Design Thinking Project Workbook

Don't find customers for your product but find products for your customers

1. Team

Team Name: Team G3

Team Logo (if any): -

Team Members:

1. [P. Karthik, 2320040019, 7989617565]
2. [R. Vinay Vardhan Naidu, 2320040117, 8639862122]
3. [KV. Sai Sri Hari, 2320040033, 8074091458]

2. Problem/Opportunity Domain

Domain of Interest: Our project is rooted in the healthcare domain, with a specific emphasis on the study and analysis of neurodegenerative diseases, which are progressive conditions affecting the nervous system and brain function over time.

Description of the Domain: In the healthcare domain, particularly in neurodegenerative diseases, several key elements, challenges, and opportunities emerge.

Key Elements:
- Data-Driven Insights: Medical imaging and patient data are crucial for diagnosing diseases like Alzheimer's and Parkinson's.
- AI/ML Algorithms: CNNs help process image data to detect early signs of these conditions.
- Patient Care: AI models improve diagnosis, treatment, and monitoring of disease progression.

Challenges:
- Data Quality: Limited access to clean, structured datasets complicates analysis.
- Complexity of Diseases: The variability of neurodegenerative conditions makes it hard to develop universally accurate models.
- Interpretability: AI's black-box nature challenges its clinical acceptance.

Opportunities:
- Early Detection: AI can detect early signs, improving patient outcomes.
- Personalized Medicine: AI enables individualized treatment plans.
- Innovation: AI-driven diagnostics offer potential breakthroughs in disease detection and management.

Why did you choose this domain?

Our passion lies in applying technology to solve real-world problems that impact human lives. Neurodegenerative diseases like Alzheimer's and Parkinson's are debilitating, affecting millions worldwide. The opportunity to use AI to potentially improve diagnosis and care for these conditions aligns with our desire to make a meaningful difference in healthcare.

3. Problem/Opportunity Statement

Problem Statement: The challenge lies in the early and accurate diagnosis of neurodegenerative diseases, which is often hindered by the complexity of detecting subtle patterns in medical images. This project aims to leverage Convolutional Neural Networks (CNNs) to analyse image datasets, providing a solution that enhances early detection and diagnosis.

Problem Description: The issue we aim to solve is the difficulty in early diagnosis of neurodegenerative diseases, such as Alzheimer's and Parkinson's, due to the subtle and complex nature of patterns in medical images. Early detection is critical for effective treatment, and current methods are often insufficient. By utilizing Convolutional Neural Networks (CNNs) to analyse large image datasets, we seek to improve the accuracy and speed of diagnosis, enabling better patient outcomes.

Context (When does the problem occur): The problem arises during the early stages of neurodegenerative diseases, such as Alzheimer's and Parkinson's, when the symptoms are subtle and difficult to detect through traditional diagnostic methods. These diseases often progress without being accurately identified until significant cognitive or motor damage has occurred. This issue is compounded by the complexity of interpreting medical images, where early signs may be too subtle for human observation. The need for more precise and early detection becomes critical in these situations, as timely intervention can significantly improve patient outcomes.

Alternatives (What does the customer do to fix the problem):
To address the early diagnosis of neurodegenerative diseases, customers use:
1. Traditional Tests: Cognitive and motor function tests, and medical imaging, though they may miss early signs.
2. Clinical Assessments: Thorough evaluations by specialists, which can also overlook subtle early symptoms.
3. Genetic/Biomarker Testing: Expensive tests to identify risk factors, though not always conclusive.
4. Symptom Monitoring: Tracking symptoms over time, relying on subjective reports.

5. Manual Image Analysis: Professionals analyse images manually, which can be challenging due to subtle early changes.

Customers (Who has the problem most often):
The primary group affected by the problem includes:
1. Patients: Individuals experiencing early symptoms of neurodegenerative diseases, who face challenges in getting accurate and timely diagnoses.
2. Healthcare Providers: Neurologists and other medical professionals who struggle with existing diagnostic tools and methods to detect subtle early signs.
3. Caregivers and Families: Those supporting patients, who need early and accurate diagnosis to better manage care and treatment.
4. Medical Researchers: Researchers working to develop better diagnostic tools and treatments for neurodegenerative diseases.

Emotional Impact (How does the customer feel):
The emotional impact of neurodegenerative diseases can be profound:
1. Fear: Patients often fear the progressive loss of cognitive and motor functions, impacting their independence and quality of life.
2. Sadness: There is a sense of sadness and grief over the loss of cognitive abilities and the impact on personal and family life.
3. Frustration: Both patients and caregivers may feel frustrated by the slow and often inaccurate diagnostic processes, leading to delays in treatment.
4. Isolation: Patients may experience feelings of isolation as their abilities decline and they struggle to maintain social connections.
5. Helplessness: Caregivers may feel helpless in their efforts to provide care and support, especially when faced with ineffective diagnostic tools and limited treatment options.

Quantifiable Impact (What is the measurable impact):
The quantifiable impact of neurodegenerative diseases includes:
1. Financial Costs: High medical expenses and loss of income for patients and families.
2. Time Lost: Delays in accurate diagnosis and significant caregiving time.
3. Quality of Life: Decreased well-being for patients and emotional strain on families.

Alternative Shortcomings (What are the disadvantages of the alternatives
The current solutions have several disadvantages:

1. Traditional Tests: Often miss early signs of neurodegenerative diseases and can be time-consuming and expensive.
2. Clinical Assessments: May overlook subtle early symptoms due to subjective interpretation.
3. Genetic/Biomarker Testing: Can be costly and may not provide definitive results or be widely accessible.
4. Symptom Monitoring: Relies on subjective reports and may not capture all relevant changes.
5. **Manual Image Analysis:** Challenging due to the complexity and subtlety of early-stage symptoms, leading to potential inaccuracies.

Any Video or Images to showcase the problem:
https://youtu.be/9u_G8PMcaGw?si=6wC3X7PSfnOnMmib

4. Addressing SDGs

Relevant Sustainable Development Goals (SDGs): **Identify which of the 17 SDGs are directly impacted by the problem or opportunity.**

G 3 (Good Health and Well-being): Global health outcome can be improved through higher well-being and prevention of diseases such as Alzheimer and Parkinson through better healthcare interventions.

SDG 4 (Quality Education): Educate the masses as well as the medical fraternity regarding neurodegenerative diseases so early detection and care practices may be enhanced.

SDG 9 Industry, Innovation, and Infrastructure: Unfolds the role of AIML in innovation development for healthcare and enhancement of diagnostic tools in health tech infrastructure.

How does your problem/opportunity address these SDGs?: Describe how solving the problem or leveraging the opportunity will contribute to achieving one or more SDGs.

This project, focused on treating neurodegenerative diseases through AIML, thus addresses **Good Health and Well-being** (**SDG 3)** in order to improve the patients' outcomes by early diagnosis and advanced treatments. It further conforms with **Quality Education** (**SDG 4)** as it enhances the training of health care providers and awareness of the public regarding health issues. Finally, it leans upon **Industry, Innovation, and Infrastructure** (**SDG 9)** in terms of the growth of health care innovation coupled with the development of sustainable technologies toward full-scale management of the disease.

5. Stakeholders

Answer these below questions to understand the stakeholder related to your project

1. **Who are the key stakeholders involved in or affected by this project?**

   Included in this are the patients and their carers who will be positively affected through better treatment and the health professionals who will use advanced diagnostics. These models would be developed by researchers on AIML, while regulation was ensured by the government. Technology companies and pharmaceutical firms also played a part by providing infrastructure and exploring options for drug discovery.

2. **What roles do the stakeholders play in the success of the innovation?**

   The patients and caregivers form the demand for these better treatments, but it is the professionals in the healthcare sector that deploy and use these AIML tools. The researchers work on the model, and regulations are provided by governments, while the technology and pharmaceutical industries provide the infrastructure and explore new remedies.

3. **What are the main interests and concerns of each stakeholder?**

   Patients and caregivers are focused on easy, cheap treatments and worries about accessibility and side effects, Care providers want dependability in a diagnostic tool and are worried about integration and training; Researchers care about the development of technology and are concerned about safety and regulation. Tech and Pharma companies are interested in innovation and market potential but worry about data privacy and regulatory hurdles.

4. **How much influence does each stakeholder have on the outcome of the project?**

Patients and caregivers hold the highest influence because they determine the treatment needs, hence the kind of changes that should be implemented, and also give feedback on the implemented change. Healthcare professionals and researchers greatly impact the project's success through tool adoption and model development, and therefore governments, technology companies, and pharmaceutical firms influence the project in terms of regulation, infrastructure and drug development integration.

5. **What is the level of engagement or support expected from each stakeholder?**

The practice should elicit high patient engagement through mechanisms of feedback and participatory processes, moderate to high support of health workers and researchers in facilitating tool integration and model development, moderate to high support from governments, technology firms, and pharmaceutical firms in providing regulatory frameworks and infrastructural services for research and drug development

6. **Are there any conflicts of interest between stakeholders? If so, how can they be addressed?**

Conflicts of interest include patients seeking inexpensive treatments against the interests of pharmaceutical companies that want to maximize profits, and healthcare practitioners requiring precise tools against the interests of technology companies wanting to market these. Such are very easily resolved by transparency, rigorous validation, and independent research.

7. **How will you communicate and collaborate with stakeholders throughout the project?**

There will be interaction with stakeholders through surveys, workshops, and collaborative platforms to ensure that their views are brought into each phase of the project. Communication and collaboration will thus ensure one is always providing updates through meetings, reports, and feedback sessions.

8. **What potential risks do stakeholders bring to the project, and how can these be mitigated?**

Risks: Include patient dissatisfaction, Health Care Professionals resistance, technical issues by technology companies. Risk mitigation through continued feedback, exhaustive training, testing in the most stringent ways, and transparent co-operation with all stakeholders.

6. Power Interest Matrix of Stakeholders

Power Interest Matrix: **Provide a diagrammatic representation of Power Interest Matrix**
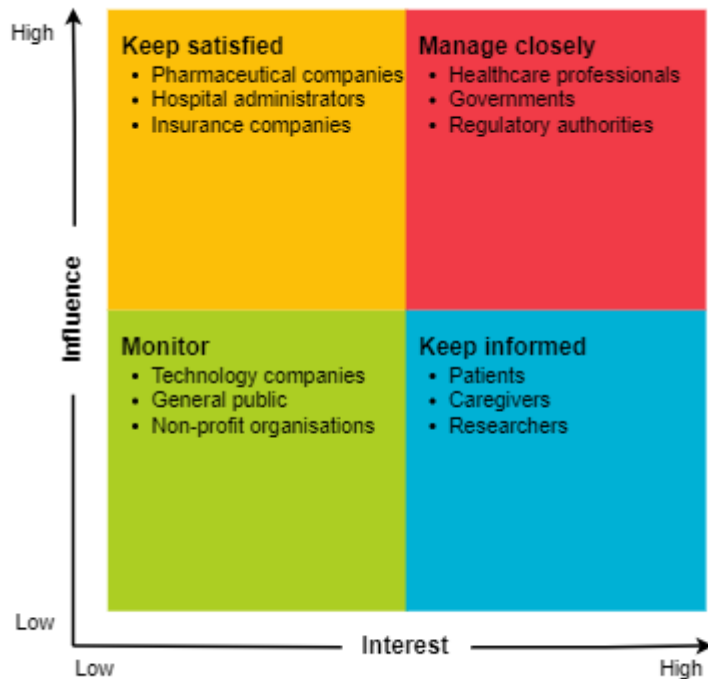
- High Power, High Interest: [Healthcare Professionals, Governments]
- High Power, Low Interest: [Pharmaceutical Companies]
- Low Power, High Interest: [Patients and Caregivers, Researchers]
- Low Power, Low Interest: [Technology Companies]