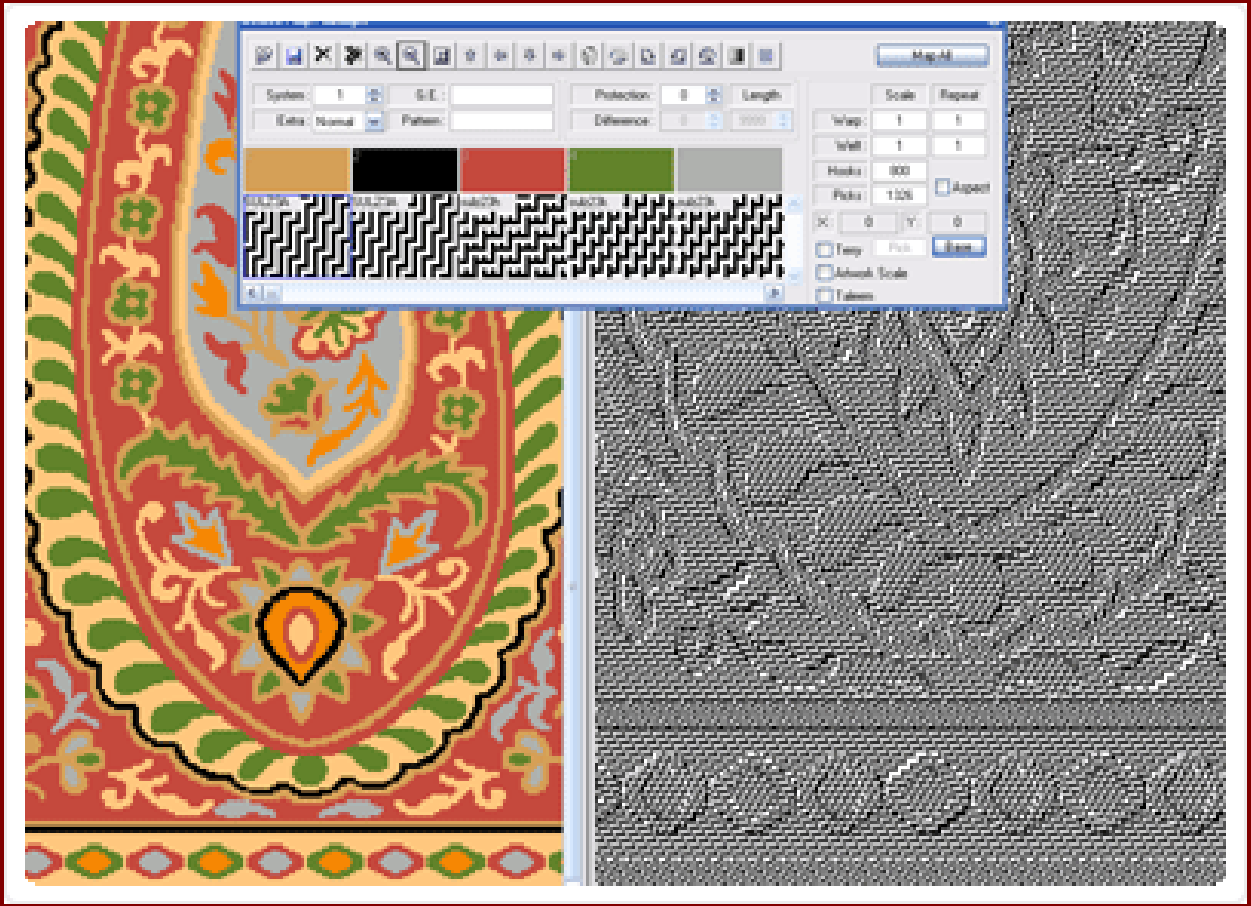
CAD/CAM Support for Jacquard Based Textile Industry



By: Ashis Mitra

Image Courtesy: textronic.com

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ABSTRACT

The move to computerization is a major trend in the apparel /textile industry today. Computers are changing the way designers all over the world are working. For the textile designers, CAD has become more or less indispensable now-a-days. Years back the process of fabric designing was extremely tedious and time consuming. Today, with the adoption of CAD/CAM and its numerous software/hardware capabilities the possibilities are endless that are unimaginable. CAD/CAM technology is a cutting-edge tool (in software and/or hardware) catering to the various needs with respect to designing, production, marketing and presentation of designs/weaves of the textile industry as a whole. Jacquard industry is one among the different segments of textile industry, where CAD/CAM is used at large. CAD/CAM solutions for jacquard based textile industry provide an opportunity for the development of jacquard projects and operation of all kinds of jacquard looms including state-of-the-art electronic jacquards as well. In addition to fabric designing software, most of the CAD/CAM solutions providers all over the globe also offer a whole range of other allied accessories for jacquard based industry including jacquard design management software, laser cutting machines for woven badges and labels, electromagnetically controlled punching machines for all types of jacquard cards, and so on. The CAD/CAM system gives an opportunity for the production of all kinds of jacquard textures ——— basic jacquard, toweling fabrics, jacquard carpets and other floorings, tags and labels of jacquard, jacquard tapestry, etc. The present article highlights on how the precision, efficiency and economy of CAD/CAM tools are being employed with ease at large to enrich the innovations in the field of jacquard designing and manufacturing, thereby revolutionizing jacquard based textile industry (both powerloom and handloom) world wide as a whole.

Keywords: CAD/CAM, jacquard, simulation colourways, 3D texture mapping.

1. INTRODUCTION

The latest CAD/CAM systems and other technological developments have given a substantial boost to the manufacture of fabrics, in particular reference with jacquard fabrics. These systems have been structured to cover dobby weaving, jacquard weaving and all other textile processes to help the designers create and view the designs prior to actual weaving. This has resulted in an increase in competition among manufacturers and hence provided quick market response.

This article highlights on how the precision, efficiency, productivity and economy of CAD/CAM tools rather support systems are being employed with ease at large to enrich the innovations in the field of jacquard designing and manufacturing, thereby revolutionizing jacquard based textile industry (both powerloom and handloom) world wide as a whole.

2. NATIONAL TEXTILE POLICY

Recognizing the vital role of IT in a progressively IT-driven global economic environment, as also its scope in bringing about speed, efficiency and transparency in delivery systems, our Govt. has been playing a proactive role in promoting and facilitating adoption of IT in the Textile Industry and Trade. The main objective of the National Textile Policy is to make IT an integral part of the entire value chain of textile production and thereby facilitate the industry to achieve international standards in terms of quality, design and marketing. As a part of fulfilling the objectives, the network of CAD/CAM systems, computerized computer colour matching and testing facilities are being expanded, particularly in the cluster of decentralized textile centres [1]. Handloom textiles, on the other hand, constitute a timeless facet of the rich cultural heritage of India. But over the years our Handloom Industry has become a dying industry due to several reasons. In order to survive this moribund industry, concentrated efforts are being made through various schemes and programmes implemented by the Office of the Development Commissioner for Handlooms (ODCH) to enhance production, productivity and efficiency of the handloom sector, and enhance the income and socio-economic status of the handloom weavers' community by upgrading their skills and providing infrastructural support and essential inputs. The handloom agencies are getting assistance for installing CAD/CAM system and availing the services of the designers to improve designs and fabrics as per requirement of both domestic and international market [1].

3. CAD/CAM SYSTEMS

The CAD/CAM systems offer an integrated technology solutions (software, hardware and associated services) dedicated to the Textile Industry as a whole, and cover a very vast application area like bed covers, towels, plastic mats, carpets, dress materials, sarees, laces, table mats, labels, knit wears, suiting & shirting, printing fabrics, furnishing, upholstery, blankets to name a few [2, 3]. Most of the IT companies worldwide have developed a complete range of software (and/or hardware) solutions consisting of several common components/modules e.g., Edit module for generalized design creation and editing, Dobby module, Jacquard module, Print module for Screen Printing Industry, Weave Library/Gallery, Yarn Library, Color Library, module for 3D Draping/Texture Mapping, and modules for optimizing and integrating the following business processes: Production Interfacing & Virtual Sampling, Marketing, Presentation & Sales, Workflow Optimization & Integration, etc. Each individual solution/module offers the highest level of functionality available beyond our imagination. Furthermore, these solutions/support systems act as building blocks that allow the users to construct a fully integrated solution to suite their current as well as future business needs [4]. The modules are industry specific and need based. Basic computer knowledge is enough for any designer to operate the software since it completely follows manual operations but with greater speeds, accuracy and efficiency. Human errors are out of question, and all the labour consuming and boring manual operations are discarded.

3.1 CAD/CAM Systems for Jacquard

Most of the CAD/CAM systems providers have implemented this cutting-edge technology to the ancient art of weaving. With the help of latest tools and machineries they have turned the tedious job into a simpler form, thus making possible for the designers and weavers to explore more and more. Jacquard industry is one among the different segments of Textile Industry, where CAD/CAM is used at large. Not only designing and weaving but the system can control all sorts of jacquards including electronic jacquards as well; that is where CAM comes into picture [4].

The conventional method of designing is tedious, time consuming and labourious, considerable skills and experience is required to produce a design. Where designers previously used to struggle over graph paper and stencils, now with the adoption of CAD/CAM they simply have to play with a mouse and a stylus (digitizer) pen to come out with innovative designs. But today

with the introduction of CAD and its many software and/or hardware capabilities, the possibilities are unlimited. The system give an opportunity for the production of all kinds of jacquard textures ——— basic jacquard, toweling fabrics, jacquard carpets and other flooring, tags and labels of jacquard, jacquard tapestry, etc. The system allows for the development of models of one-layer weave structures, multi-layer weave structures, one-layer jacquard projects, multi-layer jacquard projects, laced jacquard projects, operation of various electronic equipment producing e.g. perforated cards, etc.

A CAD/CAM system consists of both hardware and software. Hardware part consists of PC compatible Pentium processor with color monitor, digitizer, scanner, printer and plotter. The software programme can create the design and motif, process it, manipulate it, display it on the monitor and finally give output of the design and production data in a suitable format. Latest Microsoft tools and technologies are used for development of these software solutions, and international standards of design, development and distribution are strictly followed. Most of the companies have developed a complete range of software solutions for the textile industry as a whole (including handloom industry as well) which ranges from state-of-the-art CAD/CAM solutions to presentation and marketing tools for their designs, to web enabled ERP solutions to take care of the customers' business needs.

The followings are some of the winning CAD/CAM systems developed by Indian IT companies: a) NedGraphics (Texcelle/Jacquard Pro) [5], b) CadVantage Win (Jacquard) [3], c) AutoTex (Jacquard) [4], d) TEX-Style/Jac-Art ——— M/S Wonder Weaves Systems, Mumbai, e) Textronics Design Jacquard [6], f) APTextile Design [7], etc.

Some other global giants for providing all sorts of CAD/CAM supports to the jacquard based textile industries are: a) LECTRA (PrimaVision Weave) [2], b) Pointcarré [8], c) Arahne (Arah Weave) [9], d) Tukatech (TukaStudio) [10], e) Viable Systems Inc. (ViaCad) [11], f) Booria CAD/CAM Systems [12], g) Claudia Hang Textile Designer [13], h) ScotCad Textiles Ltd. (ScotWeave Jacquard Designer) [14], etc.

3.1.1 Salient features of CAD/CAM System for Jacquard

CAD/CAM System for Jacquard handles all the main issues confronting the Jacquard based Textile Industry. The CAD system can be used to develop all kinds of jacquard designs in any

repeat size and reed-pick values taking care of all aspect of designing for production of final fabrics. Jacquard software system enables to create and modify any kind of jacquard fabric, at all stages: from the designing stage to on-loom production. The following are some of the salient features of these CAD/CAM systems: • Creation of virtually any kind of design —— from simple to intricate, • New design creation in a blank graph paper or editing a scanned photograph ——— both methods are fully supported, • Facility to assign weaves to the created design and get the weaved graph instantaneously, • Sophisticated editing/retouching tools, • hundreds of tools & utilities, • Scanned image editing as well as scanned image tracing facility, • Superfast weaving by *Weaving Wizard* which ensures that no prior knowledge is required to weave the designs, • Simultaneous display of design window, fabric simulation & graph window, • Layer concept makes extra warp/weft and multi layer designing easy, • custom features for mats, label & lace designing, • Face & reverse view of graph and front & back view of cloth simultaneously, • Automatic border filling with different shapes like mango, leaf, flower, etc. created or ported from other software, • Saving any motif as a weave, • Viewing facility of multiple repeats of the motif, • Addition of selvedge of any size to the design, • Binding of floats color-wise/area-wise automatically or manually, • Automatic back binding for lace, • Programmable cursor jumps for easy editing of the graph, • Color shield facility while editing & copy paste functions enables protection of intricate motifs, • Design editing in grid mode for greater accuracy by using a range of drawing, painting, editing and retouching tools provided, • Variable brush size with differing X, Y thickness can be used in tandem with the freehand, geometric, bezier and advanced editing tools like auto outline, bandhani, etc. with multiple Undo & Redo functions • Graphical yarn balancing for loom loading, • production of gradient weave designs in fabrics, • Weaving of photo realistic images of portraits and scenery on fabrics within seconds using dithered weave filling, • Easily configurable cast out facility —— — user can define a basic casting sequence which can be replicated across the harness or user specified range, with a single click. Casting files can be saved enabling management of different harness arrangements within the same shed, • Production Outputs ———Different kinds of outputs according to the needs can be generated to give a design into the actual fabric shape. We can print the required output according to our needs like i) Weaved Graphs can be printed for manual Jacquard Card Punching or the design information can be transferred to electronic card punching machine for punching hard cards or continuous paper punched cards, ii) Electronic

outputs —— to feed Electronic Jacquards directly, all popular electronic jacquards e.g. Grosse, Bonas, Staubli, etc. are fully supported, iii) Other Printouts like Punched Cards & Weave Parameters, • Jacquard weaves can be loaded or saved as different picture formats like TIFF, GIF, BMP, PCX, PNG, etc. or any other formats as per demands, which helps in making transition or for easing work in heterogeneous environment.

3.1.2 Unique features of CAD/CAM Jacquard Systems

- Yarn Library [Fig. 1]: It enables to create different types of commonly used yarns —— both regular and fancy. We can store scanned yarns also and use them for viewing the fabric simulation. The yarn editor allows to work on parameters like yarn count/fineness, twist per inch (TPI), twist direction (S/Z), colour and other properties to generate chenille, fancy, slubs, mélanges, twisted, and all types of yarn effects.

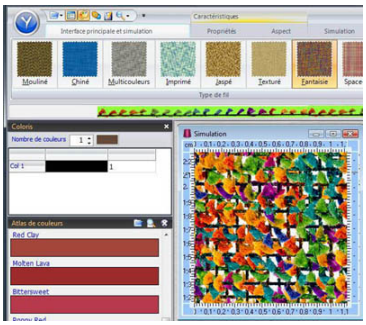

Fig. 1 Yarn Editor of YXEndis [15]

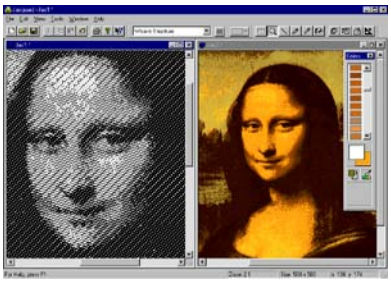

Fig. 2 Photorealistic simulation given by DESIGN Plus Jacquard of Grafixoft

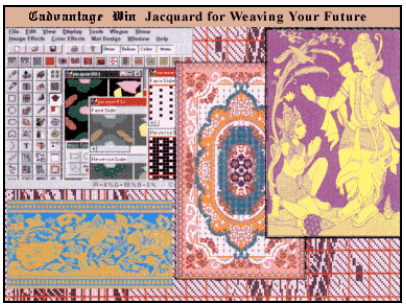

Fig. 3 GUI of CadVantage Win Jacquard with different views & photorealistic simulations

- Colour Library: Colour Library enables to create library of our own colours and use them for viewing colour combinations during fabric simulation. This feature facilitates making of custom colour pallets, colour specifications, saving of pallets, loading/retrieving of pallets, editing shade numbers, and searching of a particular colour.

- Weave Library: Weave library facilitates to create virtually any kind of weave. Weave library is provided for better management of weaves and simple drag and drop feature in combining weaves at predetermined intervals to create fascinating structures. This module supports some unique features like new weave creation, editing any existing weave, mixing multiple

weaves, weave storing facility, weave recall/retrieval facility, weave creation wizard, auto generation of weaves by simply importing bitmaps images, etc.

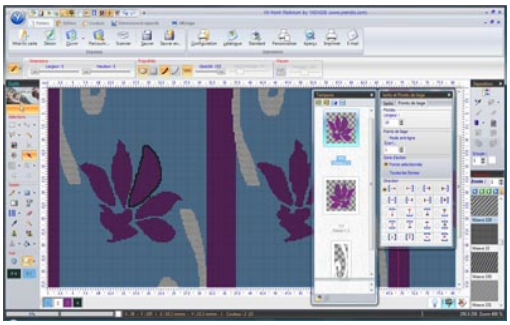

Fig .4 GUI of YXEndis Jacquard module with different views, simulation, & production parameters

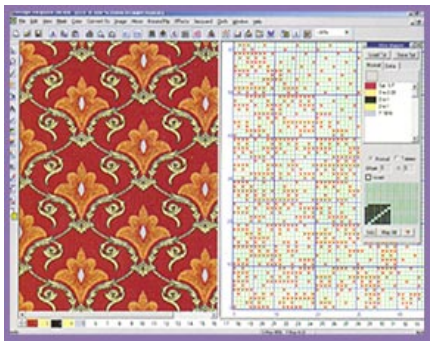

Fig. 5 Weave Mapper of Textronic Design Jacquard showing simulation, face-back weaves

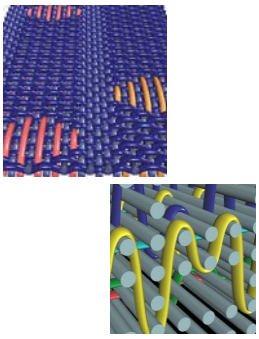

Fig. 6 Weave 3D of ScotWeave shows real-time 3D views of weave structures

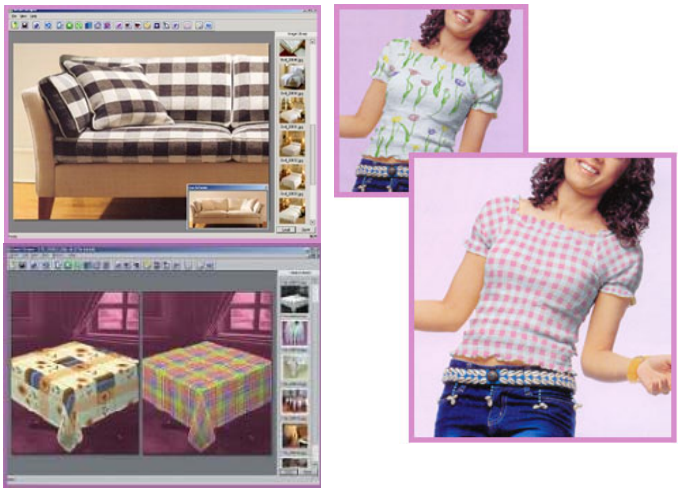

Fig. 7 Rendering & 3D texture mapping by Design 3D of Textronics

Fig. 8 Easy Map of NedGraphics shows 3D draping with simulation colorways

- Fabric Simulation [Figs. 2, 3, 4 & 5]: This feature allows to simulate the fabric effect (both front and back side) on woven designs. All the settings related to simulation like yarns to be used, warp pattern, weft pattern, yarn density (EPI, PPI) etc. can be defined in the Simulation Setup control. We can vary the different parameters of a design or edit the design and observe the result instantly. Be it an internal evaluation or a sales presentation, a good simulation is the acid test of the user's effort. The simulated output can be further tested on a 3D CAD system.

- Simulation Colorways [Fig. 8]: Powerful *Simulation Colorways* feature which acts just like a colour matching studio offers different colour combinations of any simulated design (i.e. virtual fabric) in both Manual & Auto mode. There is no restriction on the number of colours to be used. If System Colour Pallet is used, there is an option to view the simulation in 16.7 millions colour combinations. Using *Automatic Colorways* feature (auto mode), we can get one colour combination per second (though, time can be altered in the Simulation Setup Wizard). If any colour combination satisfies us, the auto mode can be paused, and after saving the combination with a name the auto mode can be resumed. Automatic generation of colour combinations from multiple colour libraries is also supported.

4. OTHER CAD/CAM SUPPORTS FOR JACQUARD BASED INDUSTRIES

4.1 CAD Solution for 3D Draping or 3D CAD System

Design 3D of Textronics, ArahDrape of Arahne, DesignConcept of Lectra, Drape 3D/Auto Drape of ScotWeave, AutoShow of PLC Consulting Co., Just Drape It/CadVantage Win Texture of Teckmen Systems or Pointcarré Shape Software are the virtual trial room in cyberspace. The image of the model is just captured or a photograph is scanned. Using these tools, the model is dressed with the chosen dress material within a few seconds. All we need to do is select our fabric design, and drag and drop it on the photo. The mapping is done automatically. Some of the CAD/CAM systems providers like Lectra, ScotWeave, etc. provides 3D viewing tools that allow more realistic fabric simulation such as fabric structure as a real 3D image (sectional views), photorealistic rendering, kinematics animation and dynamic camera tours of the virtual prototypes (i.e., facilities to move around the structure in real-time) [Figs. 6, 7 & 8].

4.2 CAD/CAM System for Automatic Jacquard Card Punching

The existing common method of jacquard weaving involves various preparatory stages like: Drawing a motif/design, selection of point paper suited to the density of warp and weft, enlargement of the motif/design, drawing the enlarged figure on tracing paper, converting the enlarged figure on tracing paper to a graph paper design with separate marking for ground and figure weaves of the design, punching the cards with the help of either ‘Piano Machine’ or

'Punching Box' (for handloom sector) [for each pick of the design repeat one card must be punched], lacing the punched cards sequentially and mounting them over the jacquard head. Many IT based company like Lectra, Viable Systems Inc., Teckmen Systems, Fancy Textiles [16], Madaan Engineering Works [17], Tex Software [15], Schleicher [18], etc. have developed basically electromagnetically controlled software-hardware systems for automatically punching the cards for jacquard flawlessly from the created design to solve the perennial problems of unreliable, labour oriented, slow and error prone process of manual card punching. Some unique features of the systems are: • High speed cutting of all types of jacquard whether handloom or powerloom, • Automatic feed with sensors to detect card bin empty, • Manual feed with easy card feeding and card size setting, • Easy to use software for card cutting with features like selvedge, extra selvedge, repeat card cutting, testing, etc., • Hooks supported —— 120, 240, 256, 400,600, 800, 1200 or as required, f) Custom diameter of punch and pitch to suit any jacquard, • Complete feedback control system for 100% accuracy checking, • Compatible with all Textile CAD software.

Teckmen Systems have developed an Electronic Retrofit Kit CadVantage Punch Retro to make the traditional pedal operated Card Punching Machine semi-automatic. This system has been specially developed for the handloom weavers and for those who have already invested in pedal operated Card Punching Machine.

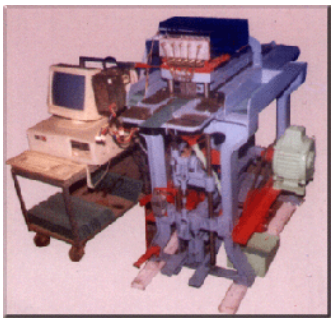

Fig. 9 CadVantage Punch Retro of Teckmen Systems

Fig. 10 Computerised Jacquard Card Punching M/c of Fancy Textiles

Fig. 11 Loom/Jacquard Controller of Booria

Fig. 12 CadVantage Jacquard Direct of Teckmen Systems

4.3 CAD/CAM System for design to fabric direct

The Ultimate in design computerization consists of direct selection of jacquard hooks from a simplified and condensed design through a computer. This form of control has already been introduced as electronic jacquards are running throughout the world. Most of the CAD/CAM Systems provide support for making design to fabric direct requiring no point paper designing, no card punching and card lacing, and hence no investment in installing punching machine ——— which means faster design changes plus cheaper design cost. What is needed is to have an optional software-hardware attachment (Windows embedded system) like Loom Controller /Jacquard Controller for controlling different electronic jacquards or electronic selection boxes. In case of CadVantage Win Jacquard Direct of Teckmen Systems, e.g., one IBM PC can control more than 6 Jacquard Direct Controllers from central control station with remote administration. All the designs can be kept at the Control Station archive and free from tampering. Last minute changes can be made to designs sitting at the Control Room. All the designs from the Design Station can be downloaded to the Controller Station via network so that no data loss or media corruption problem arises. Some of the CAD/CAM Systems like ArahWeave, Booria, Lectra, CadVantage Win Jacquard etc. support direct networking to Bonas, Staubli JC4, Staubli JC5, Staubli JC6, Schleicher, Grosse, and other popular electronic jacquard controllers via a regular TCP/IP network between the jacquard controllers and the centralized CAD station. The Jacquard Controllers need to be equipped with the network card. The software system allows us to load files directly from the loom, delete them, or send new designs to the loom. There is also provision to send one file to multiple looms with one command.

5. CONCLUSION

CAD/CAM systems for jacquard based textile industry are an integrated technological solutions (in software and/or hardware) catering to the various needs which ranges from designing, prototyping, actual production, marketing and presentation of the designs/the finished products of the textile industry as a whole and jacquard industry, in particular to web enabled ERP solutions to take care of the customers' business needs. These solutions have enabled the jacquard based textile industry which encompasses all types of jacquards from traditional handloom jacquards to the state-of-the-art electronic jacquards to reduce development costs and time, unleash greater creativity, increase responsiveness, and perpetuate their brand universe.

Most of the IT based companies provide the customers with global high value-added solutions geared to the specific needs of their sectors, vital for boosting their performance and competitiveness.

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