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# Design and Development of Virtual Instrumentation System for Measurement of Human Body Parameters

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***Abstract*— This project indicates the method of monitoring human body parameters like temperature, heartbeat rate, SPO2 (pulse oximeter), CO2, ECG, EEG using embedded web server and Lab VIEW technology in one system. The hardware is developed on Lab VIEW, wireless system and as well as different sensors. Lab VIEW is used in software part to provide GUI based environment to user and wireless is used to generate embedded web server. It can be applied on internet through website or network system so patient's condition and biomedical parameters can be monitored worldwide. It is Low cost and low power System in term of hardware as well as software.**

***Keys Words: Lab VIEW, MyRIO, Temperature Sensor, Heart rate Sensor , ECG.***

## I. INTRODUCTION

Human body monitoring system is the basic system in hospital for continuous observing patient's health care condition. This basic human body monitoring system includes biomedical parameters like temperature, pulse rate/ heartbeat, and ECG. Monitoring of these implemented system by low cost hardware component as well as GUI platform on computer by Lab VIEW [1]. The portable embedded device that can monitor the condition of patients in real time using six biomedical sensor network and provide various physiological signals via wireless communication. The data are delivered to medical personnel in real time so appropriate actions can be taken if necessary. A Temperature, ECG, pulse rate/heartbeat, sensors are integrated into the system. The communication modules that implements through wireless which facilitates stable and timely responses to external events and the appropriate sharing of resources. This embedded human body monitoring system may also be included on internet website based transmission support by using Lab VIEW and wireless as base. This system support internet web transmission of patient's body parameters as well as GUI based platform in local hospital computers by Lab VIEW interface with different biomedical sensors and hardware part. During the recent decade, rapid advancement in healthcare services and low cost wireless communication has greatly assisted in copying with the problem of medical facilities. Many governments and health provides are now concerning about the healthcare management, as the world population increases at rapid rate. This is provoked as urgent for a cheaper and smarter way to provide healthcare for patients. Various vital health parameters like Temperature, ECG, pulse rate/Heart beat and can now be measured on a single system and data can be transferred to caretaker/doctor, eliminating the need of their actual presence[2]. This lead to medical practice demand quick examination of an increasing array of vital signs both real time and treading to better understand a patient's condition improvement. Biomedical patient monitors are electronics medical devices responsible for continuously watch all these vital sign from patients in special care unit[3]. The data is provided to medical staff with tools to evaluate the physical condition of the patients and take appropriate decisions in their treatments. Biomedical monitoring systems also generate a visual digital alarm signal to alert clinicians about changes in a patient's condition that may require immediate attention. If a system is designed which can measure and transmit these body parameters through wireless could save many of patients. This could also help to reduce the trouble taken by many patients and doctors to travel vast distances. Moreover, patients can achieve comfort and thus save time and money and hospital rush can also be reduced.

## II. OBJECTIVE

To design and develop a system that is used to test biomedical parameters through wireless using a Lab VIEW. The system comprising body sensors that communicates wirelessly with the patients control device for external communication. The project focuses especially on wireless communication and multi sensor

## III. PROBLEM WITH EXISTING SYSTEM

There are some existing systems which are used only to measure one or two biomedical parameters at a time. There is no system used to measure more than two parameters at a time in a single system. Moreover all the system used now is wired systems which makes difficult for a system to be portable and connect to the Web-page on Internet. The controllers used in the existing systems are microcontrollers and others

## IV PROBLEM DEFINITION

The development of wireless healthcare application offers many challenges such as reliable data transmission, timely delivery of data, power management. Further new technology

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in healthcare application without considering security often makes patient privacy vulnerable. The coverage networks changes with time and locations. Sometimes, the coverage of wireless network is not available or coverage is available but we cannot access to the network due to lack of available bandwidth. So emergency signals may not be transmitted from patients to healthcare providers.

## V DIFFERENT TECHNOLOGIES OF WIRELESS COMMUNICATIONS

### 1. USING WAP TECHNOLOGY

A project which incorporates sensors to measure parameters like body temperature, ECG, pulse sensor and transfer it to the computer so that the patient's health condition can be analyzed by doctors in any part of the hospital. Thus, it reduces the doctor's workload and also gives accurate results.

Further this system uses WAP technology which enables the viewing of all parameters on the mobile phone. A micro-controller board is used for analyzing the inputs from the patient and any abnormality felt by the patient causes the monitoring system to give an alarm. Also all the process parameters within an interval selectable by the user are recorded online. This is very useful for future analysis and review of patient's health condition. For more versatile medical applications, this project can be improvised, by incorporating blood pressure monitoring systems, dental sensors and annunciation systems, thereby making it useful in hospitals as a very efficient and dedicated patient care system.

### 2. USING RF TECHNOLOGY

The project is designed and developed for monitoring patients remotely using a wireless communication system. The main aim of this project is to monitor the body temperature of the patient and display the same to the doctor through RF technology. In hospitals, patients' body temperature must need to be monitored constantly, which is usually done by doctors or other paramedical staff. They observe the body temperature of patients constantly and maintain a record of it.

The components used in this project include an 8051 microcontroller, a power supply unit, a temperature sensor, an RF transmitter, a receiver module and a LCD display. The microcontroller is used as a central processing unit for monitoring the body temperature of the patients. The working of this project is explained with the help of a block diagram, which consists of a power supply block that supply power to the entire circuit, and a temperature sensor that calculate a patient's body temperature.

### 3. USING GSM AND ZIGBEE TECHNOLOGY

The aim of this project is to send messages during emergency situations especially when a patient is alone at home or while the patient is travelling. If a person met with an accident or sudden heart stroke, then an alerting message is send to the mobile with the help of a GSM modem. This remote monitoring system allows the doctors to monitor the health status of the patients whenever a change occurs in patient's health condition. It is impossible for doctors and other hospital staff to work on single patient. In this system we are making use of a Zigbee communication module for helping out the doctors to take care of multiple patients' health status by monitoring them remotely. In this system, we are using a microcontroller, a Zigbee module, a temperature sensor and a heartbeat sensor the temperature sensor continuously monitors the patient body temperature, and the heartbeat sensor monitors the heartbeat rate of the patient. A GSM module interfaced with the microcontroller continuously sends the body temperature of the patient to a doctor who has a Zigbee enabled with a microcontroller.

### 4. WEB PUBLISHING USING LABVIEW

This project indicates the method of monitoring human body parameters like temperature, heart beat rate, ECG using embedded web server and Lab VIEW technology. The hardware is developed on Lab VIEW and wireless as well as different sensors. Lab VIEW is used in software part to provide GUI based environment to user and wireless is used to generate embedded web server. It can be applied in internet through website or network system so patient's condition and biomedical parameters can be monitored worldwide. It is Low cost and low power system in term of hardware as well as software.

## VI. ARCHITECTURE OF MEASUREMENT OF HUMAN BODY PARAMETERS

The block diagram of Virtual Instrumentation System for Measurement of Human Body Parameters is shown in figure 1. All the sensors are connected to the MyRIO embedded system. If the signals from the Sensors are not amplified then an Amplifier circuit is placed in between the Sensor and MyRIO embedded System. These signals are interfaced by PC using Lab VIEW.

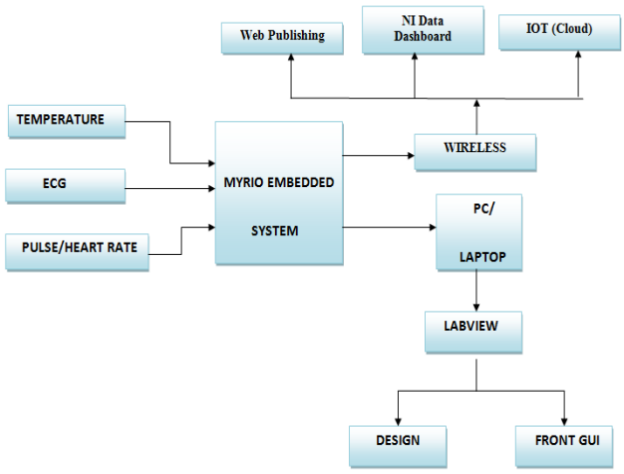


FIG 1: BLOCK DIAGRAM OF MEASUREMENTS OF HUMAN BODY PARAMETERS

## VII WORKING PRINCIPLE

This project contains different types of sensor such as temperature sensor, ECG, sensor and Pulse/Heart Rate sensor. ECG Monitor Sensor Module is based on AD8232 Analog Device IC. This is a cost-effective ECG Sensor used to measure the electrical activity of the heart. This electrical activity can be charted as an ECG or Electrocardiogram and

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output as an analog reading. ECGs can be extremely noisy, out AD8232 Single Lead Heart Rate Monitor acts as an op amp to help obtain a clear signal. Heartbeat sensor to measure the Heart Rate or pulse rate of a person. Heart Beat sensor measures the heart rate through the fingertip. This Heart Beat Sensor provides an easy way to integrate heart rate measurement into your project. When the heart beats it pumps blood into your artery of your finger tip. This causes a change in the blood volume which is then sensed by our Heartbeat sensor. This is a pre-wired and waterproofed version of the DS18B20 sensor. Handy for when you need to measure something far away, or in wet conditions. While the sensor is good up to 125°C the cable is jacketed in PVC so we suggest keeping it under 100°C. Because they are digital, you don't get any signal degradation even over long distances! These 1-wire digital temperature sensors are fairly precise (±0.5°C over much of the range) and can give up to 12 bits of precision from the onboard digital-to-analog converter duct was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment. This product is intended for use in commercial locations. There is no guarantee that harmful interference will not occur in a particular installation or when the product is connected to a test object. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

## VIII DESIGN AND IMPLEMENTATION

The LabVIEW has been used to acquire the ECG, Pulse and Temperature data obtained from physionet and display the raw signals. After the data acquisition, the waveform data are sent to Express Virtual Instruments for signal processing. This part of the process consists of digital filtering digital smoothing, wavelet de trend, and wavelet de noise. The wavelet de-trend and wavelet de-noise is a part of the Advanced Signal Processing Toolbox, which is very useful for signal processing. Signal processing removes the noise artifact. i.e., power interference, white noise from the signal. The signal is then passed to ECG feature extractor which gives parameter of ECG waveform. Virtual Instrument (VI) provides the period from peak and valley and thus the heart rate based on peak and valley is obtained. After heart rate calculation is done, this signal is passed to disease detection module which compares the ECG parameters with the normal parameter according to some rule specified and indicate the disease in front panel of virtual instrument. The processed signal is simultaneously being displayed in front panel to show the result of each step performed in virtual instrument designed After that, the program loops to the first stage and start to collect the next data and repeats the above process up to the length of prediction period. It performs the whole process until the end of data or process stopped by the user to view the result.

The Rigged up Circuit of the system is shown in figure 2. All the sensors are connected to human body which is then connected to MyRIO hardware which acquires the data from sensors. This MyRIO will be connected to PC or Laptop which consists of LabVIEW software tool in it.

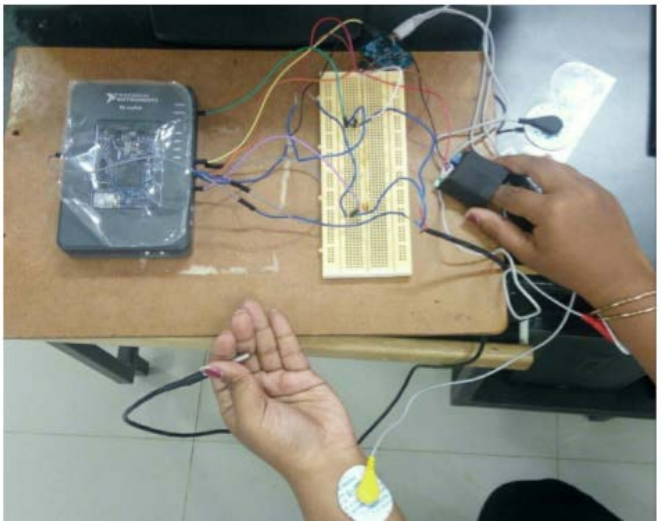

Figure 2 HARDWARE DESIGN

## XI FLOWCHART OF THE SYSTEM

- System starts to work when the power is supplied with necessary input.
- Initially the data is acquired from the sensors through MyRIO.
- If the acquired data or signal is in mv then an Amplification circuit is required.
- If No then it can proceed to next block.
- Then the acquired data is analyzed and calculates it.
- After calculation the desired output is displayed in front panel.
- As this system is designed for continuous observation of human body parameters this loop keeps on repeating.

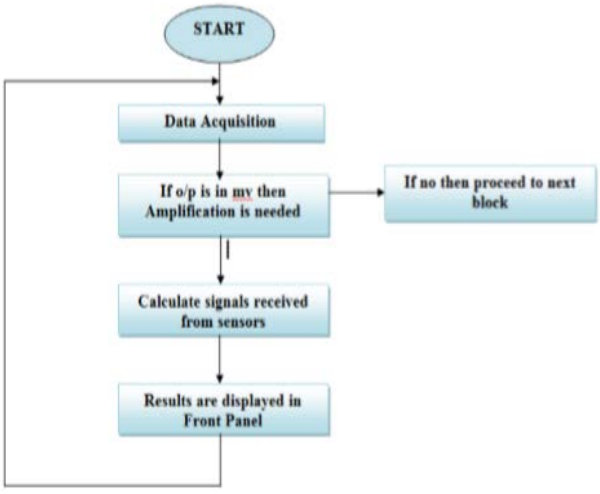


Figure 3 Flow Chart of the system

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## X RESULTS AND DISCUSSION

### 1. PULSE SENSOR OUTPUT

This is the output obtained using pulse sensor. In Block Diagram Panel the program for the pulse sensor is written and on Front Panel the output of that sensor is displayed. The below figure 4 shows the results of Pulse Output got from the sensor.

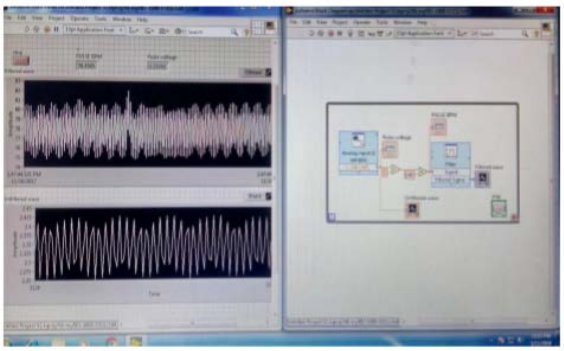

Figure 4 Pulse sensor Output

### 2. TEMPERATURE SENSOR OUTPUT

This is the output obtained using temperature sensor. In Block Diagram Panel the program for the temperature sensor is written and on Front Panel the output of that sensor is displayed. The below figure 5 shows the results shows temperature output got from the sensor.

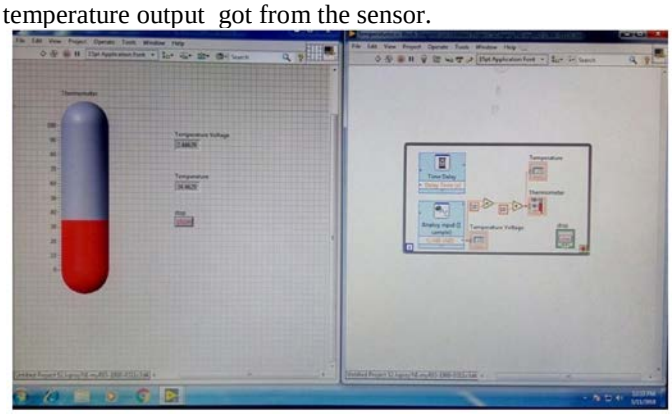

Figure 5 Temperature sensor Output

### 3. ECG SENSOR OUTPUT

This is the output obtained using ECG sensor. In Block Diagram Panel the program for the ECG sensor is written and on Front Panel the output of that sensor is displayed. The below figure 6 shows the result shows the output of ECG got from the sensor.

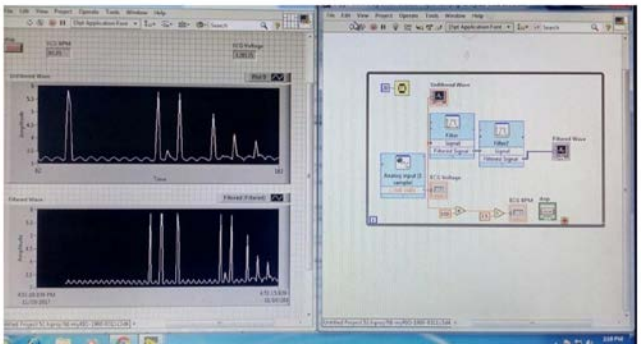

Figure 6 ECG sensor Output

## X CONCLUSION

These are many applications related to patient's monitoring system with many available sensors including temperature, oxygen saturation level, heart-beat and more. This system provides continues monitoring of patient as well as it provide GUI based environment to Users. The system designed efficiently and met all expectations as set earlier. In future more biomedical sensors can interface with this system. A Lab VIEW based system has been designed which acquires data and processes it. It helps in finding the heart rate variability, Temperature and consequent type of disease. The algorithm designed is able to acquire the data from measured file the signal, processes the data, displays waveform, displays heart rate and its abnormalities. This is indicated by blinking LEDs in Front Diagram of Lab VIEW. This virtual instrument can be very effective for an early detection of critical disease and thus can save a patient from suffering.

## XI FUTURE WORK

Lab VIEW is a new generation of highly localized wireless networks that are expected to support a wide variety of medical applications, from monitoring the functioning of implants, to tracking the health of senior citizens and bed ridden patients, to perform state-of the-art endoscopic exams. But if this emerging technological area is to mature into a thriving industry, it will need better definition of its scope and potential, and a clearer vision of its future. Owing to the increasing interest in the integration of medical technology and information and communications technology, research on Lab VIEW, which apply a sensor network to the human body, is being actively conducted. Existing sensor network technology has potential to be used in a wireless; however it has some limitations.

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