OVERVIEW OF AUTONOMOUS WEARABLE SYSTEM FOR VITAL SIGNS MEASUREMENT WITH ENERGY-HARVESTING MODULE

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ABSTRACT

Wearable devices have become very popular now days across the youth over the world. These devices have become the part of our day to day life. The market of wearable devices has grown in India in last 5 years. These mainly include the smart watches, headsets and other virtual reality devices. With development of internet of things (IoT) technology it has become possible to design and develop the smart wearable devices. The problem associated with such devices is the battery capacity and capacity to weight ratio. To overcome this problem, energy harvesting becomes and important. Authors have presented the overview of various wearable technologies and harvesting module of energy for such devices in this paper.

KEYWORDS: Wearable Devices, Smart Devices, Internet of Things, Energy harvesting System, etc.

INTRODUCTION

The wearable technology has changed the complete market situation in last five years where most of the young users have preferred the smart devices over the conventional. The monitoring of parameters in real time such as the heart beat rate, blood pressure, calories burnt, and many other has made the devices popular. The concern with the battery capacity enhancement was always important in battery operated devices. Wearable devices are compact in size and hence increasing the capacity of battery with small size becomes challenging for the designer of the system. A T-shirt capable of monitoring the heart rate, was proposed for the purpose of real time monitoring with solar based power [1].

Researchers have also developed system to detect muscle fatigue on real time basis [2]. Researchers have come up with plenty of solutions to enhance the end user experience with respect to accuracy of the data. Another application of wearable technology is to analyze the pH value from sweat [3]. Another application includes electro-encephalography with application of heat of human body [4]. Monitoring of human health has become a very important aspect in today's stressful life.

Electronics circuits and developments of electronic devices have made it possible to design the accurate systems with use of sensors to monitor human body parameters. Solar energy is the best alternative to the conventional energy sources. Implementation of solar systems with the wearable devices will again open up the doors of opportunities to enhance the performance [5]. This makes the devices truly wearable over long life. The

challenges of developing such systems are to be addressed in order to make the system sustainable. Power management is one of the basic challenges in wearable systems [6, 7]. The monitoring of vital signs mainly includes-

- Monitoring of respiration related activities
- Monitoring of cardiac activities
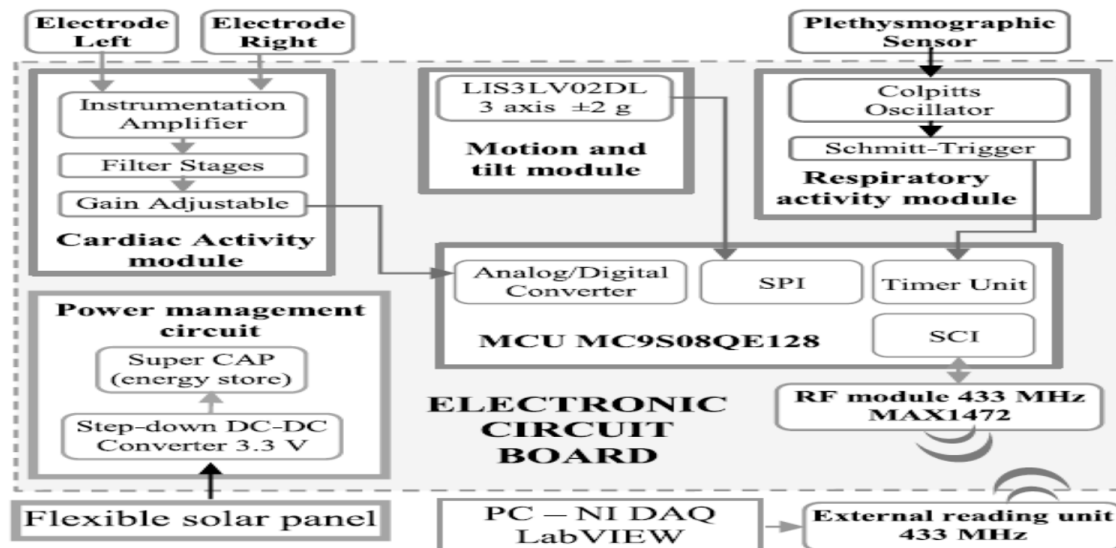- Monitoring of motion

Fig.1: Architecture of Wearable system

The figure above shows the details of the wearable system. This architecture is capable of monitoring the cardiac, motion and respiratory parameters of human. The power management circuit is consisting of super capacitor to enhance the performance of the system.

LITERATURE REVIEW

Paper name	Author name	Find parameter	Method used	Drawback	Result
Flexible stretchable sensors for wearable Health Monitoring sensing mechanisms material fabrication strategies & features	Yan Liu, Hai Wei, wei Zhao, Min Zharg	Body motion , Heart rate, temperature, metabolism parameter	Sensing material mechanism	Battery	Variable
Wearable sensors for Remote Health Monitoring	Sumit majumder, Tapas mondal , N jamal	Heart rate, temperature, Respiratory rate, ECG,	Wearable sensors , ARM7	To developed wearable platform with battery backup	Variable with patient
Human Vital sign Detection method &potential using radar	Mamade Kebe , Rida Gadhati, Baker Mohammad , Mihai Sandulenu, Hanisalen	Heart Rate , Early detection of heart, Blood pressure	Using Radar	Battery n manage signals	Varies

Continuous vital monitoring during sleep in light activity using carbon black Elastomer sensor	Titus Jayaratha, Gaetano.D.gariulo, Paul Breen	Respiratory rate, Cardiac signal, Pulse rate	Carbon black elastomer sensor with battery	To take continue record of cardiac signal and observe it continues	Changes with person to person
Non-contact monitoring of Breathing pattern & respiratory rate via RGB signal management	Carlo Massoroni, Daniel Lo Preste, Domenico farmica, Sergio silvestri,	Respiratory rate, breathing pattern	Contactless sensors, RGB	Difficulty to take breathing pattern, battery issue	Changes with patient to patient
An Autonomous wireless Health monitoring system based on HB & accelerometer sensor	Saif saad, Fakhrulddin, sadik kamel Gharghan	Heart rate, HB	Accelerometer sensors	Need network for GPS	HR-132 HB-45
Wearable Health Device –vital sign monitoring system &technologies	Duarte dias, Joao Paulo, silva cunha	Body tempareture, blood glucose, skin perspiration, ECG	Arm7	Emerging wearable health device	BG- 105 BT-34 ECG-normal
Autonomous system for Health monitoring	Vivek v. mali, Dr. Dinesh m. , Chandwadkar	Heart rate, Blood pressure, Body movement	GPS & GSM for data transfer	Network issue and electricity supply	HR-78 BP-88/120
Autonomous wearable system for vital sign measurement with Energy harvesting module	Mara Yagna, P. Sayanna	BP, Heart rate, ECG.	Embbedded system opto electronic sensor	Programming for embedded system	HR- 76 BP-80/110
Autonomous wearable system for vital sign measurement with Energy harvesting module	Alessandro Dionisi, Daniel marioli	Blood pressure, heart rate, ECG , Resiratory rate, Body movement	ARM7, solar panel	Coding and app required for connecting to pc for ECG	BP-90/120 HR- 72 RR-72

MOTIVATION OF WORK

The world is becoming smart, with introduction of freeware like Arduino and Internet of Things. The wearable technologies have become popular with the reliability and user friendly performance. While increasing battery capacity, size and weight of the battery increases which is not appropriate for wearable devices. Developing the power consumption and battery performance of wearable devices will make them increasing the sale over the

world. Authors have studied the research going on in this field and discussed it in this paper. The motivation behind this study is to develop the energy harvesting technology based wearable devices.
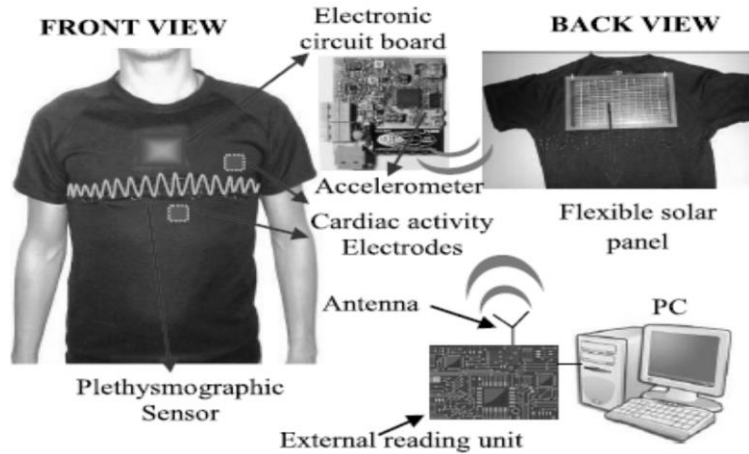
PROPOSED SYSTEM

Fig.2: Overall system of wearable T-shirt

Wearable T-shirt powered with solar energy capable of monitoring human body parameters is shown above. This can be externally connected to the computer for data handling and evaluation purpose through IoT.
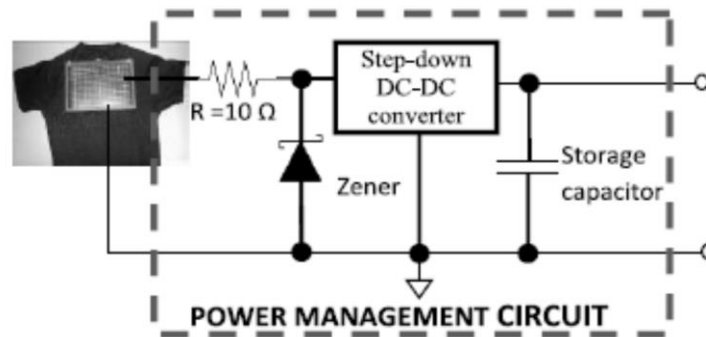

Fig.3: Solar Power Harvesting Module

The power harvesting module with the super capacitor is shown in figure above.
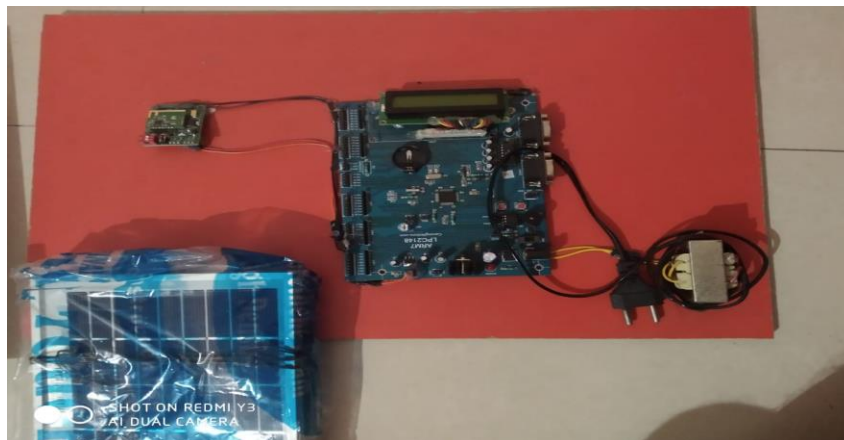

Fig.4: Hardware of the system

APPLICATIONS

The proposed system will be useful for the following applications.

1) Used in hospital.
2) Personal monitoring with doctors reference.
3) Monitoring elderly.
4) Used during games for monitoring.

CONCLUSION

Wearable technologies have become popular because of the various capabilities of monitoring the parameters, attractive aesthetics and the reliable performance. The wearable devices are facing the issue of management of energy and the enhancement of battery capacities. It is suggested by many researchers to use solar energy to power wearable devices. The overview of research carried out by the researchers is discussed in this paper. The future of electrical energy is renewable system. There are challenges to develop the systems capable of providing the power to these devices because of the compact size of the devices. While thinking of providing the energy one has to take in to consideration that the same aesthetics must be maintained for the product.

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