NAALAIYA THIRAN PROJECT - 2022
19ECI01-PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

DETECTION PARKINSON'S DISEASE USING MACHINE LEARNING

PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this report **"DETECTION PARKINSON'S DISEASE USING MACHINE LEARNING"** is the bonafide work of **DHIVYA V (420719104008), PASCA MARY C (420719104022), SATHYAPRIYA S (420719104033) AND SHANMATHI M (420719104035)** who carried out **HX 8001 PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP** project offered by IBM and Anna University, Chennai.

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PROJECT CALENDER

Phase	Phase Description	Week	Dates	Activity Details
1	Preparation Phase (Pre-requisites, Registrations, Environment Set-up, etc.)	2	22 - 27 Aug 2022	Creation GitHub account & collaborate with project repository in project workspace
2	Ideation Phase (Literature Survey, Empathize, Defining Problem Statement, Ideation)	2	29 Aug – 3rd Sept 2022	Literature survey (Aim, objective, problem statement and need for the project)
		3	5 - 10th Sept 2022	Preparing Empathy Map Canvas to capture theuser Pains & Gains
		4	12 - 17 Sept 2022	Listing of the ideas using brainstorming session
3	Project Design Phase -I (Proposed Solution, Problem- Solution Fit, Solution Architecture)	5	19 - 24 Sept 2022	Preparing the proposed solution document
		6	26 Sept - 01 Oct 2022	Preparing problem - solution fit document &Solution Architecture
4	Project Design Phase -II (Requirement Analysis, Customer Journey, Data Flow Diagrams, Technology Architecture)	7	3 - 8 Oct 2022	Preparing the customer journey maps
		8	10 - 15 Oct 2022	Preparing the Functional Requirement Document & Data- Flow Diagrams and Technology Architecture
5	Project Planning Phase (Milestones& Tasks, Sprint Schedules)	9	17 - 22 Oct 2022	Preparing Milestone & Activity List, Sprint Delivery Plan
6	Project Development Phase (Coding & Solutioning, acceptance Testing, Performance Testing)	10	24 - 29 Oct 2022	Preparing Project Development - Delivery of Sprint-1
		11	31 Oct - 5 Nov 2022	Preparing Project Development - Delivery of Sprint-2
		12	7 - 12 Nov 2022	Preparing Project Development - Delivery of Sprint-3
		13	14 - 19 Nov 2022	Preparing Project Development - Delivery of Sprint-4

Project Report Format

1. **INTRODUCTION**
   - 1.1 Project Overview
   - 1.2 Purpose
2. **LITERATURE SURVEY**
   - 2.1 Existing problem
   - 2.2 References
   - 2.3 Problem Statement Definition
3. **IDEATION & PROPOSED SOLUTION**
   - 3.1 Empathy Map Canvas
   - 3.2 Ideation & Brainstorming
   - 3.3 Proposed Solution
   - 3.4 Problem Solution fit
4. **REQUIREMENT ANALYSIS**
   - 4.1 Functional requirement
   - 4.2 Non-Functional requirements
5. **PROJECT DESIGN**
   - 5.1 Data Flow Diagrams
   - 5.2 Solution & Technical Architecture
   - 5.3 User Stories
6. **PROJECT PLANNING & SCHEDULING**
   - 6.1 Sprint Planning & Estimation
   - 6.2 Sprint Delivery Schedule
   - 6.3 Reports from JIRA
7. **CODING & SOLUTIONING (Explain the features added in the project along with code)**
   - 7.1 Feature 1
   - 7.2 Feature 2
   - 7.3 Database Schema (if Applicable)
8. **TESTING**
   - 8.1 Test Cases
   - 8.2 User Acceptance Testing
9. **RESULTS**
   - 9.1 Performance Metrics
10. **ADVANTAGES & DISADVANTAGES**
11. **CONCLUSION**
12. **FUTURE SCOPE**
13. **APPENDIX**

    Source Code

    GitHub & Project Demo Link

Project Report
Detection of Parkinson's Disease using Machine Learning

Date	19 -11-2022
Team Members	Dhivya.V Pasca mary.C Sathyapriya.S Shanmathi.M
Project Name	Detecting Parkinson's Disease using Machine Learning

Parkinson's disease:

*****Parkinson's disease is a brain disorder that causes unintended or uncontrollable movements, such as shaking, stiffness, and difficulty with balance and coordination.

∗ Symptoms usually begin gradually and worsen over time. As the disease progresses, people may have difficulty walking and talking. They may also have mental and behavioral changes, sleep problems, depression, memory difficulties, and fatigue.

∗ While virtually anyone could be at risk for developing Parkinson's, some research studies suggest this disease affects more men than women. It's unclear why, but studies are underway to understand factors that may increase a person's risk.

Project objective

- ∗ To understand the problem for to classify if it is a regression or a classification kind of problem.
- ∗ To pre-process the image by using different data pre-processing techniques.
- ∗To implement the algorithm by using OpenCV framework and machine learning to automatically detect Parkinson's disease in hand-drawn images of spirals and waves.
- ∗To know how to find the accuracy of the model.
- ∗To build web application using the Flask framework that features the detection of Parkinson's Disease

LITERATURE SURVEY

1. Jie Mei, Christian Desrosiers, Johannes Frasnelli, "Machine Learning for the Diagnosis of Parkinson's Disease," 2021.

This paper conveys extremely about the importance of Diagnosis of Parkinson's disease (PD) is commonly based on medical observations and assessment of clinical signs, including the characterization of a variety of motor symptoms. However, traditional diagnostic approaches may suffer from subjectivity as they rely on the evaluation of movements that are sometimes subtle to human eyes and therefore difficult to classify, leading to possible misclassification. In the meantime, early nonmotor symptoms of PD may be mild and can be caused by many other conditions.

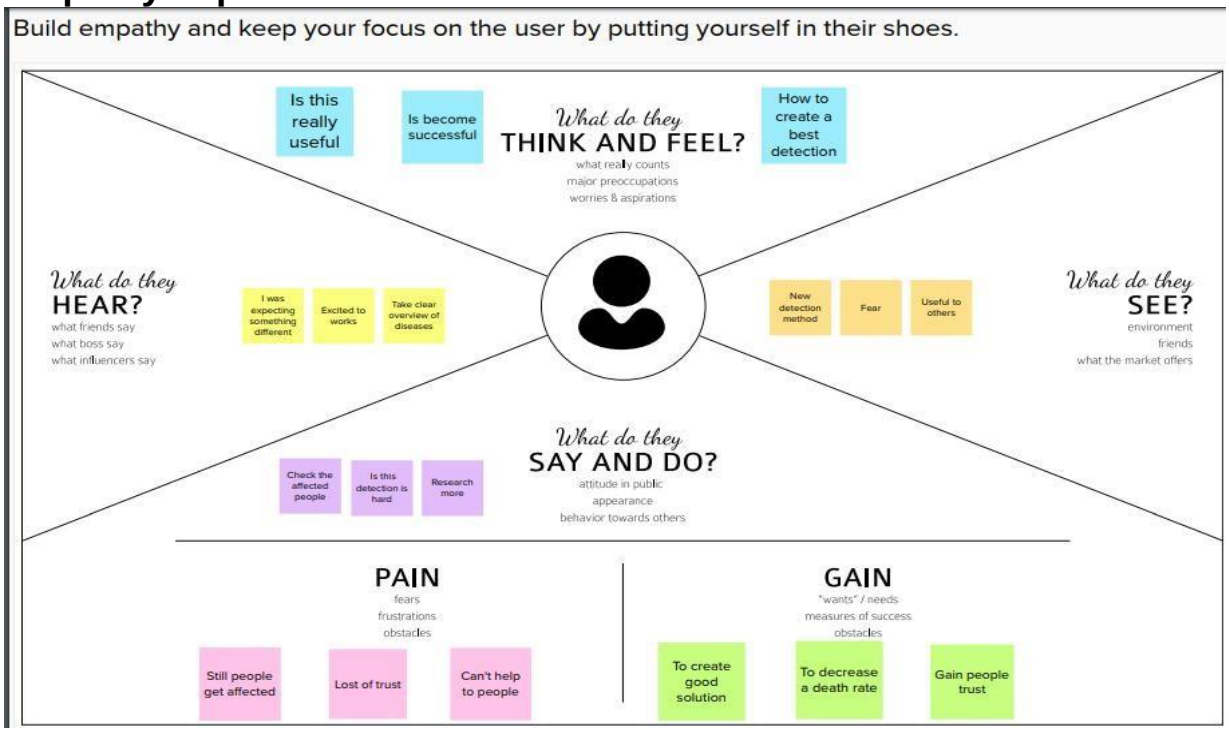
Therefore, these symptoms are often overlooked, making diagnosis of PD at an early stage challenging. To address these difficulties and to refine the diagnosis and assessment procedures of PD, machine learning methods have been implemented for the classification of PD and healthy controls or patients with similar clinical presentations (e.g., movement disorders)

Problem Statement

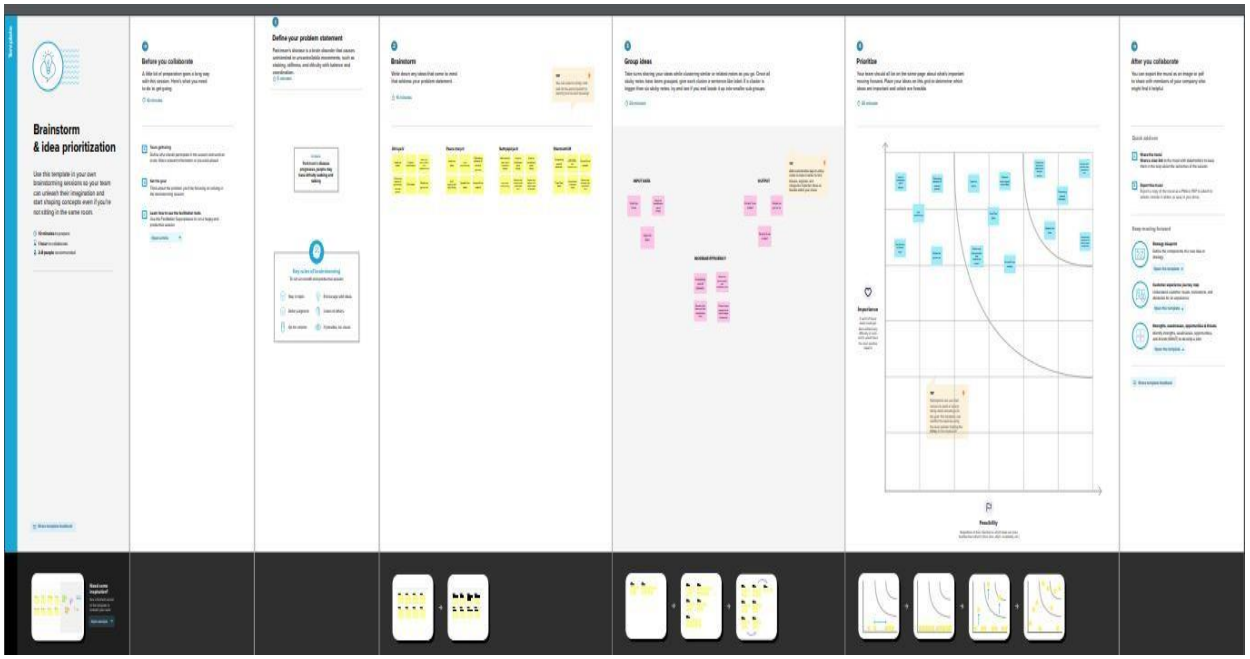
Problem statement	I am (customer	I'm trying to	But	Because	Which makes me feel
PS-1	Patient	Detected the PD affected person	Many detection methods are existing. But accurate and clear detection method is still doesn't exist	Measuring the speed and pressure of the pen is not always give a accurate results	Frustrated

IDEATION & PROPOSED SOLUTION

Empathymap



Ideation & Brainstorming



Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	MorethanMillionpeoplearelivingwithParkinson's Disease worldwide, according to the Parkinson's Foundation. While Parkinson's cannot be cured,early detection along with proper medication can significantly improve symptoms and quality of life.
2.	Idea / Solution description	this project, We are using, Histogram of Oriented Gradients (HOG) image descriptor along with a Random Forest classifier to automatically detect Parkinson's disease in hand-drawn images of spirals and waves.
3.	Novelty / Uniqueness	HOG descriptors are powerful to detect images with occlusions, pose and illumination changes because they are extracted in a regular grid. For the regions of the image it generates histograms using the magnitude and orientations of the gradient. HOG can be used to detect small-scaled images with less computational power, which means you can run HOG without having a powerful GPU. Hence, the accuracy is highly reliable.

4.	Social Impact / Customer Satisfaction	Parkinson's disease is the 14th leading cause of death in the United States, according to the Center for Disease Control, and more people currently live with it than those with multiple sclerosis, muscular dystrophy, and ALS combined. Though we cant cure it,identifying it in soon can improve the lifespan.
5.	Business Model (Revenue Model)	Early detection along with proper medication can significantly improve symptoms and quality of life. Our model can be used by hospitals to detect in early stages, which can be profit for them.
6.	Scalability of the Solution	scalability in our project is achieved by combining Statistics, ML, and Data Mining into flexible, scalable, and often nonparametric techniques. the projectionis done at image-level and therefore thecomputational cost is linear in the number of views, in our model every view is approximated at featurelevel as a linear combination of the pre-computedviews. As a result, once the views have beencomputed, the cost of computing new views is almostnegligible. This allows the model to be evaluated onmany more viewpoints.

REQUIREMENT ANALYSIS

Functional requirement

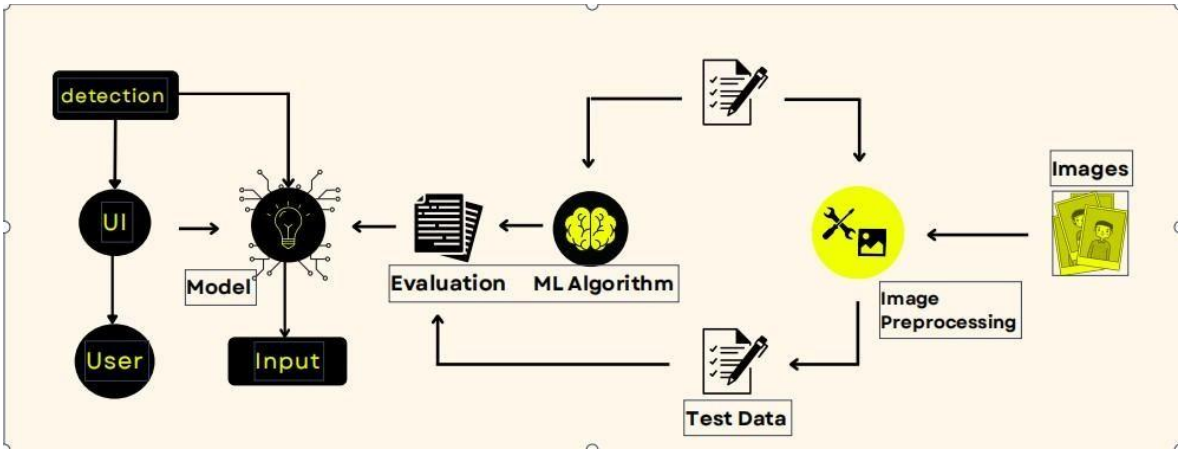
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through Phone
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP Confirmation via Call
FR-3	User details collection	Collection through forms Collections through google Upload to database
FR-4	Test application Form	Collect details Collect Payment fee if applicable Proceed to test window if payment done
FR-5	Upload image	Upload through files Upload through camera Draw on screen
FR-6	Test report generation	Classify the given image Associate with database Generate report

Non-Functional requirements

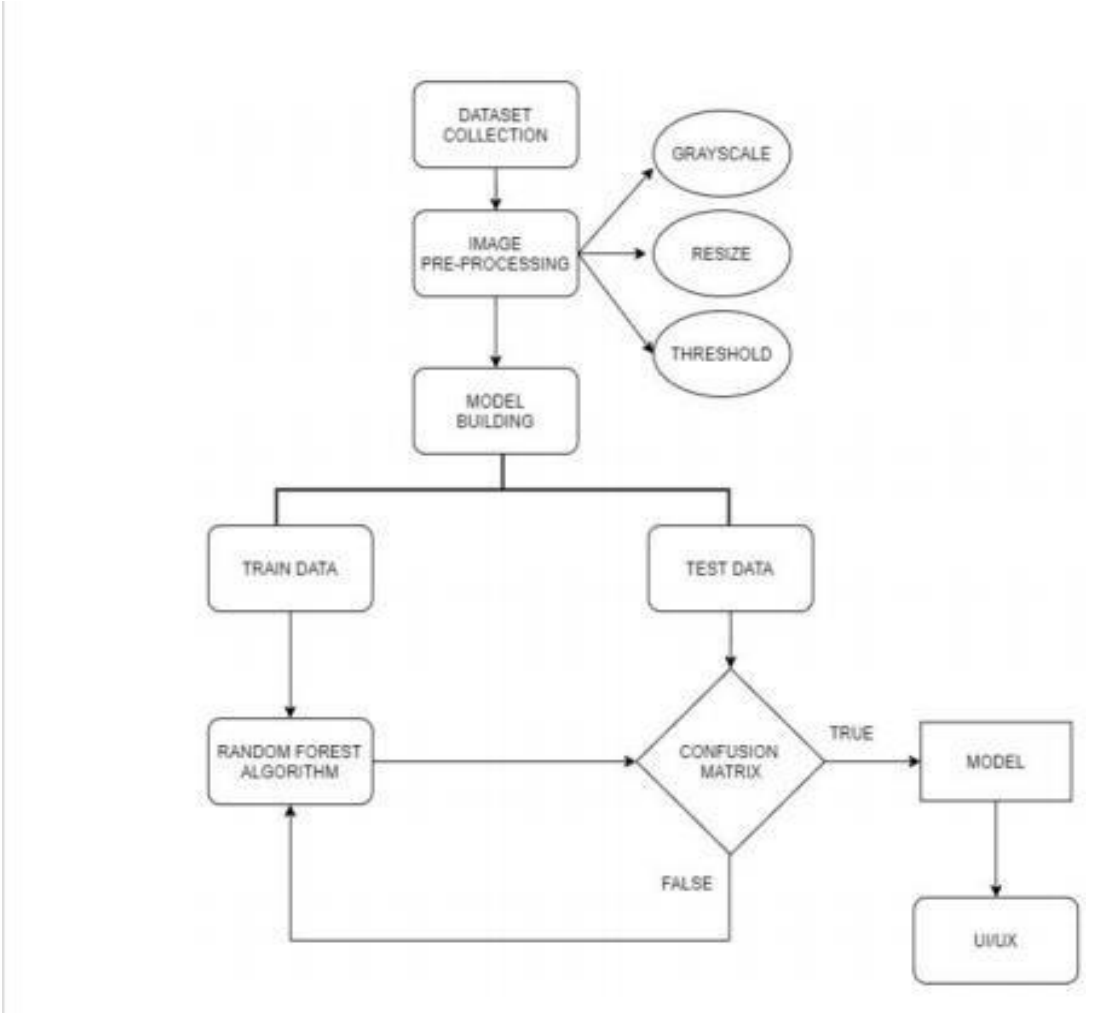
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Any smart phone with adequate camera requirements and networks access
NFR-2	**Security**	Cloud based communication hence secure as it is already provided by cloud vendor
NFR-3	**Reliability**	Reliable as the machine learning model is accurate
NFR-4	**Performance**	Fast as classification is efficient
NFR-5	**Availability**	Supports remote locations as it is web based
NFR-6	**Scalability**	Highly scalable and with more images, the model's accuracy can be improved

PROJECT DESIGN

Data Flow Diagrams



Solution & Technical Architecture



PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Upload Images	USN-1	As a user, I can upload the images in the website in order to obtain the prediction result of Parkinson's disease	2	High	1.Dhivya 2.pasca mary 3.Sathyapriya 4.Shanmathi

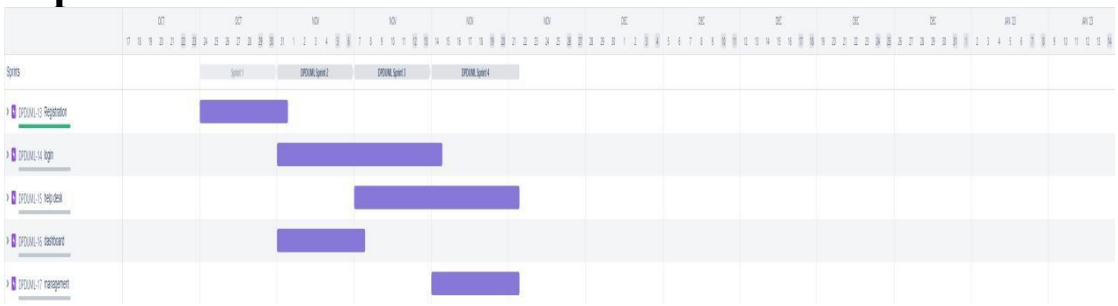
Sprint-4	Test Vital Page	USN-2	As a user, I will get the prediction result and accuracy on the test vital page.	3	High	1.Dhivya 2.Pasca mary 3.Sathyapriya 4.Shanmathi

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Dashboard	USN-3	Dashboard displays the symptoms, causes and medications for the Parkinson disease	2	Low	1.Dhivya 2.Pasca mary 3.Sathyapriya 4.Shanmathi
Sprint-1	Data Collection	USN-4	As an Administrator, I need to collect data (images of spirals and waves drawn by healthy people and Parkinson's patients).	2	High	1.Dhivya 2.Pasca mary 3.Sathyapriya 4.Shanmathi

Sprint-1	Data Pre-Processing	USN-5	As an Administrator, I should clean my data and prepare it for model building by doing pre-processing activities such as resizing, visualizing the dataset and converting from RGB to grayscale	2	High	1.Dhivya 2.Pasca mary 3.Sathyapriya 4.Shanmathi
Sprint-2	Model Building	USN-6	As an Administrator, I need to build the model using Random Forest Classifier for spiral images and Convolutional Neural Networks (CNN) for wave images	3	High	1.Dhivya 2.Pasca mary 3.Sathyapriya 4.Shanmathi
Sprint	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Story Points**	**Priority**	**Team Members**
Sprint-3	Deployment of Model	USN-7	As an Administrator, I need to deploy the Machine Learning model that was built.	2	Medium	1.Dhivya 2.Pasca mary 3.Sathyapriya 4.Shanmathi

Sprint-3	Building Frontend of the application	USN-8	As an Administrator, I need to build the website for the application using HTML, CSS etc.	2	High	1.Dhivya 2.Pasca mary 3.Sathyapriya 4.Shanmathi
Sprint-4	Connecting the ML model, Frontend and Backend	USN-9	As an Administrator, I can integrate the deployed model and web application using python flask server.	3	High	1.Dhivya 2.Pasca mary 3.Sathyapriya 4.Shanmathi

Report from JIRA



TESTING

TEST CASE

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute
TC_001	Functional	Home Page	Verify user is able to visit home page	PC or Laptop & URL	1. Login and enter the input data 2. Verify home page accessibility
TC_002	Functional	Info Page	Verify user to view the information about PD	PC or Laptop, URL & Hand-Drawn Image	1. Enter the input data and click predict 2. Verify whether upload button is working or no
TC_003	UI	Login page	Verify user is able to login if already signed in	PC or Laptop, URL & Hand-Drawn Image	1. Enter email id and password 2.click to go next page
TC_004	UI	Register page	Verify user is able to register if they are new user	PC or Laptop & URL	Enter the Name , Email id and Password to register
TC_005	Functional	user page	When the user uploads the image the, page is redirected for prediction	Hand Drawn Images	2. Upload the image and click predict
TC_006	Functional	user page	Process the uploaded image with high accuracy	Hand Drawn Images	2.Internal Process by the Model
TC_007	UI	Logout(user page)	verify the user is able to logout	PC or Laptop & URL	click logout to exit

Steps To Execute	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/	Executed By
1. Login and enter the input data 2. Verify home page accessibility	User able to visit home page	Working as expected	Pass	Easy to access	N	Harsika T K K
1. Enter the input data and click predict 2. Verify whether upload button is working or not	User is able to view the info page	Working as expected	Pass	Less time taken	N	Jothyshivani S
1. Enter email id and password 2.click to go next page	User able to Login	Working as expected	Pass	Less time taken	N	Amirthavarshini T R Preethi K
Enter the Name , Email id and Password to register	User able to Register	Working as expected	Pass	Less time taken	Y	Harsika T K K
2. Upload the image and click predict	User able to upload the spiral / wave image	Working as expected	Pass	Easy to identify the upload button	Y	Amirthavarshini T R
2.Internal Process by the Model	User able to See their result	Working as expected	Pass	Accurate result	Y	Preethi K
click logout to exit	user able to logout	Working as	Pass	Less time taken	Y	Jothyshivani S

User Acceptance

1. Purpose of Document

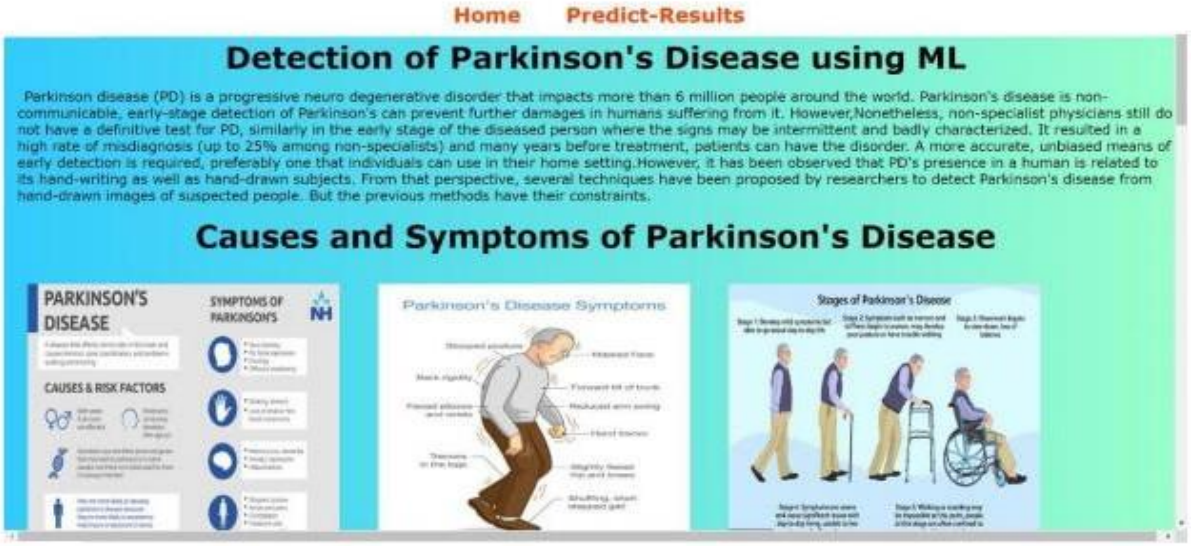
The purpose of this document is to briefly explain the test coverage and open issues of the Detecting Parkinson's Disease using Machine Learning project at the time of the release to User Acceptance Testing (UAT).

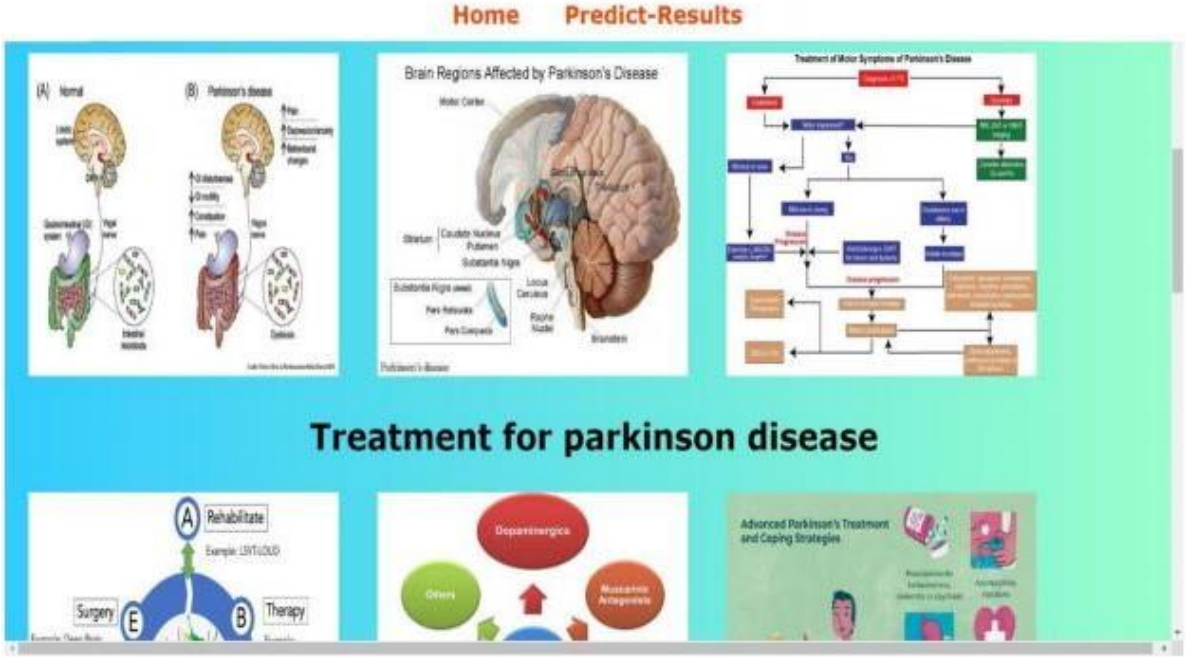
This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Login/Register Page	8	0	0	8
Home Page	1	0	0	1
Logout Page	2	0	1	1
Prediction	10	0	0	10
Version Control	2	0	0	2

Result

Home Page





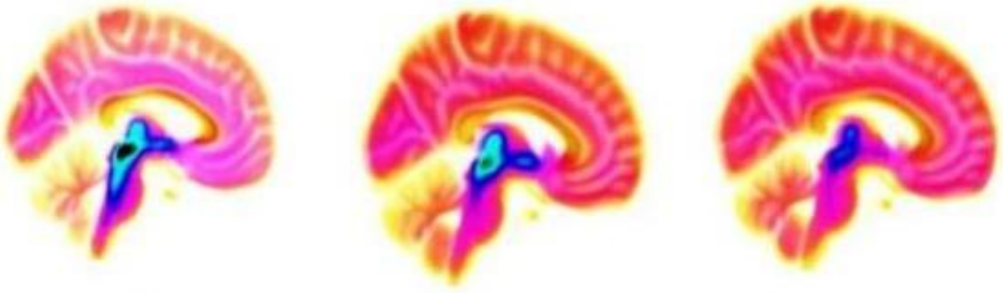
Home Predict-Results

Treatment for parkinson disease

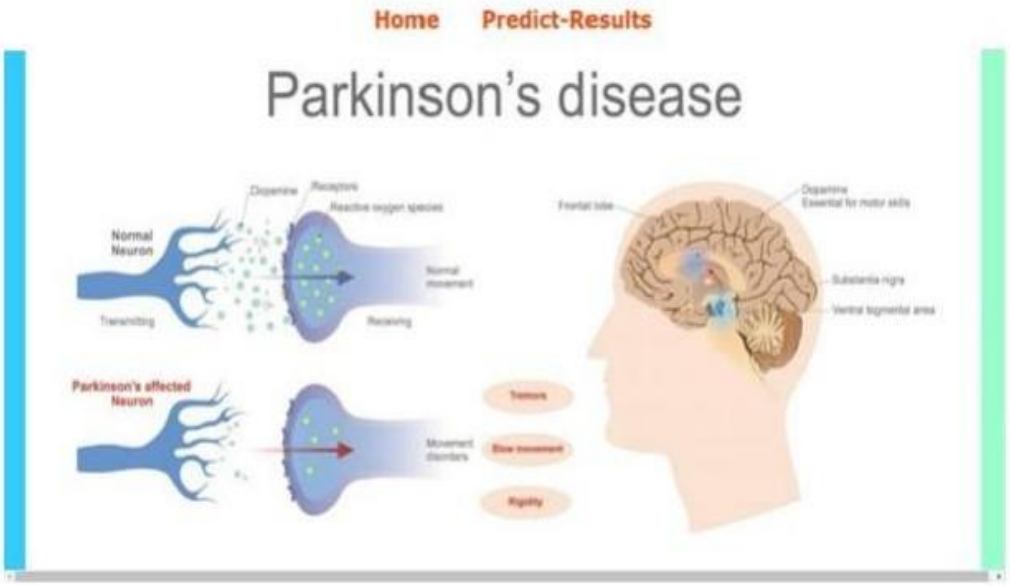
How brains looks during PD?

Home Predict-Results

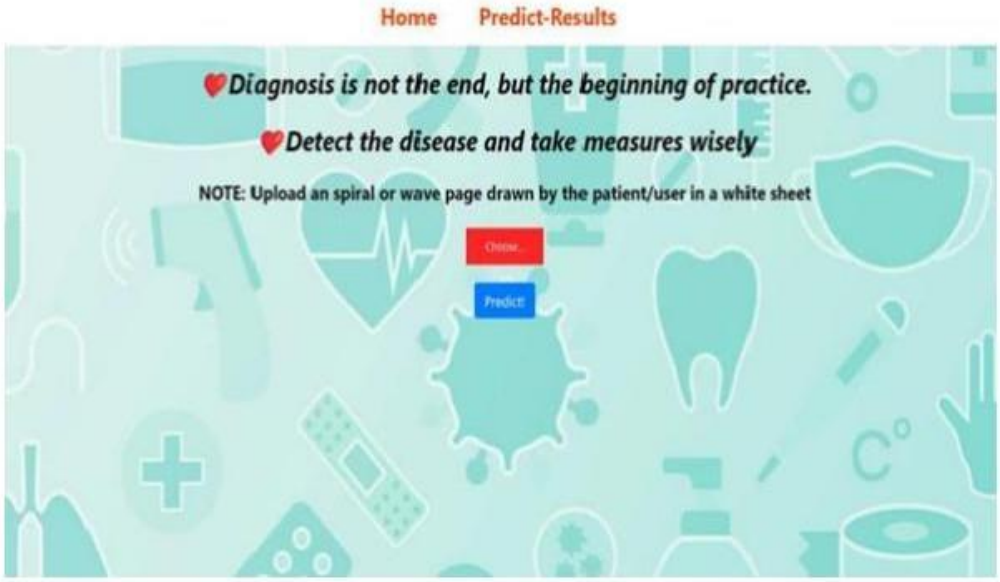
How brains looks during PD?



Healthy | Parkinson's Disease before symptoms | Parkinson's Disease after symptoms



Test-Vital Page



Predicted Result of Spiral/Wave Image

ADVANTAGES & DISADVANTAGES

Advantages

● We developed a model using the XG Boost Classifier using sklearn module of python to detect if an individual has Parkinson's Disease or not. We got the machine learning model with 96.61% accuracy, which is good as our dataset contains good labels and values.

● More accuracy in the model

● The data of any person can be entered in db to check whether the person is affected by Parkinson's disease or not.

Disadvantages

● Packages to be installed

● It produces fake results if the input data is entered wrong

Conclusion

Parkinson's disease affects the CNS of the brain and has yet no treatment unless it's detected early. Late detection leads to no treatment and loss of life. Thus, its early detection is significant. Machine Learning techniques is used to improve the accuracy of early diagnosis significantly. So, our Machine Learning model can help doctors and assist them in detecting Parkinson's disease at an earlier stage and increase the chances of survival.

Future Scope

Following years of minimal progress in the treatment of Parkinson's disease, pioneering pipeline therapies such as those previously discussed offer hope to those affected by this devastating condition.

APPENDIX

Github Link

Respiratory link: https://github.com/IBM-EPBL/IBM-Project-3855-1658656869.git

GitHub & Project Demo Link: https://drive.google.com/open?id=1ukRcwS959rD-H-ApT2CwERvAMZ-uSSsC&authuser=dhivya.v%40ckcet.ac.in&usp=drive_fs