Team details

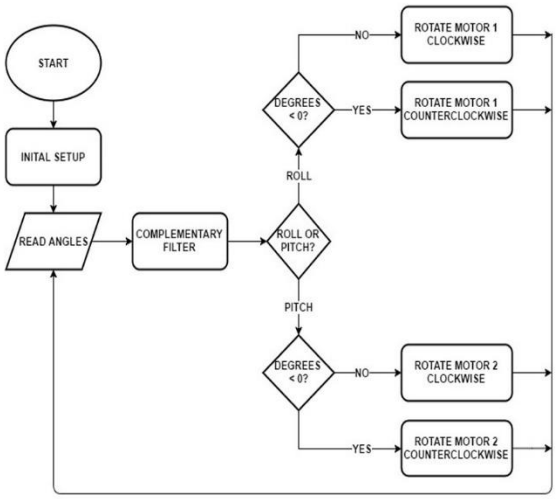
Team Name	NurelNest
University	University of Peradeniya
Domain	Healthcare Robotics
Product Name	Parkinson's Stability Spoon

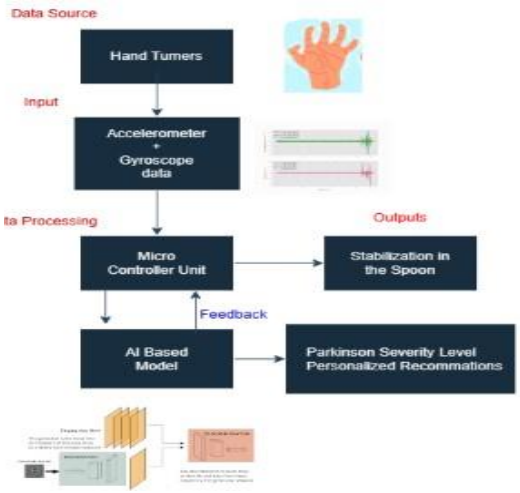
Problem Statement, Background & Motivation and Solution

Problem Statement: Parkinson's disease is a progressive neurological disorder that severely affects motor functions, leading to symptoms such as tremors, rigidity, and bradykinesia (slowness of movement). Patients find it difficult to carry out daily tasks, such as eating, due to these symptoms. Nowadays, regular clinical assessments and drug modifications are the mainstays of Parkinson's disease care. However, this conventional method frequently isn't able to provide prompt support with daily duties and doesn't enable constant monitoring of the patient's status. Our dynamic positioning spoon is intended to help with the unique difficulties that people with Parkinson's disease encounter when going about their daily lives, especially when eating. The goal of this product is to improve the quality of life for individuals with Parkinson's disease by offering a device that not only helps with eating but also keeps track of their status in real time.

Background & Motivation: Parkinson's disease patients have significant difficulties with fine motor skills, such as eating, which makes them frustrated and dependent on guardians. Tremors, rigidity, and slowness of movement characterize Parkinson's disease. Their sense of helplessness and diminished dignity are brought on by this loss of independence, which has a severe negative impact on their mental and self-esteem. Because traditional approaches do not provide continuous monitoring, the requirement for frequent clinical evaluations increases difficulties and stress. As a result, there is significant emotional and psychological strain brought on by the physical difficulties and dependency on others, which frequently results in social isolation and anxiety.

Solution: The Dynamic Positioning Spoon for Parkinson's Patients makes mealtimes simpler by providing real-time condition monitoring and stabilizing food. The spoon offers continuous health tracking and improves eating experiences by integrating advanced sensors and machine learning.





The spoon stabilizes food via actuators that alter its position in response to tremors, as shown in the two figures above. It does this by using high-precision sensors. To each person's unique movement pattern, the spoon responds differently thanks to machine learning algorithms. The spoon uses machine learning for predictive analytics to gather information on hand movements and tremor patterns. Through a linked app, caregivers and healthcare professionals receive real-time feedback.

The Dynamic Positioning Spoon shows positive outcomes in terms of quantitative results. It gives users more stability and control during meals by reducing the impact of tremors by up to 80%. Meal completion times are also accelerated, with a roughly 50% decrease, suggesting higher productivity and more comfortable eating. Furthermore, it is anticipated that the spoon will enable users to achieve greater independence and autonomy during mealtime by reducing the need for caregiver assistance by 60%.

The Dynamic Positioning Spoon significantly improves patients' quality of life in qualitative terms. Users feel more confident and independent, which improves their psychological health because they have more control over their eating experiences. The spoon's ease of use and effectiveness in reducing meal-related tremor challenges also contribute to high levels of satisfaction from customers, a sense of empowerment and contentment among users. In addition, the spoon's real-time feedback systems and ongoing data collection help caregivers and medical professionals make better decisions and act sooner when needed, which eventually improves Parkinson's patients' overall healthcare outcomes.

Product Description and Product Uniqueness

Product Description: With its innovative functions, the Dynamic Positioning Spoon for Parkinson's Patients is designed to completely transform eating for people with Parkinson's disease. Its ability to self-stabilize in real time guarantees controlled and steady movement even in the face of tremors, and machine learning algorithms enable customized support to meet individual needs. Comprehensive insights are obtained from continuous monitoring of hand movements and tremor patterns, and prompt interventions are made possible by real-time feedback. Its robust ESD protection and fail-safe mechanisms prioritize user safety, and its intelligent power management optimizes battery usage for extended operation, making it a dependable and creative solution for improved dining independence and quality of life.

Product Uniqueness: Analysis of Existing Products

Liftware (Verily Life Sciences): Hand tremor sufferers can find stabilizing utensils from Liftware. To differentiate itself in terms of functionality and adaptability, our self-stabilizing spoon seeks to offer extra features like real-time data analytics and a modular design.

Gyenno Spoon: A smart spoon made by Gyenno is available to help with hand tremors during meals. Our self-stabilizing spoon stands out due to its sophisticated features, which include an extensive data analytics system for condition monitoring, real-time feedback, and interchangeable utensils.

Other Traditional Utensil Modifications: To increase stability, some people alter conventional spoons by including weights or adjustable handles. But these fixes frequently lack the intelligent and dynamic compensation that our self-stabilizing spoon provides.

The uniqueness of Our Solution: Our self-stabilizing spoon is unique in the market because of its innovative capabilities, which include an ESP32 microcontroller incorporated with embedded intelligence, a modular design with interchangeable utensils, and real-time compensation for hand tremors utilizing sophisticated sensors. Real-time feedback is provided by the user-friendly interface with LED indications, and dependability and energy economy are guaranteed by safety measures including auto-sleep and fail-safe functions. Furthermore, thorough data analytics for condition monitoring provides insightful information for managing long-term health.

Business Model and Marketing Plan

Business Model:

Target Market:

Primary Market: Individuals with Parkinson's disease (over 10 million globally).

Secondary Market: Individuals with essential tremor and other hand tremor conditions.

Market Size: Global market for assistive devices for Parkinson's disease projected to reach USD 4.9 billion by 2025.

Competitive Landscape: Liftware, Gyenno Spoon, traditional utensil modifications.

Revenue Streams

Product Sales: Direct-to-consumer and B2B sales.

Subscription Services: Data analytics for caregivers and healthcare providers.

Replacement Parts and Accessories: Modular utensil attachments, batteries, components.

Extended Warranty and Service Plans: Maintenance services.

Business Strategies

Product Launch and Marketing: Online marketing, healthcare partnerships, trade shows.

Customer Support and Engagement: User education, community building.

Research and Development: Continuous improvement, new product development.

Success Metrics and 5-Year Goals

- Market Penetration: Achieve 10% market share in assistive devices for Parkinson's.
- Sales Targets: Reach 150,000 cumulative units sold by Year 5.
- Customer Satisfaction: Maintain over 90% satisfaction rate.
- Financial Goals: Achieve profitability by Year 3, expand revenue streams.
- Brand Recognition: Establish Dynamic Positioning Spoon as a leading brand in assistive technologies

Marketing Plan: To enter the market, we will initially focus on online platforms, healthcare partnerships, and trade shows to build brand awareness and highlight the benefits of our product. Our advertising aims to drive initial sales, highlight the special qualities of our self-stabilizing spoon, and raise brand awareness.

We intend to use influencer relationships, SEO, social media campaigns, targeted online ads, and influencer partnerships as part of a comprehensive digital marketing strategy to attract new customers. We will also work with Parkinson's associations, neurologists, and occupational therapists to suggest our product to their patients. Attending conferences and trade exhibitions will increase the number of healthcare experts and possible distributors who learn about our product.

We will collaborate closely with Peradeniya Hospital, which has a specialized Parkinson's unit, as part of our healthcare alliances. Patients in this section will receive sample spoons from us, and we will post their reviews to demonstrate practical advantages and establish our reputation.

Technical Aspects and Implementation Plan

Technical Aspects: Our product utilizes basic hardware components such as the MPU6050 sensor, ESP32 MCU, ultra nano servos, batteries, and 3D design. For predictive and real-time feedback algorithms, we employ machine learning (ML) and deep learning (DL). Additionally,

genetic algorithms (GA) are used for optimization. We plan to store and analyse data using Firebase as a backend cloud service and develop the mobile app using Flutter.

Implementation methods include 3D printing, PCB designing, firmware designing, and iterative prototyping. Real Parkinson's patient data will be used to train machine learning models, and testing and validation will be conducted at each stage of development. When going to mass production for the enclosure, using injection molding is better than 3D printing. After selling the product, we continue firmware development to enhance stabilization and predictive analysis. This ongoing improvement allows us to provide updates to users over the air, ensuring they always have access to the latest features and optimizations.

Implementation Plan –

- Initial Design and Prototyping
- Hardware Development
- Software Development
- Integration and Testing
- Iterative Refinement
- Finalization and Production
- Launch and Deployment
- Continuous Firm Ware Updates

User Scenario

Kamal, a retired teacher with Parkinson's disease, faces challenges with hand tremors during meals. His daughter Kalani buys the Dynamic Positioning Spoon for him, attracted by its self-stabilizing feature. Kalani easily pairs the spoon with Kamal's smartphone and adjusts settings before giving it to him for dinner. Kamal confidently uses the spoon, benefiting from its real-time feedback and stability.

Consumer Gains and Satisfaction:

The Dynamic Positioning Spoon grants Kamal independence and dignity during meals, fulfilling his desire to dine with his family despite his condition. Its adaptive features exceed expectations, offering physical comfort and bolstering Kamal's confidence, resulting in customer satisfaction.

Team Details

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