Semi-Automatic Shirt Ironing and Folding Machine

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***Abstract*—The Semi-Automatic Shirt Ironing and Folding Ma- chine is a multifunctional system designed to automate two time- consuming domestic tasks: ironing and folding garments. The device integrates a heating plate derived from a standard iron box with a motor-driven folding mechanism, coordinated by an Arduino-based control system. Safety is ensured through temperature sensing and relay isolation, while servo-actuated folding ensures repeatable, neat results. The design targets household and small-laundry applications, emphasizing affordability and modularity. A multipurpose home appliance, the Cloth Ironing and Folding Machine was created to automate the chores of folding and ironing clothing. In every home, these two tasks are frequently labor-intensive and time-consuming. By integrating folding and ironing capabilities into a single automated device, this concept seeks to simplify, expedite, and secure the process. The device eliminates wrinkles from clothing by using a heated plate that was taken from a traditional iron box. After ironing, the clothes are neatly folded by a motor-driven folding mechanism that is managed by an Arduino microcontroller. To guarantee precise functioning and user safety, the Arduino also manages servo motors, temperature sensors, and relays. The machine saves time, minimizes human labor, and guarantees consistent ironing quality. Additionally, it has safety features including controlled heating and automatic power shutdown to avoid overheating or fabric damage. This system, primarily intended for home usage, combines automation, convenience, and safety into a single device to provide a small, energy-efficient, and easy-to-use solution that improves daily life.**

***Index Terms*—automation, ironing, folding machine, Arduino, servo motors, temperature control**

I. INTRODUCTION

Manual ironing and folding of clothes require significant time and human effort. Conventional methods depend on user skill and often yield inconsistent results; additionally, they pose occasional safety risks due to high Everyday home tasks like folding and ironing clothes by hand frequently call for a lot of time, physical exertion, and attention to precision. Conventional ironing techniques rely significantly on the user's ability and consistency, which can lead to inconsistent ironing quality and sporadic safety risks like burns or overheating. Growing interest in creating systems that can carry out these chores automatically, effectively, and safely is a result of the quick development of automation and smart home technology.

This idea presents an automated ironing and folding machine that can manage both tasks in a single, small unit in order to overcome these difficulties. To eliminate wrinkles and press clothing uniformly, the device makes use of a heated plate that is taken from a typical iron box. After ironing is finished, the clothing is sent to a servo-actuated folding mechanism, which uses pre-programmed movements to fold it neatly and precisely. Automation of the folding and ironing processes guarantees consistent quality while reducing the need for human involvement. An Arduino microcontroller serves as the foundation for the project's control system, which regulates the functioning of servo motors, relays, and sensors. Feedback from the sensors guarantees precise temperature control and the folding mechanism operates as intended. While avoiding overheating, the relay-controlled heating circuit keeps the temperature constant to accommodate various fabric kinds. These design factors guarantee

a high degree of user safety in addition to making the system efficient.
This machine is particularly helpful in places like homes, hotels, hostels, and launderettes where a lot of garments need to be folded and ironed on a regular basis. It increases productivity, decreases workload, and saves time. Additionally, it improves comfort and convenience by offering a clever, dependable, and user-friendly solution for regular clothing care.

II. LITERATURE REVIEW

[1]. Automatic cloth folding and ironing "(Mohammed Noor Akhunji, 2024) The paper is critical to the project because it centers on the crucial integration of both ironing and folding processes. It offers a fundamental method for integrating these two functions into one cohesive machine. This provides direct support for the main objective of creating a system that automatically performs both pressing and folding.

[2]. Automatic T-Shirt Folding and Ironing" (S. Usha, M. Karthik, S. Sanjay Kumar, 2024)
This research examines automation for particular types of clothing, including T-shirts. It offers a detailed examination of the mechanical structure, control algorithms, and fabric- handling techniques essential for effective operation. Challenges such as garment slippage and wrinkle removal are also tackled in the paper, which provides practical solutions for accurate mechanical and electrical control. The results of the study are useful for creating strong systems that can manage various clothing materials and shapes, thereby enhancing reliability and performance.

[3] Study on Clothing Classification by Machine Learning for Folding System Using Two Omnidirectional Robots with Single Arm" (T. T. Khoa and T. Kawamura, 2022)
This research presents machine learning (ML) as a method for clothing classification and adaptive folding. The authors developed a dual-robot system with single-arm manipulators that can recognize garment types and automatically modify folding strategies. The research emphasizes the prospective benefits of smart automation that can learn, identify, and enhance its performance across different clothing categories, thus increasing flexibility and accuracy in garment handling.

[4]. Automatic Ironing Machine" (Aman Kaushik et al., 2014)
This article presents an automatic ironing device that uses two motorized iron plates to iron clothes from both sides at the same time. A chain and sprocket mechanism are utilized in the design to synchronize motion, and the upper iron can be removed for manual use. This concept of dual functionality offers a practical means of integrating automation and flexibility, making it suitable for both domestic and semi- industrial applications.

[5]. A Learning Method of Dual-Arm Manipulation for Cloth Folding Using Physics Simulator" (D. Tanaka, S. Tsuda, and K. Yamazaki, 2019)
This reference investigates how simulation-based learning can be applied to train robotic manipulators for folding soft, deformable materials. The research utilizes a physics simulator to create accurate and dependable dual-arm folding methods, enhancing the ability to control flexible items such as cloth in real-world robotic applications. The results are essential for creating folding mechanisms that use servos and need precise motion control and repeatability.

[6]. Electrical Iron Design" (Mohd Hazuan Bin Mohd Zawawi, 2009)
This study utilizes the Design for Manufacture and Assembly (DFMA) approach to make the construction of electrical irons easier. The aim was to minimize the number of internal components in order to reduce production costs and simplify assembly. This method offers valuable perspectives for creating heating units that are economical and easy to assemble, pertinent to the design of automated ironing systems.

[7]. Photovoltaic Powered T-Shirt Folding Machine" (N. Gomesh, Y. M. Irwan, 2013)
The conference paper investigates the viability of a solar- powered folding machine, emphasizing sustainability in automation. The design shows the integration of renewable energy sources into household automation systems. Its demon- states the

possibility of off-grid functioning and energy-saving solutions, which is in line with contemporary objectives of ecological sustainability and green technology.

[8] Automatic Cloth Folding Machine" (Xudong Li, Anran Su, Suicheng Zhan)
The focus of this paper is on the mechanical design principles of automatic cloth folding systems. It elaborates on the application of linkages, sensors, and motor control to attain precise and self-directed folding. This research delivers Essential technical details for creating a fully operational folding mechanism and acts as a primary engineering reference for system design in this project.

[9]. Automatic T-Shirt Folding Machine" (Mukesh P. Mahajan et al., Deepak Shroff, and Paresh Somani)
These works highlight the importance of automating the folding of common types of clothing, especially T-shirts. Their designs provide mechanical blueprints and control schemes that can be tailored for wider applications. This area's multiple studies bolster the current movement toward automation in clothing care and confirm that engineering such systems is vi- able.

[10]. Automatic Cloth Folding and Color-Based Sorting Mechanism" (Suraj Shah, Utkarsha Mahajan)
By incorporating color-based sorting into the process, this study expands automation to include more than just folding. It shows that automation can be applied not just to folding garments but also to post-laundry management activities like sorting and organizing clothing. The system shows the potential for multi-function automation, contributing to future smart laundry solutions.

[11]. An Automatic Cloth Folding Machine" (Hesham Alqaatabi, Alawite Musa, 2017)
This paper introduces a folding system that is designed to be reliable and simple, integrating mechanical and electrical components. Chassis design, plate actuation, and sequential control are among the aspects addressed in the work, which provides useful practical information for constructing an automated folding unit. It aids in the mechanical and structural planning of a reliable multipurpose system.
[12]. Automatic Cloth Folding and Color-Based Sorting Mechanism" (Suraj Shah, Utkarsha Mahajan, 2015)
The authors examine a mechanism with two functions: folding and sorting based on color. The design showcases a heightened degree of automation and usefulness, highlighting the potential of such systems to lessen the time and effort involved in managing laundry. It mirrors the development of automation from systems designed for individual tasks to integrated devices capable of multiple operations, and it aligns directly with the goals of the present project.

III. PROPOSED METHODOLOGY

The Automatic Cloth Ironing and Folding Machine employs a methodology aimed at simplifying and automating the tasks of ironing and folding clothes, utilizing an embedded control system based on Arduino. The process begins with the IR sensor, which identifies whether a cloth has been positioned on the input tray. The Arduino UNO activates the DC motors driving rollers to smoothly pull the fabric across the heating plate once detected. The heating plate, crafted from a regular iron box, delivers consistent heat for effective wrinkle removal. To ensure safety and a consistent ironing quality, a temperature sensor continuously checks and adjusts the heat level. All actions are managed centrally by the control system.

FIG. 1. 3D MODEL

The Arduino collects signals from the sensors, processes these signals, and dispatches commands to the motors and relay modules. It adjusts the speed of the motor, fine-tunes servo positions for folding, and controls power to the heating element via a relay circuit. This guarantees exact timing, synchronized movement, and safe management of electrical loads. Once ironing is completed, the servo motors start the

folding procedure. The arms, which can be folded, move according to a pre-set sequence in order to fold the item of clothing neatly and precisely. When the folding is finished, the cloth is automatically deposited into the output tray, ready for pickup.

The power circuit supplies the system with the required electrical energy, while the relay module serves to isolate the low-voltage control unit from the high-voltage heating element. This design boosts operational safety while guaranteeing energy-efficient performance. In summary, the methodology combines sensing, heating, motion control, and folding into a single compact system. It minimizes the need for manual work, increases consistency, and bolsters safety, which makes it a perfect automation option for domestic homes, hotels, and small-scale laundries.

IV. FUTURE SCOPE DISCUSSION

The hardware planning and preliminary design confirm that it is feasible to integrate mechanisms for ironing and folding into a single automated setup. The literature review offered direction for selecting cost-effective sensors and actuators. The system is designed with a modular approach, which guarantees that it can be expanded to include advanced features like cloth recognition and wireless control. Further evaluations in the S8 phase will confirm the uniformity of ironing, the accuracy of folding, and the safety performance regarding temperature.

V. CONCLUSION

The suggested cloth-ironing-and-folding device automates two essential household tasks, thereby simplifying the care of clothing items. The Arduino-controlled design, incorporating IR, optical, and temperature sensors, ensures safe and efficient operation. This project demonstrates the potential for smart home integration and significant time savings in daily life. Future work includes refining mechanical precision, improving temperature feedback, and implementing IoT-based remote monitoring.

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