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Real-Time Vital Signs Monitoring System

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***Abstract*— In this paper, we will discuss the modern visionary of the health care industry in order to provide better health care to patient anytime and anywhere in the world in a more economic and patient-friendly manner. Therefore, for increasing the patient care efficacy, this arises a need to improve the patient monitoring devices. The medical world today faces basic two problems: when it comes to patient monitoring, firstly the need of healthcare providers present the bedside pharmacy to the patient and secondly the patient is restricted to bed and wired to large machines [2]. In order to achieve better quality patient care, the above-cited problems have to be solved. This paper discusses the acquisition of physiological parameters such as heart rate, body temperature, breathing and ECG and displaying them in Graphical User Interface for being viewed by the doctor.**

I. INTRODUCTION

The main objective is to make a health monitoring system simple and provide the accuracy that helps a lot in monitoring only body temperature, heart rate, breathing, but a future perspective further expands our system by measuring various parameters like ECG and providing security measures through face-recognition. Analyze these parameters helps in identifying the problem to give the patient a better cure as soon as possible.

A framework will be designed that can wirelessly transmit the readings immediately to the doctor anywhere in the world that will incorporate through the concept of IOT. This framework measures each and every single parameter through this integrated environment.

II. HARDWARE REQUIRED & USED

ARDUINO UNO

Arduino Uno is a micro-controller board developed by Arduino.cc which is an open-source electronics platform mainly based on AVR microcontroller Atmega328.

HEART-BEAT SENSOR

Heartbeat Sensor is a device and is used to measure the heart rate i.e. speed of the heartbeat.

ECG SENSOR

Heart activity is closely linked to physiological and psychological arousal, making it ideal for understanding our mental states in greater detail.

The electrocardiogram (ECG) is a diagnostic tool used for recording the electrical and muscular activity of the heart over a given time period.

BREATHING SENSOR

A spirometer is an apparatus for measuring the volume of air inspired and expired by the lungs. It is used in the case of lung and respiratory tract diseases such as asthma or chronic- obstructive bronchitis.

It measures the respiratory flow rate and calculates the respiratory volume breathed in and out (inspiratory and expiratory lung volume) from this. These devices are usually designed as lightweight, portable systems that can be used conveniently in medical practices and in patients' homes.

SKIN RESPONSE SENSOR

It is the measure of the continuous variations in the electrical characteristics of the skin, i.e., for instance, the conductance, caused by the variation of the human body sweating.

LCD display

A liquid crystal display is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs).

TABLE I. NORMAL RANGE OF VITAL SIGNS

NORMAL RANGE	
Heart Rate	**60-100 beats per minute**
Breathing Rate	**12-20 breaths per minute**
Skin Response	**Dry Skin: 0-40** **Normal Skin: 40-70** **Oily Skin: 70-90**
ECG Response	**Normal: -30º to 105º** **Left Axis Deviation: -30º to -90º** **Right Axis Deviation: +105º to +180º**

III. ASSEMBLING OF THE DEVICES

To implement this framework; create an Arduino-based low-power Internet-of-Things (IOT) device with built-in sensors that can send the data to any location.

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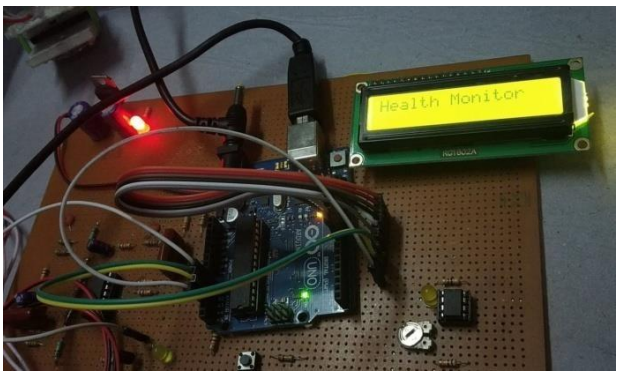

Fig. 1. Assembling of the Various Devices

In this system, it measures the patient's parameters (temperature, heart rate, pulse, breathing rate, skin response, etc.) through the different available sensors. This sensor collected data i.e. biometric information is given to raspberry pi and then it is transferred to the server. The data stored in a database and can be displayed on a website that can be accessed only by authorized personnel.

This finger type heartbeat sensor works by detecting the pulses from fingers by touching the device. Every heartbeat will alter the amount of blood in the finger and the light from the IR LED passing through the finger and thus detected by the Photo Diode will also vary.
The pulsation point of the skin surface and the vital sign can be calculated from the measured signal.
The proposed system will assist patients in remote locations (e.g. home healthcare) and that is not just about observing a severe disease state, but about helping the patients by giving those references of several doctors.

By evening this project, it will provide an inexpensive system for patient's health monitoring which can shield their lives by proving emergency attention in real-time.

Data gathered from this device is analyzed and stored, and the aggregation from multiple sensors and medical devices helps make informed decisions in a timely manner.

IV. PROPOSED APPROACH

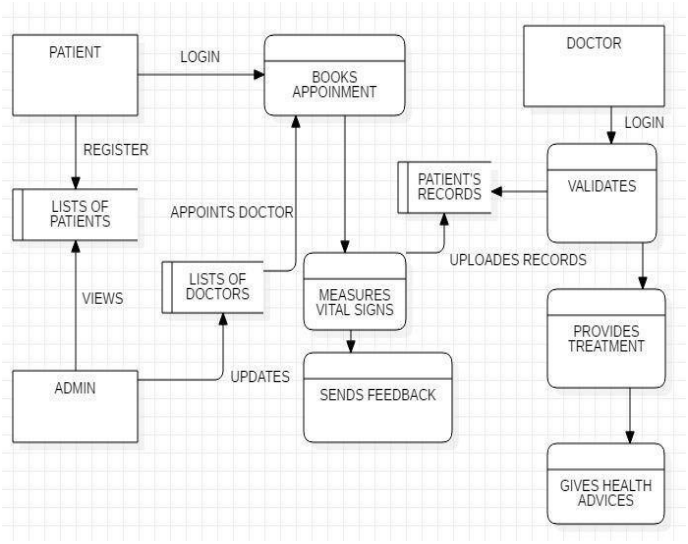

Fig. 2. Data Flow Diagram

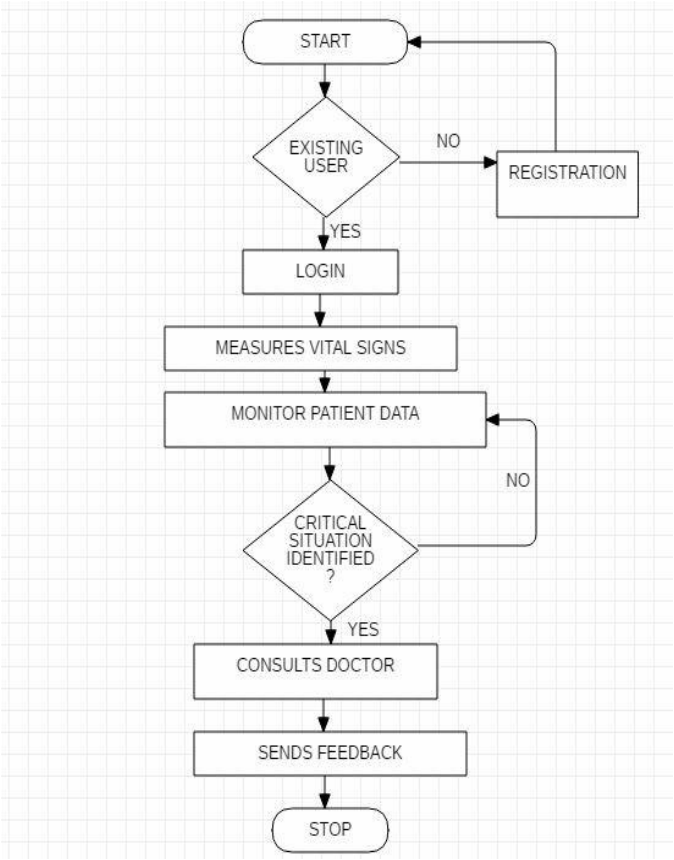

Fig. 3. Flow Chart

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V. IMPLEMENTATION OF THE SYSTEM

HEART RATE

In this, as we put our finger in the clip; the sensor attached to the clip analyzes the blood that flows through the vessels under the skin. The frequency of flowing blood will provide a movement that will be read by the sensor, this will be our Heart Rate.

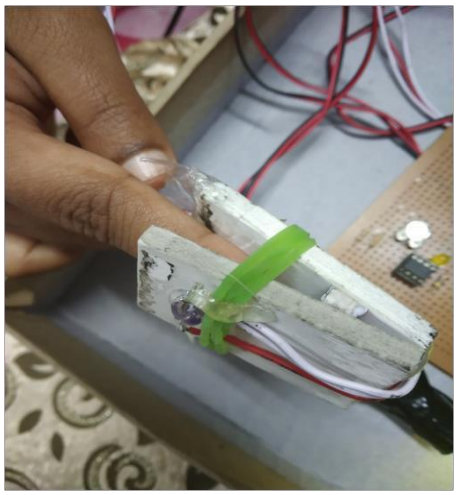

Fig. 4. Measuring the Heart Rate

BREATHING RATE

As we blow normally into the spirometer the ball inside the unit start bouncing. This bouncing of the ball will give frequency to the sensor attached to the unit. The frequency of blown air will provide a movement that will be read by the sensor, this will be our capacity of breathing. The hardware will convert the analog signal into digital signal readings.

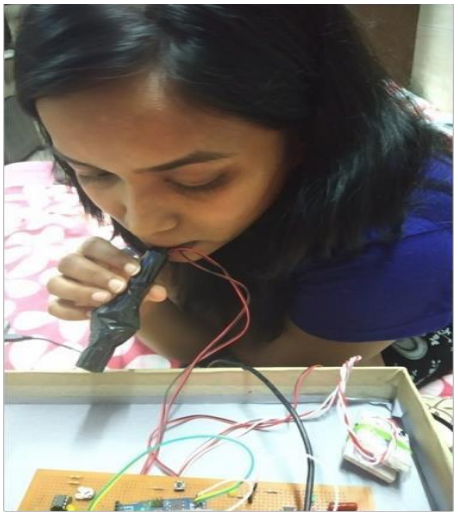

Fig. 5. Measuring the Breathing Rate

SKIN RESPONSE

The Skin Response sensor defines the conductivity of the skin. It analyzes the moisture content of skin on the basis of which type of skin related problem can find out. Sweat glands under the skin work according to the temperature and environment on the skin surface.

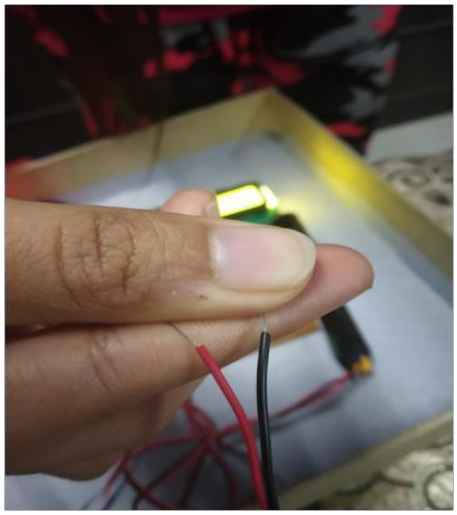

Fig. 6. Measuring Skin Sensitivity

Above all readings are displayed in LCD screen as well as on Web App. This framework will convert the analog signal into digital signal readings. These readings will fetch into the web app with the help of a serial port. In the web app, the patient can monitor his or her readings and simultaneously can approach the doctor with the reference prescribed the suggestions of it.

Fig. 7. Web App Display

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