Mandala Art Creator: Art with Python Turtle Graphics

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Abstract

This work explores the use of Python Turtle graphics as a tool for designing art with programming concepts in creative ways. Turtle graphics is an easy and entertaining approach for learners to visualize and play with code in an artistic manner. The paper explains "Mandala Art Creator"; a Python program to generate a random or customized Mandala Art using the Turtle graphics module and its implementation in the textile industry. In Mandala Art Creator the user is prompted to provide their name and choose between two options: random configuration and personalized configuration. The computer's algorithm determines colors and angles for the Mandala Art on its own in random mode. The user can customize the Mandala Art experience in custom mode by specifying colors and rotation degrees.
Keywords: Creative Learning, Customized Configuration, Interactive Coding, Mandala Art, Python Turtle Graphics, Random Configuration, Screen Printing, Visualization.

1. Introduction

Drawing a sequence of lines with randomly chosen colors produces the Mandala, an eye-catching and distinctive abstract design [1]. Functions encapsulate the process of creating abstract art, encouraging code organization and reusability. Using Python Turtle Graphics to Create Mandalas means using the elegance and simplicity of the Turtle module to create complex geometric patterns. With their origins in ancient traditions, mandalas are frequently circular patterns that radiate outward from a core, signifying spiritual unity, harmony, and balance. The turtle can be programmed to draw repetitive shapes, rotate at precise angles, and produce attractive symmetrical patterns using Python Turtle [2]. Through the deft combination of forward motions, rotations, and pen manipulations, you can create your own rare Mandalas that express both your creative sensibilities and the contemplative process involved in making them. Through the use of interactive and visually stimulating environments, users can experiment with various color combinations and shapes with the Mandala Art Creator, which promotes artistic exploration. Like the traditional practice of Mandalas in various cultures throughout history, this fusion of art and programming offers a creative journey that not only results in visually captivating designs but also offers a meditative and introspective experience. It can be possible to integrate Mandala design on textile surfaces also given that customers want variety and change, this effort may contribute to the production of textile items that are in higher demand in the national and international fashion markets [3].

1.1. Python Turtle

Originating from the 1960s Logo programming language, Python Turtle Graphics is an interactive programming paradigm that is suitable for beginners. [15] Using a virtual "turtle" that moves around the screen, users can create drawings and designs. This makes it an effective teaching tool for concepts related to programming, mathematics, and algorithmic thinking. This idea is expanded upon by Python's built-in turtle module, which enables more flexible and captivating graphics programming. Its ease of use, rapid feedback, and intuitive interface make it a great option for beginning programming and creative exploration, encouraging students of all

ages to create a solid knowledge of coding logic and problem-solving [7].

1.2. Mandala Art

Mandalas are elaborate geometric designs usually presented in a circular format, and they have their roots in ancient Indian and Tibetan traditions. These attractive artistic expressions frequently start in the center and move outward, signifying harmony, balance, and life's cyclical nature. Mandalas are much more than just designs; they have deep spiritual and psychological meaning. Making mandalas or meditating on them is said to encourage inner serenity, awareness, and a closer relationship with oneself. Mandalas are incorporated into religious ceremonies and architectural designs in numerous cultures, such as Buddhism and Hinduism, highlighting their spiritual significance. Mandalas are used as therapeutic tools in modern art therapy and mindfulness practices to help people explore their inner world, relieve stress, and bring creativity. In addition to being a visual feast, mandalas offer a profound means of self-expression and a fascinating fusion of spirituality, art, and psychological healing.[14]

1.3. Mandala Art in Textile Industry

The adaptation of traditional Mandala motifs from Buddhism for textile design through screen printing has boomed very fast [6]. The textile industry makes use of mandala art by incorporating its elaborate designs and symbolic motifs into textile products. Traditional Mandala patterns and motifs serve as a source of inspiration for textile designers, who modify them for use in screen printing, embroidery, digital printing, batik, and other textile processes. Products like clothing, accessories, home goods, and other textile items are enhanced with spiritual and auspicious meanings when Mandala art is incorporated into the textile design process. In addition to adding aesthetic value, the use of mandala designs on fabric raises consumer awareness of and appreciation for this age-old art form. In general, mandala art enhances the textile sector by bringing creative elements and cultural heritage into modern textile products [8]. It discusses the significance of Mandala art in Buddhist culture and meditation practices,

highlighting the intricate details and religious symbolism involved. The study involved collecting Mandala designs from various sources, developing different design arrangements, and evaluating them with a panel of judges. The results showcase the successful development of textile products like Kurtis, bags, and vests using the adapted Mandala motifs. The research provides valuable insights into incorporating cultural and religious elements into contemporary textile design practices. [16]

2. Related Works

A.Elumalai's book "Drawing Cool Stuff with Turtle" is a useful teaching tool since it offers imaginative methods for utilizing Turtle graphics to create a variety of patterns and designs. The book is providing useful exercises and examples to improve one's proficiency with Python graphics.[5] Probably an introduction to Turtle graphics for novices, the Real Python article "A Beginner's Guide to Python Turtle" It goes over fundamental ideas, instructions, and examples to help people get started with using Python's Turtle module to create graphics.[9]A thorough tutorial on using the Turtle library to create graphics can be found in the official documentation for Python Turtle graphics. It is an essential tool for comprehending the features and functionalities of Python Turtle graphics.[12] The Code Review Stack Exchange Python Random Mandala code probably investigates the imaginative potential of Turtle graphics in producing arbitrary mandala designs. This source is providing some insights into various methods for using Python to create mandalas algorithmically.[4] Convolution operations are probably used in the research paper "Design on Intelligent Feature Graphics Based on Convolution Operation" to create intelligent graphical features. It is to explore the interactions between machine learning and graphics, presenting insights into complex graphic design methods.[10] The integration of art and mathematics in the context of engineering education is examined in the article "Learning mathematics through art in a faculty of engineering". This has shed light on the use of creative methods, like Turtle graphics, as instructional tools for teaching mathematical ideas.[11]

3. Algorithm
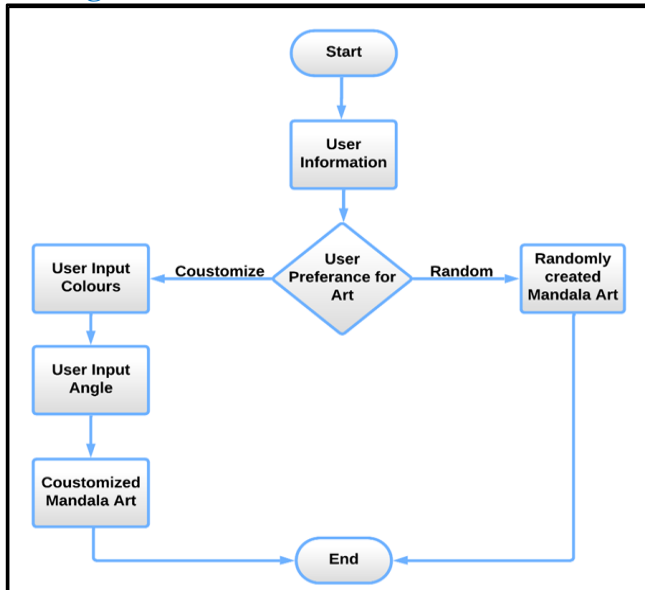
Figure 1 Algorithm

Algorithm for Mandala Art Creator The algorithm begins by initializing a Turtle graphics object for drawing by defining turtle orientation, size, speed and setting up universal variables such as line patterns and color choices [9]. The user is prompted to enter their name, ensuring it consists only of alphabets. The program then presents the Mandala Art Creator to the user, displaying a welcome message and informing the user about Art Creator. Subsequently, the user's readiness to proceed is checked; and offering options to create a random or custom mandala. In the random mode, a predefined number of lines are drawn with random colors. In the custom mode, the user selects three colors and an angle for the Mandala, and the drawing is created accordingly. Throughout the process, user-friendly prompts and error handling are incorporated. The program concludes by displaying a message indicating the completion of the drawing process or suggesting a return for later use. The Turtle graphics window remains open for interaction in Figure 1.
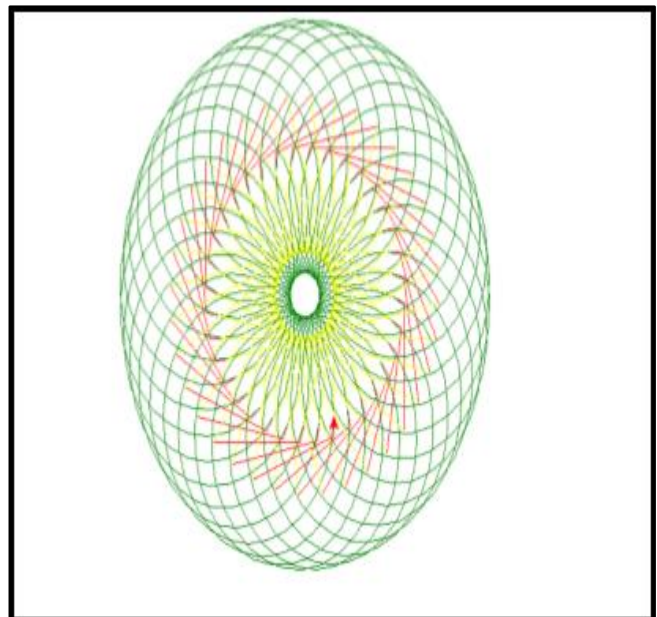
4. Results and Discussion

Figure 2 is the result showing the Random creator of the algorithm used in Integrated Development and Learning Environment (IDLE) where the creator is asking about username, validations and choices and the output will be of mandala art with green, yellow and red color is show in Figure 3 [13].

**Figure 2 Idle of Random Creator**

Figure 3 Output of Random Creator

Figure 4 is the result showing the output of the Custom creator of the algorithm used where the creator is asking about username, validations and choices in which they have to specify the three colors name and the angle of their custom art and the output will be of mandala art with green, yellow and red color. Figure 5 is output of Custom Creator at 40° and is showing art with blue, red and green colors having user-specified angle at 40°. Similarly, by giving different angle and colors creator makes various designs as shown in Figure 6.

```
Python 3.12.0 (tags/v3.12.0:0fb18b0, Oct  2 2023, 13:03:39) [MSC v.1935 64 bit (
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.

= RESTART: C:\Users\Lenovo\AppData\Local\Programs\Python\Python312\Bhavya\change
.py
###################################
Welcome to Mandala ART Creator
###################################
What is your name? Bhavya
Bhavya, In this Mandala Art Creator, you get to choose the size and colors of yo
ur art, or can have the computer generated random one
~~~~~~~~~~~~~~~~~~~~~~~~~
Are you ready or not? yes
Would you like to use our random creator function or our custom function? {rando
m/custom} custom
~~~~~~~~~~~~~~~~~~~~~~~~~
You can choose any colors from this list for your Mandala:
Darkred, red, yellow, darkgreen, green, lightgreen, darkblue, blue, purple
What is the first color? blue
What is the second color? red
What is the third color? green
What angle would you like your Mandala to turn at? 40
~~~~~~~~~~~~~~~~~~~~~~~~~
Initializing...
Determining features...
Color...
Size...
###################################
Your final result should be drawing as of this point!
Thanks for using the generator, Bhavya!
```

Figure 4 Idle of Custom Creator
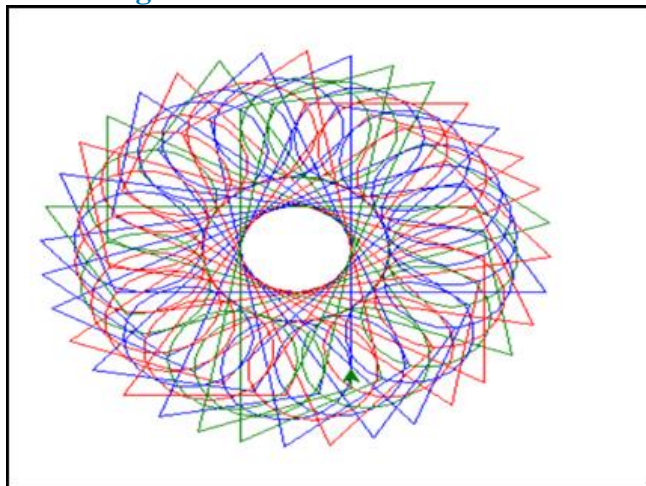
**Figure 5 Output of Custom Creator at 40°**
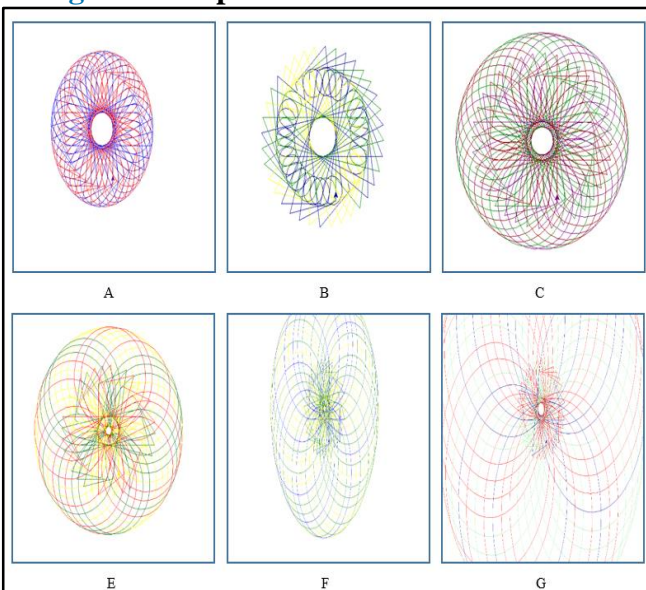
**Figure 6 Different Custom Design with Different Color and Angle**

(A) Color: Purple, Red, Blue Angle: 60°; (B) Color: Yellow, Green, Darkblue Angle: 25°; (C) Color: Green, Darkred, Purple Angle: 85°; (D) Color: Red, Darkgreen, Yellow Angle: 120°; (E) Color: Blue, Yellow, Green Angle: 210°; (F) Color: Lightgreen, Darkblue, Red Angle: 360°

4.1.Comparison

Observation of Custom Mandala Generator: Customization is the main focus of the Custom Mandala Generator. In order to provide a more interactive and customized experience, it asks users to enter their name and makes decisions about color selection and turning angles. The code adds a distinctive touch to the creative process by using a pre-draw sequence to create anticipation. Although there is a random mode available, the focus is on user-driven choices, enabling users to actively influence the final visual result. Figure 7 indicates the random generator design and Figure 8 indicates the custom generator design done by custom mandala generator. This code offers a personalized and interactive mandala creation experience, with a stronger emphasis on user involvement and decision-making.[4]
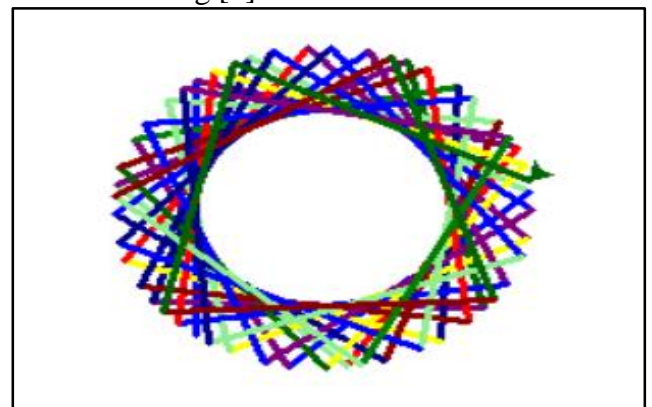

Figure 7 Random Generator
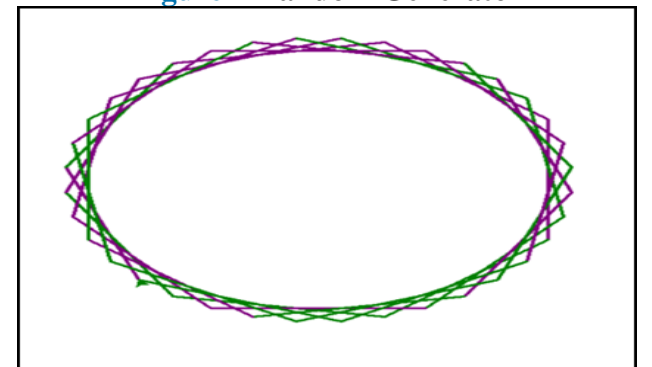
Figure 8 Custom Generator

Observation of Mandala ART Creator: With the option to create custom or random designs, the Mandala ART Creator code offers users an engaging and adaptable mandala generation platform. Input validation ensures a smooth and error-free interaction when entering user details, color selection and angle preferences, demonstrating the code's emphasis on user-friendliness. A dynamic element is added with the introduction of the time module, building suspense and enhancing the immersive user experience. In general, this code successfully integrates automation and customization in a way that is well-balanced, making it a useful tool for both artistic expression and beginning programming that can be used by a wide range of user preferences and skill levels. Figure 9 indicates the random creator design and Figure 10 indicates the custom creator design done by mandala art creator.
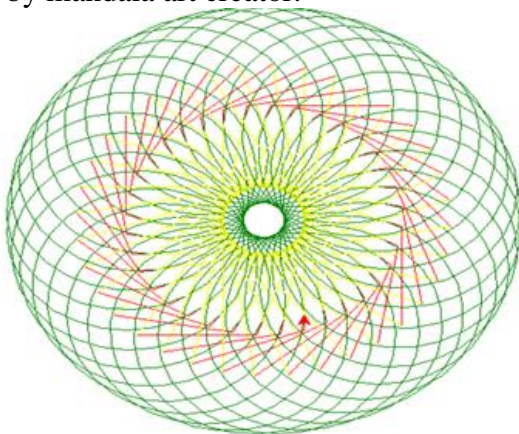
Figure 9 Random Creator
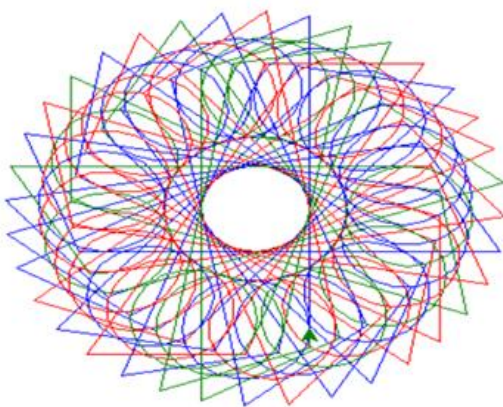
Figure 10 Custom Creator At 40°

Overall, both Python codes use Turtle graphics to create mandalas, but they place distinct emphasis on user customization and interaction, offering a variety of methods for approaching the creative process. While the Custom Mandala Generator goes deeper into user-driven customization, the Mandala ART Creator offers a wider range of experiences. The comparative study of Custom Mandala Generator and Mandala ART Creator is summarized as below:

Automation versus Customization: The Mandala ART Creator offers both random and customized options, with an emphasis on automation. The Custom Mandala Generator, on the other hand, is primarily concerned with user customization.

Dynamics and Anticipation: The Mandala ART Creator uses the time module to create anticipation, and the Custom Mandala Generator adds a special touch with a pre-draw sequence.

User-Friendliness: By validating input, both codes prioritize user-friendliness and guarantee a seamless user experience.

Goals: The purpose of the Mandala ART Creator is to balance customization and automation in order to serve a wider audience. A more interactive, user-driven experience is provided by the Custom Mandala Generator [17].

5. Future Scope

This research paper integrates Python Turtle graphics with Mandala art to present a significant intersection of contemporary computational tools with traditional art forms. Drawing on India's rich religious and cultural legacy, mandala art, which has historically been embraced by Buddhist communities, is a powerful tool for meditation and spiritual reflection. It is distinguished by its unique concentric structure and symbolic imagery. A significant step forward in enabling the creative and interactive creation of Mandala art is the release of the "Mandala Art Creator," a Python application created with Turtle graphics. Future studies should examine the viability and possible effects of directly integrating lovely motifs into the Mandala Art Creator, doing away with the requirement for external CAD methods. Further research into the program's usability and user experience is also possible, especially in terms of improving customization options and user control. Working together with academics and practitioners from

various cultural backgrounds may yield insightful information about the cultural significance of mandala art and its implications for modern society. Overall, this study offers promising directions for further investigation and advancement at the nexus of art, technology, and cultural heritage. It also lays the groundwork for future research and innovation in this area.

6. Recommendation

This multidisciplinary study combines Python Turtle graphics with Mandala art, which has its roots in India's rich religious and cultural legacy, to investigate the meeting point of traditional artistic mediums and contemporary computational tools. Mandala art, which is distinguished by its concentric structure and symbolic imagery, is a form of spiritual reflection and meditation that has historically been supported by Buddhist communities. We present the "Mandala Art Creator," a Python application designed with Turtle graphics to make it easier to create dynamic and imaginative Mandala art, taking inspiration from this rich artistic heritage. Purposive sampling and data collection from lamas and Buddhist practitioners in Uttarakhand were used to modify Mandala designs for screen printing, resulting in 45 motifs that were altered with the aid of computer-aided design (CAD) software.[16] Rather than utilizing CAD methods, the Mandala art generator offers lovely themes that users can customize or generate at random to create Mandala art. While in custom mode users can customize their experience by choosing their own colors and rotation degrees, in random mode the program chooses colors and angles on its own.

Conclusion

We weave together legacy and innovation to produce a colorful tapestry of creativity by fusing traditional artistic practices with cutting-edge computational innovation. Users can create both customized and random mandalas using an interactive platform that is provided on the Mandala ART Creator made using Python Turtle Graphics. By making use of the Turtle graphics module, the code produces a smooth fusion of programming ideas with creative expression. Using pre-established patterns and colors, the random Mandala

feature provides users with a rapid and automated creative experience. On the other hand, the custom Mandala feature enhances artistic control by enabling customized designs with user-selected colors and rotation angles. To ensure a seamless and error-free interaction, the code includes user-friendly features like input validation for the user's name, color selection and angle selection. All things considered, the Mandala ART Creator code skillfully blends programming with artistic expression, providing a fun tool for users to visually study both creative expression and basic programming ideas. Overall, a sense of anticipation is added by the Python Turtle, Random, and Time modules, which add to a dynamic and entertaining user experience. This study helps to preserve and disseminate traditional art forms in the digital age while also demonstrating the potential of Python Turtle graphics as a flexible tool for computational creativity and artistic expression. The Mandala Art Creator offers a platform for both artistic exploration and spiritual reflection, and it is a useful illustration of how computational tools can connect cultural heritage and modern innovation.

References

[1]. Amelia, G., Satiadarma, M. P., & Wati, L. (2020). The effects of drawing and coloring mandala on anxiety among pregnant women in their third trimester. Advances in Social Sciences, Education & Humanities Research, 478, 997-1002. [DOI: 10.2991/assehr.k.201209.158] (https://doi.org/10.2991/assehr.k.201209.158)

[2]. Angellim, C., Satiadarma, M. P., & Subroto, U. (2020). Mandala Drawing for Reducing Test Anxiety in College Student. In Proceedings of the 2nd Tarumanagara International Conference on the Applications of Social Sciences and Humanities (TICASH

2020) (pp. 451-456). [DOI: 10.2991/assehr.k.201209.069] (https://doi.org/10.2991/assehr.k.201209.069)

[3]. Briggs, J. R. (2013). Python for Kids: A Playful Introduction to Programming (311p). No Starch Press.

[4]. Custom Mandala Generator. (n.d.). Retrieved from[https://codereview.stackexchange.com/ questions/217644/python-random-mandala] (https://codereview.stackexchange.com/quest ions/217644/python-random-mandala)

[5]. Elumalai, A. (2021). Drawing Cool Stuff with Turtle. In A. Elumalai (Ed.), Introduction to Python for Kids (pp. 1-2). Apress. [DOI: 10.1007/978-1-4842-6812-4] (https://doi.org/10.1007/978-1-4842-6812-4)

[6]. Mac Conville, D., Farrell, M., Luckcuck, M., & Monahan, R. (2023). Modelling the Turtle Python library in CSP. arXiv Preprint arXiv:2207.09706. [DOI: 10.48550/arXiv.2207.09706] (https://doi.org/10.48550/arXiv.2207.09706)

[7]. Navaei, J., Babakmehr, M., Kalamdani, R., Liu, Y. N., Qiu, S., Farhan, J., & Blackful, J. (2021). An intelligent image processing-based approach to optimize vehicle headlamp aiming. In Proceedings of the 18th International Multi-Conference on Systems, Signals & Devices (SSD) (pp. 1-2). Monastir, Tunisia: SSD.

[8]. Orozco, C. (2014). Using Python Turtle Graphics for Mesh Representation and Engineering Graphics.

[9]. Real Python. (n.d.). Retrieved from [https://realpython.com/] (https://realpython.com/)

[10]. ResearchGate. (n.d.). Design on Intelligent Feature Graphics Based on Convolution Operation. Retrieved from [https://www.researchgate.net/publication/35 8183834] (https://www.researchgate.net/publication/35 8183834)

[11]. Ratnadewi, A., Pandanwangi, A., & Maranatha Christian University. (2021). Learning mathematics through art in a faculty of engineering. World Transactions on Engineering and Technology Education, 19(3).

[12]. Turtle Graphics Documentation. (n.d.). Retrieved from [https://docs.python.org/3/library/turtle.html] (https://docs.python.org/3/library/turtle.html)

[13]. "A Beginner's Guide to Python Turtle" on Real Python. (n.d.). Retrieved from [https://realpython.com/beginners-guide-python-turtle] (https://realpython.com/beginners-guide-python-turtle)

[14]. Wang, Q. (2021). Mandala Coloring as a Therapeutic Tool in Treating Stress-Anxiety-Depression Syndrome. Asian Journal of Interdisciplinary Research, 4, 30-36. [DOI: 10.54392/ajir2144] (https://doi.org/10.54392/ajir2144)

[15]. Wikipedia contributors. (2023, December 20). Logo (programming language). In Wikipedia, The Free Encyclopedia. Retrieved January 27, 2024, from [https://en.wikipedia.org/w/index.php?title=L ogo_(programming_language)&oldid=11908 29237] (https://en.wikipedia.org/w/index.php?title=L ogo_(programming_language)&oldid=11908 29237).

[16]. Srivastava, N., Goel, A., & Rani, S. (2019). Adaptation of Mandala Art for Development of Design Suitable for Textile Articles. International Journal of Home Science, 5(3), 01-04.

[17]. Fabmyntra: Shop the Best Fabrics - India's Online Fabric Store. (2021). Retrieved from [https://fabmyntra.com/] (https://fabmyntra.com/products/multi-color-mandala-pattern-digital-print-japan-satin-fabric-fm-jsdp01685)