Implementation of the Affine Segmentation Point Method and Image Blending Techniques in Creating New Songket Motifs

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***Abstract*—In this study, we made two new Songket Silungkang motifs and then tested them, then we combined two new Songket motifs. The purpose of this research is to create a new Songket motif twice and then tested then combine the two Songket motifs to create a newer Songket motif. The method we use to create a new Songket motif is a modification of the Affine method which we named the Affine Segmentation Point (ASP) method twice to create two new Silungkang Songkets. Then, we tested the two new motifs using the histogram method to test whether the motifs did not lose their original characteristics of the motifs. Furthermore, we combined the two motifs (blending) using the image blending technique method to get a newer motif with the aim of creating a more modern and aesthetic Songket Silungkang motif. We also made a computer application using the Matlab programming language for the implementation of the findings of this study. The result of this research is researchers can get new Songket motifs that are more modern and aesthetic by combining Songket motifs that have been reconstructed from the previous affine segmentation point (ASP) method. The important point of this study is how researchers can produce a user-friendly system for operating the Songket motif reconstruction system and the incorporation of Songket motifs so that the users of this system include Songket craftsmen, Songket artists, and Songket observers.**

Keywords*— Affine Segmentation Point (ASP) Method, Image Blending Techniques, New Songket Motifs

I. Introduction

The end product of a traditional craft in which the primary material (cloth) is composed of yarn is a songket (cotton, silk, etc.) Songket is derived from the Malay and Indonesian word "Sungkit," which means "to hook" or "to gouge." This relates to the manufacturing process of hooking and taking a specific quantity of threads [1]. The Silungkang neighborhood of Sawah Lunto City, West Sumatra Province, is one of the regions in Indonesia with the best Songket motifs or designs [2]. One of the best regions and the main producer of Songket casinos in West Sumatra and Indonesia is Silungkang. Songket is frequently utilized at traditional official occasions and weddings [3].

The Silungkang Songket weaving period has been started in 1375 AD until now, which has a relatively unchanging motif from the woven (Songket) [4]. The introduction of Silungkang Songket in the international world has been listed on the Sawahlunto city mission. The affine method, which is a method for reconstructing Songket motifs, is supported by the advantages of transforming objects in rotation, shifting, and bending [5]–[7]. This is an important point for the success of this study in reconstructing Songket motifs systematically. Without changing the meaning associated with customary norms and rules, Songket can be used as guidelines in life because the motif is very complex in the object. Therefore, it is necessary to develop the value of the Affine transformation matrix in which the Affine transformation has a symmetric positive manifold matrix value [8]–[11]. It belongs to the Lie group structure and does not obey Euclidean space [12]–[15].

The parallel straight lines in the photos are modified by the Affine transform, but the relative distances within the triangles are left unaltered. This results in a textile mapping. In essence, the Affine transformation can turn, shift, and bend; this is used by several other transformation techniques (fractal transformation) to alter the designs of batik. In Lampung batik modeling, transformations like shifting [16], [17], mirroring [18], [19], rotation [20], [21], and dilation [22], [23] can be applied to make batik, particularly the Lampung batik motif. Batik may more easily repeat motifs in a sequence thanks to the use of shifts in the creation of batik Lampung. Due to the same Batik pattern having varied shapes, rotation can create patterns that are reversed, mirrors can create the same side by side, and dilation can create patterns that are enlarged or shrunk. This has not been able to use geometric changes to its advantage in rebuilding the Songket or Batik motif during the creation of Batik. Fractal geometric patterns must also be used in Sekar Jagad modeling, with the aid of other applications, geometric transformations, and other techniques. Thus, the geometric transformation is still not independent in the processing of the reconstruction even for the reconstruction of batik or Songket motifs [24], [25]. Songket motifs (nyukit) evolve extremely slowly since making them is a tough procedure that not all weavers can complete.

Several studies on colonization that are connected to affine transformation have been completed by [26]. The area from the triangle AOB is always the same as the AO0B0 region, according to the geometric interpretation that there is a transformable pedestrian area. At this point, we will discuss permission. Tensor permittivity can be selected in analysis to indicate positions AOB and AO0B0. The solution can be understood by assuming that transformation only occurs within node x [that is, y0 y]. [27] Appropriate ratio takes into account the ratio of the number of dots features that are appropriate between the original image and the version that was created using the original image. It can be seen that the required ratio is closer to 60% for the operation of generating a standard image.

In this study, the 1st Affine Segmentation Point (ASP) method was applied to create a new songket motif 1 then applied the 2nd Affine Segmentation Point (ASP) method to create a new songket motif 2. Next, testing was carried out on the two new songket motifs produced by the method ASP 1 and testing of the new songket motifs produced by the ASP 2 method using the histogram testing method. This is done with the aim that the new songket motifs produced do not lose the original characteristics of the new motifs produced. Next, combine the images of the two new songket motifs, namely the ASP Songket Motif 1 with the ASP Songket Motif 2 to get a more modern and aesthetic songket motif.

II. METHODOLOGY

This research uses framework research like figure 1 below. We divided the framework research into four steps that are data collection, processing and transformation, Processing Transformation (Research Core) and Research results (New Motifs), and Processing Blending.

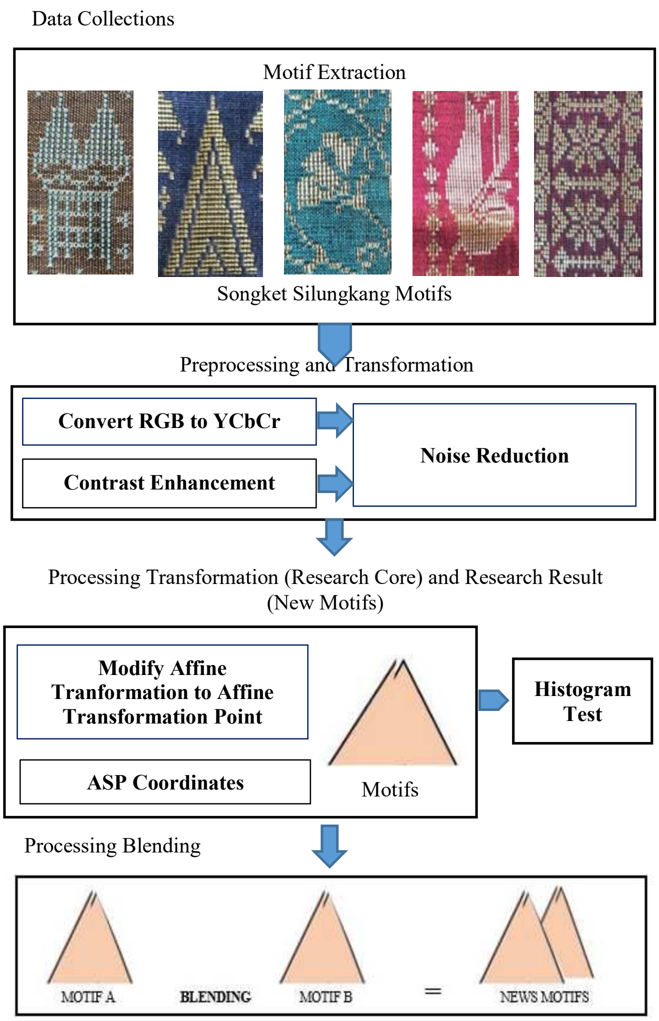
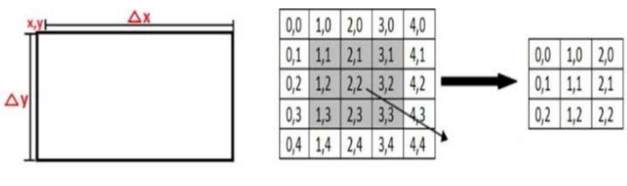


Fig. 1. Research Framework

Fig. 1 shows the methodology steps that doing in this research. From the top is the first step and at the bottom is the fifth step. The first step we doing Data Collection which is to collect all data that is needed for the research especially the image data of Songket motifs. After that, we process and transform the data using Convert RGB to YCbCr, Contrast Enhancement, and Noise Reduction. Next we Processing Transformation (Research Core) and Research Result (New Motifs). Then we do Histogram Test. Last we do Processing Blending.

The target of this research is how to get a new motif which is the result of combining reconstruction motifs from the development of the affine method, which is packaged in a very applicable application form to provide unlimited access for songket artists in spending their knowledge in the field of art. In Figure 1, we can see several stages which are summarized in one sketch, namely the research framework. The first step in this research is we capture the digital image of Songket Motif. This data collection contains the original image that is used as input data. The image used is Image Songket in the form of a file with *.jpg format. All test images used are color images with a pixel size of 1080 x 1350 pixels, where the purpose of this site is to process the dimensions of the test image to be studied. The process of taking songket images is by taking them / taking photos directly on songket fabrics available to songket craftsmen and sellers in the West Sumatra area. The tool used is a Digital Camera with the Sony A7 Mark II Brand.

In the second step, In carrying out motif extraction, a cropping technique is used, namely a rectangle crop, which reduces the size of an image by cutting the image at predetermined coordinates in an area [28]–[30]. To extract motifs (cropping songket picture motifs), to obtain the motif of the Silungkang songket image. The cropping method can be seen in figure 2 below:



(a) (b)

Fig. 2. (a) Property Area For Cropping, (b) Image Cropping Process

In the third step, we converted the RGB songket image into YCbCr image using the YcbCr color space conversion approach using the cropped image's results to streamline the subsequent step of the process and improve the number of incentives attained. To convert the image we used the formula below:

$$Y = YCbCr(:,:,1) \quad (1)$$
$$Cb = YCbCr(:,:,2) \quad (2)$$
$$Cr = YCbCr(:,:,3) \quad (3)$$

After that, in the fourth step, we will perform contrast enhancement (improving the songket motif's image quality) using the results of the YCbCr color space conversion above [31], [32], employing the technique of contrast stretching, which can maximize the motif's image with the extension of the YCbCr color space. Next the fifth step, the researcher will also do a noise reduction procedure using the outcomes of the contrast enhancement process (removing noise from the image of songket motifs), employing the median filter approach [33]–[35], which has the purpose of removing pixel noise and replacing it with pixels nearby. Next the sixth step, the Affine technique will then be modified namely Affine Segmentation Point (ASP) method two times. The first ASP method produces the first Songket motifs and the second ASP method produces second Songket motifs. To modify Affine method to be ASP Method we use the formula below:

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \end{bmatrix} \begin{cases} [q] = \min\{p \in Z | p \geq x\} \\ [q] = \max\{p \in Z | p \leq x\} \end{cases} \quad (4)$$

$$x = p + t_x \quad (5)$$

$$y_1 = {}_{(min)}q + t_y \quad (6)$$

$$y_2 = {}_{(max)}q + t_y \quad (7)$$

Where: p = the input integer value; q = the real number; x = the same as 1; y = the same as 1; y 1 = the minimum real number; y 2 = the maximum real number; and Matriks transformation: (x',y') (x ,y), The coordinates _((min)) q and _((max)) q represent the minimum and maximum values of the area around the point Point, respectively, and tx, ty represents the translation value.

In the seventh step, the new Songket motif produced by ASP Method 1 and ASP Method 2 is tested by using histogram testing. This is done with the aim that the new songket motifs produced do not lose the original characteristics of the new motifs produced. In the eighth step, two new Songket motif is blended into one new Songket motif to make a new motif that is more modern and aesthetic using this formula below:

$$C(x, y) = wa \cdot A(x, y) + wb \cdot B(x, y) \quad (8)$$

Where: $C(x, y)$: the result of image blending, wa: weight of image A, $A(x, y)$: Image A, wb: weight of image B, $B(x, y)$: Image B. $wa + wb = 1$

III. Result and Discussion

A. Data Collection

This test image consists of an image of Silungkang songket cloth, totaling 5 images, the results of processing the image will get many motifs that have been reconstructed and combined to get a modern and aesthetic motif that does not eliminate the identity of the old motif. One of Silungkang Songket cloth motifs can be seen in figure 0033 below:

Fig. 3. Example of Silungkang Songket Cloth Motif

B. Preprocessing and Transformation

Preprocessing data consists of several processes that can make the input image better than the beginning, including color space conversion, improving image color quality, and eliminating damaged image pixels/noise reduction, among these preprocessing, using methods and techniques in image processing that can produce input image quality that is following the wishes of the researcher, which aims to obtain high-quality input data.

1. Motif Extraction

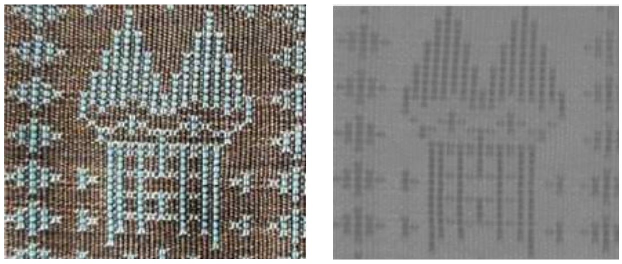
In Figure 2, it can be seen that the coordinates of the image area to be cut are formed, to form the desired cut image. In this rectangular crop technique, the selected coordinates form a minimum of 3 sides to an unlimited number of sides. Figure 4 below, it shows the image of the Silungkang songket motif that has been cut using the rectangle cropping technique.

Fig. 4. Various Songket Motifs

It is clear that the results of the image cutting using the rectangle cropping technique, this technique produces an image with precise cutting results between the sides of the image. The images tested in the cutting are 5 different Silungkang Songket Fabrics - different for each motif in it.

2. YCbCr Color Space Conversion

Furthermore, from the results of cropping the image, the researchers carried out the Preprocessing and Transformations stage, namely continuing the process of converting Songket RGB to YCbCr images using the YCbCr color space conversion method, which aims to simplify the next stage process and maximize the motifs obtained. The result of Color Space Conversion can be seen in Figure 5.

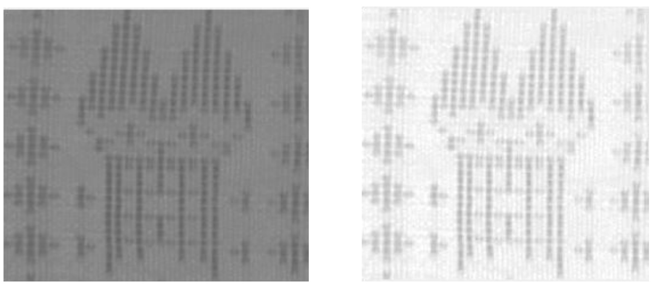


(a) (b)

Fig. 5. (a) Original Songket Image Extracted, (b) Image Conversion to YCbCr Color Space

3. Contrast Enhancement

Furthermore, from the results of the conversion of the YCbCr color space above, the researcher will perform contrast enhancement using the contrast stretching method, which can maximize the motif image with the extension of the YCbCr color space. The result of contrast enhancement can be seen in figure 6.

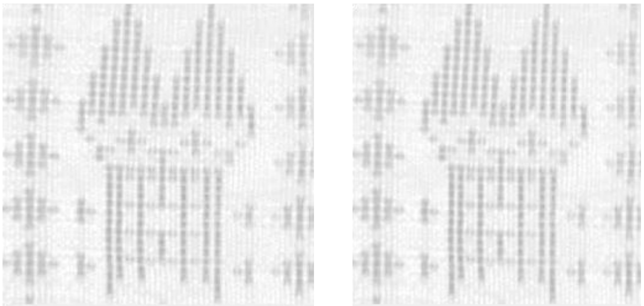


(a) (b)

Fig. 6. (a) Songket Image Color Space YCbCr, (b) Image Result Process Contrast Enhancement

4. Noise Reduction

Furthermore, from the results of the contrast enhancement process above, the researcher will carry out a noise reduction process (removing noise in the Songket motif image), in which the researcher will use the median filter method, with the function of removing pixel noise and replacing it with pixels that are around it. The result of noise reduction can be seen in figure 7.



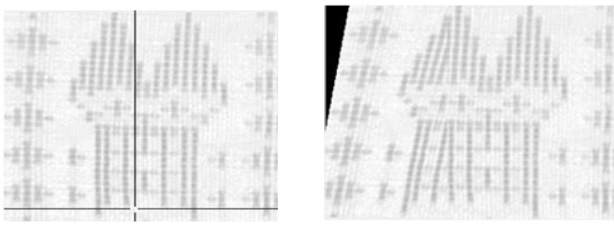
(a) **(b)**

Fig. 7. (a) Songket Image Color Space YCbCr, (b) Image Result Process Contrast Enhancement

C. Processing and Transformation

1. ASP Method

The next process is Processing Transformations, namely modifying the Affine method, which currently the Affine method is only able to bend all pixels of an image, for the problem above the researchers developed the Affine method which is more suitable and suitable for use with the image of the Songket Silungkang motif which already from the previous noise reduction process, in which the researcher will bend the Songket image motif based on the top and bottom points (X and Y axes), to produce good curves from the specified side. The result of ASP Method can be seen in figure 8 below.



(a) **(b)**

Fig. 8. (a) Image Result of Noise Reduction Process, (b) Image of ASP Processing Results

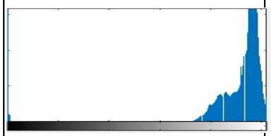
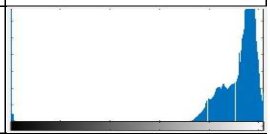
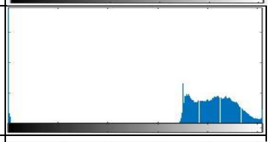
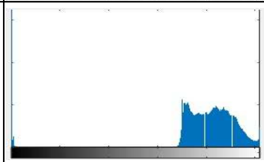
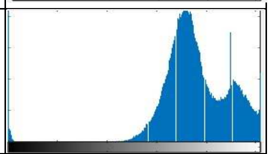
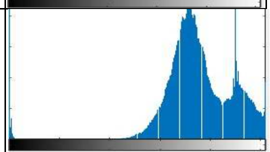
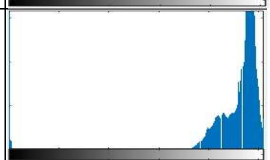
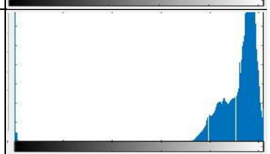
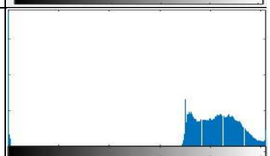
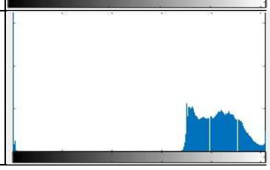
2. Histogram Test

An image histogram is a graph that depicts the distribution of pixel intensity values of an image or a certain part of the image. From the histogram will be obtained the frequency of occurrence relative (relative) to the intensity in the image. In addition, the histogram also shows the brightness (brightness) and contrast (contrast) of an image. Therefore, the histogram can be used as an image processing method that works both qualitatively and quantitatively. In digital images that have L degrees of gray are from 0 to L-1.

Testing using histograms is a step taken to determine whether the image that has been generated using the ASP method still has the same characteristics as the initial image before processing. This is done to produce an image that is not too much different from the initial image.

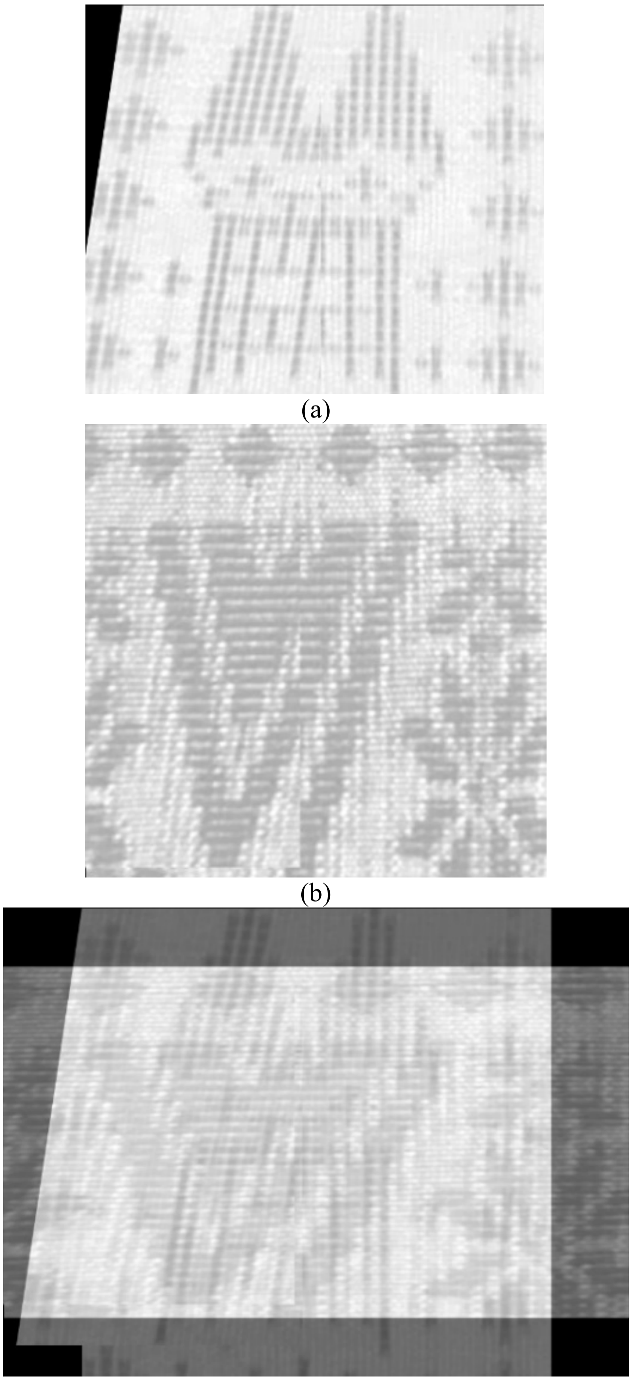
The first column in the table is the Songket Motif name, and the second column is the pixel size of the songket motif image. The third and fourth columns are the pixel height and width of the songket motif image. The fifth column in the table is the graphical result of the histogram test from the songket motif image. The first row of motif songket is the result histogram test of the original songket motif and the second row is the result histogram test of the ASP method and so on. The result of all the Histogram tests can be seen in Table 1.

TABLE I. HISTOGRAM TEST RESULT

Nama Motif	**Pixel Size**	**Pixel Height**	**Pixel Width**	**Histogram**
Rangkiang Lumbung Padi Besar	33,721	770	654	
Rangkiang Lumbung Padi Besar	35,576	770	654	
Pucuk Rebung	30,115	749	515	
Pucuk Rebung	32,120	749	515	
Bungo Kipas	30,660	525	489	
Bungo Kipas	31,295	525	489	
Bungo Tulip	13,697	702	432	
Bungo Tulip	13,697	702	432	
Tampuak Manggih	31,603	687	577	
Tampuak Manggih	33,188	687	577	

D. Processing Blending Image

The next process is the process of merging motifs that have been reconstructed using the development of the affine method, to get modern and aesthetic motifs that do not eliminate the meaning and identity of the motifs. The result of the blending motif can be seen in figure 9 below:



(a)

(b)

(c)

Fig. 9. Image of Songket Motif from ASP 1, (b) Image of Songket Motif from ASP 2, (c) Image of Songket Motifs Result of Blending Songket Motifs ASP 1 with ASP 2

E. Design of GUI ASP Method System Application and Bleeding Image

To implement this method, we make an application using Matlab. The GUI design of the application can be seen in Figure 10.

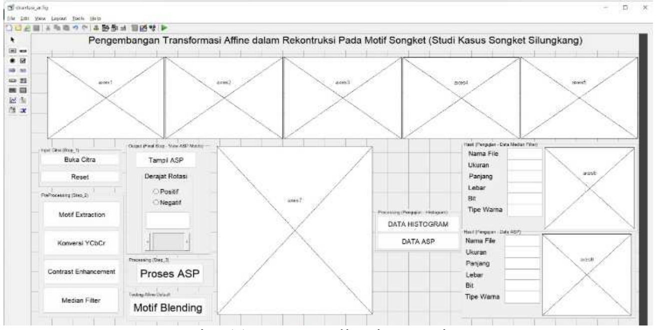


Fig. 11. GUI Application Design

IV. Conclusion

Based on the results of the research, there are several conclusion. Researchers can get new Songket motifs that are more modern and aesthetic by combining Songket motifs that have been reconstructed from the previous affine segmentation point (ASP) method. The important point of this study is how researchers can produce a user-friendly system for operating the Songket motif reconstruction system and the incorporation of Songket motifs so that the users of this system include Songket craftsmen, Songket artists, and Songket observers. In addition, they also get the convenience of being creative and imagining to create Songket motifs in general or Silungkang Songket motifs in particular which are newer and more modern and aesthetic.

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