PROJECT REPORT

Date	
Team ID	PNT2022TMID50013
Project Name	Classification of Arrhythmia byUsing Deep Learning with 2 -D ECG Spectral Image Representation

1. INTRODUCTION

Project Overview

According to the World Health Organization (WHO), cardiovascular diseases (CVDs) are the number one cause of death today. Over 17.7 million people died from CVDs in the year2017 all over the world which is about 31% of all deaths, and over 75% of these deaths occur in low and middle-income countries. Arrhythmia is a representative type of CVD that refers to any irregular change from the normal heart rhythms. There are several types of arrhythmia including atrial fibrillation, premature contraction, ventricular fibrillation, and tachycardia. Although a single arrhythmia heartbeat may not have a serious impact on life, continuous arrhythmia beats can result in fatal circumstances. In this project, we build an effective electrocardiogram (ECG) arrhythmia classification method using a convolutional neural network (CNN), in which we classify ECG into seven categories, one being normal and the other six being different types of arrhythmia using deep two-dimensional CNN with grayscale ECG images. We are creating a web application where the user selects the image which is to beclassified. The image is fed into the model that is trained and the cited class will be displayed on the webpage.

Purpose

- The main purpose of this application is to make people awareness on their generalhealth.
- Know fundamental concepts and techniques of the Artificial Neural Network andConvolution Neural Networks
- Gain a broad understanding of image data.
- Work with Sequential type of modeling
- Work with Keras capabilities
- Work with image processing techniques
- know how to build a web application using the Flask framework.

2. LITERATURE SURVEY

Existing problem

- https://apps.apple.com/us/app/ecg/id1459546745

References

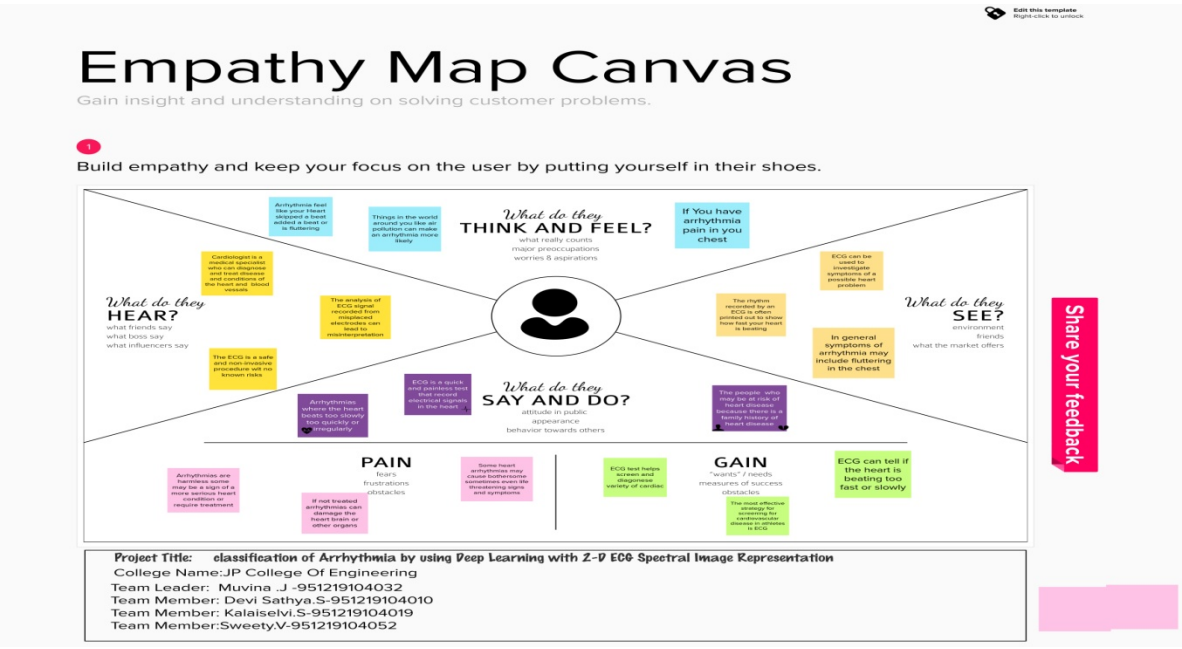
- https://www.researchgate.net/publication/341623436_Classification_o f_Arrhythmia_by_Using_Deep_Learning_with_2-D_ECG_Spectral_Imag e_Representation

Problem Statement Definition

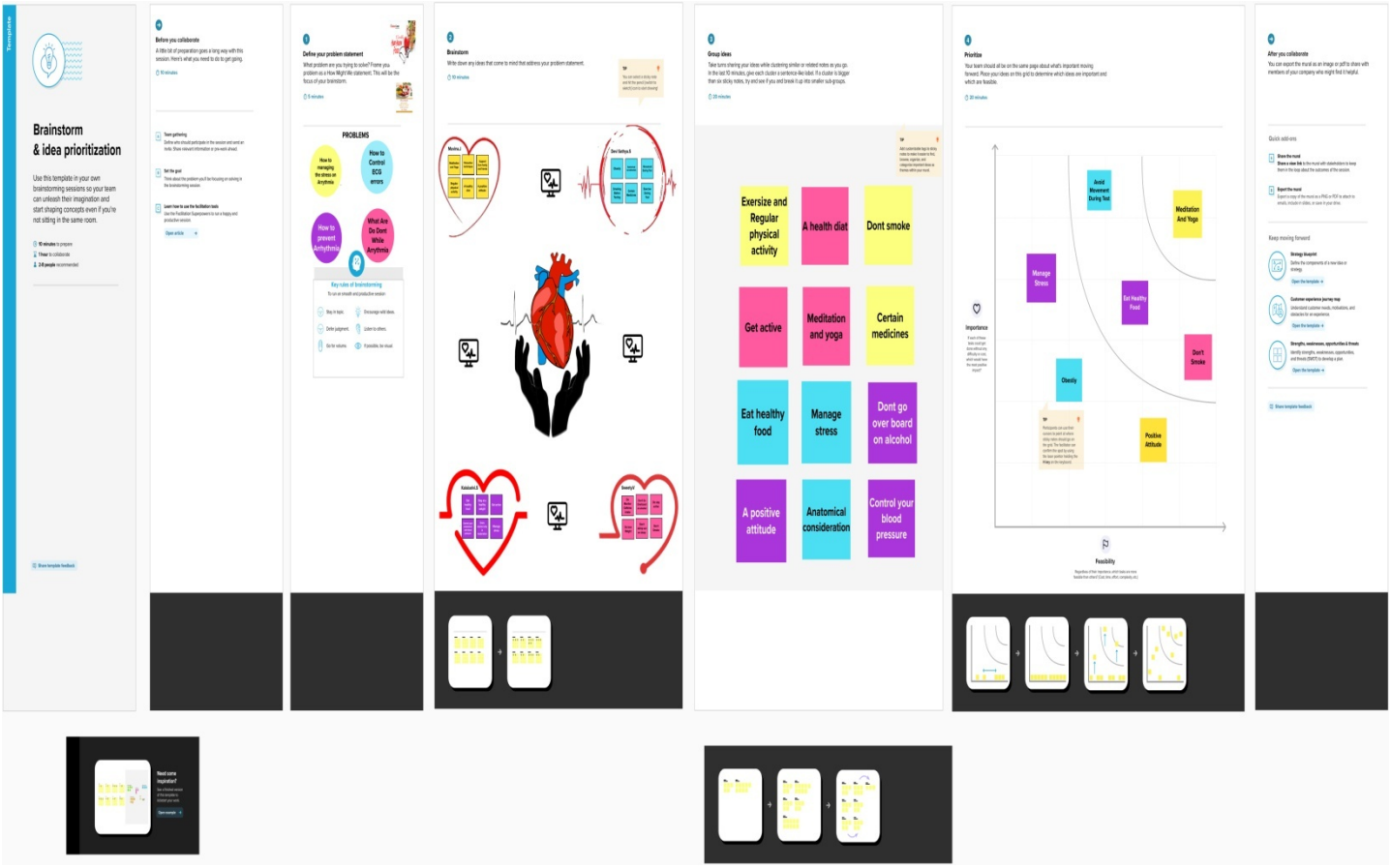
- According to the World Health Organization (WHO), cardiovascular diseases (CVDs)are the number one cause of death today.
- The annual number of deaths from CVD in India is projected to rise from 2.26 million(1990) to 4.77 million (2020).
- Arrhythmia is a representative type of CVD that refers to any irregular change from thenormal heart rhythms.

3. IDEATION & PROPOSED SOLUTION

Empathy Map Canvas



Ideation & Brainstoming



Proposed Solution

Project Design Phase-I

Proposed Solution Template

Date	24 September 2022
Team ID	PNT2022TMID50013
Project Name	Project – Classification Of Arrythmia By Using Deep Learning With 2-D ECG Spectral Image Representation
Maximum Marks	2 Marks

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Medicines are used to control abnormal heart rhythms . Ablation procedure can cure some types of arrhythmia completely. Eat Healthy Food. Excersie Regularly.
2.	Idea / Solution description	Vitamin C. Arrythmia and other heart conditions associated oxident strees and Immplamation
3.	Novelty / Uniqueness	Users can Identify the Type of Arrhythmia
4.	Social Impact / Customer Satisfaction	Avoid smoking, Maintain a regular healthy wait, keep blood pressure and cholestreol level under control
5.	Business Model (Revenue Model)	We can provide the application in a subscription based.
6.	Scalability of the Solution	Identify the type of heart disease. An ECG is used to how the Heart is functioning. It can give about importance of heart attack and Irregular beat.

Problem Solution fit

4. REQUIREMENT ANALYSIS

Functional requirement

FR No.	Functional Requirement(Epic)	Sub Requirement (Story / Sub-Task)
FR 1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
FR 2	User Confirmation	Confirmation via Email Confirmation via OTP
FR 3	User interface	Check your profile Choose your file Sign Out your account and change your password.
FR 4	Data processing	Evaluating the model using test data Training DL algorithm for a accuracy result Trained CNN model using Tensorflow,Kearas.
FR 5	Predict ECG image	User ECG images in our web application Collection of datasets Database read ECG images.

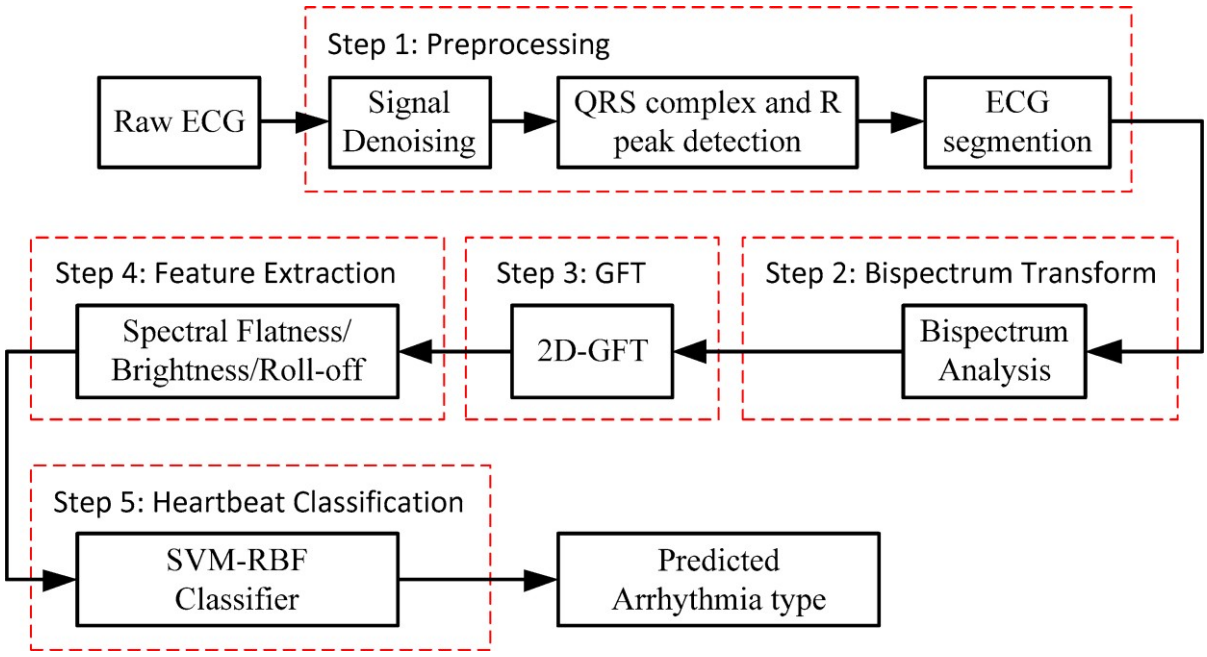
Non-Functional requirements

Non-Functional requirements

FR NO.	Non Functional Requirement	Description
NFR-1	Usability	Wireless ECG body sensor Savvy is a feasible solution for reliable and accurate long- term heart rhythm monitoring However there were on studies dealing with usability of this sensor ion field testing
NFR-2	Security	The work presented ion thispaper is applicable for encrypting and decrypting personalized Electrocardiograph ECG signals for secure transmission
NFR-3	Reliability	The extent to the consistently performs the specified functions without failure
NFR-4	Performance	It essentially specifies how the system should behave and that it constrains the ECG wavelength of accurate disease information gathering
NFR-5	Availability	Availability describes how likely the system is accessibleto a user at a given point on time and the periodically for a solutions
NFR-6	Scalability	The ability of the user problem ion arrhythmia disease to handle on increase ion workload without performance degradation or its ability to quickly enlarge

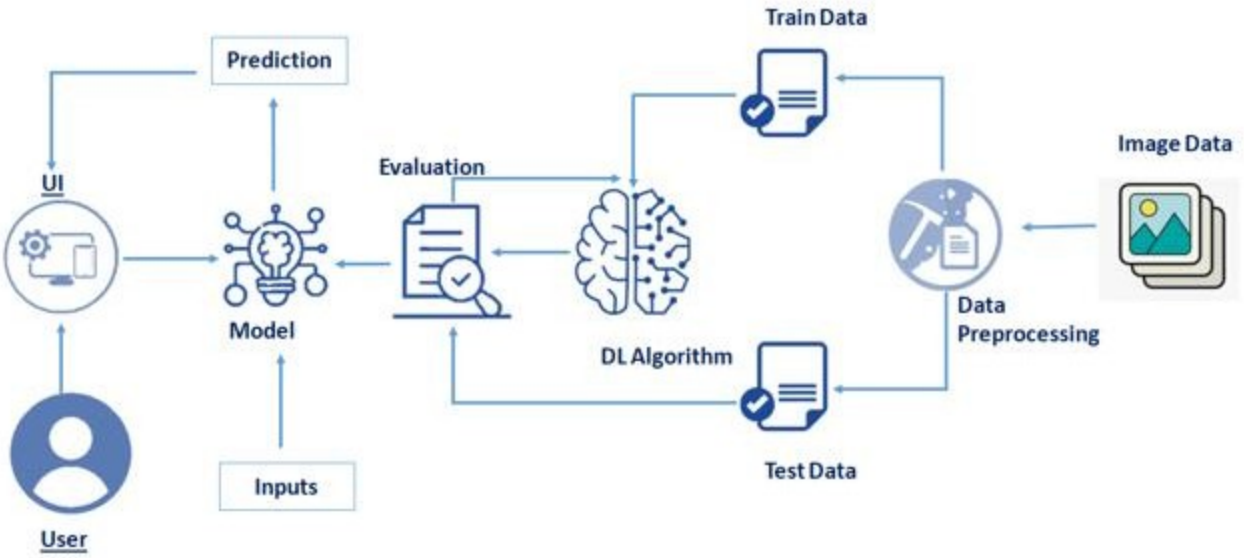
PROJECT DESIGN

Data Flow Diagrams



- A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within asystem.
- A neat and clear DFD can depict the right amount of the system requirement graphically.
- It shows how data enters and leaves the system, what changes the information, and where datais stored

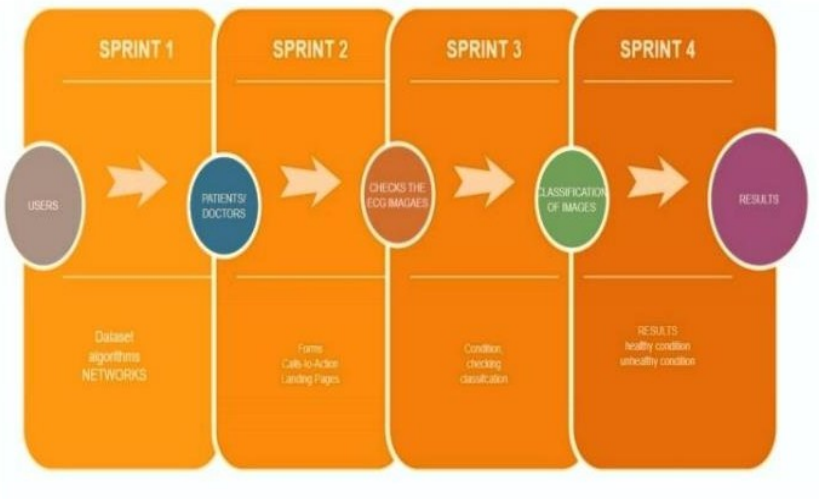
Solution & Technical Architecture



User Stories

5.PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation



Sprint Delivery Schedule

SPRINT 1:

- The team should conduct a survey of the project developed.
- The team should have a proof of the results been executed.
- The team should start by completing the

milestones.SPRINT 2:

- The team should monitor the efficiency of the process.
- The team should show a demo to the team mentors.
- The team should analyse the project

specifications.SPRINT 3:

- The team-mates should always work in coordination.
- The team-mates should understand the project work flow and structure.
- The team-mates should have a complete knowledge of the

project.SPRINT 4:

- The team should always be updating the project as per the recent trends andrequirements.
- The team should finally deploy and train the project.

- The team should always have a check on the result of the projects.

Reports from JIRA

5. CODING AND SOLUTIONING

Feature 1

```
import os
import numpy as np #used for numerical analysis
from flask import Flask,request,render_template
#  Flask-It is our framework which we are going to use to run/serve our application.
#request-for accessing file which was uploaded by the user on our application.
#render_template- used for rendering the html pages  from tensorflow.keras.models import
load_model#to load our trained model  from tensorflow.keras
.preprocessing import image    app=Flask(__name__)#our flask app
model=load_model('ECG.h5')#loading the model    @app.route
("/") #default route  def about():      return render_template("home.html")
#rendering html page    @app.route("/home")
#default route  def home():      return render_template("home.html")#rendering html page

@ app.route("/info")

#default route  def information():      return render_template("info.html")
  #rendering html page    @app.route("/upload") #default route  def test():      return
render_template("predict.html")
#rendering html page      @app.route("/predict",methods=["POST","GET"])
#route for our prediction  def upload():
 if request.method=='POST':
f=request.files['file'] #requesting the file basepath=os.path.dirname('__file__')
#storing the file directory filepath=os.path.join(basepath,"uploads",f.filename)
```

```
#storing the file in uploads folder f.save(filepath)

#saving the file   print("file save") img=image.load_img(filepath,target_size=(64,64))

 #load and reshaping the image x=image.img_to_array(img)

#converting image to array x=np.expand_dims(x,axis=0)                                    #changing the
dimensions of the image

##  pred=model.predict(x)                                                                  #predicting
classes

## y_pred = np.argmax(pred)
##print("prediction",y_pred)#printing the prediction

 preds=model.predict(x)#predicting classes

 pred=np.argmax(preds,axis=1)#predicting classes

  print("prediction",pred)#printing the prediction

  index=['Left Bundle Branch Block','Normal','Premature Atrial Contraction','Premature Ventricular
       Contractions', 'Right Bundle Branch Block','Ventricular Fibrillation']

      ## result=str(index[y_pred])result=str(index[pred[0]])return result
        #resturing the result      return None    #port = int(os.getenv("PORT"))  if __name__=="__main__":
        app.run(debug=False)#running our app      #app.run(host='0.0.0.0', port=8000)
```

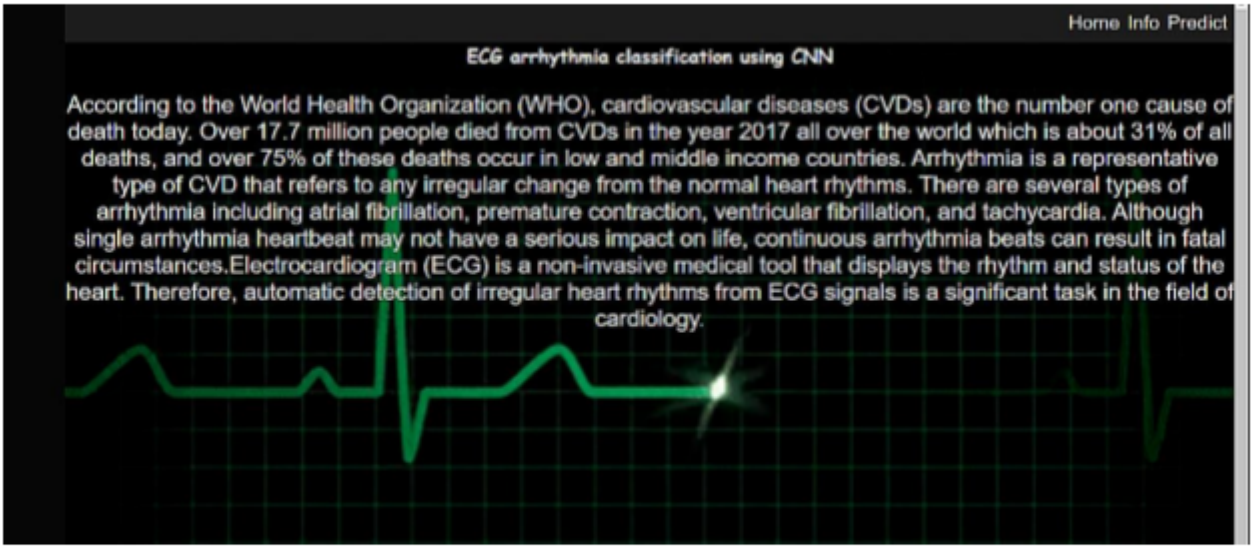
Feature 2

```
        <!DOCTYPE html>

    <html>                                                                                  <head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Home</title>
    <style>

    body {                  margin: 0px;           padding: 0px;           font-family: sans-serif;        }             /*
     .pd {

 padding-bottom: 100%;         } */

.navbar {             padding: 20px 0px 40px;         ;

background-color: #222;

 font-size: 25px;

 text-align: center;                }          .

navbar a {             color: #eee;             float: right;
```

```
   text-decoration: none;
font-style: normal;
font-family: sans-serif;
padding-right:
10px;         }                                                                                .navbar
a:hover {                                                                                  background-
color: rgb(0, 0, 0);                                                                          color:
rgb(17, 194, 238);                                                                               border-
radius: 5px;                                                                                  padding:
5px;         }         .content{             background-image: url("https://thumbs.gfycat.com/ChiefHeftyBasil-
small.gif");

 background-size: cover;
background-repeat: no-repeat;
height: 87vh;              margin-top: -21px;           }          .dic p {              color: white;      text-align: center;
font-family: sans-serif;              font-size: 30px;         }




   footer{                                                                                                  display:
flex;                                                                                  justify-content: center;
background-color: #222;
margin-top: -10px;
color: white;                 }                                                                                  </style>
</head>
<body>
<div class="navbar">
<a href="/upload">Predict</a>
<a href="/info">Info</a>
<a href="/home">Home</a>
</div>
<div  class="content">
<h2  style="display: flex;justify-content: center;
color:white;size:15;font-family:comic Sans MS">
ECG arrhythmia classification using CNN
</h2>
<div class="dic">
<p>According to the World Health Organization (WHO), cardiovascular diseases (CVDs) are the
number one cause of death today. Over 17.7 million people died from CVDs in the year 2017                all
over the world which is about 31% of all deaths, and over 75% of these deaths occur in low and middle
income countries. Arrhythmia is a representative type of CVD that refers to any irregular change from the
normal heart rhythms. There are several types of arrhythmia including atrial fibrillation, premature
contraction, ventricular fibrillation, and tachycardia. Although single arrhythmia heartbeat may not have a
serious impact on life, continuous  arrhythmia beats can result in fatal circumstances.Electrocardiogram
(ECG) is a non-invasive medical  tool that displays the rhythm and status  of the heart. Therefore,
automatic detection of irregular heart rhythms from ECG signals is a              significant task in the field
of cardiology.                                                                                  </p>
</div>
```

```
<footer>
 <h4>@All Rights Reserved</h4>

</footer>  </body>      </html>
```

OUTPUT:



6. TESTING

Test Cases

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Home page	3	0	3	3
Information page	6	1	1	5
Predict page	2	0	0	2
Final Report Output	4	0	0	4
Version Control	2	0	0	2

User Acceptance Testing

Team ID	PNT2022TMID19938
Project Name	Classification of Arrhythmia by Using Deep Lea
Maximum Marks	4 marks

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status
Navigation	Functional	Home Page	Validate all the tabs in the navigator		1.Enter URL and click go		All the three tabs should be visible	Working as	pass
Home	Functional	Home page	Verify the visibility of the video		1.Enter URL and click go		User should able to view the video	Working as	Pass
Home pageTC_002	Functional	Home Page	Validate the description of the image		1.Enter URL and click go		Description should be visible on	Working as	Pass
Home pageTC_003	Functional	Home Page	Verify the user is able to navigate to		1.Enter the URL and click go		It should redirect the user to the	Working as	pass
Inforation_page_T	Functional	Introductio	Verify the user is in the introduction		1.Enter the URL and click go		User should be in the introduction	Working as	pass
Information_	Functional	Introductio	Verify the page title and information		1. Enter the URL and click go		User should able to view the	Working	pass
Predict page	Functional	predict	Verify the working of predict page		1.Enter the URL and click go		User should be able to visit the	Working	pass
Predict page	Functional	predict	Verify the upload image option		1.Enter the URL and click go		Make sure the option works	Working	Pass
Predict	Functional	predict	Verify the choose button is enabled		1.Enter the URL and click go		The choose button option should	Working as	Pass
Predict	Functional	predict	Verify the user is able to access		1.Enter the URL and click go		Image should be uploaded	Working as	pass
Predict	Functional	predict	Verify the selected image is same		1.Enter the URL and click go		Selected image should be an ECG 2D	Working as	pass
Predict	Functional	predict	Verify the working condition of the		1.Enter the URL and click go		The type of arrhythmia should be	Working as	pass

7. ADVANTAGES & DISADVANTAGES

ADVANTAGES

- The proposed model predicts Arrhythmia in images with a high accuracy rate of nearly 96%
- The early detection of Arrhythmia gives better understanding of disease causes, initiates therapeutic interventions and enables developing appropriate treatments.

DISADVANTAGES

- Not useful for identifying the different stages of Arrhythmia disease.

➤ Not useful in monitoring motor symptoms.

8. CONCLUSION

- In this project, we proposed a 2-D ECG-based classification model forautomatic classification of cardiac arrhythmias using ECG signals.
- An accurate taxonomy of ECG signals is extremely helpful in the prevention and diagnosis of CVDs.

These results indicate that the prediction and classification of arrhythmia with 2-D ECG representation spectrograms and the CNN model is a reliable operative technique in the diagnosis of CVDs.

- It is endowed with an ability to effectively process the non-filtered dataset with its potential anti-noise features. Besides that, ten-fold cross-validation is implemented in this work to further demonstrate the robustness of the network.

9. FUTURE SCOPE

- ✔ For future work, it would be interesting to explore the use of optimization techniques to find a feasible design and solution.
- ✔ The limitation of our study is that we have yet to apply any optimization techniques to optimize the model parameters and we believe that with the implementation of the optimization, it will be able to further elevate the performance of the proposed solution to the next level.

10. APPENDIX

Demo Link: IBM-Project-41147-1660639817/Demo video.mp4