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Early Detection of Heart Attack

Interim Report I, submitted in partial fulfilment of the requirement for the degree of
Bachelor of Technology (B. Tech) and Bachelor of Design (B. Des)

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Introduction

Chronic heart diseases are one of the most dangerous and life-threatening disease worldwide. The fundamental cause of heart failure is narrowing and blockage of coronary arteries, where the heart fails to supply enough blood to other organs. The coronary arteries must be accessible to supply blood to the heart. According to a recent study, heart disease is most common disease in the United States and worldwide with a high percentage of heart disease patients. Common symptoms are shortness of breath, swelling feet, and tiredness. Junk food with a maximum number of cholesterols, smoking, poor nutrition, high blood pressure, and physical inactivity increase the risks of heart disease. Heartburn, stroke, and heart attack are all symptoms of coronary artery disease (CAD). Other heart disorders include heart rhythm problems, congenital heart disease, congestive heart failure, and cardiovascular disease. Due to Lack of medical understanding and diagnostic instruments, on time detection and treating heart disease in poor countries is very difficult.

User Field Study

According to the WHO, 17.90 million people died from cardiovascular disease (CVD) in 2016, accounting for 30% of all deaths globally and death counts are still increasing per year. According to the European Society of Cardiology (ESC), there are 26.5 million people in Europe who suffer from heart disease, with 3.8 million new cases being discovered each year. Heart disease kills 50–55% of patients in the first year, and treatment costs 4% of the yearly healthcare expenditure. Invasive diagnostic procedures relied on a patient's medical history, physical examination results, and an examination of symptoms to make a diagnosis of heart disease. Traditional methods like angiography are regarded as the most precise practice when it comes to detecting heart abnormalities but still facing certain limitations, such as high costs, various other side effects, and a high level of technical expertise is required, and most importantly it is much expensive, computationally difficult, and take time to assess [11, 12], to overcome the limitations of conventional invasive-based approaches for detecting cardiac disease. Predictive machine learning and deep learning algorithms were used to construct non-invasive Internet of Medical Thing (IoMT), smart healthcare systems such as KNN, SVM, NB, DT, LR, RF, and ANN. As a result, the death rate among individuals with heart disease has exponentially dropped per year.

The main objectives of this research study are as follows:

(i) To develop an intelligent medical decision system for the identification of cardiac illness on time.

(ii) Artificial Intelligence and Machine learning classification methods such as decision tree (DT), stochastic gradient descent (SGD), K-nearest neighbour (KNN), naive Bayes (NB), random forest (RF), logistics regression (LR), and support vector machine (SVM) are used to select the best model for early heart disease diagnosis.

Current research has imbalanced distribution, e.g., some approaches are accurate but required a long time for computation, and some techniques responded on time but are not very accurate to diagnose such serious disease. As a result, there is a great deal of work to improve the performance evaluation rate in this area.

Technical/Product Specification

Following sensors would be used in the device:

1. **Pulse Sensor**:
   A pulse wave is the change in the volume of a blood vessel that occurs when the heart pumps blood, and a detector that monitors this volume change is called a pulse sensor.
2. **Oximeter**:
   An instrument to measure the proportion of oxygenated haemoglobin in the blood.
3. **Sweat Sensor**:
   Device to monitor the levels of sweating and substances in sweat.
4. **Electrocardiogram**:
   A compact and wearable EKG, to detect the beating of heart.

Concept Generation

The main objective of this fabrication project is to make a wearable and portable device, for people with heart disease and complications who has a higher risk of heart failure and/or stroke, to assist them in recovery and detect and prevent heart attack.

The concept is to gather the medical history of a patient along with their current time cardiovascular health with the help of oximeter and ECG in the device.

We are to analyse this data along with surveys of various other patients with similar health issue and predict if a person is at a risk of a heart attack with the help of machine learning algorithms and AI, as early as possible and alert the patient, his doctor and kin via a mobile alerting mechanism. The device will also help in assisting doctor to keep a real time medical history of a patient.

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