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Evaluating the integrated performances of two CAD systems applied in garments manufacturing process

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ABSTRACT

The purpose of this paper is to identify the weak points of Gerber and Grafis CAD systems during practical application in a knit garments manufacturing process and also evaluate their integrated working performances for the same product. At first, the comparative working capability of both CAD systems has been investigated considering the elements like: i) Pattern development (ii) Pattern modification (iii) Pattern grading (iv) Marker development (v) Data transferring facility (vi) Advanced features and (vii) Purchasing cost. Afterward, both of those systems have been integrated only taking their strong elements and applied for the same product. Finally, the working performances of integrated systems have also been evaluated comparing with the individual performance of those CAD systems .The results revealed that the Grafis system has shown more effective performance than Gerber in respect of majority elements. Moreover, the results from integrated approach have expressed the significant advantages for all the selected elements. The results of our study suggested that the integration of Gerber with Grafis CAD systems would be one of the better solutions than individual for effective application.

Keywords: Garments CAD system, Garments manufacturing, Gerber, Grafis, Integrated performance.

1. Introduction

In the intensity and pace of today's cutthroat competitive business environment around the world, the garments manufacturers are using advanced computer technology extensively like other manufacturing areas for product designing, planning , manufacturing and marketing [1]. As an essential technology, the Computer Aided Design (CAD) has also been using for the garments manufacturing process, which provides support to the creative work in the design studio for pattern designing, pattern grading and marker making [1-3] . By using CAD systems in garments manufacturing, three main advantages would be achieved such as: production flexibility, productivity and storage capacity [2], which leads to benefits like reduction of lead times, lowering of direct cost and most importantly quick communication with customers and suppliers [3].In order to fulfill the increasing user's demands, a wide number of CAD systems namely Gerber, Lectra, Investronica, Bullmar, Optitex, Grafis, PAD and Assyst have been developed by the different companies, [3,4]. The available CAD systems developed for garments manufacturing have been featured with different working scopes according to the user's demands. All of those have some strong and weak points in respect of working flexibility and purchasing cost. Specially, the price of the CAD systems is one of the crucial factors for medium and small size garments manufacturers to invest. Due to higher investment cost, only large companies can able to purchase costly one, which have more operation flexibility [3]. Recently, some cheap garments CAD systems have also been developed with flexible working scopes. So, there is a need to analyze the working scopes and abilities of both costly and cheap CAD systems in order to find the possibility of combined application to fulfill the user's all requirements in a reasonable price.
In order to achieve that goal, in this research, two well known CAD systems Gerber (costly) and Grafis (cheap) have been analyzed through a practical application considering their working scopes, flexibilities and price in order to indentify the week and strong points. Then, an integrated application including both of those systems has also been investigated for the same product by taking positive features from both CAD systems.

2. Research methodology

In this research, at first, the comparative working capabilities of Gerber [5] and Grafis [6] CAD systems have been investigated through practical application on a knit garment manufacturing process considering the elements like: i) Pattern development (ii) Pattern modification (iii) Pattern grading (iv) Marker development (v) Data transferring facility (vi) Advanced features and (vii) Purchasing cost. Afterward, both of those systems have been integrated only taking their strong elements and applied for the same product. Finally, the working performances of integrated systems have also been evaluated comparing with the individual performance of those CAD systems by using qualitative and quantitative methods based on the elements characteristics.

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3. Findings and Discussion

3.1 Pattern development

During developing the patterns of our product using Grafis, the following steps have been used sequentially: i) Call the basic pattern block from Grafis basic block storage ii) Adjust the basic block according to required measurements iii) Call the sleeve from Grafis basic block storage iv) Adjust the sleeve shape according to required measurements v) Call the collar from Grafis basic block storage and adjust it vi) Call the hood from Grafis basic block storage and adjust it vii) Finally all patterns have been completed. All Body measurements used in this drawing have been given input only in mm. There was no other option. On the other hand, for the same product, the patterns development steps were as follows while using the Gerber system: i) All basic blocks have been drawn manually by preparing a Rectangle for each pattern part ii) All individual patterns have been developed from the basic blocks and completed all patterns parts. In Gerber system, there were various options to input the body measurements such as mm, cm and inches.
To draw pattern curves using Grafis system, there was an adjustable curve containing two handles at both ends. It was very easy to adjust by using those handles. But in Gerber system, there was a moveable smooth line to adjust the curve that was time consuming function.

During dart drawing on pattern parts using Grafis system, there were adjustable darts within the basic blocks, which were very easy to modify and relocate. The shape of side seam was changed automatically with the changing of dirt amount. But in Gerber system, there was no adjustable dart without manual dart addition. The shape of side seam was changed manually with the changing of dart amount, which was also time consuming.

The finished measurements chart preparation during pattern construction was very easy while using Grafis system. In this system, it was needed to measure the body measurement for the basic pattern. In Gerber system, it was only possible to see the measurement by measuring body measurements.

After drawing the basic patterns for our selected product through applying the aforementioned operations, a comparison has been tabulated between both systems considering the different operations used for pattern development as shown in the table 1.

3.2 Pattern modification

Just after developing the basic patterns of our product, it was required to modify the pattern parts, which includes the following operations: shoulder forwarding, addition of seam allowance, developing mirror of the pattern, developing the hem shape, dart modification, modification of sleeve curve and addition of side vent.

Table 1: Comparison between Gerber and Grafis for pattern development operations

Element	Operations	CAD Systems		Leading System
		Gerber	Grafis	
Pattern Development	Initial drawing	Complicated (Requires more time)	Easy (Requires less time)	Grafis
	Input of Body measurement	Flexible (mm,cm, inch)	Not flexible (only mm)	Gerber
	Curve drawing	Complicated (Requires more time)	Easy (Requires less time)	Grafis
	Addition of dart	Complicated (Requires more time)	Easy (Requires less time)	Garfis
	Preparing finished measurements chart	Manual (Time consuming)	Automatic preparation	Grafis

During using Grafis for shoulder forwarding, it has been taken the interactive mode of shoulder part from the interactive option by clicking the right button of the mouse and given the input of required amount of shoulder forwarding. But in Gerber system, several steps have been used. At first, the parallel lines have been drawn by taking shoulder forward amount and then made the mirror of front neck curve, armhole curve and parallel line against the shoulder seam. Finally, got the shoulder forward of front and back parts using tracing from this block. Upon completing the shoulder forwarding, it has been experienced that the use of Grafis system for this operation was easy. On the other hand, it was difficult in Gerber system, where some extra works were required.

For addition of seam allowance in the pattern parts using Grafis, it was required to add the seam allowance individually after selecting the different individual pattern parts. But it was possible to give input the seam allowance after selecting all the parts at a time within the same window.

At the time of preparing mirror of the pattern parts by using Grafis, it was required to make mirror for individual patterns by selecting the different pattern parts individually. While using Gerber, it was possible to develop mirror of the pattern parts at a time by

selecting all the parts at the same time in a same window.

Different shapes of hem of pattern parts have been drawn through adjusting the interactive mode of the basic block in the Grafis system. Afterward it was clicked on the “test run” and all changes were transferred into other parts of pattern automatically. But in Geber system, the hems of pattern parts were drawn manually. At first, it was required to draw the hem shape manually and then traced it.

In order to modify the shape of sleeve curve, different shapes of sleeve curve were made by adjusting the interactive mode of the sleeve block in the Grafis system. Then it was clicked on “test run” and all changes were transferred into other parts of pattern automatically. By using Gerber system, different shape of sleeve curves were modified manually and finally traced it.

During dart modification, different shapes of darts were modified by adjusting the interactive mode of dart in the bodies block while using the Grafis system. Then it was click on “test run” to be active and all changes were transferred into other parts of pattern automatically. But**,** different shapes of dart of pattern parts were developed manually in the Gerber system.

In case of ladies item, sometimes darts are required for close fitting. The dart addition and relocation in pattern is always a difficult task within Gerber system. Because, whenever darts are added in the pattern parts, some changes are occurred within the patterns, thus need to adjust the pattern manually. There is no interactive dart adjusting tool in Gerber system. But, Grafis system has interactive dart adjusting tool.

After analyzing all the steps of pattern modification, it was experienced that this function is a unique property and easy to work within Grafis system. There is a special option such as ‘test run all'. After modifying the different shapes of different interactive blocks of a style, just clicked 'test run all' and all the patterns will be changed within a moment. On the other hand, in Gerber system, pattern modification is a difficult task. Because there is no interactive basic blocks but it exists in Grafis system. Although there are some auto shapes in Gerber system version 8.5, it's very poor in function and not possible to modify it later on when it will require**.**

For addition of side vent of pattern it was found that the Gerber system was difficult to work but Grafis system was very easy to work.

In the table 2, a comparison has been presented in between Gerber and Grafis system considering all sub operations of pattern modification.

3.3 Pattern grading

It was found two options of pattern grading while using the Grafis system. One is interactive grading and another is manual grading. During the interactive grading, it was possible to perform the grading of pattern parts in interactive mode not only for bodies blocks but also all others blocks. At first, sizes were taken from the size table and then went to the interactive mode to assign the sizes through the 'set break sizes’. After that, the values of grading amount were given input for each measurement place. Finally, it was clicked on 'test run all ' which enabled all the grading and transmitted to different pattern parts. For manual grading, all pattern parts were extracted into grade rule pattern to add the grade points and finally the values of grading amount were given input for each part separately.

Table 2: Comparison between Gerber and Grafis for pattern modification factors

Element	**Operations**	**CAD Systems**		**Leading System**
		Gerber	**Grafis**	
Pattern Modification	Shoulder forward	Complicated (Requires more time)	Easy (Requires less time)	**Grafis**
	Addition of seam allowance	Easy to work (Possible to hide during drawing)	Complicated to work (Not possible to hide during drawing)	**Gerber**
	Developing mirror of pattern	Easy to work (Possible to hide during drawing)	Complicated to work (Not possible to hide during drawing)	**Gerber**
	Developing of hem shape	Complicated to give the required shape (Require more time)	Easy to give the required shape (Requires less time)	**Grafis**
	Dart modification	Complicated to work	Easy to work	**Grafis**
	Modification of sleeve curve	Complicated to work	Easy to work	**Grafis**
	Addition of side vent	Complicated to work	Very easy to work	**Grafis**

During grading with Gerber system, it was only found the manual grading option. At first, the rule table was prepared in the Explorer and then assigned this rule

table in the different parts of the pattern. Finally, the grading values were given input for each grading point using 'edit delta' for each individual part of the pattern.

It was also noticed that during the styling process, Grafis internally creates a record of the modification steps, basically continuing the drafting instructions of the basic blocks. The record can then be re-called to create other sizes automatically thus, eliminating incremental grading. The Construction parameters can be applied during pattern development. This enables the user to comfortably modify already finished patterns by changing the construction parameter simply. The Gerber system has only the point grade rule system, which is old manual system. There is no option to save the all grade rule points all together even the record can‘t then be re-called to create other patterns automatically thus, eliminating incremental grading and the construction parameters can be applied during pattern development. The comparison between Gerber and Grafis system for the operations of pattern grading is presents in the table 3.

Table 3: Comparison between Gerber and Grafis for the operations of pattern grading

Element	Operations	CAD Systems		Leading System
		Gerber	Grafis	
Pattern Grading	Manual	Have Manual incremental system with point grade rule system,	Also have manual incremental grading but little bit difficult.	**Gerber**
	Auto	There is no auto grading rule.	There is auto grading in the Interactive mode, copy or recall possible	**Grafis**

3.4 Marker development

During marker development of our selected product by using Grafis system, it was found that along with normal marker making tools, there is an option for matching of pattern for side matching marker. The side matching was indicated through a green line. But this system has some limitations such as: it was not possible to open the marker from other formats directly except Grafis marker. On the other hand, in Gerber system, although there was no option for matching the pattern without manual system, it could open marker from some other formats directly such as: Lectra, Investronica and Assyst marker.

By using Grafis, markers can be created from different styles. Apart from the common functions such as butting pieces together, rotate, flip and buffer a large number of options and aids for specialist applications are available. These include matching points for laying checks and stripes, use of marker templates, automatic generation of fusing blocks, consideration of material flaws and shrinkage and many more. Special lay planning options for folded lays or tubular material and step-lays can be selected. In case of matching garments, sometimes it's needed to match the front part and back part of matching garment horizontally and vertically within the marker. The Gerber system have no option for matching of front and back part of a garment and need to do it manually within the marker. It's not only time consuming but also difficult while using the Gerber system. A brief and specific comparison is presented in the table 4.

Table 4: Comparison between Gerber and Grafis for marker development operation

Element	Operations	CAD Systems		Leading System
		Gerber	Grafis	
Marker Develop-ment	Marker making	Pattern matching is manual system	Pattern matching is auto system	**Grafis**

3.5 Data transferring facility

After marker making, next task was to transfer the data to subsequent process. It was only possible to import the 'standard dxf' and ‘Grafis’ data of pattern and export into different data formats by using the Grafis system. But during using Gerber system, there was lots of flexibility for the pattern and marker data in respect of exporting and importing. By using Gerber system, it was possible to import the data of pattern parts directly from other formats such as Lectra, Investronica, Assyst, Standard dxf, etc. and possible to export different data format like as AAMA(dxf), ASTM, Standard dxf ,IGES and so on.

Normally, all Grafis users who deal with production abroad or provide pattern services for companies will have to deal with export and import. According to basic rule, during data exchange between CAD systems a loss of information occurs as the patterns are reduced to an agreed data format. During export, the interactively adjustable patterns in Grafis are converted to a contour with grade rules including additional information on grain line, notches, text and symbols. The exported patterns contain no information regarding x values, body measurements and piece interdependency. Patterns from foreign systems can be imported into Grafis only as grade rule patterns. Grade rule patterns consist of a pattern perimeter with grade points. Each grade point is

assigned a grade rule table with size dependant point movement in x and y direction.

On the other hand, it's possible to import a model or pattern pieces from different data format in the Gerber system as well as it's possible to export a model or pattern pieces from the Gerber system. It's also possible to open the patterns or a model from other systems (Lectra design, Assyst design, Investronica design, IGES) directly. The comparison is presented in the table5.

Table 5: Comparison between Gerber and Grafis for data transferring operations

Element	Operations	CAD Systems		Leading System
		Gerber	Grafis	
Data Transferring System	Data import/ export	Easy from other systems	Not easy from other systems	**Gerber**

3.6 Advanced features

The development of clothing 3D simulation technology made a tremendous impact on the apparel field including fashion design, garments manufacture and marketing [7-9].The researches on the application of 3D clothing simulation in the garments industry have given more and more attention [9] .The Gerber system has the 3D simulation technology (Vsticher) auto nesting and so on [5] but the Grafis system has no 3D simulation technology. Only it has auto nesting advanced features [6].

Table 6: Comparison between Gerber and Grafis for advanced feature factor

Element	Operations	CAD Systems		Leading System
		Gerber	Grafis	
Advanced Feature	Auto motion	Have Full automation	No, but can be used	**Gerber**
	3D simulation	Possible	Not possible	**Gerber**

3.7 Purchasing cost

During investigating the price of both selected CAD systems, it was found that the Price of Gerber system is extensively high compare to Grafis system. The price of one set Gerber system is near about 8000 USD in Bangladeshi market, where as the price of one set Grafis system is near about 4000 USD.

Table 7: Comparison between Gerber and Grafis for price factor

Element	Factor	CAD Systems		Leading System
		Gerber	Grafis	
Price	Value of unit system	$ 8000	$ 4000	**Grafis**

3.8 Evaluating the performance of integrated system

Upon investigating the working capabilities, flexibilities and scopes of Gerber and Grafis CAD systems for our selected product, it was observed that the Grafis system has shown great advantages for most of the elements and the Gerber system has shown advantage for some elements. Afterward an integrated system has been developed taking the advanced elements from both CAD systems and applied all three systems (Gerber, Grafis and Integrated) to develop our selected product. After application of all systems, a comparison among all three systems has been done in respect of different operations used for the product development. The comparative analysis is presented in the figure1.

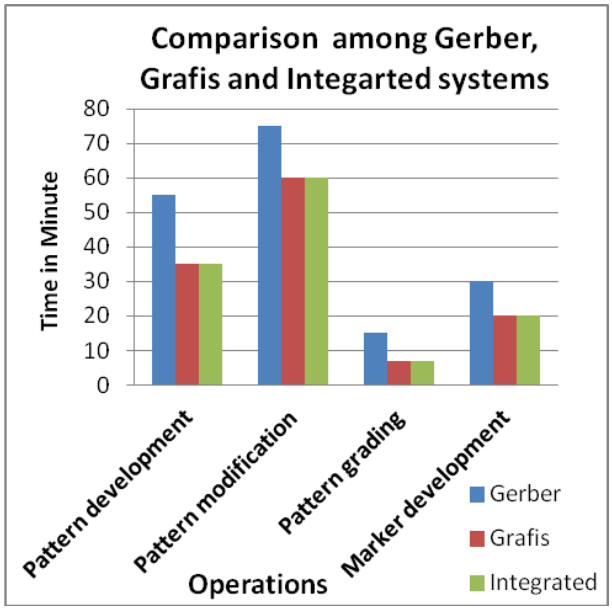

Figure1: Evaluation of the integrated system comparing with Gerber and Grafis system

Actually, it was possible to analyze four major operations (i.e pattern development, pattern modification, pattern grading and marker development) quantitatively during our product development. The results presented in the Graph (figure 1) evident that for all four major operations, the integrated system have showed significant advantages like as Grafis, as because

those elements were taken from Grafis system for integrated system.
After the quantitative analysis, a qualitative analysis has been done for "Data transferring facility" and "Advanced features" exist in the Gerber and Grafis systems (presented in the table:5 and 6). In respect of both cases, the Gerber system has shown more advantage than Grafis system. That's why to use the advantage of those elements within the integrated system; it was taken from Gerber system.
Further, another comparative analysis has also been done in respect of price factor, which is very much important for the end users. For this analysis, the price of five units of Gerber systems, five units of Grafis systems and five units of "Integarted systems" (One unit Gerber and four unit Grafis; which is a good combination to get all working facilities) has been calculated. As shown in the figure2, the price of "Integrated system" is little higher (approx. 16%) than Grafis system but 40% lower than the Gerber system, which very much significant. But working flexibility and scopes are same and or better (in some cases as discussed in the previous section) than individual Grafis or Gerber system.

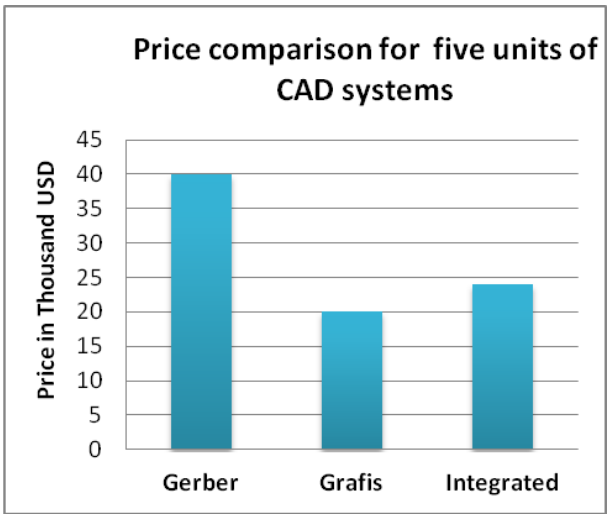

Figure 2: Comparison among Gerber, Grafis and Integrated systems in respect of price

4. Conclusions

The results from the practical application revealed that the Grafis system has shown more effective performance than Gerber in respect of Pattern development, Pattern modification, Pattern grading, Marker development and Purchasing cost. On the other hand, the Gerber showed better performance for Data transferring facility and advanced features. Moreover, the results from integrated approach have expressed the significant advantages for all the selected elements. This article has documented the advantages of integrated application of two CAD systems in garments manufacturing unit. During this time many garments manufacturing units are trying to increase their working flexibility and production rate through introducing more work stations with existing Gerber CAD system. The results of our study suggested that the integration of Grafis system with Gerber system would be one of the effective solutions for the expansions of their CAD facilities.

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