

Monitoring Heart Rate with SD Card

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Sumber
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Abstract
Monitoring heart rate is an electronic device used to observe the condition of the heart continuously. Monitoring devices available today only display a patient bpm value every minute, while one of the tasks of nurses should take note and make graphs for analysis bpm monitoring patients' health. Hope authors nurses can directly monitor bpm values and see the result of the patient's chart bpm simultaneously.
BPM obtained from the pulse / vascular blood flow to the fingers that were censored by the finger sensor. The sensor signals result is what will be processed in the microcontroller circuit. In the processing of the data to be displayed on the display the authors using the IC ATMega32 as micro processors. The monitoring process is done with the device storage bpm results every minute on the SD Card.
The purpose of this research is to design a Heart Rate Monitoring include data stored on the SD Card. Design of this research is a pre-experimental research with this type of research After Only Design.
The result of this research is show the maximal error measurement about 0.5%. Signal conditioning heart rate circuit can detect the patient heartbeat with fc about 2,34 Hz. With 2x gain use 101x reinforcement.
Keywords: Heart Rate, BPM, Microcontroller, SD Card

1. INTRODUCTION

Cardiac monitoring is important as our bodies continue doing blood circulation to all organs of the body. The health condition of a person can be known through the heart rate. The heart rate of children with adults is different, as well as the sick and healthy people. The rate of pacemaker depends on the age and condition of the human self. Heart monitor is an electronic device that can be used to observe the condition of the heart continuously. It allows somone to put a numerical value on health based heartbeat. (Machriz Erliyanto, 2008)
According to observations by researcher during in hospital, one of the tasks of nurses on duty in the ICU which should monitor the BPM (Beat Per Minute) of patients every hour and keep records and create graphs monitoring for analysis of the patient's health condition. Monitoring device available today only display bpm with numbers only. Conditions such as these researchers observed are less effective, because nurses are not able to monitor her bpm. Hope nurse researchers could monitor its value bpm per minute and can see the results of the patient's chart bpm every minute.

This monitoring device ever made by (I Ketut Gede Silagunarta 2010) Mini Patient Monitor with Body Temperature parameter and BPM with graphic LCD, however displays only show graphs monitoring. In the Year 2013 Dyah Khoirunnisa making BPM and Temperature Monitoring using Wireless Microcontroller based Atmega8, which only displays the BPM. According to observations of researcher some device already made it still has the disadvantage that the user can not monitor graphs monitoring and for a long time. Referring to the results of the identification of the problems above, the researchers wanted to enhance BPM monitoring device equipped with a data logger storage so that any changes to the increase and decrease BPM stored on SD card and can be displayed on the PC in the form of graphs through applications already on your PC.

2. RESEARCH METHOD

This research was experimental research that was conducted in the field with the design of posttest only control group. The subject of this research is hearth rate. The procedure of this research was descriptively measurement hearth rate with sd card.

3. RESULT AND DISCUSSION

Heart

The heart is located in the chest cavity somewhat to the left, between right lung and the left lung. Its mass is less than 300 grams, the size of the fist owner. The heart has to pump blood function. With the heart, blood can flow throughout the body via blood vessels. The human heart is divided into four chambers, namely right atrium and the left atrium and the left ventricle and the right ventricle. Part chambers (ventricles) of the heart walls thicker than portico (atria) of the heart. *(Wikipedia.org)*

Heart Rate Calculations

The calculation of the heart rate can also name beats per minutes (BPM), using the direct and indirect technique. Directly carried out by detecting the heart itself. While indirectly by exploiting the blood vessels, the use of flavorings sense on the third finger on the stick to blood vessels and counted manually for 1 minute, or uses leads (sensor) connected with counters heartbeat.

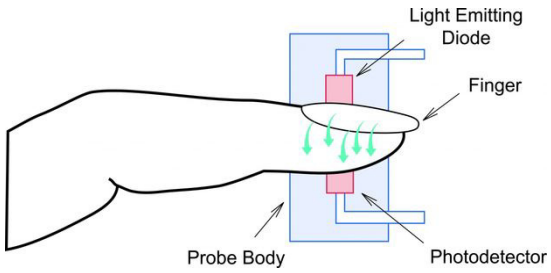

Figure 1.Sensor Placing

Microcontroller Circuit Atmega 8

Specifications microcontroller circuit module that is needed is:

1. Input voltage +5VDC
2. Push Button 1,2,3 grounded and PINB.0,1,2

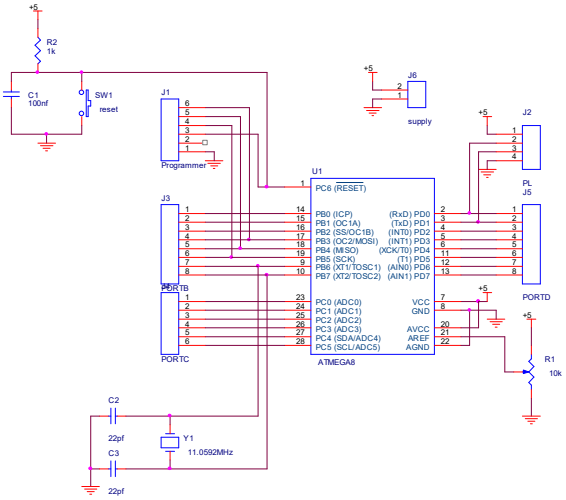

Figure 2. Microcontroller Circuit Schematic

Minimum SystemProgram
Microcontroller input function library

```
#include <SD.h>
#define pinDataBPM
File;

Csv.FILE_WRITE
```

The program above to enter the library SD Card to connect with IC ATmega328 that authors use to work. There is also a library define pin data BPM for data input ADC acquired from the reading finger sensor, library files to create a file that holds the temperature data from the sensor readings and library csv to form data from sensor readings to be stored on the SD Card in the form of a csv file.

Signal Conditioning Circuit
While the sensor works, Infrared as a light source and a photodiode as the receiver. Infrared emit light with a wavelength of 980 nm of the fingers, then the light penetrates the finger and received by the photodiode. Light received is affected by concentrations of blood pumped by the heart. 150 Ohm resistor (R1) to function as a safety resistor Infrared, while the 1 M resistor (R2) is used as a voltage divider to Photodiode resulting voltage change and make the output of the photodiode forming the AC signal. The signal can not be calculated frequency and amplitude. The signal is entered in the circuit blocks DC 1 uf (C1) with a 68K resistor (R9) is called passive filter serves to suppress the DC voltage at GND, so the signal is passed only AC signals to be amplified and filtered. The AC signal is entered on the LM358 IC where the signal is amplified using a Non Inverting with Gain 101 x 2 times and will be filtered using the Low Pass Filter to Cut Off 2.34 Hz.

With 2 times the gain of the High Low AC signal coming out of the last amplifier is very large, but because LM358 Supply 5,0V only use the output signal generated a minimum of 3.3 V. The presence of a voltage drop caused by the characteristics of the LM358 which lowers the voltage 1, 7 V of the working voltage of LM358.

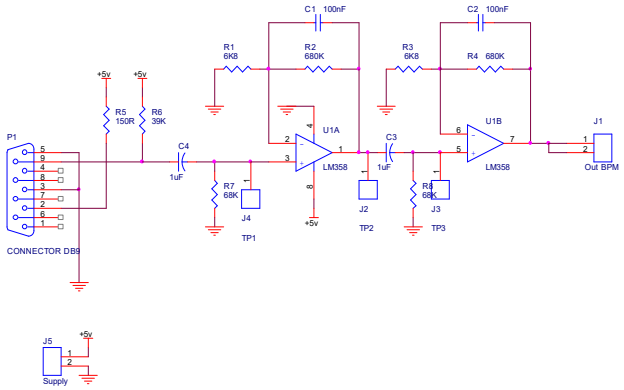

Figure 3. Schematic Signal Conditioning

Inisialisasi SD Card

```
Serial.println("Inisialisasi SD Card...");
reading =0;
if (!SD.begin(10)) // 10 -->dr CS
{
Serial.println("Inisialisasigagal!!!");
return;
}
Serial.println("Inisialisasiberhasil");
}
```


The program above functioned as inisilisasi SD Card for initiation reading of data to be stored, beginning with the reading of the ADC from 0, when CS received data input it directly data will be stored on the SD Card, if it does not receive input data is then initialize the SD Card failed because no the data to be stored.

Diagram Block Methode

Count the number of heart rate should clipped part of his finger into the finger sensor. In the infrared sensor is present that lights will illuminate the finger and there is also a photodiode that will be sensitive to light intensity. Every blood flow, there will be differences in intensity. The intensity of this light will then be received by the photodiode. The analog signal from the photodiode will be processed in the signal conditioning circuit, which consists of a separation between the AC signal using AC coupling circuit so that DC signals can be detained even eliminated. Data / analog signal will be strengthened by the non-inverting amplifier circuit. Data / analog signal generated is compared with a reference comparator to trigger further monostable input in order to provide high or low logic input to the micro and processed in the microcontroller to calculate the value of BPM patient. The output signal will go into PINB.0 (T0) on the microcontroller. Microcontroller will read how many incoming trigger for 60 seconds. Data obtained during the 60 seconds will be saved on the SD card that serves as a data storage and sensor readings of BPM will be displayed on a personal computer in a csv file.

Discussion

Figure4. Equipment Heartbeats with Sd Card Data Storage (a) Initial conditions (b) Opening Start Condition

At the beginning after the appliance in ON it will detect the SD Card (already installed or not). After SD Card already installed it will wait for the START button is pressed to start collecting data on patients.
For initial testing overall circuit before being used on a patient require the tools and materials as follows:
1. Notebook / PC (Personal Computer)
To see the output of the test circuit (in the form of setting the value of the function generator) which will connected to the oscilloscope and function generator.
2. Osciloscope
Serves to show the results of a setting signal from the function generator.
3. Function Generator
Serves to produce / generate signals for testing a series of sensors, signal processing and microcontroller.

BPM 60

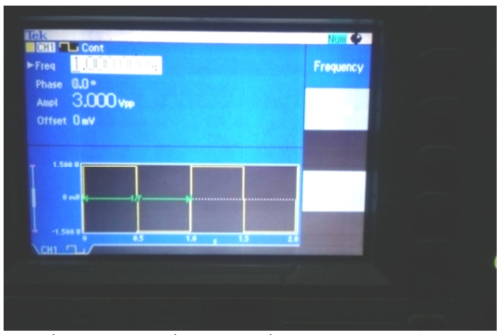

Figure 5. Setting Function Generator 1 Hz

$$T = \frac{1}{f} = \frac{1}{1\ Hz} = 1$$

$$BPM = \frac{60}{T} = \frac{60}{1} = 60\ BPM$$

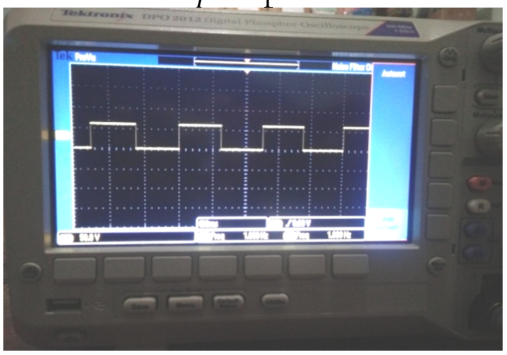

Figure 6.Output from Setting Function Generator 1 Hz

From the results of this test series Signal Conditioning prove that the suite can skip a frequency of 1 Hz or equal to 60 BPM.

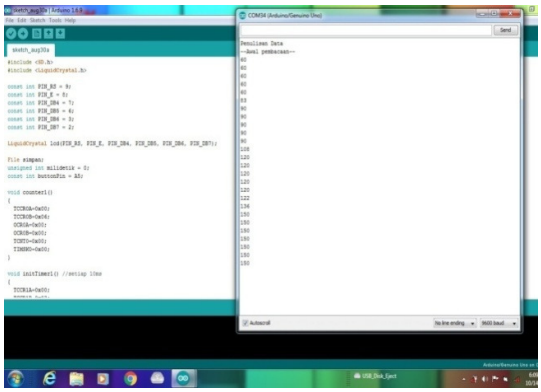

Figure 7. Results of Initial Testing Function Setting Generator Is Viewed On a PC

Data Retrieval

Tabel 1. Table Measurements Patients 1, 2 and 3

Data	BPM
1	95
2	95
3	94
4	95
5	96
6	95
7	96
8	95
9	95
10	94

(a)

Data	BPM
1	84
2	83
3	83
4	84
5	85
6	86
7	86
8	85
9	84
10	84

(b)

Data	BPM
1	87
2	87
3	87
4	86
5	87
6	88
7	87
8	88
9	88
10	86

(c)

On taking data is collected on the 3 respondents each respondent will be stored data is BPM her for 10 minutes.

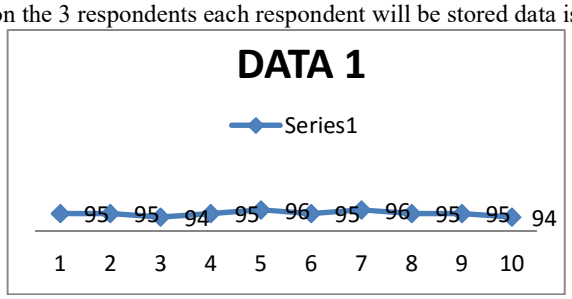

Figure 8. Graph Measurement Results Patient 1

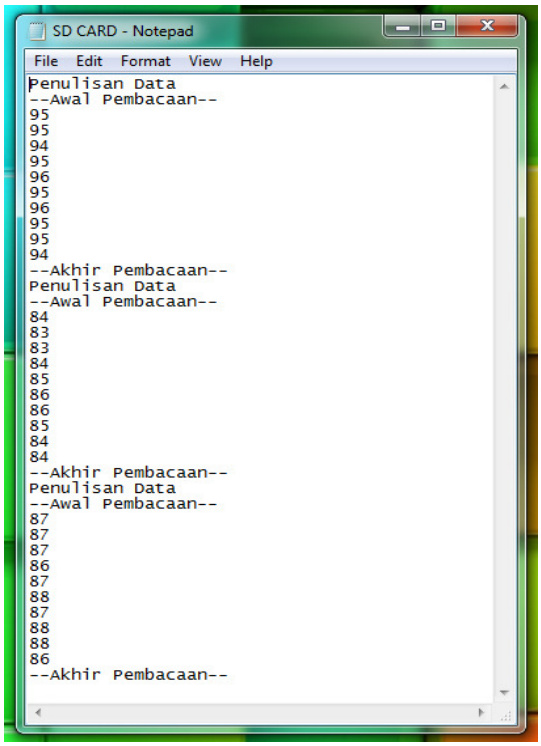

Figure 9.Image Storage On SD Card Results

The image above is the contents of a file on the SD card. There are 3 respondents where each respondents had the time of measurement for 10 minutes.

4. CONCLUSION

1. Overall this research can be concluded that:
2. It can be made modules Heart rate monitoring device with lcd graphics with a maximum error of 0.5%.
3. Analog signal conditioning or circuit can detect the heart rate of patients with a heart rate about 2,34 Hz of fc.
4. The circuit use 2x gain with 101x reinforcement.
5. Minimum system able to run program and so can show data storage in sd card.
6. Software that has been created using the C language in the Code Vision AVR and arduino can work sequentially in accordance with its program listings.
7. Results bpm and time can be saved on the SD Card

5. SUGESTIONS

1. Added temperature parameters
2. Added of the battery level indicator
3. Added of RTC for time Parameter

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