

# JEEVAN RAKSHAK PATIENT MONITORING SYSTEM USING MATUINO

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## Abstract

This project is based on Matuino which is basically the interfacing of Matlab with Arduino UNO. As we all know now-a-days, it becomes very difficult for relatives as well as for the doctor to be available at all time for their patient who might need them at any time while he/she is suffering from a disease or any other disability. So continuous monitoring of the health parameters of the patient like heartbeat, temperature, drip (glucose bottle) level, position and GSR becomes difficult. Hence to remove the human error and to lessen the burden of monitoring patient's health parameters time to time by doctor, this project continuously monitor all health parameters of the patient and sends an SMS to the doctor as well as beep a buzzer when any of the health parameter goes above or below the normal level. It also displays all the measured values on a LCD display and the real-time graphs of temperature and heartbeat on Matlab GUI.

**Keywords:** Arduino, GSM, GSR (Galvanic Skin Response), LDR, Matlab GUI, Matuino, etc...

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## 1. INTRODUCTION

This project is basically useful in the hospital ICUs and it offers less cost and size. In the case of emergency for oldage person who is suffering from heart related or any other disease constant monitoring of these type of patients is required which is sometimes impossible in the hospital, or in rural or remote areas, the patient location is far away from the hospital that's why they can't be given proper medical treatment. In this case, this project become useful for measurement of the heart rate, temperature, drip level (glucose bottle level), position and GSR of the patient and the information is transmitted with the help of GSM module to the doctor when any critical condition arise so the patient can be provided with proper treatment at right time, also prevent them from many serious kind of situation before they reach to the hospital. There are mainly five sensors used to measure the heartbeat, temperature, position, drip level and GSR. All the sensors are interfaced with the help of Arduino UNO development board and all the measured values by these sensors are displayed on a 20\*4 LCD display. It also displays the real-time graphs of the heartbeat and temperature of the patient on Matlab GUI. When any of the measured value is out of the defined range it sends SMS to the doctor and beeps a buzzer indicating an emergency. An emergency switch is also provided so that in any more critical condition, by pressing the switch, an emergency call is sent to the doctor.

## 2. SYSTEM HARDWARE AND WORKING PRINCIPLE

The heart of the system is Arduino UNO development board which is interfaced with mainly five health parameter sensors which are heartbeat sensor, temperature sensor, 3-axis accelerometer sensor (tilt sensor), drip level circuit and

the GSR (Galvanic Skin Response) module circuit. The block diagram and circuit diagram of this system is given in the figure below:-

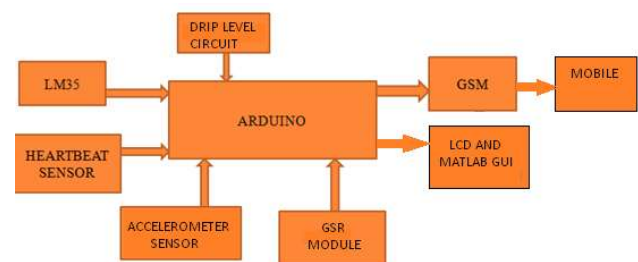


Fig-1: Block diagram of this system.

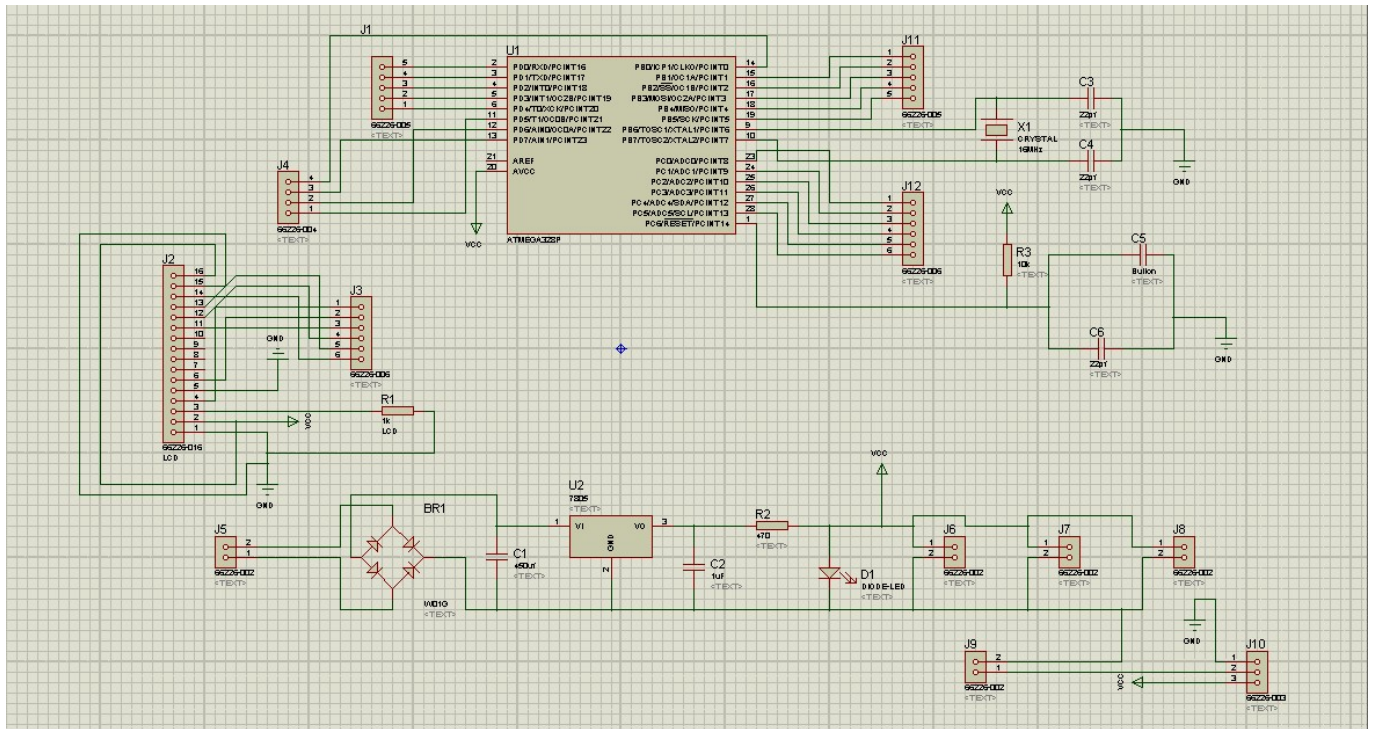


Fig-2: Circuit diagram of this system.

### 2.1 Heartbeat Sensor

This technique is used to measure the heartbeat with the help of changing blood volume in arteries of the finger while the heart continuously pumping the blood. It consists of an infrared LED from which an IR signal is transmitted through the fingertip; a part of this signal is reflecting back by the blood cells. The signal which is reflected is detected with the help of photo diode sensor. The change in blood volume with change in heartbeat results in a pulse train at the output of photo diode. It gives output in beats per minute (BPM).

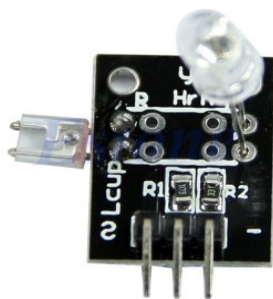


Fig-3: Heartbeat sensor.

### 2.2 Temperature Unit

The LM35 is a precision IC. In LM35 temperature sensor, the output voltage is basically linearly proportional to Celsius (Centigrade) temperature. The LM35 series ICs thus has an advantage over the linear temperature sensor ICs calibrated in ° Kelvin scale, as it's not necessary to subtract a constant voltage from the output to obtain most convenient Centigrade scaling. The LM35 is rated to operate in a range of -55° to +150°C temperature, while the LM35C sensor is rated for a range of -40° to +110°C (-10° for the improvement of accuracy).

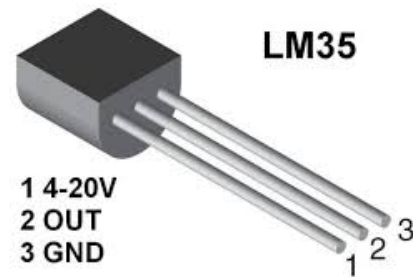


Fig-4: Temperature sensor.

### 2.3 Accelerometer Sensor

The ADXL335 sensor is a thin, small, low power, 3-axis accelerometer with conditioned voltage outputs. The ADXL335 has done acceleration measurement with minimum full-scale range +3 and -3 g. This sensor can measure the static acceleration of the gravity in applications of tilt-sensing, as well as the dynamic acceleration which is resulting from shock, vibration, or motion. When there is any sudden movement in the patient it indicates position alert by means of an SMS.



Fig-5: 3-axis accelerometer sensor.

### 2.4 GSRCircuit

Galvanic Skin Response Sensor or GSR helps in measuring the electrical conductance of the patient’s skin. Strong emotion can particularly cause stimulus to the nervous system, results in more sweat which is being secreted by sweat glands. GSR basically allows you to spot such type of emotions by attaching the two electrodes to the two fingers of one hand. When the patient become in the sweating state the resistance of their body become low so the electrical conductance of the skin become high and when it becomes high an SMS is sent to the doctor indicating GSR is high. The circuit uses voltage divider to measure the resistance.

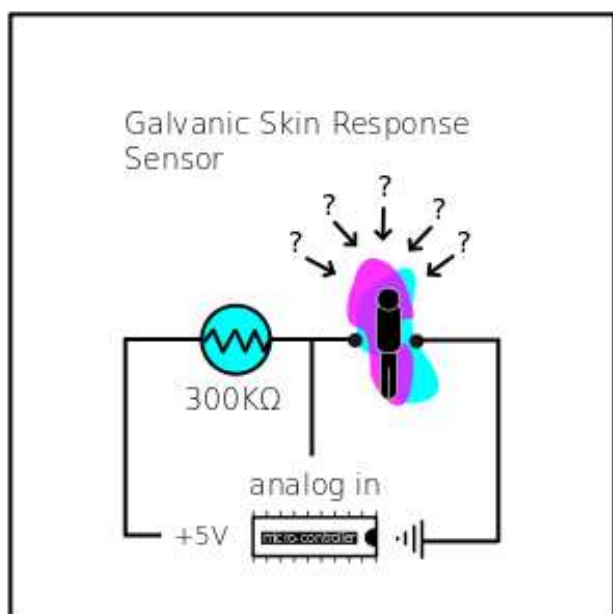


Fig-6: GSR Circuit.

### 2.5 Drip Level Circuit

In this, LED and LDR (Light Detecting Resistance) sensors are used to monitor the glucose bottle level. A LDR sensor is an electronic instrument which changes its resistance when light is fall into it. It is used with an emitter LED placed on opposite side of LDR sensor. When bottle become empty a SMS is sent to doctor indicating empty bottle.



Fig-7: Drip level circuit.

### 2.6 Arduino UNO

The Arduino UNO is a development board which is based on ATmega328 microcontroller. It has 6 analog input pins, 14 digital I/O pins (6 pins can be used for outputs of PWM), a crystal oscillator of 16 Mhz, a power jack, a USB connection, and a reset button. It contains almost everything which is needed to support microcontroller; it has to be connected simply to a computer with a USB cable or we can also power it with an AC-to-DC adapter or a battery to get it started.

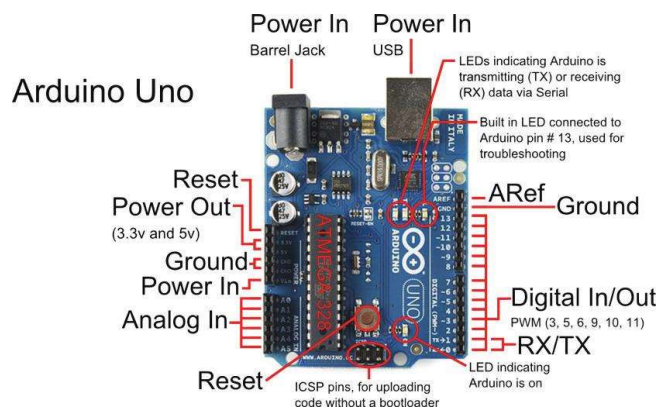


Fig-8: Arduino UNO board.

### 2.7 GSM Module

The GSM basically stands for Global System for Mobile Communications. In this, we have used GSM SIM900 module which supports in 900Mhz band. This GSM module requires a 12 volts input. So we feed it using a 12V, 1A DC power supply. It controls via AT commands (GSM, ITU, GPRS and manufacturer supplementary). It basically requires a SIM (Subscriber Identity Module) card like cell phones for activating communication with network.



Fig-9: GSM Module.

### 3. FLOW CHART

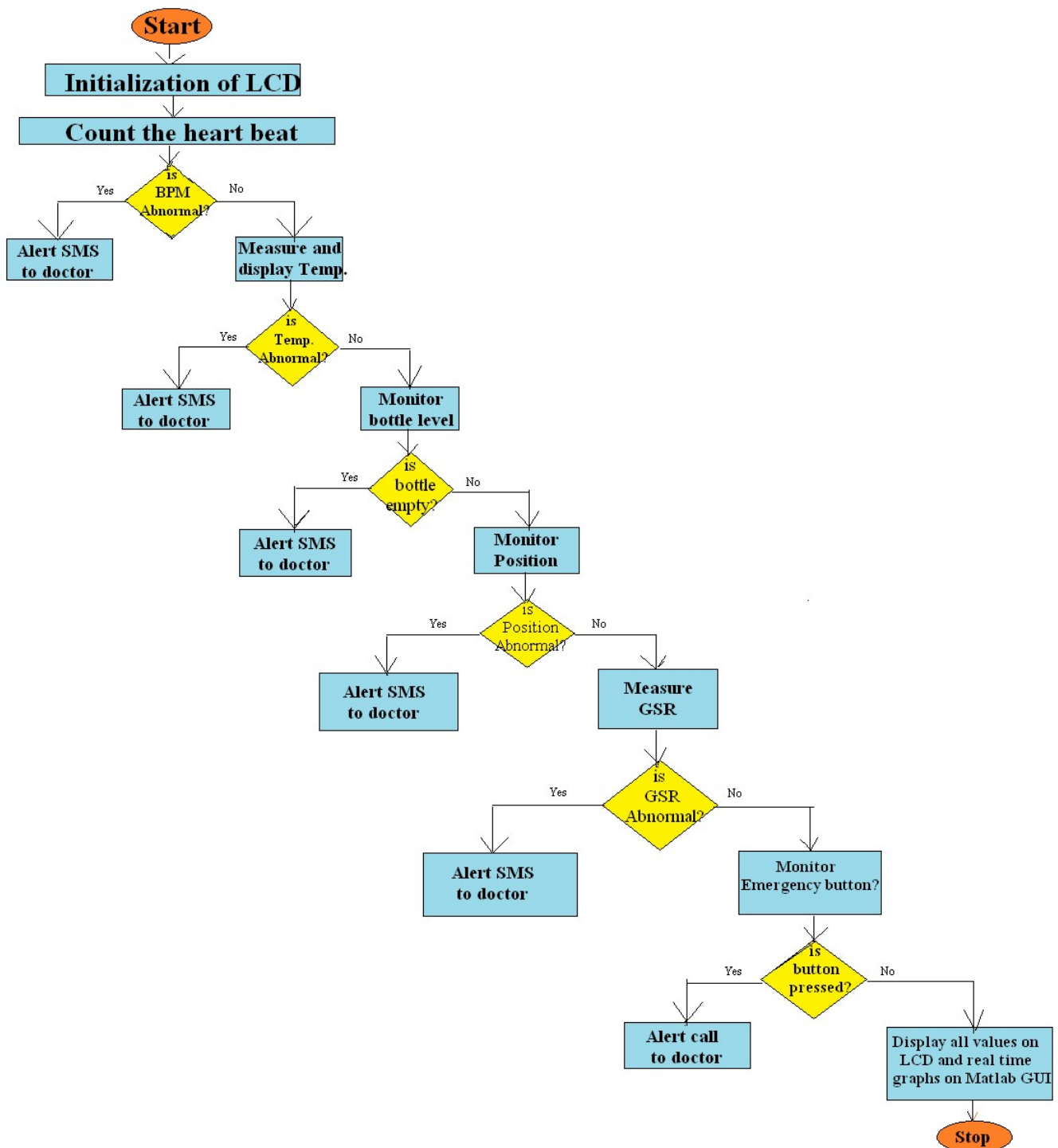


Fig-10: Flow chart of this system.

### 4. ARDUINO INTERFACING WITH MATLAB

In this project we interface the Arduino UNO development board with the Matlab. With the help of this, doctor can see the real-time graphs of heart beat and temperature of the patient. Both these real-time graphs can be seen on Matlab GUI (Graphical User Interface).

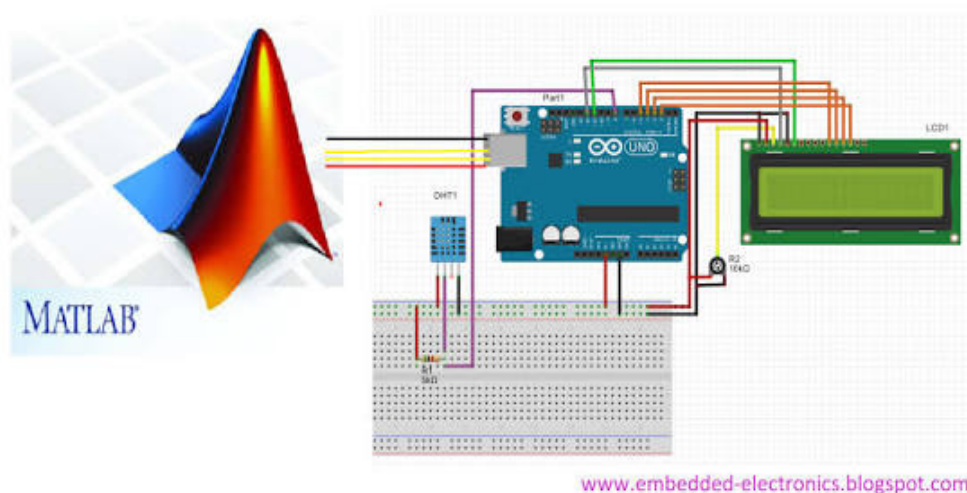


Fig-11: Matlab interfacing with Arduino UNO.

## 5. RESULTS

All the values measured by the sensors are displayed on a 20\*4 LCD display. It also displays the glucose bottle empty or filled and the GSR of the patient. When any parameter goes above or below the defined range it indicates to doctor by sending a SMS and by beep a buzzer. When ArduinoUNO development board is interfaced with Matlab, we can easily see the real-time graphs of patient's temperature and heartbeat with the help of Matlab GUI. The real-time graphs of temperature and heartbeat are obtained on MatlabGUI which is shown in Fig-12.

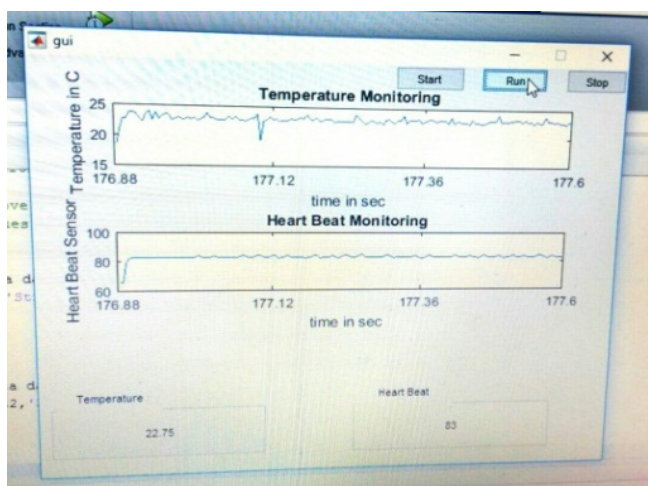


Fig-12:Real-time graphs obtained on Matlab GUI.

## 6. CONCLUSION

The main purpose associated with this project is to provide proper treatment to the patients who need urgent treatment in emergency condition in remote location as fast as possible. This project is low cost and can also be used for real-time as it is embedded with the Matlab GUI. It can also be used at home as well as in hospitals as it is portable and easy to use. We can also expand this system by adding medicine reminder, blood pressure sensor and other biometric sensors as a future aspect. When the controller

detects any abnormalities in the health of the patient at that time it sends an SMS to doctor via GSM so that best treatment can be provided as fast as possible by doctor.

## ACKNOWLEDGEMENT

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