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System to Monitor Vital Parameter of Patient and Form a Database Wirelessly

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***Abstract—* Nowadays, due to hectic lifestyle and changing eating habits, people are more prone to diseases. Also as people grow older, they contract diseases like Diabetes, Blood pressure, Cardiac diseases, etc. It is important to keep a check on these disorders so as to have a healthy life. This project aims to develop a patient monitoring system to measure basic parameters like Blood pressure using pressure sensor, Glucose concentration using test strip, temperature using temperature sensor. High blood pressure can lead to stroke while low blood pressure can cause dizziness and fainting. Diabetes, in the long run, can cause problems in eyes, kidneys, nerves. Body temperature is an indicator stating whether a person is suffering from fever.**

One of the oldest methods to measure blood pressure is using mercury sphygmomanometer. With new emerging technologies and decrease in the cost of the electronics devices and components, many new methods for blood pressure measurement have been proposed. In this project blood pressure is measured using Oscillometric method and a digital value for the same is display. Diabetes is most common health disorder now a day's which can be determined from the glucose concentration in the blood. In this project, the blood glucose concentration is measured using Amperometric method and the body temperature is measured using a temperature sensor and parameters are displayed.

***Keywords—* Wireless Sensor Networks, Pressure sensor, glucosmeter, temperature, LabVIEW.**

I. INTRODUCTION

Due to hectic lifestyle and changing food habits, the health of people is degrading. Disease like diabetes, blood pressure, cardiovascular diseases etc. are common names. To prevent and treat such diseases, it is necessary to warn people about serious condition, if any. Hence proper monitoring of health is required. There are many digital systems available in market to check blood glucose, blood pressure, temperature which do not require interference of doctors and can be used by individuals independently. Thus, individuals can keep check of their health and take necessary precaution. These systems are costly and no database is created in order to comment on any progress or degradation of health of an individual. The patient monitoring system designed in this project combines the three systems – measuring blood pressure, diabetes and temperature and also displays an appropriate message. The system transmits the measured parameters and maintains a database of all the parameters so that overall health status can be kept in check and fatal conditions can be avoided.

Patient Monitoring System means "Repeated or continuous observations or measurements of the patient, his or her physiological function, and the function of life support equipment, for the purpose of guiding management decisions, including when to make therapeutic interventions, and assessment of those interventions"[1]. A patient monitor may not only alert caregivers to potentially life-threatening events, many provide physiologic input data used to control directly connected life-support devices. When accurate and immediate decision-making is crucial for effective patient care, electronic monitors frequently are used to collect and display physiological data. We discuss the use of computers to assist caregivers in the collection, display, storage, and decision-making, including interpretation of clinical data, making therapeutic recommendations, alarming and alerting.

II. SYSTEM OVERVIEW

Fig. 1 the functional block diagram of the Patient Monitoring System used in this project. In Blood pressure measurement cuff gets inflated by pumping air in it up to 160 mmHg. The cuff is deflated by releasing the valve. Amperometric method is use for blood glucose measurement. Glucose test strip contain three electrodes. Electrons are produced during chemical reaction when glucose undergoes oxidation. Test strip output is current that must be converted to voltage using current to voltage converter. These signals are then amplified and send to ADC of microcontroller. Body temperature is measured by temperature sensor. By using wireless communication transmitting all data is transmitted to LabVIEW.

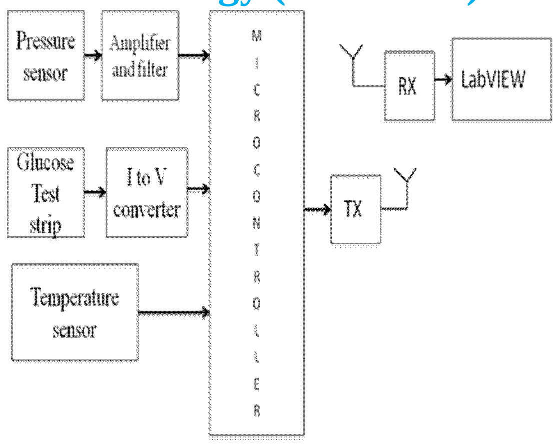

Fig. 1 Block diagram of entire system

III. DETAILS OF THE SYSTEM

All The hardware components used for designing the prototype described in this paper are:

A. DS18B20 Temperature Sensor

The DS18B20 [2] digital thermometer provides 9-bit to 12-bit Celsius temperature measurements. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. The accuracy of the measurements is high because the sensor does not depend on the accuracy of the microcontroller to measure the analog signal.

B. MP3V5050 Pressure Sensor

MP3V5050 [3] is a simple pressure sensor. It is piezoresistive transducer is a state-of-the-art monolithic silicon pressure sensor designed for a wide range of applications. This patented, single element transducer combines advanced micromachining techniques, thin-film metallization, and bipolar processing to provide an accurate, high level analog output signal that is proportional to the applied pressure.

C. Cuff

An essential part of measuring a blood pressure is the compression of the artery so that no blood flows through. The operator then listens to the sounds of the blood being pushed through as the compression is gradually reduced. An inflatable bladder encased in a cloth sleeve, which is wrapped around the upper arm, accomplishes the compression. This part is called the cuff. The size of the cuff and bladder used influences the accuracy of the blood pressure readings. If the cuff is too narrow, the observed blood pressure will be too high, and if it is too wide, the reading may be too low.

D. Arduino UNO R3

The Arduino Uno [4] is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. 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.

E. nRF24L01 2.4GHz Radio/Wirless Transceivers

Figures nRF24L01 2.4 GHz radio/wireless transceiver [5] allows two or more Arduino to communicate with each other wirelessly over a distance. These are a series of 2.4 GHz Radio modules that are all based on the Nordic Semiconductor nRF24L01+ chip. The low-power short-range (200 feet or so) Transceiver is available on a board with Arduino interface and built-in Antenna.

The software’s used for designing the system described in this paper are:

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A. Arduino IDE

The Arduino integrated development environment (IDE) [6] is a cross-platform application written in Java, and derives from the IDE for the Processing programming language and the Wiring projects. The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. A program or code written for Arduino is called a "sketch". Arduino programs are written in C or C++. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier.

B. LabVIEW

LabVIEW [7] is licensed software. LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a highly productive graphical programming language for building data acquisition and instrumentation systems. It is a graphical programming language that uses icons to create applications instead of lines of text to create applications. LabVIEW programs are called virtual instruments, or VIs, because their appearance and operation imitate physical instruments, such as oscilloscopes and multimeters. Although there are many different software's in market for building virtual instruments such as LabWindows/CVI (C for Virtual Instrumentation), HP VEE (Hewlett-Packard's Visual Engineering Environment), TestPoint and Measurement Studio, LabVIEW has superseded all of these due to its unique features.

IV. DESIGNED SYSTEM AND RESULTS

Fig. 2 (a) shows the implementation of Blood pressure meter. Fig. 2(b) shows the implementation of Blood glucose meter. Fig. 2(c) shows the implementation of temperature sensor The GUI is designed in LabVIEW.

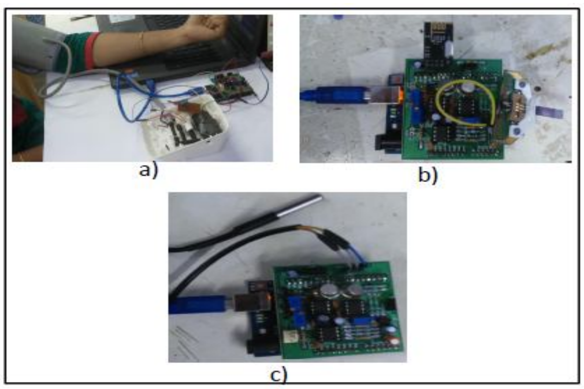

Fig. 2 (a) Setup of Blood Pressure (b)Setup of Glucose meter (c) Setup of Temperature sensor with nRF2L01 2.4Hz

Fig. 3 shows the front panel of the Patient monitoring system. After pressing the tab monitoring system, a signal is transmitted to start measuring system using nRF2L01 transmitter. At receiver side Arduino start to execute the medical parameters and it again transmit to monitoring side. It show remark in 'Remark' box and show picture for remedial action.

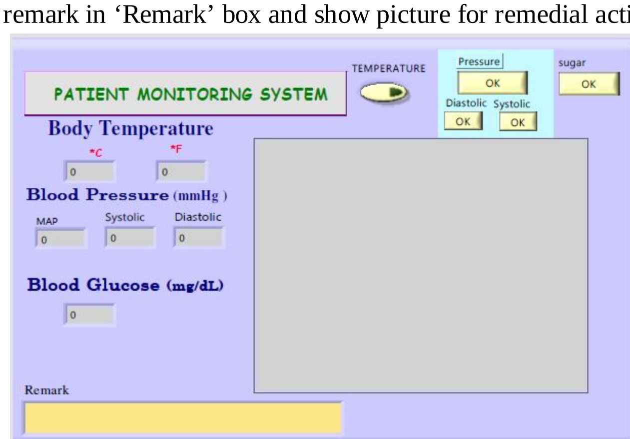

Fig. 3 Front Panel of Patient monitoring system.

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A. Blood Pressure Measurement

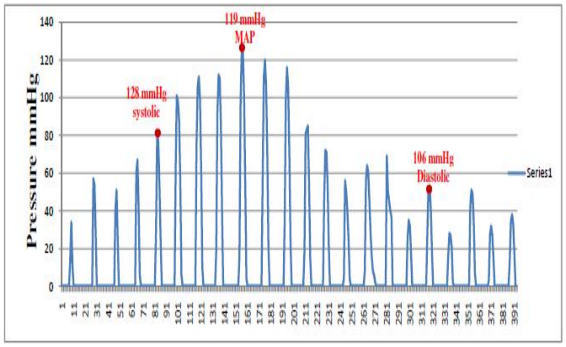

Fig. 4 Blood Pressure oscillation

Fig 4 shows blood pressure oscillation. From oscillation we can find peak. That peak is nothing but MAP (Mean arterial pressure). Systolic pressure is 70% and Diastolic pressure is 50% of MAP.

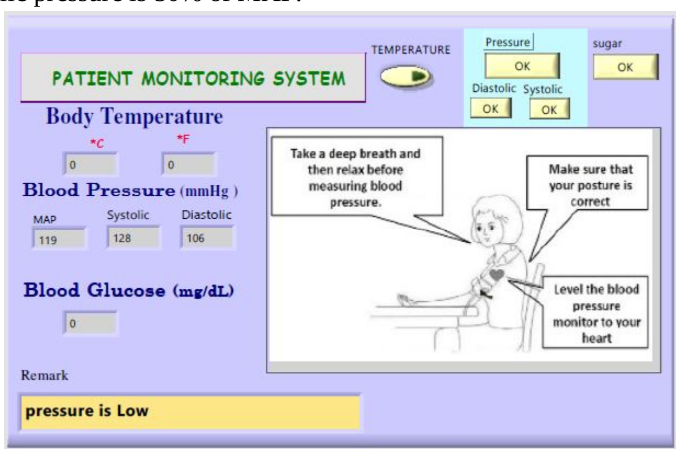

Fig. 5 Blood Pressure LabVIEW front panel

B. Blood Glucose Measurement

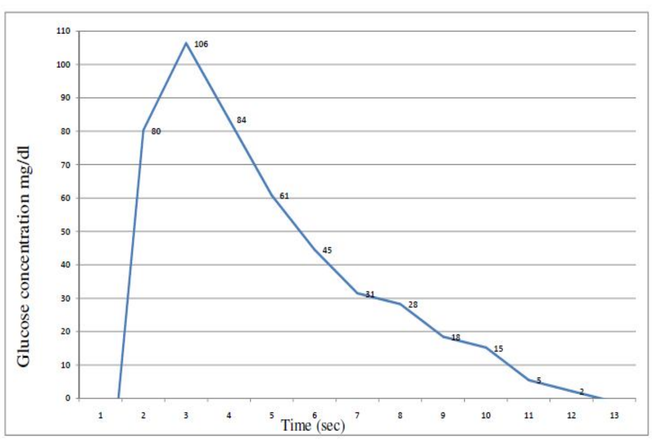

Fig. 6 Glucose concentration step by step

Blood glucose concentration represented by voltage converted from sensors current by transimpedance amplifier is sampled by internal 10-bit ADC. Blood glucose concentration is computed from sensor voltage measured after exactly two seconds from the beginning of measurement. This voltage is used to calculate blood glucose concentration in the mg/dL units. When sample is applied to the test strip the voltage jump to a peak value and then begins to decay linearly between 1 and 5 seconds. The voltage reading is taken for peak valu**e.**

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Table 1. Blood glucose meter reading

	One-Touch meter mg/dL	Glucose metere mg/dL
Kanchan	107	106
Rasika	76	72.3
Rupali	87	87.6
Jatin Sir	108	118

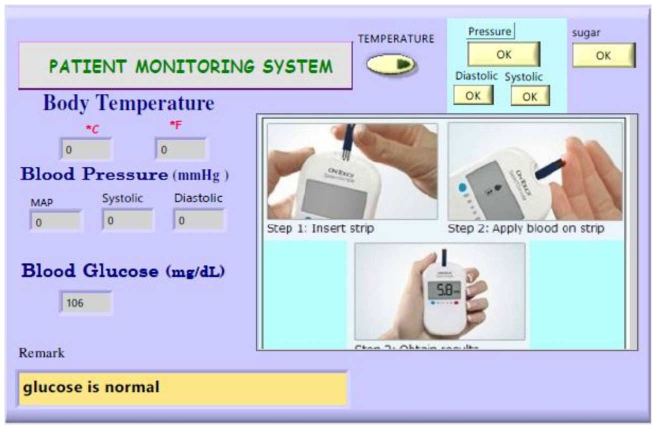

Fig. 7 Blood Glucose LabVIEW front panel

C. Body Temperature Measurement

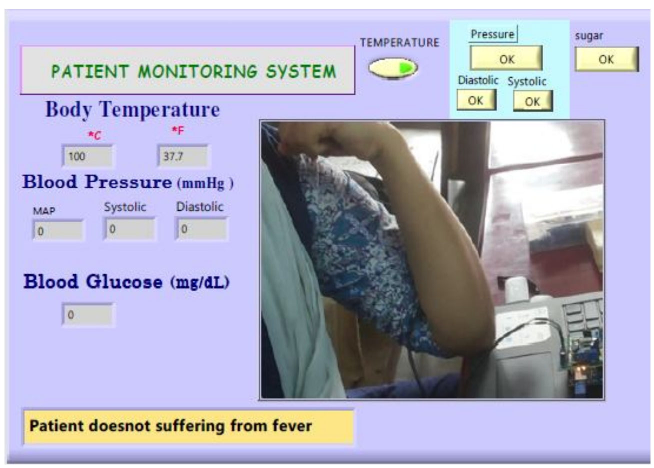

Fig. 8 Body temperature LabVIEW front panel

Fig. 8 shows Body temperature LabVIEW front panel. For Body temperature measurement DS18B20.DS18B20 is one wire sensor

V. CONCLUSIONS AND FUTURE DEVELOPMENTS

There are many manufacturing industries making diagnosis devices for Blood Pressure, Glucose meter & Temperature measurement, but in this work single diagnosis equipment is implemented which can measure and display Blood pressure, Glucose concentration and Body temperature. It was found that the readings for blood pressure and glucose level measurement showed 10-20% variation as compared to the devices available in market while the temperature measurement was found to be accurate with the digital thermometers available in market. This system is well suited for hospitalized people and for those people who require day to day health analysis at home. The system is cost effective, precise and fast.

By using various sensors, this system can be modified to monitor parameters like ECG, heart rate, pulse rate, heart rate, SPO_2, etc. and transmit and store them simultaneously. GSM modem can be interfaced to this system and SMS can be sent to the respective doctor in case of any emergency. This can also be interfaced with Wi-Fi and the reports can be sent to the doctor for daily analysis and treatment. Telemedicine system can be integrated with this system for treatment of patients. Introducing telemetry to this system will be a boon to people living in remote places. Various methods to measure Blood pressure, glucose level and temperature may be used to modify the system.

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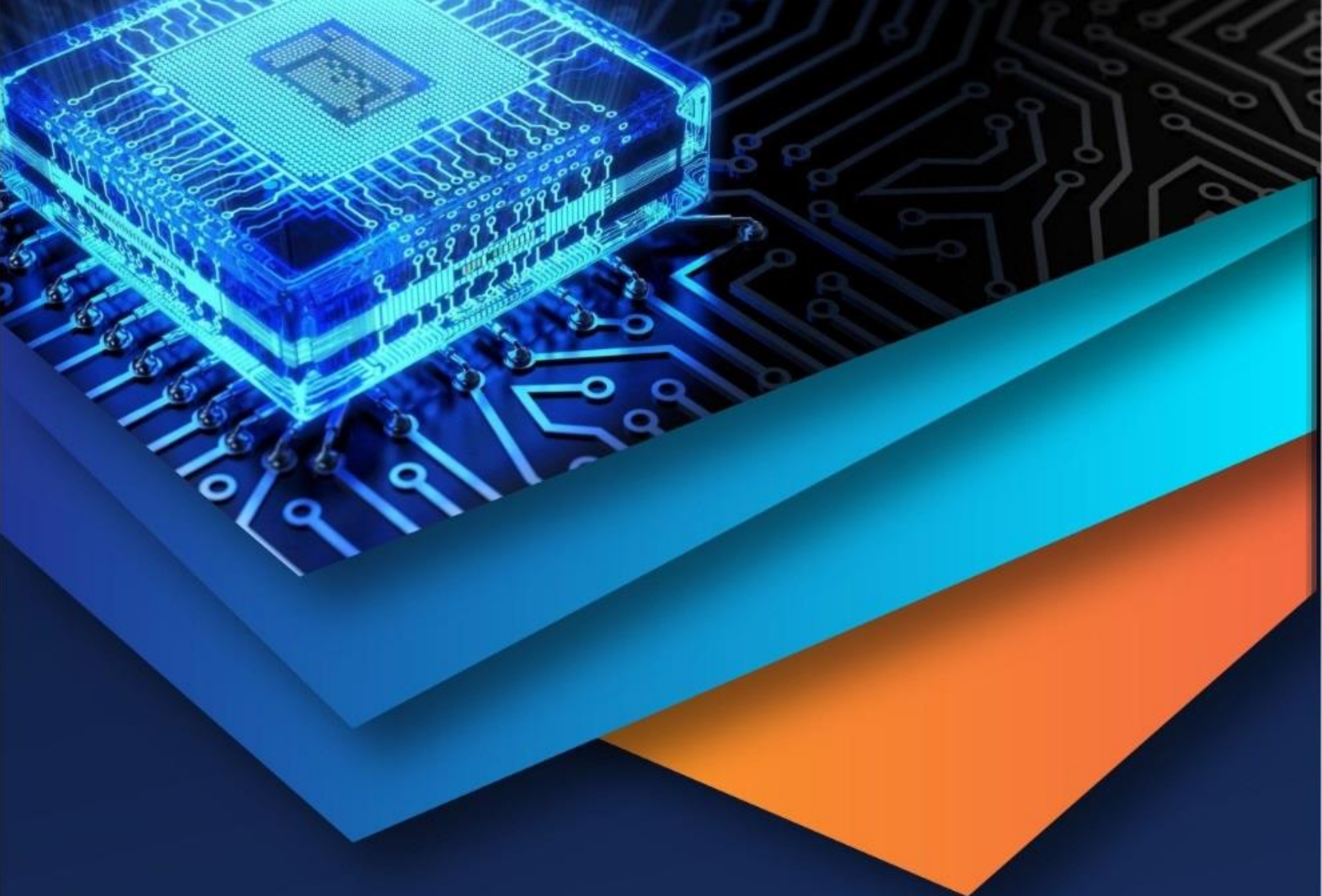

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