

BSN with GSM

V. N. S. Manaswini, Y. Gayathri, Gowtham Mamidiseti

Abstract: -In this paper, Body Sensor Network Based Health Monitoring System is presented. In these days where mobility is needed everywhere wearable gadgets monitoring of health parameters for patient with medical warning is essential. To address the need of such patients this system is proposed. The proposed BSN uses miniature sensors to detect the health parameters. These health parameters are then communicated to physician's server. The physician set various threshold values for the health parameters to caution the patient. The caution messages are generated by the physician's server to send back the physicians advice to the patient on his current health condition. The communication of patient health parameters to physician server and physician advice to the patient are successfully implemented using long range wireless technology GSM.

Keywords: Body Sensor Network(BSN); HMS (Health Monitoring System);GSM (Global System for Mobile Communication); Health Parameters; Miniature Sensors; Physician's server

I. INTRODUCTION

With the growing needs of healthcare services and the recent advances in technology, there has been considerable interest in development of wearable and wireless health monitoring systems. Wearable health monitoring systems coupled with wireless communications are an emerging class of sensor networks: Wireless Body Sensor Networks (WBSNs).WBSN is one of the most promising approaches in building wearable health monitoring systems.WBSN plays an important role in enabling communication between the patient and the physician which targets at a health status monitoring. A typical WBSN is comprised of small, lightweight and miniature sensors and microcontroller unit, which wirelessly provides the physiological signals. Each physiological sensor is capable of measuring one or more Significant physiological parameters, e.g. body temperature, heart rate, blood pressure, etc. These sensors could be placed on the human body or integrated into users clothing. This offers the freedom of mobility and enhances the patient's quality of life.

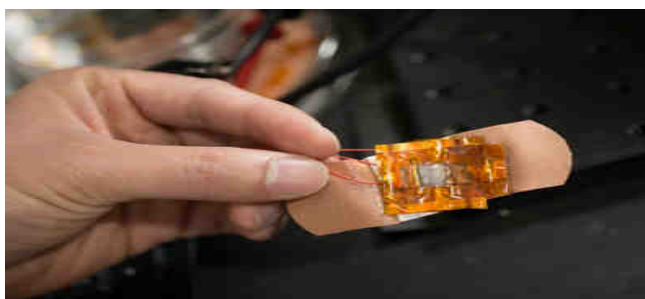


Figure: Minute Sensors for detecting health parameters

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This wearable health Monitoring system provides monitoring of status of the health parameters without disturbing the daily activities of the patient. Providing the health services to the patient by physician is made possible with the help of long range wireless communication technology: GSM. In case, if the patient is not in the network coverage area, the data regarding the health parameters would be continuously collected by microcontroller unit (MCU) and then it is transmitted to the medical server as soon as patient reaches into coverage area. By examining the values of the patients' health parameters on the medical server from any location, physician can initiate healthcare action accordingly. An additional facility is also designed such that, when the values of the health parameters would cross the threshold values; message will be sent to the doctor's mobile phone as well as on the predetermined mobile phone.



Figure : Sensors that look at heart rate and more.

II. SYSTEM ARCHITECTURE

In design and implementation of a WBSN based HMS to monitor the patients' health parameter status, WBSN is implemented at the patient side and the patient database is created at medical server side by maintaining a unique patient ID on wireless health monitoring device not only receives physiological signals, but also transfers the physiological data through the wireless network to the back-end health management server, so that complete and continuous personal physiological records can be kept. The communication between the patient server and medical server is accomplished by GSM/GPRS wireless communication technology.

III. HARDWARE ARCHITECTURE

Hardware architecture is implemented at the patient side. The components of the wearable and wireless health monitoring system include miniature sensors, microcontroller, and LCD display and wireless transmission device. The different kinds of vital sign sensors are placed strategically on human body to collect vital health signals from human body. The different sensors are infrared sensors for body temperature estimation and optoelectronic sensors for heart rate measurement. These physiological sensor nodes are connected to microcontroller unit to

continuously collect the data regarding the number of health parameters such as body temperature, blood pressure, heart rate. The communication between the sensors and microcontroller is a wired transmission. Microcontroller display the measurement results of health parameter on LCD screen and transmits the data regarding of physiological parameters to the medical server using GSM. When the sensor wearing patient is out of the range of transmissions of health parameters data, the measurements of health parameters are recorded in an on-board storage medium, and can be uploaded to the server when the wearer is again back within the transmission range. In addition, microcontroller always perform the comparison between the measured values of the patients' health parameters and the threshold values of the health parameters set by the physician, and if in case any value of measured health parameters would crosses the threshold value, then the facility is provided to send message on to physicians mobile phone and also to relative's mobile phone in case of threatening conditions. The program on the microcontroller, reads the value of body temperature, BP, heart rate . Then the processed output in digital form is sent to the medical server through GSM/GPRS transmission and also display on LCD screen. The microcontroller programming is done using Embedded C, a middle level language for controller units. The microcontroller has an Operating Speed Max 16 MHz Memory consists of Flash Program memory, RAM, EEPROM and Data Memory. It has 3 ports for internal and external usage. It has three on chip Timers and in built Analog to Digital Converter. It has serial as well as Parallel Communication facilities.

IV. SOFTWARE ARCHITECTURE

At the medical server the database is created using MySQL and PHP. Database of patient is stored by giving unique ID to the patient having wearable WBSN based HMS. To monitor the health parameters of the patient a webpage is designed, so that the physician can access the webpage via internet at any time, any location and examine the patients' health status. To monitor the health parameters and to initiate a healthcare service physician should know username and password as there is a login facility for security purpose. The webpage access is limited to physicians having username and password. After performing login to the webpage, the physician can monitor the health parameters of the patient by observing the graph of each health parameter. On the same page there is a facility to send the message of healthcare and to set the threshold values to the patient by entering a patient ID. When the values of the health parameters would cross the threshold values, physician receives message (SMS) and he will access the internet to initiate a healthcare action accordingly.

V. ALGORITHMS FOR SCHEME OF WORKING ALGORITHM AT PATIENTS' TERMINAL

1. Place the physiological sensors on human body and switch on the WBASN based HMS.
2. Systems display the title — Health Monitoring System sing microcontroller.
3. Display the values of health parameters such as body temperature, BP, heartbeat rate.

4. Connect to GPRS to upload the current values of the health parameters.
5. Read response from medical server.
6. Extract the message of doctor and threshold values
7. Compare current health parameters with threshold values,
 - i) If current values cross the threshold values then send message to physician's number. And go to step 5.
 - ii) If health parameters are in expected health metrics then go to step 5.

VI. ALGORITHM AT MEDICAL SERVER

1. Open the webpage of Health Monitoring System.
2. Login to homepage by entering username and password inspective fields
3. Click on each health parameter to load the recorded of points.
4. Click on -Plot Graph| tab to observe graph of respective health parameter to check the health status.
5. If values of health parameters are not in expected range of health metrics initiate healthcare action.
6. Enter patient ID in the field of -Patient Number|.
7. Type message in -Message| field.
8. Set threshold values in -Threshold Values| field.
9. Click on -Send Message to Patient| to send healthcare message.

VII. CONCLUSION

WBSN based HMS monitor vital signs and provide ubiquitous and affordable health monitoring. The proliferation of wireless and wearable devices and recent developments in miniature sensors prove the technical a viability of ambulatory health monitoring system. In this paper we have presented design and implementation at patients' terminal and at medical server and also the scheme of working for overall system. A continual communication between patients' terminal and medical server is achieved using GSM/GPRS wireless communication technology. Health parameters are continuously uploaded on medical server using GPRS service. Any abnormalities in health conditions are informed via SMS to the indicated mobile number through GSM. WBASN based health monitoring system prove that Internet has changed the way people communicate to each other and allowan individual to manage their health in a better manner. We believed that wearable and wireless health monitoring system has potential to provide a better quality of life with self-management of chronic diseases.

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