

Chapter 24

An IoT-Based Remote Health Monitoring System for Smart Healthcare: Cardiac Health Monitoring-Based Approach

Uday Maji

Haldia Institute of Technology, India

Rohan Mandal

Haldia Institute of Technology, India

Saurav Bhattacharya

Haldia Institute of Technology, India

Shalini Priya

Haldia Institute of Technology, India

ABSTRACT

Many automated health monitoring devices detect health abnormalities based on gleaned data. One of the effective approaches of monitoring a senior cardiac patient is the analysis of an Electrocardiogram (ECG) signal, as proven by various studies and applications. However, diagnosis results must be communicated to an expert. An intelligent and effective technology gaining wide popularity known as ‘internet of things’ or ‘IoT’ allows remote monitoring of the patient.

INTRODUCTION

Twenty first century's most alarming issue is public health care as the greatest number of people suffering from different diseases due to uncertain changes in environment specially for pollution and also due to unhealthy food qualities. World health organization (WHO) is reported that many people dies annually from different diseases mainly from cardiovascular diseases (CVD). Moreover 80% of CVD death is observed in low and middle economic countries among men and women both in almost equal percentage. It is also reported that by 2030, almost 23.6 million people may die from cardiovascular diseases and strokes [WHO 2013]. Different organizations have been taken several initiatives to reduce this miserable trained of human health issues. But another way to reduce and save human from this trained is to employ continuous or regular health monitoring system. Effective health monitoring systems can diagnosis human health with proper care of experts. But the availability of experts especially in rural area in the country like India is very difficult. An automated health monitoring system can help to overcome this problem with its self-diagnosis capability. This type of expert system diagnoses health condition based on the given data from the patient with the help of wearable sensors. The system is also capable to communicate with the experts of patients' relatives in emergency condition. This literature mainly focuses on modern health monitoring system on cardiovascular diseases.

At present time IoT (internet of things) based system [Yang Z, 2016] is gaining popularity in all the fields from human daily appliance to big industries. Looking at its popularity, this system has also adapted in the diagnosis of human health condition and makes our life better. In the following sections, how this can be used to monitor the ECG signal for cardiac health diagnosis is described.

Conventional ECG monitoring systems

The electrocardiogram (ECG) is a main tool used by the doctors to diagnose and monitor heart patients. It is the graphical representation of the time variant voltage produced by the muscle tissue of heart (myocardium) during cardiac cycle. Fig1 shows basic waveform of the normal ECG signal. The P-wave generates due to atrium contraction, QRS complex generates due to atrium relaxation and ventricle contraction and T-wave is produced due to ventricle relaxation. This waveform represents the rhythmic electrical depolarization and repolarization of the myocardium. Basically ECG waveform is used to diagnosis different kind of heart diseases. For the diagnosis of the heart disease cardiologist first checks the heart rate and in normal health condition its value lies in between 60 to 100 beats per minute. Heart rate of any person can be slower or faster than the normal range, former is termed as bradycardia whereas latter situation is called tachycardia. The cardiologist checks the ECG waveform and detect the various disease on the basis of change in rhythmic oscillation like, if the cycles are not evenly spaced the person suffers from arrhythmia (abnormal heart rhythm) or if the P-R interval is greater than the normal range (0.12 to 0.20 sec), it can indicate the blockage of the autrio ventricular (AV) node etc.

The instrument is used to obtain and record the ECG waveform is known as electrocardiograph. The first ECG monitoring device was appeared in the hospitals around the year 1910. As the year passes lots of technical changes occurred in the electrocardiograph. But still the conventional method is preferred in the most of the health center. Few conventional ECG monitoring systems are briefly described below:

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