

Sudan University of Science & Technology

College of Engineering

Biomedical Engineering Department

Design of Electronic Thermo-stethoscope

Presented by:

- Alaa Abdelrahman Abdullah
- Esraa Mohamed Osman
- Samah Mohamed Dahab

Supervised by:

Dr. Mohamed Yagoub Esmail

August 2014

Abstract

The stethoscope is an acoustic medical device for listening to internal sounds in human body. One problem with acoustic stethoscopes is that the sound level is extremely low.

The thermometer is medical device used to measuring body temperature, one problem is that the traditional thermometer has re-usability constraint, less convenient measurement and has mercury environmental hazards.

This project is an attempt to build an electronic thermo-stethoscope that is used to measure the heart beat and body temperature, heart signals are amplified and filtered in desired frequency band then fed to microcontroller with the body temperature to process them and displayed on LCD. The circuit is designed tested and improved.

المستخلص

سماعة الطبيب هي جهاز طبي للاستماع إلى الأصوات الداخلية في جسم الإنسان ، المشكلة التي تواجه السماعات الصوتية هي انخفاض مستوى الصوت .

مقياس الحرارة هو جهاز طبي يستخدم لقياس درجة حرارة الجسم، المشكلة التي تواجه مقياس الحرارة التقليدي هي أن له قيود اعاده استخدام ، وهو قياس غير مريح وله مخاطر بيئية .

هذا المشروع هو محاولة لبناء سماعة طبيب الكترونية حرارية تستخدم لقياس نبض القلب ودرجة حرارة الجسم، وتتضمن إشارات القلب وتتم تصفيتها في نطاق التردد المطلوب ثم توصل للمتحكم مع اشارة درجة حرارة الجسم لمعالجة الاشارتين وعرضهما في صورة رقمية على الشاشة.

تم تصميم الدائرة، اختبارها وتحسينها .

Abbreviations

LCD (Liquid crystal display (

K-ohm (Kilo ohm (

S/N ratio (Signal to noise ratio (

dB (decibel (

R (resistance (

C (capacitor (

F (frequency (

M-ohm (mega ohm (

nF (nano farad (

Hz (hertz (

μ F (micro farad (

C (centigrade (

mV (milli volt (

GND (ground (

DC (direct current (

M-Hz (mega hertz (

I/O (input / output (

ADC (analog to digital converter(

Table of contents:

هيكلاً.....	I
DEDICATION.....	II
ACKNOWLEDGMENT	III
Abstract	IV
لختسلا ص	V
Abbreviations	VI
Table of contents:	VII
Table of Figures:.....	IX
CHAPTER ONE	1
1. Introduction.....	2
1.2 Statement of the problem:	2
1.3 Objectives:	2
1.4 Methodology:	3
1.5 Layout of thesis:	3
CHAPTER TWO	4
2. Theoretical foundation and literature review.....	5
2.1 Anatomy of the heart:	5
2.2 Heart sounds:	7
2.2.1 Normal heart sounds:	7
2.2.2 Abnormal heart sounds:.....	8

2.3 Stethoscope:.....	9
2.3.1 Acoustic Stethoscope:.....	9
2.3.2 Electronic stethoscope:	11
2.4 Temperature:.....	12
2.4.1 Normal body temperature:.....	13
2.5 Thermometer:	13
2.6 Electronic thermometer:.....	15
2.7.1 Stethoscope:	15
2.7.2 Thermometer:	16
CHAPTER THREE	18
3. Methodology	19
3.1 Introductory	19
3.2 Elements of system design:	19
3.2.1 Sound sensor:	20
3.2.2 Operational amplifier:.....	20
3.2.3 Filter:	21
3.2.4 Mono stable:	23
3.2.5 Temperature sensor:	25
3.2.6 Microcontroller:	26
3.2.7 LCD:	26
3.3 The system design using simulation program:	29
CHAPTER FOUR	31
4. Results and discussion	32

4.1 Results:	32
4.2 Discussion:	35
CHAPTER FIVE	36
5. Conclusion and recommendations.....	37
5.1 Conclusions:	37
5.2 Recommendations:	37
REFERANCES:	38
Appendix	40

Table of Figures:

(Figure 2.1: Anatomy of the heart and associated valves)	6
{Figure 2.2 : Laennec stethoscope)	11
(Figure 2.3 : The Stethoscope)	12
(Figure 2.4 : Mercury thermometer)	14
(Figure2.5 : Digital thermometer)	15
(Figure 3.1: General block diagram of electronic thermo stethoscope)	19
(Figure 3.2: Electric Sound Sensor)	20
(Figure 3.3: Audio amplifier (LM386) circuit diagram)	21
(Figure 3.4: Low pass filter with cut off frequency (120 HZ))	23
(Figure 3.5: 555 timer circuit diagram)	24
(Figure 3.6: LM35)	25
(Figure 3.7: Microcontroller at mega 16)	26
(Figure 3.8: 16*2 LCD).....	27
(Figure 3.9: The hardware circuit of electronic thermo-stethoscope)	28
(Figure 3.10: Simulation circuit diagram).....	30
(Figure 4.1: The pulse rate displaying for the first sound)	32
(Figure 4.2: The pulse rate displaying for the second sound).....	33
(Figure 4.3: The pulse rate displaying for the third sound)	33
(Figure 4.4: The air temperature in practical circuit)	34
(Figure 4.5: The air temperature in real digital thermometer)	34

CHAPTER ONE

1. Introduction

1.1 general over view:

The stethoscope is an important diagnostic tool for the analysis of heart sounds which are normally produced by various mechanical activities of the heart during the heart cycle.

[1]

Temperature plays important role in the analysis of patient or subject's health condition.

The doctors always need to measure the patient's temperature during any medical checkup. So it is necessary to send the information about the patient body temperature to the doctor for proper diagnosis of the patients .

Thermometers are used in medicine to take the core body temperature of patients.

1.2 Statement of the problem:

Using of acoustical stethoscope is not efficient; because of the limitations of the human's ear sensitively especially that heart sounds have low frequency and low intensity and the sounds of surrounding environment like noise that cause the doctors difficulties in getting the accurate result. Acoustical stethoscope makes the evaluation of cases differs between physicians. Traditional thermometers have re-usability constraint, less convenient measurement and have mercury environmental hazards.

1.3 Objectives:

The main objective of our project is to observe and take the values of the heart rate and body temperature to process it by microcontroller to provide a numerical display for a heart rate and body temperature in LCD in minimal time and maximum accuracy.

1.4 Methodology:

An electric condenser microphone senses the heart sounds and converting them into electrical signals, the signals is amplified, filtered in desired frequency band and converted into digital form.

LM35 temperature sensor sense the body temperature and converting them into electrical signals.

Heart sounds and body temperature signals are then connected to the microcontroller at mega16 to process it and then display the heart rate and body temperature in 16*2 LCD.

1.5 Layout of thesis:

- Chapter one consists of brief introduction and general overview.
- Chapter two consists of theoretical foundation and literature review.
- Chapter three consists of methodology.
- Chapter four consists of results and discussion.
- Chapter five consists of conclusion and recommendations.