PROJECT REPORT -

DETECTION OF PARKINSON'S DISEASE USING MACHINE LEARNING

TEAM ID: PNT2022TMID24825

TEAM LEADER:

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KRISHNA VAMSI P

ALAHARI ARYAN

1. INTRODUCTION:

1.1 Project Overview

Parkinson’s Disease is one of the most overlook, underrated diseases that most affect humankind. It is hard to live for any person that has the disease which is discovered later in their lifetime. Here in this project, we try to solve this issue by constructing a solution that can predict the disease in the earlier stages of the person’s life with the help of their hand-drawn spiral and wave images. We have created a Machine Learning model to calculate the result and produce a clear output.

1.2 Purpose

Parkinson's disease (PD) is a complex neurodegenerative disease. Accurate diagnosis of this disease in the early stages is crucial for its initial treatment. This disease cripples the person for life. If diagnosed earlier, there are few treatments that can slow down the disease and give the person a few extra healthy years to live independently. It is important that we must find a solution to solve the same. Even though the disease is not preventable or curable but diagnosing it earlier can help a lot in terms of treatment.

2. LITERATURE SURVEY:

2.1 Existing Problem:

There is no accurate method to detect the Parkinson's disease. So, we created a real-time application to detect the Parkinson's disease.

2.2 References:

[1] Early Identification of Parkinson's Disease from Handrawn Images using Histogram of Oriented Gradients and Machine Learning Techniques - Ferdib-Al-Islam, Laboni Akter.

[2] Prediction of Parkinson's Disease using Machine Learning and Deep Transfer Learning from different Feature Sets -Supriya Kamoji, Dipali Koshti, Valiant Vincent Dmello, Alrich Agnel Kudel, Nash Rajesh Vaz

[3] Parkinson's Disease Detection from Spiral and Wave Drawings using Convolutional Neural Networks: A MultiStage Classifier Approach - Abyasachi Chakraborty, Satyabrata Aich, Jong-Seong-Sim, EunyoungHan, Jinse Park, Hee-Cheol Kim

[4] An Early Detection of Parkinson's Disease from Geometric Drawings - Vishal Nandan Medhi, Kaustav Moni Basumatary, R Murugan, TriptiGoel

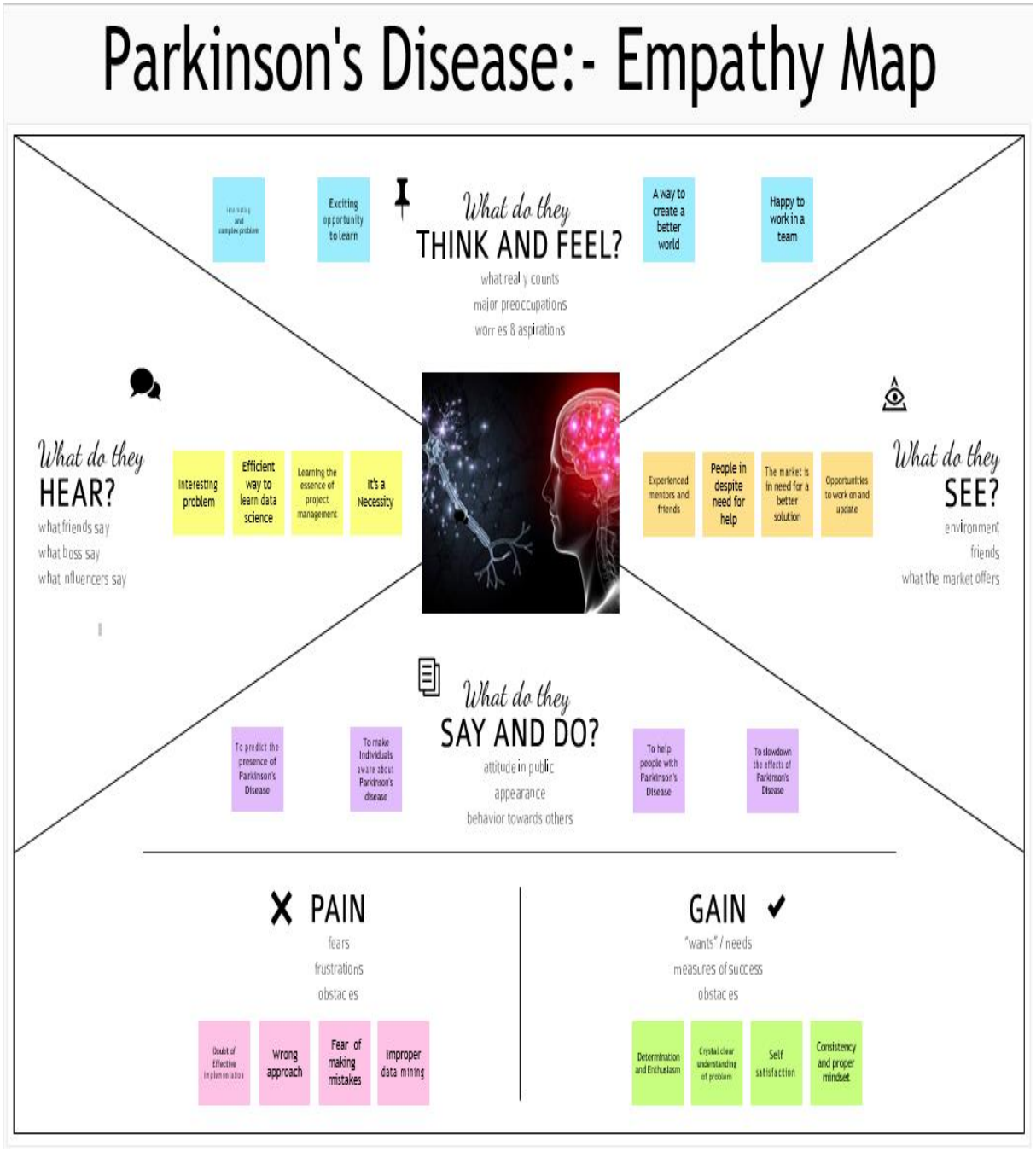
[5] Parkinson's Disease Detection Using Voice and Spiral Drawing Dataset - Korakanchi Madhu Mohan Rao, Mallavarapu Sai Naveen Reddy, Vemula Ravi Teja, Padmaveni Krishnan, D. John Aravindhar, M.Sambath.

2.3 Problem Statement Definition:

Parkinson's disease is a global public health concern. Nerve cells, the building blocks of the nervous system in the brain stop producing when they are damaged. Thus, less dopamine is produced which inhibits motor skills and speech. Voice changes in the first stage before brain cells are affected, hence helping identify Parkinson's disease in the early stages and therefore preventing brain cell damage that can lead to reduced fusion and movement. The introduction of different ML algorithms for the classification of Parkinson's disease is presented. There we need to detect Parkinson's Disease using Machine Learning at an earlier stage?

-3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:



3.2 Ideation & Brainstorming:

1

Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

PROBLEM

How might we detect Parkinson's Disease using Machine Learning?

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

Alahari Aryan

- Should look into the research papers available.
- List down the suitable ML and DL models.
- Shouldn't consider the accuracy alone, but consider the feasibility also.
- Speak with experienced doctors in the field.

Issac Shelton J

- Need to data mine precisely.
- Should use the old and new data sets combined.
- Should deep dive into related topics.
- Should meet up with the end users.

P Krishna Vamsi

- Look into the pre-existing solutions.
- Comparing and finding the efficient solutions used previously.
- Must use combinations of multiple data sets.
- The final prediction must have all the details, the individuals need to know.

Rohith Narayanan S

- Look into the technical papers.
- Should meet up with experts in the field.
- Should consider cross validation methods, while selecting the methods.
- Should consider on multiple algorithms from different sources.

3

Prioritized Ideas

Considering all the 16 approaches best 3 of them are listed below.

5 minutes

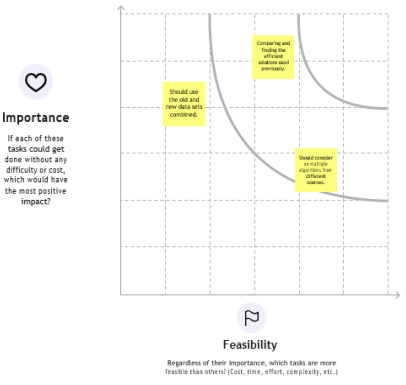
- Comparing and finding the efficient solutions used previously.
- Should use the old and new data sets combined.
- Should consider on multiple algorithms from different sources.

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

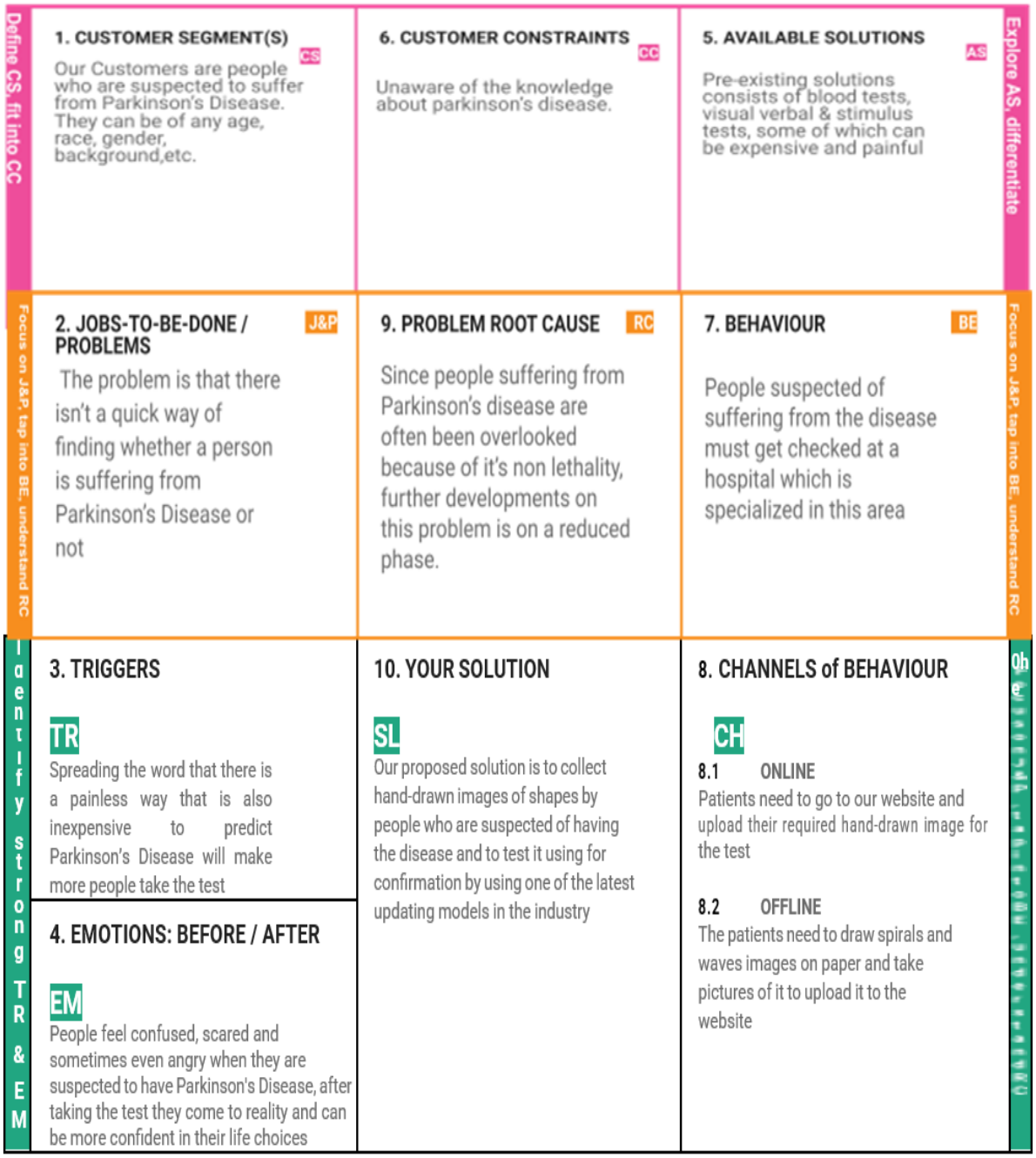
20 minutes



3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Detection of Parkinson's Disease using Machine Learning with hand-drawn images as input.
2.	Idea / Solution description	The Solution is to create and train a machine learning model that can efficiently classify hand-drawn images.
3.	Novelty / Uniqueness	Instead of default models, we have used the advantage of science by utilising the mobilenet_v2 model created and constantly trained and updated by Google.
4.	Social Impact / Customer Satisfaction	Since the model shows maximum accuracy the prediction is close to perfect, so it seems to have a profound impact on society.
5.	Business Model (Revenue Model)	We identify whether an individual suffers from Parkinson's Disease at an earlier stage by considering vital data.
6.	Scalability of the Solution	It is fit for use on a wide scale of individuals disregarding their age, race, background, etc.

3.4 Problem Solution Fit:



4. REQUIREMENT ANALYSIS:

4.1 Functional Requirement:

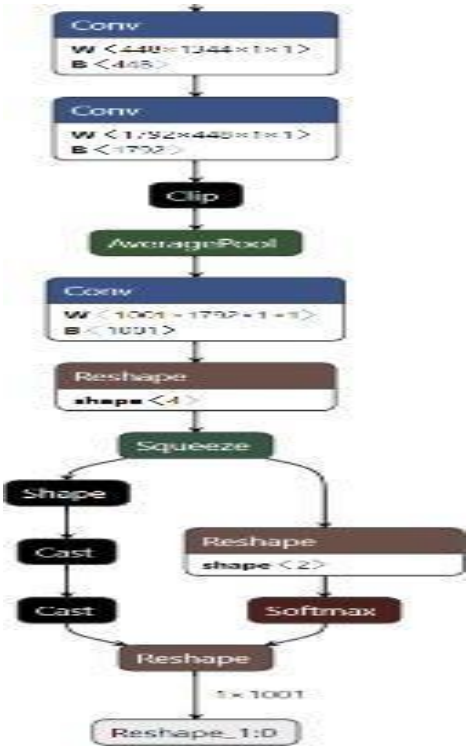
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Drawing	The user draws the spiral and wave diagrams.
FR-2	User-Taking Pictures	The user needs to take images of the drawings.
FR-3	User Uploading	The user uploads the images of the spiral and wave in the website.
FR-4	User Confirmation	The user gets the confirmation on the screen.

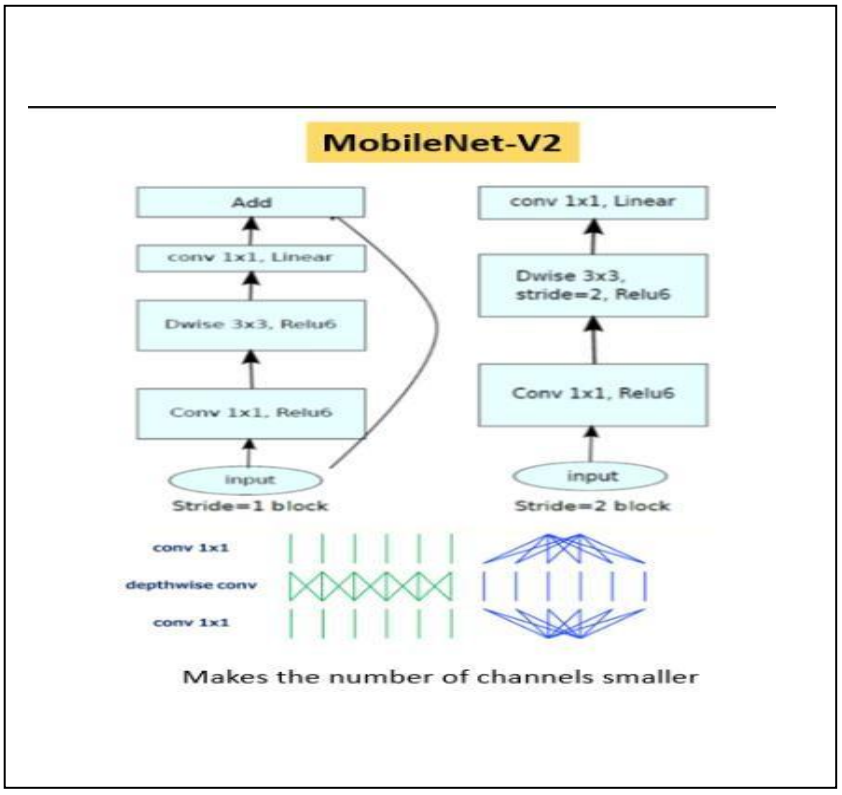
4.2 Non-Functional Requirement:

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Taking clear picture.
NFR-2	**Security**	Uploading correct file type.
NFR-3	**Reliability**	Taking a clear picture.
NFR-4	**Performance**	Should draw once or twice and select the best for uploading.
NFR-5	**Availability**	-
NFR-6	**Scalability**	-

5.PROJECT DESIGN:

5.1 Data Flow Diagrams:





5.2 Solution & Technical Architecture:

Technical Architecture & Stack:

Table-1: Components & Technologies:

S. No	Component	Description	Technology
1.	User Interface	The user uses our website via pc or mobile to get their diagnosis	HTML & Python
2.	Application	The model predicts the diagnosis using the image uploaded by the user	IBM Watson, Machine Learning & Python
3.	Database	Image files like png are what we use to train, test & run model	Python
4.	Cloud Database	We store the model in the Database to Diagnosis the person	IBM DB2, IBM Cloudant etc.
5.	File Storage	The model will be saved in h5 format and images in png, we use under 500 MB to store the files	IBM Block Storage & Local Filesystem
6.	External API	Here we connect our customer with the model for testing	IBM Weather API, etc.
7.	Machine Learning Model	The machine learning model predicts whether the person has Parkinson's disease or not	mobilenet_v2 Model, etc.
8.	Infrastructure (Server / Cloud)	The model is deployed in both cloud and local servers for usage	Local & IBM Cloud Server

Table-2: Application Characteristics:

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	mobilenet_v2 & Tensorflow were used in model construction	Opensource & Python
2.	Security Implementations	Basic Security	Basic Security
3.	Scalable Architecture	Works on the said type files	HTML
4.	Availability	Standard Availability	HTML
5.	The performance	Accuracy of the model is the maximum it runs one picture at a time	Python, HTML

5.3 User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Individual (Mobile user)	Test Taking	USN-1	As a user, I open the website and upload the image and got the diagnosis	Image input	High	Sprint-2
Individual (Web user)	Test Taking	USN-2	As a user, I open the website and upload the image and got the diagnosis	Image input	High	Sprint-3
Individual (Mobile user)	Test Taking	USN-3	As a user, I open the website and upload the image and got the diagnosis	Image input	High	Sprint-3
Individual (Web user)	Test Taking	USN-4	As a user, I open the website and upload the image and got the diagnosis	Image input	High	Sprint-4
Individual (Mobile user)	Test Taking	USN-5	As a user, I open the website and upload the image and got the diagnosis	Image input	High	Sprint-4
Individual (Web user)	Test Taking	USN-6	As a user, I open the website and upload the image and got the diagnosis	Image input	High	Sprint-4

6. PROJECT PLANNING & SCHEDULING:

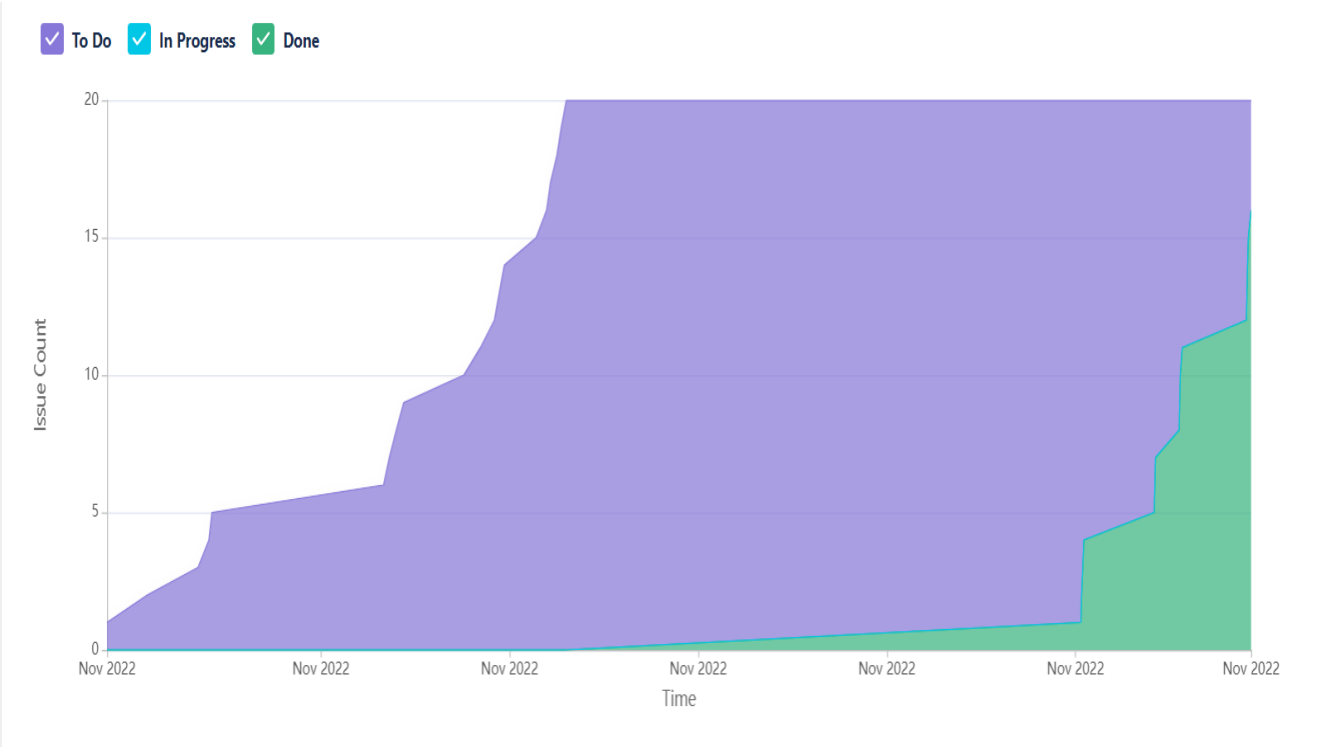
6.1 Sprint Planning & Estimation:

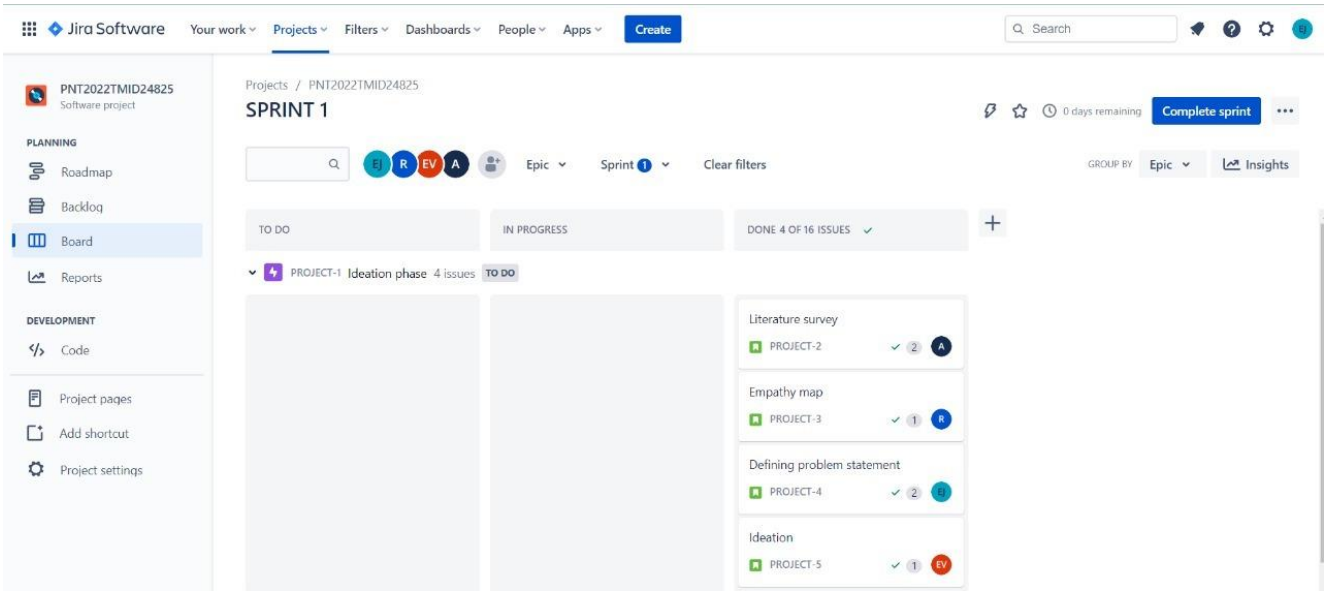
Sprint	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Study the problem and formulate the solutions	2	High	Aryan(M1), Issac(M2), Vamsi(M3), Rohith (TL)
Sprint-2	Model constructing and testing	2	High	Aryan(M1), Issac(M2), Vamsi(M3), Rohith (TL)
Sprint-3	Model pruning and testing	1	Medium	Aryan(M1), Issac(M2), Vamsi(M3), Rohith (TL)
Sprint-4	Model deployment and testing	2	High	Aryan(M1), Issac(M2), Vamsi(M3), Rohith (TL)

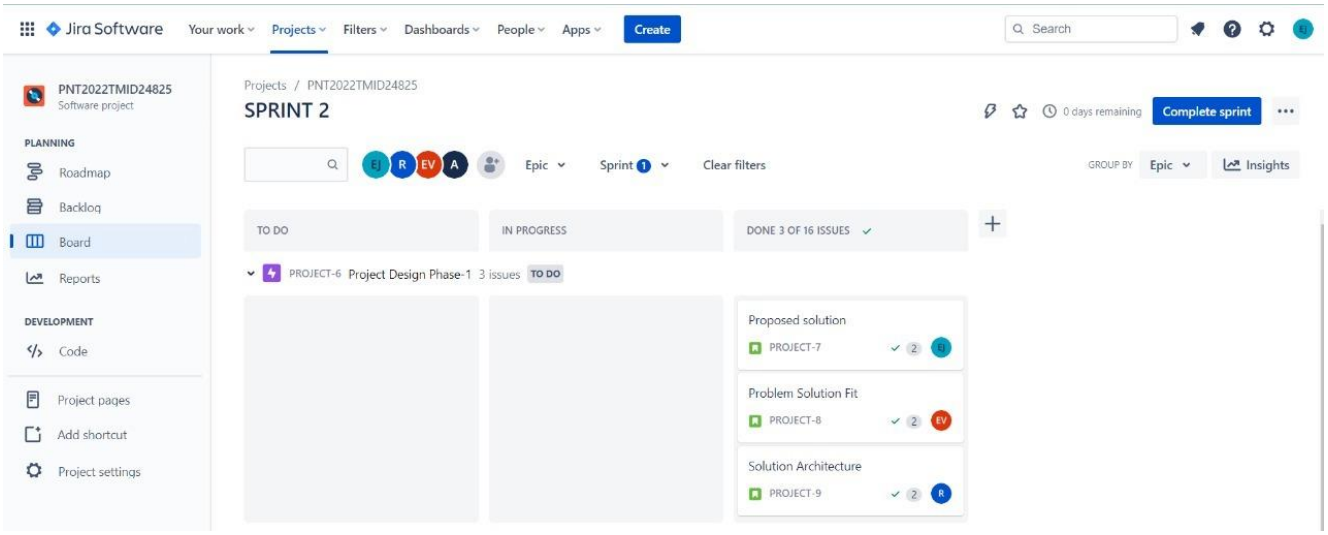
6.2 Sprint Delivery Schedule:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA:






Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
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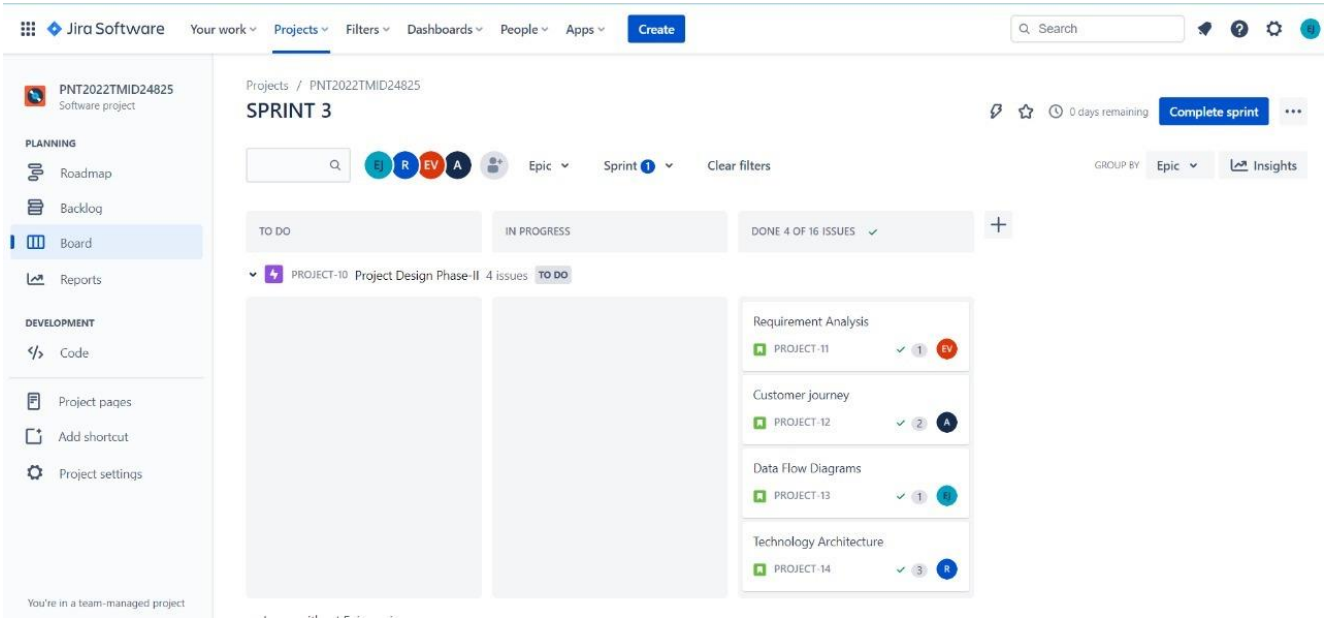
Software project
PLANNING
Roadmap
Backlog
Board
Reports
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
Projects / PNT2022TMID24825
SPRINT 2
0 days remaining
Complete sprint
Epic
Sprint 1
Clear filters
GROUP BY
Epic
Insights
TO DO
IN PROGRESS
DONE 3 OF 16 ISSUES
PROJECT-6 Project Design Phase-1 3 issues TO DO
Proposed solution
PROJECT-7
Problem Solution Fit
PROJECT-8
Solution Architecture
PROJECT-9


Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
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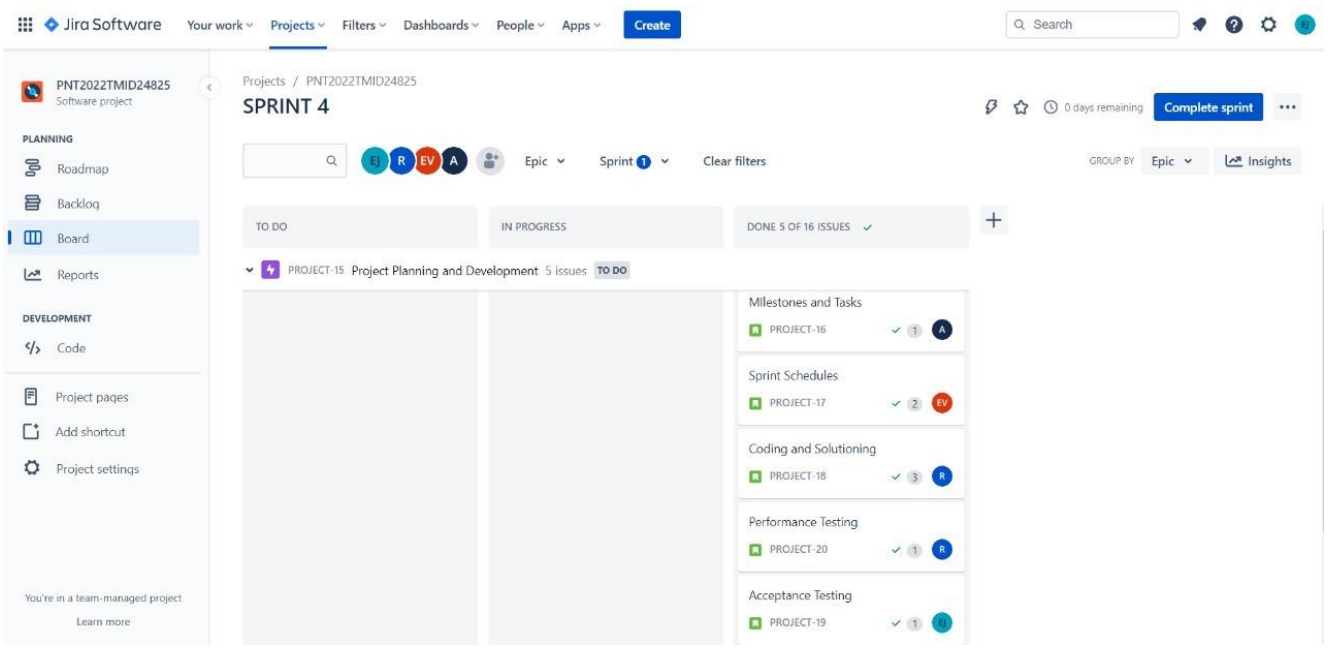
Software project
PLANNING
Roadmap
Backlog
Board
Reports
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Projects / PNT2022TMID24825
SPRINT 3
0 days remaining
Complete sprint
Epic
Sprint 1
Clear filters
GROUP BY
Epic
Insights
TO DO
IN PROGRESS
DONE 4 OF 16 ISSUES
PROJECT-10 Project Design Phase-II 4 issues TO DO
Requirement Analysis
PROJECT-11
Customer journey
PROJECT-12
Data Flow Diagrams
PROJECT-13
Technology Architecture
PROJECT-14


Jira Software
Your work
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Software project
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Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / PNT2022TMID24825
SPRINT 4
0 days remaining
Complete sprint
Epic
Sprint 1
Clear filters
GROUP BY
Epic
Insights
TO DO
IN PROGRESS
DONE 5 OF 16 ISSUES
PROJECT-15 Project Planning and Development 5 issues TO DO
Milestones and Tasks
PROJECT-16
Sprint Schedules
PROJECT-17
Coding and Solutioning
PROJECT-18
Performance Testing
PROJECT-20
Acceptance Testing
PROJECT-19

7. CODING & SOLUTIONING:

7.1 Feature 1:

Instead of going with the ordinary models, here we work around the Mobilenet_v2 model that operates on images with the help of advanced open cv operations.

7.2 Feature 2:

The advantage of our model is that we use an open-source model that's been updated throughout the year by multiple experts, therefore our model becomes robust day by day to handle the workloads and functions efficiently.

7.3 Database Schema:

The Schema of the source image for model training and testing consists of two types of images. They are spiral and wave hand-drawn images. Here we segregate these images into healthy and not healthy groups and work around them to produce maximum accuracy.

8. TESTING

8.1 Test Cases:

The majority of the test cases we tried have come as successful due to the advancement of our model. We made sure the cases that we used were highly diverse in nature.

8.2 User Acceptance Testing:

1. Purpose of Document

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

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	1	1	0	0	2
Duplicate	1	0	0	0	1
External	0	1	0	0	1
Fixed	2	2	0	0	4
Not Reproduced	0	0	0	0	0
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	4	4	0	0	8

3.Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Client Upload	18	0	0	18
Client Application	20	0	0	20
Final Report Output	7	0	0	7

9.RESULTS:

9.1 Performance Metrics:

Validation Evaluation

	precision	recall	f1-score	support
0	0.93	0.78	0.85	18
1	0.73	0.92	0.81	12
accuracy			0.83	30
macro avg	0.83	0.85	0.83	30
weighted avg	0.85	0.83	0.84	30

10.ADVANTAGES & DISADVANTAGES:

Advantages:

- ➔ The detection of Parkinson disease in the early stage helps the person to take necessary steps.
- ➔ The detection is quick.
- ➔ User-friendly access.
- ➔ It can be accessed from anywhere at any time.
- ➔ The efficiency of the detection process is about 80%.
- ➔ Low detection error.

Disadvantages:

- ➔ The user may wrongly upload the file for detection.
- ➔ The user needs a good network connection.

11.CONCLUSION:

Parkinson’s disease (PD) is becoming an important degenerative disease of the central nervous system, affecting the quality of lives of millions of seniors worldwide. Symptoms of PD can progress differently from one person to another because of the variety of the disease. Patients with Parkinson may show symptoms including tremors mainly at rest. Different types of tremors are possible: tremors in hands, limb rigidity, and gait and balance problems. As technology advances, the detection of Parkinson's disease is easy. The detection can be done by using the machine learning algorithms. The people must be aware of Parkinson's disease and to know about the easy way to detect the disease. They must have to keep trust in the advanced technology. Our algorithm has an excellent efficiency.

12.FUTURE SCOPE:

In advancement to our project, we would like to implement the new features to the user. The features like medical support, mental support etc... to our users. The application will contain the necessary steps to be taken after the user is diagnosed with Parkinson's disease. We will improve the confidentiality of the user's data. The application will be free at cost. We would try to spread the details of our application to the neediest person. Our main objective is to detect the Parkinson's disease at the early stage itself. This helps the affected person to get the medical support. We try to research more on the Parkinson's disease and improve the efficiency. Our application can be extended to detect many other diseases using machine learning algorithms.

13.APPENDIX:

SOURCE CODE:

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-46314-1660745023

DEMO LINK:

https://drive.google.com/file/d/1egJRw_jBmTkNWs7rCMUBGWi1-wruXa2G/view?usp=share_link