(REFEREED RESEARCH)

A MODEL OF TECHNO-TAILORING SOFTWARE APPLICATION ON GARMENT PATTERN DESIGN

GİYSİ KALIP TASARIMINDA ÖRNEK BİR TEKNO-TERZİLİK UYGULAMASI

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ABSTRACT

In this study, a sample software called intelligent pattern program in literature for gaining time while designing customized measured garment pattern is improved. The target of this study is to constitute a infrastructure of a computerized pattern program developing for tailors. In this study, for designing an intelligent pattern program tree different intelligent pattern programs were analysed and data gained from the analyses was guided for improving a new program on skirt pattern designing. The new system was improved on the basis of Delphi Editor. A basic skirt, A-line skirt and a flared skirt patterns were added as sample models on the program library. The new program's accurate measuring is tested by confronting accounting coordinates with coordinates deciphering on the computer screen. As a conclusion, some offers presented for an intelligent pattern program, used for rapidly production of customized measured garment pattern and convenient to all garment style and model. This study contains some new offers that belong to a new technology to accelerate the customized measured pattern for producing private garment.

Key Words: Customized garment production, Computer aided garment production, Tailor, Pattern, Intelligent pattern program, Bezier curves.

ÖZET

Bu çalışmada, kişiye özel ölçülerde giysi kalıp tasarımını hızlandıran ve literatürde akıllı kalıp programı olarak adlandırılan örnek bir yazılım geliştirilmiştir. Bu araştırmada, terzilik alanında kullanılacak bilgisayarlı bir kalıp programının tasarım zamanında, izlenecek yöntemleri için bir altyapı oluşturması amaçlanmıştır. Çalışmada örnek bir akıllı kalıp programını tasarlamak üzere, ulaşılan üç ayrı kalıp programı incelenerek durum analizleri gerçekleştirilmiş buradan elde edilen veriler ışığında etek kalıbı üzerinde uygulama sağlayan yeni bir sistem geliştirilmiştir. Yeni sistemle geliştirilmiş kalıp programı, Delphi yazılım geliştirme editörü üzerinde yazılmıştır. Örnek teşkil etmesi bakımından yeni geliştirilen kalıp programının kütüphanesine temel etek, evaze etek ve godeli etek kalıpları eklenmiştir. Tasarlanan kalıp programının kalıplar üzerinde doğru ölçülendirme yapıp yapmadığı, kalıplar üzerindeki veri noktalarının teorik hesaplamalar sonuncunda elde edilen koordinatları ile bilgisayar ekranı üzerinden okunan değerlerin karşılaştırılmasıyla test edilmiştir. Çalışma sonunda kişiye özel giysi üretiminde kalıp tasarımını hızlandıracak olan ve tüm modeller için uygulanabilir bir akıllı kalıp programının işlevleri için öneriler sunulmuştur. Bu çalışma kişiye özel giysi üretiminde, yeni ölçülerde kalıp uygulamasını hızlandıracak, yeni bir teknolojiye ait öneriler içermektedir.

Anahtar Kelimeler: Kişiye özel giysi üretimi, Bilgisayar destekli giysi üretimi, Terzilik, Kalıp, Akıllı kalıp programı, Bezier eğrileri.

Received: 19.01.2010 Accepted: 07.07.2010

1. INTRODUCTION

Last decades, individualism is a prominence event. Individuals make more efforts to make an impression on his/her peculiar characteristic in society. In the future, it's forecasted that the event will be more important (1). Especially on self requirements, people are thought to expend substantial amount of money.

Customized production, focusing on individual preferences and requirement, must be used as rivalry fact on consumer satisfaction and service (2). From now on, are customers with special requisitions the centre of all the things (3) Also, most of the studies dealing with the effects of clothing on the wearer have focused on consumers' needs and expectations (4). And clothing comfort is an important factor for every kind of clothes, it has more importance in the area of surgical clothing (5).

Nowadays, garment requirements are commonly supplied by ready-made clothing producer. At apparel industry, garments are produced for "standard" body sizes. Size recommendation is a problem of relating body measurements to individual garment sizes. Because, most clotting is made to fit a small number of stands which are hoped to represent standards average sizes (2). Because of this fitting problem, the 40% of garments sold predicted to be rendered (6).

On the other hand, people get smart appearance by wearing perfect fitting garments. Producing perfect fitting garments for all customers are very

difficult (7). For perfect fit, tailors are preparing customized patterns for garments designed. As far as following media today's, riches are buying customized garments. Because they want to be special. Tailors lived difficult days "Since widespread preference of ready-made clotting owing to low costs, high efficiencies and prompt productions (8), have competitiveness through customized production nowadays. However, due to the advantages of the price and speed of mass production, competitiveness of the customized garments manufacturing remains weak.

To capture competitiveness against ready-made clothing manufacturing, customized garment manufacturing process must be accelerated and flexible production strategy quickly respond to the demands needs to be determined (2). So to capture competitiveness, leaving to compete to the Asian countries with low labor costs, apparel firms are recommended to develop new systems and/or flexible production methods for customized garments. Companies aim to combine the advantage of mass production with sense of aesthetic and impeccable service of tailoring, should seek new technologies for responding to customized orders promptly.

Todays' technologies, which provide expansion for tailoring, bring new opportunities manufacturers and also for consumers. There are many systems available for tech-tailors, who use technologies.

Customized garment pattern designing, which is a large loss of time and labor, is one of the most important processes to improve for tech-tailors, who are customized garment manufacturers. Therefore, more practical methods than existing should be developed with the help of technology. Regarding as it is a prevision that technology be the fundamental driving force of individual and social welfare in the next twenty years (1), it is thought to be worthwhile developing infrastructure of a software program used to design customized garment.

2. MATERIAL AND METHOD

This research includes works on a "skirt pattern software program" called as intelligent pattern program in literature, enabling mass customization and made-to measure patterns. Selected programs named Cadterns, Garment Designer and Fashion Cad as sample in the programs for made to measure patterns and relevant literatures constitute research materials. The functions of all three programs in the context of pattern designing were defined by examining demo versions of these programs, and compared in a table as qualitative. The functions supported by at least two of the program have been targeted for the new intelligent pattern program developed.

In order to understand the logic of a pattern program functions, firstly the traditional methods of pattern designing steps have been identified. Then perspectives of the programmer, who executed the software part of the study, and the pattern expert, who worked in the technical part, to pattern were investigated. Pattern expert regard pattern as a combination of physical measurement, curve lines such as hip fold, darts notches. According to programmer, pattern consists of coordinates group.

In the developed intelligent pattern program, skirt was taken up as sample. In the library of new program called EtekCAD, it was decided to add basic skirt, A-line skirt and flared skirt patterns, which developed on German Muller Pattern Method (GMPM) (9). In this context, the skirts' patterns were modeled mathematically. Before modeling, the critical points of two-dimensional patterns were determined as data points. Then, the distance of data points to a local center assigned were designated on the coordinate system based on size of 38. Thus, the basic patterns were ready to be transferred to the computer environment. On Figure 1, it's given the scratching method of basic skirt pattern on GMPM (9).

As a result of researches, Delphi, which is object-oriented programming, was selected as software method. The meaning of the labels is given in the brackets in English. As the program developed in Turkish on designed time, all the variables are in Turkish. On Eckert's paper called "A Garment Design System Using Constrained Bezier Curves" (10), Bezier curves was determined as an appropriate method for computer based pattern programs. Considering that, application was decided to fulfill with the help of the Bezier curves. On purpose of helping program design, library called GeometrikRend, (11) which includes some Bezier curve's functions, and library called Abrevia (12), which is used for recording some basic functions, were downloaded on web side as open source and added to the Delphi editor.

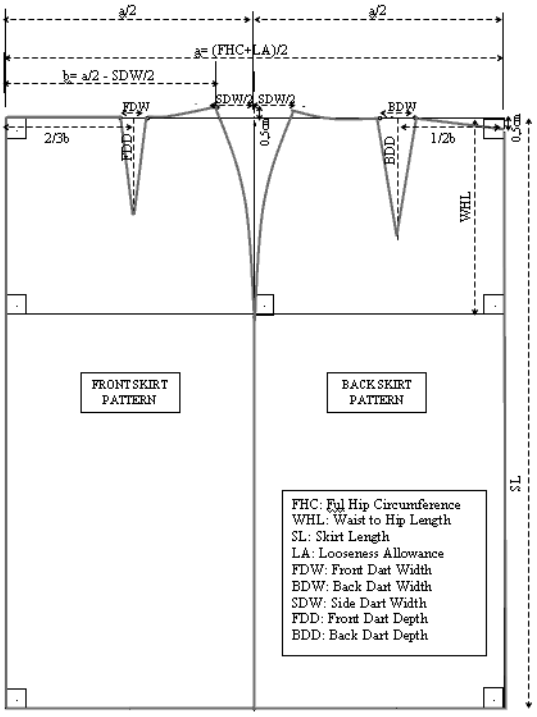

Figure 1. Basic skirt pattern – front and back parts (9)

3. RESULTS

In this part of the study, firstly demo version of sample pattern programs, Cadterns (13), Garment Designer (14), Fashion Cad (15), were analyzed. A table was created by placing these three programs' functions on lines and then sample pattern programs and new developed program on columns (Table 1). Each function on Table 1 were matching with the programs on columns and crossing cells of programs and functions that support each others were marked with X. If X was marked on two columns of sample programs opposite of functions lines, in other words, if two programs performed a function, then it was targeted for the developed program, EtekCAD. How targeted functions for EtekCAD work on the other programs were examined and best applicable working method was tried on the developed pattern program.

Table 1. Matching of intelligent pattern programs

FUNCTIONS	Cadterns	Garment Designer	Fashion Cad	EtekCAD
1. Basic pattern library	X	X	X	X
2. Basic patterns for nonstandard size and abnormal posture	X	X	X	X
3. A window for size input	X	X	X	X
4. Existing data point for measuring	X	X	X	X
5. Feasibility of adding new data point or grading point on working time			X	
6. Customer library	X	X	X	X
7. Existing a body silhouette at the background		X	X	
8. Free drawing icons	X		X	
9. Feasibility of adding extras as waistband, pocket etc.	X	X	X	X
10. Flexible on patterns creating or modifying	X		X	
11. New pattern entry from out of computer			X	
12. Seam allowance entry	X	X	X	
13. Integration of other CAD systems	X			
14. A visual menu bar	X		X	X

3.1. The Inputs on the Developed Pattern Program

For creating a skirt on intelligent pattern program the inputs are setting like this:

- Skirt Pattern,
- Sizing Information.

For skirt pattern constructed by Muller System sizing information are estimated like this:

- Full Waist,
- Full Hip,
- Waist to Hip,
- Skirt Length.

3.2. Skirt Pattern Generation on Developed Pattern Program

On the program the process of skirt pattern generation is respectively as follows:

- With aim of skirt pattern generation, first of all a skirt pattern without dart with the name of sample model was defined on the program.
- Then a dart was adding over the waist of skirt with the help of dart adding procedure.
- Accepting the sample model included dart as front skirt, it is duplicated and symmetrized.

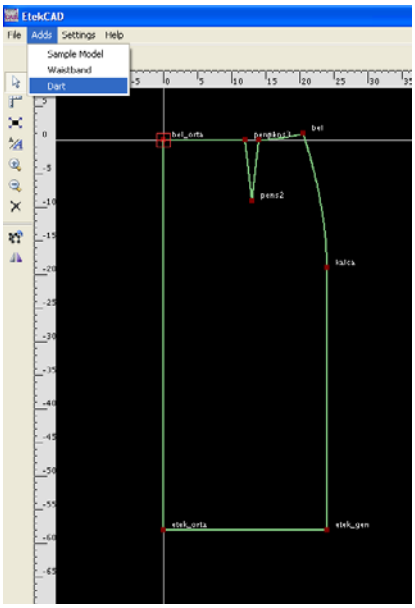

Figure 2. Sample model on EtekCAD

So front and back pieces can be moved symmetrically on coequal points. But front and back pieces are not always modified symmetrically, so for styling the pieces independently the asymmetrical motion procedure was created.

- Moreover, a waistband was added for optionally disposing.
- Then auxiliary functions for pattern modifying were added on program.

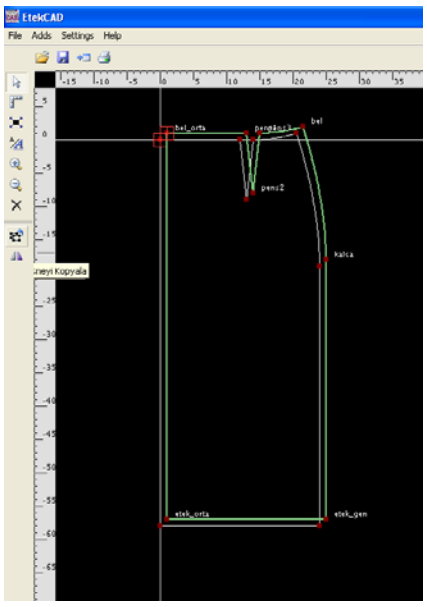

Figure 3. Duplicating sample model on EtekCAD

The pattern program was named as EtekCAD ("Etek" means skirt in Turkish, "CAD" is the reduction of Computer Aided Design). Figure 2, 3 and 4 shows the skirt pattern generation process respectively.

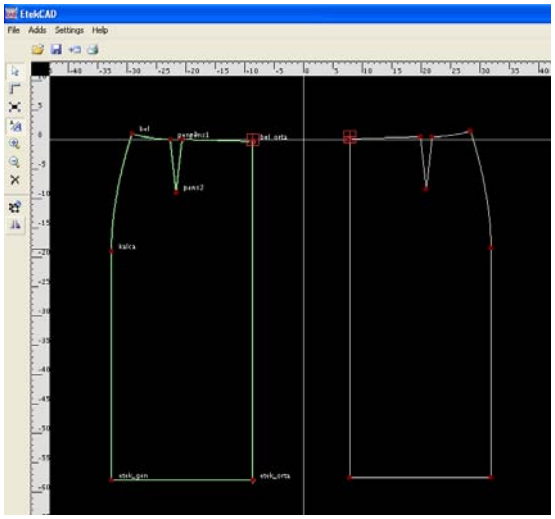

Figure 4. Horizontally symmetrized of model on EtekCAD

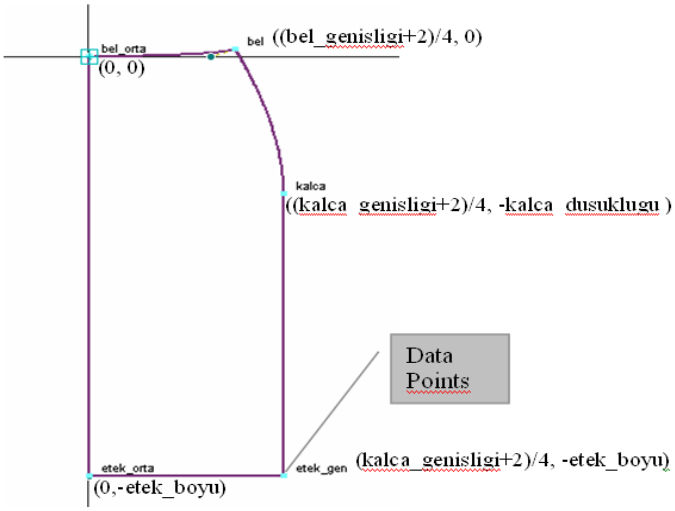

Figure 5. Local center of sample model defined on “bel_orta”.

3.3. Model Create Procedure

Firstly, a sample model is generating in the model create procedure for guiding to the other patterns. The sample model of which local centre is defined on centre of waist line is shown on Figure 5. 2 dimensional shapes that generate as sample model is represented the one third of a skirt. Pattern accepted with 2 cm LA over full size styled with data points defined on waist line, hip line and hemline.

Labels of each data points were defined. Because of each line is one third of the full circumstances, the x axis of each data points is estimated according to one third of full circumstances. The sizing variable used on the coordinates and initial values on size of 38 (Waist Circumstance (WC)= 70 cm, Hip Circumstance (HC)= 94 cm, Waist to Hip (WH)= 19 cm, Skirt Length (SL)= 58 cm).

Table 2. Coordinates of sample model

Labels	Coordinates (x; y)
bel_orta	(0;0)
bel	$(\frac{bel\_genisligi+2}{4}; 0)$
kalca	$(\frac{kalca\_genisligi+2}{4}; -$ kalca_dusuklugu)
etek_gen	$(\frac{kalca\_genisligi+2}{4}; -$ etek_boyu)
etek_ort	(0; - etek_boyu)

The coordinates of data points, which is labeled as bel_orta (waist_centre), bel (waist), kalca (hip), etek_gen (skirt_width), etek_orta (skirt_centre), estimated according to sizing variables is shown on Table 2. (The meaning of the labels is given in the brackets in English. As the program developed in Turkish on designed time, all the variables are in Turkish.)

For creating data points defined as coordinates given on Table 3, firstly some records and properties must be defined on Delphi Editor. A record is defined as TPointData. The properties of TPointData are defined as the name of “id, point, lcpoint, rcpoint, pointtype, name”. When data point on Table 2 is recorded, Bezier curves are scratched automatically between each point in rows by the program. Then a dart create procedure and waistband create procedure were generated similar to model create procedure.

3.4. Sizing Procedure

In sizing procedure coefficients were determined which formed the new pattern according to new sizes. Coordination of pattern which is wanted to resize is multiplied to determined coefficients. These coefficients are estimated by proportioning the objective sizes to the initial sizes. Data point is estimated by the help of size it is on. For instance, point of “bel” is estimated by the proportion of second waist circumstances to initial value. On Figure 6, basic skirt on size of 38 is sized to 42.

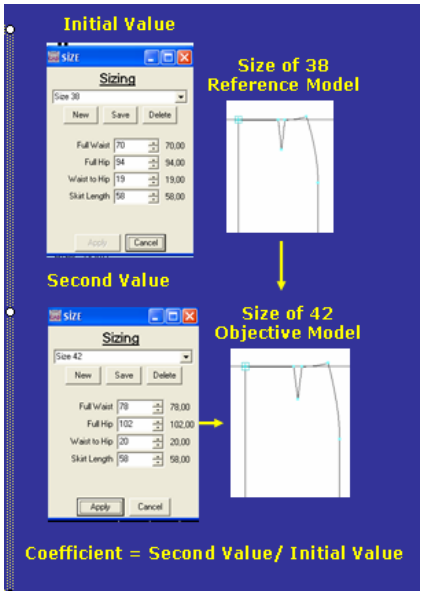

Figure 6. Sizing

For resizing initial values are grouped as referans_model (reference model) and second values are grouped as hedef_model (objective model). In sizing procedure a point called “temp” is defined for equaling data points

temporarily while estimation (temp : PointData). Then the sizing groups of referans_model and hedef_model were defined as variables. Sizing Procedure (ResizeModel) is ready by appearing of the Sizing Form opened by a press on the botton of sizing at the main form on screen. As shown as Figure 7 form named “Sizing” was created.

Variables were defined as RxSpinEdit component on the new unit on which the form created. When the form is opened reference sizes in kisi.ini file are transferred to the pattern on the screen. This size values that transferred to the form were transferred to the instant reference values at the same time. On run time, pressing on the sizing button, “sizing” form is shown on the screen. If a model of pattern is selected, Apply buton is activated. (Reversely it is inactive.) If there is a selected model on the screen, sizes are able to change by entering new values to the RxSpinEdit boxes. At the moment of form being created on the screen, the first values of variables named “edbel_genisligi, edkalca_genisligi, edkalca_dusuklugu, edetek_boyu” on the screen is equaled to the reference model size group.

After entering the new sizes to the boxes and striking the Apply button, new values were appointed to the objective model size group and sizing procedure runs and so pattern with new sizes would be generated. If a new size name is written into the Combox upwards of the form and “save button” is pressed after the values in RxSpinEdit box changing with the new ones, new values are accumulated in a variable named as “kisi”(means person in Turkish) and recorded in a file named “kisi.ini”. After pressing on “Apply” button and implementing of objective model sizes on the model, these sizes are the old ones and are equaled to the reference values once again. Sizes are able to record on a name and be called for later by the help of ComboBox object. So Figure 8 show the sizing of skirt pattern on EtekCAD pattern program.

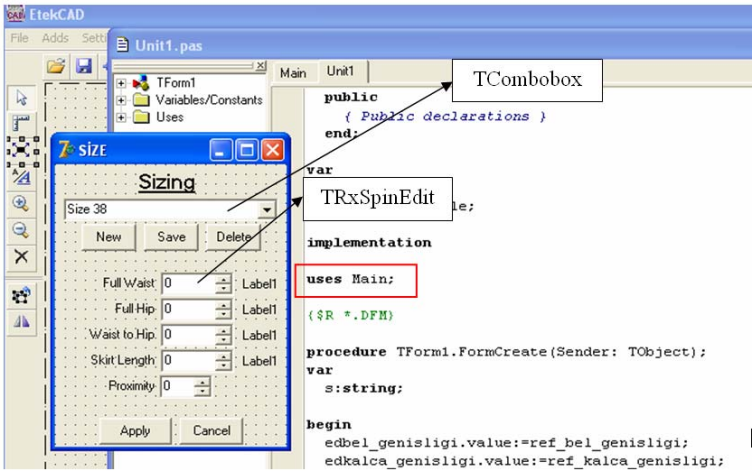

Figure 7. Creating sizing form on design time at delphi editor (EtekCAD.dpr)

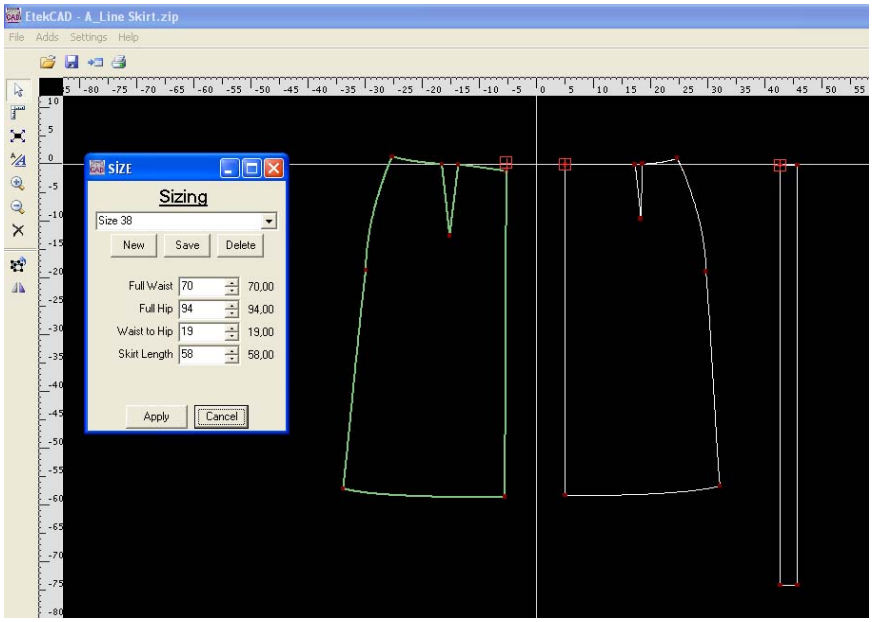

Figure 8. Skirt pattern in size of 38 (EtekCAD.exe).

3.5. Creating a Model Library

It is determined to add “basic skirt, A-line skirt and flared skirt” generated with respect to German Muller Pattern System to model library. Just as adding the skirt pattern to the model library, Sample model created on design time was duplicated and symmetrized and an operation proper to mathematical model is done on the patterns. After symmetrical motion button inactivated, catching the data points of patterns by cursor, it is supplied to be placed on the coordinates estimated by the mathematical models. (On the new designed program, pursuit of coordinates is provided by a scroll bar showing the coordinates according to the motion of cursor.)

Before placing the coordinates, data points’ coordinates of patterns were estimated. Skirt patterns were placed on the coordinate system by matching to x axis with waist line and y axis with vertically centre line, and then it is mathematically determined the distance of the data points to the centre point.

3.6. Mathematical Modeling

Basic skirt patterns front piece’s coordinates are shown at Figure 9, back pieces are shown at Figure 10. The coordinates of data points formulate with respect to the sizing variables. The size of 38 is fixed on the formula and the basic skirt pattern coordination was estimated. And so patterns based on the size of 38 in the new program’s library was introduced by these coordinates. Mathematical model of A-Line skirt and flared skirt are estimated by the help of some trigonometric calculation on declaration from basic skirt in size of 38.

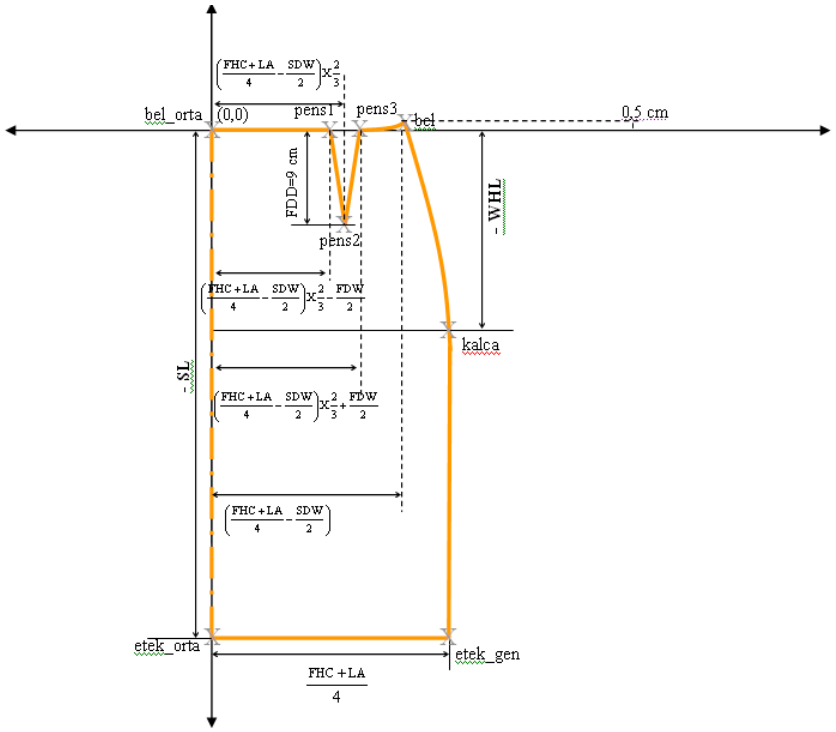

Figure 9. Mathematical coordinates of basic skirt pattern front piece.

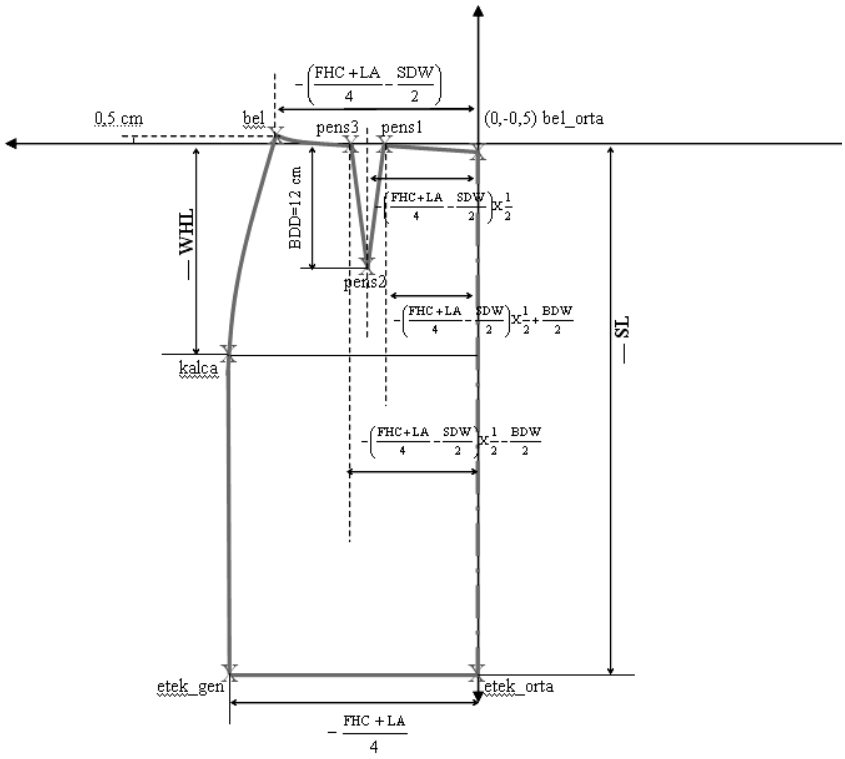

Figure 10. Mathematical coordinates of basic skirt pattern back piece.

3.6. Testing of Pattern Program

To demonstrate the perfect resizing of the new developed intelligent pattern program, EtekCAD, a resizing test was implemented on the basic skirt front piece. For testing basic skirt resized from 38 to 42 sizes and front pieces coordinates (in size of 42) were deciphered from computer screen and compared to the manually scratched skirt pattern's front piece in size of 42. Firstly, the coordinates of basic skirt front piece scratched by conventional method were determined. Then Basic Skirt in size of 38 from EtekCAD library resized to 42 by the help of sizing screen on EtekCAD. Coordinates of newly resized basic skirt expected in size of 42 are deciphered from the scroll bar on screen and recorded on a form. The coordinates of conventionally scratched basic skirt front piece in size of 42 were compared to the coordinates deciphered from EtekCAD screen. Analyzing the table, it is seen on the "Variation" column there is millimetrical variations. It is identified that this variation derived from the LA that proportionally extended with the size coefficients. On basic skirt the variation is maximum 0, 34 cm and it is resulted maximum 1 cm extra allowance on full circumstances, so it can be acceptable in this version of the program. In conclusion, a perfect resizing is implemented on basic skirt by the help of EtekCAD Pattern Program.

4. CONCLUSION AND DISCUSSION

EtekCAD, intelligent pattern program, developed by reference of skirt patterns is a trial version, so it can not suitable for many functions. With the help of additional procedure on design time, the program can be feasible for many kind of apparel. But so many functions must be added for an effective program.

The suggestions for the program function are as follows:

1. For protection of the original basic pattern, the modification over the basic models in the developed pattern library should be recordable only save as module.

2. The conventional pattern system must be analyzed carefully for the developed program being available for all kind of apparel style. One of the advantages of customized apparel production is the intervention of the undesirable areas of the apparel (16). It is thought that the undesirable areas of the apparel are derived from abnormal size measures of the person. So, for the person possessing abnormal size measures, it is necessary to determine the critical points of the patterns. If so the purpose is the super fit of the apparel, this is realized by only perfect basic pattern designing. For resizing on program, the critical point should be definable at run time.

3. An apparel fitting is determined by the presentation a good-looking (17). Customized measures aren't a

unique fact to provide a super fit of course. For a perfect looking of an apparel model on a person, the importance of the model detail and the importance of variation of looseness allowances depending on personal characteristics (17) are emphasized by researchers. Seem allowance must be changeable for all kind of fabric and clotting on program in order to provide a perfect fitting control according to looseness allowances.

4. In Fashion industry, in terms of functionality, a pattern program must be provide all kind of clotting style of pattern in an easy way. In the programs which examined as a reference, Fashion Cad is thought to be the most suitable for the easy usage and so the functions of the program is suggested to dealing with as reference for the future researches.

a. In that context, transferring of scanned or photographed pattern to the computer screen is provided a practical solution for pattern generation. So the patterns of different experts can transferred to the computer in an easy and cheaper way.

b. Data points are created at run time for conversion of pattern image transferred to the computer screen to vectorial image. Owing to controllable data, every kind of measuring can be applicable easily.

5. In order to provide operations like trimming, separation and rotation for modifying vectorial patterns, new data points must be definable at program's run time (2). After that, for modifying, functions and procedure of the components must be designed. For example, "dart, pleat addition, smocking addition at determining ratio on marking data points" must be designed. This function must be connected to a visual and a basic interface.

6. In order to provide unrestricted usage to the client on the program, free line components and automatically insertions like basic pocket models, waistband must be attached.

7. On account of cutting, functions like seem allowance, pledge etc. should be set on computer and functions providing a single or multi sized cutting plan should developed.

8. It is suggested that pattern outputs should be exported in order to integrate with the 3 D virtual programs. For further versions researches should be done to design components providing 3 D virtual Catwalks.

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*Bu araştırma, Bilim Kurulumuz tarafından incelendikten sonra, oylama ile saptanan iki hakemin görüşüne sunulmuştur. Her iki hakem yaptıkları incelemeler sonucunda araştırmanın bilimselliği ve sunumu olarak **"Hakem Onaylı Araştırma"** vasfıyla yayımlanabileceğine karar vermişlerdir.*