1. REVIEW OF LITERATURE

The review of literature for this study is discussed under the following heads

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2.1 The Textile and Apparel Industry of India

Textile making is a very ancient craft, with a history almost as old as mankind itself. Textiles and clothing, a truly global industry is produced in almost every country of the world and from the cottage industry to the multi-national corporation states Wilson (2005). Until the European industrial revolution, India was the world’s foremost centre of textile production write Gillow and Barnard (1991). Textile sector comprises mostly small-scale, non-integrated spinning, weaving, finishing and apparel-making enterprises. It contributes about 14% to the GDP and 12% to export earnings (Vaid, 2009 and Textile Trends, 2011). For India dresses have always been a winner and even during the recession (Jan-Dec 2010) the product bought business to the country (Apparel Online, 2011). According to Kumar and Sunderesan (2010), textile is among the leading sectors in the Indian economy in terms of production, exports, employment and contribution to the exchequer.
India earns around 27% of the foreign exchange from exports of textiles and its related products remark Gopalakrishnan et-al (2010). To quote Panthaki (2005), the textile industry in India is vital to the economy of the country as it contributes to over 6% of the gross domestic product to India and earns 18% of the total foreign exchange earnings of the country. The textile industry in India has been the forefront in employment generation besides export earnings express Nayak and Ahamed (2010). Considered as one of the largest employment generator, the Indian textile industry provides employment not only to people involved in it but also to various ancillary sectors like agriculture and recent survey has revealed that the textile industry contributed twelve million jobs in the year 2010 (Indian Textile Journal, 2011). The present garment segment of the textile industry provides employment to around seven million people (Apparel Talk, 2005). According to Kunz and Garner (2007), the textile and the apparel business provides employment for more than any other business segment, directly providing a livelihood for many millions of people, including 37 million individuals in India alone.

The textile industry globally has witnessed a Compound Annual Growth Rate (CAGR) of over 3% from 2000 to 2010 with buildtech, geotech, oekotech and indutech being the fastest growing segments (Apparel Online, 2010). Chakrabarti (2010) is of the opinion that the globalization of capital and steady rise in capital inflows has made it easier for India to maintain a favourable balance in foreign trade accounts. Retail industry in India is a lucrative one (Apparel Views, 2011). As competition and pressure on profit margin grow, fashion manufacturers are looking wider for inspiration on how to maintain a competitive business (The Indian Textile Journal, 2010).

Indian garment exports to the markets in 2011 have started with a very positive note (Apparel Online, 2011). US based internationally recognized foreign policy think-tank predicts that India will be the third largest economy in the world after China and Unites States by 2050. According to the Indian commerce ministry the merchandise
exports in January 2011 will be $14 billion thereby maintaining positive growth for the third consecutive month after a thirteen month contraction (Textile Trends, 2010). According to Venkatrangappan (2010), it is worth mentioning that today we have reached a prominent milestone. We are now having an annual capacity of about Rs 8050 crores and achieved highest production of approximately Rs 6200 crores during 2007-08. Ramkumar (2010) points out the recent global economic prospect reports by the World Bank predict that Indian economy is expected to grow at the rate of 7.5 – 8% during 2010-12. Arvind Kumar (2010) states that the garment exports registered a modest year on growth of 1.5% to Rs 728 million in October 2010 even though the demand from western markets remained lacklustre.

India is an enormous country and is a home to nearly one billion people harbouring a wide variety of ornamental and decorative styles opines Lehri (1999). According to Naik (1996), Indians are world famous for their magnificent workmanship and produced the most beautiful hand spun and hand-woven textiles.

2.2 Fashion and Style

Fashion talks, it lives and it grows quotes Hidalgo (2007). Fashion as part of history repeats itself and is defined as the prevailing style in clothing at any given period of time write Amaden and Crawford (2005). To create fashion, nothing more than paper, pencil, ruler and a table are required, in addition to ideas, curiosity, ambition, concentration and endurance explains Entwerfen (2010). The continual change, fashion involves the exercise of creative design skills which results in products that range from the basic to the rare and elaborate feels Easay (2009). Fashion today is not restricted to grown-ups, but kids too are becoming fashion conscious these days especially when it comes to dressing (Apparel Online, 2010). As per Amsamani and Punna (2010), there is now a buzz in the fashion and high tech industries about integration of technical and smart intelligent functionality into fabrics for clothing.
With fashion rapidly becoming ‘a must have’ for the masses and technology playing an important role in making it viable to incorporate fashion elements at reasonable prices, the retailers around the world are also embracing this change. ‘Leggings’ seen as a fashion forward statement in the 80s is now a universal trend that has become mainstream fashion and this versatile fashions are the fashion world’s latest obsession (Apparel Online, 2011). When it comes to fashion, where change is a constant, there is a growing need for good information tools to remain ahead of competition opine Paul and Paul (2011). Fashion has truly become a serious business in India (Textile Trends, 2010). Today with wide spread ability to spend, the great masses of people follow fashion and thus fashion determines both the character and direction of consumption say Jarnow et al (1987). According to Koshy (1997), fashion garments are differentiated by innovative fabrics and / or substantial use of trims, embellishments and / or presence of high degree of craftsmanship in the form of bead, sequin work and / or sophisticated design, colour and styling inputs. Home (2006) states that fashion play a vital role in respect to shaping relationship between people to people levels through institutes.

Fashion in any part of the world reflects economic, social habits and lifestyle aspects of the people. Fashion dictates expansion plans of exporters and over the few years bags have emerged as the most important accessory that is today the perfect extension to clothes and a must to complete the look when offering buyer collection (Apparel Online, 2011). To quote Priest and Pullen (1990) clothes that are currently popular are called fashion. Fashion is the regular change that occurs in the appearance or design of an object. Usually fashion changes are new, different and appealing. In this contemporary world of fashion, where dressing is a powerful form of expression, more and more youngsters are adopting ‘character inspired merchandise’ by wearing their favourite cartoon and comic characters on their T-shirts (Apparel Online, 2011).
Individual interpretations or versions of the same style are called designs. Compared to the number of styles in any given product, the possible variety of designs is limitless. In a fashion Industry, when a style becomes popular, many different designs or versions of that style maybe produced views Dickerson (2003). According to Frater (1995), the style with which a folk embroiderer expresses herself is not chosen, but assumed. A folk style evolves over generations of experiences largely shared and it reflects the continued unity of a community in its perfect replication in each member’s embroidered art.

2.3 Design and the Designer

Designs express the artist’s mind and enhance the beauty of the product (Clothes Line, 1995). Design in the fine arts is considered to be a creative process and design is the word used loosely in all the arts and particularly in their instruction to mean composition, style or decoration defines Encyclopaedia Britannica (1979). Design is arrangement or putting our creative ideas on paper and a designer often gets inspired by the post-civilisation and great art works opine Sumathi (2004). Design can be described as the visual expression of an idea and the idea is conveyed in the form of a composition view Villamil and Elias (1997).

Every fashion designer should have detailed knowledge of the process of garment construction, which helps in designing, making it more practical says Jindal (1988). Doab (2007) is of the view that fashion has become a way for designers to openly display the progress and development of the collective conscious of the society in which they live. To quote Diamond and Diamond (2008), the designer or the design team proposes numerous sketches for the line. Many are rejected, but the surviving ones eventually transforms into patterns and then into samples. A sample thus constructed becomes the part of the initial or preliminary line. Prakash (2004) reiterates the fact that the textile designers are concerned with the designs of fabric for a variety of purposes from clothes to carpets, while fashion designers anticipate or predict fashion trends and design clothes
for particular needs. According to Lee (2005), today high-end fashion designers are struggling to find their identity in a competitive global market, adding that fashion is experimentation. Stone (2007) is of the view that the fashion was once considered an art form controlled by designers who dictated its content, but today fashion can be measured and evaluated.

A single clue that strikes a designer should be revolutionary and trend seeking. Such single ideas put together produce fashion believes Bethi (1996). In a buying agency the stress is more on duplication of the artwork or any sample as desired by the customer perceives Sharma (2005). Fashion designers are the artists of the apparel industry. In addition to colour, texture and style, a designer must understand the construction and characteristics of specific fabrics such as durability and stiffness views Fairhurst (2008). According to Satyan (2011), even the developing countries like India has come into fashion focus time and again.

The 21st century is a time of freedom of choice. Designers have acknowledged that they alone cannot decide what their customers want and they are offering a smorgasbord of fashion to consumer’s attention, opine Diamond and Diamond (2008). For a designer the principles of design serves as a guideline for combining the elements of design, writes Frings (1982). According to Richmond (1990), the design process is not so easy to articulate and it is impossible to predict what will trigger a new idea. La mode and Der mode (2009) feel that the fashion designers want to incorporate works of art into their designs in order to elaborate unique, innovative creations.

2.4 Dress and Dress Designing

Costumes of a community or nation are an essential part of cultural heritage, a mirror of the time and the people of that particular community. In order to have a proper understanding of the present status of textiles, it is important to know the age old
traditions and traditional costumes opine Borah and Mog (2010). Clothing technology has a long history which could be said to have started with the discovery of the needle about 1800 B C views Cooklin (2004). Clothing has been recognised as a primary need of mankind throughout the world. Uncomfortable clothing takes away the joy of living view Babel and Nagpal (2010). Chatterjee et-al (2010) define the clothing manufacture as a process of converting two-dimensional garment structures by assembling different pattern pieces together. The process flow of garment making is constituted of numerous stages starting from collection of standard body measurements, pattern making, cutting, sewing and assembling, packaging and final dispatch of garments. Jefferson (2005) refers clothing as coverings and garments intended to be worn on the human body and the word cloth is related to fabric or textile.

Clothing play an important role in the life of every individual since it is symbolic. It is a symbol to identify the groups of people region wise, culture wise and designates the rank, role, occupation, status and standard of living of community at large opines Naik (1996). According to Seema (2010), clothing protects people from humidity, heat and cold and helps them feel physically comfortable. Clothing gives the wearer a sense of well-being. Clothing affects the way others see and also gives social comfort. Sarkar and Sil (2010) feel that clothing is one of the basic needs of human beings after food and shelter contributing appeal to human personality. Hidalgo (2007) is of the opinion that clothes are a sign of the body that wears them, barometer of the person’s illusions, frustrations or dreams. According to Borah (2011), clothing plays an important role in social interaction and the choice of clothing varies due to the values, interest and attitude. That appearance does something to the wearer. To quote Niesson et-al (2003), clothing provides an opportunity to display oneself to others in ways that can register one’s actual or desired identity. To quote Woodward (2007), clothing is not defined by what it has been in the past, but what it can be in the future, as people imagine themselves wearing the clothing.
Designing is an art and the art is a product of creative process. It is the human power to conceive, plan and realize the products that serves human beings in the accomplishment of any individual or collective purpose quote Saxena et-al (2010). The desire to create garments that reflect the beauty of the world around us and provide the expression of artistic nature has been evident from the early human history opines Kothari (2011). ‘Dress designing is always an important art’ and a well-designed garment has beauty and appropriateness, which makes it right for the wearer say Gupta et-al (1989). A garment is attractive only if it fits well. To achieve a good fit, it is necessary to give attention to finer details such as individual proportions and contours expresses Anna (1996). To quote Aitken (1992), the aim of dressmaking is to achieve a graceful, flattering and unbroken and harmonious line. According to Harold and Barbera (1988) a dress is generally assembled from several parts. The first stage in the manufacture of garments is the cutting of the materials into necessary pattern shapes. These are then joined together by means of seams to create 3D garments.

Traditionally manufacturing of apparels has been considered to be labour intensive which requires a high level operating skill in handling tiny pattern pieces and stretchy materials quote Kavitha and Manohari (2011). Cooklin (1991) describes designer as a person who develops variations from the core designs. These core designs are garments which contain the main design and fabric features of the collection and they will be used as the themes for developing the full range of samples. According to Frings (1982), ideas are sometimes originated from the drawing board. Starting with an idea for a silhouette or a neckline, the designer may experiment sketching alternative ways to complete the design. From the 2 dimensional designs the designer must be able to imagine how the garment will look 3-dimensionally, when made up in fabric.

1.5. Introduction to Computers

Computer maybe defined as a device that operates upon information or data. A computer can store, process and retrieve data as and when required states Sinha (1992).
The basic function performed by a computer is execution of the program and a program is a sequence of instructions which operates on data and performs certain tasks (Pearl Software, 2000). According to Rajaraman (1996), a computer maybe thought of a servant who will work at a very high speed without exhibiting any emotion. Sanders (1988) describes computer as a fast and accurate electronic symbol (or data) manipulating system that’s designed to automatically accept and store input data, process them and produce output results under the direction of a stored program of instruction. In its simplest terms a computer is an electronic machine for accepting and processing of data and helps in retrieving information when needed states Singh (1998). To quote Jaiswal (1999), a computer maybe defined as a machine that can solve problems by accepting data, performing certain operations and presenting the results of those operations under the direction of a program. Norton (1998) states that a computer is controlled by programmed instructions which give the machine a purpose and tell it what to do.

Any computer system essentially has three important parts, namely input device, central processing unit (CPU) and output device. The CPU has three parts namely memory unit, control unit and arithmetic logic unit describes Saxena (1999). Capron (1996) is of the view that the basic personal computer system consists of a central processing unit and memory, a monitor (screen), a keyboard and a mouse, a storage device and a printer. According to Hamacher-et-al (1996), computer consists of five functionally independent main parts; input, memory, arithmetic and logic, output and control units. To quote Joseph and Surabhi (2000), a computer has five elements – a storage device for recording the data, a processing unit for manipulating the data, input device for feeding the data into the machine, output devices for getting the data from the machine and programs for controlling the process of data. De Vries (1995) defines computer as an electronic machine that receives and stores data, performs some action according to a planned program and outputs the results. Rajaraman (1999) states that the fastest and the most expensive computers available at any given time are generally called super computers.
Computer is a machine that handles data. The computer stores, retrieves, sends, receives, analyses and synthesizes the data to produce information remarks Basandra (1999). A computer can receive information, perform some basic operations on that information and produce results according to a pre-determined program and the desirable characteristics of computers are their speed, storage capacity and accuracy remark Subramaniam and Chitra (1995). The term ‘computer’ is used to describe a device made up of electronic and electromechanical components. By itself, a computer has no intelligence and is referred to as hardware. Software is the term used to describe the instructions that tell the hardware how to perform a task, without software instructions, the hardware does not know what to do explains Basandra (1996). To quote Hamacher et-al (1996), a contemporary computer is a fast electronic calculating machine that accepts digitized input information processes it according to a list of internally stored instructions and produces the resulting output information.

According to Sybex (1999), the personal computer revolution has created an insatiable market for faster, easier-to-use and most powerful components and peripherals. Kothari (2008) is of the opinion that computer is certainly one of the most versatile and indigenous developments of the modern technological age and today people use computers in almost every walk of life. According to Norton (1998), computers are so fundamental to the modern society that without them, our country would grind to a halt. With the invention of digital computers, time consuming and error prone numerical computations are done with relative ease and accuracy write Janakiraman et-al (1993). Leach et-al (2007) are of the opinion that it is difficult to find an area in life today that is not influenced in one way or another by a digital computer. Mittal and Goel (2006) is of the view that computers are seen in schools, colleges, universities, hospitals, business establishments, research centres and in many other organizations. It is also used to forecast the weather, operating complex machines automatically and even flying aircrafts without pilots.
1.6. Computer Aided Designing (CAD)

Computer aided designing is becoming popular due to its simplicity and accuracy in drawing opines Jeyapoovan (2006). With CAD, the designs can be produced at a faster rate with more accuracy in drawings. Moreover special drafting techniques can be employed and the design calculations are quick and superior says Chockalingam (1999). According to Zeid (1991), Computer Aided Design (CAD) can be defined as the intersection of three sets, geometric modelling, Computer graphics and the design tools, based on their constituents. To quote Groover and Zimmers (1999), computer aided design involves any type of design activity which makes use of the computers to develop, analyse or modify an engineering design. Mukherjee (1999) states that computer aided design is probably the single largest factor which is responsible for a significant and useful application of geometry in the fascinating growth of computer graphics and one of the earliest application of CAD was in the automobile industry.

In general terms CAD means computer assistance whilst a designer converts his or her ideas and knowledge into a mathematical and graphical model represented in a computer, feel Radhakrishnan and Subramaniam (1997). According to Kazlacheva (2005), CAD systems help in design, constructing and modelling of garments with rapidity and extra accuracy. The apparel design is very specific with its various drawing tools and tools for modification in CAD systems. The maximal aid is possible only after the optimum use of tools. McMahon and Brownie (2000) are of the opinion that CAD enables the designer to tackle a task more quickly and accurately, or in a way that could not be achieved by other means. To quote Diamond (2011), CAD (computer-aided design) has become a major part of the design process and to become a designer or manufacturer, one should understand the importance of CAD software in today's fashion industry.

2.7 Computers in Textile and Apparel Industry
The automation efforts of the apparel and textile industry in India has been at a rapid pace since a decade to provide comprehensive solutions to the company through the connecting power of information technology opines Kumar (2009). Mattila (1997) is of the view that the development of computer systems has made it possible to have online control of all shops, even worldwide. Mont (1996) affirms that the consumer gets to see the products displayed before they are developed – virtual products in virtual stores. The internet is a form of virtual store. To market a product there in reality, there is no need to physically produce the product, what is needed is an electronic representation of the product. Brannon (2006) states that a fashion scout can see a new design in Europe, transmit the same through a colour photograph to the corporate headquarters, where a prototype design can be developed using computer aided designing.

CAD in textiles is highly sophisticated and precise, making the design process rapid and cheap. A design maybe created from the scratch using a stylus, with colours and textures from the large library of the system. Previous designs can be recalled and modified. It is also possible to produce a image from photographs which can be digitized and modified using different drapes and lights state Carr and Pomeroy (1992). Teckmen systems are one of the pioneers in CAD/CAM for textiles. Teckmen offers several products namely software for jacquard designing, dobbi designing, print design and texture mapping software; and machinery for card punching and lacing, whereas SUMA HT CAD is the software aimed at fabrics manufacturing contractors or designers with a complete understanding of CPM weaving. With this software one can design fabrics from a technical stand point or take a simulation produced by SUMA HT CAD and put the final touches required for production (The Indian Textile Journal, 2010).

‘Quick response’ is a new computer technology invested to increase productivity in textile mills and improve communication among textile mills, their suppliers and their customers view Burns and Byrant (2002). Stone (2007) is of the opinion that computer technology is playing a key role in quick response programs that improve
communications among fibre, fabric, apparel and retail businesses. Quick response shortens the time between the placement of orders by retailers and the delivery of goods.

Computers have found a place of prominence in almost all the apparel industries briefs Koshy (1997). Kaplan (2004) feels that computers and computer-controlled equipment aid in many functions such as designs, marking and cutting. Also many employees seek designers who know how to use computer assisted design. According to Chatterjee et-al (2010), the advent of the technology of computers, the apparel industry is changing from a traditional, labour intensive industry to a highly automated and computer integrated industry. Dickerson (2003) opines that the fashion industry of the new millennium is one that is quite different from the one that existed a decade or two ago. New computer technologies have been incorporated into virtually all aspects of the industry to increase efficiency, save time and produce value for the consumer.

Designers use computer programs to illustrate their collections, scanning in their original artwork and then applying colourways, fabrications, text and typography to present ideas views McKevley and Munslow (2007). Amsamani et-al (2007) are of the opinion that CAD/CAM has become a foundation tool for the upcoming designers and a CAD designer can sketch an idea digitally directly. Bethi (1996) believes that computer in the hands of designers can prove to be tool of unlimited creativity with the system working as an artist’s sketch book. The designer can experiment with new ideas, with little effort and in a few minutes achieve a totally new design without incurring the cost of making a sample garment. To quote Frings (1982) computers are being programmed to sketch designs and automatically make the first pattern from the sketch. Burns and Byrant (2002) feels that CAD software programs have become common in any apparel Design studios. The computer can store a croquis, or a series of croquis in various poses. The designer selects a desired pose that then appears on the computer screen. Kodolph (2007)
Diamond and Diamond (2008) opine that with CAD systems, basic components can be replicated quickly, easily and accurately. Modifications of colours, motifs or design lines are made so that the designer can easily explore several alternates.

The computer takes the place of cutting and drawing of patterns and of laborious marker making on paper. This saves time and the accuracy is considerably more than is required of this type of work, opine Taylor and Shoben (1990). Cooklin (1991) describes CAD in pattern designing as one of the computerised system and defines pattern design as construction and development of pattern garments. ‘Style testing’ meaning pretesting with consumers, can aid in easy identification of styles with low consumer interest and can be eliminated. Parthasarathi (2010) acknowledges that CAD and CAM are a part of computer technology. He adds that the increased competitiveness and demand for shorter lead times has lead to the slow, but definite proliferation of CAD/CAM systems in India, even in the textile and apparel industry.

2.8 3D Garment Designing

Designing 3D object is inherently a difficult task compared to that of a 2D object states Mukherjee (1999). At present, the garment industry uses two-dimensional CAD tools. It is expected that three-dimensional tools might be used for garment design to improve the efficiency of pattern generation and for more attractive design presentation. Studies have shown that pattern designers wish to design patterns directly on a 3D human model. It has been estimated that most designers still prefer to express their creative design ideas through 2D sketches say Wang et-al (2003). Manipulation, viewing and construction of three dimensional graphic images require the use of 3-D geometry and complex co-ordinate transformation (ISRD, 2006). Beazley and Bond (2003) are of the view that the developments within the CAD for fashion and clothing have been realized in the development of 3D software. Offering the designer a virtual prototyping system
has been an active research area for many years. In relation to the pattern design the ability to move from 2D to 3D is perhaps the area of most interest. To quote Jeyapoovan (2006), three view drawings are used to describe any object more clearly and completely.

Some software involves drawing 2D patterns by using 2D CAD systems. Modules have to be developed to generate, starting from 2D patterns, data necessary to define the 3D physical model of the garment and execute the simulation. 2D patterns are automatically generated as well as data for assembling and positioning 2D patterns around the mannequin to define the physical model view Cugini and Rizzi (2002). According to Durupinar (2004), today there is an increasing demand for the involvement of 3D computer graphics in textile industry and entertainment industry. Especially, computer aided design systems, fashion design programs, new generation movies and computer games require new tools that perform realistic simulations. However, the demands vary for different areas. Hinds et-al (1992) are of the view that the designer can move around the body form inserting style lines where desired, while making a visual assessment of shape and position.

Geometric transformations are more involved in three dimensional space than in two dimensions. Viewing transformations are much more complicated because we have many more parameters to select when specifying how a three dimensional scene is to be mapped to a display device view Hearn et-al (2007). To quote Chockalingam (1999), 3D modelling is time consuming in man hours and computer response. However 3D modelling improves efficiency in many design and manufacturing application. Avadhani (2006) states that three dimensional viewing of objects requires the specification of a projection plane, a centre of projection or the direction of projection and a view volume in world co-ordinates.

Based on analyzing the contact characteristics between the human body and the garment, a mechanical 3D model is developed based on the theory of dynamic contact
mechanics. The garment is regarded as an elastic shell of geometric nonlinearity and the human body is assumed to be rigid. The contact between body and garment is modelled as a dynamic sliding interface state Zhang and Yueng (2002). The new emerging technologies, systems and practices are 3D whole body scanners, automatic body measurement, 3D CAD systems for the customization of existing styles, virtual-try-on visualization techniques and new smart card techniques (World Communion, 2007). Rabb (1993) points out that the illusion of 3 dimensions can make a graphic come to life with its bold, clear colours and sharp edges.

After 3D garments are designed, fabric choices such as silk, cotton, denim or fur are selected and simulated in a fitting room. Garments are then taken to the PhotoStudio, where lights and camera angles are set. In the final step, the MaterialEditor adjusts materials and changes fabric colours. After the garments are created, print-ready images can be easily produced in a virtual photo-shoot (e-frontier, 2006). Kim and Park (2008) reiterate that the 3-dimensional computer-aided design has become one of the most indispensable elements in modern industries. It is very difficult to find any design process that is not aided by CAD systems in traditional manufacturing processes of machinery, aircraft, and watercraft and most engineers take it for granted nowadays. “My background is 3D design and technical fashion and my enduring passion is in merging technical and aesthetic considerations providing comfort - physiological and psychological - and ease of movement, through appropriate garment fit” opines Watkins (2005). To quote Volino et-al (2005), future systems may simplify some garment design tasks by testing automatically the created garment for fitting and comfort against a selected range of sizes and postures.

Liu and Geng (2003) propose a new approach to realize intelligent design of 3D garments which includes, setting up the 3D garment prototype and studying the relationship between the parameters of the 3D garment prototype and different garment styles. Carr and Pomeroy (1992) state that with 3-Dimensional images fabric can be laid,
model rotated and both the lighting and drape adjusted. Stone (2007) is of the view that CAD allows 3D-dimensional contouring of objects on screen. Folds, creases and textures are simulated so that CAD generated garments drape and hang accurately. Once the design is set on the computer, the image is used to create a pattern that is complete with darts, seams and tailor’s markings. The 3D image can be rotated to see all sides of the garment. Many companies are thus reducing the number of costly sample garments that they produce. Instead of a physical sample, they use the computer image in merchandising and sales presentation.

3D technology will dramatically change the way apparel designers work. Rather than designing garments with flat 2-Dimensional drawings, they’ll create 3-Dimensional images that can be rotated for viewing from different angles. As they experiment with different materials, the program will adjust the drape of the garment to reflect the characteristics of the material say Burns and Byrant (2002). A design in 3D with picture perfect texture eliminates the guess work in sample making because garments, fabrics, seams, prints and logos can be designed, presented and transmitted with photo quality representation (Apparel Views, 2007). Boissieux et-al (2006) state that modelling dressed characters is known as a very tedious process. It usually requires specifying 2D fabric patterns, positioning and assembling them in 3D and then performing a physically-based simulation. The latter accounts for gravity and collisions to compute the rest shape of the garment, with the adequate folds and wrinkles.

2.9 Software Available for 3D Designing

VSticher, 3D garment design and application software from Browzwear, is distributed in the Asia-pacific region by Pragma solutions, represented in India by AIE Apparel Pvt Ltd. This has created waves in the industry with its ability to enable designers to create exceptionally detailed virtual garment from 2D patterns over a 3D true-to-life body image. This software offer e-business capabilities by allowing user to create an e-store through a display of creations in a high quality interactive 3D catalogue.
at any point of time – from preproduction to production to final merchandising (Apparel Views, 2007). Chatterjee et-al (2010) point out that Modaris 3D fit enables simulation and validation of styles, fabrics, motifs and colour ranges; it allows pattern designers to check garment fit in various fabrics and sizes.

Lectra Fashion PLM pushes back the limits of product lifecycle management by covering all the necessary steps for creation of collection and bringing together role-based applications for product-design, pattern making and physical and 3D virtual prototyping with tools for the planning and management of collection (The Indian Textile Journal, 2010). 3D fashion pattern making software ‘My Label’ is launched by BERNINA International. This brand new innovative 3D pattern software allows sewers to create their personal outfit from 20 basic styles and to view it 3Dimensionally on the screen. As soon as the measurements are entered, the My Label model assumes the particular proportions and shows the fit of the chosen outfit in razor-sharp images. The design can be examined on the model in 3D from all sides and in any desired positions (Apparel Views, 2007). 3ds Max is a professional three dimensional animation rendering and modelling software package used to create and animate objects and remarks that 3ds Max has become the industry standard 3D modelling and animation software (Kogent Solutions, 2008). To quote Fontana et-al (2005), Modules for 3D shape modelling include V-Stitcher by Browzwear, OptiTex Runway 3D by OptiTex and DressingSym by Digital Fashion. Optitex specialises in the development of innovative, easy-to-operate 3D CAD/CAD solutions for cut fabrics. It creates a virtual world when testing manufacturing designs. Optitex uses 3D visualization technology for garment fitting by synthetically reproducing a three dimensional model of clothing items. Optitex develops innovative, user friendly 2D and 3D solutions for all cut-fabrics and fashion related industries (Indian Textile Journal, 2010).

Gerber Accumark technology and Lectra are two of the most widely used CAD systems for fashion apparel, while Adobe Photoshop and Adobe illustrator are two
mainstream programs that serve as excellent digital interpreters of the drawing skills of a designer, expresses Calderin (2009). Maya is the state-of-the-art industry standard application that is widely used for 3D modelling, animation and effects. Users of the program produce content for film and television production, video games development, web design and print production. Maya is a culmination of technologies created by Alias and Wavefront, the premiere computer graphics software, explain Meade and Arima (2006). Assyst software is in widespread use in all aspects of the fashion industry worldwide including children’s wear, men’s wear, ladies wear, couture, lingerie and outerwear. For creating designs in 2D and 3D, body measurement, pattern cutting, style development, grading, ratings and costings, marker making and cut order planning Assyst software is used (assystbulmer.co.uk, 2011). Animation Master is a 3D character animation application offered by Hash, Inc. that includes tools for modelling, rigging, animating, texturing, lighting and rendering. Although Animation Master was developed for and is targeted towards independent artists, with a workflow optimized to enable one artist to create a rendered animated piece from start to finish, the workflow also presents economic advantages for larger workgroups (wikipedia.com, 2011).

Cinema 4D has come a long way since its initial release on the Amiga platform back in the early 1990s, growing from a small 3D application primarily used by hobbyists to a recognised professional application (3dworld reviews, 2011). Jerrysartarama (2011) describes that ‘Poser Figure Artist’ is a virtual studio with realistic 3D human models. Figure artists depict the human form on mixed media using oils, watercolours, pen and ink or charcoal, or in sculpture. Poser Figure Artist provides everything needed to replace the traditional models, gives you the tools to create amazing art finished in the style you choose, and comes complete with extensive learning tools to get you working in the magic of 3D quickly and easily.

2.10 Library and Digital library
The library is a place where books, journals, microfilms, audio and visual materials and computer data and terminals are kept and organized to support the needs of the general public or specific groups of users. The trend of library policy is clearly toward the ideal of making all information available inexpensively and quickly to everyone (Grolier Encyclopaedia of Knowledge, 1999). The library catalogue is built according to certain basic principles, whose goal is to make the catalogue useful to all users, views Bloomberg (1981).

Collection of texts and images encoded so as to be stored, retrieved, and read by computer is called as digital library (sir.arizona.edu, 2011). This is a term used to refer, collectively, to all of content areas and collections (aluka.org, 2011). Digital libraries are comprehensive databases that replicate in digital media, many of the functions of traditional libraries. They tend to contain a purposefully selected collection of texts plus various means of access to these texts (scils.rutgers.edu, 2011). Digital Libraries are technological and social developments that are fuelled by information technology, bioinformatics, and networked information (twason.com, 2011). A digital library is a collection of documents in organized electronic form, available on the internet or on CD-ROM (compact-disk read-only memory) disks. Depending on the specific library, a user may be able to access magazine articles, books, papers, images, sound files and videos (cesa8.k12.wi.us, 2011).

An integrated set of services for capturing, cataloging, storing, searching, protecting and retrieving information is a library (wtec.org, 2011). Rajasekhar (2009) defines a digital library is an organized and focused collection of digital objects, including text, images, video and audio, along with methods for access and retrieval, and for selection, creation, organization, maintenance and sharing of the collection. There is much interest today in digital libraries due to large number of computer based activity by large grant projects, international conferences and a great deal of activity on the internet opines Harter (2009). Digital library collections are not limited to document
surrogates but they extend to digital artifacts that cannot be represented or distributed in printed formats (Association of Research Libraries, 2009).