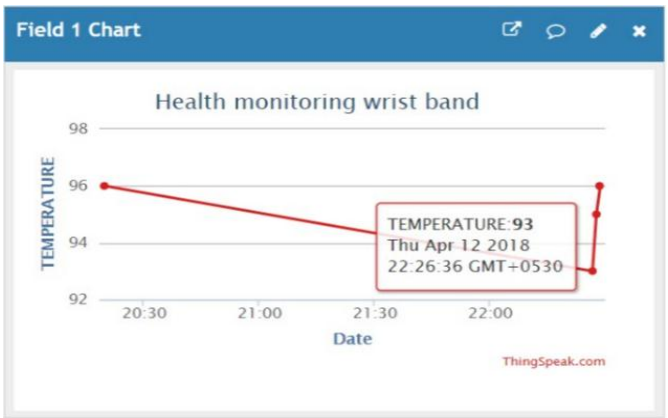

Figure 10. Temperature viewed using IoT

The normal heart rate of a person varies from 50-90 bpm as in case of adults it may vary from 60-100 bpm. The heart rate shown in Fig.9 is normal.

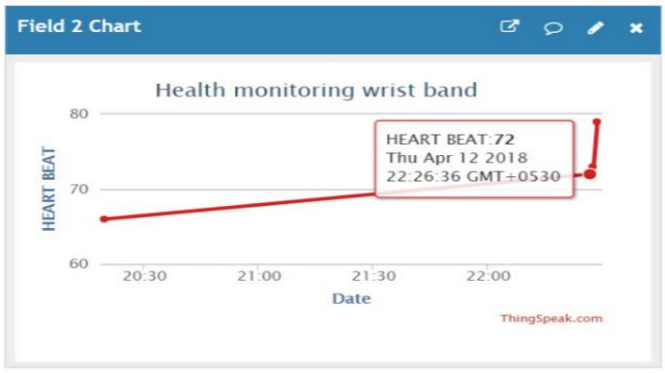

Figure 11. Heart rate viewed using IoT

Based on the axis of the accelerometer, fall is detected and is monitored using IoT. In Fig.10, no fall is detected, hence the value is displayed as zero. When a fall is detected, the value is incremented accordingly and a buzzer buzzes to indicate the onset of fall.

Figure 12. Fall detection viewed using IoT

The Fig.13 shows the respiratory rate viewed using IoT. The above viewed result is found to be normal.

The above obtained results are normal and if the values are abnormal, the alarm buzzes as a way of alerting the caretaker.

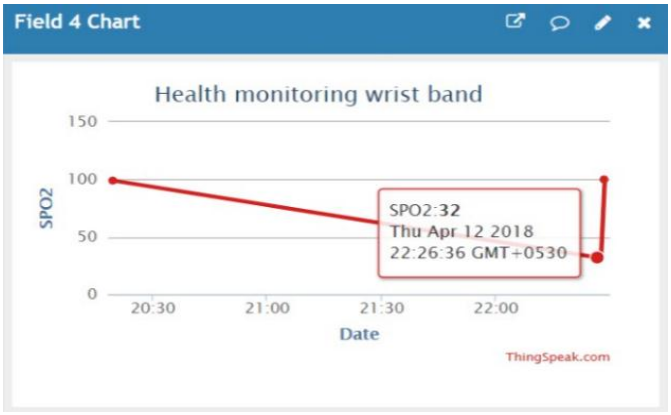

Figure 13. Respiratory rate viewed using IoT

ACKNOWLEDGEMENT

We thank the management and Principal of Sri Ramakrishna Institute of Technology for providing us moral support and valuable comments to improve the quality of this paper.

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