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RECENT TRENDS IN IoT IN TEXTILES

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ABSTRACT

Textile industry has always been a massive labour-oriented manufacturing process where right from machine operation, stoppages, mending, and efficiency calculations and maintenance data were absolutely controlled manually. To address this, large numbers of technical & non-technical personnel need to be recruited. On joining, they used to undergo training as per the Management`s Information Services.

KEYWORDS: *Textile industry, Labour-Oriented Manufacturing Process, Machine Operation.*

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Introduction

Since the data collected manually, their authenticity used to be questioned very often before going for the implementation of any action. With advancements of technology, especially technologies like IoT (Internet of Things), AI(Artificial Intelligence), it has been able to achieve a high degree of automation over the complete textile fabrication process – right from design, fabric creation to finishing. At the moment, emerging approach ofautomation is available to address multifarious parameters in the manufacturing value chain viz.

- monitor almost all parameters of production data
- fault finding and locating its origin
- achieved efficiency with the causes of deficiency
- remote sensing and providing solution
- recovery of malfunctioning of machines
- fabric defect and yarn tension monitoring
- colour/ shade matching and many more

Today the entire profitability depends on quality and accuracy, value added production with right quantity and bulk, minimum wastages, minimum manpower with efficient management. They are linked to:

- **Energy:** Since energy cost is increasing every day, the machines are being designed to consume less energy.
- **Economics:** Creative process and technology allows higher production rate, herby increases profit. Flexible, shorter process & better process control also increases profit.
- **Ergonomics:** Reduced operating effort, reliable structure & user-friendly maintenance, helps in minimum personnel requirements.
- **Environment:** With less energy consumption, better process control thereby reducing waste ultimately helps Environment. We all know about the hazards of Air/water pollution done by Textile Industry.

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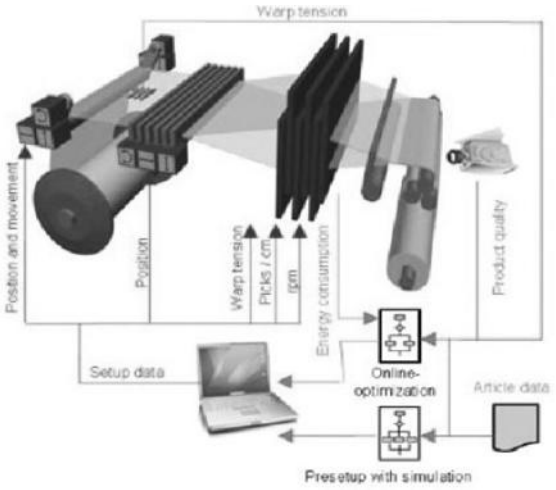
The Internet of Things (IoT) is the extension of internet connectivity into physical devices and everyday objects. Embedded with electronics, internet connectivity and other forms of hardware (such as sensors), these devices can communicate and interact with each other over the Internet, and they can be remotely monitored and controlled.

The definition of the Internet of things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation and others all contribute to enabling the Internet of things. One typical Example of IOTconnectivity has shown below:



The Scope in IoT

IoT defines the Access of individual parameters of a machine at its Microlevel for all gamut of Machines, giving access and control from remote location (through App) along with other required factory data e.g. financial, SAP and other MIS. IoT is the pillar for Digitising Industry. The Internet of Things (IoT) is considered to be one of the enablers of the next industrial revolution. It is fuelled by the advancement of digital technologies, as well as dramatically changing how companies engage in business activities and people interact with their environment. The IoT's disruptive nature requires the assessment of the requirements for its future deployment across the digital value chain in various industries and many application areas.

The IoT is bridging the physical, digital, cyber and virtual worlds and requires sound information processing capabilities for the "digital shadows" of these real things. IoT applications are gradually moving from vertical, single purpose solutions to multi-purpose and collaborative applications interacting across industry verticals, organizations and people, which represent one of the essential paradigms of the digital economy. IoT technologies are key enablers of the Digital Single Market (DSM), which will have a potentially significant impact on the creation of jobs and growth, along with providing opportunities for IoT stakeholders in deploying and commercialising IoT technologies and applications in the global markets.

The IoT in Weaving Loom Shed

The loom shed or thecloth manufacturing units in India is still dominated by Power looms which is 22.9. Lakhs (ministry of textiles) and that of Handlooms i.e.23.77 lakhs (MOT, handloom development corporation). For the Socio-economic problems, they will remain. But for the Global challenge, quality and commercial viability, the need of the Shuttle less looms are unavoidable. Today (2019) there are 2.5 lakhs Shuttle less looms as against 1.5L in 2012-13 and as on 31st March'11 it was 1,05,000(Ministry of textile).Many of them are low cost China flexible Rapier looms and a Chunk of Air Jet & that of Water Jet looms are 2nd hand.

Today, the Shuttle less loom manufacturers have come with lots of Technical Features such as sturdy with high precision vibration free mc frame, effective Centralised lubricating system, Direct Drive motor with Oil cooling (Itme fair, Barcelona19) reduced power and maintenance cost, improved Ergonomy, better beating force for the heavy cloth, better shed geometry, motorised weft cutter, weft

selection up to 12 col, adjustment of pick density through direct control, dedicated software to prevent stop marks, continuous monitoring of let-off and take-up and the shed geometry through microprocessor that practically eliminates starting marks, electronic weft tensioner to run weak yarn, iPOS (intelligent production optimising system) is designed to optimise machine productivity by monitoring mc speed & stop level.The E-Dobby can control individual Heald frame through Servo motor with motor HP of 1.5 or 2 which was invented by Toyota in 2003-4. Special i-Reed for the Airjet Looms to optimise the Air flow that minimises 23% air consumption.

The ITME'19 at Bercelona has shown the Speed of Air jet Looms as high as 1550rpm of 190 cm width (Picanol,ITEMA,Toyota), Water Jet has reached to 2000 to 2100 rpm (Tsudakoma) , Flexible Rapier looms 900 rpm(Picanol, Toyota), Donear Heavy loom for Technical Textile with Jacquard , Terry motion etc. All these require a sophisticated yarn preparation, continuous tension Monitoring, having microprocessor attached with each loom for the instant studies of warp &weft breakage, efficiency and deficiencies. The pictures below show the loom with microprocessor.

Tsudakoma 9100Airjet

Toyota 810Airjet

Gone are those days when the management had to wait to know the production, quality, efficiency, breakage rate, snap studies etc till next day and because of manual operation , had to depend on the production supervisors, clerks and Operators where it was not only time consume but also every chances of errors.

Today the microprocessor helps you to know the graphical representation of the location of the breakages with duration, weft breakages including out of shed or package faults, tension monitoring to get defect less fabric like starting mark. Any mc. parameter can be changed from any machine or from office where all the processes are being monitored. Every parameter i.e. shed angle, weft colour pattern, pick density, defects are available and can be monitored. Toyota Monitoring System has come with latest IOT technology with dedicated software which is connected with each loom, loom to server and server to Internet.

- In warping Machine too there is automatic noting of breakage rate, continuous tension control and production and Efficiency.
- In Sizingmachine, the stretch control is monitored as per your desired level (sayyou want 0.5% or even negative) and the same is of Pick up%. All the data is available instantly and can be monitored sitting at Office including production, mc. speed, Efficiency, no of stoppage with duration, viscosity, temperature of sow box, Drying and cooling zone, Moisture level, power fluctuations.

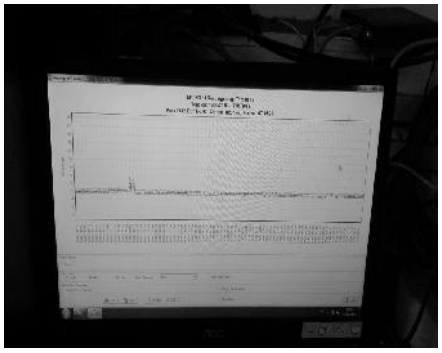
The Karl Mayer Sizing mc with latest Technology where the Sow Box rollers are individual controlled, creel is divided in Zones, continuous monitoring of Tension and the rolls are done.

The IOT in TexturisingIndustries

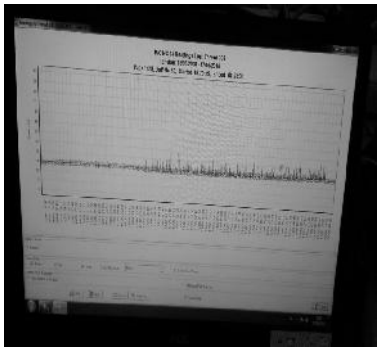
In today's Textile Industries, the Polyester yarn and fabric is occupying the most promising and high-profile stage because of the limitation in Earth in growing Natural fibres. The concept of the 1st Crimping i.e.Torsion Crimping Process was developed by Heberlein and Bemberg before 1940. It was licenced to Helenca a Polyamide Producer. In the year 1954, the first bulked Nylon Yarn was produced by Fourne. That time the machine speed used to be 20 mpm to 50 mpm with absolutely manual operation. Any parameter change used to be done by Mechanical way. The 1st Pin twister Texturing machine Scragg, UK was started in the year 1978 followed by Murata Crimper with a speed of 100mpm with display system of the machine parameters only. Now there is the Sea change in the Texturing Industry where the Mechanical Speed is developed up to 1500 mpm. But in India, the max running speed is found to be 1100mpm i.e. Because of the limitation in Yarn quality and it is preferable to go for the quality than the quantity.

The above picture shows the Computer display of a Texturising Machine. The 2nd Picture is showing the yarn path sensor i.e. OLT (Online tensioner). Today with the advancement of Technology with IOT background the machines are found with Close heater (15-20% energy savings), auto doffing and splicing that generates less wastages, saving in energy and environment.Gone are the days when the Industries had to appoint engineer to conduct breakage studies and tension checking of each spindle. Today, IOT helps in getting the speed of the machines, efficiency at any time, All the parameters (D:R, D:Y, PH, SH,SOF, T/UP, oil roller Speed, winding angle) , individual speed of Input, intermediate, output and take up roller, the graphical representation of the breakage of the yarn(see graph below),time taken to attend the breakage , idle spindle with duration, yarn Tension fluctuations with causes so that the packages can be downgraded as per the norms and the Tracing system through barcoding for any bobbin.There is the system to display of the Motor current so that the same can be controlled. There is some display of the tension variation through OLT with causes that helps the industries to take the measures to upgrade the qualities immediately.

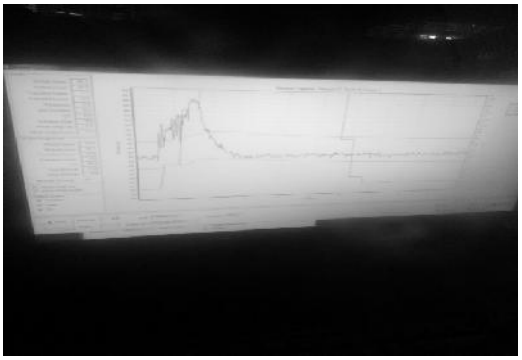
Now IOT helps to monitor all the machines through master Control Unit, sittingin a Cabin and getting A to Z data at any time with print out. Actions can be taken instantly. The next page has shown randomly selected 6 graphs taken from OLT Rejections. There are so many. The doffs are downgraded according to the tension range allotted.



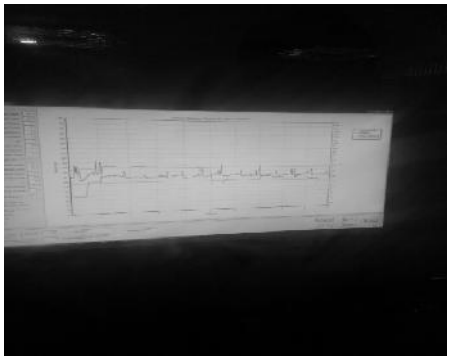
Guide adjustment



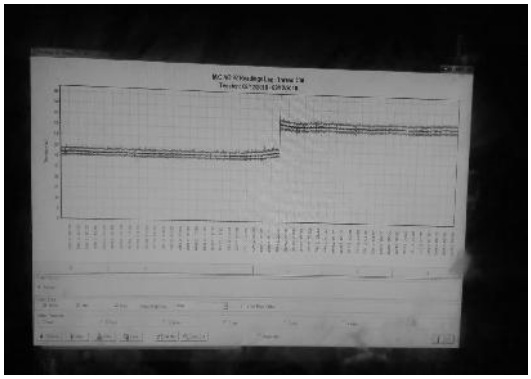
Uster variation in POY



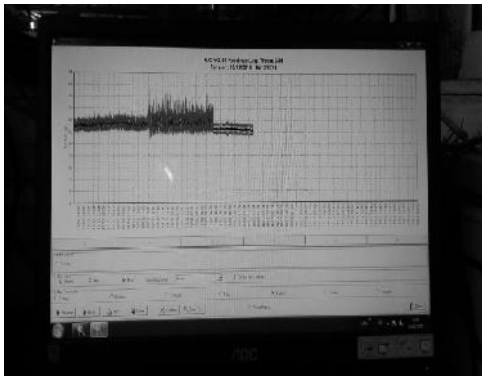
Joint passing



B.F./Loop in the POY



D.F. Changed after joint pass



High b.f in the POY

Every graph represents one or other cause for the Rejection. Today, the doffs are downgraded even before doffing unlike the earlier days that the package would be downgraded after the physical verification by a Checker.

Material Handling

Material handling is essential in any logistics and manufacturing project. Essentially, material handling is a process that includes short distance movement inside the scope of a building, or between the transportation vehicle and the building.

- **Manual Handling**. This type of handling is where workers use their hands in moving individual containers. They lift, lower, fill, empty, or carry the containers when transporting them. However, this can be hazardous for workers since it exposes them to physical activities where they can be injured. In most cases, workers suffer from sprains and strains in their lower back, upper limbs, and shoulders. It is time consuming, every chances of manual & clerical error, Space constrains, chances of material damage etc. The manual system has the following limitations.
  - It has low through put.
  - Workers do mistake while storing goods & dispatching goods. For example, while dispatching the worker will dispatch the goods to Tarapur instead of Tirupur and vice a versa.
  - Following an order like FIFO/ LIFO (first in first out/ last in first out) becomes very difficult and almost impossible to follow manually when stored manually on the floor.
  - Traceability of the goods stored. Sometimes dispatches are held up as the worker is unable to trace goods which has to be part of large consignment. This causes losses as the vehicle waits for one single item.
  - It requires huge manpower where large volume of productions & SKU (store keeping units) has to be moved & stored. Many times, workers are not available. This constraint is particularly noticed in case large shirting & dying units.
  - High operating cost.

Today all the processes are done automatically through IOT and the textile industries are highly benefited through the system. It is also known as Robot packing.

- **Automated Handling**. Equipment is used in reducing or replacing manual handling of materials when economically and technically feasible. Thanks to the ongoing improvements in machine programming, sensing, and robotics, there is a move to completely automate the handling of materials.

With the globalized and competitive environment, it's also critical to reduce time and control cost, follow the delivery time lines in any material handling management. An effective process typically promotes the following:

- save money
- increase safety
- reduce downtime
- improve ergonomics
- increase efficiency
- reduce fork transport traffic
- increase capacity
- save space
- increase flexibility
- improve the work environment
- Development method that promotes simplified and improved work process.
- Overall productivity is improved.
- Effective material handling management to reduce production costs.

How the IOT in Logistics Works?

The Cloth roll is doffed from the loom> Barcode is generated where all the fabric details are available say length, warp/weft /reed pick/GSM etc > goes to theinspection table >then stacking at defined place where it is traceable at any moment with all the details of the inspection reports by an automated guided vehicle programmed through a certain logic or by conveyer which is sensed and the conveyor will read the identity of the goods. After Checking the identity is changed. One for wet Processing and other for grey sale. Now one new identity is generated with a new barcode to identify the storage location (warehouse). Before entering to W.H. through the shuttle the identity is read by vision camera or by barcode reader at proper location. Now for the despatch the artificial intelligence will inform the robot and the movement of the goods will start and the material will reach at despatch location. The operator will *scan and the material will be loaded on truck. The scan* will tell about the vacant place and location and through SAP other systems will work. Similar system is followed in case of Finished goods after the wet processing is done.

The above picture denotes the stacking system ASRS for Fabric Rolls.
Shuttle and Conveyer

Conclusion

The IOT is not a very new concept and the network of smart devices was discussed as early as 1982, with a modified Coke vending machine at Carnegie Mellon University becoming the first Internet-connected appliance. (Wikipedia, Internet of things). in 1991 the contemporary vision of IOT was developed by Mark Weiser. The field gained momentum when Bill Joy envisioned device-to-device communication as a part of his "Six Webs" framework, presented at the World Economic Forum at Davos in 1999. The term "Internet of things" was likely coined by Kevin Ashton of Procter & Gamble, later MIT's Auto-ID Centre, in 1999, though he prefers the phrase "Internet *for* things".At that point, he viewed Radio-frequency identification (RFID) as essential to the Internet of things which would allow computers to manage all individual things.IoT is simply the point in time when more "things or objects" were connected to the Internet than people.

Today, it has become an essential Technology especially in the Textile Industries. In the world of quality and competition the IOT can help in producing the desired quality with less conversion cost. More advanceddata, automatic fault rectification and total automation will be seen in near future.

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