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Development of a Matlab Based Pattern Design System for Plain Textile (Ankara)

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Abstract: *Textile designing involves producing patterns for cloth used in clothing, household textiles (such as towels) and decorative textiles such as carpets. In the past, numerous printing techniques have been employed in patterning textiles and they give an accurate representation of designs when utilized but designs produced by the conventional method are static and rigid. Hence, MATLAB was used in this work to enable dynamic designs be created for a particular textile material.*
This work develops patterns for printing different textiles and creating innovative designs using mathematics to serve as instructions for artistic.

Keywords: *Pattern, textile design, MATLAB*

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I. Introduction

Clothing is one of the three big essentials of life among which include food and housing. It is of paramount importance that clothing is of reasonable price, hence the need for improved production efficiency which is obtainable from investment in pattern design system. A textile is a flexible material consisting of a network of natural or artificial fibres (yarn or thread). Yarn is produced by spinning raw fibres of wool, flax, cotton, hemp, or other materials to produce long strands. Textiles are formed by weaving, knitting, crocheting, knotting, felting, or braiding.

Designing in textile is an important component of textile production. The execution of a good design needs the consideration of certain essential factors such as the pattern, motif and arrangement of motifs, and style of rendering, combined with the use of color. Design themes or motifs can be chosen from various sources such as natural, artificial, geometrical, traditional symbols, pictorial scenes, and proverbs among others. For a design to be transferred onto a fabric, it needs to go through a printing process [3].

Printing is the process of applying color to fabric in definite patterns or designs. In properly printed fabrics the color is bonded with the fibre, so as to resist fading and friction. Textile printing is related to dyeing but in dyeing properly the whole fabric is uniformly covered with one color, whereas in printing one or more colors are applied to it in certain parts only, and in sharply defined patterns.

African wax print (Ankara) is the most worn and the most valued fabric in West Africa, but it is also the most imitated. African print is a general term employed by the European textile firms in Africa to identify fabrics which are machine-printed using wax resins and dyes in order to achieve batik effect on both sides of the cloth, and a term for those imitating or achieving a resemblance of the wax type effects [1]. Its principal characteristic is the unique combination of pattern and color. The introduction of wax-print in West African culture consists of the ascription to the fabric, series of local names, permitting its integration into various local strategies of consumption. African textile prints are mostly sewn into dresses. Traditionally, many African textiles were not cut or tailored. Instead, they were draped and tied to suit various occasions. But with the current trend in fashion designing, textile prints fabrics are cut and fashioned into contemporary clothing for various occasions. Textiles are made from many materials, with four main sources: animal (wool, silk), plant (cotton, flax, jute), mineral (asbestos, glass fibre), and synthetic (nylon, polyester, acrylic). The first three are natural. In the 20th century, they were supplemented by artificial fibres made from petroleum. Textiles are made in various strengths and degrees of durability, from the finest microfibre made of strands thinner than one denier to the sturdiest canvas.

Earlier, numerous printing techniques have been employed in patterning textiles. Amongst the numerous methods was screen printing which involves developing screens by transferring paper designs unto tracing sheet before copying onto screens coated with photo-sensitive chemicals which have been exposed to light. This conventional process of developing designs has been the normal practice over the years. It gives an

accurate representation of designs when utilized but designs produced by the conventional method are static and rigid [3], this motivates the development of a MATLAB based pattern design system for plain textiles.

II. Material And Methods

Overview of Related works

This section discusses some of the reviewed related works: [7] stated that Garment producers spend hours excruciating over sketches, measurements and small details that ultimately make an entire garment come together. With computer technology, this process can become streamlined and efficient, leaving the designer more time to develop and create designs. Computer use reduces the need for pencils, erasers, and other drafting tools because they are all built into the software. The purposive sampling technique was used to select 100 garment producers out of a list of 200 in Accra and Tema. The instruments used for the data collection were a structured interview, questionnaire and an observational guide. It was discovered that although the instructors had fair idea about computer technology it was not detailed. It was also detected that CAD can be used for grading, pattern drafting, marker making, fabric design, design illustration, drawing of figures and garment parts. They finally saw the need to incorporate computer technology in the fashion curriculum to enhance the profession. Based on the results, the drawback of this system was that every garment producer who was to use the computer technology had to undergo some training to learn to use the computer as well as the design software first. [3] Screen printing has increasingly become appreciated especially by textiles designers. Designs are relatively easy to transfer to screens and frame size can be readily varied. The designer also has the freedom to choose any repeat size. A significant characteristic of screen printing is that a greater thickness of the ink can be applied in the printing process than is possible with other printing techniques. This allows for some very interesting effects that are not possible using other printing methods. Designs were generated using leaves, weeds, crocheting thread, cardboard, wood chipping, coconut husk, coconut tree bark, sponge and twigs. The flaw in this system is that it does not enable bulk production of materials because one screen prints one material at a time. [2] stated that motifs play an important role in designing. Each motif, like the fabric itself has an origin, evaluation and variety in shape and presentation. In designing, a weaver, embroider, dyer or printer creates dreams of beauty using motifs familiar through culture, religion, environment and history on textiles. The design may be created from these developed motifs and best designs in selected placement may be transferred on to saris using appliqué for each design in selected color way. The drawback of this system is that motifs had to be manually sketched and scanned, and that did not guarantee that the gotten design was going to be used. The best out of a given collection was usually chosen. [9] Textile designs and concepts which are culturally influenced incorporate the strengths of their textile history as a means of creating, producing and marketing new innovative designs. Harnessing the power of modern technical design capabilities with the creative heritage of traditional culturally based textiles can facilitate the development of numerous commercial possibilities within the textile and fashion sectors. Representing a product with a cultural style and a context can also enhance existing product lines and lead to the development of new market opportunities. Designing with cultural concepts, embodied with symbolic cultural meanings can aid revitalization. Culturally influenced products are modernized traditional cultural products which have both cultural meanings and commercial values, therefore allowing these products to fit into contemporary markets. The process of design reinvention is considered to be an important inclusion of the design process for producing commercially successful cultural based products. [6] African people have developed rich textile traditions and distinctive forms of fabrics to communicate and enhance cultural meanings. These textiles have an exceptional significance as a means of communication, information and mutual association in communities. The history of textiles across Africa has been richly innovative, and has contributed to the development of a myriad of distinct genres of cloth and design. Their patterns are original artistic explorations of sophisticated visual paradigms with shimmering luminosity, dense composition, and its immense rippling effect viscerally engaging the viewer.

Methodology

A system that designs patterns for textile using mathematical expressions was developed using MATLAB 2008b. The system was developed to allow different mathematical expressions to be used if the one initially generated does not meet the desire of the user. When the correct patterns are gotten, they are arranged in different styles to suit the user. The final printing on the textile is done after the patterns have been arranged.MATLAB was used to generate and implement the patterns.

MATLAB allows a user to create various graphical objects including two-and three-dimensional graphs, graphical user interfaces (GUIs), etc. The basic function used to create 2-D graphs is the plot function. The function takes a variable number of inputs arguments. MATLAB has several built-in functions for plotting three-dimensional objects. MATLAB has several colors which were used to plot graphs of the design. The colors are y for yellow, m for magenta, c for cyan, r for red, g for green, b for blue, w for white and k for black.

Structure of the Design System

The design system is explained with the development of an algorithm and flowchart. The developed algorithm consists of the procedure necessary for the design process and is listed as follows:

a) Start
b) Input plain textile
c) Supply mathematical expression for pattern
d) Generate pattern and apply color.
e) Required pattern achieved? If yes, go to step (f) and if no go to step (c)
f) Arrange patterns as desired
g) Print the design
h) Evaluate system performance
i) Stop

The flowchart is presented in figure 1.

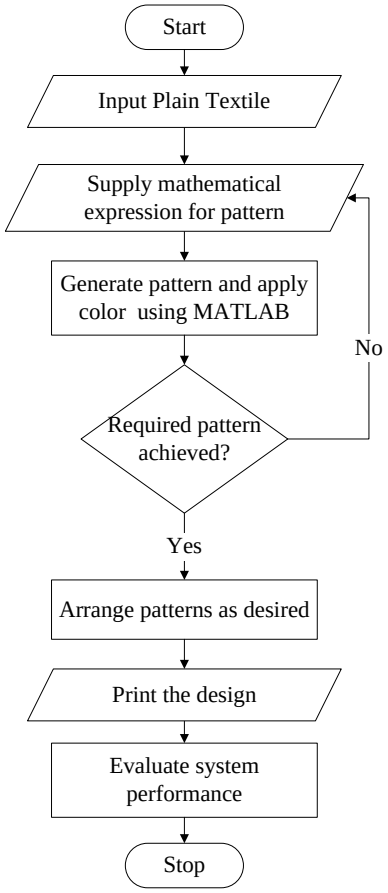

Figure 1: Flowchart showing the textile design process

Mathematical Expressions for the Pattern Design System

The mathematical expressions for the patterns developed are as presented below.

a) **Floral Pattern** can be mathematically expressed as

$r = n * \cos(n\theta)$, where $\theta = 0 \leq 0.1\pi \leq 2\,\pi$ and $n = 1, 2, 3,\ldots$

b) **Combined Floral** is basically superimposition of floral patterns on each other to form a more fascinating pattern. It can be mathematically expressed as that of floral patterns with multiple values for

$r = n * \cos(n\theta)$, where $\theta = 0 \leq 0.1\pi \leq 2\,\pi$ and $n = 1, 2, 3,\ldots$

c) **Petals**can be mathematically expressed as

$y = \sin(2x)$

$z = \cos(2x)$

$x = 0 \leq \frac{\pi}{100} \leq \pi$

d) **Spiral** was generated by a set of mathematical expressions expressed as follows

$\rho_1 = \theta^2,\ \rho_2 = 12\theta,\ \rho_3 = 15\theta$, where $\theta = 0 \leq 0.2 \leq 5\,\pi$

e) **Star**can be mathematically expressed as

$\theta = {}^{\pi}/_{2} \leq {}^{4}/_{5}\,\pi \leq {}^{9}/_{4}\,\pi$

$r = [1\ 1\ 1\ 1\ 1\ 1]$

III. Result

This work developed patterns for printing Ankara textiles and creating innovative designs using mathematics to serve as instructions for artistic, architectural and constructional work.

Some of the patters developed are presented in figure 2…,7. Most of them serve as background designs in textiles and printing. Others are for embroidery, motifs and abstract logo designs, architectural designs, screen printing, sculpture pieces designs, general pattern designs, etc.

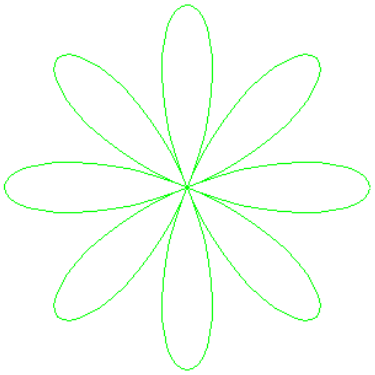

Figure 2: Floral Pattern

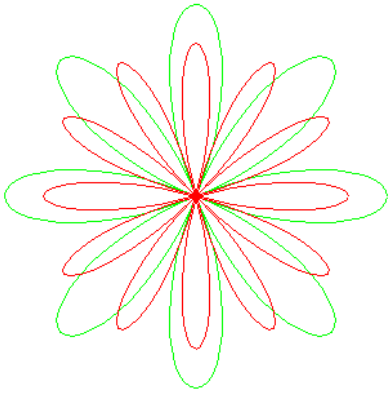

Figure 3: Combined Floral

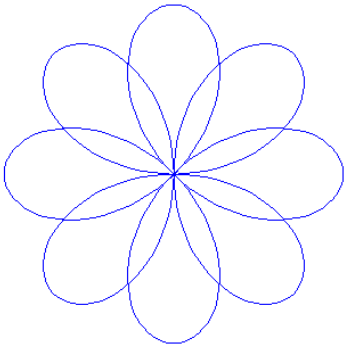

Figure 4: Petals

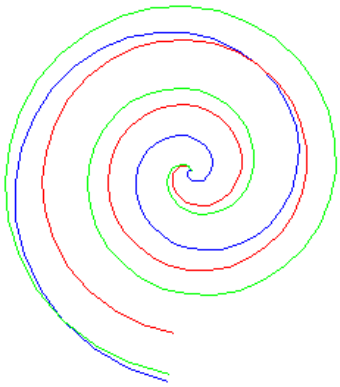

Figure 5: Spiral

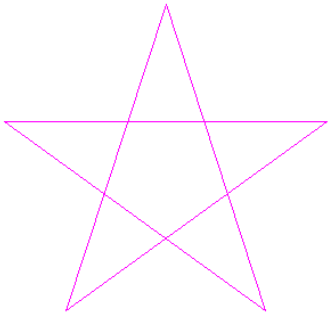

Figure 6: Star

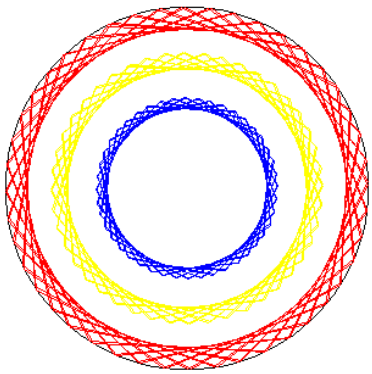

Figure 7: Circular pattern

IV. Discussion

Ankara design 1, as represented in figure 8 shows the combination of floral pattern as shown in figure 2 and petals shown in figure 4.
Ankara design 2, as represented in figure 9 shows the arrangement pattern of the star seen in figure 6 with different colors used to beautify it.
Ankara design 3, as represented in figure 10 shows the combination of floral pattern as shown in figure 2 and combined floral shown in figure 3.
Ankara design 4, as represented in figure 11 shows the arrangement pattern of the petals seen in figure 4 with different colors used to beautify it.

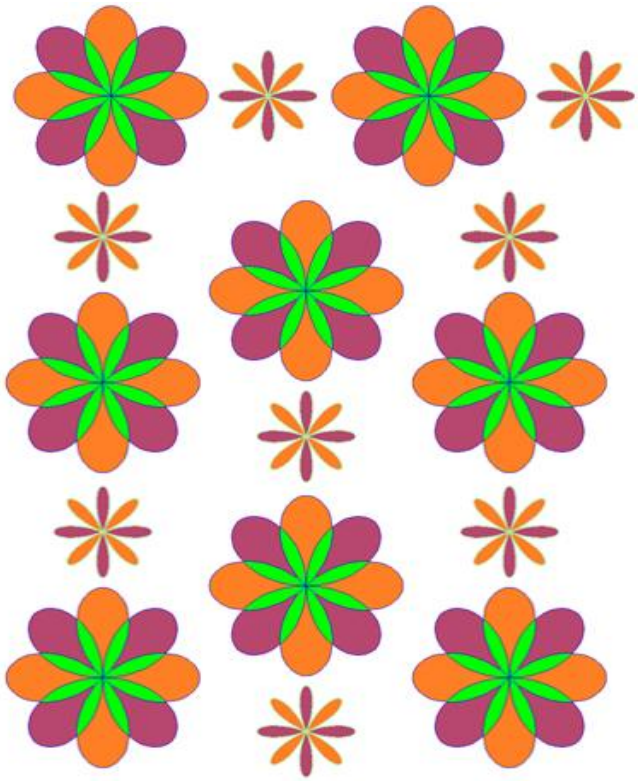

Figure 8: Ankara Design 1

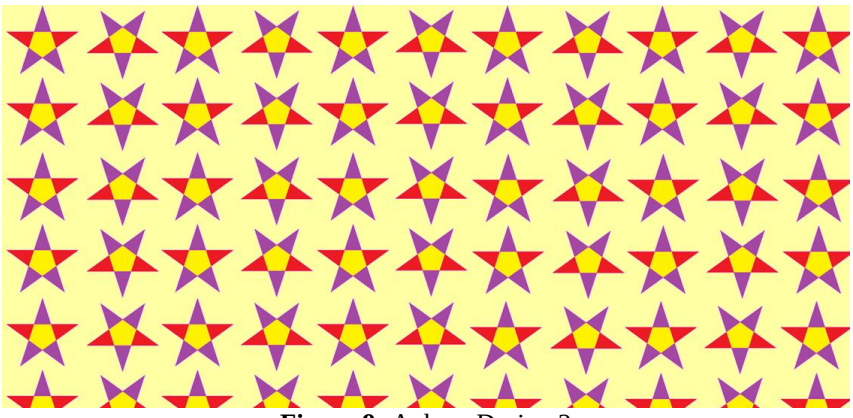

Figure 9: Ankara Design 2

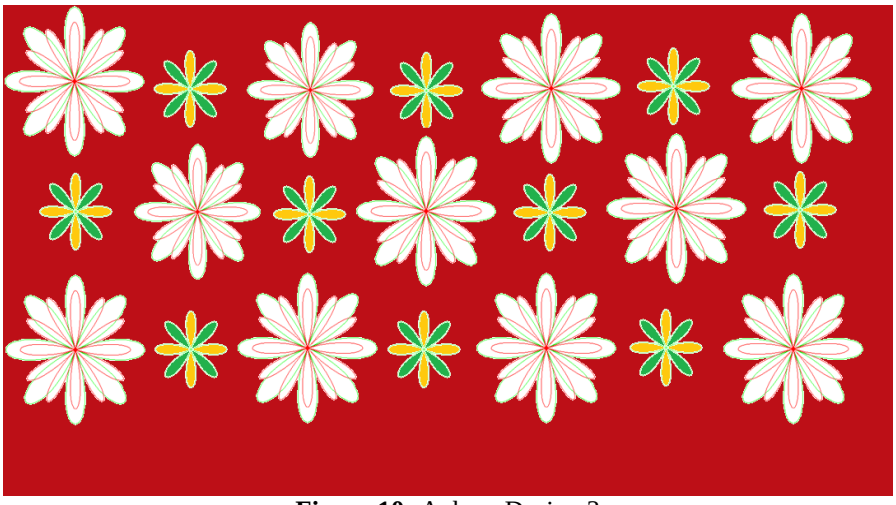

Figure 10: Ankara Design 3

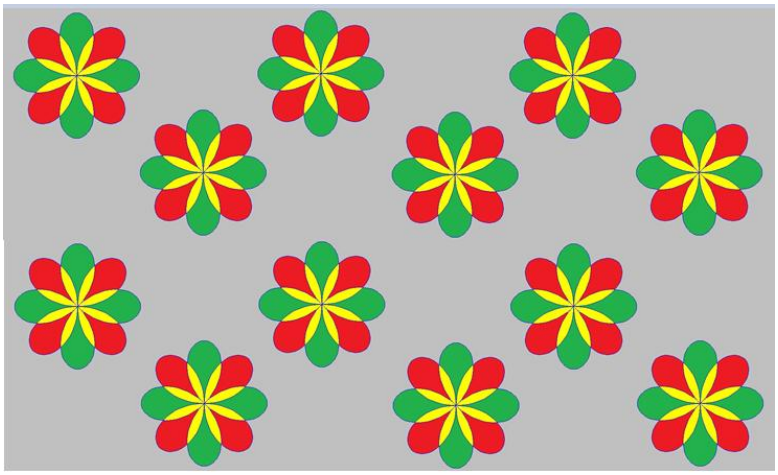

Figure 11: Ankara Design 4

V. Conclusion

African prints (Ankara) have seen significant changes since it was introduced into the country by the Europeans. While the contemporary designs which are mostly fancy prints are gaining prominence, the classical prints which carry proverbial names are still patronized by consumers especially the elderly. This work generated mathematical designs and patterns which textile designers and artists in general strive to achieve. Pattern designs developed from the study can be used for textile printing.

In conclusion, this research was able to achieve the set objectives of developing a pattern design system for plain textile material and simulating it using MATLAB. Also the use of MATLAB enabled definite and consistent patterns to be gotten as opposed to previous methods of designing Ankara materials that were used.

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