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Revival and Digitization of Bygone Woven Design through Textile CAD/CAM System- A Case Study

Mallika Datta, Suman Mitra, Md. Samayun Sk.
Government College of Engineering and Textile Technology, Serampore
12, William Carry Road, Serampore, Hooghly, West Bengal 712201, India
Maulana Abul Kalam Azad University of Technology, India

***Abstract**: The scope of this research work deals with the revival and digitization bygone woven design for handloom. The case study evolves the scientific methodology for creation of a data dictionary of the design of the handloom section through utilizing the latest jacquard technology, CAD systems. Selection of thread colour, and thread count help in revival process. Technical documentation of design under consideration provides a complete design solution for weavers of the locality by qualitative information on current and future demand.*

***Keywords**: Weaving Design, CAD; Image Processing; Jacquard*

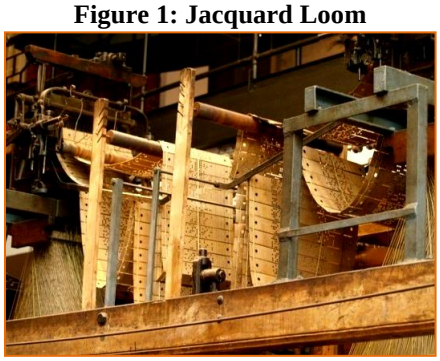
I. Introduction

Technological developments are key to the future success of the textile industry. The future requires entirely new manufacturing processes. There has been a remarkable change in the entire fabric manufacturing process with the implementation of computer programming and processing. Latest textile CAD/CAM systems and other technological developments have given a substantial boost to the manufacture of fabrics, in particular reference with jacquard based hand woven fabrics [1]. The main goal of the work is to develop scientific methodology for the generation of the data dictionary (digitization) of the design for the handloom weavers with appropriate use of latest jacquard technology, textile CAD systems, selection of thread colours and thread diameter (count). Technical documentation of various designs can be provided as a complete design solution for weavers of the locality by qualitative information on current and future demand.

II. Jacquard Loom

The Jacquard loom is a mechanical loom, invented by Joseph Marie Jacquard in 1801, that simplifies the process of manufacturing textiles with complex patterns such as brocade, damask, and matelasse [2]. The loom is controlled by punched cards with punched holes, each row of which corresponds to one row of the design. Multiple rows of holes are punched on each card and the many cards that compose the design of the textile are strung together in order. It is based on earlier inventions by the Frenchmen Basile Bouchon (1725) [3], Jean Baptiste Falcon (1728) [4] and Jacques Vaucanson (1740) [5]. The use of the card with punched holes for programming a complex design is the first steps of digitization.

Figure 1: Jacquard Loom



A. Principles of Operation

Each hole in the card corresponds to a "Bolus" hook, which can either be up or down. The hook raises or lowers the harness, which carries and guides the warp thread so that the weft will either lie above or below it. The sequence of 'raising and lowering' threads is what creates the pattern. Each hook can be connected via the harness to a number of threads, allowing more than one repeat of a pattern. A loom with a 400-hook head might have four

threads connected to each hook, resulting in a fabric that is 1600 warp ends wide with four repeats of the weave going across.

The term "Jacquard loom" is a misnomer. It is the "Jacquard head" that adapts to a great many dobby looms such as the "Dornier" brand that allow the weaving machine to then create the intricate patterns often seen in Jacquard weaving.

Jacquard looms, whilst relatively common in the textile industry, are not as ubiquitous as dobby looms which are usually faster and much cheaper to operate. However unlike jacquard looms they are not capable of producing so many different weaves from one warp. Modern jacquard looms are controlled by computers in place of the original punched cards, and can have thousands of hooks.

The threading of a Jacquard loom is so labor-intensive that many looms are threaded only once. Subsequent warps are then tied in to the existing warp with the help of a knotting robot which ties each new thread on individually. Even for a small loom with only a few thousand warp ends the process of re-threading can take days.

B. Importance of Computing

The Jacquard loom was the first machine to use punched cards to control a sequence of operations. Although it did no computation based on them, it is considered an important step in the history of computing hardware [2]. The ability to change the pattern of the loom's weave by simply changing cards was an important conceptual precursor to the development of computer programming. Specifically, Charles Babbage planned to use cards to store programs in his Analytical engine

C. Advances in Jacquard Weaving

Intricate and large-figured designs, which include tapestry, are woven on jacquard weaving machines. Other fabrics made on jacquard weaving machines include damask and brocade. Many of these weaving machines are integrated with computer aided design systems.

Jacquard weaving provides the possibility to design complex pictorial and other patterning effects with infinite combination resulting from warp colors, filling colors, and weaves. It has been twenty years since jacquard design has been working in tandem with computer. The advent of CAD/CAM and electronic Jacquard machines has revolutionized the Jacquard weaving industry and has become a necessity rather than a luxury for Jacquard industries.

The CAD/CAM system has changed the entire thought-process of the textile sector right from the core idea, pattern, creation, assimilation of technical data to the final production. It has given stability to the unpredictable market conditions and increased the marketing effects by providing shorter production cycles, intense communications and globalization of the entire production process. Various programming tools including 3D simulation and marketing, compact discs with patterns and collections catalogues and virtual fashion shows are also available in the market. The system along with the above mentioned tools improves dobby and jacquard weaving in proper density by considering all constructional parameters. A complete automated process with immediate response to customer's demand seems to be a reality in the near future with these systems [6].

III. Methodology

A. Raw Material

The final fabric was weaved with 2 plied 120 tex cotton warp yarn and 310 tex weft jute yarn.

B. Machine

Handloom with jacquard facility of ICAR - National Institute of Research on Jute & Allied Fibre Technology, India of 200 hooks is used in this work as shown in Figures 2 for weaving jute base decorative fabric. This machine has features to create realistic "soft design" from scanned photo of mother fabric with supplied default yarn palette and library of graduated weaves. CAD Advantage Windows Jacquard software was used for generation of final design following the steps mentioned in flow diagram (Figure 3). At first the mother fabric was scanned, saved in jpg form and loaded to CAD software. The design was recreated with selection of colour and thread from the yarn palette in graphical view with necessary correction. The punching of the cards (Figure 4) was made in accordance to weaving of design for revival.

Figure 2: Weaving of fabric using handloom with jacquard facility

Figure 3: Flow diagram of replication of original fabric

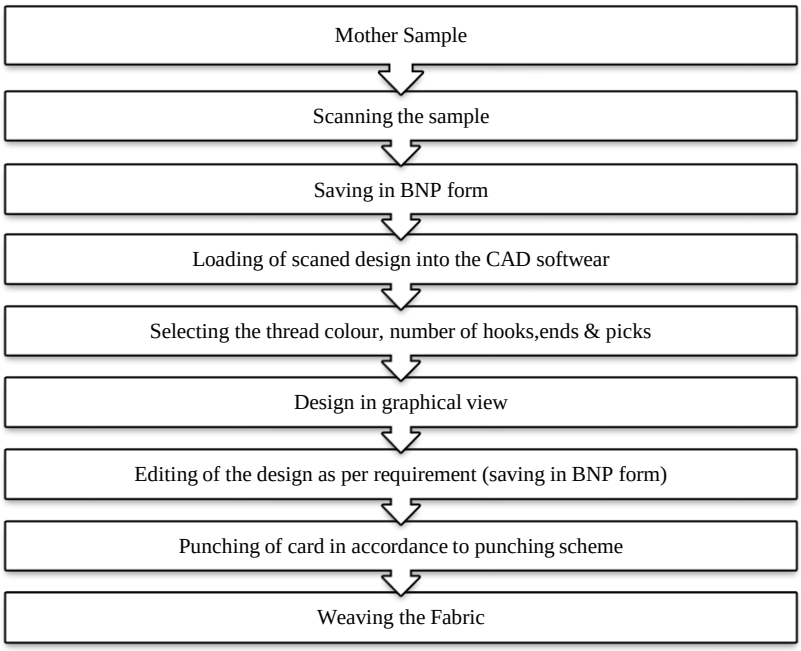
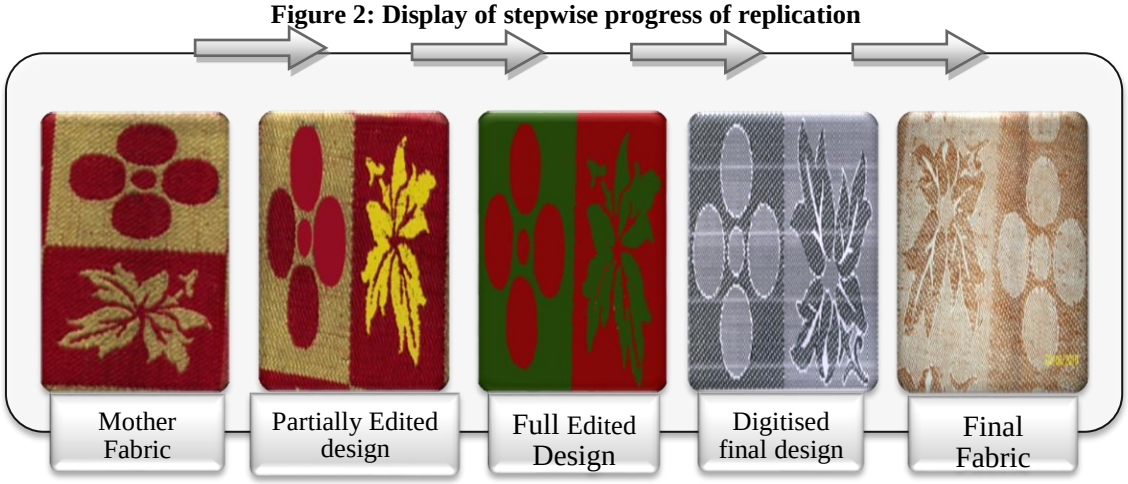


Figure 4: Strand of cards with punched holes

Figure 2: Display of stepwise progress of replication



IV. Discussion

The original design used for this work was made of two different colour wefts combing with the warp of finer count. The regeneration of mother design after transferring scanned design to software was realised by appropriate selection of a thread count. The original fabric comprises of the motif with a twill weave, while in the final fabric,

satin weave was used to get the full effect. The count of the thread, other than 'mother fabric' was used to modify the appearance of the final fabric. Use of the coarser weft yarn distorted the design in the first replica leads to use of finer count weft thread in the final fabric. The visual comparison of mother's fabric was made with the replicas are shown in Figure 6.

Figure 3: Visual comparison of distorted fabric and final fabric

The final fabric is not the exact replica of the original fabric due to the fact that same harness and same warp beam were not used in two cases. The software is equipped with the facility to modify the design image for more accurate replication of the original fabric and minor modification can be done in the original pattern to get the design as per customer requirement.

V. Conclusion

The scope of this work deals with the generation and revival of the bygone design with CAD facility in jacquard equipped handloom with rapid and accurate drafting, selection of colour and count of thread. The unique feature of CAD is layering of the pattern with transparency, which enables drafting, patterns against the mother design as reference for effective digitization. This work can be carried out further for development of design data bank to serve the community people.

VI. References

[1] Mitra, Ashis. 2014. CAD/CAM Solution for Textile Industry An Overview, *International journal of Current research and Academic Review,2(6,)* ISSN: 2347-3215. pp. 41-50

[2] Doyon, André and Liaigre, Lucien. 1967.*Jacques Vaucanson: mécanicien de génie.* Paris : Presses Universitaires de France, 1967.

[3] Essinger, James. 2004.*Jacquard's Web: How a Hand-loom Led to the Birth of the Information Age.* Oxford : Oxford University Press, 2004. ISBN 0-19-280577-0.

[4] Fava-Verde, Jean-Francois.Silk and Innovation: The Jacquard Loom in the Age of the Industrial Revolution.

[5] North Carolina State University. 2007.*Color Prediction Model for Jacquard Tapestry Woven Fabrics.* s.l. : ProQuest, 2007. ISBN: 0549376941, 9780549376941.

[6] Snodgrass, Mary Ellen. 2015.*World Clothing and Fashion: An Encyclopedia of History, Culture, and Social Influence.* London & New York : Routledge, 2015. ISBN: 1317451678, 9781317451679.

VII. Acknowledgments

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