Podiy: A Design and Production Support System for Pouch

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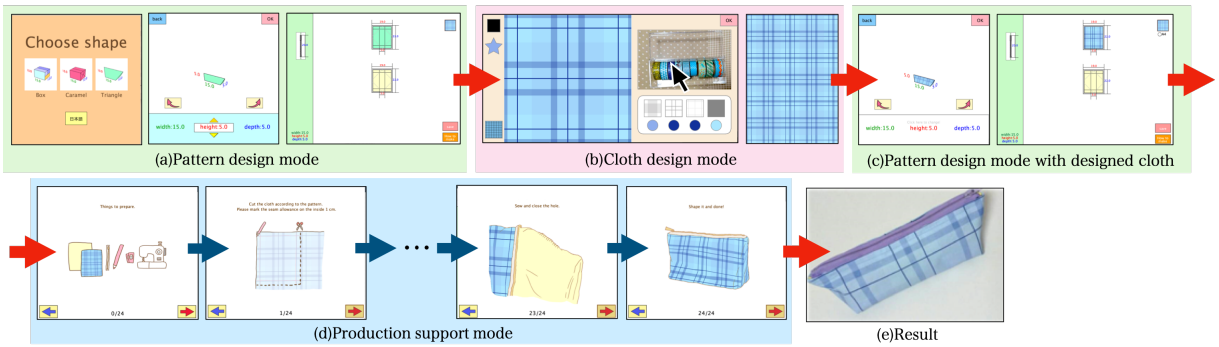


Figure 1: Overview of the proposed system. The red arrows show the flow of the entire system, and the blue arrows show the flow in production support mode. (a) Input shape and size of the pouch. System simulates a three-dimensional pouch and corresponding patterns to make the pouch. (b) Design fabric, and (c) use it in other modes. (d) Show the tutorial of making the pouch. (e) Result.

CCS CONCEPTS

• **Human-centered computing → Human computer interaction (HCI)**.

KEYWORDS

handicraft, design, novices, fabrication

ACM Reference Format:
Yuki Ikeda and Yuki Igarashi. 2020. Podiy: A Design and Production Support System for Pouch. In *Special Interest Group on Computer Graphics and Interactive Techniques Conference Posters (SIGGRAPH '20 Posters), August 17, 2020.* ACM, New York, NY, USA, 2 pages. https://doi.org/10.1145/3388770.3407432

1 INTRODUCTION

In order to make handicrafts, it is necessary to go through the following processes: designing, calculating patterns, collecting materials and sewing. Each process has difficult points for novices to complete their works. For example, to design an original pouch, one needs to construct an appropriate 2D pattern which is very difficult. Some studies have already been proposed for computer-assisted handicrafts for novices. Plushie is an interactive design system that allows nonprofessional designers to develop their own original plush toys[Mori and Igarashi 2007]. Igarashi et al. proposed a system to design a customized cover for a given 3D model[Igarashi et al. 2009].

SIGGRAPH '20 Posters, August 17, 2020, Virtual Event, USA

ACM ISBN 978-1-4503-7973-1/20/08.
https://doi.org/10.1145/3388770.3407432

We propose "Podiy", a system that supports novices to create their original designed pouch. By supporting the process from design to production, we aim to support the difficulties that the user has to complete their handicraft work.

2 SYSTEM

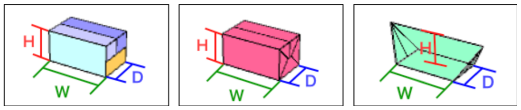
We implemented the proposed system with Processing-3.0.2. It runs on a notebook PC (macOS High Sierra version 10.13.16, processor 2.7 GHz Intel Core i5, memory 8 GB). The system consists of three modes, pattern design mode, cloth design mode and production support mode.

2.1 Pattern design mode

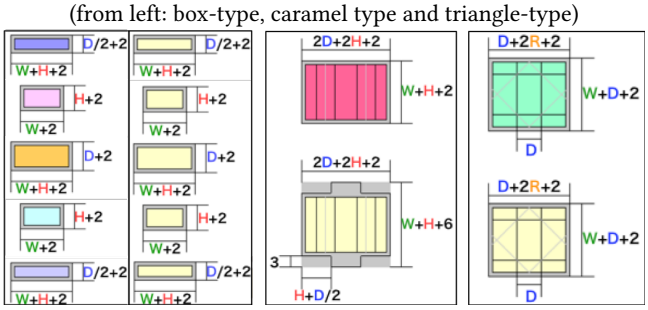
User choose the shape and input the size of the pouch that they want to make. The system calculates and presents the 3D simulated pouch on the "3D simulation screen", and patterns on the "pattern simulation screen". This mode supports the user to easily imagine how it will look like when the pouch is completed. At the same time, this can prevent users from errors in pattern calculation, and support to collect the materials correctly. Here, the seam allowance is calculated as all 1 cm.

Users can choose the pouch from three basic shapes: box-type, caramel-type and triangle-type (Figure 2(a)). All of them can interactively change the values, width (W), height (H) and depth (D). The patterns are automatically generated and displayed as shown in Figure 2.

2.1.1 3D simulation screen. Poidy system simulates the completed pouch from the input that user made. Box-type pouch consists of five patterns. User can choose to create multiple patterns with different cloth or as patterns connected with the same cloth.



(a) 3D simulation screen
(from left: box-type, caramel type and triangle-type)



(b) Pattern simulation screen

Figure 2: Pattern calculation from input value

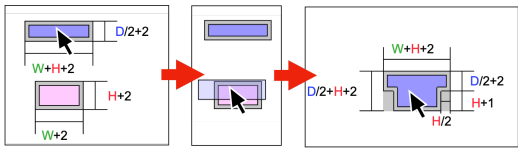


Figure 3: Pattern merging

Due to the characteristics of the caramel-type pouch, it is not possible to make the pouch with the height is longer than its depth. If the user's input meets this condition, the system alerts to choose one of two methods: one is to set the size of height and depth same, and the other is to exchange them. This function allows the user to design a pouch that can be actually manufactured. In triangle-type pouch, R in Figure 2(b) is calculated by the following formula: $R = \sqrt{(D/2)^2 + H^2}$. The number after the decimal point are rounded up. The width specified by the user is applied to the bottom of the pouch. The system automatically calculates the pattern of the pouch so that a rectangular box of the size input by the user can be enter to the completed pouch.

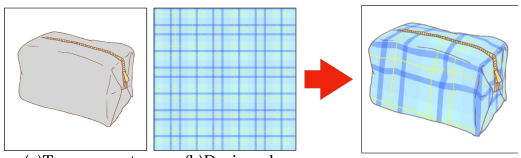
2.1.2 Pattern simulation screen. The system automatically calculates the patterns from the information of input by the user. In the box-type pouch, the system presents the user with a two-dimensional layout with five patterns in the first presentation. The user can connect the patterns by drag and drop and merge them into one (Figure 3). Since it is possible to create all the patterns with one piece, we provided a function to merge all the patterns together. On the other hand, we also provided a function to separate all the patterns. When the patterns are merged on the 3D simulation screen and the "OK" button is pressed, the result in the pattern simulation screen is updated. Also, when patterns are merged on the pattern simulation screen, the 3D simulation screen is updated each time. Every shape can use the image designed in the cloth design mode below.

2.2 Cloth design mode

The user can design a plaid using the color selected from an image (Figure 1(b)). Two types of designs are available: tartan check and gingham check. The user sets the image to be referenced and acquires the color with the color picker. By selecting the part to be adopted, a check pattern using that color is automatically generated and an A4 size image is saved. This image can be used for simulation of other modes. Furthermore, it can be printed on cloth that can be printed with an inkjet printer and use for actual production.

2.3 Production support mode

In this mode, the procedure for making the pouch designed by the user is presented as an illustration. As shown in Figure 4(a), we prepared an illustration for each step, and made the fabric part transparent to use the designed pattern and color(Figure 4(b)). The texture is superimposed on this in consideration of the orientation, and make it possible to display the procedure using the pattern designed by the user (Figure 4(c)). In the box-type pouch, the color is associated from the merged information of the patterns and the procedure is displayed (Figure 5).



(a)Transparent illustration (b)Designed pattern image (c)Result

Figure 4: Production support mode

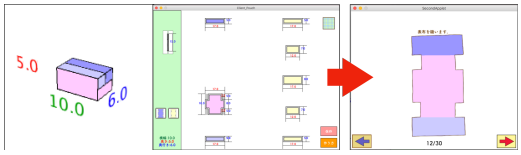


Figure 5: Merging disjoint patterns into one in box-type

3 RESULTS

Figure 6 shows the results of having two subjects design the pouch using our system. Figure 1(e) shows the result of making a pouch using the designed fabric. This was designed and created by the author. The cloth was designed by selecting colors from the image of masking tape. The resulting pouch is a masking tape case.

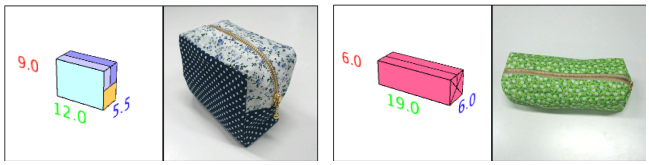


Figure 6: Results of making a pouch using the system

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