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PATIENT MONITORING AND DAILY HEALTH REPORTING BY GSM MODULE

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Abstract- *Heart disease has become one of the top three reasons of death for over twenty years. Most of the victims are elderly persons. This paper is presented with a motto to save both time and transportation cost of patient for their daily general treatment. We have designed a cheap reliable system which can precisely measure HR and detect abnormal Heart Rate and send relevant information to the doctor. Implementation of GSM technology in the medical field is also our prime concern. The Heart Rate is measured by IR and Photo Diode sensor circuit which works on the principle of light modulation of blood flow through finger at each pulse. The measured data from the sensor then send through GSM modem.Through GSM module, patients can be monitored continuously .It is also very economic as lots of transportation cost for general check up can be saved.*

Keywords: Heart Rate Measurement (HRM), Fingertip sensor, AT Command, GSM.

1. INTRODUCTION

Modern heath care expenses are increasing day by day. This heath care expenditure is threatening country's entire economy. To reconstruct heat care system early detection is important. For cardiovascular patientScreening ECGs[1] (either at rest or with exercise) are recommended. But ECG is one of the expensive and sophisticated devices to measure heart rate. ECG is expensive and for using in home by patient in not economical.

Low-cost devices wrist watches are also available for measurement of the heart rate [2].So our main motto is to design a cheap and economical HRMunit for continuous and long term monitoring [3][4].Heart Rate (HR) is the primary parameter of any health report. The device is constituted of three main parts: External hardware (Analog circuit, Microcontroller and GSM module). The analog circuit converts the pulse into readable and usable analog waveforms. The MCU samples the waveforms so that further calculations can be made.The MCU also controls the operation of the devices such as switching, LCD display and interfacing with the GSM modem.By GSM modem,the output will be send to the patient's consultant doctor. Whatever the condition of a patient, the relevantinformation will be sent to the doctor.HR measurement report via GSM Modem provides information about the patient's physiological status and response to activity. In BANGLADESH, people measure HR when they feel sick. It is necessary to keep regular check up but most people neglect it. The main cause of this negligence is the complexity of measuring HR. People have to go hospital or doctor's chamber for this general check up. The main purpose of our project is the simplicity of this check up which can be done by the user himself at home and also able to get the prescription wherever the doctor & the patient are.This project also helps the older as they don't need to move hospitals.

2. OBJECTIVES

The objectives of this project are to make a digital health checkupsystem (HRM) and interfacing with a GSM module which can send the report to doctor. For patient with heart disease needs continuous monitoring. But continuous monitoring at hospital or chamber is expensive& clumsy also. By this HRM system, people may maintain daily check up and medicated at a shortly possible time.

3. HARDWARE

3.1 HRMUnit

The basic principle of sensor is to read the bio-medical sign for heart rate measurement. The sensor circuit consists of IR & PHOTO DIODE [5]. The intensity of blood changes with every heart beat[6]. IR and Photo Diode sensor pair can detect the bloodvolume's change as it measures changes in light absorption. In our project IR &Photo Diode are placed side by side. Crosstalk should be avoided between them. So, reflected IR lights from finger can go to Photo Diode. AS the finger will be over the sensor and no crosstalk between them, then the only light that goes to Photo Diode will be reflected light. When blood intensity changes reflected light's intensity also changes.Photo Diode can detect light's intensity change. Photo Diode gives around 30-200mV outputfor this reflected light with amplifying and proper filtering. The pulse will be measured by microcontroller. Timer module will be set on counter mode to count pulse and then it will be shown on LCD.

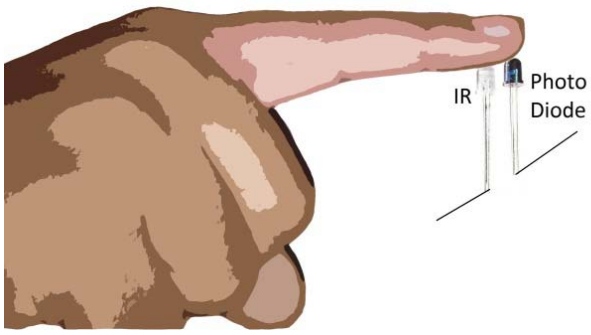

Fig.1: Illustration of fingertip sensor

A 1 uF capacitor at the input of each stage is required to block the dc component. The main challenge here is to design filtering circuit. First we tried to guess the frequency range of heart Rate in human. The heart rate of adult is in therange of 70 and 90 beat sands for an enfant,the heart rate is in
a range of 100 and 170 beats per minute at rest[7]. So from that basis we can say Heart beat frequency is about 2.5 Hz. Taking 180 bpm as our upper limit we calculated and designed a filter which will reject Frequencies over 3 hertz. The formula is,

$$f=\frac{1}{2\times pi\times R\times C} \quad (1)$$

$$=\frac{1}{2}\times pi\times 560k\times 100nF$$

$$=2.84Hz$$

Gain of each stage=$1+\frac{R_f}{R_i}$

=1+560/5.6

=101

Total gain =10,201

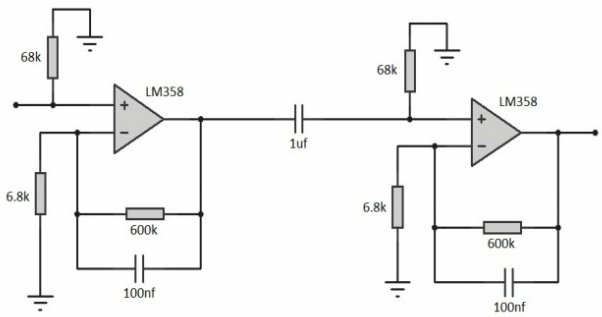

Fig.2: Filter and amplifying circuit for heart rate measurement.

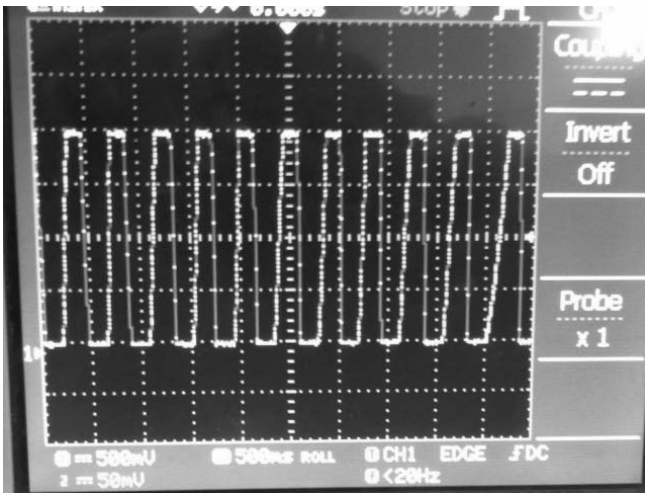

Fig.3: Output of filtered and amplified circuit.

From the Figure2 we see that our output is pretty much good for counting.

3.2 GSM Communication

GSM stands for Global system for Mobile Communication.Textual data can be sending by GSM [through asynchronous serial communication.Microcontroller can't directly communicate with GSM. Microcontroller & GSM has different logic level. MAX232 is connected with GSM for serial data communication.So logic level conversion has been done by MAX232 ic [8]. It is dual driver .It is used to convert the TTL/CMOS logic levels to Rs232 level in serial communication of microcontroller.RS232 standards are used for serial communication. In order to communicate GSM modem has special set of AT command.

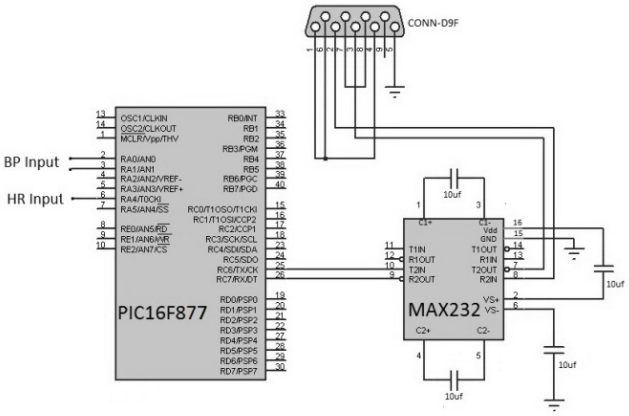

Fig4:RS-232 connection circuit

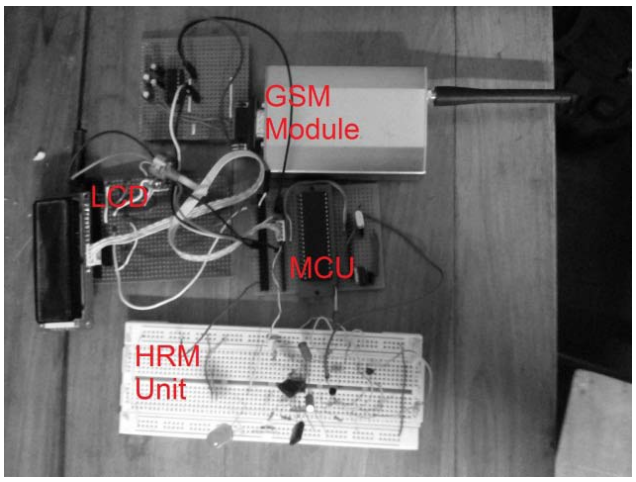

Fig.5:Circuit of the kit.

4. SOFTWARE DESIGN

A start button waits for user to push. When pushed, software will go to measure heart rate. MCU counts pulse for 15 second and then LCD will show heart rate. At the same time report will be send to doctor by GSM module.

4.1 Heart Rate Measurement

For counting the pulses timer0 module has been set to counter mood using OPTION_REG. PIC 16f877A MCUcounts pulse for 15 seconds [9].

So, pulse per minute= $value\ of\ timr0 \times 4.$ (8)
Now, MCU will show values on LCD.

4.2GSM Module

GSM module is initialized with baud rate. The baud rate of 115200 bps is chosen to make compatible with the GSM baud rate.A set of AT command is generally used to communicate with GSM [10]. AT first "AT" is sent via UART. After that, "AT+CMGF" command is sent to set GSM in SMS mode.With"AT+CMGS="mobile number" " command doctors number is set. Then the data will be sent to doctors mobile.

Table 1: AT Command Set

AT Command	Description
AT	For general response
AT+CMGF	Select SMS message format
AT+CMGS	Send SMS message
AT+CSCB	Select cell broadcast SMS message
AT+CSDS	Show SMS text mood parameters
AT+CSMP	Set SMS text Mood parameters
AT+CSMS	Select message service
AT+CSAS	Save SMS settings

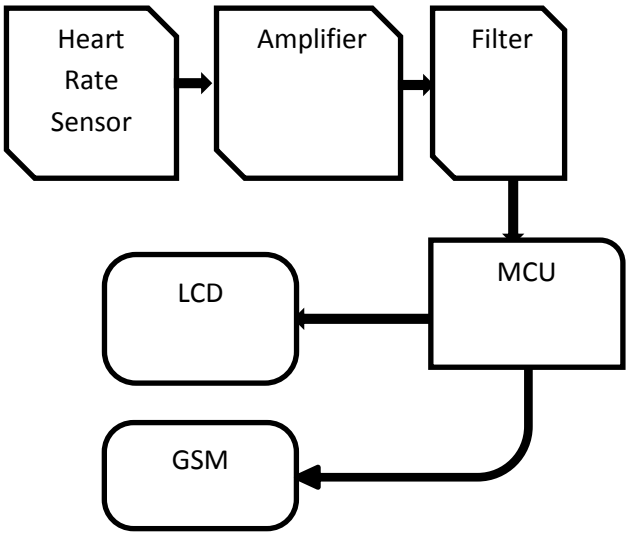

Fig.6: Block diagram of this System

6. RESULT

Readings are quite satisfactory. Some times it gives error. 50 Hz noise is a big problem in this circuit. While measuring user should be stand still. Other wise it will add oscillation in the original signal. Sunlight can also create disturbance and give false signal as sunlight radiates infrared ray also. But at room condition it works perfectly. So if we use one op amp then the gain have to be big.[gain bandwidth product]. Which make us realize that higher the gain the more sensitive the kit will be. Also LM358 (which is used to amplify) pin's are close to each other that it will create capacitance between the pins. As pin 1 out and 2, 3 input in LM358, it can make feedback capacitance between them. Also a bypass capacitor should be introduced between VDD AND GROUND. If not used, inductance will be produced which will cause voltage drop in them according to $v = l \times \frac{di}{dt}$ equation. Our device is compared with a traditional device. The comparison is shown in table 2.

Table 2: Results

Sl. No	Traditional device	Our device	% of error
1.	84 bpm	90 bpm	7.14%
2.	82 bpm	89 bpm	8.53%

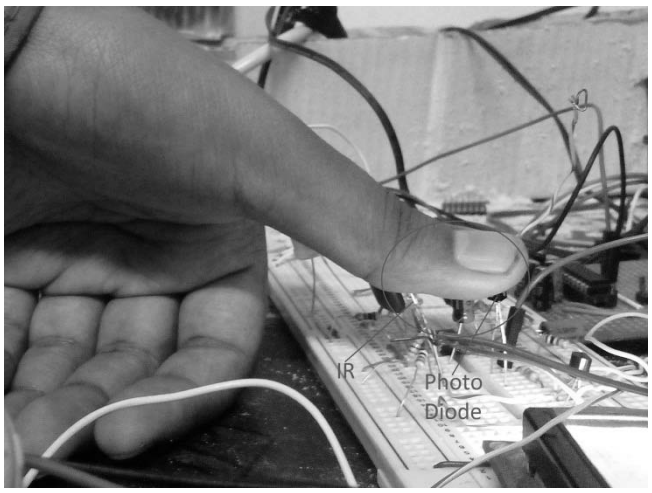

Fig.7: Testing HRM unit

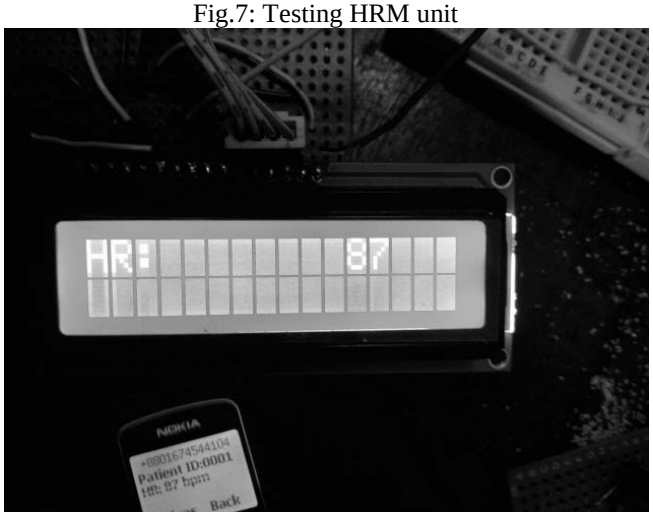

Fig.8: Results view in LCD and mobile.

7. CONCLUSION

It is undeniable that nowadays people are more aware of the health conditions. One of the most widely used methods to test the health conditions of an individual is to measure his/her heart rate.Our health kit is useable to most adult and cardiac patients. Through GSM module, patients can be monitored continuously .It is also very economic as lots of transportation cost for check up can saved .The measurement method is time saving also. Ordinary people can use it.Proper use and modification of our project can behelpful for people with health problem, especially on cardiac.

8. FUTURE WORK

This system can be improved in certain areas such as

1. Other diagnostic equipment can be added as like Blood pressure measuring unit, body temperature measuring unit, digital stethoscope.
2. GSM modem can receive suggestiveSMS from doctor.

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