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AUTOMATION IN APPAREL INDUSTRY

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Abstract

The definition of automation that is used most frequently is "automatically controlled operation of an equipment, process, or system by mechanical or electronic devices that replace human organs of observation, effort, and decision-making.

"In the context of the garment sector, the goal of this article is to look into the current situation and the consequences of technology adoption on the degree of organizational elements.

Key Words: Automatically controlled operation, Decision Making, Technology, Observation,

1.1 Introduction

The automatic operation of a tool, process, or system by mechanical or electronic technologies that take the position of human organs for effort, observation, and resolution is a common definition of automation. Due to the heightened rivalry on the global market, manufacturers needed to prosper and acquire a lasting competitive advantage through improvements in both technology and production methods. Large manual activities and automated assembly are still a common part of garment manufacturing processes. The demand for technical help in the apparel sector technology may not be as great as it could be because the production of clothes still requires more labour than technical effort.

Advanced textile manufacturing technologies have been asked to boost productivity and manufacture high-quality goods, in high volumes, in short cycles, and at cheap cost in response to the rising cost of labour.

Adopting cutting-edge technology is a strategy to enhance these areas and satisfy export requirements. Automated data monitoring, computer-aided design, automatic fabric spreaders, automatic fabric cutters, high-speed sewing machines, improved pressing and finishing machines, etc. are examples of recent automation in the apparel sector. This helps the global garment industry generate more sophisticated products and offers a fresh perspective on how manufacturers might adopt technology while still competing on the world market.

The Demand for Automation in the Clothing Sector

In modern global trade, technology adoption has become a crucial competitive choice. The ability to lower costs or expand production without raising costs is the primary driver of the trend toward more mechanisation and automation. The industry will boost production without increasing overall cost if it can lower the cost per unit. It was almost equally critical to be able to raise the quality without raising the price per item. For businesses to become globally competitive, flexibility, quality, inventory reduction, an effective production cycle, and reduced lead times were crucial. It is clear that for businesses today looking to enhance their market share, cost reduction and production capacity improvement are of utmost importance. Because enterprises may maintain quick reactions and market needs utilising technology, the widespread introduction and adoption of new technologies becomes a significant component in the competitive advantage of the global market.

Changes in several areas of the clothing business

1.2- Automation in Design and pattern making with CAD/ Cam systems

The design and development technique known as computer-aided design, or CAD, has been used in a variety of industries. CAD is used in the textile and garment industry to create clothing and accessories, patterns, grades, and virtual simulations using programmes like Gerber, Lectra, Apparel CAD, Illustrator, Photoshop, and Optitex. The CAM system handles many tasks that are directly relevant to manufacturing, such as cutting, spreading, and marking planning. By reducing the need for sample production, cutting down on the amount of time needed for the entire job, and minimising fabric waste, CAD/CAM systems, such as pattern design, grading, 3D virtual simulation, and markers, improve overall productivity, accuracy, and efficiency in the actual clothing production process [3,13,14]. The CAD/CAM system was used in this project as a component of the automated production process for smart apparel.

3D Designing

In the Apparel industry, 3D designing is the process of draping 2D digital pattern pieces on virtual mannequins and then making adjustments in accordance with the needs of the designs. Later, an actual garment can be made to display this virtual clothing on the real body. In the clothing sector, numerous computer-aided design techniques for visualizing 3D designs have already been adopted.

1.3 Automation in Cutting room

The production and quality of clothing are improved productivity and Quality through automation in the fabric cutting room. In the near future, it will be beneficial to reduce human intervention and guard against production errors in the manufacturing houses. Even though marker paper is not made while cutting fabric automatically, the working design is still kept directly in the computer. The automated cutting device cuts many plies of fabric succinctly and automatically in accordance with computer instructions. Modern cutting rooms allow apparel manufacturing facilities to use a variety of cutting techniques, including computer-controlled cutting, laser cutting, water jet cutting, plasma cutting, and even ultrasound. Modern manufacturing companies utilize these cutting machines because they can cut fabric with several plies.

1.4 Spreading development –

Rolls of cloth are spread out on large, long tables in preparation for cutting. It must be done exactly because it is the first step in producing a high-quality end product. The spreading of numerous fabric layers depends on the stitching of several garments. Spreading may be carried out by hand or with the use of machinery. For mass production, fabric spreading machines are employed.

Automatic machinery can spread fabric automatically on the spreading surface. Some machines may deal with fabric used in a variety of applications, including clothing, automotive, container bags, industrial uses, high-performance applications (such Nomex, Kevlar, and carbon), nonwovens, and felts. 12 Automation in Garment Manufacturing

The machine's liquid crystal display touch screen can be used to enter fabric specifications including length, width, and ply counts. The machine automatically spreads the fabric for the specified number of plies and then stops when the specified number of plies is reached. Additionally, the machine has the ability to slow down as it approaches both ends and use sensors to ensure that the cloth grain line is aligned. Similar automatic cutting machines can be used to cut many plies of a variety of fabric kinds, including high-performance industrial fabrics and lightweight garment materials.

A computer receives the marker through a USB connection, and the cutting head automatically moves to cut the pattern pieces in accordance with the marker. Cutting can be done with a laser, a knife, or a water jet. Other features include automatic drilling and notching, blade sharpness detection and alert when the blade is blunt. When compared to other cutters, laser cutters have some advantages, including accuracy, no fabric tearing, smooth and precise cutting edges, and no need to change blades (Nayak et al., 2008). Increased productivity and accuracy, simplicity in cutting single and many plies, and flawless cutting the first time are all benefits of automatic cutting over manual cutting.

1.5 Intellect software –

This method operates in the cutting department, which is the stage of fabric consumption. It's crucial to spread cloth correctly before cutting out the pieces for the outfit. We benefit from Intellocut's features, which include planned automation, paperless execution, warning signals, and real-time visibility. The most effective cut plan is provided by Intellocut, which assists us in automatic planning with the use of artificial intelligence.

Paperless Execution: Intellocut uses a system or tablet application to control important activities, like the creation of the lay plan, without using any paper. Warning Signals: If the cutting department provides any unfavourable input, the Intellocut software can instantly and with just one click replan the cut plan. Real-time visibility: Using the BOM and real data, Intellocut tracks fabric usage or waste. This will help us understand the present situation with department cuts.

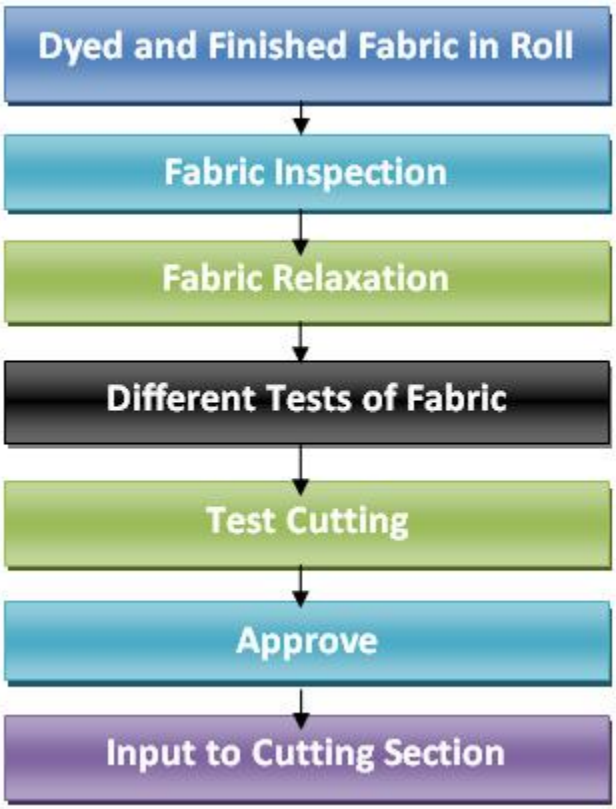

Figure 1: Process flow of Intellocut system (source- Intellocut)

1.6- Automation in Cutting

Clothing producers utilise computerised fabric cutting equipment for high-volume fabric cutting. This is regarded as a cutting-edge approach to the manufacture of clothing. A CNC fabric cutting machine is another name for a computerized fabric cutting machine. The computerised cutting machine makes it feasible to automate the cutting room.

Many garment factories cut their orders in bulk using computerized cutting equipment. The cutting method used by the device is quite creative and uses a reciprocating blade for precise cutting. Different widths of automatic cutting devices are available. The machine offers a variety of cutting options, including crosswise, one way, mixed, symmetrical, tubular, and clockwise/anticlockwise. This type of automatic fabric cutting machine is used in even small industries in nations where it is difficult to find skilled labour. You don't need to label the cloth layer with a pattern when using a computerized fabric cutting machine. The CAD system's marker is loaded. Any CAD system can be used with several computerized fabric cutting technologies. Therefore, if you already have a CAD system and want to automate the cutting room, you can purchase any robotic fabric cutter solutions that meet your needs.

Gerber Cutter (Blade)

Gerber introduced the world's first automated cloth cutting machine, which brought a revolution to the apparel industry.

Gerber Cutter

Key Features

Easy to use The Gerber cutter is simple to use; a user can pick it up in a few of hours and rely on its in-built intelligence to help them complete any cutting operation.

Maximum throughput - Machine aids in quick and precise setup. Additionally, the self-adjusting intelligence of the machine enables a faster and more efficient start to cutting. It increases output and workflow, and since the machine produces cut parts, it shortens lead times.

Optimal first-run yield- The machine strikes a delicate balance between part quality and cut speed. Only when the final cut parts are of the highest quality does the machine operate at its maximum speed.

Uptime- Operator can replace knife-sharpening stones in few seconds and get up to three times more usable life than traditional stones.

Metrics that matter- -It offers simple analytics that include details like total cutting time, idle time, the gap between jobs, the number of units cut, and more. The management team can control the flow of processes by using these parameters.

Integrated data sharing- Gerber cutter can work with CAD and automatic spreading the machine, and by increasing system visibility; it can help save time and lower error rates. There is no need to look for a file and manually enter information like ply count and material type, etc. because a machine can just scan a barcode to retrieve a specified parameter.

2. Plasma Cutting

The original purpose of plasma cutting was to meet the demand for precise cutting of aluminum and stainless steel. However, the fabric may now be cut using plasma cutting in the apparel sector. With this system, cutting is done with a high-velocity jet of ionized gas at a high temperature (Argon). This technique can speed up the process of cutting cloth plies, however it causes issues with the cutting's precision. Using a specific gas (Argon), which transforms into plasma at a temperature of 30.000 °C, plasma cutting can be used to cut one or more plies of cloth at once. The nozzle, which is formed of argon gas, cuts the fabric at a faster rate.

Figure 3: Plasma Cutting Machine (Source – Clothing Industry)

3. Water jet

A water jet cutting machine is one that uses a high-pressure water jet to cut things. Either carefully treated water or an abrasive substance may be utilized for this purpose. To cut the fabric, a very fast, fine water jet is pushed through a nozzle. Water has a pressure of around 60,000 pounds per square inch. When cutting the fabric, the high-pressure water jet functions as a reliable tool.

Figure 4: Water Jet Machine (Source – ETMM Online)

4**. Laser cutting machine**

In a laser cutting machine, cutting is done by directing a laser beam into a very small area. This device is frequently used in the leather and clothing industries. The cutting head is controlled by a computer. In the clothing sector, laser cutting is mostly used by fashion designers. In synthetic textiles, the laser melts the fibers and fuses them at the edges, giving the edges a well-finished appearance. This prevents the problem of frayed fibers at the edges of cut sections made by traditional knife cutters. In laser cutting, the cloth is cut using a laser to create the required shapes or patterns. Cutting occurs by vaporization after a very small laser is focused on the fabric's surface to raise the temperature.

The amount of fabric lays that can be cut is the only restriction on laser cutting. The accuracy and precision of this cutting are not achieved with more plies; it is best suited for cutting of one or a few lays. Therefore, cutting single-ply is the best use for this equipment.

Figure 5: Laser cutting machine (Source – Core.ac.uk)

1.7 Sewing

IT-based sewing room for real-time data management and process automation ATIRA (Ahmadabad's Textile Industry's Research Association) created and put into use this system. A host computer, many single-board microcomputers, and other components make up the system. There is a single board Microcomputer in every sewing machine. Twisted pair wire is used to connect each microcomputer to the host computer. Microcomputers gather information on things like machine uptime, piece handling and stitching times, bundle entry and exit times, and more. Each station receives data from the host computer, stores it in memory, and then transfers the requested data to the host computer. It analyses the data and generates numerous reports about productivity, the location of each piece of material on the shop floor, the effectiveness of the operator, the current status of open jobs, etc.

Equipment Automation

Proc Automatic collar marking (model-3006) from MAICA marks collar parts when point perforation is not a possibility. It also features a piece discharger and a straightforward size marking adjustment. This electro-mechanical collar rotation and point shearing device for shirts is made by MAICA and goes by the model number MTP. The shearing angle can be adjusted to meet the desired position without requiring new dies or punches.

Buttonhole Indexer by JUKI, Model ACF-172-1790:

This buttonholing indexer machine allows for the simultaneous entry of twenty patterns. There can be one to twenty buttonholes. It employs 25 mm stitches and runs at a rapid 4200 rpm (lockstitch).

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This buttonholing indexer machine allows for the simultaneous entry of twenty patterns. There can be one to twenty buttonholes. It employs 25 mm stitches and runs at a rapid 4200 rpm (lockstitch).Operation panel. This machine not only reduces the time required for the belt attachment process but also achieves labour saving, such as the completion of the previous process i.e. belt-loop cutting.

1 Buttonhole indexer

Computer-controlled buttonhole indexer is newly renovated next-generation buttonhole machine supplied with the preset mechanism to increase productivity and sub-clamp mechanism helps to achieve both accurate and consistent buttonholing quality. It has one operational panel box to give inputs to the machine-like distance between two holes, type of buttonhole, etc.

2. **Other**

Apart from this, there are many other industrial sewing machines like pocket creasing and setting, automatic presser foot force control. Additionally, shirt front contour seamers, automatic hemmers, automatic surging of a panel with four sides surged, automatic cuff makers, ultrasonic sewing, belt turners with air-operated, cuff shapers are contributing in the automation of the garment industry .

3. **GSD**

GSD stands for General Sewing Data, which gives accurate data to calculate SMV for precise costing, line balancing, capacity, and efficiency calculations and to improve workers performance. During the production, unbalanced sewing lines results in bottleneck formation. Uncertain production capacity results in missed delivery times, production break time and overtime. Inefficient SMV calculations cause incorrect costing and production capacity. To overcome all these issues GSD provides the ability to design and measure each step or process in a production process, from cut pieces to packaging .To measure each step GSD makes the work **performed by a sewing machinist broken down as follows**

Get part or parts and matcher-form and/or put parts to machine foot

Sew parts together align or add parts between bursts

Trim threads

Put parts aside

GSD develops a common language (GSD Codes) to establish real-time production and costs, as well as a tool to create cost-effective production or production opportunities. Each code has a time value attached expressed as TMU's (Time Measurement Units). It establishes 'International Time Standards' using the appropriate predetermined 'Motion Code' for each step in the Operation Bulletin. GSD provides a scientific, truth-based method of estimating and improving production methods and costs. Also, accurately and consistently establishes 'International Standard Time' for clothing and other products are sewn in the Apparel Supply Chain. These results in Accurate Costing, Increase productivity Lesser the defects On-time delivery, Improve workers performance.

This process then creates an accurate & consistent Methods Database for the organization. This database can be used further for a different style of production. The standard values set by GSD are accurate, the breakdown of the process is easily understood and therefore greater efficiency is obtained. Managers and supervisors can gain the value understanding within the short-term training.

3. ETON

ETON in the garment industry is fully automated and highly flexible material handling system, which designed to minimize manual material handling. This system helps to improve productivity, quality of a finished garment. Technically this system consists of overhead conveyors on which individual carriers are placed. These carriers consist of several clamps in which all parts of the single garment are hanged. These carriers are moves automatically finding its way to the correct next operation, according to pre-determined operations. This movement is monitored by computer and provides all necessary data required for monitoring and managing the process of the production line. The system can be easily modified according to distinct changes in the operation cycle that is why it is considered a highly flexible system. When an operator performs his /her operation; he/she will push a button placed on one side of a sewing machine. The system will actuate and the carrier is passed to the next operation. When a carrier leaves its place and moves to the next place it is recorded by the data collection system.

This system minimizes manual material handing because of which improves lead-time, improves ergonomics and substantially shorter throughput time, improves efficiency may vary from 30%-100%. ETON system is the most valuable investment made by garment industries from all over the globe. Additionally, with minimum manual handling, the system helps to keep floor clean and workstation free from bundles of garment parts. In this ETON system, material-handling methods are based on ergonomics. With this system, it is possible to move material up to the distance of one centimeter from operation workstation. All opening, retying, reaching, lifting, pulling of bundles and work in process of bundles can be eliminated. Because of the application of this system operator experiences fewer injuries, less fatigue, which reduces absenteeism. Pain and injuries at the shoulder and neck are a common type of injuries causes in this system [20].

1.8 Finishing and packing

A form finisher that may be used for pants, tops, and jackets is the Cosmos Rotor Cabinet. In form finishing, the garment is pressed after being fitted to the test subject. By using this form finisher, the garment maintains its ideal shape after pressing because the dummy is used to press the fabric.

MACPI 310: This machine is also a form-pressing tool that may be used to press jackets, coats, raincoats, and other garments. For each pushing step, an automatic timer cycle is present.

It is used to finish many types of outerwear. VEIT 8381 Multiform Finisher. It has shapes with adjustable shoulder width and breadth. Additionally, it makes tensioning movements easier to adjust.

Packing

Fully automated ATS 101 bagging of clothing: This is an automated bagging system. Bag sensing is automatic and fixed length. Programs can be configured for various styles.Additionally; it incorporates a touch pad technology for operator convenience. Installations for hanging clothing in an automated warehouse (METALSISTEM): It is an overhead storage system for hung clothing that delivers the clothing right to the operators' workstation. Additionally, it makes automatic garment search easier. The storage capacity of 10,000 clothes is ideal.

1.9 Material Handling

ETON 5000 SYNCHRO

An overhead conveyor system used in a sewing room is the ETON 5000 SYNCHRO. It does away with the need for labor-intensive material handling. It aids in keeping a real-time record of production and work in progress.

GARTNER SYSTEMS: It offers a conveyor system for the full factory supply chain, from the time the fabric is received to the latter stages of warehousing and shipping. It provides the market with manual, partially automated, and completely automated solutions utilizing RFID and bar code technology. In addition, automatic trolley coupling and trolley marshalling are both options.

Conclusion

The industry itself cannot wait because of the ongoing pressure from importers and competitors requiring testing and equipment improvements, therefore new inventive things in the sector won't wait. In order to keep up with the adjustments necessary by the rapidly evolving fashion, the paper has been produced to evaluate the numerous types of innovations in the apparel business. From the beginning to the end of the apparel industry; automation has been covered in the paper.

References

WWW.Fiber 2 Fashion.com

Laurel D. Romeo, Young-A Lee, “Creative and technical design skills: are college apparel curriculums meeting industry needs?”, International Journal of Fashion Design, Technology and Education 6:3, pages 132-140, 2013.

Jaideep Singh & Yogesh Prasad

http://www.threadsol.com/intellocut, cited on 30 October.

https://www.dksh.com/global-en/products/tex/gerber-cutter-paragon#accordion1412913113345-1-collapse, cited on 8 November.

https://clothingindustry.blogspot.com/2018/01/methods-fabric-cutting.html, cited on 8 November.

https://garmentsmerchandising.com/fabric-cutting-machines-apparel/, cited on 8 November.

https://www.etmm-online.com/water-jet-cutting–function-methods-and-applicationexamples-a-834966/, cited on 10 November.

https://fashion2apparel.blogspot.com/2016/12/types-fabric-cutting-machines.html, cited on 10 November.

https://core.ac.uk/download/pdf/81741943.pdf, cited on 9 November.

Minkyung Kim , In Hwan Sul , Sungmin Kim, “Development of a Sewing Machine Controller for Seam Pucker Reduction using Online Measurement Feedback System”, Journal of Engineered Fibres and Fabrics, Volume 12, Issue 2 – 2017.

Ryder C. Winck, Wayne Book, “A novel approach to fabric control for automated sewing”, ResearchGate, Conference Paper, August 2009.

juki.co.jp/en/products/industrial/, cited on 9 November 2020

Helder Carvalho, João Monteiro, “Automatic presser-foot force control for industrial sewing machines”, Article in International Journal of Clothing Science and Technology, February 2012.

Nadine Ruyle Latrhop, “Automation and mechanization in the apparel industry in the state of Washington”, May 4, 1973.

Helder Carvalho, Fernando Ferreira, Patricia Mellero , Sandra Biegas, “Monitoring and control of industrial sewing machines”, International Conference on Engineering, Technology and Innovation (ICE/ITMC), June, 2017.

https://textilespedia.blogspot.com/2020/08/production-systems-in-garment-industry.html, cited on August 24, 2020.