Human Activity Monitoring and Energy Expenditure Calculation using Body area Network

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Abstract: **Every Human performs numerous physical activities per day. These physical activities are Sleeping, Sitting, Standing, Walking and many more. It is important to monitor every physical activity so we can calculate total daily energy expenditure using Body Area Network. The system consists of embedded hardware and software for monitoring Physical activities, Zigbee for Wireless Communication and Accelerometer Sensor for sensing Human Activity. Accelerometer sensor is attached to human body, depending on bodily movement Activities get classified. Output of Accelerometer sensor is interfaced to the microcontroller using inbuilt ADC. Output of microcontroller is interfaced to the Zigbee. Zigbee transmits this output to another Zigbee which is present at server side. Server is PC where in Visual Basics software we can monitor all activities with Total Daily Energy Expenditure reading. Also detailed report is generated in excel sheet.**

Keywords: **Wearable Sensor, Wireless Sensor Network, Zigbee, Accelerometer**

1. INTRODUCTION

In the world, many countries are present. In these countries many industries are present. People work in different industries. Because of this rapid industrialization people perform very less physical activity. Due to this very less physical activity people suffer from various diseases such as cancer, Asthma, Cardiovascular disease. If people perform regular physical activity these diseases can be prevented. As per WHO (World Health Organization) Physical inactivity is 4th leading risk factor for Global mortality. WHO suggest every adult should perform Physical activity 150 minutes per week. Recreational activity, active transformation and ambulation are part of physical activity. So that it becomes very important to monitor all these physical activities and calculate Total Daily Energy Expenditure. We can calculate Total Daily Energy Expenditure using Harris Benedict equation. By performing physical activities weight can be controlled.

This system can be used for many applications. Elderly people can be monitored using this system. In some houses there is no one to take care of elderly people. This system is also useful for sports person because this system can provide feedback which is useful for sports person, coaches and doctors. Wireless body area network can also be used by post-operative patients for monitoring their physical activity.

The following are objectives of the proposed system

- Different Physical activity monitoring as follows
    1. Sleeping
    2. Sitting
    3. Standing
    4. Walking

- Various vital signs monitoring of Normal, Asthma, Cardiac Person as follows
    1. Temperature
    2. Pulse Rate
    3. Respiration Rate
- Total Daily Energy Expenditure Calculation
- Detail Report Generation in Excel sheet

2. LITERATURE REVIEW

A. In 2014 [1]Zongjian He,Xiaolin Bai proposed A Wearable Wireless Body Area Network for Human Activity Recognition. In this paper 2-axis accelerometer sensors are used for human activity recognition. Threshold based algorithm is used to detect different physical activities such as standing, walking and running.

B. In March 2015,[2] Subhas Chandra Mukhopadhyay, Fellow, IEEE, proposed "Wearable Sensors for Human Activity Monitoring" In this paper Wearable sensors are used which detect abnormal situations by monitoring different symptoms and different physiological parameters. Wearable sensors are used in many applications which include entertainment, healthcare, medical.

C. In February 2015[3]Yogita L. Kumbhare, Pankaj H. Rangaree, "Patient Health Monitoring Using Wireless Body Area Sensor Network," In this paper hardware is developed to monitor different vital signs such as heart rate, temperature, blood pressure, respiration rate. This system detects abnormal conditions, gives alarm to patient and sends sms to doctor or caretaker.

3. PROPOSED SYSTEM

This is Body Area Network based project. There are two nodes Activity classification node and Patient monitoring node. Activity node will monitor all activities performed by user of the system. Patient monitoring node will monitor vital signs. Biomedical sensors are attached to human body which will track patient as well as his activities.

Specifications of Proposed system are as follows:

1. This kit can be used for various activities monitoring such as Sleeping, Sitting, Standing and Walking.
2. In the android app user can monitor different vital signs such as Temperature, Pulse Rate and Respiration Rate.
3. In case any parameter exceeds the given set points message will be displayed on Visual Basics software.

Block Diagram of Proposed System

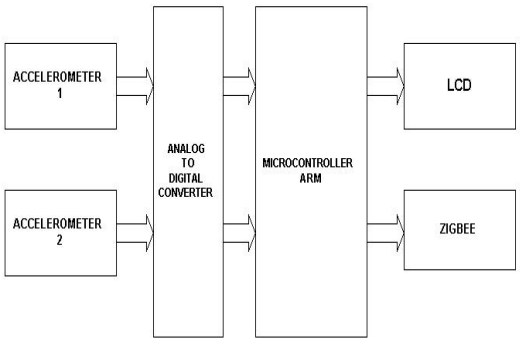

Figure 1: Activity classification node

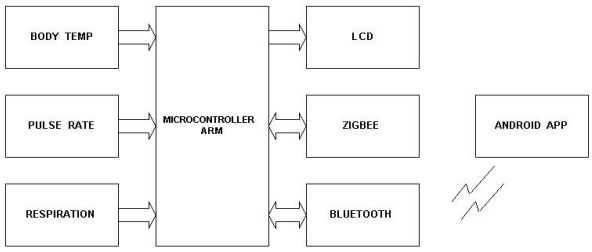

Figure 2: Patient monitoring Node

4. RESULTS

1. VB Application

Data is collected from Accelerometer Sensor, depending on Accelerometer position various physical activities are detected and shown on LCD and also sent to VB through serial communication. In VB Energy Expenditure is calculated and also report is generated in excel sheet.

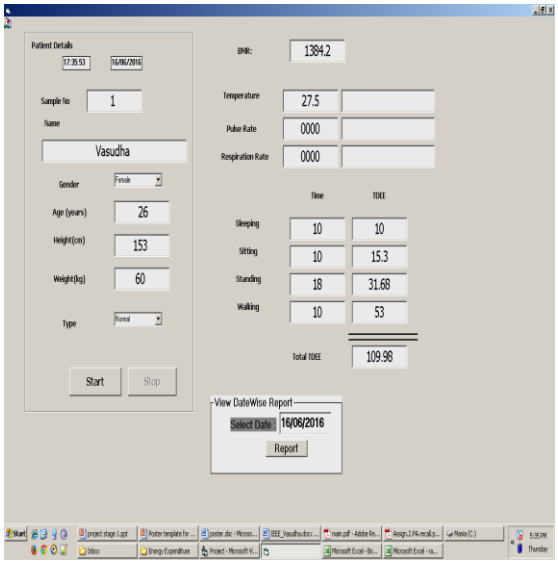

Figure 3: Screen Shot of Visual Basics application

2. DATABASE

Using implemented System Database is generated depending on the Age, Height, Weight and Gender.

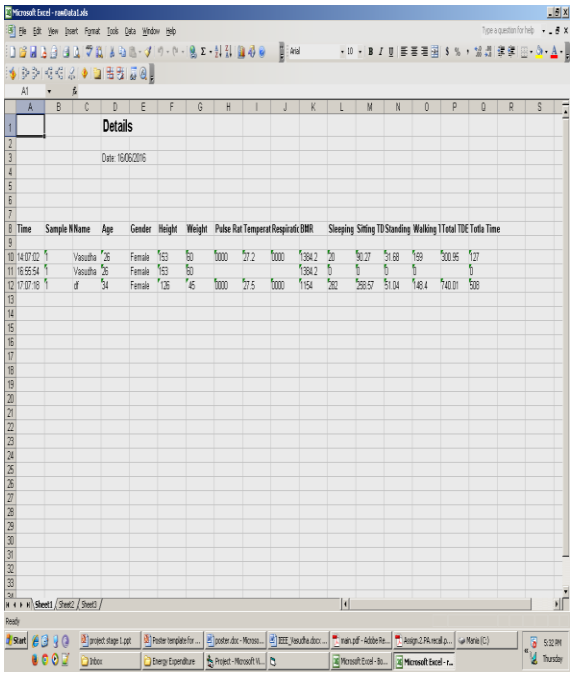

Figure 4: Database of different person depending on Age, Height, Weight, Gender

5. CONCLUSION

We have proposed a system which will monitor different physical activities such as sleeping, sitting, standing, walking. System will also monitor various vital signs such as Temperature, Pulse Rate and Respiration Rate. Depending on different Physical activities performed by people, Energy Expenditure is calculated. It explains that wireless sensor networks can be widely used in healthcare applications, Sports application, and elderly patient monitoring application and in medical field related application.

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