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Low Power, Portable Solar based ECG System

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Abstract:- This document gives design and development of device for rural healthcare known as Low powered portable Solar ECG System. This ECG system provides us heart rate, P wave, QRS complex and ST interval, PR interval analysis to determine the AV block using single lead ECG (lead I). Using solar panel and battery, we capture ECG signal and this signal are sent to the physician or health care centers with no time through STMP API and doctor can view remotely and dynamically his/her patient's vital parameter in the HTML format in android phone or PC and for this, there is no need of any special requirement on his PC; all he/she required to access is internet.

Keywords:- Electrocardiogram, Cost efficient, portable one-lead ECG device, solar panel, energy efficient.

I. INTRODUCTION

In today's life, Cardiovascular disease is one of the prominent reason of death worldwide this involves heart, blood vessels such as arteries, veins and capillaries. Electrocardiogram (ECG) it is one of the diagnostic technique which is used for the earlier diagnosis of heart to prevent from heart attack. Electrical signal from cardiac muscle is recorded by ECG device to predict the irregularity present in the heart. Existing ECG devices are set only in big hospitals and healthcare centers. The patients suffering from heart disease must wait for the ambulance to come and then he must get diagnosis. the significant signal complementary with the heart attack may be weakening, while waiting for the ambulance and thus making the doctors loss traces of the origins of the heart attack.

Electricity is one of the key factors which initiative the healthcare economy. Due to lack of electricity most of these areas thus have no access to good health care facilities. Therefore, it is very important to develop portable and solar based ECG devices with least reliance on line voltage. The portable device will make it possible to place the devices in health centre or even in one's patient home which works by solar panel and battery to obtain ECG signal and transmit ECG waveform over large distance safely. The analysis will also be considerable easier and cheaper with portable ECG portable solar based ECG device. Furthermore, it is possible to acquire 12lead ECG using single lead. The formatter will need to create these components, incorporating the applicable criteria that follow ECG.

II. SYSTEM DESCRIPTION

Our aim is to design a low power portable electrocardiograph which is power-driven by solar cells, so far to acquire and transmit ECG waveform over large distance safely.

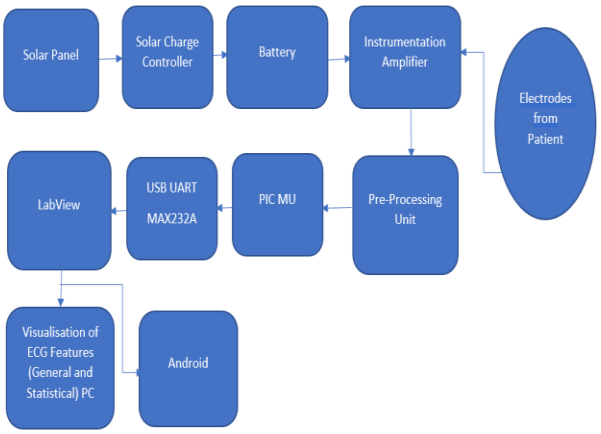

Fig. 1:- Block Diagram

A. PIC Microcontroller

The PIC18F2550 PIC12F675 from Microchip has all the features that are like microcontrollers usually have. It is used in our design for its wide range of application such as: measurement of dissimilar values, the controller of different processes in manufacturing engine control devices, etc... and for its low price, informal availability and high quality. This microcontroller consists of three types of memory- ROM, RAM and EEPROM, two parts: general-purpose registers and special-function registers (SFR). When power goes off both the registers are cleared through both groups of registers are cleared when power goes off and even through they are manufactured, and they act in the similar way and functions in the same manner.

B. Operational Amplifier(TL071)

The operational amplifiers TL07xx JFET-input integrate well-matched with, high-voltage JFET and monolithic integrated circuit as a bipolar transistor. low offset-voltage temperature coefficient, offset currents, low-input bias and high slew rates are the features of this device. The low noise and low harmonic distortion make the TL07x series preferably matched for audio pre-amplifier applications and high-fidelity.

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C. Power Supply

1) Solar Panel: A solar cell can be used as a complex of large photovoltaic system to generate and supply electricity in marketable and suburban applications It is a set of photovoltaic modules electrically connected and mounted on a supporting structure. The electricity from solar panel are obtained using light energy (photons) from the sun through the A single solar module can produce limited amount of so most installation contain multiple modules. photovoltaic effect since they can produce limited amount of power multiple modules are used during installations. Thin film cells based on silicon or cadmium telluride and wafer based crystalline silicon are used in most of the modules, these cells must be endangered from mechanical damage and moisture.

2) Battery: The required voltage required to the connected equipment are supplied by the battery and we make use of 12V battery in our design.

D. USB -UART Converter (TTL level)

There are a variety of USB to serial converter cables available. Serial USB-UART cable interfaces and connectivity between USB are provided by USB TTL serial cables. Usually cables offer 5V, 3.3V connectivity or user specified signal levels with various connector interfaces.

E. Instrumentation Amplifier (INA128)

The INA128 and INA129 is a 3-op amp design low-power, general purpose instrumentation amplifiers offering excellent accuracy. It is ideal and used in wide range of applications because of its small size. At high gain of (200 kHz at G = 100) input current feedback circuitry delivers wide bandwidth.

F. Pre-processing unit (High pass filter)

The electrode offset rejection is achieved by connecting RC network between output of an instrumentation amplifier, HP sense and HP drive. This RC network is placed at the output of an Instrumentation amplifier and we obtain electrode offset rejection and RC network formulae an Integrator and maintains high signal gain and without saturating any node eliminates the offset and feeds any in the Instrumentation Amplifier DC signal are feedback by RC network and. To minimize baseline wander it also act as a high pass filter.

G. Software

1) MP Lab: For debugging, hardware emulation and for application development a 32-bit application on Microsoft Windows with several free software components are used. In MPLAB IDE v8 uses both C programming languages and Assembly language and for hardware development tools, third-party software, unified graphical user interface for additional Microchip it serves as a single.

2) Embedded C: To discourse commonality problems that exist between C extensions for different embedded systems we use extension language of C Programming language by the C Standards committee. It defers from normal C by some features such as, fixed-point arithmetic, named address spaces, and basic I/O hardware addressing.

3) LabView and Real Term Software: Hardware integration are made simpler with LabView and from any I/O device we can quickly acquire the data and visualize data sets, whether by NI or a third-party. Combined with a graphical programming syntax that reduces programming time is system engineering software designed specifically for test, measurement, and control applications with rapid access to hardware I/O and data insights to turn ideas into innovations. Real term software is used to acquire and save raw ECG signal in .txt format.

H. Voltage Regulator

A voltage regulator may include negative feedback and may use a simple feed-forward design and that provides a stable dc voltage independent of the load current, temperature and ac line voltage variations. The design of voltage regulator uses an electronic components or electromechanical mechanism. may be used to regulate one or more AC or DC voltages.

III. SETUP AND PROCEDURE

In our design the device utilizes energy from of solar panel which eliminates the requirement of electricity. Using USB UART cable and LabVIEW Biomedical Toolkit software the acquired ECG data is analyzed and transmitted to Doctor's to keep the track of patients in the HTML format from any remote area for further consultation. In our project the acquired ECG signal can be stored in the format of HTML file and can be sent to any remote area for further consultations from doctors. Acquired data are sent through LabVIEW SMTP email or through web services to doctors and doctors can have access to the ECG data from his place with the help of internet and changes in parameters normal value are immediately notified by a warning message from SMTP API.

IV. CONCLUSIONS

In this paper the measurement of the vital signs such as Heart Beat Rate and statistical analysis such as QRS width, PT interval, ST Intervals and AV Block analysis is done. This paper also proposes a model for low power portable solar based healthcare system. Since this device is small and portable and does not depend on electricity makes easier to obtain ECG data and transmit to Physician at any distance.

This system is low cost and compactable as they use solar power. When medical facility is not accessible properly and does not require electrical power and hence it can be worked during the power failure for daily health checkup in rural areas this ECG devices is used. By using LabView we transfer the data to the nearby mobile/Pc to keep the database of the measurement to monitor our regular health condition and database can be used to show the report and to consult the doctor during any abnormalities.

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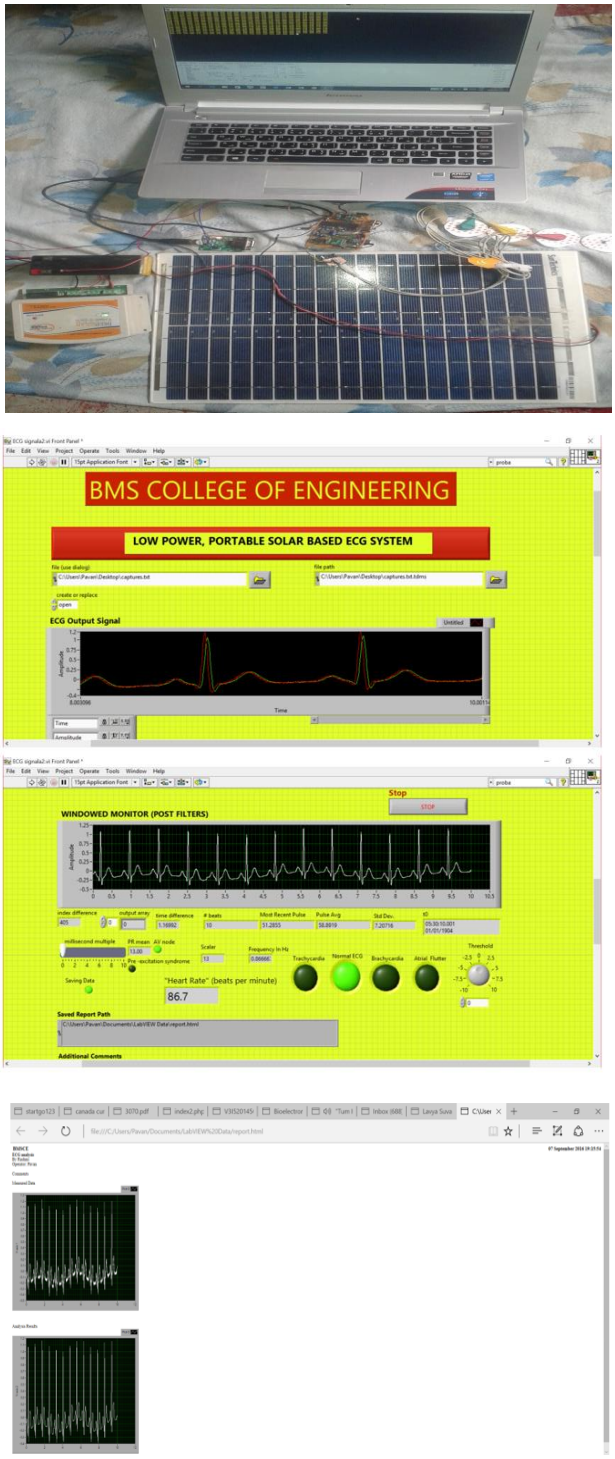

Fig. 2:- Hardware setup and Results

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