Wearable Glove using IOT for Health Monitoring

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Abstract- The design of a health monitoring wearable biosensor device was mainly motivated due to high health-care costs and also the recent technological developments in miniature biological sensor devices, wireless communication. Instead of using a number of different sensors or measuring devices for health monitoring it will be more easy and reliable if the required number of sensors are embedded on a single platform. These system consists of various small biological sensors, Transmission modules, microprocessors and thus can provide low-cost meek solutions for continuous anyplace and anytime health monitoring. The interrupted advancing of a wearable sensor based glove will modify the time to come for personal health management and omni-present patient health monitoring. A prominence is given to physiological sensing devices, providing reliable solutions and accurate measurements and including real time decisions for premature detection of symptoms and to take necessary steps.

Index Terms- Biosensor, Health monitoring, wearable systems.

I. INTRODUCTION

Wearable health-monitoring systems (WHMS) has gained a lot of attention in recent times due to high health costs and for a continuous tracking of a person's health. There is an increasing demand to monitor a patient's health status while the person is out of hospital. The system will consists of a wearable glove which will consist number of sensors placed or fixed on it to provide with accurate measurements. Once the glove is put on the sensors will sense the real-time health's condition of the patient. These values will either be for user itself or to a hospital or directly to a doctor. The WHMS also consists a new method of approach for addressing issues of Chronic illness, Elderly patients, people in rehabilitation and people with special abilities.

Wearable glove will contain various types of Miniature Biological sensors, wearable or implanted, these sensors will then detect real time health condition of the person like the body temperature, blood pressure, heart beat rate. Also this glove will consists of a flex sensor. Once detected the values will then be transferred to the Arduino board placed inside the glove through wired means. Fig .1The Arduino board is then connected to the Wifi Arduino module (ESP8266), from the Wifi module the values will then be send to the person's display device with the help of IoT platform. The person can later send it to the respective physician or doctor consulted. The wearable glove or system should meet certain wearability medical criteria like the weight and size of the system should be small and should not make it difficult for the wearer to make movements. The radiation emission should also be taken into consideration since it should lead to health disorder to the person. The important factor is to minimize the power consumption of the system as much as possible. The last criteria is that the system should be available at an affordable cost so that it can be used by as many people as possible.

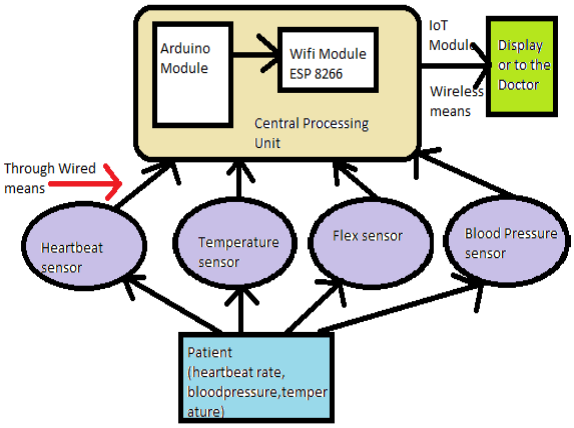


Fig.1 The block diagram

II. RELATED WORKS

The following are some examples of a similar kind of systems but they have limited features and differ in terms of cost.

Manufacturers such as Nonin, Philips, Nellcor, Agilent, Redding Medical provides small, wearable, low cost monitoring device to provide real time display of oximeters and blood oxygen saturation. A washable Light weight vest was developed by

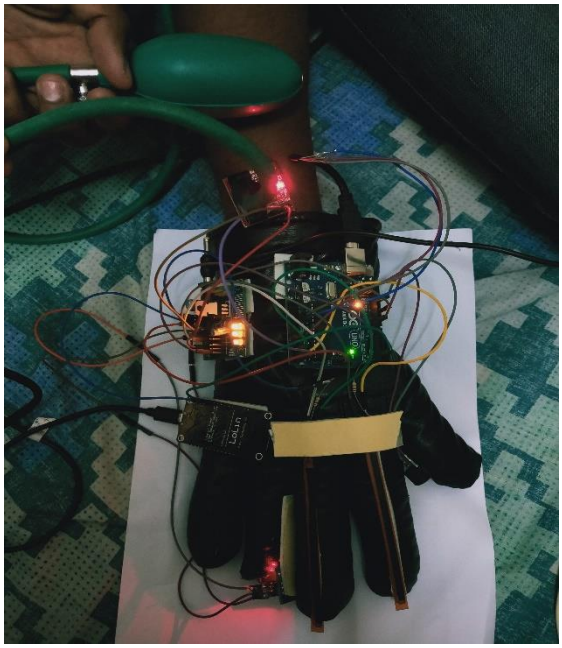
VivoMetrics. CardioNet developed an ECG monitoring device called the mobile cardiac outpatient telemetry (MCOT). Other such similar systems are developed in the form of a wristband, vest or a chest belt.

III. MATERIALS AND METHODOLOGY

A. Materials

a) Types of Sensors

Temperature sensor: Basically LM-35 is a Temperature sensor which can measure or detect the temperature varying from -55 to 150°C. It can measure temperature in both the standard parameters of measuring temperature that is in degree centigrade and Fahrenheit. In this project the temperature is measured in terms of degree Fahrenheit.



Heartbeat sensor: A heartbeat sensor works on the principle of Photo plethysmography. This means the sensor uses Light emitting diode to transmit the IR rays through a vascular region like an earlobe or the tip of a finger. At the receiving end a light detector diode or a photodiode is placed in order to consume the incoming IR rays. Heartbeat causes air gap in the blood which in turn leads variation in the blood flow. The IR rays emitted by the diode then passes through the tissue later through the blood vessel in the absence of blood and get detected at the receiving end. The blood in the blood vessel plays like an obstacle for the IR rays. The amount of light absorbed depends on the blood volume in that tissue. The output of the detector is in the form electrical signal and is proportional to the heart beat rate.

The electrical signal is actually a DC signal relating to the tissue and the AC signal corresponds to heartbeat so in order to get the AC signal, the DC signal is passed through a low pass filter – High pass filter circuit and is then converted to the AC with the use of a comparator circuit.

Blood pressure sensor: The blood pressure sensor is a non-invasive type of sensor. In this the cuff is wrapped around the upper hand or at the wrist. This cuff is then inflated to its maximum so at that very particular time no blood flows through the artery. The cuff then starts to deflate and when it is below the patient's systolic pressure there occurs a vibration in the artery which detects the high blood pressure. Vibrations occurs at both the time indicating the high as well as the low blood pressure. The low blood pressure is detected when the cuff pressure falls below the diastolic pressure, at this time the blood through the artery flows through the artery smoothly. This way of checking the pressure is called the non-invasive type. Other method to check the blood pressure is by invasive means where a cannula is inserted in an artery.

Flex sensor: Finger has been used for interacting and manipulating with the environment in a huge number of tasks in everyday life. Flex sensors works on the principle of orientation. When the flex sensor is in the flat orientation the resistance is about 25KΩ. When the Flex sensor is in bent orientation the resistance changes to 125KΩ. These sensors are available in two different sizes one is 2.2 inch and the other is 4.5 inch long. The flex sensor consists of two pins of which one is connected to Vcc and the second pin is connected to a resistor of 1KΩ to the ground and also it from this pin the output is measured. The output can either be in terms of voltage or resistance. In the project there are two flex sensors used which will be implanted in the glove. Depending on a particular finger movement when the resistance falls or rise beyond a certain default value the patient's requirement will be displayed. As it is evident that not everyone is well versed with the sign language these sensors will be useful in order to know the patients requirements.

b) Arduino UNO

Arduino UNO is a microcontroller board where UNO in Italian language refers to "one". This board consists of a set of analog as well as digital pins. In this project the flex sensor is provided with additional power supply board because these sensors require a power supply of 5V which cannot be supplied by the Arduino board. It has an in built LED driven by a digital pin 13. It has an automatic reset

button which when pressed the entire data will be lost. It has 14 digital pins and 6 Analog pins all of which has some special functions. The special functions consists of UART/ Serial, external interrupts, SPI, TWI. It can provide with both 3.3V and 5V. Pulse Width Modulation (PWM) pins 3, 5, 6, 9, 10, 11 gives 8-bit PWM output.

c) Node-MCU (ESP8266)

Node-MCU is an open source IoT platform. It uses the ESP8266 Wi-Fi SoC and hardware ESP-12 module. Node-MCU provides access to General purpose Input and Output. ESP8266 is a Wi-Fi Arduino module which will collect the varying values from sensors and will send it to the cloud through wireless means. After the ESP module has received the values, with the help of different platform the datas can be interpreted in the required forms whether it is graphical representation or pictorial representation.

B. Methodology

The main components used for a wearable health monitoring system are Temperature sensor, Heartbeat sensor, Blood pressure sensor, Flex sensor, Arduino UNO, Node-MCU. The temperature sensor which is of the type LM35 consists of three pins namely the Vcc, Ground, Output pin. This sensor doesn't consume much power so it is directly connected to Arduino board through wired means. Once the patient holds the temperature sensor close to the body it detects the variation in the temperature compared to the room temperature. The Heartbeat sensor works on the principle of Photo-plethysmography. By detecting the variation in blood flow through the artery. This heartbeat sensor consists of a light emitting diode and the transmitting end and a photodetector at the receiving end.

The blood pressure sensor will be of non-invasive type that is it will consist of a cuff which can be easily wrapped around the upper hand or wrist. The cuff is then inflated in order to stop the blood flowing through the artery. The systolic and diastolic pressure are taken into consideration. The flex sensor is a sensor which calculates the resistance based on their orientation. When it is in flat orientation and in bent orientation the resistance are 25K and 125K respectively. All this sensors are connected to the Arduino board for power supply. Only the flex sensor is connected to an external power supply since there are two flex sensors used and each one of them requires a power supply of 5V which cannot be supplied using a Arduino board.

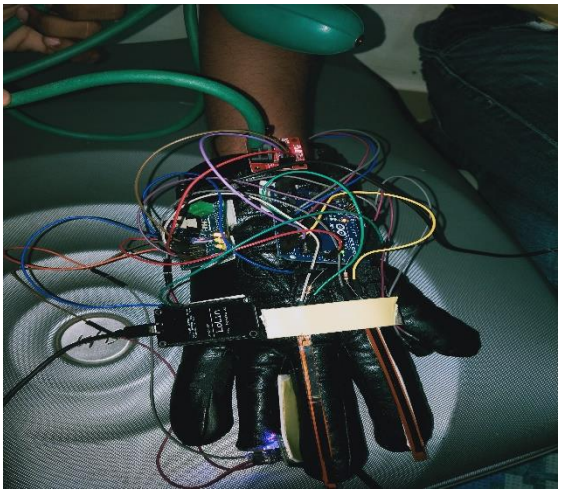
The system will also consists a buzzer which will ring an alarm if any of the parameters sensed are abnormally below the normal the required value. These all will be connected to Arduino board through wired means.

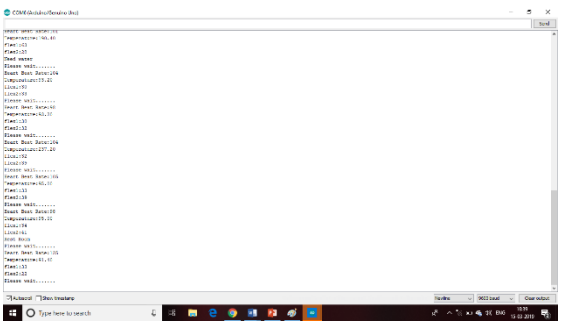
The Arduino board is then connected to the Node-MCU which is an ESP8266 (Wi-Fi Arduino Module) which will then send to the cloud. The main reason to use the Node-MCU is it supports various different platform for any type of required output whether it is a graphical or pictorial representation. The cloud will then display the values whenever the patient or the person like a physician, Doctor. The system will give a real-time value of the parameters which are sensed.

The system will be more useful for the patient's to needs to keep an update on their health even once they are out of hospital. Also it will be very useful for daily needs.

IV. RESULTS

The following are the pictures of results obtained when the either of the flex sensors are bent.





```
Please wait.......
Heart Beat Rate:98
Temperature:95.00
flex1:34
flex2:41
Rest Room
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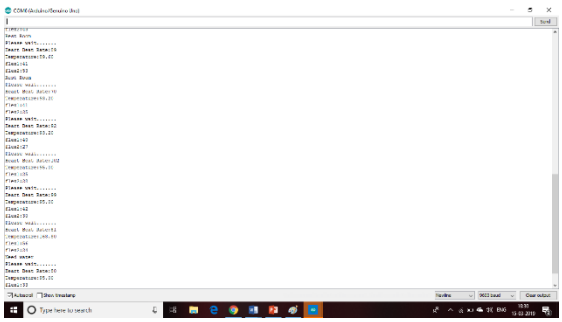
Pic.1 Flex sensor 2 is bent

When the flex sensor 2 is bent and the resistance value goes beyond 35K then the message pops up is Rest Room implies that the patient or person needs use rest room.



```
Please wait.......
Heart Beat Rate:96
Temperature:93.20
flex1:57
flex2:28
Need water
```

Pic.2 Flex sensor 1 is bent

When the flex sensor 1 is bent and the resistance value goes more than 55K then the message pops up on screen is need water which implies that the patient or the wearer needs water to drink.

The result might take a little while since the sensors and the exact orientation of flex sensor do requires a small amount of time in order to display the sensed values.

V. CONCLUSION

The proposed system is designed to provide a real-time analysis of a patient's health. As of now, no such system with these many number of sensors has been proposed, so it is versatile. These sensors are programmed in such a way that they should provide with accurate readings. The range of the systems varies over a wide range, reliable. These systems will make it easy for the patient to know their real time health status. Since this system will be available at a low cost, it should be affordable by as much people as it can. The proposed system will have low power consumption also the radiation emitted by the system should not affect the patient's health. The proposed system has also taken into consideration medical criteria of wearability which refers to the size and weight.

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