International Journal of Advanced Research in Education and TechnologY(IJARETY)

ISSN: 2394-2975 | www.ijarety.in| A Bi-Monthly, Double-Blind Peer Reviewed & Referred Journal |

|| Volume 8, Issue 6, November 2021 ||

LabVIEW Based Health Monitoring System Using Arduino

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ABSTRACT: This paper indicates the sophisticated method of monitoring human body parameters like temperature, heartbeat rate, SPO2 using embedded web server and LabVIEW technology. The hardware is developed on Arduino atmega328 controller board and internet connectivity as well as different sensors. LabVIEW is used in software part to provide GUI based environment to user which makes user friendly simpler than coding and internet is used to generate embedded web server. Hence this interfacing makes our project to leap to the next generation of, anywhere anytime access. It can be fed to internet through website or network system so patient's condition and biomedical parameters can be monitor worldwide. It is Low cost and low power system in term of hardware as well as software. It is achieved by means of embedded Real time operating system. For Pervasive Healthcare web based real time monitoring uses the Context Aware instantaneous subordinate healthcare architecture and healthcare professionals can remote live monitor the patient.

KEYWORDS*:* Arduino, Ethernet Shield, GUI, LabVIEW, Pulse oximeter, SPO2, VISA, Webpage, Web Server

I. INTRODUCTION

This system includes biomedical parameters temperature-LM35, heartbeat-TCRT1000 and SPO2-MQ2 monitoring implemented system by simple hardware component as well as in computer by LabVIEW software. This live human body monitoring system using embedded also includes internet website based transmission support by implementing using Arduino atmega328 and Ethernet shield as base. This system support live internet web transmission of patient's body parameters. A GUI based platform in local hospital computers by LabVIEW interface sensors which acts as biomedical devices. This paper consists the basic system for Human body monitoring implementation for a patient in hospitals. This type of system really helpful in hospitals for the critical situation patients who need continuous observation overseas . In this plan obviates the requirement of digital signal processor and A/D converter, it leads to a small single chip solutions. The novel logarithmic transimpdence amplifier is used here for power reduction.

II. RELATED WORK

- The system takes up Heart Beat Rate, Temperature, Blood Oxygen Level (Oxygen saturation) and Breath Rate. Sensors are tethered to microcontroller. XBee transceiver receives the results of sensors, and the Database is maintained to store it in the computer. Graphical User Interface (GUI) is used here to display the value . Alarm is generated if there is any abnormality in physical parameters of patient monitoring. System can also be used to monitor performance of athletes based on received physical parameters.

- The objective of this research is to design a device which is low-cost, non-intrusive, wireless, portable and reliable to use. This device will provide the information about the four parameters on Electrocardiogram, Body Temperature, Oxygen Concentration and Heart Rate in real time and it will be sent wirelessly from remote to base station.
- The health care sensors are playing a vital role in hospitals. The patient monitoring system is one of the major improvements because of its advance technology. This project proposes a system that provides temperature and humidity monitoring system based on GSM interfaced with LabVIEW.

- This study describes the development and implementation of an Android based smart phone in the home monitoring health care system. The system utilizes Android devices as mobile access terminals for patient-monitoring services.

III. PROPOSED SYSTEM

Basic Requirement

This System requires basic hardware and software requirements which covers low cost, less power consumption and low size.

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Hardware Requirement

- Arduino Atmega328 Development Board
- Ethernet shield
- Temperature Sensor-LM35
- PC with LAN driver installed
- Heartbeat Sensor-TCRT1000
- SpO2 Sensor-SEN1327

Software Requirement

- Windows Operating System
- National Instruments LabVIEW 2013
- Web Browser

IV. BLOCK DIAGRAM

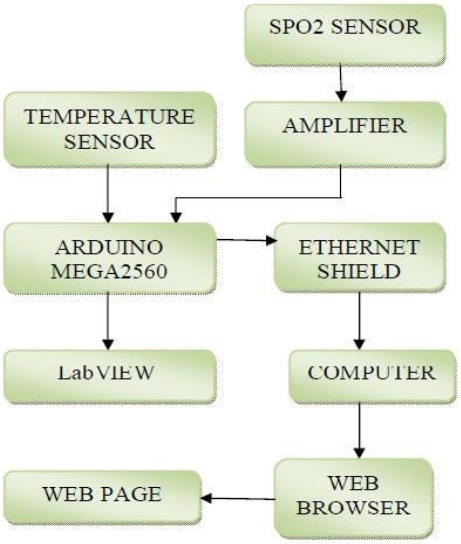

Fig. 1 Architecture of Human Body Temperature Monitoring System

V. HARDWARE IMPLEMANTATION

ARDUINO

The Arduino is a microcontroller board, based on the ATmega8/168/328, UNO R3 major in ATmega328. Arduino UNO R3 have 14 digital input/output pins (which include about 6 pins PWM output), analog inputs-6 and 1 ceramic resonator-16MHZ , 1 USB connection and Power jack, an ICSP header (In Circuit Serial Programming) (like MAX232, RS232 programming) [5]. The Arduino Uno has a resettable poly-fuse that protects your computer's USB ports from shorts and over current. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

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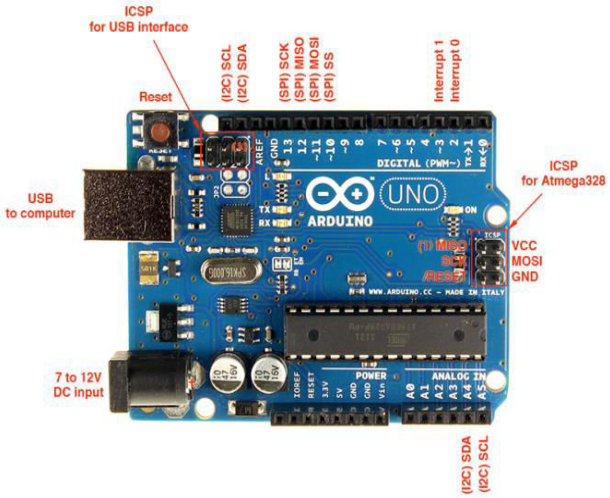

Fig. 2 Arduino ATmega328

TEMPERATURE SENSOR

LM35 sensor is used as a temperature sensor which gives current temperature in analog form . This analog formed value is given to Arduino atmega328 ADC channel for digital conversion [6]. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. We generally measure human body temperature in Fahrenheit but sensor gives output in Celsius form. Finally temperature readings are converted into Fahrenheit.

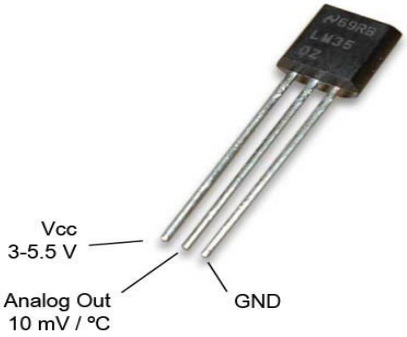

Fig. 3 LM35(Temperature Sensor)

SpO2 SENSOR

Pulse oximeter works on the principal of reflectance/transmittance and absorption of light by multiple components like skin, muscle and blood vessel .To estimate the percentage of oxygen, pulse oximetry is the method used [1]. It consists of a small device that clips to the finger and transfers its readings by wire or wirelessly . To measure the absorption of red and infrared light in the extremity it uses IR light-emitting diodes in conjunction with a light-sensitive sensor [4]. The difference between oxygenated and deoxygenated hemoglobin makes the calculation possible. Absorption of light takes place at two wavelengths but this sensor gives very low power output so output signal must be amplify.

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Fig. 4 Pulse Oximeter Sensor

HEART-BEAT SENSOR:

A pulse, an indication of a heart rate when counted over the time span of a minute, can be detected in several ways. The detector are arranged in the same direction to sense the presence of an object by using the reflective IR-beam from the object.PPG (photo-pleysmography) receives heart-rate simultaneously by means of piezo-electric or optical heart rate detection [3].TCRT1000 is the IC used here to measure the heart pulse. As it is sensitive to light, the accuracy will occur when the IC set to be closed or away from light. The operating wavelength is 950 nm. The detector consists of a phototransistor.

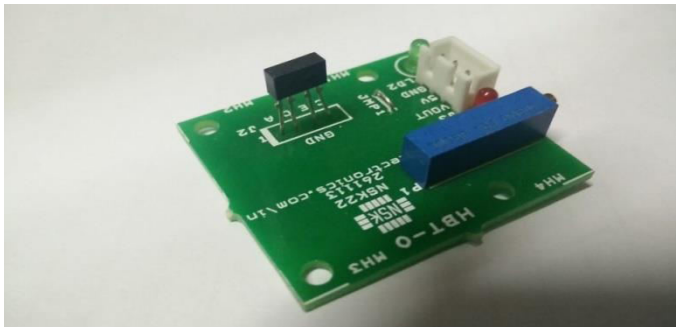

Fig. 5 TCRT1000

DATA TRANSMISSION

These data are serially transmitted over serial port of LabVIEW. In LabVIEW screen, current biomedical parameters are displayed. Web-page is used to display current temperature readings through internet, web-based protocol HTTP is used and website is designed into simple HTML language.

Ethernet Shield is used for interfacing the web-server with this project. This transmission is done over a LAN to the PC clients by means of HTML.

VI. SOFTWARE IMPLEMENTATION

- Windows Operating System
- National Instruments LabVIEW 2013
- Web Browser

LabVIEW LINX

An add-on for LabVIEW which is free open source is linx and interfaces with common embedded platforms by providing unified API such as chip KIT, Arduino and more. LINX's is an abstraction layer provides support for hardware peripherals as well as common sensors. To interface with a chip-KIT or Arduino base board it enables the same code. VISA driver establishes the serial communication between arduino and LabVIEW.

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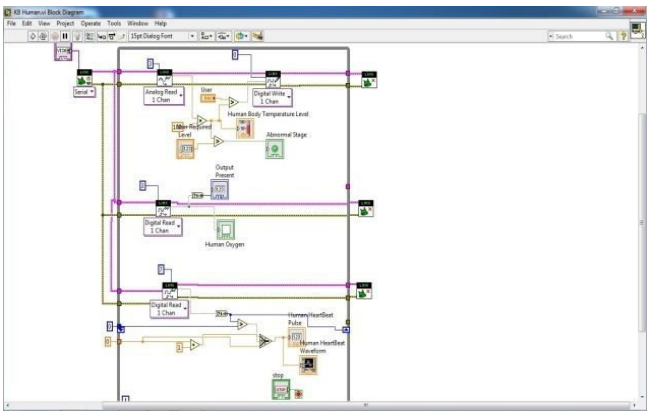

Fig. 6 Block Diagram In LabVIEW

GUI based Flow Diagram

Simple LabVIEW front panel is designed which looks like below. VISA(*Virtual Instrument Software -+Architecture)* drivers to establish serial communication has to be installed and then VISA controls is used in the block diagram, For this purpose we use , VISA Open, VISA Read, VISA close blocks

There are different indicators in LabVIEW to screen temperature, Heart beat and SPO2 readings . Thermometer and numeric indicators are available for temperature. Same as numeric display also available for spo2 sensor . Waveform chart for heart beat readings[2].

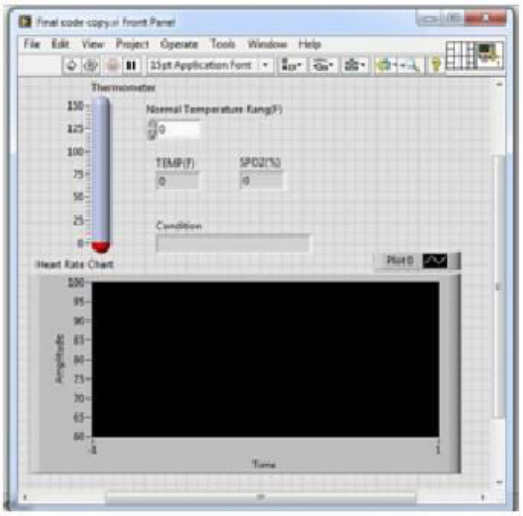

Fig. 7 Front Panel in LabVIEW

Front panel and block diagram screens are appear in LabVIEW.

WEB PUBLISHING:

In the LabVIEW software there is a VI package manager which is used to download the several packages regarding this software. Hence there is a package named arduino web publishing which has to be downloaded for web publishing i.e., 24*7 live monitoring [6]

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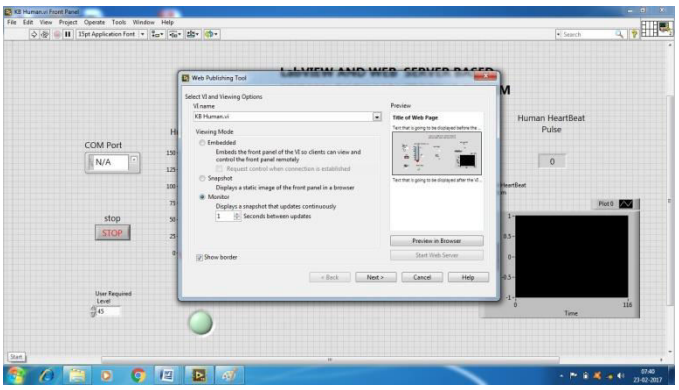

Fig. 8 Web-publishing

VII. RESULT

All hardware & software programming parts are completed, also troubleshoot the connection between PC and arduino Ethernet shield successfully, and Webpage will be displayed by typing appropriate IP address of the server shield on pc's browser. GUI based environment is provided to Users for continuous patient monitoring. The system designed efficiently and met all expectations as set earlier.

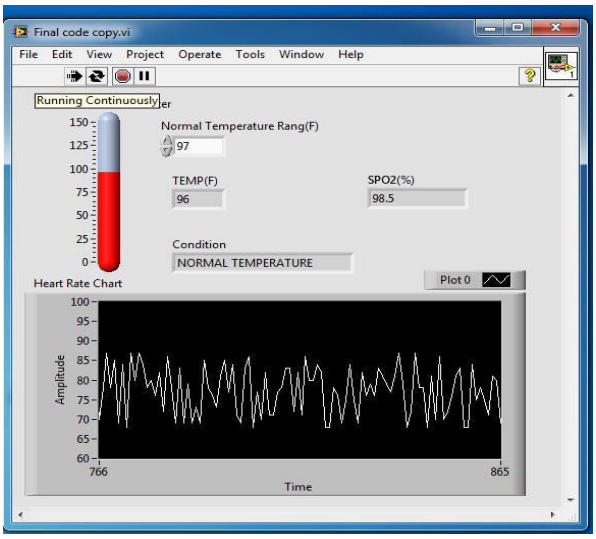

Fig. 9 Result in LabVIEW

VIII. CONCLUSION

Hence the patient's monitoring system with many available sensors which includes temperature, oxygen content in blood, heart-beat made possible for live monitoring and there are many application related to patient health monitoring [7].

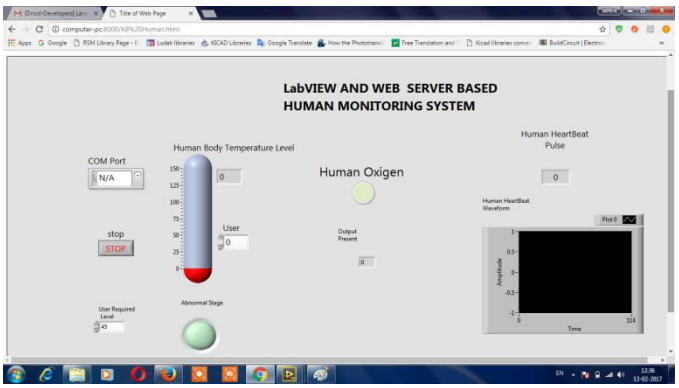

Fig. 10 LabVIEW Output in webserver

In future more biomedical sensors can interface with this system.

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