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Real Time Pulse Rate Monitoring System using Arduino Uno and GSM Technology

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***Abstract*— The pulse rate is one of the most important parameter used by doctors to diagnose a patient. Few electronic gadgets like smart watches, these days come equipped with a heart rate measuring module. But, these gadgets with heart rate sensor are quite expensive and a doctor will not be always with a patient to regularly monitor the patient's pulse. A real time pulse monitoring system is presented in this paper. The proposed system uses Arduino Uno, Heart beat sensor and GSM module. With this model, the measured pulse rate is compared with a configurable threshold via microcontroller which is defined by a specialized doctor who follows the patient; in any case of emergency a short message service (SMS) will be sent to the Doctor's mobile number along with the measured values through GSM module. The system becomes effective for use at home at a low cost.**

Keywords—pulse rate; monitoring; Arduino Uno; low cost; senor; GSM module

I. INTRODUCTION

Heart rate is the speed of the heartbeat measured by the number of contractions of the heart per minute (bpm). Cardiovascular disease is one of the main causes of death in the many countries. The delay between the first symptom of any cardiac ailment and the call for medical assistance has a large variation among different patients and can have fatal consequences. One critical inference drawn from epidemiological data is that deployment of resources for early detection and treatment of heart disease has a higher potential of reducing fatality associated with cardiac disease than improved care after hospitalization. Hence new strategies are needed in order to reduce time before treatment. Monitoring of patients is one possible solution. Also, the trend towards an independent lifestyle has also increased the demand for personalized non-hospital based care.

Figure 1. Existing gadgets to measure heart rate

There are a few electronic gadgets like smartwatches, Fitbit (wearable tracker) and high end smartphones that have a heart rate measuring capability. These gadgets are expensive and are not dedicated for pulse rate measurement. We propose a low cost system that is dedicated for real time monitoring of pulse rate.

The presented system in this paper can be used by anyone to measure and monitor their heart beat at home. In case of any abnormality in the heart beat rate of the patient, the system will immediately message to the concerned doctors and relatives about the condition of the patient and abnormal details.

II. PROPOSED SYSTEM'S ARCHITECTURE

The proposed model has a heart rate sensor, Arduino Uno Microcontroller, LCD, GSM module. Fig. 2 shows the system architecture. The heart rate sensor sends digital signal to the Arduino Uno. The received signal is used to calculate the heart rate according to the programming done and displays the output on the LCD. When the pulse rate is abnormal (high/low), the Arduino will communicate with the GSM Module to send Short message service (SMS) to the Doctor.

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Figure 2. Proposed System Model

A. Heart Rate Sensor

The heart rate sensor is the input unit for our system. It Sends digital signals to Arduino for processing. There are two commonly used heat rate sensors: KEYES KY-039 and PULSE SENSOR HW-01. They have three terminals: VCC, OUT, GND. A supply of +3V to +5V is given to the VCC terminal and GND pin connected to zero potential (ground). The OUT pin of the sensor is the input pin that delivers signals to the Arduino UNO.

Figure 3. Heart Rate Sensors

Sensor is designed to provide digital output of heart beat when a finger is placed on it. When the heart beat detector is working, beat LED flashes in unison with each heartbeat. This digital output can be connected to Arduino Uno to measure Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

B. Arduino Uno

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, and a reset button.

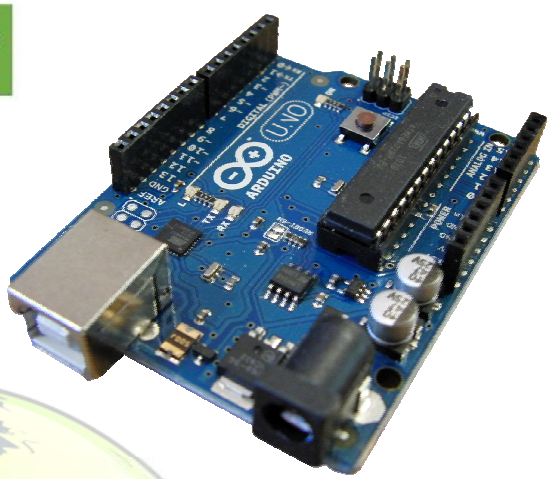

Figure 4. Arduino Uno

C. LCD Output Screen

The HD44780U dot-matrix liquid crystal display controller and driver LSI displays alphanumeric, and symbols. It can be configured using the Arduino Uno microcontroller.

Figure 5. HD44780 LCD Display

D. GSM Module

GSM module has a dedicated transmission & reception pin which are connected to Arduino Uno. It works on 12Vdc supply. We use the module SIM900A. It's a cheap and simple GSM module available in the market now.

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Figure 6. SIM900A GSM Module

III. Working And Implementation

The structure of the proposed system with the main building blocks and the interconnection relationships among the system blocks is explained here. First, the heartbeat rate is calculated in the Arduino and then it is displayed in the LCD.

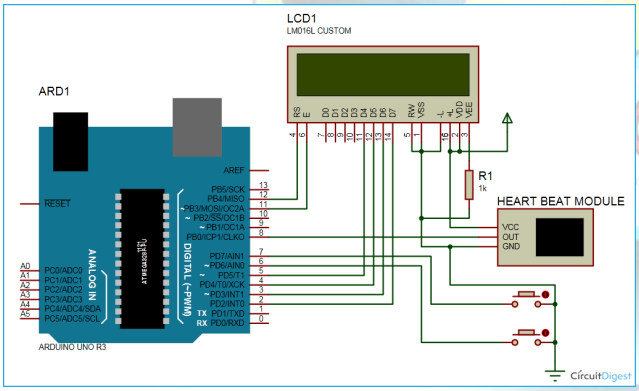

Figure 7. Interfacing Heart Rate sensor and LCD with Arduino

A configurable threshold value of pulse rate is defined by a specialized doctor who follows the patient via the Arduino microcontroller. If the measured pulse rate is higher than or lower than the maximum and minimum values configured, then the counter value is incremented and the pulse is again measured after a delay. If the Pulse rate remains abnormal (high/low) continuously for 20(this number can be adjusted) tries, the Arduino will communicate with the GSM module to send the SMS to doctor.

As depicted in Figure 7, which illustrates the overall model, when the patient's heartbeat rate changes badly, the Arduino which recorded Pulse Sensors readings, orders GSM shield to send an SMS message containing these readings and patient ID, to his doctor's mobile phone, who -by his turn- send an ambulance to the patient's location.

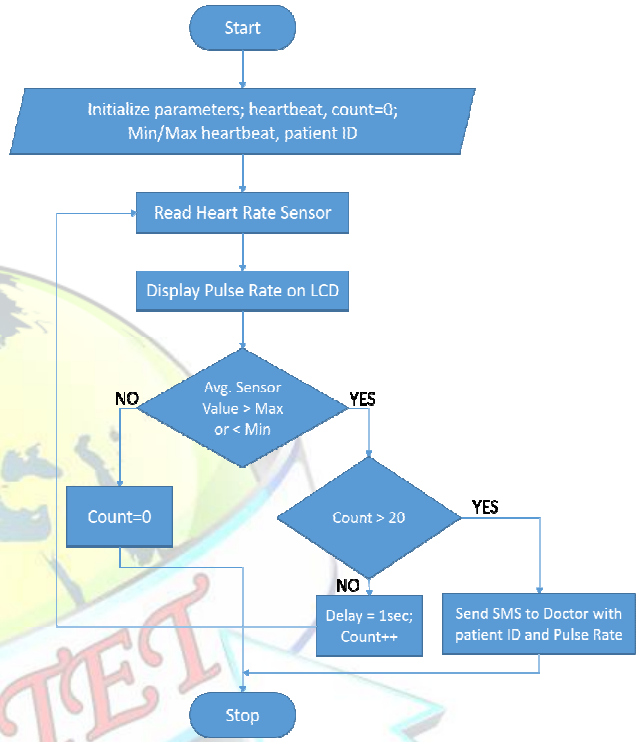

Figure 8. System Flow Chart

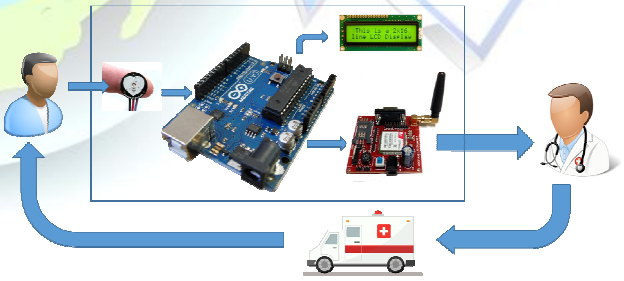

Figure 9. System Overview

IV. Upgradation Possibilities

The system can be upgraded to monitor other physical parameters like body temperature, blood pressure and sugar with appropriate sensors and logic. Thus a Whole home based medical utility can be made. Hence the proposed model is versatile and can be used for more applications.

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V. CONCLUSION

Healthcare field is one of most delicate and important fields to be developed and enhanced by smart systems that are simple, have low energy consumption and real time feedback. The system designed and shown in the paper can improve the quality of health services and reduce the total cost in healthcare by avoiding unnecessary hospitalizations and ensuring that those who need urgent care get it sooner. It is a system which can measure heartbeat rate and can be upgraded too measure body temperature, blood pressure, sugar, etc., and communicate them in cases of extraordinary behaviors to supervision medical entities using GSM, to deliver immediate actions to rescue patients life with potentiality in the future to add other vital factors measurements according to available sensor in the market which can achieve the objective of providing a reliable effective application for real time health monitoring and tracking. Thus this device can really be a boon to elderly society by assisting them in getting quality assistance at their own houses.

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