



# **Physical Activity Monitoring and Calculating Energy Expenditure using Body Area Network**

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**ABSTRACT:** There are various physical activities such as Standing, Walking and Running. It is important to monitor all these physical activities and calculating energy expenditure for maintaining adequate activity levels with an impact in health and well-being. The system consists of a smart body area network for classification of inactive postures and physical activities which is used for calculating total daily energy expenditure. The solution contains an embedded hardware which will monitor all the activities of user. The signal from the accelerometer sensor is interfaced to Microcontroller which classifies various physical activities. Using the output of the activity classifier energy expenditure is calculated by the user. The proposed solution is a trustworthy consists of embedded hardware and software. Server based activity monitoring is present which classifies the activities of daily living throughout the entire day and allowing to calculate total daily energy expenditure without causing any changes in the user's daily routine.

**KEYWORDS:** Wearable sensors, Wireless sensor network, ZigBee, Accelerometer.

## **I.INTRODUCTION**

World Health Organization (WHO) suggests that Physical inactivity as the fourth leading risk factor for global mortality. Adequate physical activity has been shown to correlate with the prevention of several pathological conditions such as cardiovascular diseases, Asthma, cancer and depression. WHO recommends regular physical activity of moderate intensity during at least 150 minutes per week for adults, however this target is not being achieved by a large population, especially in countries where people work in industries.

Physical activity includes a broad range of bodily movements, for example recreational activities, active transportation and ambulation. Therefore, it is difficult for people to keep track on their Physical activity and reach the desired levels. Pervasive physical activity monitoring would provide this information accurately and help to achieve adequate Physical activity levels. Moreover, the automatic quantification and awareness of the energy expenditure associated to regular physical activity may play an important role in Weight control. Energy expenditure (EE) is the most commonly used single metric to quantify Physical activity.

The majority of patients are hospitalized and they are under predictive and personalized monitoring systems. Such patients are suitable for their physiological condition monitored using low-power, sensors which are present on the body. Predictive monitoring concept is used to get data from mobile patient and perform necessary action on it. Independent livings for elderly population is possible by activity recognition based approaches have been investigated deeply to infer the activities of daily living. Sport applications is very important area for deploying Wireless Body Area Networks (WBAN) as this technology can provide a feedback which can be seen by the user, coaches, doctors and the viewing public.

The following are the objectives of the proposed work:

- Patient monitoring as well as activity monitoring such as
  1. Standing
  2. Walking
  3. Running



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- In the android app monitor all the vital signs such as
  1. Body temperature
  2. Pulse rate
  3. Respirationon the Android GUI.
- In case any parameter exceeds the given set point or in case of medical emergency then communicates with relatives and Doctors.
- Energy Expenditure measurement

## II.LITERATURE SURVEY

A. In 2014 [1]Zongjian He,Xiaolin Bai proposed A Wearable Wireless Body Area Network for Human Activity Recognition. In this paper accelerometer is used for human activity recognition. This is the wearable wireless body area network using ZigBee. Android mobile phone is used as a part of wireless sensor network to act as a base station, which displays live information about various parameters to the user. The lightweight sensor devices are using Contiki and the wireless design is present which allows users of the system to move freely. In addition, the use of social network greatly improves the user experience. In this research paper, 2-axis accelerometer sensors are used. and also a threshold based algorithm is present to recognize the different physical activities include standing, walking and running. The possible applications include monitoring patient, exercise measurement of athletes and activity monitoring of peoples daily living. Wireless sensor networks have become an interesting and promising research field these days, and various monitoring applications have been implemented such as industrial, healthcare, environmental, security, etc. Using wireless sensor networks to monitor and recognising human activity has become important area for many researchers since it can be widely used in different kinds of applications such as motion monitoring of patients, exercise measurement of athletes and activity monitoring of peoples daily living.

B. In March 2015,[2] Subhas Chandra Mukhopadhyay, Fellow, IEEE, proposed “Wearable Sensors for Human Activity Monitoring” In which they explained a world population has increased significantly in which There is a significant aging portion due to which there is a rapid rises in healthcare costs. The healthcare system has gone through a lot of transformations in which continuous monitoring of patients is possible even without hospitalization. The advancement of various sensors, embedded hardware and software, wireless communication, nano technologies, and miniaturization makes it possible to develop smart systems which can be used for human beings continuously. Wearable sensors detect abnormal situations by monitoring different physiological parameters and different symptoms. Therefore, necessary help can be provided when required. This paper reviews the latest reported systems on human activity monitoring based on wearable sensors and issues to be addressed to handle the challenges. Wearable sensors have become very popular in many applications such as medical, healthcare, entertainment. They can be extremely useful in providing accurate information on peoples daily living activities, thereby possible to ensure a safe and sound living environment. It may be possible using smart wearable sensors technology will revolutionize human life, social interaction among individuals and activities.

C. In February 2015[3]Yogita L. Kumbhare, Pankaj H. Rangaree, ”Patient Health Monitoring Using Wireless Body Area Sensor Network,” which presented the wireless Body Area Sensor Network which is application of ubiquitous computing. The ubiquitous computing is useful in our lives including the hospital, emergency and critical situations. The Wireless Body Area Sensor networks (WBASNs) is type of wireless networks have enabled the design of low-cost, intelligent,tiny, and lightweight medical sensor nodes.which can be placed on human body to monitor various physiological parameters of patient for a long period of time and providing feedback to the user and doctor. In this paper, developing a hardware which will monitor different vital parameters of a patient such as blood pressure, heart rate, temperature and respiration rate using gsm modem and all information lively transmitted to gsm mobile. Sensors are attached on patients body and they sense the various heath parameters of patient such as blood pressure, heart rate, temperature, and respiration rate. These health parameters are then transmitted to physicians at the server side. The physician has various threshold values of the health parameters for every patient. This design can be used to detect the various abnormal conditions, issue an alarm to the patient and send a SMS to the doctor. The majority of patients in the hospital are under observation, and thus, they are suitable for monitored using wearable sensors for the purposes of proper medical care. The goal of this system is to provide early warning of patients medical health such that



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preventative clinical action may be taken to improve patient life. A WBASN is used for health monitoring which consists of multiple sensor nodes. Each sensor node is capable of (i) sensing one or more physiological signals, (ii) processing physiological signals (e. g. filtering, feature extraction, and feature recognition), (iii) processed data storage, and (iv) transmitting the processed and stored data to a WBASN server. Intelligent, online processing of these large datasets is, therefore, required for monitoring, the results of which should consider the limited capabilities of human experts to those parameters of patients who are at risk of being unstable physiologically, and who are in need of expert review. In this paper the patients heart rate, blood pressure, temperature, and respiration rate contains is measure. However, devices which are validated clinically compare physiological data to threshold level and generate an alert if those thresholds are exceeded. When the thresholds are exceeded it sent the message to doctor on mobile phone with the patients measuring data. So doctor after watching and analysing the measuring data can help the patient.

D. In 2014[4]Apeejay Stya University, “Body Area Network-A Perspective, “discussed that Recent technological advances in integrated circuits, wireless communications, and sensing elements of physiological parameters, lead to the development of smart, low power, light weight, multifunctional devices. Consequently a number of these devices can be integrated into a Wireless Body Area Network (WBAN), This is a new and enabling technology for health monitoring. It provides patients increased level of confidence, a better quality of life, and promotes healthy life and health awareness. Applications of BAN is highly useful in thickly populated countries for addressing complex issues and providing better healthcare solutions. Due to technological advancements a low power networked systems and medical sensors merged as wireless sensor networks (WSNs) in health care. These WSNs carry the promise of improving and expanding the quality of human care across wide variety of settings for large set of population. When tiny wireless sensors are placed on/in a patients body, create a WBAN. The patients equipped with wireless body area sensor network need not be physically present at the hospital for their diagnosis, infact these devices communicate wirelessly and transmit data from human body where multiple sensors are present to a home base station, from where data can be forwarded to a hospital, caregiver, and physician, emergency. BAN containing various sensor nodes which are in close proximity to a body of patient which monitors different vital signs, providing real time feedback to allow many patient diagnostics using continuous monitoring of chronic diseases and progress of recovery from an illness. The biomedical sensor based approach to medical care makes it more efficient by decreasing the response time. The exact system architecture and number of system tiers depends predominantly on available infrastructure, type number of end users and target applications.

## III.DISCUSSION AND CONCLUSION

This review paper has presented reported literature on wearable sensors and devices for monitoring human activities such as Standing, Walking and Running. The human activity monitoring is a vibrant area of research and a lot of commercial development has done. It is expected that many more light-weight, high-performance wearable sensors will be available for monitoring a wide range of activities. The development of light-weight physiological sensors will lead to comfortable wearable devices to monitor different physical activities of individuals.

It explains that wireless sensor networks can be widely used in healthcare applications. The role of wireless sensor networks or Body sensor networks in medical field can be further enlarged and we are expecting to have a feasible and proactive prototype for wearable or implantable WBAN system, which could improve the quality of human life.

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