International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 385-400 www.ijaem.net ISSN: 2395-5252

Automation in Garment Manufacturing Cut to Pack Process

Karthi Krishna S, Moushika T, Karthikeyan M R
Department of Fashion Technology, Sona College of Technology, Salem, Tamilnadu, India

Submitted: 01-06-2022 Revised: 05-06-2022 Accepted: 08-06-2022

ABSTRACT
Automation is the process or technique of completing certain activities using mechanical equipment rather than human operators during the creation of a product. To achieve automation, highly automated tools and equipment are frequently used. Integrated with high-tech technological devices, they remove human operators from a specific work and replace them with other responsibilities to support the automated system, even though automation eliminates the need for humans. Tools and Equipment Manufacturing, medical, healthcare, engineering, supply chain, and distribution are just a few examples of sectors where automation is commonly used.
During the development of a product, automation is the process or technique of executing particular activities using mechanical equipment rather than human operators. Highly automated tools and equipment are regularly utilised to achieve automation. Even though automation eliminates the need for humans, they integrate high-tech technological equipment to remove human operators from certain tasks and replace them with other duties to assist the automated system. Equipment and tools manufacturing, medical, healthcare, engineering, supply chain, and distribution are just a few of the industries that use automation.
Keywords: Automation, Garment, Machine Learning, Quality.

I. INTRODUCTION

Clothing is the second most important need for humans after food. This demand is developing globally as a result of rising population and lifestyle changes. Rapid fashion is becoming more popular among consumers. The global demand for clothing has been satisfied. Lower-cost clothing is manufactured since it is not economically viable to use production facilities in poor countries in wealthy countries. Clothing has evolved significantly during the last few decades. Exporting countries include Bangladesh, Vietnam, China, Indonesia, India, and Pakistan. Cambodia has the world's lowest wages.

The final garment price has stayed cheap due to the reduced labour overhead. In recent years, however, severe global competition, rising labour prices in many countries, a scarcity of skilled labour, and a shift in customer behaviour inspired by fast fashion and social media have all impacted garment production. Furthermore, today's shoppers expect high-quality, fashionable goods to arrive at their door in a timely way.

Definition

"The automatic operation of an instrument, process, or system by mechanical or electronic systems that replace human organs for observation, effort, and resolution," is a common definition of automation. With rising global competition, it is more important than ever for manufacturers to prosper and gain a long-term competitive advantage through technological or conceptual innovations as well as industrial improvements. Significant manual procedures and automatic assembly are still frequent in the garment manufacturing process. Because garment manufacturing necessitates more labour than technical work, technical help in the apparel industry may be in short supply. Faced with escalating labour costs, innovative textile production processes have been enlisted to increase efficiency and produce high-quality textiles in huge quantities, swiftly and affordably.

One way to improve these areas while also meeting export regulations is to adopt innovative technology. Computer-aided design, automatic fabric spreaders, automatic fabric cutters, high-speed sewing machines, enhanced pressing and finishing machines, and other modern textile automation aids the advancement of innovative goods in the global apparel supply chain and provides producers with a fresh viewpoint on how to adopt technology while remaining competitive in the the global market.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 385-400 www.ijaem.net ISSN: 2395-5252

Need for automation in the textile industry

Technology adoption has become a vital competitive decision in modern global trade. The capacity to minimise expenses or expand production without increasing costs is the most convincing argument for moving toward further automation and mechanisation. The industry can increase production without increasing total costs if the cost per item can be reduced. It was almost as important to be able to raise quality without raising the cost per item.

Fast sewing machine speeds, CAD and computer-aided manufacturing (CAM) software, novel cutting, fusing, and pressing methods, and the usage of robotics have all profited from technical advancements in garment manufacture. Incorporating modern technologies into the garment production process can result in a considerable increase in productivity and work quality. As a result, the garment industry is transitioning from a labour-intensive, traditional industry to one that is highly automated and computer-assisted.

Automation in garment production

A garment industry's competitive edge in the global market is determined by the level of innovative technologies and automatic tools and equipment used in designing, production planning, manufacturing, supply chain, and retailing. By implementing modern technology and automation into their quick response (QR) and just-in-time manufacturing processes, clothing manufacturers may meet the global market need for excellent quality at a cheap cost. Budget constraints in many developing nations prevent garment manufacturers from adopting innovative technologies.

Requirements for automation

Almost every stage in the garment production process necessitates the use of skilled workers. Quality control on the finished garment is more subjective, relying on a non-numerical description of the quality and a detailed understanding of the garment's style and design requirements. Automation can undoubtedly increase production productivity, minimise the number of errors, and lower total manufacturing costs. Automation can help meet the global need for high-quality clothing with low manufacturing costs and a competitive edge. However, the full benefits of automation in garment manufacturing will take some time to manifest.

Areas of automation

Automation is employed in a multitude of disciplines in the garment industry, including yarn and fabric production. A general overview of yarn and fabric manufacturing automation was previously provided. Fabric inspection, CAD and CAM, fabric spreading and cutting, stitching, pressing, and material handling will all be covered in this area, as well as the usage of radio-frequency identification (RFID) in automation.

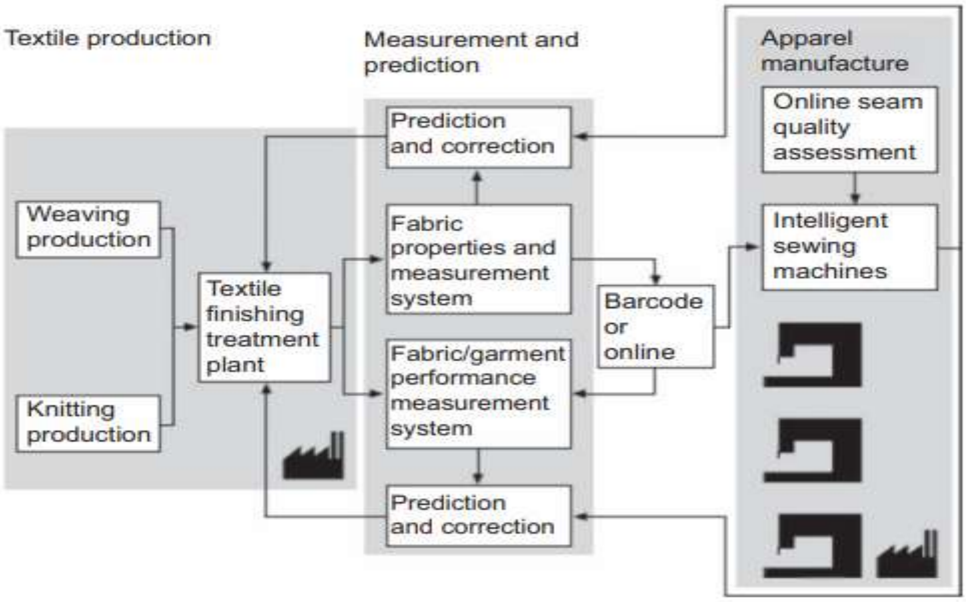

Figure 1. The intelligent textile and garment manufacturing environment

Computer-aided design

Computer-Aided Design (CAD) is an acronym for Computer-Aided Design. It is the process of creating, modifying, and optimising a design using a computer. CAD software is used to boost a designer's efficiency and productivity by allowing them to visualise how their product design's 3D model will look. CAD is used in a wide range of industries, including automotive, shipbuilding, and aerospace. In the film industry, CAD is often used to generate computer animation and special effects. Computer-aided design (CAD) is widely used in the design and manufacturing industries.

CAD software has become a vital tool for fashion designers and garment producers by allowing skills such as pattern making, virtual test fitting, pattern grading, and marker development. With the use of CAD, software designers can visualise the final product and inspect these models to make modifications. The system contains capabilities for animating these goods so that their movement may be visualised, in addition to converting a 2D model to a 3D model. We can spin the model to see it from different angles. As a result, 3D modelling eliminates the need for actual samples, and each design may be saved online for future reference.

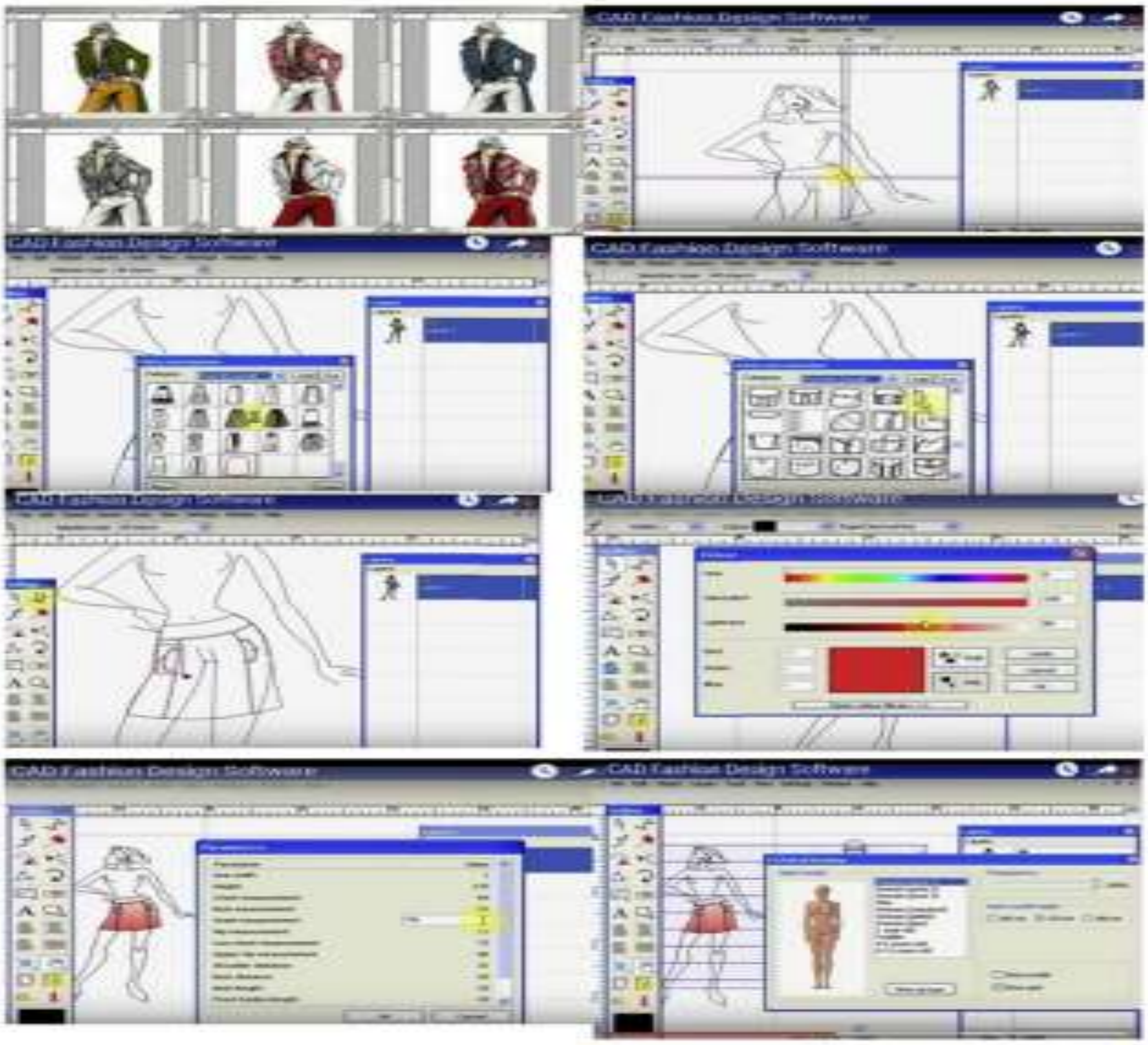

Figure 2. Style of skirt, pocket style and positioning, color change, and visualization on model using design computer-aided design software.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 385-400 www.ijaem.net ISSN: 2395-5252

Figure 3. Three-dimensional simulation

Automatic fabric inspection

Images of regular woven fabrics are dominated by a texture, which always demonstrates a high periodicity among sub-patterns due to the features of the weaving technique used in fabric creation. If a fault is present, the fabric's local regularity is interrupted, resulting in imperfection or anomaly against the homogeneous texture. When inspecting flaws with computer vision techniques, a defect in a fabric image is generally described as any aberration coming from the homogeneous texture backdrop. The ability to explain such anomalies is used by researchers as a starting point for creating detection systems. Automatic fabric inspection approaches have been studied extensively and are classified into three categories: statistical, spectral, and model-based inspection.

Statistical approach

By assessing the spatial distribution of pixel values, the statistical approach aims to divide the image of the studied fabric into statistically distinct sections. The important assumptions in this technique are that the statistics of defect-free zones are stable and that these regions encompass a significant portion of the inspected images. Higher-order statistics (three or more pixels) are based on a set of pixels that determine the local features.

First-order statistics are used to calculate the average and variance of individual pixel values, ignoring the spatial interaction between image pixels. Second- and higher-order statistics, on the other hand, estimate the attributes of two or more pixel values that occur at different positions about each other. Texture characteristics extracted from fractal dimensions (FDs), first-order statistics, cross-correlation; edged detection, morphological operations, co-occurrence matrix (CM), Eigen filters, rank-order functions, and a variety of local linear transforms are all included in this area.

Spectral approach

Spectral algorithms are dependable and efficient computer vision approaches for identifying fabric flaws. Texture primitives or texture elements, as well as the spatial arrangement of these primitives, define texture in these systems. As a result, the primary purpose of these methods is to extract texture primitives first, followed by modelling or generalising spatial placement rules. Spectral approaches should only be utilised for computer vision of evenly textured materials like fabrics since they require a high degree of periodicity.

To overcome the inefficiencies of numerous low-level statistical methods, such approaches are being developed for automated defect detection. As a result, these methods are reliable methods for detecting fabric flaws on the internet. When dealing with random texture pictures that cannot be defined using primitives or displacement rules, spectral techniques are more efficient in terms of computing, but they are less dependable. The Fourier transform (FT), Gabor transform, and wavelet transform are frequently used to determine texture features in spectral-domain approaches.

Model-based approach

Texture analysis methods based on models seek to capture the texture creation process. It attempts to represent the texture by identifying the parameters of a previously specified model. Model-based approaches are especially well adapted to fabric images with stochastic surface fluctuations (owing to fibre heap or noise), as well as randomly textured fabrics, for which statistical and spectral approaches have yet to establish their efficacy. These methods usually require that image attributes at varying levels of precision or detail fit one of several possible image class models. This operation becomes highly difficult and computationally

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 385-400 www.ijaem.net ISSN: 2395-5252

intensive when the models are complex and a large number of models must be evaluated.

A simple function of an array of random variables is stochastic modelling (SM) of an image's random field. SM is classified into three areas in image processing: covariance, 1D, and 2D models. Autoregressive models are included in the 1D category. The 2D models provide forecasts for casual, semicasual, and noncasual events. The Markov random field is one of the non-obvious predictions (MRF).

Commercial automated fabric inspection system

In recent years, adaptive and NN systems have been used to create automated machinery. Fabric inspection systems detect and classify faults in a variety of fabrics, including greige, garment, upholstery, furniture, dyed, finished, denim, and industrial fabrics. BMSVision Cyclops, ZellwegerFabriscan, Elbit Vision I-Tex, and Shelton webSpector are just a few examples of systems that have proven to be reliable and consistent.

BMS vision cyclops

In contrast to Elbit Vision System (EVS) and ZellwegerUster, the BarcoVision Cyclops system incorporates a travelling scanning head and maybe put directly on the weaving machine. Fabric is inspected in full width by both I-Tex and Fabriscan, either at the butcher for greige textiles or at the finishing machine's exit end. As a result, if Cyclops detects a severe or running fault, it can halt the weaving process and prevent the production of inferior material. Cyclops would stop a loom if it had running warp flaws, recurring filling problems, or a substantial concentration of local defects (Figure-4).

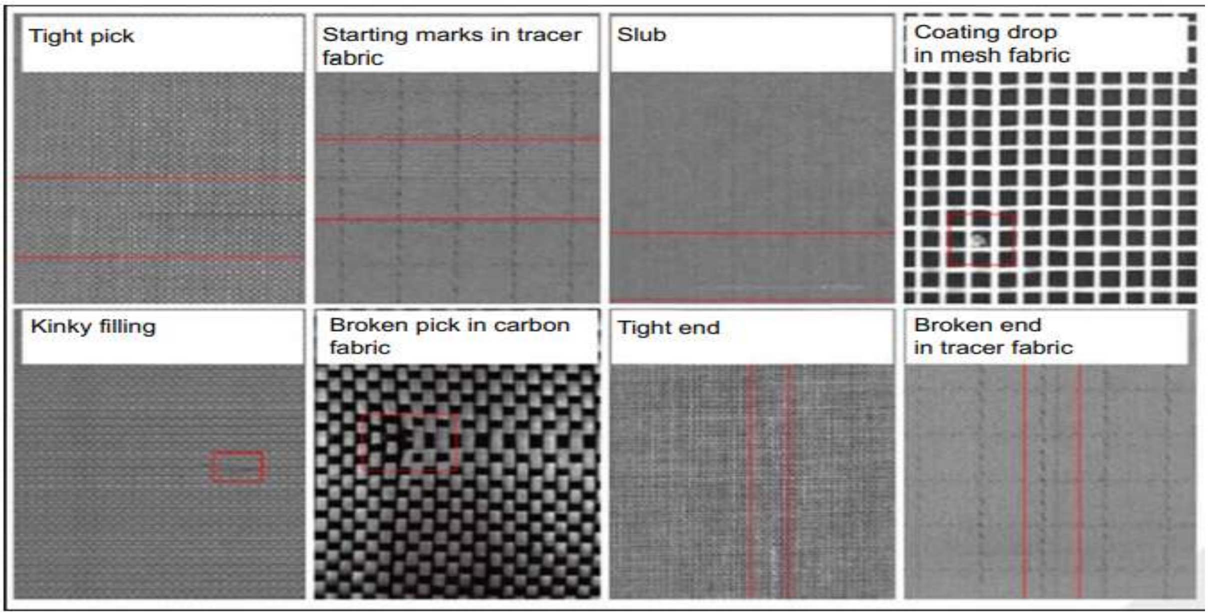

Figure 4.Fabric defects detected by Cyclops.

The Cyclops' scanning head can move at a speed of 18–54 cm/s. The head is equipped with a camera and an illumination system, and it can halt the weaving process to avoid production issues. The camera employs complementary metal-oxide-semiconductor technology. The purpose of the illumination system was to achieve the best possible identification of faults in woven structures. Proprietary algorithms process photos on a combination of in-house developed processing hardware and an industrial PC. Cyclops is driven by embedded software that runs on special-purpose hardware designed by Barco. Camera and light calibration, as well as image processing algorithm tuning for warp/weft density and weave, boundary detection, and JPEG-encoded image saving of fabric flaws, are all included in the software.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 385-400 www.ijaem.net ISSN: 2395-5252

Figure 5.BMSVision Cyclops.

Automated spreading machine

Spreading by hand takes time and effort. It was no longer possible to reach the requisite productivity with the growth of mass production, necessitating the development of specialised equipment capable of spreading at a much faster rate. Spreading machines carried a roll of fabric across the table in the first stage. Computer technology has now completely automated the spreading process. Automated spreading systems have increased the spreading process' productivity and reduced the spreading operator's workload, but they haven't modified the operation's core principles. Lectra (France), Gerber (US), Kuris (Germany), Bullmer (Germany), Phillips (UK), Eastman (US), Unicraft Corporation (US), Cosmotex (Spain), Ottoman (Spain), Morgan Tecnica (Italy), FK group (Italy), B.K.R. Italia (Italy), Caron Technology (Italy), Caron Technology (Italy), Caron Technology (It (Italy).

Figure 6. The automatic spreading machine, Apolo Smart 300 by Cosmotex.

Figure 7. The automatic spreading machine Apolo Smart 300 by Cosmotex equipped with several special devices to lay tubular fabrics.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 385-400 www.ijaem.net ISSN: 2395-5252

Automated cutting systems

Automated cutting devices are used to process a wide range of materials. Despite differences in cutting instruments and materials to be cut, the automated cutting process's core principles and essential components remain the same. A cutting device and carriage, as well as a crossbar (gantry, beam, and cutting bridge) that carries the carriage over the cutting surface, a working surface, a control panel to manage the cutting process, and nesting and cutter control software, are all included.

Figure 8. The automated multi-ply cutting system Raptor by Eastman.

Gerber auto cutting machine

Gerber was the first company to develop an automated cloth cutting machine, which changed the textile industry forever.

Gruber motorised cutting machine highlights

1) The Gerber cutter is easy to use; an operator can pick it up in minutes and rely on its built-in intelligence to help them through any cutting procedure.

2) High throughput- The equipment assists us in rapidly and properly set up. An operator can also start cutting faster and more efficiently due to self-adjusting intelligence. It improves efficiency and workflow since the machine produces chopped components, which reduces lead time.

3) For the best first-run output, the machine finds a delicate balance between cut speed and part quality. Only when the final cut pieces are of the finest quality does the machine speed rise.

4) Uptime- The operator can replace knife-sharpening stones in seconds, resulting in up to three times the useful life of traditional stones.

5) It provides simple measurements for things like total cutting time, idle time, the time between tasks, total units cut, and so on. These characteristics can be used by the management team to control the workflow of processes.

6) The Gerber cutter can work with CAD and share data automatically.

Spreading the machine can help save time and reduce errors by making the system more visible. Because the machine can simply scan a barcode to acquire the desired parameter, there is no need to look for a file and manually enter parameters like ply count and material type.

Figure 9.Gerber Blade

Plasma cutting machine

Plasma cutting was created to fulfil the growing demand for precision stainless steel and aluminium cutting. Plasma cutting, on the other hand, may now be used in the apparel industry to cut cloth. In this technology, cutting is done with a high-velocity jet of high-temperature ionised gas (Argon). This method can cut cloth plies more quickly, but it compromises cutting quality. Plasma cutting uses a particular gas (Argon), which turns into plasma at 30000 °C, to cut one or more plies of cloth at the same time. The nozzle, which is made of argon gas, is utilised to cut the fabric more quickly.

Figure 10. Plasma Cutting Machine

Water jet cutting machine

A water jet cutting machine is a machine that cuts materials with a high-pressure water jet. This can be accomplished using either specially treated water or abrasive material. A fine jet of water is sprayed at a high velocity through a nozzle to cut the cloth. The pressure of water is approximately 60,000 pounds per square inch. The high-pressure water jet is an excellent instrument for cutting fabric.

Figure 11. Water Jet Machine

Laser cutting machine

In a laser cutting machine, the laser is used to cut through a ray of light in a very small area. This machine is extensively used in the leather and garment industries. A computer is in charge of the cutting head. Most fashion designers choose laser cutting in the apparel industry. The laser melts synthetic fibres and combines them at the edges of synthetic textiles, resulting in well-finished edges. This solves the issue of fibre fraying at the margins of cut pieces caused by standard knife cutters. In laser cutting, a laser is used to cut the cloth into the appropriate designs. A very fine laser is focused on the fabric surface, raising the temperature and allowing vaporization-based cutting to take place. Fabric cutting is usually done with co2 gas lasers

Figure 12. Laser cutting machine

The introduction of automation in spreading cutting should improve the following:

- Fabric defect removal to reduce spreading time and fabric loss
- Production planning and control systems to plan and schedule work processes more efficiently and reduce fabric loss
- Automated pattern matching systems for single-ply and multi-ply fabric spreading,
- Multi-purpose cutters, which can cut a wider variety of materials and do additional tasks while cutting cloth
- Universal spreaders and cutters that can process a wide range of materials with the same equipment
- Reduce the operator's involvement in the work process by simplifying automated system operation and improving work process monitoring and control systems.
- Online operator assistance, remote technical assistance, maintenance forecasting, and breakdown prediction

Automated sewing machines

Sewing machines are vital in garment creation because they use thread to stitch fabric pieces together. The sewing machine was invented during the first industrial revolution (18 to 19 century). Stitching machines have ushered in a move from manual to automatic sewing in the apparel sector, allowing workers to produce outfits at the push of a button. As a result of this automation, the clothing industry's efficiency and production have greatly improved. The impact of automation in the apparel industry has triggered considerable developments in other industries. To accommodate the demands of the apparel industry, fabric manufacturers, for example, have boosted production.

Automated machines include single needle lock stitch, two-needle lock stitch, overlock, button stitch, buttonhole machine, and others. work aids can help to do this, some of the automated sewing machines are listed below.

Automated surging machine

Surge is merely a case of the edges overlocking. The majority of the work is done at the trouser level. Only a trouser pattern must be provided to the automatic surging machine, and it will surge both edges of the pattern automatically. When the surge is finished, the machine inserts the patterns on the handle. Each edge of the pattern is sewn separately in a traditional sewing process, but in an automatic sewing process, it is put together in a single operation.

Figure 13. Auto Serging Machine

Computer-controlled cycle machine with an input function

Cycle stitching is very widespread in the apparel industry. The cycle sewing machine comes with a small operating panel box for data entering and a clamp to keep the pattern in place. Only sewing characteristics such as length, width, and stitching path, as well as clamping the pattern, are required of the operator. Following that, the machine will stitch the pattern as instructed.

Figure 14. Computer-controlled cycle machine with an input function

Automated pocket attaching machine

One of the most significant techniques is welt pocket sewing. Sewing 3 to 4 parts and performing 4 to 6 operations are required for this technique. By completing all of the procedures at once, this automatic pocket-stitching machine streamlines the process.

Figure 15. Automatic pocket attaching machine

Automated belt-loop attaching machine

Three stages are required for belt loop attachment: belt loop development, cutting, and stitching. The operation panel allows you to easily change the shape and size of the belt-loop stitching. This machine not only cuts down on the time it takes to attach the belt, but it also saves time and labour by finishing the previous operation of belt-loop cutting.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 385-400 www.ijaem.net ISSN: 2395-5252

Figure 16. Automatic belt-loop attaching machine

Sewing machine with automated bobbin changer

The automatic bobbin changer works on the principle of checking the remaining thread in the bobbin and then replacing it with a filled one by a robotic catcher once the bobbin reaches a certain amount of remaining thread. The first automatic bobbin changer was displayed at the Bobbin Show International in 1995, where Juki had a two-position bobbin changer on display. There are only two bobbin cases in use, and one bobbin is stitched while the spare bobbin winds up and needs to be replaced.

The magazine-type automatic bobbin changer was then invented by Philippe Mall of Germany and Kinoshita of Japan, in which loaded bobbins are first placed on magazines, and then magazines are attached to the sewing machine. A two-and-a-half-hour continuous stitching session with an eight-bobbin magazine is possible. This is ideal for thick thread sewing and projects that require regular lower thread change. It's perfect for sewing items with no overlapped thread. The auto bobbin changeover not only boosts productivity but also reduces stitching errors and lessens worker stress. A Kinoshita automatic bobbin checker is shown in Figure 9.25, while a Kinoshita magazine-type automatic bobbin changer is shown in Figure 9.26.

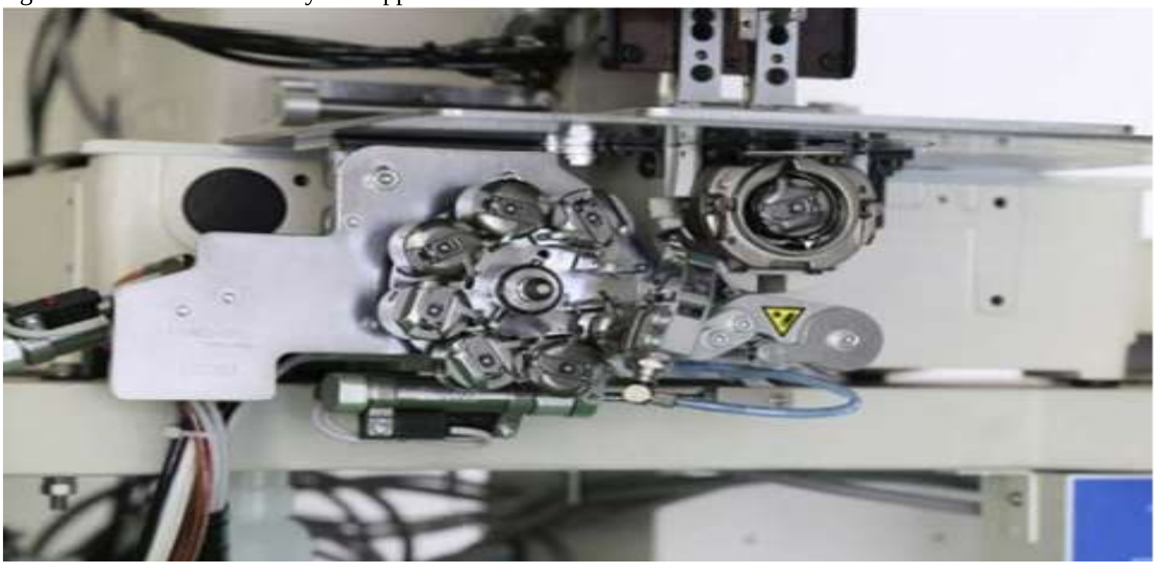

Figure 17. Automatic bobbin changer

Buttonhole indexer

The computer-controlled buttonhole indexer is a newly renovated next-generation buttonhole machine with a preset mechanism to increase production and a sub-clamp mechanism to assure constant and accurate buttonholing quality. It features a single control panel box where you can input data such as the distance between two holes, the type of buttonhole, and so on.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 385-400 www.ijaem.net ISSN: 2395-5252

Figure 18 Buttonhole Indexer

II. FINISHING AND PACKING

Vapour stream press

Ironing can be a frustrating, time-consuming, and tough task. Using a steam iron provides your clothes with a sharp, polished look and helps you to iron more quickly than before. Steam is being used in new types of machinery since it accelerates the process. According to studies, steam is necessary for wrinkle-free and exceptionally crisp clothing. The use of an automatic vapour or steam press simplifies and expedites the pressing process. To produce steam for this, the industry will require a separate boiler. This can be accomplished by finishing the clothing and making it wrinkle-free for the consumer using a "Vapor-Phase Durable Press." In the American method, formaldehyde gases are used to cure garments in an enclosed reaction chamber. Hand retention, abrasion resistance, and wrinkle resistance,tensile strength are among the benefits stated.

Another option for automatic pressing is a buck press machine. The design of a jacket, trousers, or shirt differs depending on the type of garment. It usually comes with blowing suction for the garment's stability. The machine applies more pressure to the garment by using a significant amount of steam produced by a boiler, giving it a faultless form and wrinkle-free appearance.

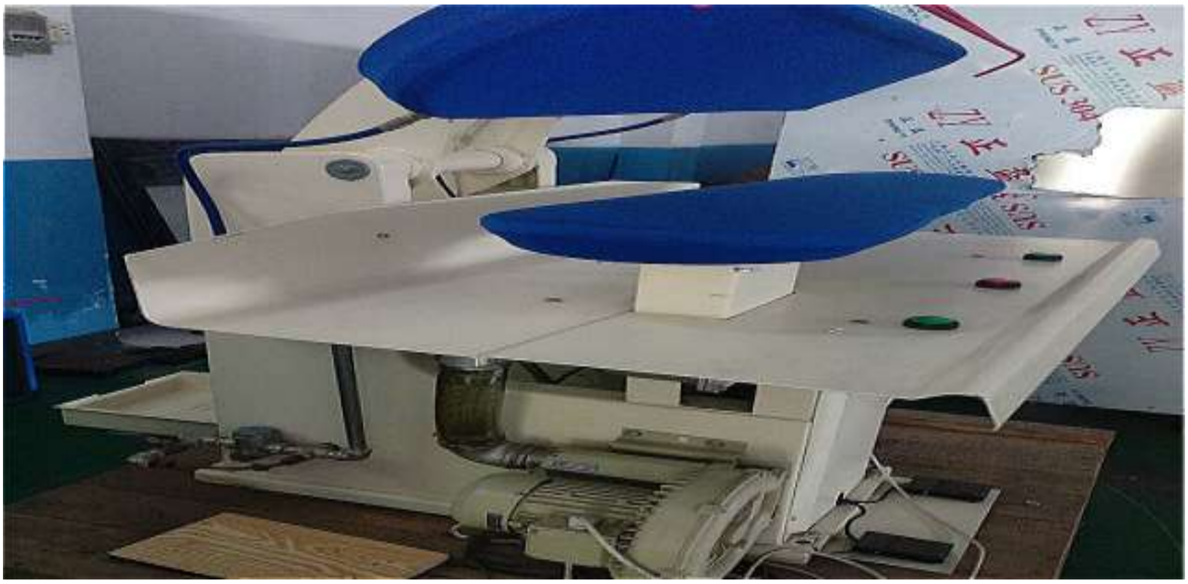

Figure 19.Automatic vapor (steam) press

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 385-400 www.ijaem.net ISSN: 2395-5252

Automatic folding machine

The automatic garment folding machine is a wonderful piece of technology that can fold almost any garment that a manufacturer wishes to fold before selling it. This mechanical folding machine can fold in roughly half the time it takes to fold by hand. Manual folding used to take 30–35 seconds to fold one T-shirt. However, with an automatic folding machine, this time was reduced to 8–10 seconds. The machine's operation requires only a few individuals (manual), which is a significant benefit for a firm that is constantly looking for ways to save time.

Users simply place their garments on the folding tray of the machine, and the machine will pick them up for folding as soon as the operator presses the button. The operator must supply a clothing folding pattern to the machine for this to work. The traditional apparel industry approach of t-shirt wrapping is now done quickly and with little attention or monitoring. This device can help users reduce their effort, and it's especially useful for individuals who fold shirts in bulk. Clothing distribution and sorting take time and are prone to human error. In this industry, automation saves time and ensures an error-free clothing supply.

Figure 20. Automaticfolding machine

Automatic packing system

Packing is the last process in the garment production factory. After the items have been folded, they must be packed according to the buyer's specifications. The automated garment bagging system adds to the automation of the garment industry. This automatic device accepts garments of any length and on any type of hanger. A typical monorail system transports the apparel to the packing facility. The bottom of the garment is detected, the length of the garment determines the length of the bag, and the clothes are packed with rollable packing material. Because of the equipment's adaptability, clothing can arrive at the packer in random order and yet be packed in the exact length of the bag, all without the need for direct operator labour.

Figure 21. Automatic packing system

Advantages of automation in the garment industry

The following are some of the benefits of using automatic tools and equipment in the garment production process:

Productivity increases

Automation increases productivity by streamlining processes. There is a chance of inaccuracy, reduced efficiency due to fatigue, and the worker's breaks while a labourer performs a job. The job's automated method, on the other hand, eliminates these obstacles and increases productivity.

Increased inventory turnover

Inventory turnover has increased as the industry's output has increased. In manual procedures, raw materials, cut components, and semi-finished components must wait longer to be converted into the final garment. Inventory turnover is increased as a result of automation.

Quality improvement

As previously said, automation minimises the number of human mistakes in clothing by eliminating human interference. As a result, there are fewer flaws, improved quality, and reduced rejection rates in the items.

Replacement of repetitive and monotonous work

The progressive bundle system (PBS) is utilised by the majority of textile factories to replace repetitive and monotonous work. A task is completed by one worker before being passed on to the next in PBS. As a result, the worker's work becomes boring and repetitive. This might lead to exhaustion and decreased productivity. By automating all of these repetitive operations, automation, on the other hand, can help to avert these concerns.

Reduction in human labour cost and overheads

Automation can help you boost your production and efficiency. Tasks that need several operators can also benefit from automation. In addition, the necessity for worker training for each new style, as well as other quality-related training, is decreased. As a result, human labour costs and labour overheads are minimised.

Disadvantages of automation in garment production

Although automation has significant benefits in the garment manufacturing business, it also has several disadvantages, which are discussed below:

The high initial cost of installation

When compared to the unit cost of a garment, the initial expense of introducing automated tools and equipment is too high. The cost of the investment may be favourable when automation is applied to a large number of things over a lengthy period.

High research and development costs

The cost of researching and developing automation tools in the garment industry is significant. As a result, obtaining the benefits of automation and cost savings may take some time.

Security risks

Because autonomous systems lack intelligence, errors are common when there is an unexpected change in normal operation or a departure from the immediate scope. Automated subsystems are unable to solve common problems utilising simple logic concepts.

High maintenance costs

Repairing and maintaining automated equipment requires specialised spare parts as well as experienced employees. As a result, the cost of care and maintenance will be higher than with ordinary machinery.

Unexpected production delays

If the automated equipment breaks down or ceases working, this problem will arise. Because the automatic equipment will take longer to fix, there will be production delays. The entire product line will be harmed if automatic equipment malfunctions or fails.

Limited scope

It is impossible to automate all of the steps required in garment production. Automating some processes is difficult or expensive. Fabric flexibility, right alignment of two linked components, proper tension during sewing, and fabric slippage during garment manufacturing are among the issues that limit automation's reach in garment manufacturing.

III. CONCLUSION

Apparel production has been a labour-intensive enterprise since it was first industrialised in the 19th century. Sewing technology and related operations have not improved considerably, despite major technological improvements in many other areas. The modern clothes manufacturing process is characterised by low fixed capital investment, a wide range of product designs and hence input materials, unpredictable production volumes, high competitiveness, and often high demand for product quality. To obtain things at competitive rates, several fashion companies have moved their production operations to develop countries such as Bangladesh, Vietnam, China, Indonesia, India, and Cambodia. Several textile industries in these countries still use manual labour due to cheap labour costs, high automation costs, and the complexity of the processes. Manual techniques are unable to keep up with rising labour costs and demand for high-quality apparel.

Automation tools and equipment are necessary to satisfy these goals at lower manufacturing costs. Fabric inspection, spreading, cutting, sewing, pressing, and material handling are all areas where automation can be used in garment production. Automation is achieved by the use of automated tools and equipment, including robotics that is incorporated with sophisticated electrical components. Despite its lack of commercial success, the use of robots and high-speed sewing machines has aided in the manufacturing of complete clothes without the use of labour. These techniques will be expanded in the future to include fully automated commercial apparel manufacturing by robots.

Increased manufacturing efficiency, improved quality accuracy, and shorter lead times are all advantages of automation. Automation reduces human involvement to a bare minimum in a variety of fields, resulting in labour and energy savings as well as improved precision. Although automation eliminates the need for human operators in some operations, it also provides new occupations to support the automated tools and equipment. Clothing production will be completely automated in the future, removing the need for highly specialised workers. This will help businesses obtain a competitive advantage while keeping product costs down.

REFFERENCE:

[1]. Bailey, T., 1993. Organizational innovation in the apparel industry. Industrial Relations: A Journal of Economy and Society 32, 30–48.

[2]. Behera, B., 2015. Role of fabric properties in the clothing-manufacturing process. In: Garment Manufacturing Technology. Woodhead Publishing, pp. 59–80.

[3]. Jones, P., Clarke-Hill, C., Hillier, D., Comfort, D., 2005. The benefits, challenges and impacts of radio frequency identification technology (RFID) for retailers in the UK. Marketing Intelligence and Planning 23, 395–402.

[4]. Au, C.K., Ma, Y.-S., 2010. Garment pattern definition, development and application with associative feature approach. Computers in Industry 61, 524–531.

[5]. Kim, S.M., Kang, T.J., 2003. Garment pattern generation from body scan data. Computer-Aided Design 35, 611–618.

[6]. Nayak, R., Padhye, R., 2014. Introduction: the apparel industry. In: Nayak, R., Padhye, R. (Eds.), Garment Manufacturing Technology. Elsevier.

[7]. Ade, F., Lins, N., Unser, M., July 1984. Comparison of various filter sets for defect detection in textiles. In: International Conference on Pattern Recognition, vol. 1, pp. 428–431

[8]. Guruprasad, R., Behera, B.K., June 2009. Automation fabric inspection system. Indian Textile Journal 119 (9). Available from: http://www.indiantextilejournal.com/articles/FAdetails.asp?id=2131.

[9]. Harwood, D., Ojala, T., Pietikäinen, M., Kelman, S., Davis, L., 1995. Texture

classification by center-symmetric auto-correlation, using Kullback discrimination of distributions. Pattern Recognition Letters 16 (1), 1–10.

[10]. Degraeve, Z., Gochet, W., Jans, R., 2002. Alternative formulations for a layout problem in the fashion industry. European Journal of Operational Research 143, 80–93.

[11]. Hui, C.L., Ng, S.F., Chan, C.C., 2000. A study of the roll planning of fabric spreading using genetic algorithms. International Journal of Clothing Science and Technology 12 (1), 50–62.

[12]. Bobbin Show International, 1995. Bobbin Show International Daily Review. Bobbin Show International, Atlanta, USA.

[13]. Tyler, D.J., 2000. Carr and Latham's Technology of Clothing Manufacture, third ed. Wiley. s.l.

[14]. Stylios, G., Wan, T.R., Powell, N.J., 1996. Modelling the dynamic drape of garment on synthetic humans in a virtual fashion show. International Journal of Clothing Science and Technology 8 (3), 95.

[15]. Zoran, S., 1995. Computer-aided processes in garment production – features of CAD/CAM hardware. International Journal of Clothing Science and Technology 7 (2/3), 81–88.