Department of Electronic and Telecommunication Engineering
University Of Moratuwa

EN - 2160

Conceptual Design Report

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Design Driven Innovation

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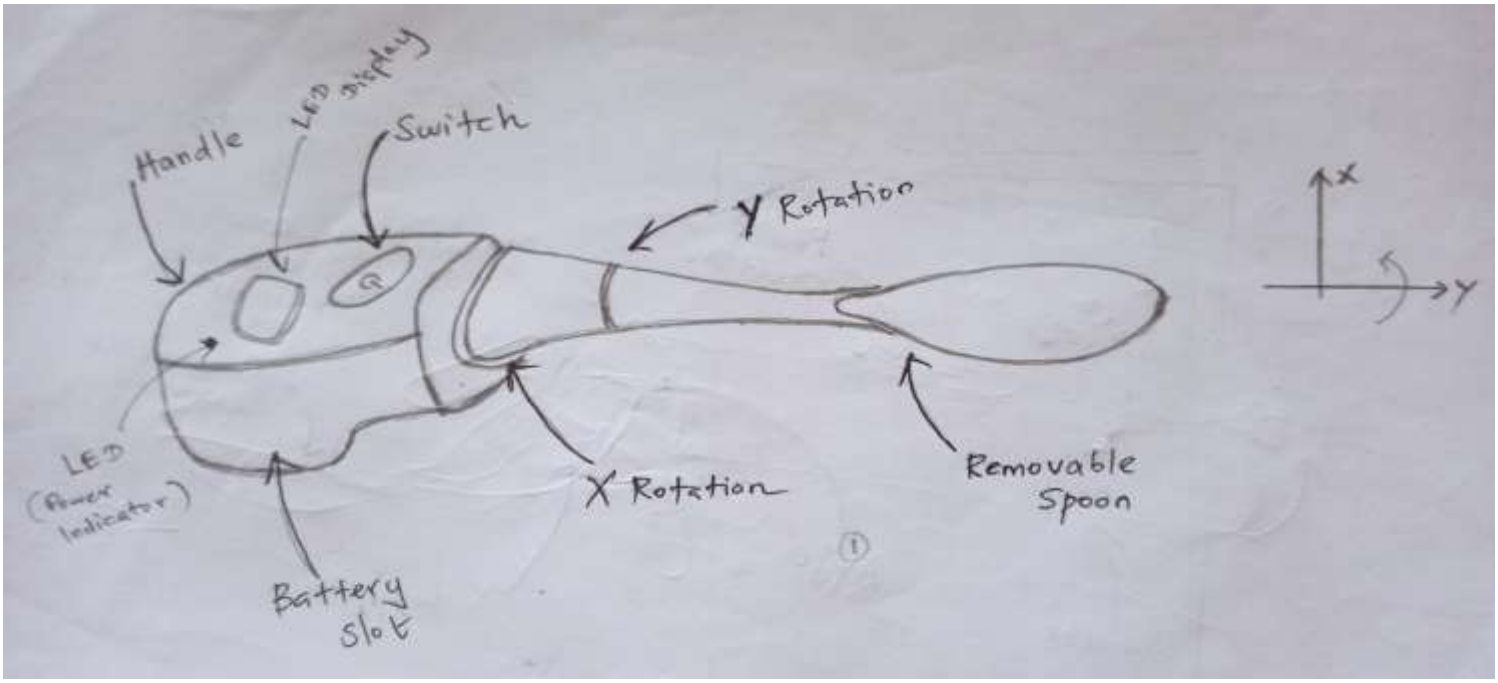
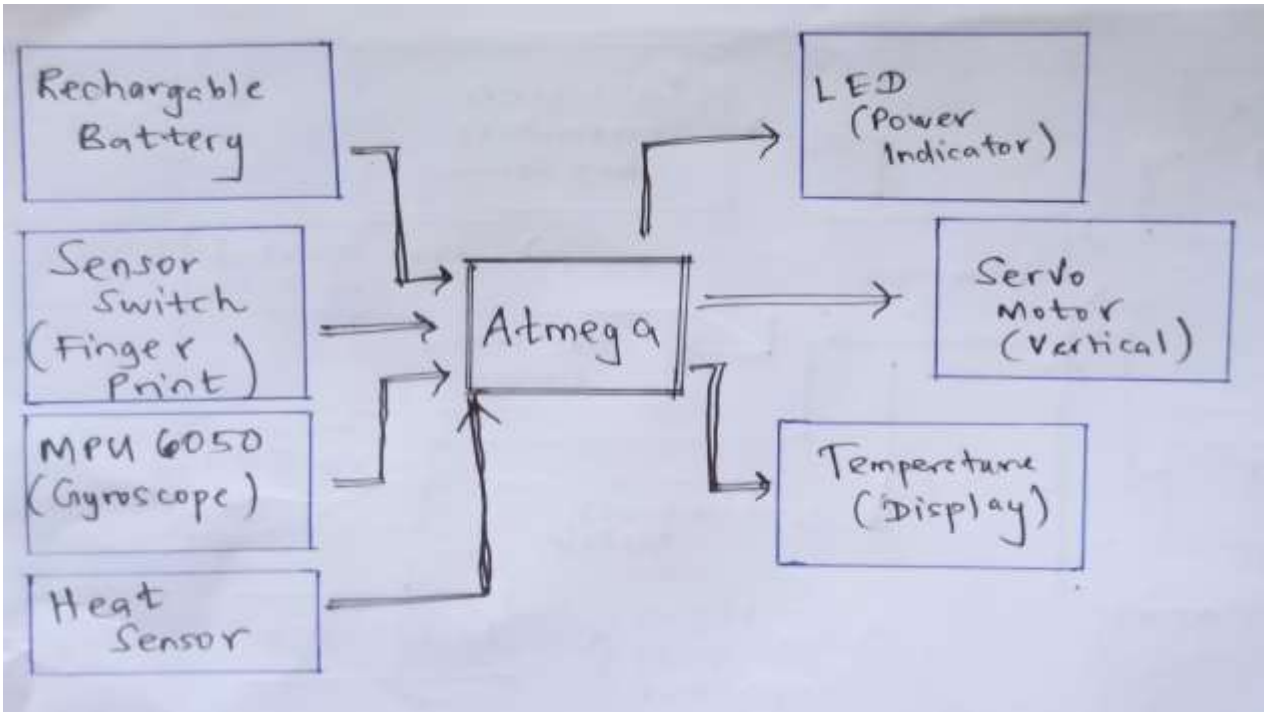
Design 01 Sketch



This enclosure diagram showcases a self-stabilizing spoon with advanced features. It incorporates an LCD display, allowing users to easily access information about their food consumption or set specific parameters. The inclusion of a thermo sensor ensures precise temperature monitoring for optimal eating experiences. Additionally, the finger sensor switch enables seamless vertical rotation, allowing users to adjust the spoon's angle effortlessly. The design prioritizes user convenience and accuracy, making it suitable for individuals seeking a high-tech and precise self-stabilizing spoon.

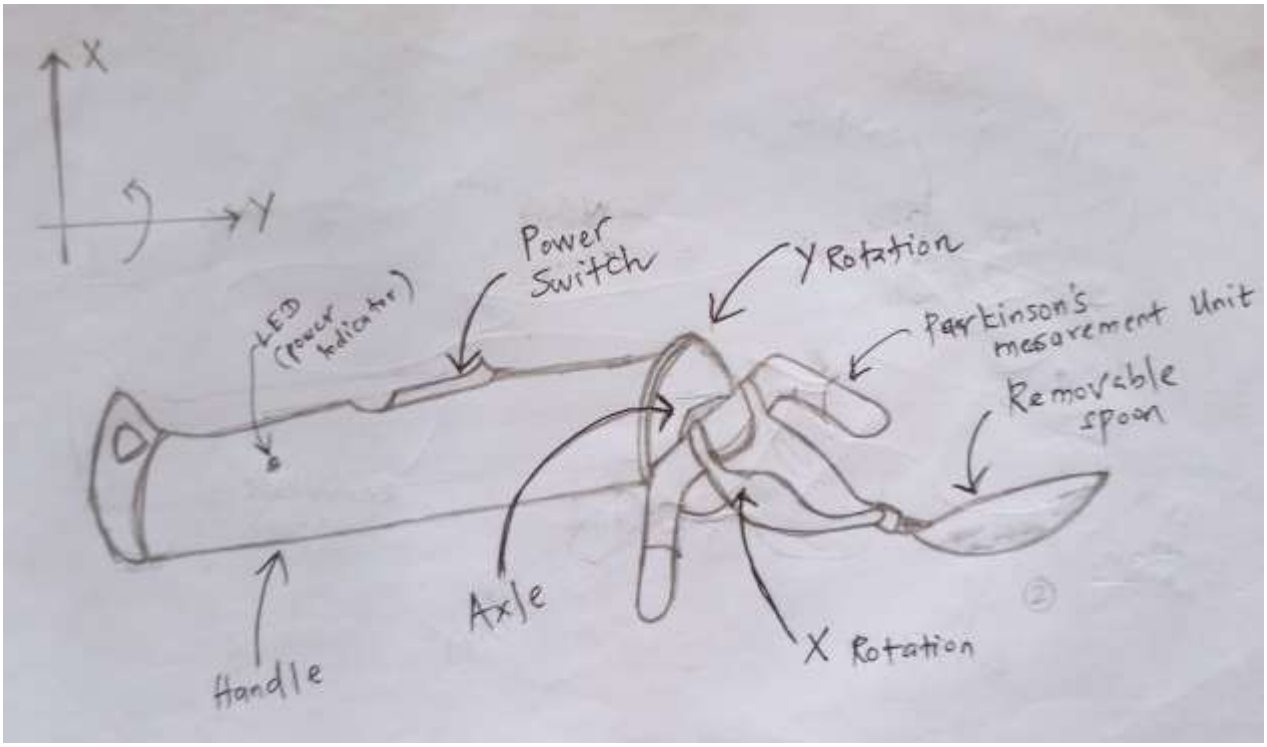
The enclosure design for this self-stabilizing spoon features an ergonomic handle that provides a comfortable grip. The LCD display is integrated into the spoon's body, ensuring easy visibility for users. The thermo sensor is positioned near the spoon bowl to accurately measure the temperature of the food. The finger sensor is conveniently located for intuitive control, enabling users to adjust the spoon's angle effortlessly. The vertical rotation servo motor is enclosed securely within the spoon to ensure stability and precise movement. Overall, this design offers a user-friendly interface and advanced control features.

Block Diagram



This circuit block diagram showcases a self-stabilizing spoon with advanced sensing and control capabilities. It incorporates an LCD display, providing users with visual feedback and information about the spoon's status. The thermo sensor ensures accurate temperature detection, allowing users to monitor the heat of their food. The finger sensor enables intuitive control, allowing users to interact with the spoon effortlessly. The servo motor switch facilitates vertical rotation, adjusting the spoon's angle as desired. Powered by a battery or rechargeable battery, the circuit block diagram also includes an MPU 6050 sensor for precise motion detection and servo rotation. This design is suitable for individuals who desire precise control and real-time feedback in their self-stabilizing spoon.

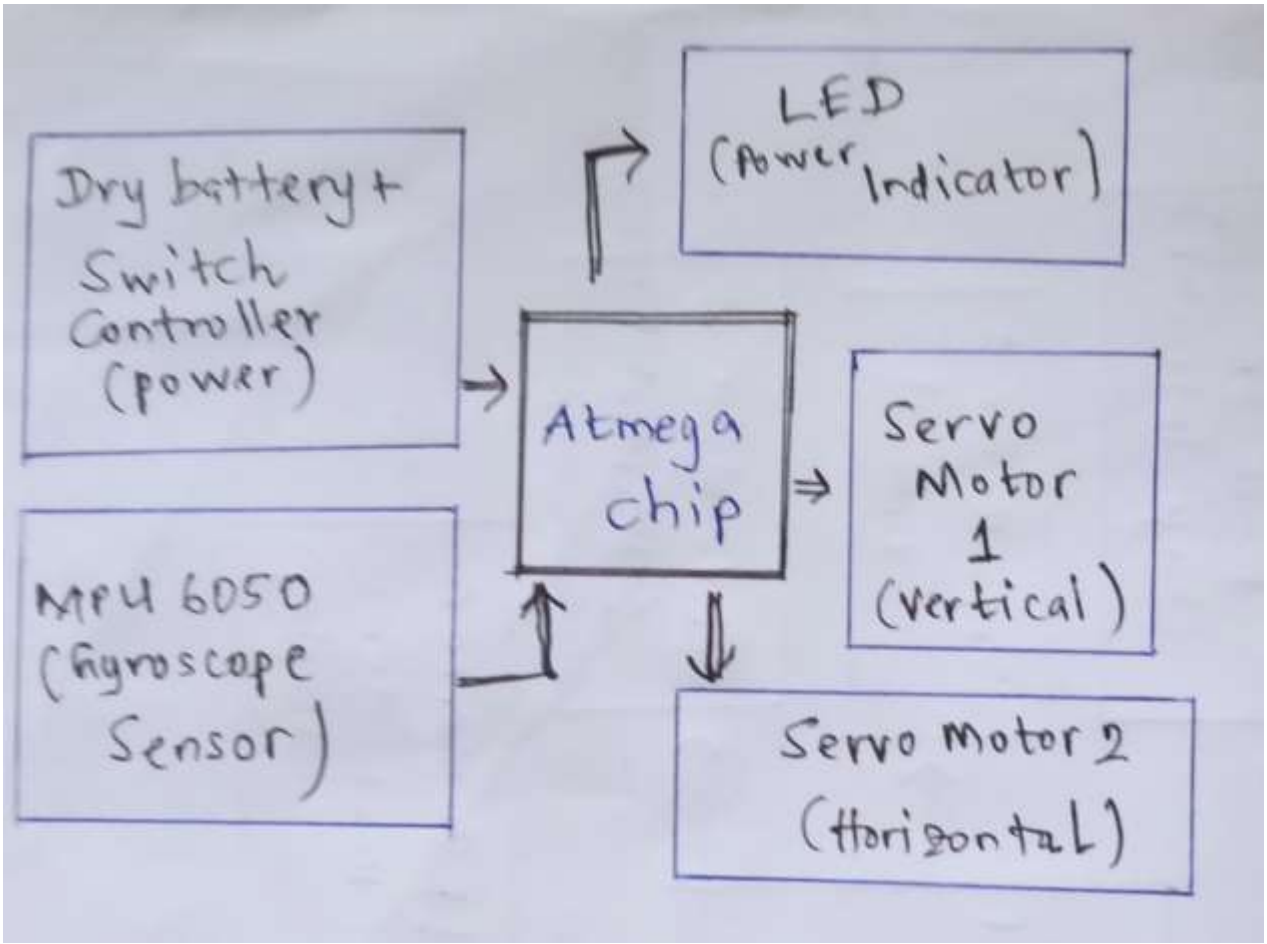
Design 02 Sketch



Enclosure Diagram 2 presents a versatile self-stabilizing spoon with user-friendly functionalities. It features a manual power switch that allows users to control the spoon's operation easily. The X and Y axis rotation capabilities enable users to adjust the spoon's position to their preference. The inclusion of a removable spoon enhances convenience for cleaning or customization purposes. The LED power indicator provides visual feedback on the spoon's power status, ensuring users are aware of its functionality. This design is suitable for those who value simplicity, versatility, and ease of use.

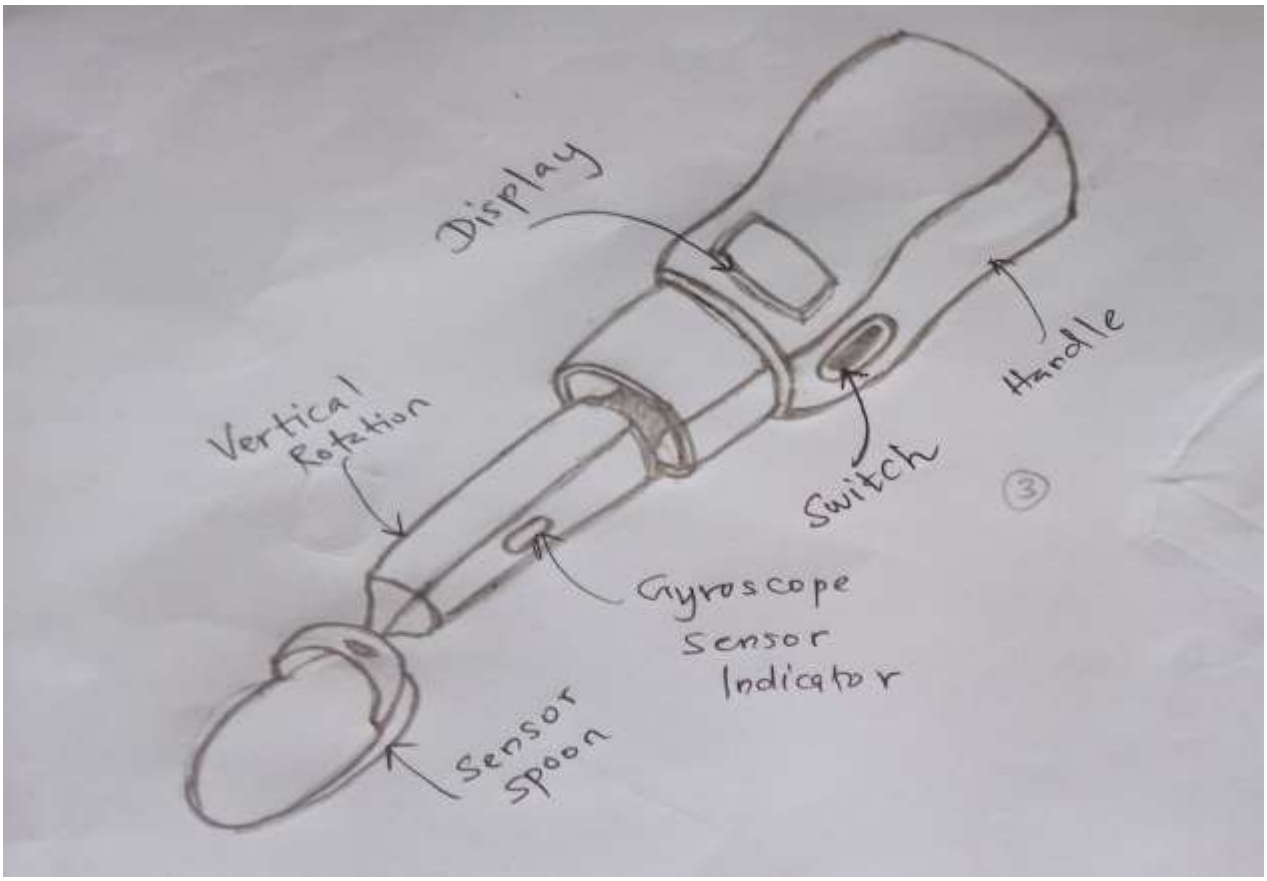
The enclosure design for this self-stabilizing spoon features a comfortable and ergonomic handle for easy handling. The manual power switch is conveniently positioned for user access, allowing them to control the spoon's operation easily. The X and Y axis rotation servos are discreetly integrated into the spoon's body, providing smooth and precise movement. A removable spoon design ensures practicality for cleaning and customization purposes. The LED power indicator is strategically placed to provide clear visibility of the spoon's power status. This design offers a balance between manual control and convenience for users.

Block Diagram



Enclosure Diagram 2 depicts a self-stabilizing spoon with manual control options and enhanced convenience. The circuit block diagram includes a manual power switch that enables users to turn the spoon on or off easily. The X and Y axis rotation servos provide adjustable movement options, allowing users to position the spoon according to their preference. The inclusion of a removable spoon enhances convenience for cleaning or customization purposes. An LED power indicator provides visual feedback on the spoon's power status, ensuring users are aware of its functionality. Powered by a battery or rechargeable battery, the circuit block diagram also incorporates an MPU 6050 sensor for precise motion detection and servo rotation.

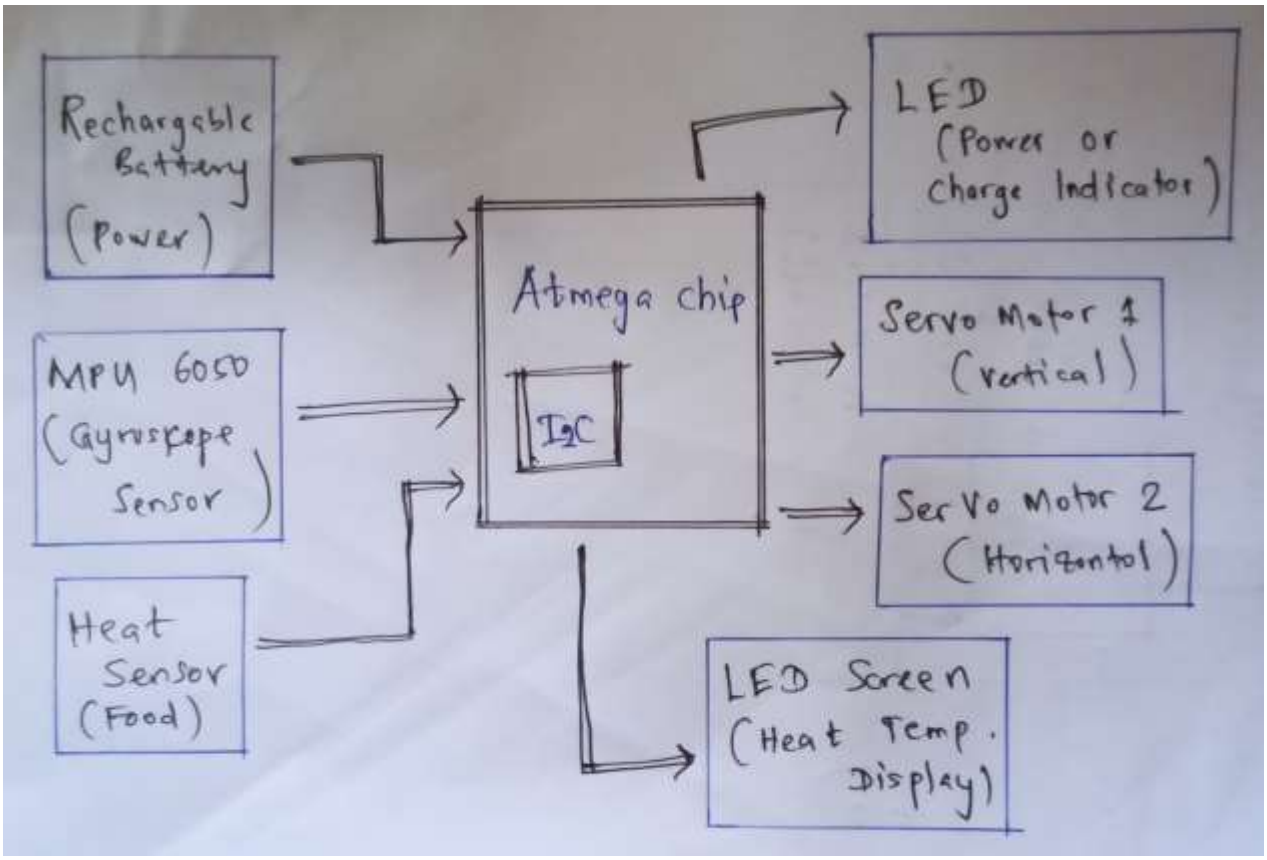
Design 3 Sketch



Enclosure Diagram 3 showcases a self-stabilizing spoon designed for enhanced control and usability. The inclusion of X and Y gyroscope sensors ensures accurate motion detection, enabling precise stabilization and control during usage. The push switch allows users to toggle between different modes or activate specific features effortlessly. The grip handle provides a comfortable and secure grip, ensuring stability and ease of use. The sensor spoon further enhances the overall functionality and control of the device. This design is well-suited for individuals who prioritize precise control and ergonomic design.

The enclosure design for this self-stabilizing spoon prioritizes user comfort and control. The X and Y servos and the gyroscope sensor are strategically positioned within the spoon's body to ensure optimal motion detection and stabilization. The push switch is easily accessible, allowing users to switch between different modes or activate specific features with ease. The sensor spoon is designed with precision and sensitivity to enhance overall control. The handle of the spoon is ergonomically shaped to provide a comfortable grip. This design offers advanced control capabilities for users who seek comprehensive functionality.

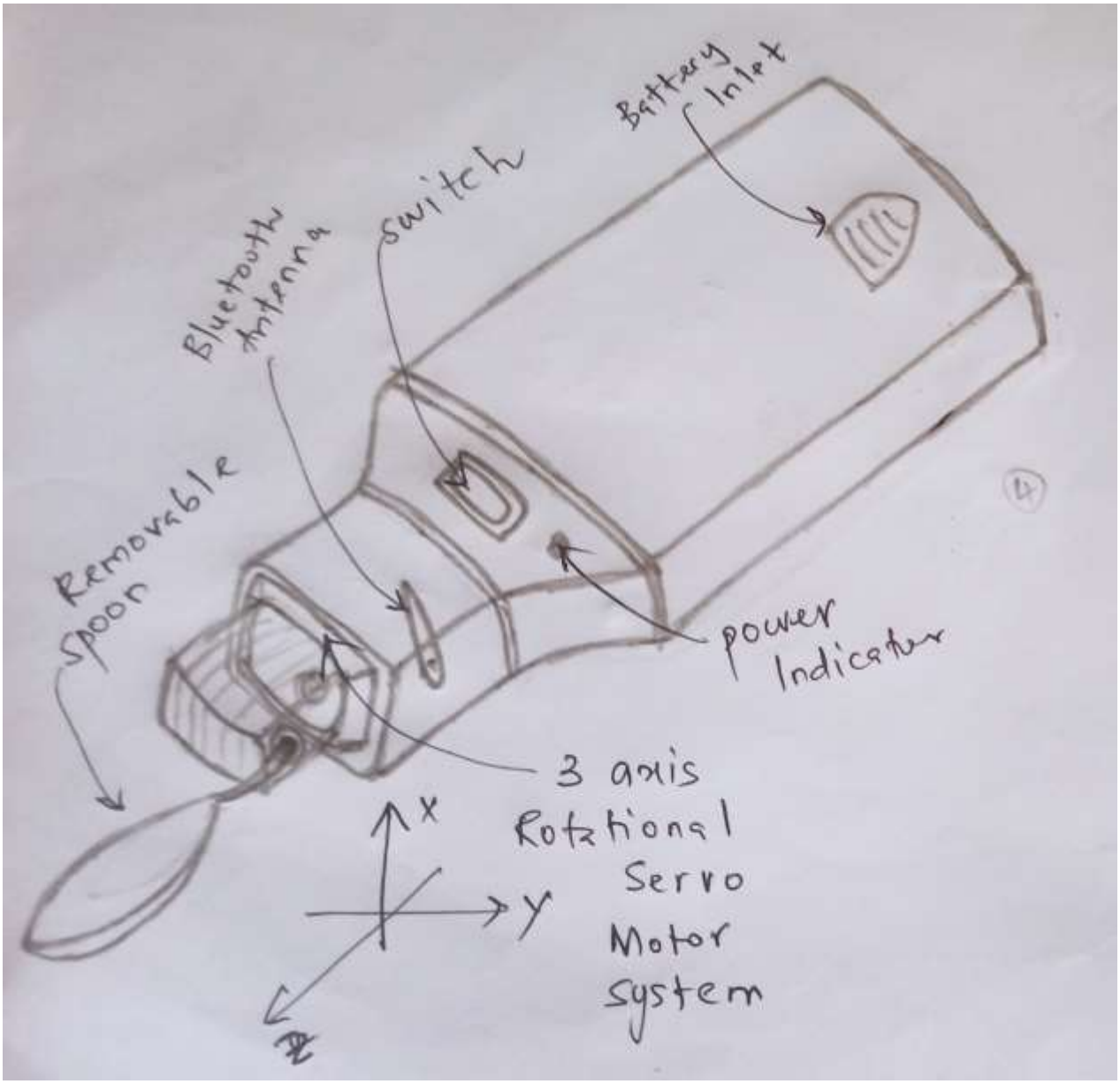
Block diagram



Circuit Block Diagram 3 represents a self-stabilizing spoon with comprehensive sensing and control features. The diagram includes X and Y servos and a gyroscope sensor for accurate motion detection and stabilization. The push switch allows users to toggle between different modes or activate specific features effortlessly. The sensor spoon enhances the overall functionality and control of the device. Powered by a battery or rechargeable battery, the circuit block diagram also incorporates an MPU 6050 sensor for precise motion detection and servo rotation.

User Centered Design

Sketch

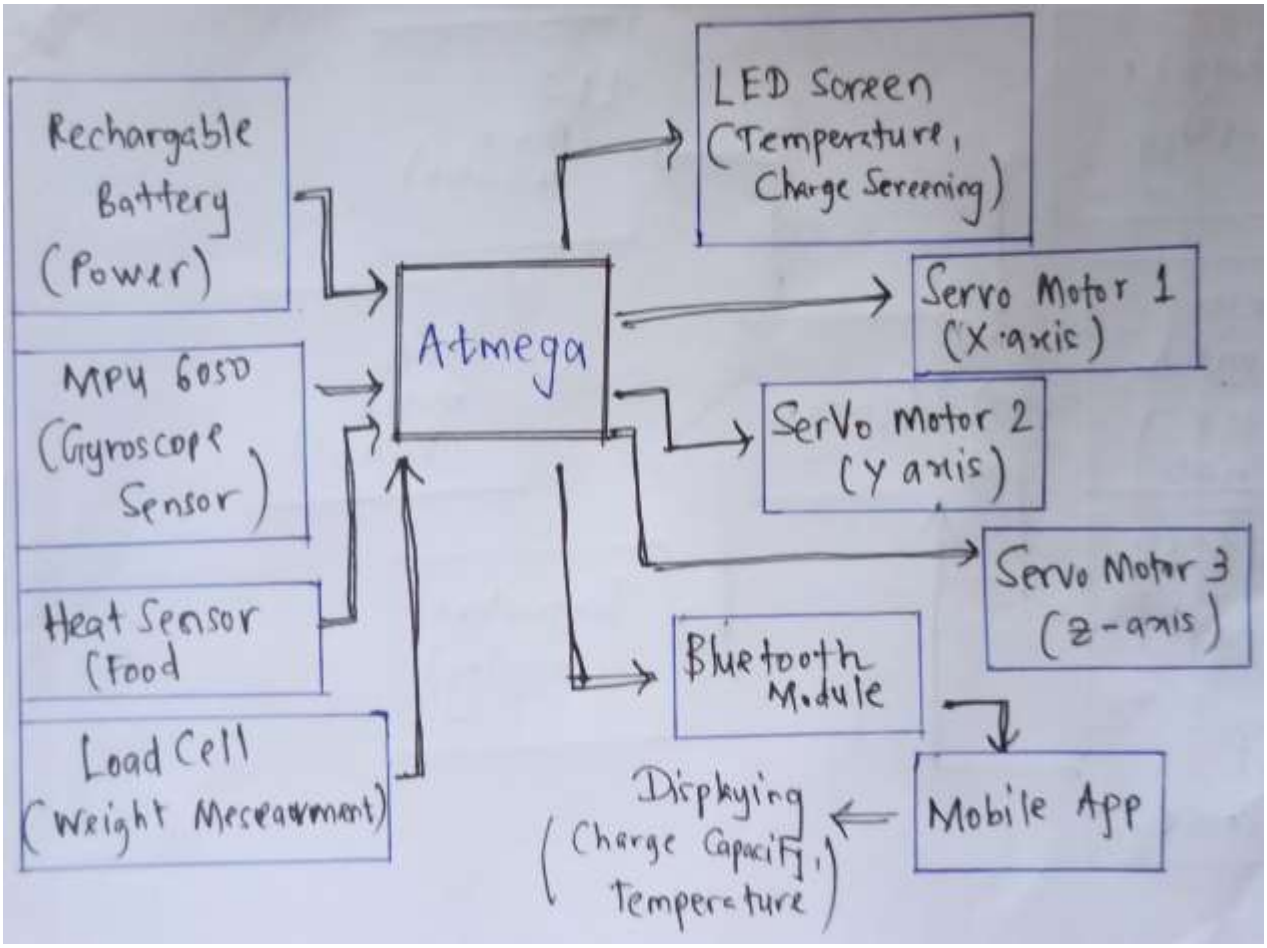


Enclosure Diagram 4 represents a self-stabilizing spoon with advanced features and connectivity options. The inclusion of X, Y, and Z rotation capabilities allows for comprehensive control and customization of the spoon's position. The power indicator provides visual feedback on the device's battery status, ensuring users are informed about its power levels. The Bluetooth antenna enables wireless connectivity, facilitating integration with compatible devices or

applications. The removable spoon allows for easy cleaning and customization. The manual on-off switch provides convenient control over the spoon's operation. This design is ideal for tech-savvy individuals who value advanced features and connectivity options in their self-stabilizing spoon.

The enclosure design for this self-stabilizing spoon is sleek and modern, catering to users who appreciate advanced technology. The X, Y, and Z rotation servos are skillfully integrated into the spoon's body, allowing for smooth and precise movement in multiple directions. The power indicator is positioned for easy visibility, providing users with clear information about the battery status. The Bluetooth antenna is discreetly incorporated into the handle, enabling wireless connectivity with compatible devices. The removable spoon design ensures practicality and convenience for cleaning and customization purposes. The inclusion of a load cell and heat sensor adds precision to weight and temperature detection. This design offers cutting-edge features and connectivity options for tech-savvy users.

Block diagram



Circuit Block Diagram 4 showcases a high-performance self-stabilizing spoon with advanced features and connectivity options. It includes X, Y, and Z rotation servos, enabling comprehensive control and customization of the spoon's position. The power indicator provides visual feedback on the device's battery status, ensuring users are informed about its power levels. The Bluetooth antenna allows for wireless connectivity, facilitating integration with compatible devices or applications. The removable spoon design enhances practicality for cleaning and customization purposes. The circuit block diagram also incorporates a load cell and heat sensor for precise weight and temperature detection. Powered by a battery or rechargeable battery, the diagram includes an MPU 6050 sensor for precise motion detection and servo rotation.

Evaluation matrix for Design sketch

	Design 01	**Design 02**	**Design 03**	**User Centered Design 04**
Stability	well-designed self-stabilizing mechanism 5	Medium stability 4	high stability 5	Medium stability 4
Ergonomics	high ergonomics 3	shows high ergonomics with a user-friendly design 5	high ergonomics 4	shows high ergonomics with a user-friendly design 5
Durability	high durability , ensuring a long lifespan 4	medium durability, indicating potential areas for reinforcement 3	high durability , ensuring a long lifespan 4	medium durability, indicating potential areas for reinforcement 3
Safety	high safety features, prioritizing user protection 4	high safety features, prioritizing user protection 3	medium safety, suggesting potential enhancements 2	demonstrates high safety attributes. 5

Adaptability	offer medium adaptability and could be improved to enhance versatility. 3	high adaptability accommodating diverse food types and eating habits. 4	offer medium adaptability and could be improved to enhance versatility. 3	high adaptability accommodating diverse food types and eating habits. 5
Cleaning and maintenance	indicate easy cleaning and maintenance, providing high convenience. 5	require moderate effort for cleaning and upkeep. 4	require moderate effort for cleaning and upkeep. 4	indicate easy cleaning and maintenance, providing high convenience. 5
Aesthetics	feature appealing aesthetics, enhancing the user experience. 5	moderate aesthetics, allowing room for visual improvement. 4	moderate aesthetics, allowing room for visual improvement. 3	feature appealing aesthetics, enhancing the user experience. 5
Time take to design	Average time will be taken 5	Average time will be taken 5	Some higher time will be taken based on the size and the shape. 2	Time is also average since, even the size is reduced design complexity has increased 4
Innovation	high innovation, incorporating unique and creative features. 5	display moderate innovation potential. 4	display moderate innovation potential. 4	high innovation, incorporating unique and creative features. 5
Cost-effectiveness	exhibit high cost-effectiveness, offering a well-balanced design in relation to	medium cost-effectiveness, suggesting areas for optimization.	exhibit high cost-effectiveness, offering a well-balanced design in relation to	medium cost-effectiveness, suggesting areas for optimization.

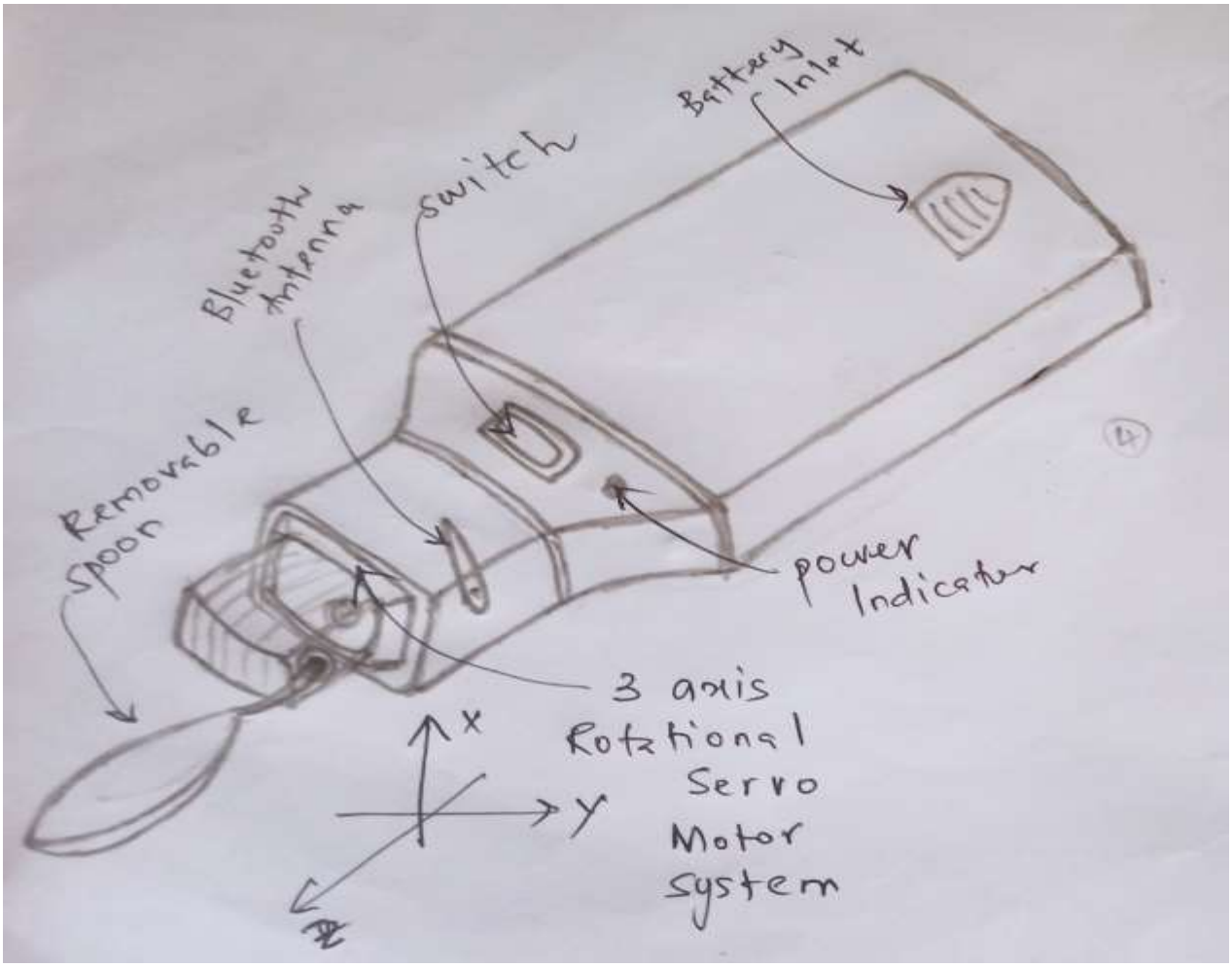
	manufacturing costs 2	3	manufacturing costs 2	5
Overall Performance	falls behind in multiple aspects, resulting in a medium overall performance 3	overall performance is better 4	demonstrate high overall performance, meeting several criteria effectively 4	demonstrate high overall performance, meeting several criteria effectively 5
	44	43	37	51

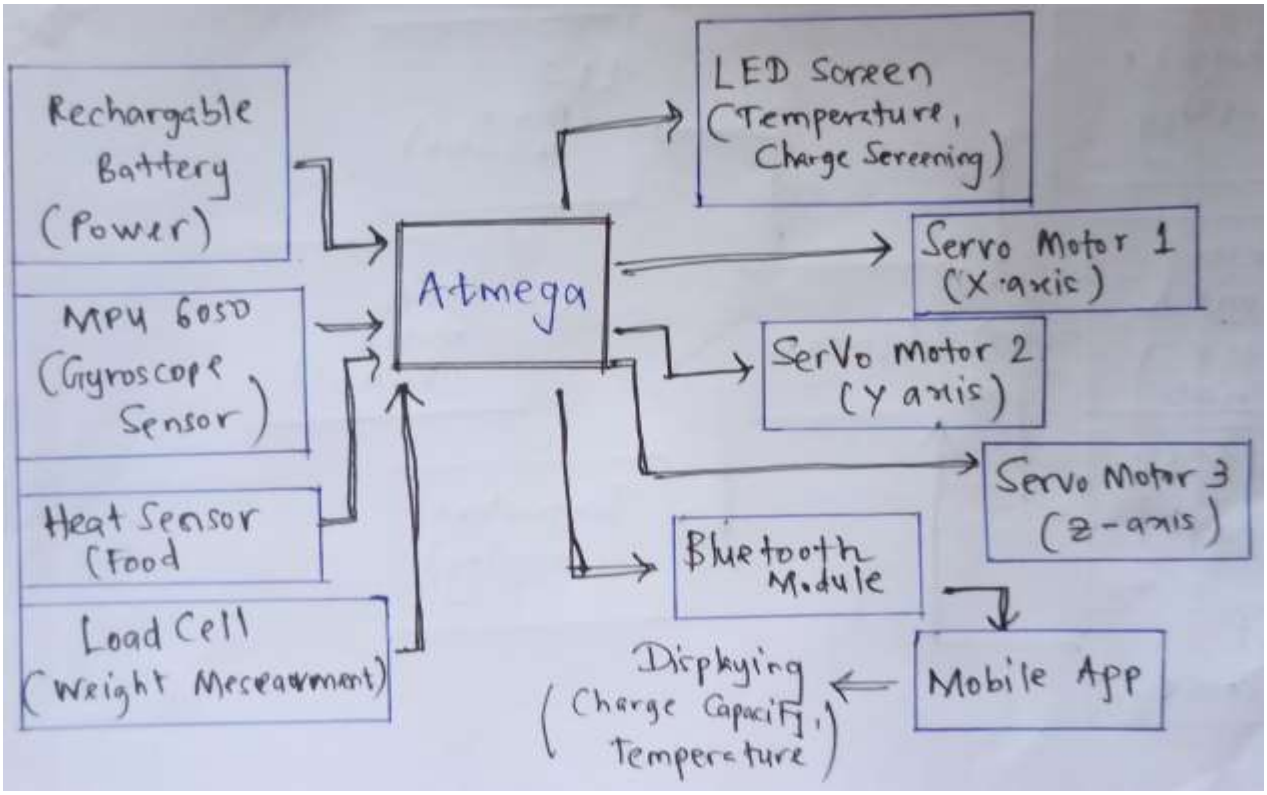
Evaluation matrix for Block diagrams

	Diagram 01	Diagram 02	Diagram 03	User Centered Diagram 04
Size of PCB	Average; much lesser with 100% SMD components 4	Average; much lesser with 100% SMD components 4	Relatively large; much lesser with 100% SMD components 3	Relatively very small 5
cost	Average cost 4	An amount near to 1st diagram 4	Little bit higher 2	Very low 5
Complexity of PCB	Will be almost same as earlier 5	Bit complex 3	Average amount 4	Sometimes that can be Hard to deal with the naked eye 4
Space change of the enclosure	Existing space is reduced but with the new parts, no much space is needed as sensors are keep outside . small space for the display 4	Existing space is reduced but with the new parts, no much space is needed as sensors are keep outside . 4	Little more space needed because of the allocated sensors . 3	Space used is greatly reduced 5

Power usage	Low power 5	Low power 5	Medium level power 4	Medium level power 4
Manufacturing considerations	Printable to a PCB 5	Printable to a PCB 5	Printable to a PCB. Using multiple PCBs for each session is recommended 4	Printable and complete SMD components are better 5
complexity	Average 5	Average 5	Bit complex 4	Average 5
	32	30	24	35

Selected design and sketch





People who contributed for design driven innovation

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