

Bab 1. INTRODUCTION

The heart is one of the most essential organs in the human body. The heart's main function is to circulate blood containing oxygen throughout the body. Because the heart is a vital human organ, so when someone is exposed to diseases related to the heart, it will be hazardous to health and safety from various kinds of heart disease, one of the deadliest diseases is coronary heart disease (CHD). [1] stated that CAD is one of the most significant factors that cause death and kills as many as 17.9 million people yearly. CHD itself occurs because fat deposits block the heart's blood vessels, called coronary arteries. The more fat accumulates in these blood vessels, it will result in reduced blood flow to the heart and can cause a heart attack. Coronary arteries supply blood to the heart muscle. When the inner lining of these arteries becomes hard due to calcium deposits, the blood supply to the heart is blocked [2]. However, the application of technology has resulted in a rapid improvement in the quality of healthcare services [3], CHD can be detected more efficiently using Photoplethysmograph (PPG) signals and machine learning.

PPG is a simple technique to detect volumetric changes in circulating blood visually. [4] PPG is an optical technique used to distinguish waves of heartbeats that propagate throughout the body. Tissue analysis is performed using a light source and a PhotoPlethysmoGraph (PPG) photodetector signal to estimate pulse rate, blood pressure, blood oxygen levels, hemoglobin and biometric identification, etc. [5]. The way PPG works is by utilizing low-intensity infrared light; when light travels through the body, the light will be absorbed by the bones, skin pigments, as well as veins and arteries. Blood vessels absorb the most light, so when there is a change in blood flow, it can be detected by the PPG signal as a change in light intensity. Besides being simple, PPG signals are also easy to access because using a smartphone you can also use PPG signals. CHD detection can also be performed using an ECG. ECG-based Heart Rate Variability (HRV) analysis is a technique that has become popular among researchers for diagnosing heart disease [6], but its use is more difficult because of the many equipments that must be used.

To find out if someone has CHD, machine learning will be used as a tool for diagnosing CHD. In machine learning, it has several stages, namely Denoising, Selection, and Classification. Each stage has its function, for the classification stage has the process of determining the final result whether the user suffers from CHD or not. In this study, a classification algorithm will be carried out to detect CHD based on PPG signals using a smartphone.

Research conducted by [7] determined the relationship between breathing problems and PPG signals in sleep apnea patients. The study was conducted using 32 of the 34 features found and using several classification algorithms such as the k-nearest neighbor's classification algorithm, radial basis function neural network, probabilistic neural network, and multilayer feedforward neural network (MLFFNN) and combining several classification methods. MLFFNN achieved the highest accuracy with an accuracy value of 97.07%.

Researchers [8] introduced a new system that is useful for monitoring heart health using PPG signals implanted in smartphones. PPG is an optical-based technique that can be used to estimate blood pressure in certain organ parts. The test was carried out using a smartphone that has a rear camera and LED flash and also has a pretty good accuracy, according to the author, so that it can be developed further

Research conducted by [2] proposes a new system that monitors coronary artery disease (CAD) using PPG using the SVM approach to classify. The data set used comes from the MIMIC-II database containing data on CAD patients. From this study, it can produce a sensitivity value of 85% and a specificity of 75% from all processed datasets, and it can be concluded that PPG can be used to diagnose CAD.

Research [9] wants to make a comparison of machine learning performance to predict coronary heart disease (CHD). This performance test uses several machine learning methods such as Random Forest, Decision Trees, and K-Nearest Neighbors. The data set used in this trial utilized the "Framingham Heart Study," which consisted of 4240 medical records. The accuracy of each method is 96.8% for Random Forest, 92.7% for Decision Trees, and 92.89% for K-Nearest Neighbors.

this study [10] tested several machine learning methods to detect CHD. Some of these methods are Naïve Bayes (NB), Support Vector Machine (SVM), and Decision Tree (DT). The South African disease data set was used in this study, with a total of 462 cases. The accuracy in this study was 0.705, 0.715, and 0.71 for the DT, NB, and SVM methods.

Previous related research will be used as a guide in doing this research. Still, there will be several factors that will be changed, such as the selection of the classification algorithm to be used and several other methods. Because no one has studied comparing methods for detecting CHD disease using PPG signals, this study conducted a classification to determine which method is the best for detecting CHD using PPG signals. The classification algorithm used in this research is Support Vector Machine (SVM), K-Nearest-Neighbors (KNN), and Decision Tree. The three classification methods will produce an accuracy score which will later be compared and get the best one. In addition, the data we take is also different from previous research because we collect data collectively so that the information we collect is relevant to the system we have built and tested.