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Self-Stabilizing Parkinson's Spoon

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Abstract: ***Parkinson's disease is one of the most commonly occurring neurodegenerative disorders, ranking 2nd after Alzheimer's affecting largely senior people and characterized by significant nerve cell degeneration that limits motion and daily activities. While the usual age of onset is 60 years, persons as young as 18 years old have been diagnosed. Unintentional shaking and tremors in the hand may be the patient's initial symptoms, making it hard for them to do ordinary actions such as eating food from a spoon. The goal of this project is to produce a stabilising spoon for Parkinson's disease patients so they can eat comfortably despite suffering tremors since it compensates for the user's movement. This project intends to create a less expensive solution to the Liftware and Gyenno "smart" spoons, hence boosting our device's availability and usability. As a result, the major goal of this project is to provide a more accessible and less expensive alternative to the existing "smart" spoons in the industry, which is just as effective and hence beneficial to society.***
Keywords: Parkinson's Disease, Self Stabilizing Spoon, Tremors, Biomedical Device, Microprocessor

I. INTRODUCTION

Parkinson's disease is a neurodegenerative disorder that produces excessive involuntary shaking in the limbs, making it difficult to lift food with a spoon. People who have hand tremors may have Parkinson's disease, whereas those who are functionally impaired may have Cerebral palsy. We intend to create this gadget first and foremost to assist persons with tremors and those who are functionally challenged due to neurodegenerative disorders such as Parkinson's disease and have difficulty moving their hands causing tremors. Parkinson's disease has no established origin, however, it is believed to be caused by both hereditary and environmental factors. The signs of Parkinson's disease generally appear gradually. Other signs include slowed mobility, stiffness, and a lack of balance. Parkinson's disease is an illness that affects the central nervous system and causes cell death in various parts of the brain. One of these areas is the substantia nigra, which contains dopamine, a neurotransmitter that provides impulses to improve movement regulation. Nerves pulse irregularly without dopamine, making it difficult for patients to maintain control of their motions. Physicians classify Parkinson's disease as a mobility illness since it affects a patient's capacity to move. The purpose of this research is to develop a stabilising spoon capable of correcting undesired movements such as tremors. With a limited budget, the goal is to develop a super-efficient prototype primarily comprised of a microprocessor and servo motors. The self-stabilizing spoon will be connected with a sensor that uses gyroscopes and accelerometers to determine which side of the device's handle is tilted and how quickly its position changes. To create a two-degree-of-freedom system, two servo motors will be positioned orthogonally to each other. The spoon is designed to keep its spoon bowl horizontal in this configuration.

II. WORKING

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. This spoon can move at a rate of 500 degrees per second, essentially stabilising the spoon. We have taken a power supply from a 12V – 1 Amp adapter which is then converted to 5V by using a voltage regulator (7805). Then this supply is given to both Arduino and reference circuitry.

The gadget will not only make it easier for users to take food from a plate/bowl, but it will also aid their recovery by allowing them to communicate with a designated doctor in an economical and detailed manner.

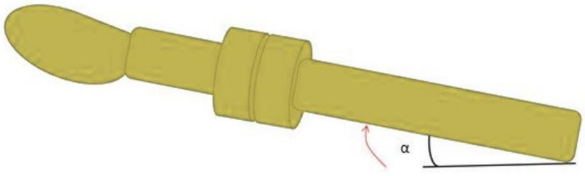


Fig. 1.1 The spoon is moved upwards in angle α

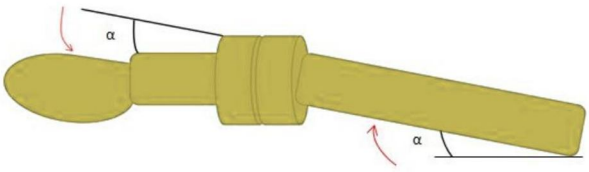


Fig. 1.2 The head of the spoon moves to balance by angle α

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III.COMPONENTS

The Arduino Uno is a microcontroller that can be configured to control various devices. Multiple CPUs, memory, and programmable I/O make up the system. For this project, we utilised an Arduino Uno. Sensor: IMU-MPU6050 is made up of 3 gyroscopes and 3 accelerometers that are arranged perpendicularly to produce a coordinate system. A gyroscope records the rotational location in relation to an arbitrary defined coordinate system, whereas an accelerometer records inertial acceleration. They can identify where an item is in space and if it is leaning when used together. With a 3-axis gyroscope and a 3-axis accelerometer on the same board, as well as an inbuilt Digital Motion ProcessorTM, the MPU6050 can monitor human motions precisely. Servo motors are frequently utilised in recreational projects such as robot construction. A servo motor's location feedback is extremely accurate, meaning it can tell you exactly by what angle the motor shaft has moved. Regardless of how the device is moved, the spoon always maintains a horizontal position with the help of these devices and stays balanced at all times making it very easy for the patient to eat from it.

IV.RESULT AND ANALYSIS

In the present method, results are summarized through snapshots. A complete model developed by the authors is as shown in Fig. 2.1 and Fig. 2.2

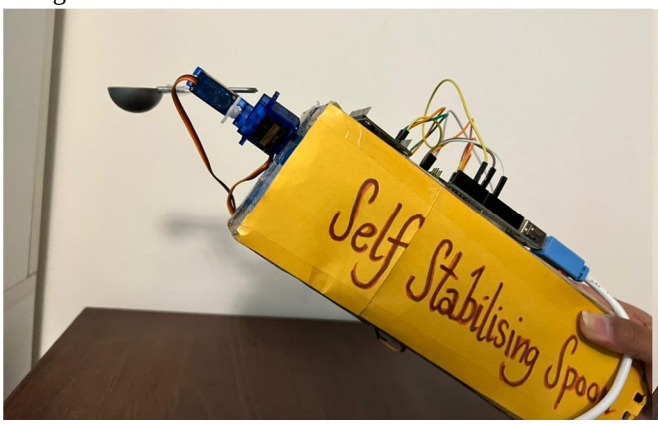


Fig. 2.1 Spoon held in a positive pitch motion, i.e. rear-downward

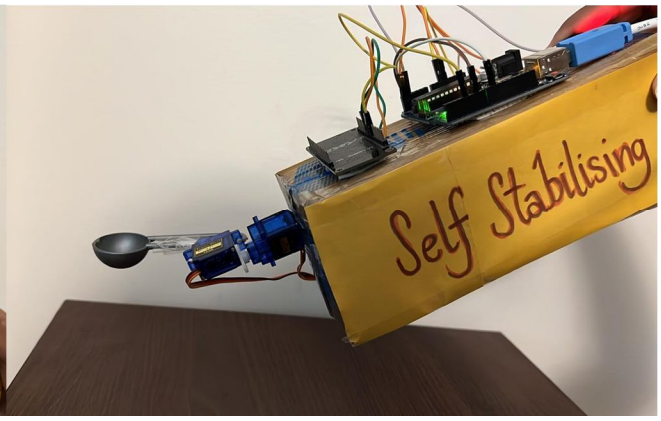


Fig. 2.2 Spoon held in a negative pitch motion, i.e. rear-upward

Tremors aren't only a Parkinson's or ET problem. Many people experience temporary issues as a result of muscular weakness, surgery, neurological disorders, medicine, and other factors. Almost everyone over the age of 50 suffers from impaired hand control and tremors. As a result, such gadgets will be in high demand in the future.

This project intends to provide a less expensive alternative to the Liftware and Gyenno "smart" spoons, hence increasing the device's availability. As a result, the major goal of this project is to develop a more reasonable and affordable alternative to the existing "smart" spoons on the market that is just as effective. We are confident that this project has a strong market potential as we have managed to construct it at less than 10% of the market price of other big companies' products which makes this product an extremely affordable option if it makes its way to the public.

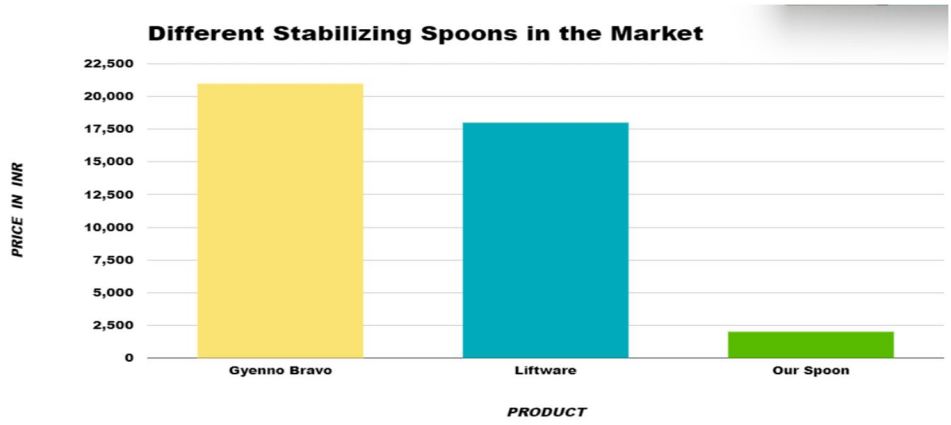


Fig. 3 Cost Comparision between other products

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V. CONCLUSIONS

As we age, our bones and nerves weaken, resulting in a variety of issues and health disorders. Parkinson's disease is one of the most prevalent neurological disorders. It is the second most prevalent nervous system ailment, behind Alzheimer's disease. It produces uncontrollable tremors in their hands and throughout their bodies, making it difficult for patients to do simple daily chores independently, such as eating meals without assistance.

Unfortunately, there is no treatment for this illness, so we created this self-stabilizing spoon with the aid of microcontrollers and sensors to make their life simpler. It combats the tremors that arise in a patient's body and allows them to perform normal activities like eating by themselves. Parkinson's disease is a condition that requires immediate care since it affects one million people in India every year. Living with sickness like this without aid is not only horrible but also unthinkable. The self-stabilizing spoon is designed to make life easier for these individuals on a daily basis by helping them do the minimal task of eating independently. Our study of microprocessors, their uses, and how they work has extended our horizons in terms of possible technologies. The information and focus applied to this methodology resulted in the product we have today. We decided to combine all of our efforts into this project because we wanted to construct intelligent biological devices based on microprocessor principles to help in real-life purposes for the healthcare society. While applying complicated algorithms, we worked on the notion of simple and basic hardware to complete this project.

VI. ACKNOWLEDGMENT

Acknowledgement is not a mere obligation but an epitome of humility and ineptness to all those who have helped in the completion of this project. I am thankful to my guide Mr Rajarajan G(Assistant Professor, VIT Vellore) and Vishal Hingorani and Chirag Chaturvedi for their kind support and guidance throughout the course of the project. They gave me the needed confidence, enthusiasm and perseverance. It gives me immense pleasure to acknowledge the faculty, staff of VIT, my family and friends who helped me a lot in finalizing this project within the stipulated time frame.

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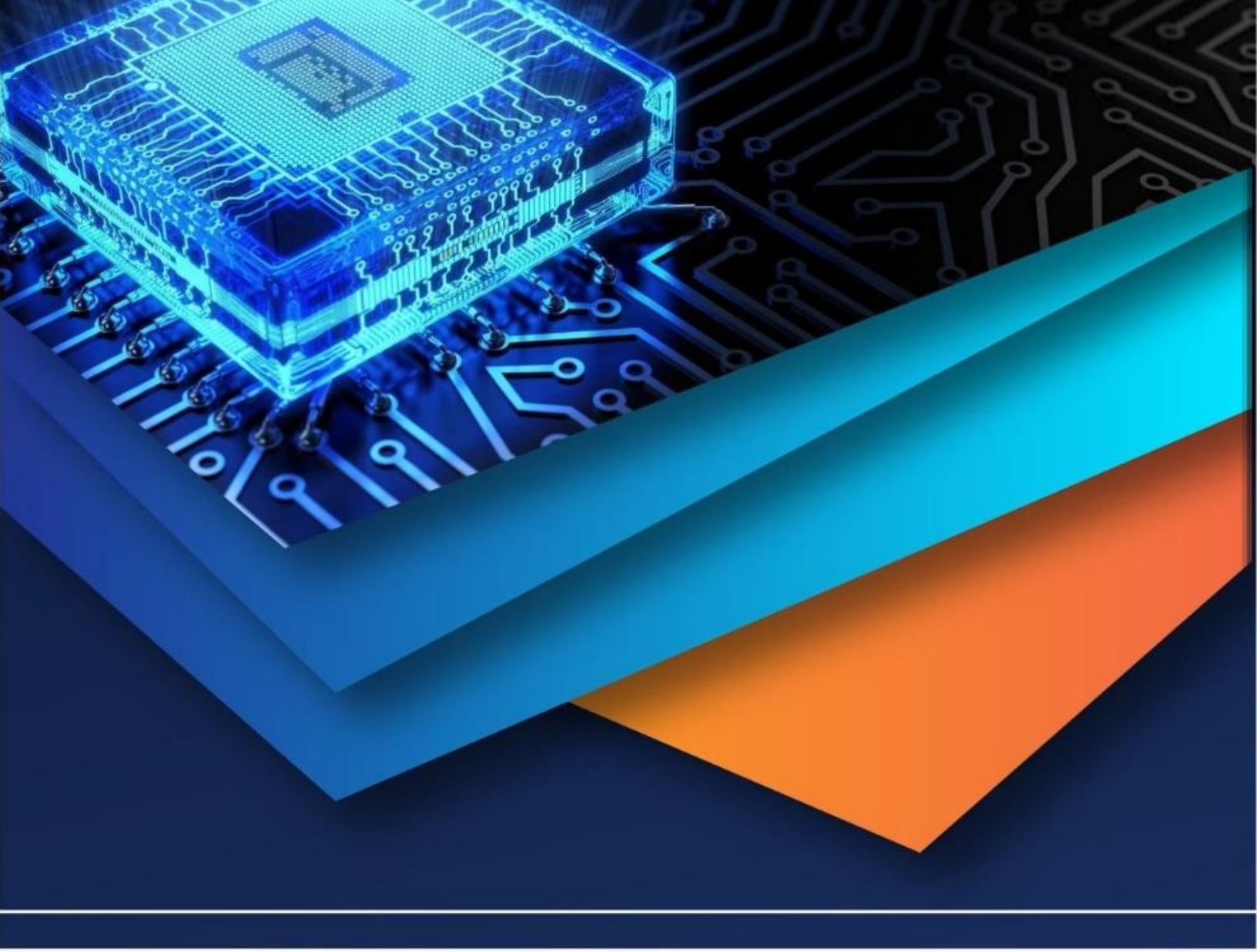
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