

Development of Embedded Stethoscope for Heart Sound

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Abstract—In India, about 25 percent deaths occurs in the age group of 25 - 69 years because of a cardio-vascular disease [7]. There are numerous diagnostic tests are available that can be used to determine variety of heart disease depending upon risk of heart disease, patient history and the symptoms one might have but the initial diagnose can be done using the stethoscope which is used to hear auscultations. The stethoscope serves as the most frequently employed technique in primary health care especially in rural areas. Sometimes hearing the patient Heart Sound & Murmur which are low amplitude and frequency signal using a stethoscope could lead to the false diagnosis. Also this technique requires lots of expertise and skills which is decreased over the time. The solution of this issue is highly important in early detection of abnormality of heart sound by medical professionals. In this paper, an embedded stethoscope has been designed to serve as a platform for the computer aided diagnosis (CAD) of cardiac sound for the detection of cardiac murmurs. The portable device has ability to hear heart sound in real-time and at the same time display it on TFT LCD Display for visual interpretation. In addition, the heart sound signal can be stored in micro SD card that can be helpful for offline analysis. Critical analysis can be done on the recorded sound signal in time and frequency domain using NI LabVIEW. Software module discloses predominant information about the cardiovascular disorders; hence solve the shortage of specialist doctors and help them in urban as well as rural clinics and hospitals.

Keywords—Stethoscope, Heart Sound, Heart Murmur, Auscultation, Arduino, NI LabVIEW.

I. INTRODUCTION

Heart auscultation, is one of the most fundamental process of interpreting the sounds produced by heart to diagnose various cardiac disease. It works as the most frequently used technique in primary medical care and in the situation, where sophisticated medical equipment is not available. Detecting the heart sound or murmuring using the traditional stethoscope is key problem that always arise for doctors/medical physicians, and GP's at hospital. Generally, Heart murmurs may go unnoticed during routine check-ups since detection relies on the training or expertise of the physicians, the quality of the equipment used, and the severity of the condition. That is why some form of digital stethoscope needs to be developed to replace the existing acoustic stethoscope. A digital stethoscope allow physician to analyze cardiac signals in real time as well as

record patients heart sound instantly onto their Laptop or computers for further examination and visualization. With a conventional Stethoscope which is currently available in the market, distinguishing between innocent murmur and suspicious murmur is very difficult. As a result, most of the cardiologist's report that a very high number of patients referred to them are actually not suffering from murmurs that require treatment. Current problems ask for an embedded stethoscope that is low in cost, has more desirable acoustic response, and can be integrated with the latest technologies better than the current acoustic stethoscope overall making cost effective design.

In this project the main purpose is to design and implement an embedded stethoscope to serve as a platform for the computer aided diagnosis (CAD) of cardiac sound for the detection of cardiac murmurs. The system uses a custom-built micro-phone sensor to capture heart sounds and converting it to electrical signals which are processed by front end circuitry. Moreover, the amplitude of the signal can be amplified as per the physician requirement, helping them to improve their reliability of diagnosis for different patients. Also, the provisions were made to play heart sound signal in real-time with or without earphone in the portable device. In addition, the system uses a memory chip to record and playback audio waveforms, so that it can be used as a reference in future analysis and visualization.

II. HEART SOUND AND HEART MURMURS

Heart sounds are generated by the resultant flow of blood through artery [14] (the turbulence created when the heart valves snap shut). In healthy people, there are two normal heart sounds often described as a lub and a dub or dup, that occur in sequence with each heartbeat as shown in figure 1. The first heart sound (S1) is caused by the closure of the atrioventricular valves. First the mitral valve followed shortly by the tricuspid valve. The closure of the aortic valve, closely followed by the pulmonary valve closure, causes the second heart sound (S2). The third (S3) and fourth (S4) heart sounds are the result of passive ventricular filling (early diastole) and active ventricular filling sound (late diastole) respectively. The presence of S3