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HUMAN HEALTH MONITORING SYSTEM USING WEARABLE SENSORS

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Abstract - ***The main focus of this paper is to implement the health monitoring system continuously without hospitalization using wearable sensors. Wearable sensors monitor the parameters of the human body like temperature, pressure, heart beat by using sensors and also display the symptoms in the LCD. For emergency the alert message is send to the ambulance or to the doctor's mobile phone using GSM technology. The main purpose of GSM is to provide the mobile healthcare for remote areas. This method reduces the time, easy to use and also used for self monitoring the patients anywhere at any time. The implementation of the system is done by using PIC16F877A and the simulation results are fulfilled by PROTEUS 8 software.***

Key Words: *wearable sensor, GSM, monitoring, proteus8, LCD.*

1. INTRODUCTION

The health problem is rising along with increasing population in the today's world. In hospitals, continuous monitoring is needed for heart attack, after major/minor operation, temperature related illness, physical disorders. But the 24x7 monitoring of patients is difficult and also leads to high cost. For elderly people who alone stay in home for long term monitoring without person is a complex situation. To overcome the situation without hospitalization for monitoring the patients using wearable sensors is used in this paper. Wearable sensors are popular in many applications such as entertainment, security, medical purposes. Wearable sensors are worn on the human body for temperature, pressure, heart beat, etc., In the medical field, sensor are collect the data about the person and send the information using wireless technology. This method reduces the health care cost of patients.

Julia Schnepper et al [1] proposed a method used to monitor the physiological parameters such as temperature, heart rate of a human body. It is an electronic device that is worn on the hand for risk person. The person is monitored wirelessly using a sensor. It detects the critical condition and intimates alarm to the receiver unit. The impact sensor finds the detection and falls of the patients, but the emergency button is to manually operate by users. Phillip A. Shaltis et al [2] proposed a new principle for blood pressure measurements by using the hydrostatic method. This technique eliminates the inflationary pressure cuff. Data are obtained using miniaturized ring BP sensor and a height estimation system. The height of the sensor is estimated by twin accelerometer. Tal Shany et al [3] proposed a system using body fixed sensors for monitoring the human movements and fall detection. It is estimated by using different accelerometer such as vibrating gyroscope, Accelerometers, magnetometers, goniometer, sole pressure sensor, pedometer, actometer etc., this paper gives the theoretic scope for physical activity monitoring. Pietro Salvo et al [4] designed a system for measuring sweat rate of the sport person using wearable sensors. On previous method, sweat rate was possible only based on laboratory. Ziyu Lv et al [5] proposed a method for elderly people to monitor the blood pressure, ECG/accelerometer and transmit the information to the smart phone using Bluetooth module. It stores the data using icare application for future reference. Nagender Kumar Suryadevara et al [6] proposed a system to detect the abnormal behavior of the elderly person in the home. The Sensors are installed in the household appliances for monitoring the daily activities using Zigbee communication. The data are also preprocessed in the system. Amruta Chopade et al [7] proposed a system using ATMEGA controller for monitoring the heart beat, temperature of the patients. Data are collected from many patients and display on the personal computer using Zigbee communication.

The proposed system is to monitoring the patients continuously from remote areas using wearable sensors. This system consists of many sensors such as temperature, pressure, heart beat, and accelerometer. The temperature sensor is used to measure the body temperature. The Pressure sensor is used to find the

pressure level of a person. Heart beat sensor has calculated the pulse rate of the person. Data are collected and analyzed using microcontroller. Based on the predefined values it compares and displays the information about the patients with stage in liquid crystal display using embedded c coding. If it exceeds that condition immediately send the information to the ambulance or doctor's mobile phone or relatives via SMS using GSM modem.

2. BLOCK DIAGRAM:

2.1 Transmitter Section

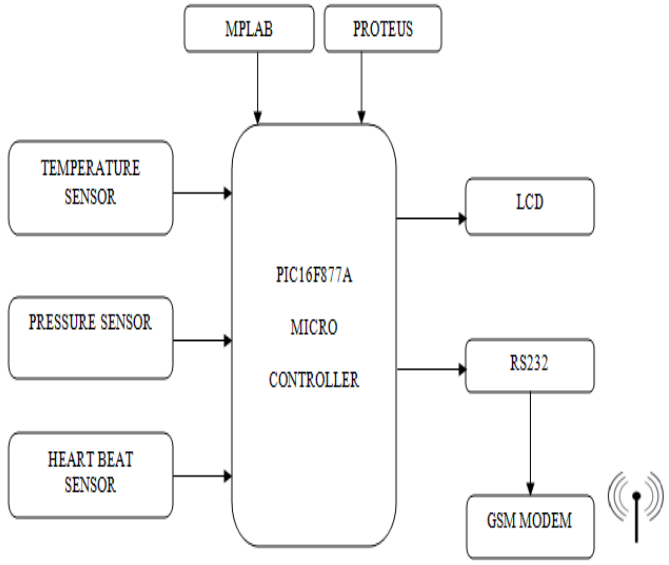

Fig – 1: Block diagram of the transmitter section

The transmitter section consists of temperature, pressure, heart beat sensor, PIC microcontroller, LCD, GSM modem. The receiver section consists of mobile phone.

2.2 Receiver Section

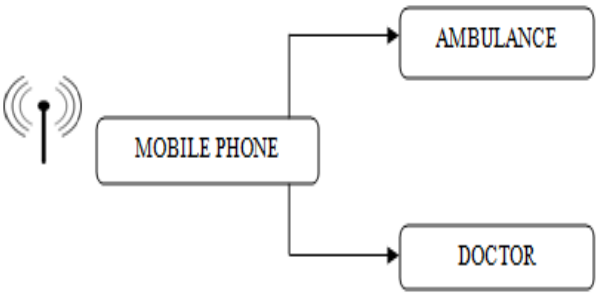

Fig - 2: Block diagram of the receiver section

3. SENSOR DESCRIPTION

3.1 Temperature Sensor

LM35 sensor is used to measure the temperature of the human body. Body Temperature changes depend upon on the time to time and day to day, but no more than 1.0°C.For many diseases such as typhoid , viral fever etc.,. So it needs to monitor continuously the patients. It also used to self monitoring the patients easily. If the temperature level is too low, the patient needs medical emergency. Because too low temperature leads to death occur and also for high level. It is measured in degrees Celsius (°C).

Table – 1: Classification of temperature range

Category	Temperature Range (°C)
Hypothermia	<35.0
Normal	36.5 – 37.5
Hyperthermia	> 37.5 – 38.3
Stage 1 hypothermia	35-36
Stage 2 hypothermia	34 – 33
Stage 3 hypothermia	32
Hyperpyrexia	>=40.0 -41.5

The common symptoms of heat related diseases are Deterioration, Heat rash, Heat cramps, Dizziness, Heat exhaustion, Heat stroke requires medical emergency.

3.2 Pressure Sensor

The Pressure sensor is used to measure the systolic and the diastolic pressure level using the device. Systolic is the higher of the two number measures the pressure in the arteries when the heart beats. Diastolic is the lower of the two number measures in the arteries between heart beats. It is measured in millimeter mercury (mmHg). Blood pressure changes from minute to minute.

Table – 2: Classification of blood pressure.

Category	Systolic/diastolic pressure (mmHg)
Hypotension	< 90/60

Desired (normal)	90-119 / 60-79
Prehypertension	120-139/80-89
Stage 1 hypertension	140-159/90-99
Stage 2 hypertension	160-179/100-109
Hypertensive	>= 180/>=110

The symptoms of the low blood pressure are Dizziness or lightheadedness, Fainting (syncope),Lack of concentration, Nausea, Depression, Thirst, Cold, Clammy, pale skin, Blurred vision, Rapid, shallow breathing, Fatigue.

3.3. Heart Beat Sensor

Heart beat sensor is used to measure the pulse rate of the heart in digital output. when a finger is placed on it. LED is used to detect the heart rate. The normal heart beat of the person is 78 bpm. It is measured based on the beats per minute. If the heart beats more than 100 BPM causes Tachycardia. If the heart beats less than 60 BPM causes Bradycardia. Figure 2 shows the information about the hear t rate of the person with time.

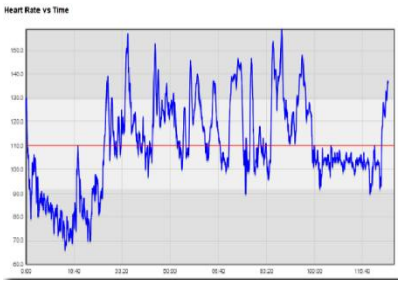

Fig -2: Heart Rate v_s Time

4. SOFTWARE DESCRIPTION

4.1 MPLAB IDE

MPLAB IDE is a software program that runs on windows operating system. It is used for developing the application for microchip microcontrollers and digital signal controllers. MPLAB provides a single integrated environment is used to develop the code for embedded microcontroller. So it is called as an integrated development environment. The features of MPLAB are comprehensive editor, project manager and design desktop. It is used for application development of embedded designs using Microchip PIC MCUs and dsPIC DSCs. The HI-TECH C compiler is used to build the embedded c coding in the MPLAB software.

4.2 Proteus 8

PROTEUS 8 is a simulation tool for embedded microcontroller. PROTEUS means PROcessor for Text Easy to Use. Its features are being fully functional and procedural programming function, clear and comprehensible syntax. It is easy to use, efficient, complete, and readable. C/C++ language is mostly used in the software. Its advantages are powerful string manipulation, comprehensibility of Proteus scripts, availability of arrays, AVL trees etc,.

5. FLOW CHART

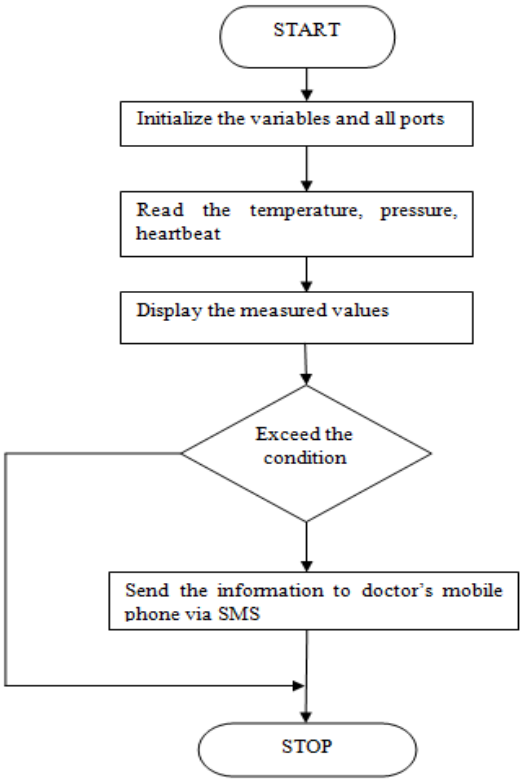

Fig –3: Flow chart of the proposed system.

6. SIMULATION OUTPUT

In this paper PIC microcontroller is used for processing the data. The simulation circuit is drawn as per circuit diagram using the proteus 8software. In the existing system, 8051 microcontroller is used. The disadvantages of 8051 microcontroller are complex architecture so understand their functionality is too difficult. The development time of microcontroller and cost increases due to complexity of a circuit board. The advantages of PIC controller is reliable, power conception less, programming is easy, connect analog devices directly without using extra-circuitry. The performance of the PIC

controller is very fast due to RISC architecture and the malfunctioning of PIC controller is very less.

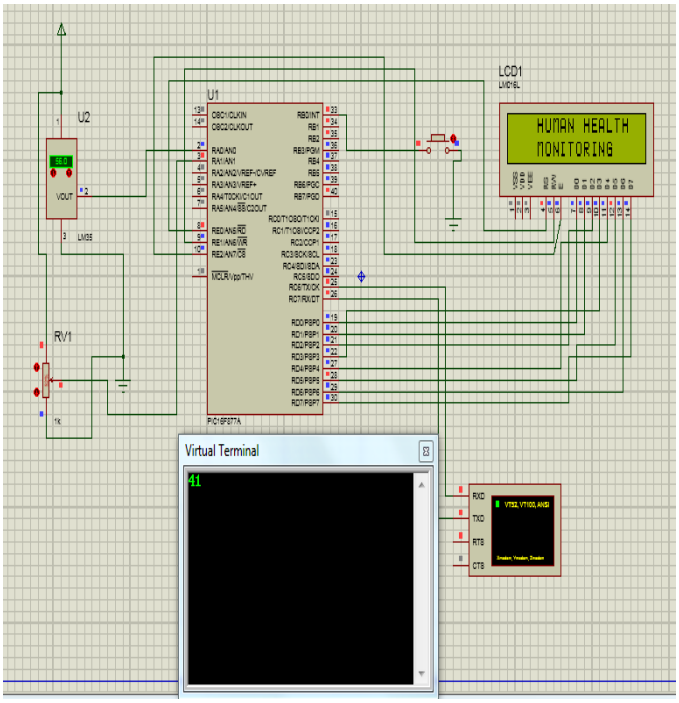

Fig -4: schematic diagram of the system

In the Figure 4 shows the circuit diagram of the system. sensors are connected to the processor. The collected information is displayed based on the condition.

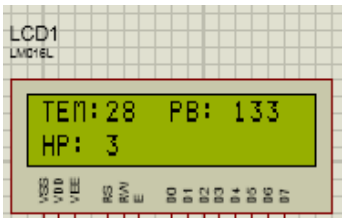

Fig -5: level of the parameters.

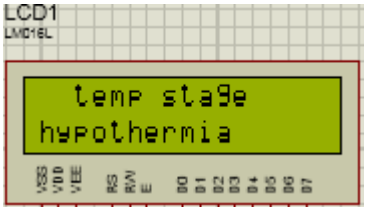

Fig -6: temperature stage

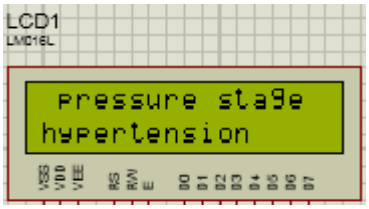

Fig -7: pressure stage

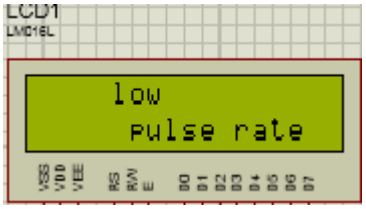

Fig -8: pulse rate

In the figure 5 shows the temperature, pressure, heart beat values of the particular patients. Figure 6 shows the stage of the person for temperature. Figure 7 shows the information about the pressure condition. Figure 8 shows the data regarding the pulse rate of the person.

7. CONCULSION

In our simulation, results are easily obtained using PROTEUS software to provide the real time monitoring of the patients. We get the input from sensors and processed using microcontroller. For emergency send the intimation to the caregivers. This system is low cost, self monitoring device and used in remote areas efficiently.

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BIOGRAPHIES

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V.Vinothkumar was born in India, in the year 1989. He received his bachelor degree in electrical and electronics engineering from Anna University, Chennai in 2006. He worked as lecturer at Thiagarajar Polytechnic College for one year. At present he is working as an Assistant professor in Kongunadu college of Engineering and Technology. He published papers in two international conferences and in that one IEEE conference and two international journals. His current research area is multi-level inverters and wavelet transforms. His areas of interests are power electronics and electrical machines.