ABSTRACT

Atrial fibrillation (AF) is a type of arrhythmia characterized by rapid and irregular electrical activity of the heart, which can increase the risk of stroke and heart failure if not detected early. This study aims to design and develop an atrial fibrillation detection system based on a Convolutional Neural Network (CNN) integrated with a portable ECG device, enabling early detection and independent monitoring by users.

The developed system utilizes an ADS1293 sensor to record cardiac electrical signals, which are then processed by an ESP32 microcontroller and transmitted to a mobile application. The signals undergo preprocessing for noise reduction, followed by feature extraction in the form of RR intervals and data segmentation as input to the CNN. The CNN model is designed for binary classification, distinguishing between normal and AF conditions.

Experimental results show that the system produces valid ECG signals with a sampling rate of 267 Hz, complete PQRST morphology, and heart rate values comparable to a reference oximeter. The system achieved an accuracy of 99.48% and an F1-Score of 97,80%. The mobile application is designed to display ECG signals, BPM values, and classification results (“normal” or “atrial fibrillation”). Thus, the system is not only effective for detection but also allows users to conveniently and efficiently monitor their heart condition independently.

Keywords*: *Atrial Fibrillation, Portable ECG, RR interval, Microcontroller, Convolutional Neural Network, Mobile Application.