Hybrid Approach for Cardiac Arrhythmia Classification

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Abstract: Cardiac arrhythmia is a hazardous disease that is characterized by an irregular heartbeat. Dysfunctional nodes in cardiac muscles lead to irregular rhythm of heartbeat patterns which induce severe health problems such as cardiac arrest. This irregular heartbeat could be either too slow (less than 60 beats /min) or fast (greater than 100 beats /min). This disease can happen to people at any age. Since it is a life-threatening disease, early arrhythmia diagnosis is useful to save lives. An Internet of Things platform is useful to modernize the health care sectors and this helps to save lives. An IOT platform for the prediction of arrhythmia disease using a device that continuously acquires the patient's ECG signal and processes the ECG signal. Using this device people can check their heart condition by the ECG signal in their home. While processing if there is an emergency it gives an alert to the physician. This helps the physician to analyze the disease as early as possible.

Keywords: ECG telemetry system, ECG sensor, Electrodes, Heart rate, Temperature.

I. INTRODUCTION

Cardiac arrhythmia is a severe disease that has to be diagnosed in its early stages. Arrhythmias are treatable by taking medicines or by following the procedures to control irregular heart rhythms. If not treated, arrhythmias can damage the heart and other organs also this cardiac arrhythmia is an abnormal heart rhythm that causes a pause between heartbeats. There may be no symptoms, alternatively including trouble breathing, chest pain, dizziness, fainting episodes, etc. If you experience any of such symptoms it's important to consult a healthcare professional. Treatment may include Medications, lifestyle changes, therapies, devices, and surgery. Ventricular arrhythmias are responsible for approximately 80% of cardiac death. Whereas ventricular arrhythmias are the abnormal heartbeat that makes the heart's lower chamber flutter instead of the pump. In a normal heart rhythm, the electrical activity in the heartbeat flows in the normal pattern. In an abnormal heart rhythm, the electrical activity in the heartbeat flows in an abnormal pattern. Cardiac arrhythmia is always referred to as abnormal heart rhythms. When the Electrocardiogram sensors are attached to the chest they acquire ECG signals and also detect the electrical activity of the heart. Prediction of arrhythmia could potentially be achieved by the computational technique that is supervised by machine learning algorithms. Most people also have occasional cardiac arrhythmia. Machine learning can be used to classify the different types of arrhythmia.

II. METHODOLOGY

This project consists of both hardware and software, the hardware part consists of an ECG sensor, heartbeat sensor, and Temperature sensor, The output of these sensors is processed by the microcontroller and written to things speak through the wi-fi module. Then data is read from the thing speak and processed by an ML program and the output is shown in a web application. In the software part, the ML program is trained by dataset this dataset is pre-processed. In pre-processing if any data is missing from the data set it is removed or zero is substituted in its place, then the data which are required to predict, and classify the arrhythmia is extracted from the dataset.

1classification Based on Algorithm:

In this project, 3 algorithms are used that is KNN, WKNN, and LR., KNN:
- K- the nearest algorithm is also known as K-NN, which is a direct learning classifier.
- K-NN is based on finding adjacent points which are like one another hence it is used to classify a single data point's grouping.
- It is also used to solve problems with regression, and it is also used as a classification tool.

WK-NN:

- Classifications of the datasets were done by using the WK-NN algorithm.
- We can also modify the previous WK-NN by adding weight concerning the sample number, which improves the accuracy of the classification of cardiac arrhythmia.
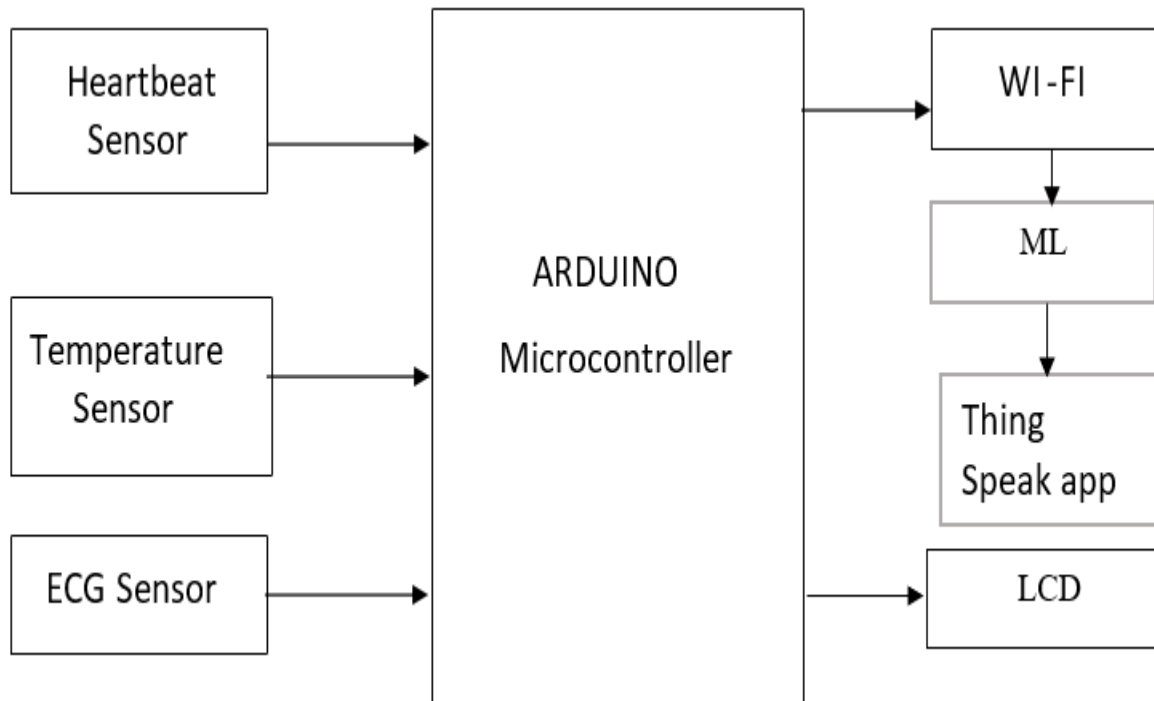

Figure 1: Block diagram of cardiac arrhythmia

LOGISTIC REGRESSION:

- Logistic regression is used to predict a dependent variable using predefined sets.
- For categorical dependent variables, logical regression is used to predict the outcome.
- As a result, the outcomes must be categorical or discrete.
- Logistic regression is used to address classification difficulties

III.   FLOWCHART

The working of cardiac arrhythmia is based on ML (machine learning). Pre-processing is the term for the adjustments we make to our data before sending it to the algorithm, as seen in the figure. Data Pre-processing is a method for transforming messy data into a tidy collection.

To put it another way, when data is collected from several sources, it is done so in a raw form that prevents analysis.
- Performing a NaN(not a number) check
- Checking for not a number is critical during data pre-processing. We were only able to find a few not a number in this try.
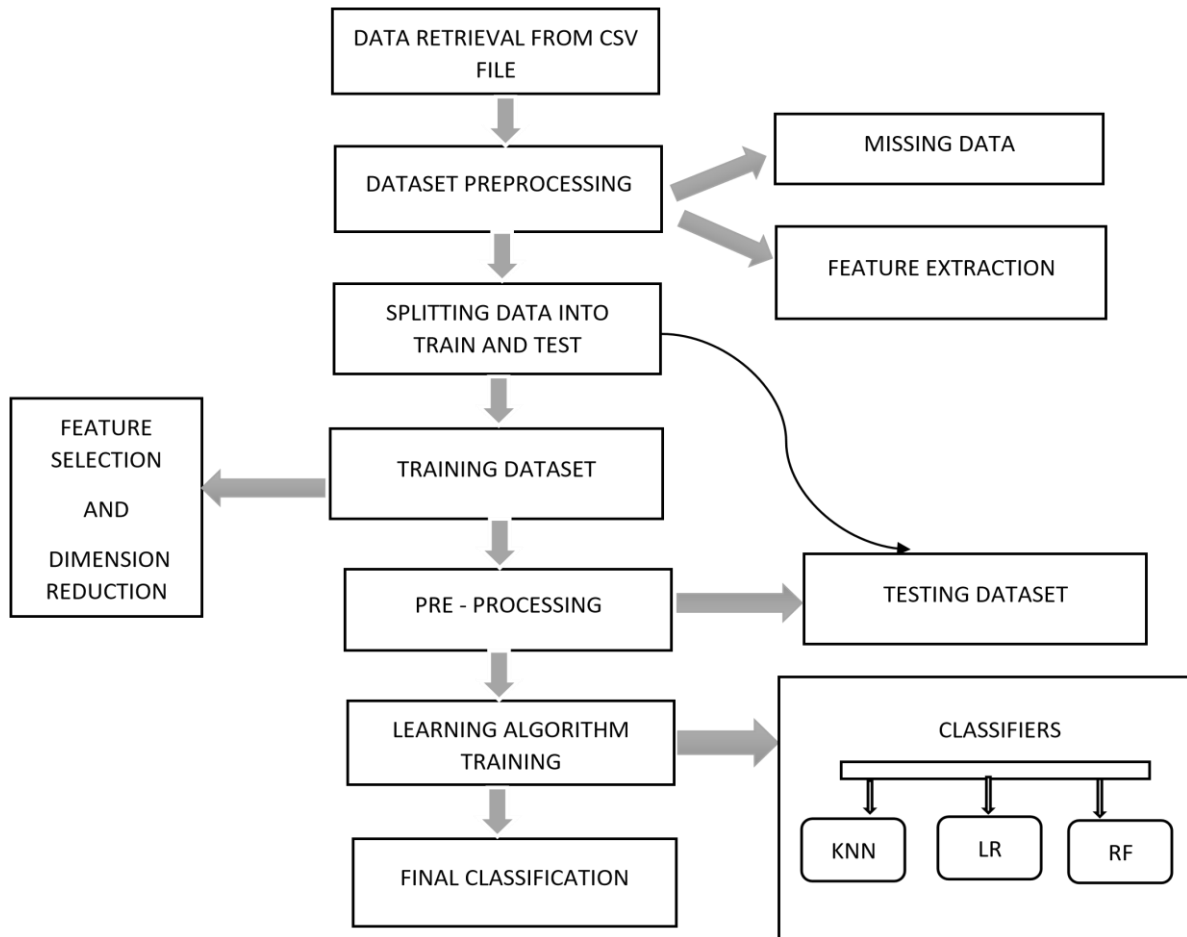
Figure 2: Flow chart of cardiac arrhythmia

- Changing the value of not a number.
- It's critical to get rid of the not a number values.

This may be accomplished by:

- Removing the whole column having a large number of not a number values.
- Method of forward fillna(). The fillna() method replaces the null values with a specified values.
- Method of backward fillna().
- Using the mean technique Data analysis Data analysis is the process of dissecting, sanitising, modifying, and modelling data with the aim of revealing relevant information, guiding deductions, and assisting in decision making. Data analysis has many different components and steps, including a wide variety of methods with different names that are applied in a number of business, scientific, and social science fields. Because it helps businesses to operate more efficiently and make more scientific judgments, data analysis is essential in today's business environment. Feature Extraction Feature extraction is the process of converting raw data into numerical traits that may be used while keeping the specifics of the original data set. Compared to just applying machine   learning to raw data, it produces superior outcomes. As a consequence, when training a dataset, it is possible to quantify how much each feature lowers impurity. The greater an attribute's ability to eliminate impurity, the more significant it is. In random forests, the impurity decrease from each feature may be averaged across datasets to determine the variable's final significance. Train and Test dataset It's time to fit the first machine learning model into your data once you've cleaned it up, visualised it, and learnt more about it. Creating two sets of data: one for training and one for testing.

Training Dataset: A portion of the data was used to fit the model.
The test dataset is used to objectively assess the final model's fit to the training dataset. Prediction and Accuracy Stated machine learning algorithms are taught to forecast the customer's smart phone decision. The ability to forecast the

customer's choice of smart phone is critical in helping smart phone makers improve their standards by observing what characteristics are important to customers when choosing a smart phone. Simply put, accuracy refers to how well your machine learning model predicts the proper class for a given observation.
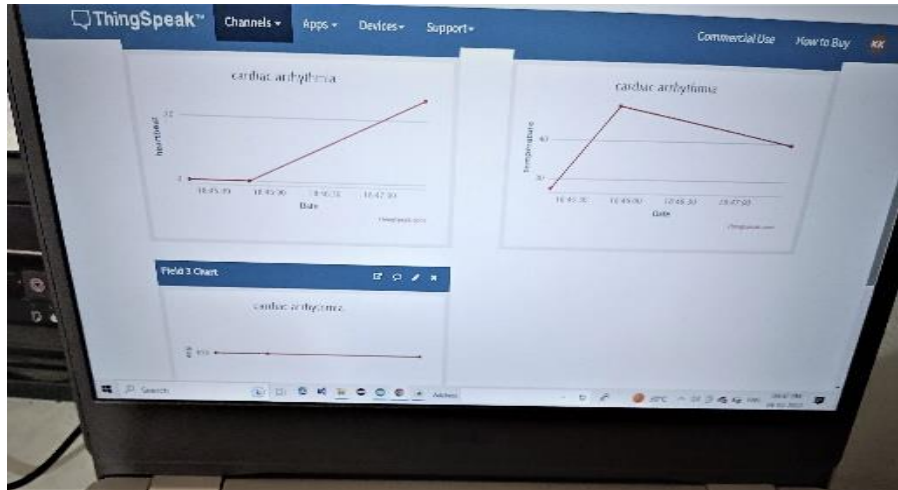
IV. RESULT ANALYSIS

Figure 3: Graphical representation of sensors

In this project we have built and designed a system that could robustly detect cardiac arrhythmia and classify it as one among the 13 board classification of cardiac arrhythmia by tracing the ECG wave, heartbeat, and temperature by using the web application which is also developed in this project, As discussed in the classification is based on the three machine learning algorithm namely Logistic regression, Weighted k-nearest neighbor, k-nearest neighbor as mentioned above have been used in prediction, the output and the precaution are sent to the patient.
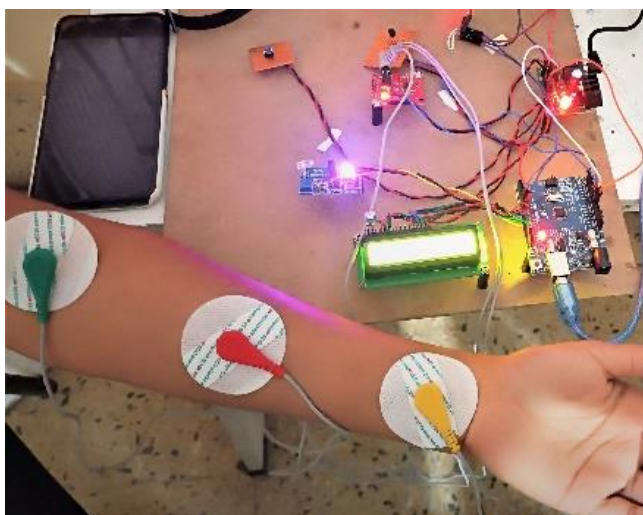

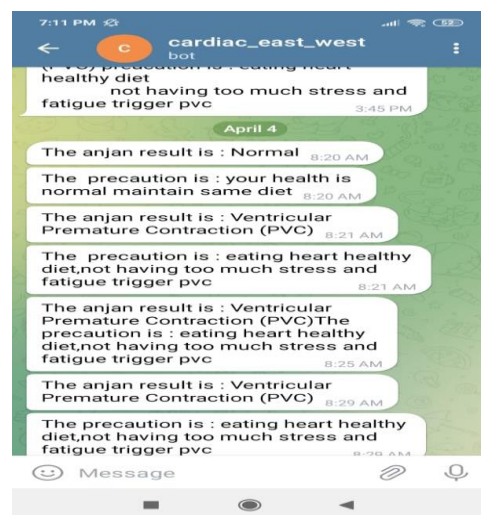Figure 4: Electrodes are connected to the ECG sensor

Figure 5: Snapshot of a message to a doctor

V. CONCLUSION

In conclusion, In this proposed work all the objectives were achieved, a website for the prediction of an healthy or unhealthy heartbeat in a person. As discussed in the result section the implementation of four ML algorithm can aid in the diagnosis of cardiac arrhythmias. It helps in the prediction of cardiac arrhythmia in its earliest stage. The earliest prediction would help to take precautions in earlier stages.

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