

Automatic T-Shirt Folding Machine

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Abstract: T-shirt folding is a process used everywhere to pack the garments and keep them neat. The textile industry hasn't witnessed the growth in the field of automation in the manufacturing sector of the clothing industry. In addition, automatic folding mechanism has been used in this machine. Automation has been achieved by designing with the help of sensors and other actuators. This will make a fully automated technology in textile industry which it has been lacking for years. At present the system will be created based on materials and components available to bring simplicity and cost effectiveness in the system. The entire system can be easily implemented to the current system without any high volume changes in the industries.

Keywords: Automatic t-shirt folding machine, actuators, control unit, sensors.

1. Introduction

Introduction of automation in textile industry has not been done yet, even though we have huge development in technologies there were lots of mechanism which can be implemented. It will help the textile industries by using automation in the field of manufacturing process. The aim is to implement automation in textile industries by giving out T-shirt folding machine [2]. Washing machine has been introduced in the year 1858, till now no new innovation has been implemented. So the concept of T-shirt folding machine will be more effective. In this modern world people are running short of time, so the introduction of Dishwasher, Vacuum cleaner, and Washing machine, helps us to reduce some work [6] but folding of laundry makes much time and energy consumption is damn high [4]. usually laundry follows the pattern of washing, drying and folding, for folding there are some solutions like Quick-Press sold by Daisaku Shoji Ltd is which provides easy folding for T-shirt but it is manual procedure [6]. Here we concentrate on adding an innovation of folding clothes automatically by folding mechanism. In laundry there are various kinds of garments but we mainly focused on T-shirt and testing which has been made [5]. Simplicity has been bought into this by using the components which has been easily available in market. By using this setup we can use this in industry with less power consumption [2].

2. Components

A. Actuators

Actuators are component which produce motion and controls the working environment in a system. Both linear and rotary motions can be produced by actuator [11]. Linear motion is

produced using hydraulic cylinders and pneumatic cylinders, rotary motions are produced using electric motors [12].

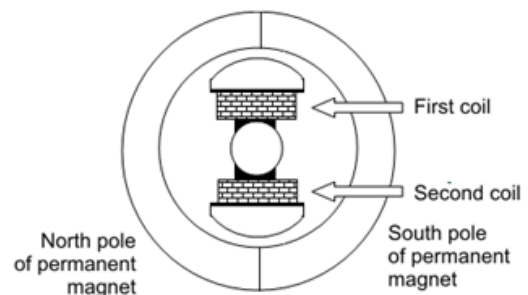


Fig. 1. DC motor [1]

B. Control Unit

The sequence in a system for completing a job is maintained and controlled by some of the controllers. Its circuit is designed and simulated using software's [13]. The hardware is interfaced with actuators to make a controlled motion. Some of the widely used controllers are Arduino UNO, microcontrollers, Programmable logic controllers and some printed circuit boards [14].

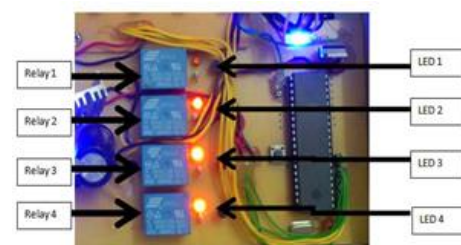


Fig. 2. Relay sequence [1]

C. Sensors



Fig. 3. Ultrasonic sensors [2]

Sensors are devices used to detect and respond to electric signals. Sensors are main components for making an automated

system [15]. Sensors plays a vital role in automation from keeping human safes from some accidents happened from the machine. Some of the sensors used in the automation are IR sensor, ultrasonic sensor, photo sensor and speed sensor [16].

3. Literature review

[1] N. Gomeshal et.al Photovoltaic powered t-shirt folding machine offers an efficient solution to these challenging tasks by providing a fully automated machine which folds a t-shirt just in 2 seconds. Finally, the machine has been more efficient than the manual folding, it also reduces the burden of folding

[2] Suraj Shah et.al takes one leap towards automation by folding the t-shirts by sorting mechanism. Folding has been automated by the usage of Arduino UNO which can be easily replaceable and huge availability in market.

[3] Xudong li et.al works on the safety of human hands during the folding process, they include photo sensors and infrared sensor to monitor the human invasion, they also found solution for power supply.

[4] Mukesh P. Mahajan et.al works on using gear motors same as the photovoltaic t-shirt folding machine. To overcome conventional chores it can be used in household also. This will overcome the past complex designs and rare failures

[5] Kachunallenwong et.al experimented on a folding machine which is a very advanced technology created for folding t-shirts, the process is of fetch, stretch and fold. The fetch function is done by using an arm which is actuated by using electric motor and the sensors check whether the arm picks a t-shirt or not.

[6] Ryunosuke miyamoto et.al showcased an machine, were the garment is hung on the specially made hanger which has a push button for picking and dropping the garments. By using this it makes the process of picking the garment easy rather than using conveyors.

[7] Yiwei Liu et.al deals with the process and calculations of design, the main motto is to reduce human effort by easy folding of clothes. It must have two set of patterns and also completes within 20 seconds.

[8] Steffen Leonhardt et.al works with the maximum force which can be withstand by the human muscle when the pneumatic cylinder is in working condition and they found out the maximum range where the muscle can withstand.

Suraj Shah et.al [9] proposed work were done by using PLC and pneumatic cylinders where the advantage of using PLC is that it will not need maintenance and it will not affect by the external environment in industries but it leads the project to a very high cost and made the project more complex to handle.

4. Process flow

Once the button has been pressed the T-shirt folding process begins. The system consists of three sequences, initially B flap will actuate in anti-clockwise direction. This sequence will complete on time, which has been coded in the program. Then the flap B back to his original position. Followed by flap A

which actuates in clockwise direction and the same process followed for flap B. Then the flap C and D follows their respective sequence. T-shirt folding machine has been controlled by four motors which help to complete the folding process. Motor A, motor B, motor C, motor D are those above mentioned motors. The process will begins with the actuation of motor B, which gives movement for flap B which was connected with polystyrene so it produces rotation towards left. Then the following sequence has been programmed for upcoming motors, motor A produce rotation towards right, motor C produces rotation from bottom to top. At last the folding mechanism have been done by rotating the motor D which gives rotation of top and ensure that T-shirt has been stacked on folding tray.

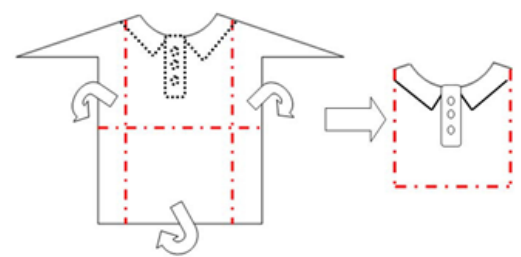


Fig. 4. T-shirt folding sequence [2]

5. Problem statement

- For folding n number of T-shirts in textile industry through manual folding is a tedious process.
- As it takes 8-10 seconds for a single T-shirt, so the time consumption for the folding also very high.
- Cost of the polystyrene is high so the setup cost increases.
- Efficiency is less, cost is high, and speed control is difficult for dc motor.

6. Result

For folding one T-shirt manually human takes 4secs, but T-shirt folding machine hardly takes 2 seconds for folding a single T-shirt. If we take comparison between manual folding and automatic folding machine, for 1hour manual (3600 seconds) folding by human only folds 900 T-shirt, whereas automatic T-shirt machine can fold 1800 T-shirts in same 3600 seconds. Efficiency of T-shirt folding machine is 50% greater when compared to manual folding [4].



Fig. 5. Folding process [1]

A. Discussion

Before going with the fabrication process, initially we made a prototype mode of T-shirt folding machine. Even though it's a prototype model we faced lots of difficulties. Selection of appropriate pneumatic cylinders, solenoid valve is the difficult part. As pneumatic cylinder has to lift the folding material. On the other hand, cost of the components must also be low. surface of the folding tray must not be smooth or else T-shirt may be slipped. So the polystyrene tray has been chosen. It is light in weight and has rough surface [4].

7. Conclusion

Various activities have been done to complete the entire T-shirt folding machine. It has been proved that it is better than manual folding. The cost and weight of the machine also low. There were no new innovations in textiles industries for past 160 years so the Introduction of automatic T-shirt folding machine will be the new innovation in the field of textile industries. So this can be used for home a usage also. The main motto of the product is to replace the damaged components which can be easily available in the market. reusable components are the priority so that the cost may be reduced. The product has been designed for common man with affordable cost.

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