Digitalization and down streaming of Sumatra batik motifs as symbols of cultural heritage: turtle graphics as a tool for sustainable development

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ABSTRACT

The importance of preserving Sumatra *batik* motifs as a cultural heritage is facing major challenges in the digital era. The problem of this research lies in the difficulties in digitalizing and commercializing *batik* motifs effectively and maintaining authenticity and cultural value. This article aims to explore the use of the Turtle Graphic as a tool for digitalizing and down-streaming Sumatra *batik* motifs. Turtle graphics were initially crafted as an instructive instrument for educational settings, paving the way for teachers to demonstrate drawing concepts. On a different note, it also serves convenience to coders needing graphic output - offering them a solution without necessitating more complicated or external libraries in their projects. The research method involves applying graphical programming (using Turtle graphics) to produce digital representations of *batik* motifs. The technical aspects of digitization implemented in the Turtle Graphic are (1) data identification, which is done by creating a table to select motifs that are currently rare; (2) motifs that have been identified are revitalized through making simple sketches; (3) sketches are made in digital Turtle Graphics to make it easier for MSMEs to document and implement into prototype *batik* models. One example of the *batik* motif used in this research is the Daun Sirih Melayu batik motif. This *batik* motif often uses images of betel leaves that are intertwined and sticking out. The *Daun Sirih Melayu batik* motif was chosen as a representative example because the philosophical meaning of the betel leaf *batik* motif symbolizes a form of respect. Betel leaves are also important in tradition, especially at proposals, weddings, traditional title awards, and other events. The research results show that Turtle Graphics can simplify digitalization. These contribute to the preservation and socialization of Sumatra batik and support the sustainability and popularization of *batik* in an increasingly digital global context. Academics can also use this research as a basis for further research, while for MSMEs, it is a good opportunity to implement it in batik centers in the archipelago, especially on Sumatra island.

1. Introduction

Researchers from within and outside the country have developed digitalization in the process of creating batik motifs. However, research that focuses on digitizing *batik* with rare motifs made from the Sumatra island has not been developed much by researchers, especially in documentation using Turtle Graphics. This is a great opportunity to increase the accessibility and preservation of traditional *batik* motifs, but it can also pose challenges in maintaining authenticity and cultural identity amidst increasingly developing design innovations. The rich cultural heritage of Indonesia is epitomized by its traditional textile art, particularly *batik*, which has been recognized by UNESCO as a Masterpiece of the Oral and Intangible Heritage of Humanity [1]–[3]. This research aims to contribute to the

preservation of culture, particularly *batik* motifs as symbols of cultural heritage. *Batik*, a wax-resist dyeing technique applied to whole cloth, has been practiced in Indonesia for centuries, with each region developing its own unique motifs and styles that reflect the local culture and history [4], [5].

Among the various regions known for their *batik*, Sumatra stands out with its distinct motifs and techniques that have been passed down through generations of artisans. Sumatra *batik* is characterized by its bold colors, intricate patterns, and symbolic meanings. The most well-known *batik* motifs include the *Parang*, and *Kawung*. The *Parang* motif, for example, features diagonal lines that represent the waves of the ocean, symbolizing strength and resilience. The *Kawung* motif, on the other hand, is composed of intersecting circles that represent the coconut palm, a symbol of prosperity and fertility [4]. The transformation process to digital format must be balanced with strategies that ensure the cultural values in *batik* motifs are maintained while supporting the continued creativity of craftsmen in the modern era. The advent of digitalization presents both challenges and opportunities for the preservation and evolution of these traditional *batik* motifs.

Digitalization refers to the process of converting information into a digital format, which can enhance the accessibility and preservation of cultural heritage [6]. In the context of *batik*, digitalization can facilitate the documentation of motifs, making them available for future generations while allowing artisans to innovate and create new designs. Artisans can experiment with new color combinations, scale, and layout by converting traditional batik patterns into digital formats while maintaining the original motifs' essence. One innovative approach to digitalizing *batik* motifs is using Turtle Graphics, a computer graphic programming program that creates graphics using simple commands. Turtle Graphics, named after the "turtle" that moves on the screen following a set of instructions, offers a unique method for replicating intricate *batik* designs using mathematical algorithms [7]. By translating the "turtle" movements and patterns into digital representations of *batik* motifs, artisans can preserve these designs in a digital format while exploring new creative possibilities [8].

This research focuses on developing a digital Turtle Graphic platform for rare *batik* originating from Sumatra island. The reason for using Turtle Graphics is its relatively easy application for digitally documenting *batik* motifs while still paying attention to the original design, as the data stored is a program code for drawing *batik* motifs based on the original *batik* motifs. This paper aims to investigate the effectiveness of Turtle Graphics in the digitalization of Sumatra batik motifs, assess the impact of digitalization on the sustainability of batik culture, and propose strategies for integrating digital tools into traditional *batik* practices, which were selected based on their cultural significance and visual complexity. The research design employs a qualitative approach involving field research, interviews with local *batik* artisans, and the documentation of various *batik* motifs prevalent in Sumatra. The digitalization process using Turtle Graphics includes selecting traditional motifs, developing a program that translates these designs into a series of commands, and validating the digital representations with local artisans to ensure accuracy and fidelity to the original designs [9]. The results of this study demonstrate the successful application of Turtle Graphics in generating digital representations of selected *batik* motifs. Each motif was created by combining various geometric shapes and lines, showcasing the versatility of Turtle Graphics in capturing the essence of traditional designs. The digital representations were validated by local artisans, ensuring that the essence of the original motifs was maintained.

The impact of digitalization on the sustainability of *batik* culture is multifaceted. Firstly, the creation of digital archives of traditional motifs plays a crucial role in preserving cultural heritage. This documentation uses Turtle Graphics by reconstructing patterns and motifs digitally through programming-based visualization so that motifs can be preserved and accessed in a modern way. By safeguarding these designs in a digital format, artisans can protect their cultural identity against globalization and cultural homogenization threats. This preservation is vital for maintaining the historical significance of *batik* in Indonesian culture and ensuring that these traditions are passed down to future generations [10], [11]. Secondly, the digitalization of *batik* motifs opens new avenues for economic development. By creating digital designs, artisans can expand their market reach through online platforms, allowing them to sell their products to a global audience. This not only enhances their income but also promotes the cultural significance of *batik* on an international scale. Moreover, the integration of digital tools into the *batik*-making process can streamline production, reduce waste, and increase efficiency, further contributing to the economic sustainability of the industry. Thirdly, Turtle Graphics serves as an educational tool for teaching the principles of design and mathematics.

By engaging students in the digitalization process, they can learn about traditional art forms while developing their programming skills. This interdisciplinary approach fosters a greater appreciation for cultural heritage and encourages innovation in traditional practices. By combining the knowledge of *batik* motifs with digital programming skills, students can develop a unique perspective on the intersection of art and technology, potentially leading to new creative applications in the future. Despite the advantages of digitalization, several challenges persist.

The initial learning curve associated with Turtle Graphics may deter some artisans from adopting this technology, as it requires a basic understanding of programming concepts. Additionally, the reliance on digital tools may lead to a disconnect from traditional craftsmanship, which is integral to the *batik*-making process. *Batik* craftsmen have a work pattern with a division of tasks determined by the owner. *Batik* craftsmen in the pattern-making department usually always make them manually, with a special digitalization process that can help craftsmen enrich *batik*-making patterns so that the resulting *batik* motifs will be much more productive, thereby increasing the craftsmen's economy. The large number of motifs created can be a great opportunity to expand the marketing reach of *batik* for the owner. Artisans must strike a balance between embracing technology and maintaining the integrity of their craft, ensuring that the human touch and cultural significance of *batik* are not lost in the process of digitalization. In conclusion, the digitalization and down streaming of Sumatra *batik* motifs through Turtle Graphics represent a significant step towards sustainable development in the realm of traditional arts. By preserving cultural heritage, creating economic opportunities, and serving as an educational tool, digitalization has the potential to revitalize the *batik* industry and ensure its continued relevance in the modern world.

2. Digitalization through Turtle Graphics

2.1. Research Design

The research design for this study is centered around the application of Turtle Graphics to digitally represent traditional Sumatra batik motifs. This design employs a qualitative approach, focusing on the integration of technology into traditional art forms, specifically examining how digital tools can enhance the creative process for *batik* artisans [12]–[14]. A qualitative approach is used because it can explore motifs using turtle graphics to produce *batik* patterns. Which can follow the motif elements in traditional *batik*, such as motifs that are symmetrical, have rhythm, and can be used in creating compositions. The resulting pattern can be accurate in repeating patterns with the same visual form. The study aims to explore the effectiveness of Turtle Graphics in capturing the intricate details of *batik* motifs while providing artisans with a modern platform for innovation.

2.2. Data Collection

Data collection was conducted through a combination of field research and participatory observation. The primary subjects of this study included local *batik* artisans from various communities in Sumatra who possess extensive knowledge of traditional *batik*-making techniques. The *batik* artisans are selected based on their experience in the field of *batik* from previous research studies, based on the production results of the batik cloth they have produced, and being selected from *batik*-producing centers. Interviews were conducted to gather insights into their experiences with digital tools and their perspectives on the potential benefits and challenges of digitalizing *batik* motifs. In addition to interviews, the research involved documenting various *batik* motifs prevalent in Sumatra. This documentation included photographing existing *batik* fabrics, sketching traditional motifs, and recording the artisans' methods of creating these designs. The selected motifs for this study, *Sirih Melayu*, were chosen based on their cultural significance, visual complexity, and representation of the region's heritage.

3. Method: Digitalisation Process

The digitalization process using Turtle Graphics consists of several key steps, as in Fig.1.

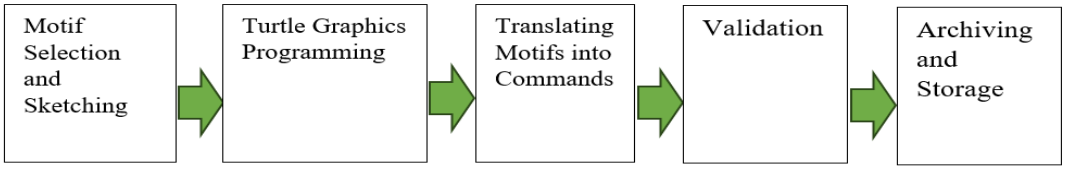


Fig. 1. Digitalization process

- Motif Selection and Sketching: The initial step involved selecting the traditional motifs to be digitized [15], [16]. The selected motifs were then sketched on paper to serve as a reference for the digitalization process. This step ensured that the essence of the traditional designs was preserved in the digital format.
- Turtle Graphics Programming: A program is developed using Turtle Graphics, a programming language that allows for creating graphics through simple commands [17], [18]. The turtle's movements are controlled by a set of instructions that dictate its position, direction, and drawing actions. The basic state of the turtle is defined as a triplet (x, y, α), where (x, y) represents the turtle's position on a Cartesian coordinate system, and α represents its heading or direction. The turtle can move forward, turn left, or turn right based on the commands given.
- Translating Motifs into Commands: Each traditional motif is translated into a series of Turtle Graphics commands [19]. For instance, to create the *Parang* motif, the program specifies the angles and lengths of lines that represent the diagonal patterns. Similarly, for the *Kawung* motif, the turtle is instructed to draw overlapping circles at defined intervals, while the *Udan Liris* motif is created by programming the turtle to draw a series of parallel lines at varying lengths and angles.
- Validation: After generating the digital representations, local artisans validate the accuracy and fidelity of the designs. This step is crucial to ensure that the digital versions maintain the essence of the original motifs. Feedback from artisans is incorporated into the program to refine the digital representations further.
- Archiving and Storage: The final digital designs are archived for future use. Digital storage allows for easier access and sharing of these motifs, ensuring that they can be preserved and utilized in various applications, such as educational tools, online sales, and design innovation.

3.1. Advantages of Using Turtle Graphics

The use of Turtle Graphics for digitalizing *batik* motifs offers several advantages:

- Simplicity and Accessibility: Turtle Graphics provides a user-friendly interface that allows individuals with minimal programming experience to create complex designs [20]–[22]. This accessibility encourages more artisans to engage with digital tools and explore innovative ways to express their art.
- Efficient Storage: Digital representations of *batik* motifs require less memory compared to physical storage of fabrics and designs. This efficiency facilitates easier archiving and retrieval of traditional motifs, allowing for better preservation of cultural heritage.
- Educational Potential: Turtle Graphics can serve as an educational tool for teaching design principles and programming concepts. By engaging students in digitalization, they can gain a deeper appreciation for traditional art forms while developing valuable technical skills.

4. Results and Discussion

4.1. Turtle Graphics

The Turtle graphics are used for research purposes: the *Batik Kawung* Pattern and the *Batik Purwakarta* pattern [6]. And the digitization methods used in the implementation here are turtle graphics and mathematical calculation [23]. Turtle graphics are used for arbitrary *batik* motifs and mathematical calculations [24]. Before drawing the Turtle Graphics, we first sketch the *batik* motif on paper and then formulate the graph equation. The basic idea of turtle interpretation is defined as three elements (x, y, α). The Cartesian coordinates (x, y) represent the turtle's position, and the angle α

called the heading (head), is interpreted as the direction the turtle is facing. For example, a turtle starting at (0, 0) in the x-y plane. To start a turtle environment, import it, then give it the command turtle.forward (15), and it moves (on a computer monitor) 15 pixels in the direction it is facing, drawing a line as it moves. Then, give it the command turtle right (25), and it rotates in place 25 degrees clockwise. If negative values are used, it means it is rotated counterclockwise. The following simple example code program uses Python to program the Daun Sirih Melayu batik motif using Turtle Graphics. In Fig. 2, the result is the depiction of curves forming the branches of a tree, and in Fig. 3, the result is the depiction of the first leaf at the top of the tree branch. Next, in Fig. 4, Fig. 5, Fig. 6, Fig. 7, the results are the depictions of the second to fifth leaves.

```
Import turtle
turtle.penup()
turtle.goto(-20,56)
turtle.pendown()
turtle.right(15)
turtle.forward(50)
for i in range(11):
  turtle.forward(15)
  turtle.right(5)
for i in range(9):
  turtle.forward(15)
  turtle.right(-6)
for i in range(9):
  turtle.forward(12)
  turtle.right(-10)
turtle.penup()
turtle.goto(-15,50)
turtle.pendown()

turtle.left(15)
for i in range(8):
  turtle.forward(5)
  turtle.right(-5)
for i in range(12):
  turtle.forward(10)
  turtle.right(-5)
for i in range(3):
  turtle.forward(10)
  turtle.right(5)
turtle.right(-150)
for i in range(3):
  turtle.forward(10)
  turtle.right(5)
for i in range(5):
  turtle.forward(3)
  turtle.right(5)
for i in range(8):
  turtle.forward(10)
  turtle.right(-5)
for i in range(20):
  turtle.forward(4)
  turtle.right(-5)
turtle.forward(3)
turtle.right(-90)
turtle.forward(3)
turtle.right(15)
```

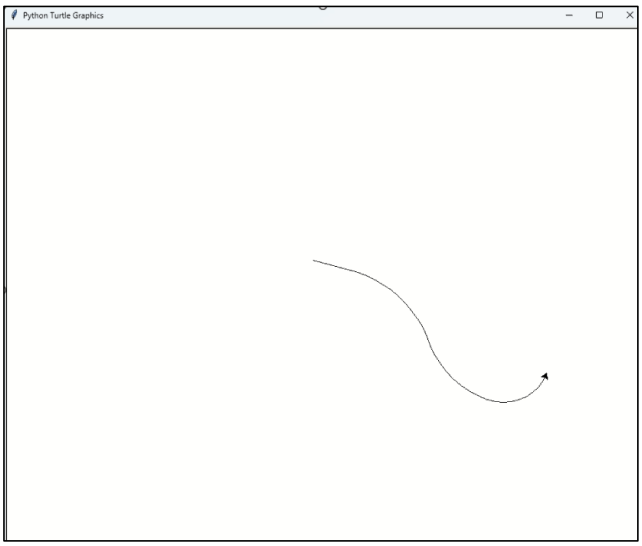


Fig. 2 Step 1 of Simple Example Code Program of *Daun Sirih* Melayu Batik Motif Using Turtle Graphics

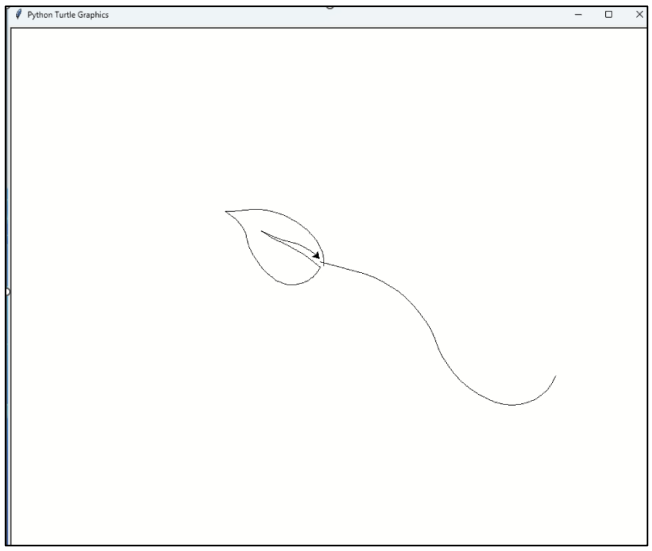


Fig. 3. Step 2 of Simple Example Code Program of *Daun Sirih* Melayu Batik Motif Using Turtle Graphics

```
for i in range(6):
  turtle.forward(10)
  turtle.right(-3)
for i in range(5):
  turtle.forward(8)
  turtle.right(3.1)
turtle.right(170)
for i in range(5):
  turtle.forward(8)
  turtle.right(-3.1)
for i in range(9):
  turtle.forward(8)
  turtle.right(5)
turtle.penup()
turtle.goto(80,20)
turtle.pendown()

turtle.right(155)
for i in range(8):
  turtle.forward(5)
  turtle.right(-5)
for i in range(12):
  turtle.forward(10)
  turtle.right(-5)
for i in range(3):
  turtle.forward(10)
  turtle.right(5)
turtle.right(-150)
for i in range(3):
  turtle.forward(10)
  turtle.right(5)
for i in range(5):
  turtle.forward(3)
  turtle.right(5)
for i in range(8):
  turtle.forward(10)
  turtle.right(-5)
for i in range(20):
  turtle.forward(4)
  turtle.right(-5)

turtle.forward(3)
turtle.right(-90)
turtle.forward(3)
turtle.right(15)
for i in range(6):
  turtle.forward(10)
  turtle.right(-3)
for i in range(5):
  turtle.forward(8)
  turtle.right(3.1)
turtle.right(170)
for i in range(5):
  turtle.forward(8)
  turtle.right(-3.1)
```

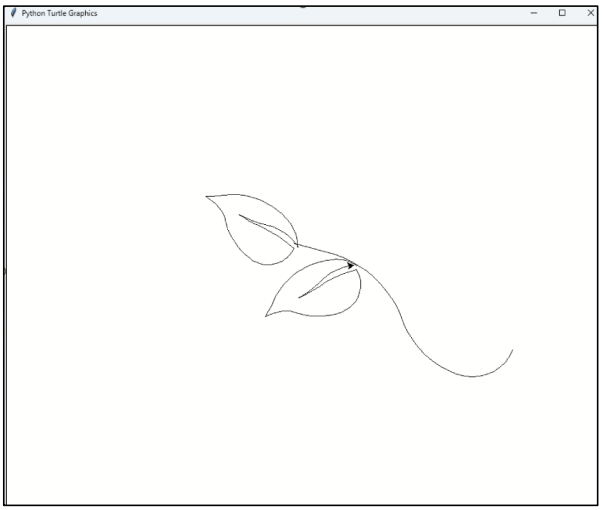


Fig. 4. Step 3 of Simple Example Code Program of *Daun Sirih* Melayu Batik Motif Using Turtle Graphics

```
for i in range(9):
  turtle.forward(8)
  turtle.right(5)
turtle.penup()
turtle.goto(128,-23)
turtle.pendown()

turtle.right(45)
for i in range(8):
  turtle.forward(5)
  turtle.right(-5)
for i in range(12):
  turtle.forward(10)
  turtle.right(-5)
for i in range(3):
  turtle.forward(10)
  turtle.right(5)
turtle.right(-150)
for i in range(3):
  turtle.forward(10)
  turtle.right(5)
for i in range(5):
  turtle.forward(3)
  turtle.right(5)
for i in range(8):
  turtle.forward(10)
  turtle.right(-5)
for i in range(20):
  turtle.forward(4)
  turtle.right(-5)

turtle.forward(3)
turtle.right(-90)
turtle.forward(3)
turtle.right(15)
for i in range(6):
  turtle.forward(10)
  turtle.right(-3)
for i in range(5):
  turtle.forward(8)
  turtle.right(3.1)
turtle.right(170)
for i in range(5):
  turtle.forward(8)
  turtle.right(-3.1)
for i in range(9):
  turtle.forward(8)
  turtle.right(5)
turtle.penup()

turtle.goto(162,-88)
turtle.pendown()

turtle.left(-20)
for i in range(8):
```

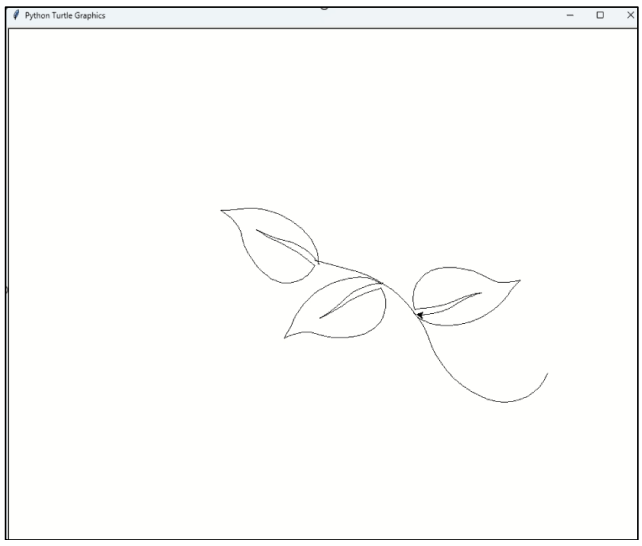


Fig. 5. Step 4 of Simple Example Code Program of *Daun Sirih* Melayu Batik Motif Using Turtle Graphics

```
  turtle.forward(5)
  turtle.right(-5)
for i in range(12):
  turtle.forward(10)
  turtle.right(-5)
for i in range(3):
  turtle.forward(10)
  turtle.right(5)
turtle.right(-150)
for i in range(3):
  turtle.forward(10)
  turtle.right(5)
for i in range(5):
  turtle.forward(3)
  turtle.right(5)
for i in range(8):
  turtle.forward(10)
  turtle.right(-5)
for i in range(20):
  turtle.forward(4)
  turtle.right(-5)

turtle.forward(3)
turtle.right(-90)
turtle.forward(3)
turtle.right(15)
for i in range(6):
  turtle.forward(10)
  turtle.right(-3)
for i in range(5):
  turtle.forward(8)
  turtle.right(3.1)
turtle.right(170)
for i in range(5):
  turtle.forward(8)
  turtle.right(-3.1)
for i in range(9):
  turtle.forward(8)
  turtle.right(5)
turtle.penup()
turtle.goto(226,-148)
turtle.pendown()

turtle.right(15)
for i in range(8):
  turtle.forward(5)
  turtle.right(-5)
for i in range(12):
  turtle.forward(10)
  turtle.right(-5)
for i in range(3):
  turtle.forward(10)
  turtle.right(5)
turtle.right(-150)
for i in range(3):
```

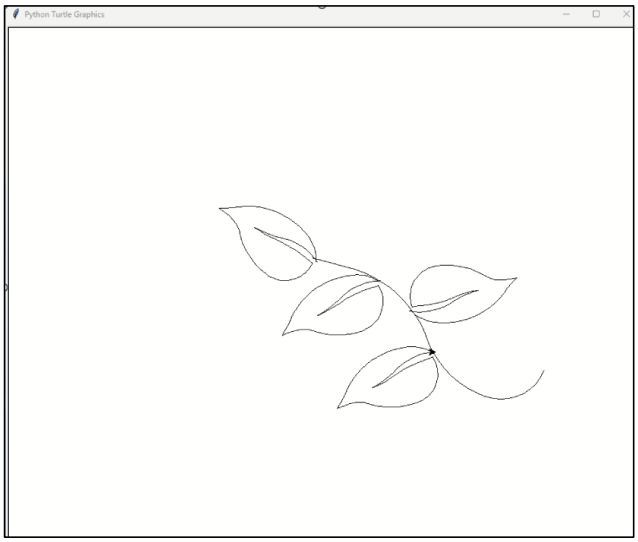


Fig. 6. Step 5 of Simple Example Code Program of *Daun Sirih* Melayu Batik Motif Using Turtle Graphics

```
  turtle.forward(10)
  turtle.right(5)
for i in range(5):
  turtle.forward(3)
  turtle.right(5)
for i in range(8):
  turtle.forward(10)
  turtle.right(-5)
for i in range(20):
  turtle.forward(4)
  turtle.right(-5)

turtle.forward(3)
turtle.right(-90)
turtle.forward(3)
turtle.right(15)
for i in range(6):
  turtle.forward(10)
  turtle.right(-3)
for i in range(5):
  turtle.forward(8)
  turtle.right(3.1)
turtle.right(170)
for i in range(5):
  turtle.forward(8)
  turtle.right(-3.1)
for i in range(9):
  turtle.forward(8)
  turtle.right(5)
turtle.penup()
```

The following picture (Fig 7) is the final output of the simple example program using Turtle Graphics, and the next picture (Fig 8) is the picture of the program file.

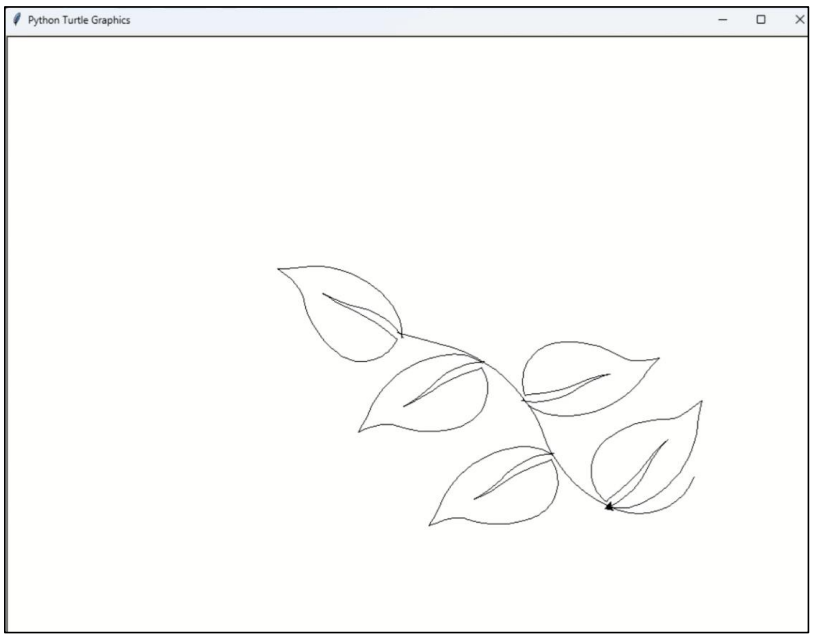


Fig 7. Final Output of Simple Example Code-Program of *Daun Sirih Melayu Batik* Motif Using Turtle Graphics

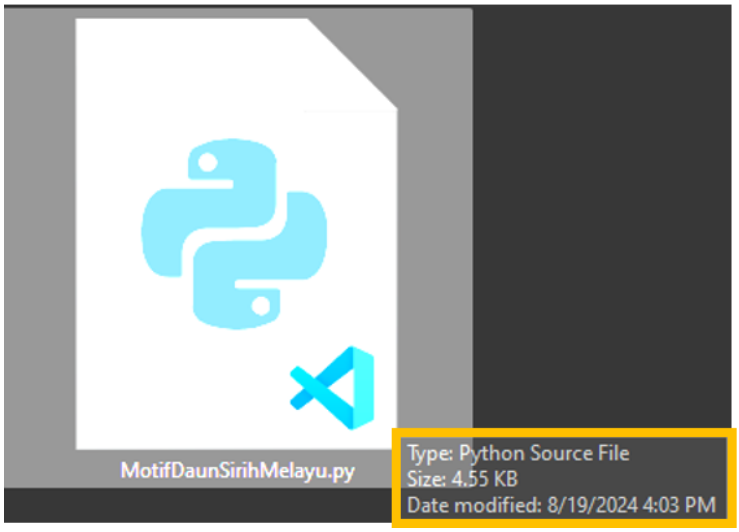


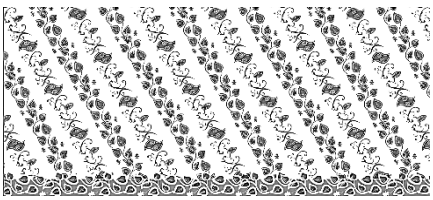
Fig 8. File of code-program

Program code files created using Turtle Graphics with the Python programming language in ***.py** format require relatively less data storage space compared to storing images in ***.png** or ***.bmp** format. For example, in Fig. 8, the file size of the ***MotifDaunSirihMelayu*.py** program is only 4.55 KB.

4.2. Continuation After Using Turtle Graphics

The following is an example of Turtle Graphics for the *Daun Sirih Melayu batik* motif in Table 1.

Table 1. Turtle Graphics for the Daun Sirih Melayu *batik* motif

Daun Sirih	**Visual Form Sketch in the form of Stillation of Daun Sirih**
 Daun Sirih	 Stillation of Daun Sirih
Description	
Betel leaves in the archipelago are known as an ingredient for herbal medicine [25], [26]. The oval shape of the leaves with pointed leaf tips attracts a lot of people's attention so that they can be visualized as part of creating batik motifs. The fresh green color with a shiny surface indicates that the betel leaf is fresh and safe to consume or process. This betel leaf is the main idea in the process of creating batik motifs in North Sumatra. The shape of the leaf becomes the main motif that is distilled so that it is more rhythmic and aesthetic. Betel leaves are made in sketch form with a 45-degree tilt, making this batik different from batik in North Sumatra, which is generally arranged in a vertical or horizontal direction.	
Digital processing	
 Digital Processing of Motif Design	

The following picture (Fig.9) is an example of improving the design of the *Daun Sirih Melayu batik* motif [27].

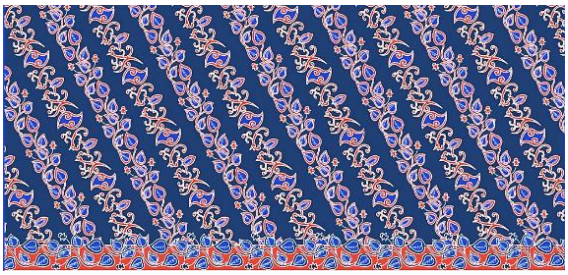


Fig. 9. Example of improving the design of the *Daun Sirih Melayu batik* motif

Daun Sirih Melayu Batik Motif often uses images of betel leaves that are intertwined and sticking out. The philosophical meaning of the betel leaf *batik* motif symbolizes a form of respect. Betel leaves are also important in Malay tradition, especially at proposals, weddings, traditional title awards, and other events. The visual appearance of this *batik* motif is arranged into two parts. At the bottom, there is a pattern with a motif of leaves, and at the top, motifs are arranged in the same pattern and have the same slope and point towards the horizontal. The visual form of the motif is blue leaves and purple, which is a repetition of the background at the bottom. Meanwhile, the slope background is blue. The placement of the pattern and the choice of colors become interesting, and the color of this batik becomes a harmonious whole because of the repetition of colors on the bottom and top.

4.3 Process of Downstreaming of Sumatra Batik Motifs

The process of downstreaming Sumatra *Batik* motifs in Pekalongan City by *batik* motif *canting* stamps craftsman (can be seen in Fig.10).

Fig. 10. The process of Making *Canting* Stamps for Sumatra *Batik* Motifs by Craftsmen

Stamped *batik* is a faster method of making batik than written *batik*. The following are the steps in the process of making stamped *batik*, which consists of several key steps in Fig.11.

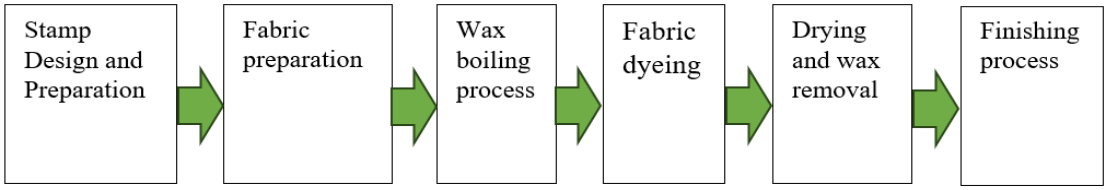


Fig. 2. Process of Making Stamped *Batik*

- Stamp Design and Preparation. First, the *batik* design is created. This design can be a traditional pattern or a new design that wants to apply to the fabric. Then, proceed with stamp making. The batik design is transferred to a stamp made of materials such as copper or brass. This stamp

is made by attaching a design to a metal surface or other material, usually using a carving or printing technique. The stamp will be used to print patterns on the fabric.

- The next step is fabric preparation; the fabric to be used, usually cotton or silk, is selected and cut to the desired size. The cloth is then washed to remove dirt and oil so that the dye can stick well.
- Batik wax is melted and mixed with dye in the wax boiling process. This wax functions to cover areas that you don't want to be exposed to dye. Wax is applied to the surface of the cloth using the stamp that has been made. This process is carried out by attaching a stamp that has been smeared with wax to the cloth to print a pattern.
- In fabric dyeing, the fabric is soaked in the dye after the wax is applied and dries. These dyes can be natural or synthetic dyes. This coloring process usually involves several layers to get the desired color.
- After that, drying and wax removal are carried out. After the dyeing process, the fabric is dried. Once dry, the wax used to print the pattern is removed by boiling or washing with hot water. This process reveals the batik pattern that has been previously printed.
- At the finishing stage, the fabric that has been washed and cleaned is then checked to ensure that the *batik* pattern is clear and there are no defects. The fabric is then dried again and ready to be cut and sewn into final products such as clothing, accessories, or other items.
- With this process, stamped *batik* can be produced in larger quantities than written *batik*, but it still maintains the beauty and craftsmanship that are characteristic of *batik*.

5. Conclusion

Batik motifs based on the rich culture and traditions of North Sumatra, with one example being the *Daun Sirih Melayu batik* motif, have been successfully realized using Turtle Graphics using the Python programming language, thus achieving the goal of digitalization and down streaming of batik motifs as symbols of cultural heritage. This creative process can be developed for other Indonesian *batik* motifs which have many *batik* motifs as a sustainable development. Making *batik* motifs can be utilized and implemented in the creative industry at *batik* centers in Indonesia. Program code files created using Turtle Graphics with the Python programming language in **.py* format require relatively less data storage space compared to storing images in **.png* or **.bmp* format. Besides, the reconstructed images' quality is scaled by Turtle Graphics better than the photo image quality. Traditional batik makers can use this Turtle Graphics batik motif when making initial images on cloth; then batik craftsmen can color with *canting* following the *batik* motif produced by Turtle Graphics. It is hoped that the younger generation will be able to continue making *batik* by following the *batik* motifs that have been created with Turtle Graphics.

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