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<td>A2</td>
<td>Aortic component of second heart sound</td>
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<tr>
<td>ADC or A/D</td>
<td>Analog to digital converter</td>
</tr>
<tr>
<td>ADCSRA</td>
<td>Analog to Digital converter Control and Status Register A</td>
</tr>
<tr>
<td>A-V</td>
<td>Atrio-Ventricular</td>
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<td>CPU</td>
<td>Central processing unit</td>
</tr>
<tr>
<td>dB</td>
<td>Decibel</td>
</tr>
<tr>
<td>DC</td>
<td>Direct Current</td>
</tr>
<tr>
<td>DLL</td>
<td>Dynamic-link library</td>
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<td>DMA</td>
<td>Direct memory access</td>
</tr>
<tr>
<td>DSP</td>
<td>Digital signal processing</td>
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<tr>
<td>EC</td>
<td>Ejection click</td>
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<td>ECP</td>
<td>Extended capabilities port</td>
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<tr>
<td>EEPROM</td>
<td>Electrically Erasable Programmable Read-Only Memory</td>
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<tr>
<td>EPP</td>
<td>Enhanced parallel port</td>
</tr>
<tr>
<td>FFT</td>
<td>Fast Fourier transform</td>
</tr>
<tr>
<td>FIFO</td>
<td>First in first out</td>
</tr>
<tr>
<td>Fs</td>
<td>Sampling Frequency</td>
</tr>
<tr>
<td>HES</td>
<td>Heart energy signature</td>
</tr>
<tr>
<td>HostAck</td>
<td>Host Acknowledge</td>
</tr>
<tr>
<td>HostClk</td>
<td>Host Clock</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz (Cycle / minute)</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>I/O</td>
<td>Input / Output</td>
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<td>IrDA</td>
<td>Infrared Data Association</td>
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<td>ISA</td>
<td>Industry Standard Architecture</td>
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<td>ISR</td>
<td>Interrupt service routine</td>
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<tr>
<td>LPC</td>
<td>Linear prediction coding</td>
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<tr>
<td>LSB</td>
<td>Least significant bit</td>
</tr>
<tr>
<td>µs</td>
<td>Micro second</td>
</tr>
<tr>
<td>ms</td>
<td>milli second</td>
</tr>
<tr>
<td>m/sec</td>
<td>Meter / second</td>
</tr>
<tr>
<td>MHz</td>
<td>Mega hertz</td>
</tr>
<tr>
<td>mV</td>
<td>milli volt</td>
</tr>
<tr>
<td>op amp</td>
<td>Operational amplifier</td>
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<td>OS</td>
<td>Opening snap</td>
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<td>P2</td>
<td>Pulmonic component of second heart sound</td>
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<td>PC</td>
<td>Personal computer</td>
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<td>PDS</td>
<td>Power density spectrum</td>
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<td>PeriphAck</td>
<td>Peripheral Acknowledge</td>
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<td>PeriphClk</td>
<td>Peripheral Clock</td>
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<td>PS/2</td>
<td>Simple bidirectional port</td>
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<td>SCSI</td>
<td>Small Computer System Interface</td>
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<td>Seg.</td>
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<td>SPP</td>
<td>Standard parallel port</td>
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<td>SRAM</td>
<td>Static Random Access Memory</td>
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<tr>
<td>STD</td>
<td>Standard of deviation</td>
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<td>STFT</td>
<td>Short Time Fourier Transform</td>
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<td>TFR</td>
<td>Time-Frequency Representation</td>
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<td>USART</td>
<td>Universal Synchronous and Asynchronous serial Receiver and Transmitter</td>
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<td>USB</td>
<td>Universal Serial Bus</td>
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ABSTRACT

Using acoustic stethoscope is not efficient always because of the limited sensitivity of the human ear in addition to the noise and artifact. This fact led to the invention of the electronic stethoscope.

In this thesis an electronic stethoscope has been designed and implemented to process, analyze and record heart sounds in real time. This will help in auscultation and diagnosis. Two types of designs are introduced. The first was microcontroller based electronic stethoscope, while the other was PC based electronic stethoscope.

A system of algorithms for analysis of heart sounds has been applied using time-frequency representations. This system performs calculations to obtain some parameters that give useful indicators and help in diagnosis. The algorithms calculate the timing of heart sound components, the duration of each of them, and their energy then plot their spectrogram. The sound components include first heart sound, second heart sound and abnormalities like murmur.

These algorithms have been applied on normal and abnormal heart sounds in some Sudanese specialized hospitals.

The designed electronic stethoscope gave good and valuable results in recording and analysis of heart sounds.
المستخلص

لاست السماعة الطبية السمعية كفاءة دائما بسبب الحساسية المحدودة للأذن البشرية بالإضافة إلى تأثيرات الضوضاء والأخطاء المضافة. هذه الحقيقة أدت إلى اختراع السماعة الطبية الإلكترونية.

في هذه الأطروحة تم تصميم وتنفيذ سماعة طبية إلكترونية لمعالجة وتحليل وتسجيل أصوات القلب في الوقت الحقيقي، وهذا سيساعد في الاستماع والتشخيص.

تم تقديم نوعين من التصاميم، الأول سماعة إلكترونية باعتماد المتحكم الدقيق بينما كان الثاني سماعة إلكترونية باعتماد الحاسوب الشخصي.

ثم تم تطبيق نظام من الخوارزميات لتحليل أصوات القلب باستخدام تمثيلات الزمن مع التردد. يقوم هذا النظام بالحسابات للحصول على بعض العوامل التي تعطي المؤشرات المفيدة وتساعد في التشخيص.

تقوم الخوارزميات المطبقة باحتساب توقيتات مكونات صوت القلب، مدة كل منها، وطاقتها ثم القيام برسم المخطط الطيفي لها. تتضمن مكونات صوت القلب: الصوت الأول للقلب، والصوت الثاني للقلب، والحالات غير الطبيعية كالهمومية.

تم تطبيق هذه الخوارزميات على أصوات القلب الطبيعية وغير الطبيعية في بعض المستشفيات السودانية المتخصصة.

أعطت السماعة الطبية الإلكترونية المصممة نتائج جيدة وذات قيمة في تسجيل وتحليل أصوات القلب.