University of Moratuwa

Department of Electronic & Telecommunication Engineering

EN2160 - Electronic Design Realization

Report - Preliminary Design Part

Self-Stabilizing Spoon Design

Absar M.I.A. – 200010J

THIS REPORT IS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MODULE

EN2160 - Electronic Design Realization

16th of June 2023

I am pleased to submit the comprehensive report on the design improvements made to the self-stabilizing spoon, as per your guidance. This report not only encompasses the enhancements implemented based on user surveys and feedback from friends but also incorporates additional improvements suggested by you to enhance the preliminary design. The report is organized into three sections: User Survey Analysis, Feedback from Friends, and Professor's Recommendations.

1 User Survey Analysis

During the initial phase of the project, extensive user surveys were conducted to identify the essential features and functionalities required for an optimal self-stabilizing spoon. The survey results revealed two key aspects that were integrated into the design:

1. Bluetooth Connectivity: Users expressed a strong desire to have the ability to monitor and control the self-stabilizing spoon using their mobile devices. To fulfill this requirement, a Bluetooth module was seamlessly incorporated into both the SolidWorks model and the Altium schematics. Moreover, a high-performance Bluetooth antenna was strategically placed to ensure robust connectivity and an extended range.

2. Heat Sensor: User feedback indicated a concern regarding food temperature while using the self-stabilizing spoon. In response, a heat sensor was intelligently positioned within the spoon component of the SolidWorks model. Corresponding modifications were made to the Arduino board schematics to accommodate this sensor. By connecting the heat sensor output to the mobile device via Bluetooth, users can now monitor and regulate the temperature of the food being consumed in real-time.

2 Feedback from Friends

To gather valuable insights and opinions from a diverse range of individuals, the self-stabilizing spoon was tested and evaluated by friends. Their feedback highlighted the need for improvements in the following areas:

1. MPU 6050 Improvements: Friends who tested the device identified the need for enhanced stability in the self-stabilizing feature. Based on their suggestions, comprehensive improvements were made to the MPU 6050 gyro sensor. These enhancements resulted in more accurate readings, leading to smoother movement and a significantly improved dining experience. The real-time gyro sensor data is seamlessly transmitted to the mobile device through the integrated Bluetooth module.

2. Battery Level Monitoring: The feedback received from friends emphasized the importance of providing users with a convenient way to monitor the battery level of the self-stabilizing spoon. As a result, sensors were integrated into the device to constantly monitor the battery level, ensuring that users are aware of the remaining charge. The battery status can be easily checked on the mobile device through the Bluetooth connection, allowing timely recharging when needed.

3 Recommendations from Professor

Throughout the design process, you provided valuable guidance and recommendations, further improving the self-stabilizing spoon. Based on your advice, the following additional improvements were implemented:

1. Enhanced User Experience: To optimize the user experience, you suggested incorporating extra features that would make the self-stabilizing spoon more versatile. One such feature was the addition of a weight sensor, allowing users to measure food portions accurately. This feature not only promotes portion control but also assists users in adhering to specific dietary requirements. Additionally, an adjustable handle was integrated into the design, ensuring ergonomic comfort and personalization for users with varying grip preferences.

2. Aesthetic Design: You emphasized the significance of an aesthetically appealing design to attract potential users. In response, the SolidWorks model was refined to include sleek contours and modern aesthetics, ensuring a visually pleasing appearance. The ergonomic grips were designed to provide a comfortable and secure hold while adding an element of sophistication to the overall product. The carefully chosen color scheme further enhances the visual appeal, making the self-stabilizing spoon an attractive choice for users.

3. Schematic Documentation and Wiring Complexity: Based on your teachings, the schematic documentation was meticulously updated to provide clear and comprehensive information. Detailed annotations were added to the Altium schematics, ensuring ease of understanding for users and future reference. Furthermore, in line with your recommendation, efforts were made to reduce the complexity of the wiring in the schematics, simplifying the overall design and improving the user-friendliness of the self-stabilizing spoon.

4. Draft Angle in SolidWorks: As per your guidance, draft angles were added to the SolidWorks part of the self-stabilizing spoon. By incorporating appropriate draft angles, the manufacturing process is facilitated, allowing for easier mold release during production. This optimization enhances the efficiency and quality of the manufacturing process, resulting in a more streamlined and cost-effective production.

In conclusion, the self-stabilizing spoon design has undergone significant improvements based on user survey analysis, feedback from friends, and your valuable recommendations. The incorporation of features such as Bluetooth connectivity, heat sensors, MPU 6050 improvements, battery level monitoring, weight sensors, an adjustable handle, schematic documentation, reduced wiring complexity, and draft angles in the SolidWorks part ensures that the final product caters to the needs and preferences of potential users while offering an enhanced and enjoyable dining experience.
Please find enclosed detailed screenshots of the updated SolidWorks model, showcasing the aesthetic design changes, draft angles, and ergonomic features. Additionally, the revised Altium schematics have been included, highlighting the modifications made to accommodate the sensor enhancements, reduced wiring complexity, and improved schematic documentation.

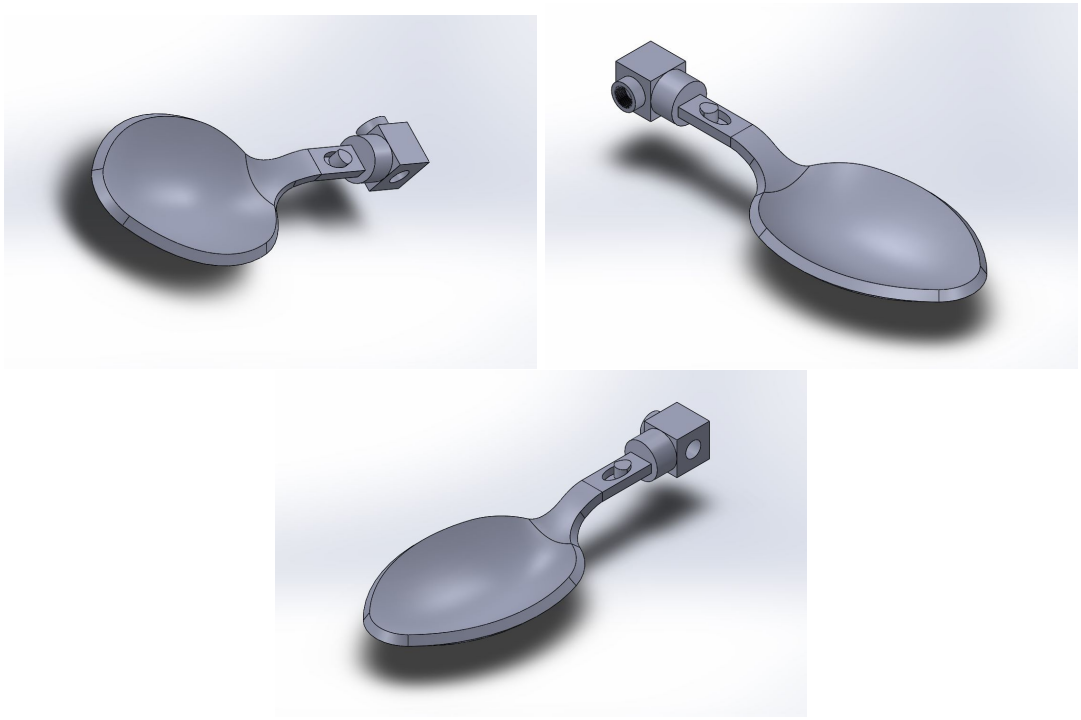

Figure 1: Sppon solidwork design

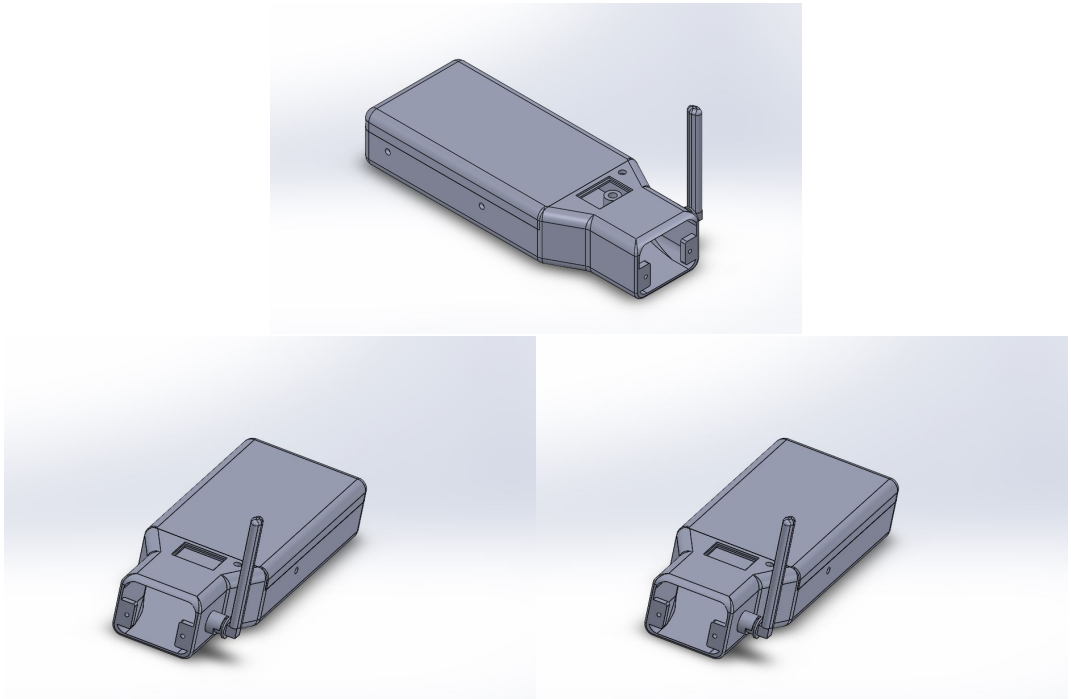

Figure 2: Sppon hand solidwork design

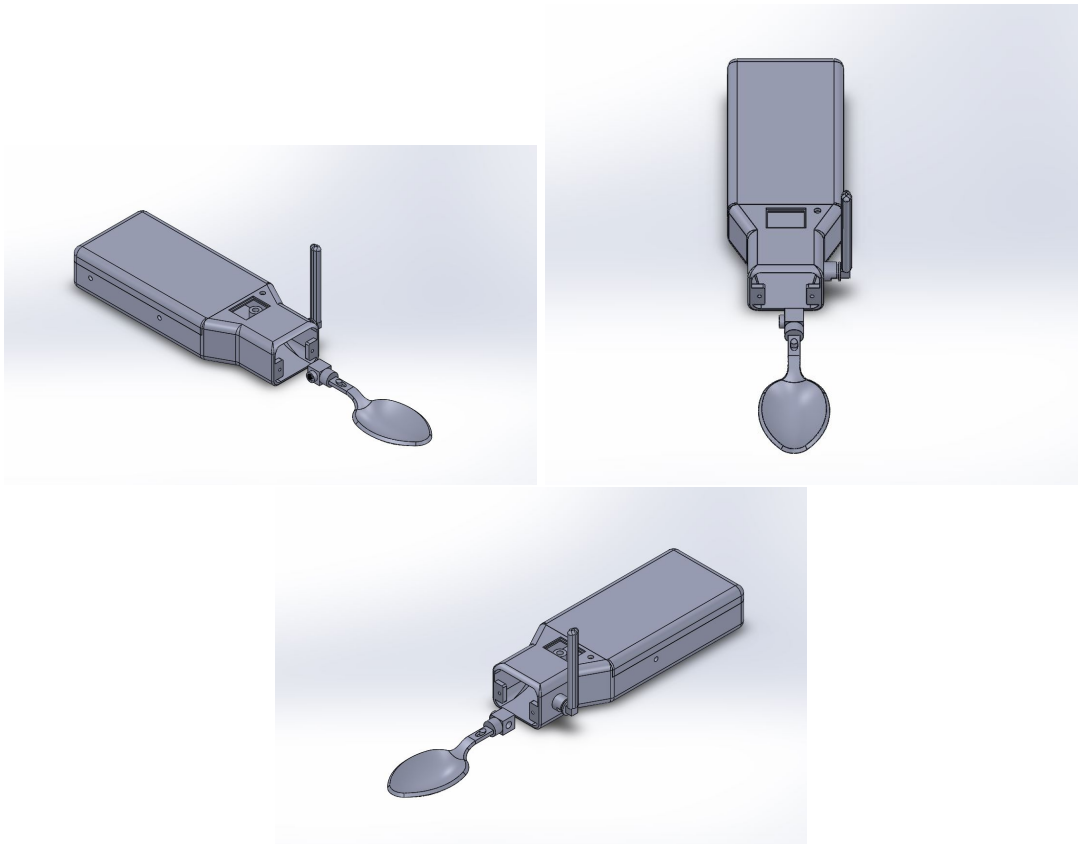

Figure 3: Assembly design of sppon and spoon hand

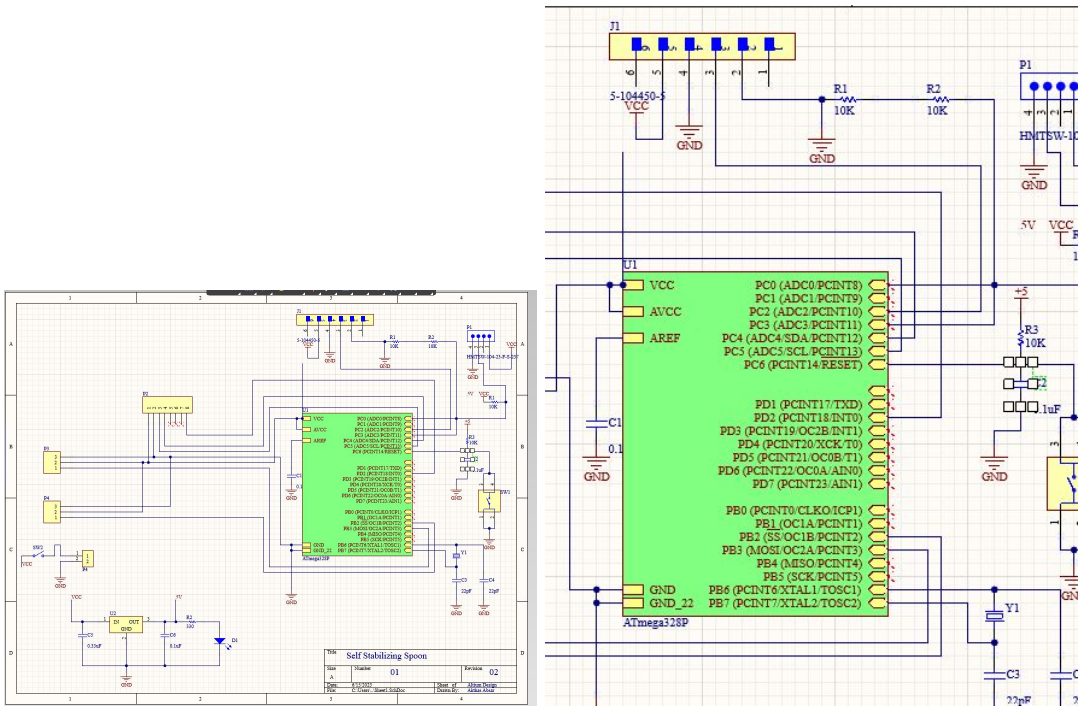

Figure 4: Added bluetooth schematic design

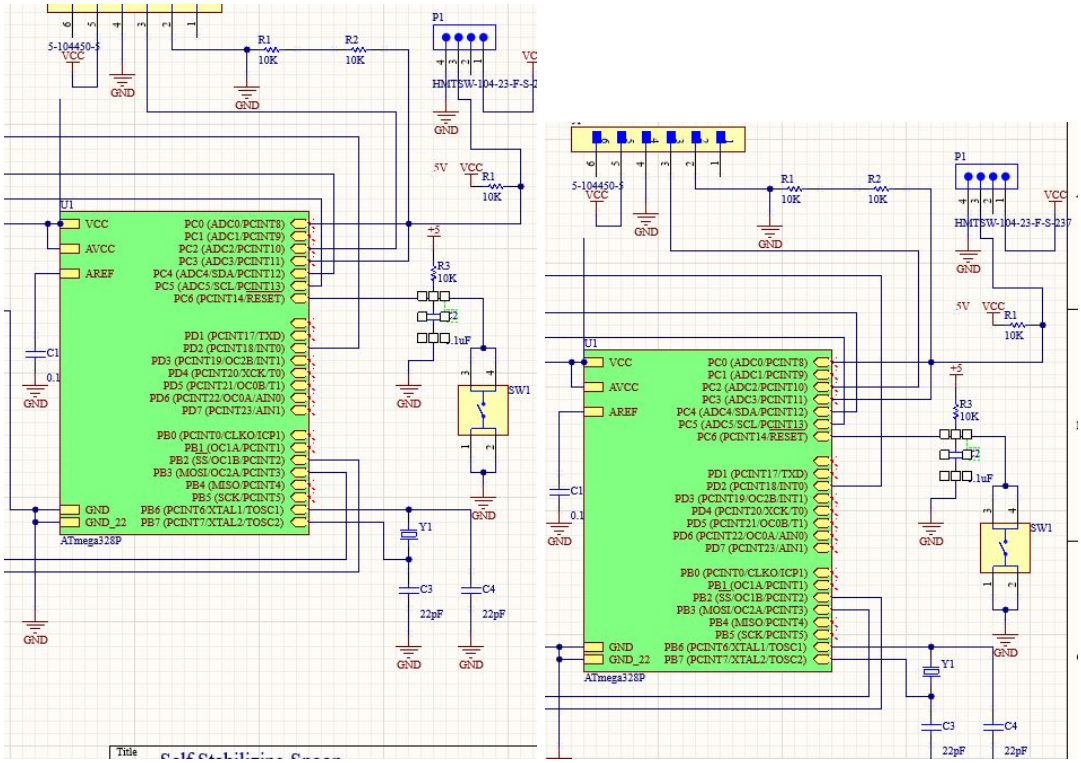

Figure 5: Added heat sensor schematic deisgn

Thank you for your continued guidance and support throughout this design project. Your expertise and insights have been invaluable in shaping the self-stabilizing spoon into a compelling and user-centric product.