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An Ergonomic Solution to Parkinson's Tremors: The Adaptive Feeding Spoon

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Novel Solution, Indigeneous Design to A Problem, Challenge

Abstract: ***Parkinson's disease is a progressive neurodegenerative disorder affecting millions worldwide, often causing debilitating tremors that severely impair the ability to perform basic tasks like feeding oneself. This project introduces a self-stabilizing feeding spoon designed to counteract involuntary hand tremors in Parkinson's patients. Inspired by image stabilization technology in cameras, the spoon employs motion sensors, microcontrollers, and servo motors to detect and counteract tremors, ensuring food remains stable. With an ergonomic design and active cancellation hardware, the spoon not only aids functionality but also restores dignity and independence to users. This innovative device promises to improve the quality of life for patients and reduce the stigma associated with eating in public.***

Keywords: Parkinson's disease, self-stabilizing spoon, assistive device, neurodegenerative disorder, motion stabilization, Arduino Uno, tremor suppression, ergonomic design

1. Rationale

The project aims to design and develop a feeding spoon for Parkinson patients, which could become a boon for the sufferers of this neurodegenerative disorder in the future. Patients suffering Parkinson's disease have serious tremor that happens whenever they try to grab something with their hands. More accurately it happens whenever they focus on the part of their body because their brain is damaged thus cannot control the body on their will. Major disadvantage that comes with this symptom is not being able to eat on their own . Our well thought designed spoon promises to stabilize the vibrations and help make feeding on their own a reality.

2. The Scientific Principle / Concept

The technology behind the design of feeding spoon for Parkinson patient is very similar to the image stabilization feature used in high end cameras. The self-stabilizing spoon adjusts its spoon head position according to the patient's tremors. It begins with calibrating itself and taking an initial reading of the angle it is at. Now every time there is a change in that angle, it sends a signal to the motors to adjust the position. The stabilising spoon adjusts for the user's involuntary tremors or shakes by balancing its head against such forces, maintaining the spoon steady at all times.So somebody with a neurological disorder might be moving up to an inch in magnitude. There is a little micro controller (arduino) inside that is running an algorithm and motion sensors,that would basically sense the person's motion, and smartly move opposite to what that motion does. The result is the device remains smooth and level, despite the movement of the user's arm or hand. Thus enabling the Parkinson patient to consume food that otherwise normally would fly off, by stabilizing it on the spoon.

3. Materials Used

The materials used in the development of the self-stabilizing spoon include an Arduino Uno/ Nano microcontroller, an MPU6050 motion sensor (gyroscope and accelerometer), and servo motors, rechargeable lithium-ion battery

4. Description

The problem is more common than many of us think: Essential tremors and Parkinson's disease affect more than 10 million people worldwide. Parkinson's disease (PD) is a neurodegenerative disorder, initially characterized by a loss of dopaminergic neurons in the substantia nigra that spreads over the course of the disease to almost the whole central nervous system. But although the first description of the ―shaking palsy‖ by James Parkinson was published almost 200 years ago, there is still a lack of understanding of the causes of PD. Initial symptoms usually include asymmetrical tremor, stiffness of the body and a decrease in speed of movement and activity. One of the biggest challenges for people living with Parkinson's is the difficulty - and sometimes inability - to feed themselves, due to the shaking tremors associated with the disease. The basic act of getting food from plate to mouth can be difficult and frustrating. However, using this self-stabilizing spoon, we can fix this.

Our specially designed spoon electronically stabilizes itself so the utensil shakes up to 85% less than a normal spoon would. Its handle includes built-in sensors, a computer, and monitors to sense and counteract tremors. The weighted handle adds control while keeping the utensil steady in your hand, perfect for those with limited dexterity. This elegant weighted spoon has a discreet design, making it visually indistinguishable from everyday dinnerware. The handle's finger indentation provides an ergonomic grip, and the spoon's recessed edge, along with its weighted handle, prevents spillage. The feeding spoon is about the size of an electronic toothbrush — use active cancellation hardware. In other words, the bowl of the spoon doesn't move, even when the handle is moving.

5. Application

Being able to eat unaided is a huge issue for people with Parkinson's Disease. Assistive tools like these spoons can

give people back a much-needed sense of self-sufficiency and safety. Not only that, being able to eat in public without embarrassment or fear is hugely helpful in maintaining a sense of dignity and confidence, and avoiding the isolation and depression that so all-too-often accompany a progressive illness. For the 12 million Parkinson patients, the specially designed spoon will not be just an electronic spoon; it's a tool that could give them their dignity and self-respect back.

Photograph

Figure 1: Prototype of feeding spoon

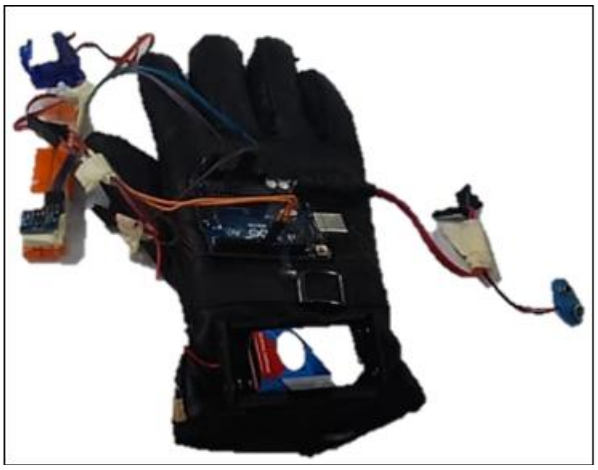

Figure 2: Prototype of glove attached feeding spoon

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