A Low Cost Automated Fluid Control and ECG Monitoring System for Medical Application using Smart Device

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Abstract- The implementation of an automated liquid monitoring and controlling method using an IR sensor and ECG waveform can be monitored through wifi module. The IR sensor will be latch onto the drip chamber of the saline container to know the saline flow rate as well as an exact number of drops of the saline flow rate will be displayed through LCD. The IR sensor continuously sense the flow rate and if any mismatch is found, microcontroller commands the servomotor to change the circulation rate with the buzzer alert .The main cause of the heart attack is a lack of medical care at the right time. To avoid this, there is a need of regular checkup of health. In some cases it might be required to monitor ECG frequently. With the use of this portable device patient can monitor their ECG anytime, anywhere and send the report of ECG to the doctor and can efficiently communicate with the doctor. In case of any abnormality, Gmail indication will be provided to doctor and doctor may alert the patient situation. This paper presents the development of low cost, low power, portable and time saving ECG monitoring device.

Index terms: ECG sensor, servomotor, IR sensor, Think viewer Tool.

I.INTRODUCTION:

As continuously increasing population rapidly, health care is essential for survival.Rapid technology improvement in medical field using different sensors and the microcontroller withheld for analysing and controlling the causes of many diseases. Several researches and reinforcement for saline flow rate can be
Monitored and controlled [1]-[3].The flow rate can be detected using IR sensor, it operates up to 4.5-6 volts, it is very sensitive and having larger wavelength than visible light. Wave length range from 0.75 μm to1000μm is called infrared region, the wavelength from 0.75μm-0.3μm called near infrared region, region from 3μm-6μm called as mid infrared region and greater than 6μm is called as far infrared region.The infrared region is invisible to human eyes. The flow rate can be viewed through LCD display.

Cardiovascular disease that indicate the disease in heart /blood vessels.Most of the poverty and low income peoples are die due to heart diseases because of high price.To overcome this we are proposing a low cost and portable ECG monitoring system using wifi module to smart device.

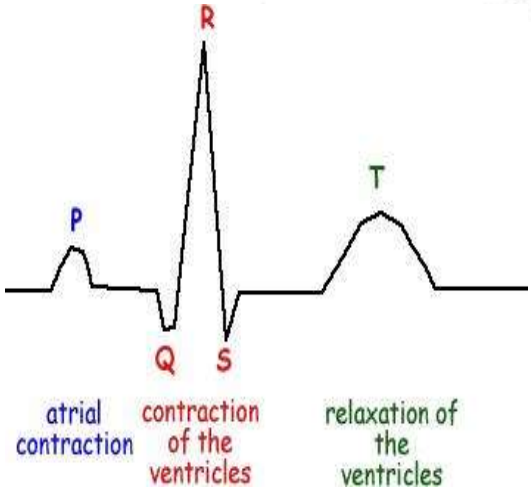

Fig.1 ECG Waveform

Willem Einthoven who invented the ECG machine in the year of 1901.The Electrocardiogram is a test which measures the electrical movement of the heart.It records the heart rhythms and diagnose the poor blood flow and heart diseases.The waveforms is classified as P,Q,R,S and T.Since P wave denotes the atria is contracting and pumping blood to ventricles QRS waveform indicates ventricular depolarisation and contraction.

II.RELATED WORK:

After the reference of several papers based on the saline monitoring system,which uses a complex systems which increases the price of manufacturing components[1]-[5]and this system will only monitor the saline rate but it will not control the flow rate.The main theme of our paper is to monitor and control the saline flow rate with a low cost portable device. And if any mismatch occurs it will be indicated through buzzer.

The census taken by the world health organisation(WHO) 80% of cardiovascular disease deaths takes place in middle &low income countries and more than 27% of the deaths caused in developing countries like Bangaladesh[6].The cardiovascular disease or heart disease for a patient can be detected only in a pathology centre. The cost of the equipment is tremendous, so poor peoples cannot offer more desirable services. Based on the home based cardiac care is proposed [7].They demonstrate an Electrocadiogram detector by the PDA as Personal Health Information management system.This is designed to be used in a home environment. In our project microcontroller has been used to command and monitor the fluid rate and ECG waveform.

III.PROPOSED SYSTEM:

The proposed paper describes the low cost portable fluid control and ECG monitoring system .The fluid rate can be monitored using an IR sensor .It is a high sensitivity device and which has a larger wavelength, in case any small disturbances occurred that can be analysed easily .The timer is used to set a certain time delay to monitor the flow rate per minute or the time we have assigned. Microcontroller will reset when the task is completed .The crystal oscillator is used to ensure the timer to stable, it produces clock signal to synchronize all internal operations.

Fig2 Servomotor

Servomotor is used to control the flow rate if any mismatch is occurred with the assigned value. It is used with specific angular positions to control the devices. It works on the principle of Pulse Width Modulation. The flow rate can be viewed through LCD display and in case any mismatch occurs the buzzer will be on.

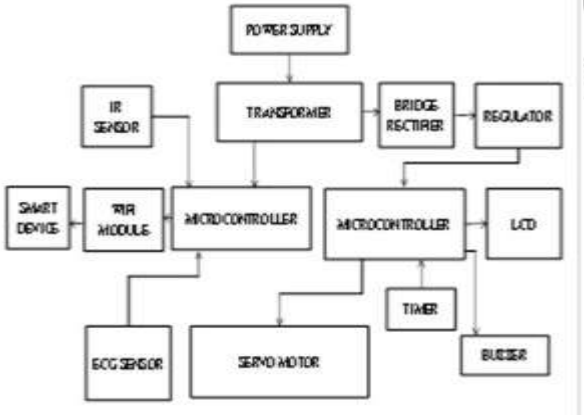

Fig.3Block diagram

And also the ECG waveform can be monitored using ECG sensor (AD8232).We are using a 3 lead system.The monitored signal can be given to wifi module(EPS) by using an Arduino IDE software.the signal will be stored in a cloud, from the cloud the data can be accessed by the server, by using an android application we can view the signal all over the world.In monitoring ,if any critical situation occurs the alert message will be send to the doctor in the way of Gmail indication.

IV. METHODOLOGY:

A.A low cost automated fluid control:

The system has been proposed fluid rate monitoring and controlling method. The 230 volts power supply will be converted into 12 volts using a step down transformer. The power supply required to operate the device is 5 volts,by using bridge rectifier the power supply will be reduced to 5volts.The saline rate will be assigned by the caretaker .the common drop factors are 10 drops/ml(blood set),15drops/ml(regularset),60drops/ml(microdro p).The IR sensor will be used to sense the flow rate continuously,if any mismatch has been occurred with the assigned flow rate .
Operating range of IR sensor:3V to 5V
Detection range: 2cm to 30cm 43mAOn board obstacle detection LED.

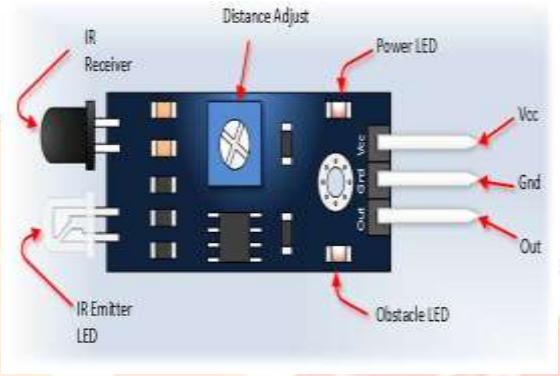

Fig 4.IR sensor

Servomotor will be used to control the fluid rate with the assigned value .If the flow rate has been increased with the assigned value,it will rotate in anticlockwise direction and if flow rate will be decreased with the assigned rate ,the servomotor will rotates in clockwise direction.

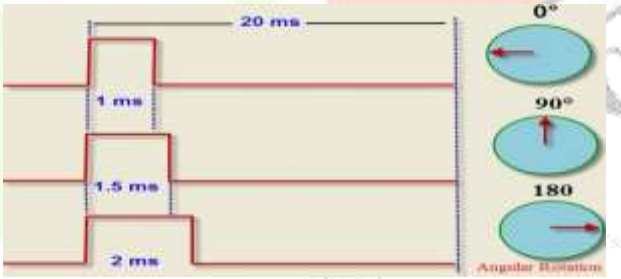

Fig 5.Servomotor angle rotation

Advantages of servo motor

- If an engine gets substantial load the driver will expand the flow to the engine curl as its endeavors to pivot the engine. For the most part, there is no out-of-step condition.
- High-speed task is conceivable by the servo engines.

Timer is used to assign the flow rate per minute and microcontroller will command the instructions.For the certain time rate the flowrate will be assigned to check the flow rate is normal or abnormal.

The microcontroller used in this system is ATMEGA328.It is a 8- bit microcontroller family of RISC architecture.This microcontroller consists of EEPROM of 1Kb.The maximum operating frequency is about 20 MHz.The flow rate will be displayed through LCD(16×2),by the command of microcontroller.incase any mismatch has been occurred in the flow rate it will be displayed in

LCD as the patient in the critical situation.The data in the ASCII values of the character can be viewed through LCD.

Buzzer will be indicated during the critical situation,that is when the flowrate is in increased or in decreased level.Since the buzzer will be operated in 12volts.Hence Relay is an electromagnetic switch that operates electric current it provides turn ON or OFF.

B. A low cost ECG monitoring system:

ECG estimation device is the most fundamental apparatuses for determination of the heart issues. This hardware at first originated from the Western nations at an exceedingly cost. So it is basic to make a minimal effort ECG flag generator circuit to get constant identification of heart maladies. The proposed framework utilizes three terminals which are set on various focuses on the patient's body on as fig.6. These terminals identify the minor electrical changes on the skin that emerge from the heart muscle's electrophysiologic example of depolarizing and repolarizing amid every pulse. It is a generally performed cardiology test.

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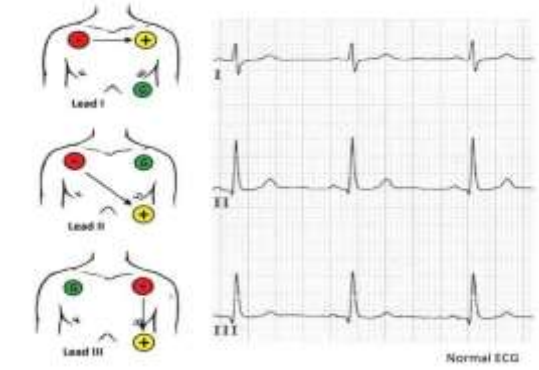

Fig.6. Three lead electrode placement

The ECG sensor (AD8232) is used to detect the ECG signal from the patient body continuously. The AD8232 is a slick little chip used to gauge the electrical movement of the heart. This electrical action can be diagrammed as an ECG or Electrocardiogram. Electrocardiography is utilized to help analyse different heart conditions.

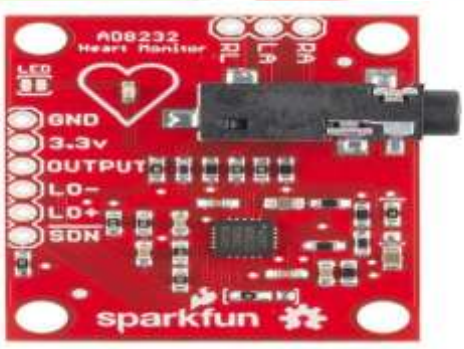

Fig.7.ECG Sensor

Board Label	Pin Function	Arduino Connection
GND	Ground	**GND**
3.3v	3.3v Power Supply	**3.3v**
OUTPUT	Output Signal	**A0**
LO-	Leads-off Detect -	**11**
LO+	Leads-off Detect +	**10**
SDN	Shutdown	**Not used**

Table1.Pin connections

ATMEGA (328) microcontroller has been used to command, to monitor ECG waveform through wifi module.The microcontroller has 20 pins. The sensed ECG signal is stored in the cloud using a wifi module.The C program will be used to store the data in the cloud.By using an arduino IDE software is used.fig.8

Fig.8Arduino IDE software

The ESP8266 is a minimal effort Wi-Fi microchip with full TCP/IP stack and microcontroller. This little module enables microcontrollers to interface with a Wi-Fi system and make straightforward TCP/IP associations utilizing Hayes-style order. Instruction cache RAM 32 KB.Instruction user data RAMS 80 KB. Instruction data RAM 32 KB.

Fig9. ECG Output waveform

The sensed ECG signal is send to the wifi module(ESP8266) and save in the cloud.The data from the cloud can be accessed by the open source software Think viewer. By giving the channel ID and user password the ECG waveform for a patient can be viewed. The critical situation of a patient can be indicated through gmail to the doctor since they cannot monitor at all times. They can monitor every day about the situation of a patient also date can be displayed at the output.

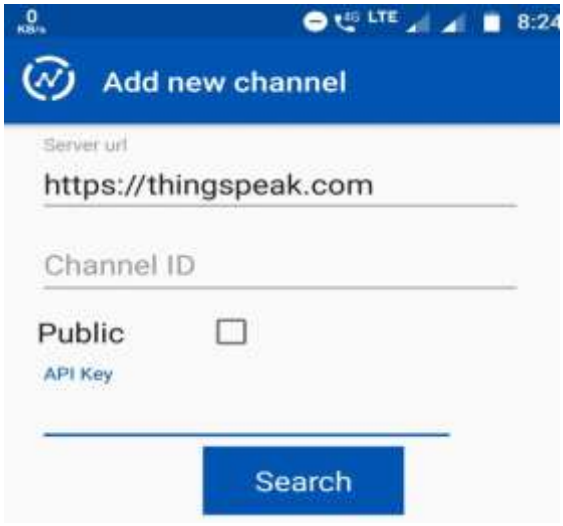

Fig 10.Think viewer Tool

The output waveform X axis represents the time period and by clicking on the waveform which represents the date, y axis represents the data of ECG signal by using an open source application Think Viewer using smart phone.

V.CONCLUSION:

This project work proposes the two essential orders of prescription and designing, the therapeutic office and treatment have accomplished a quick headway and advancement. The primary troublesome was to plan a gadget which reactions effectively and in addition quickly and plan of sensor to identify the liquid drop and controlling it by utilizing a servomotor. The IR sensor is utilized to detect the flow rate can be shown through LCD .This sensor is exceptionally touchy and could recognize any kinds of little disturbances. The ringer will be demonstrated incase critical circumstance. The framework configuration comprises of a convenient ECG flag generator circuit, an information has been put away in the cloud utilizing wifi module and a smart device. Present day advancements have built up that advances agreeable and better life which is disease free. This minimal effort restorative gadget may have potential use for quiet human services**.**

REFERENCES:

[1] C.C. Gavimath, Krishnamurthy Bhat, C.L. Chayalakshmi, R. S. Hooli and B.E.Ravishankera, "Design And Development Of Versatile Saline Flow Rate Measuring System And Gsm Based Remote Monitoring Device", International Journal of Pharmaceutical Applications, vol. 3, no. 1, pp. 277-281, 2012.

[2] Manoj Kumar Swain, Santosh Kumar Mallick, Rati Ranjan Sabat, "Smart Saline Level Indicatorcum Controller", International Journal of Application or Innovation in Engineering & Management (IJAIEM), vol. 4, no. 3, pp. 299-301, 2015.

[3] Mansi G. Chidgopkar, Aruna P. Phatale, "Automatic and Low Cost Saline Level Monitoring System Using Wireless Bluetooth Module And Cc2500 Transreceiver", International Journal of Research in Engineering and Technology, vol. 04, no. 09, pp. 274-276, 2015.

[4]I.S.Tawade,M.S.Pendse,H.P.Chaudhari "Design and Development Of Saline Flow Rate Monitoring System Using Flow Sensor, Microcontroller and Rf Zigbee Module", International Journal Of Engineering Research And General Science, vol. 3, no. 3, pp. 472-478, 2015.

[5] Priyadharshini.R , Mithuna.S , Vasanth Kumar.U, KalpanaDevi.S Dr. SuthanthiraVanitha.N,"Automatic Intravenous Fluid Level Indication System for Hospitals", International Journal for Research in Applied Science & Engineering Technology (IJRASET), vol. 3, no. 8, pp. 427432, 2017.

[6] World HealthRankings Live Longer Better,[Online].Available:http://www.worldlifeexpectancy.c omlbangla desh-coronary-heart-disease.

[7] *K. W. Goh, J. Lavanya, Y. Kim, E. K. Tan, and C. B. Soh, "A PDA based ECG beat detector for home cardiac care," 27th Annual Conference Shanghai, IEEE. Engg. in Medical And Biology, China, pp. 375-378, September 1-4, 2005.*