Study And Implementation Of Healthcare Monitoring System Using Solar Energy Harvesting Techniques

Madhu Mitha M, Dr.Sundararajan TVP
Sri Shakthi Institute Of Engineering And Technology

Abstract-Iot is a current trending technology which access electronic components through internet .In this paper, various sensor nodes can be placed on different positions of the body to measure the subject's body temperature distribution, heartbeat and detect falls.To extend the lifetime of the wearable sensor node, a flexible solar energy harvester with an output based maximum power point tracking (MPPT) technique is used to power the sensor node.The system with solar energy harvesting demonstrates that long-term continuous medical monitoring is possible.There are various energy harvesting techniques available from that solar energy harvesting is used to extract energy and send it to the rechargeable battery.By using rechargeable battery with energy harvesting technique long term 24 hours autonomous medical health monitoring is possible.

Index terms—Energy harvesting, Iot, MPPT technique.

I INTRODUCTION

Internet of things (IOT) is a technology that gain attention in recent years. Nowadays most of the electronic devices and appliances with iot is trending in markets. IoT devices can be used to enable remote health monitoring systems. These health monitoring devices can range from blood pressure and heart rate monitors to advanced devices capable of monitoring specialized implants, such as pacemakers, Fitbit electronic wristbands, or advanced hearing aids. Some hospitals have begun implementing "smart beds" that can detect when they are occupied and when a patient is attempting to get up. It can also adjust itself to ensure appropriate pressure and support is applied to the patient without the manual interaction of nurses. Moreover, the use of mobile devices to support medical follow-up led to the creation of 'm-health', used "to analyze, capture, transmit and store health statistics from multiple resources, including sensors and other biomedical acquisition systems".

Fig 1. Wireless body area network with IOT connected healthcare platform

II – BLOCK DIAGRAM AND COMPONENTS

The solar energy harvester with the output based MPPT is fabricated and tested with a flexible solar panel. To further extend the lifetime of the wearable sensor node or even enable the autonomous 24 hours operation, the solar energy harvester is used to power the sensor node. The proposed wearable sensor nodes can be placed on different positions of the body to measure physical signals like the temperature distribution and heartbeat. It can also detect falls using the accelerometer on the node for emergency notification. In the future, the wearable sensor node can accommodate more signal detections to cover many areas

of WBAN applications. The output based MPPT technique is applied to extract the maximum power from the flexible solar panel.

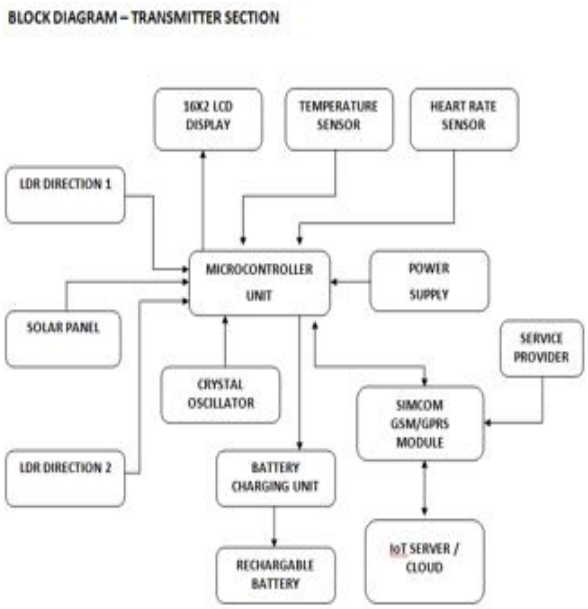

Fig 2. Block diagram for energy harvesting healthcare system

III SYSTEM ARCHITECTURE

System interface can comprise of system components, the externally visible properties of those components, the relationships between them.The components in this project are:

1.ATMEGA 328.
2.Flexible solar panel.
3.GSM/GPRS Modem.
4.GPS Modem.
5.Temperature Sensor.
6.Blood Pressure Sensor.
7.Heart beat sensor.
8.LCD Display.
9.LDR Sensor.
10.Mobile phone or laptop with internet connectivity.

GSM: Global System for Mobile Communication (GSM) is a set of ETSI standards specifying the infrastructure for a digital cellular service.
GPS: Global Positionining System (GPS) technology is the technology used to provide location details.
LCD: Liquid-crystal display (LCD) is a flat panel display, electronic visual display that uses the light modulation properties.

A) SOLAR PANEL AND MPPT

A solar panel is also known as a photovoltaic (PV), is a non-linear semiconductor device that absorbs the light energy and converts into electrical energy. The electrical energy generated by the solar panel varies with the environmental conditions. Here the LDR sensor is used to find at which direction the intensity of light is higher and the panel gets energy from that direction. The light intensity may differ from sun light and artificial light. The below graph shows the intensity in sun and artificial light.

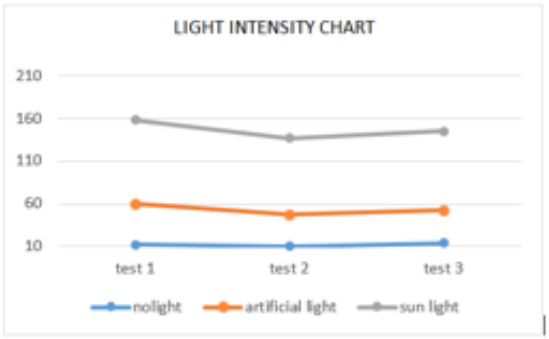

Fig 3. Light intensity graph

According to this graph the light intensity is maximum at sun light when compard to artificial light. Then in artificial light the intensity reduces slightly. And in no light the light intensity is 0 in that state no power produced. The below graph shows the intensity of the light.,

Weather condition	LIGHT INTENSITY		
	TEST 1	TEST 2	TEST 3
SUN LIGHT	98	90	93
ARTIFICIAL LIGHT	48	37	38
NO LIGHT	12	9	14

Table 1. Intensity of light based on weather.

B)TEMPERATURE SENSOR

The temperature sensor monitors the patients temperature and it gives the live information through iot. We can able to monitor the value anytime anywhere. The sensor gets the energy from the rechargeable battery.

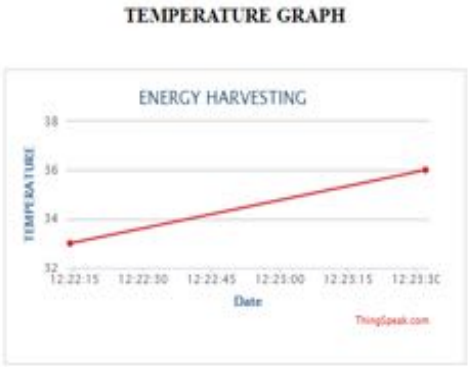

Figure 4. Temperature graph

The temperature of the patient is displayed in graph we can easily monitors the health conditions of the patient

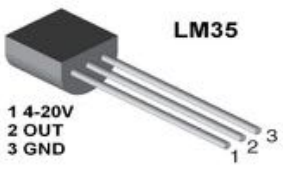

Figure 5. Temperature sensor

C) HEARTBEAT SENSOR

The heartbeat sensor is used to monitor the pulse of the patient. The sensor reading is monitored through iot. It is easy to monitor patient health at anytime. By using solar panel and a rechargeable battery the sensor operation improves and it operates for a longer time.

Figure 6.Heartbeat sensor

D) LDR SENSOR

The LDR sensor is used to find the maximum light intensity. The sensor gives information at which direction light intensity is higher in the panel and it gives information to microcontroller and the battery gets charged in that side of the panel.

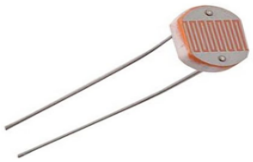

Figure 7. LDR sensor

IV EXPERIMENTAL RESULT

A) FLEXIBLE SOLAR ENERGY HARVESTING

The flexible solar panel gets energy from the sun light and the light energy is converted into electrical energy. The rechargeable battery stores the energy get from the panel and microcontroller is used to get how much power percentage solar panel gets and that percentage is displayed in LCD.

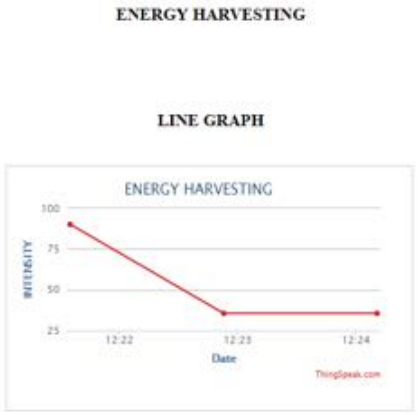

Figure 8. Light intensity graph

This graph shows the intensity of the light. It shows the intensity varies at different condition in direct sun light the intensity is maximum and in the artificial light the intensity decreases.

V CONCLUSION AND FUTURE IMPROVEMENT

This paper shows the solar energy harvesting is possible in healthcare related systems. An autonomous healthcare monitoring is achieved by using this technique. The wearable sensor node can be improved further in terms of usability and wearability.For example, size and shape should reduce in future and if it is used in large scale the maximum power is needed.In the future,the secondary storage is needed for the bad weather conditions.

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