Implementation Of QR Code As An Effort To Preserve North Sumatra Ornaments Using Screen Printing Technique

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Abstract. The utilization of QR Codes to convey information about North Sumatran ornaments can serve as a modern innovation aimed at optimizing efficiency and accuracy in the preservation process. The theoretical relevance, as proposed by Z.S. Minata et al., directly aligns with this study's findings, demonstrating that QR Codes can effectively store and facilitate quick and accurate searches, thereby aiding in the preservation of North Sumatran ornaments. This research adopts a qualitative method, aiming to introduce QR Codes as a means of supporting local cultural heritage preservation, allowing easy and quick access through smartphone scanning. The outcomes of this study include the design of North Sumatran ornament patterns, QR Codes, and typography printed on T-shirts made from 20s cotton combed fabric using screen printing techniques. The functional evaluation results indicate that implementing QR Codes offers a practical solution for introducing North Sumatran ornaments, which have become less recognized among local communities.

Keywords: Preservation, Ornament, QR Code, Printing.

1 Introduction

Several research papers such as "*Gorga* Batak Toba di Kabupaten Samosir: Kontinuitas dan Perubahan Bentuk dan Fungsi," "Kontinuitas *Gorga* Batak Toba," "Aplikasi Ornamen Sumatera Utara Kreasi Kekinian pada Desain Busana Ready-to-wear dengan Teknik Sablon Printing," and "Redesign of North Sumatra Ornaments in The Catalog with Circular Composition" explain that the beliefs of the people of North Sumatra about the mysticism of North Sumatra ornaments have begun to change. [1]

This research has implemented QR Codes as an effort to preserve North Sumatra ornaments, which have undergone changes in the beliefs of the North Sumatra community. Efforts to preserve North Sumatra ornaments have been identified and classified into a large database on Google Drive; the data on North Sumatra ornaments has been integrated with information that is attractively compiled in layouts, including: 1) the cover of each North Sumatra ornament; 2) traditional North Sumatra ornaments sourced from Baginda Sirait; 3) manual redesign of North Sumatra ornaments; 4) digital redesign of North Sumatra ornaments; 5) redesign of North Sumatra ornaments with traditional colors (red, black, white, yellow, and green) manually; 6) digital redesign of North Sumatra ornaments with contemporary color creations; and 7) visualization, meaning, form, creation process, and

registration at the HkI. This information on North Sumatra ornaments has been stored in Google Drive URLs and converted into QR Codes.

The objective of this research to implement QR Codes that facilitate the rapid preservation of the ancestral heritage of the North Sumatra community; when QR Codes are scanned on other devices on smartphones, the information on North Sumatra ornaments stored in Google Drive will open immediately without the need to type complicated URLs. One of the advancements in smartphones has enabled the creation of QR Codes, with younger generations as the primary users, making this an efficient and effective initial step in disseminating information about North Sumatra ornaments. The scanning process on QR Codes is directly connected to Google Drive URLs, which store valid and original information about North Sumatra ornaments. This information is sourced from several references, including literature studies, interviews with North Sumatra cultural historians, and direct observations. The implementation of QR Codes realized in this research is expected to provide convenience to the people of North Sumatra in introducing North Sumatra ornaments to tourists seeking important information and supporting its educational preservation as a cultural heritage of the North Sumatra community.

The integrated designs of the ornaments and QR Codes from the seven local ethnic of North Sumatra have been printed on T-shirts made of 20s cotton combed fabric using screen printing technique based on principles of composition and aesthetics. The goal of preserving North Sumatra ornaments using QR Codes has not been envisioned by other authors. This is the rationale behind the authors' immediate introduction of North Sumatra ornaments so that the community, which rarely sees the visualization and meaning of North Sumatra ornaments, can preserve and pass them on to future generations. The province of North Sumatra has a wide variety of ornaments spread across seven local ethnicities, each with its unique characteristics, both in form and meaning.

1.1 Implementation of QR Codes

Implementation refers to execution or application, often related to tracking information by users in the search process, with the aim of simplifying and saving operational time [2]. This means that this implementation facilitates users in the search process for information related to North Sumatra ornaments, which have diverse forms, symbols, and meanings specific to each ethnicity in North Sumatra. Additionally, ornaments are also used as decorative elements, often resembling natural forms, with compositions arranged based on meaning to support value congruence, thus presenting both beauty and the significance inherent in each applied form. [3]

QR Code (Quick Response Code) is a two-dimensional matrix image with data storage capabilities. QR Codes evolved from barcodes, now serving as symbolic identifiers of objects [4]. QR Codes have the ability to store various explanations within them, such as URLs (Uniform Resource Locators), numbers, text, and more. QR Codes excel in storing information vertically and horizontally. Therefore, QR Codes can hold more information than barcodes, which are limited to a single dimension. [5]

Based on previous literature reviews, many studies have implemented the use of QR Codes in various fields of life as devices capable of fast and accurate searches without having to type what is being searched for in a URL, including: 1) Manu in 2019 implemented QR Codes to identify historical objects in museums; 2) Faisal and Anas in 2020 implemented QR Codes to enhance customer satisfaction services in restaurants; 3) Manullang and Hastuti in 2021 implemented QR Codes as a medium for introducing history in high schools to engage

students; and 4) Ismail et al. in 2021 used QR Codes as a medium for conveying information about tree species in botanical gardens. Based on the analysis of previous research, it is understood that QR Codes serve to facilitate fast and accurate searches to simplify daily life. [6]

The use of QR Codes in various locations allows individuals to quickly, accurately, and precisely access information contained in the code scanned by smartphones. The use of QR Codes has so far focused on a single link, meaning that the information contained in the code is intended for one purpose only, without providing comprehensive information. In line with this information, the development of QR Codes as essential devices is crucial, as they can provide comprehensive and necessary information to the public because the use of QR Codes is rarely applied to facilitate searches for information without having to conduct literature studies, observations, or interviews. [7]

QR Codes can be read by scan support applications on smartphones from any direction because the device has position detection patterns located at three corners. QR Codes can also be read even when there is distortion. QR Codes have distinct characteristics from barcodes, one of which is the ability to store large amounts of data [8]. Additionally, QR Codes aim to provide readers with easy access to information, deliver it quickly, and provide accurate information [9]. The implementation of QR Codes in this research uses codification starting from the data collection of North Sumatra ornaments. Codification for each piece of information requires a block code for each digital item, as the code has meaning, and subsequently, QR codification is created. [10]

2.1 Screen Printing Technique

T-shirts made of 20s cotton combed fabric with screen printing technique have evolved and are popular among the younger generation. T-shirts with screen printing technique involve printing on T-shirt fabric using chemical inks on fabric media with the aid of computers and printing tools [2]. Screen printing technique on 20s cotton combed T-shirts can be used as a medium to preserve North Sumatra ornaments with QR Codes that store information in URL links, allowing the community to easily conduct searches quickly and effectively without having to type the names of North Sumatra ornaments, which are often in their original ethnic languages; the search process can be done simply by scanning the QR Code using scan support devices on smartphones with screen-printed T-shirt designs.

2 Research Methods

This study utilized a qualitative research method, focusing on an artistic–aesthetic exploration to implement QR Codes as a tool for preserving the cultural heritage of North Sumatra ornaments. The analysis of this research is structured into five key stages: analysis stage, design stage, implementation stage, testing stage, and usage and maintenance stage.

In the first stage, the analysis phase, data is gathered through literature review; particularly referencing sources like Baginda Sirait, to identify the challenge of North Sumatra ornaments becoming less recognized by the younger generation. This stage also involves collecting ornament motifs from the seven local ethnic in North Sumatra through direct observation of architecture that incorporates these ornaments and conducting interviews with local historians to support the redesign of North Sumatra ornaments.

The second stage, design, commences once sufficient data has been collected and analyzed. System requirements are defined by selecting two ornament designs from each of the seven North Sumatra local ethnic. These designs are screen-printed, with QR Codes storing information on the visual form, meaning, and creation process of each ornament. This phase includes creating layouts that feature the cover of each ornament, sourced from Baginda Sirait, as a legacy of North Sumatra heritage. It involves manual and digital redesigns of traditional ornament colors (red, black, white, yellow, and green) and modern reinterpretations, along with explanations of the visualization, meaning, form, and creation process. Each design's URL is converted into a QR Code and stored on Google Drive.

The third stage, implementation, involves preparing the QR Codes as developed in previous stages. The design layout, including the logo of the Politeknik Negeri Media Kreatif, North Sumatra ornament, QR Code, and typography, is organized based on design principles. This stage includes screen-printing seven T-shirts, each representing an ornament from one of North Sumatra's seven local ethnic, onto 20s cotton combed fabric. The QR Code enhances ease of access, enabling users to search quickly and accurately without needing to type a URL. This streamlines the process for the people of North Sumatra to recognize, understand, preserve, and maintain these traditional ornaments.

In the fourth stage, testing is conducted through User Acceptance Testing (UAT) to verify that QR Codes can be accessed on smartphones and that all design elements, from the North Sumatra ornament covers to the creation processes, are easily readable. Additionally, respondents with backgrounds in Information Technology evaluate the unique QR Codes to confirm their effective operation for each of the seven ethnic designs.

The final stage, usage and maintenance, examines the QR Code's scanning function for any flaws. QR Codes are tested after screen-printing on T-shirts, and durability testing is done by washing the T-shirts multiple times to ensure the screen-printed design's longevity. This iterative testing process helps refine the QR Code application, ensuring its effective, error-free use by the North Sumatra community.

The research stages of this qualitative study are summarized in a flowchart as follows:
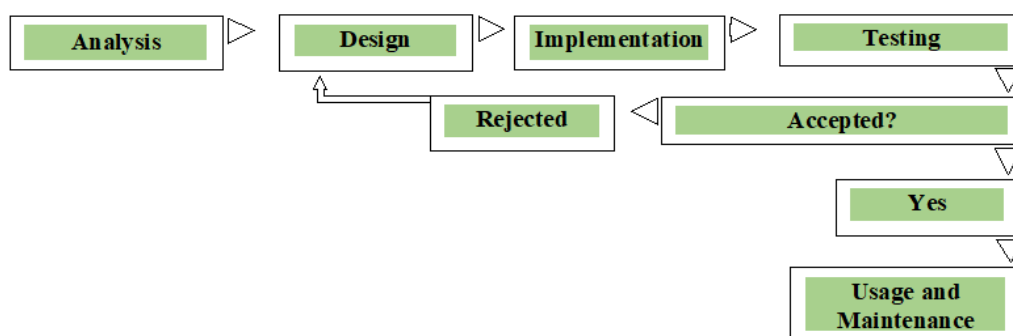
Fig 1. The Research Stages of This Qualitative Study.

3   Result and Discussion

The layout of the QR Code information is carefully composed with visualizations of North Sumatra ornaments, ranging from traditional to modern, based on a redesign process

that makes them acceptable and aligned with contemporary styles favored by the younger generation. The designs aim to convey an elegant, simple, neat, comfortable, and stable impression. The T-shirts are made from 20s combed cotton and feature highly precise screen printing with colors that are attractive yet not overly bright, ensuring that the design elements are well-coordinated. The result of this research is seven T-shirts made from 20s combed cotton, each featuring 14 North Sumatra ornaments and 14 QR Codes, designed to be as visually appealing as possible with a combination of imagery, typography, and colors based on the current creative styles of the younger generation. The visual representation of the North Sumatra ornaments and QR Codes occupies 80% of the design, while typography makes up the remaining 20%, creating a systematic arrangement. This allows viewers to easily identify the traditional ornaments passed down by the ancestors of North Sumatra communities and understand the symbols believed by the seven local ethnic in North Sumatra. Additionally, in the layout design of the T-shirts, the information is structured starting from the cover of North Sumatra ornaments from the seven local ethnic, through to the creation process, ensuring that it is easy to read and the images are clearly visible.

3.1 Layout and Design of QR Code Information with North Sumatra Ornaments

This research has produced 14 North Sumatra ornaments along with QR Codes, each of which provides information about the motifs and symbols historically believed by the Batak Mandailing, Batak Toba, Batak Simalungun, Batak Karo, Batak Pak-pak Dairi, Melayu, and Nias local ethnic. The North Sumatra ornamental motifs include: 1) *Gorga Parbincar Mataniari (Singengu)* motif and *Gorga Gimbang* motif from Batak Mandailing local ethnic; 2) *Gorga Simarogung-Ogung* motif and *Gorga Simata Ni Ari (Matahari)* motif from Batak Toba local ethnic; 3) *Gorga Desa Na Uwaluh (Bindu Matogu)* motif, *Gorga Suleppat* motif, and *Gorga Ambulu Ni Uwou (Jombut Uwou)* motif from Batak Simalungun local ethnic; 4) *Gerga Tapak Raja Sulaiman* motif and *Gerga Desa Si Waluh* motif from Karo local ethnic; 5) *Gerga Parsalimbat* motif and *Gerga Desa Siwaluh* motif from Batak Pak-pak Dairi local ethnic; 6) *Ragam Hias Sinar Matahari Pagi* motif and *Ragam Hias Roda Bunga* motif from Melayu local ethnic; dan 7) *Sora-Sora Nioafi-afi* motif, *Sora-Sora Nioiozasai* motif, *Sora-Sora Niotalinga Woli-Woli* motif, *Sora-Sora Niosolafiga* motif, and *Sora-Sora Niogama* motif from Nias local ethnic. This demonstrates that North Sumatra province possesses a rich variety of ornamental motifs, each with distinctive characteristics and symbolic appeal, original to the seven local ethnic.

Implementation of QR Codes the unique codification of the QR Codes is intended to make information about North Sumatra ornaments easily and quickly accessible, preserving the authenticity and originality of the motifs and symbolic meanings specific to the seven local ethnic in North Sumatra. The T-shirt designs, using screen printing technique, convey a non-symmetrical, neat, modern, and stable impression. The colors chosen are characteristic of the seven North Sumatra local ethnic, with a white base for the T-shirts. The material used is 20s combed cotton with a single knit weave, making it thicker than other types of combed cotton. The research produced seven T-shirt designs, as detailed below:

1) First T-Shirt: Batak Mandailing Local Ethnic
The design concept for the first T-shirt involved a creation process that considered various design perspectives and the current needs of the Batak Mandailing local ethnic. This T-shirt features the logo of Politeknik Negeri Media Kreatif, redesigned North Sumatra ornaments,

QR Codes, and typography as decorative elements with aesthetic value, making the design more appealing and visually pleasing. Additionally, the design reflects the ancestral heritage of the Batak Mandailing local ethnic. The T-shirt visualizes the *Gorga Parbincar Mataniari (Singengu)* motif and *Gorga Gimbang* motif, predominantly using black, red, and white to avoid being overly conspicuous.

(a)   (b)   (c)

Fig 2. (a) T-Shirt design front and back views, (b) QR Code *Gorga Parbincar Mataniari (Singengu)*, (c) QR Code *Gorga Gimbang*.

2)   Second T-Shirt: Batak Toba Local Ethnic

The design concept for the second T-shirt involved a creation process that considered various design perspectives and the current needs of the Batak Toba local ethnic. This T-shirt features the logo of Politeknik Negeri Media Kreatif, redesigned North Sumatra ornaments, QR Codes, and typography as decorative elements with aesthetic value, making the design more appealing and visually pleasing. Additionally, the design reflects the ancestral heritage of the Batak Toba local ethnic. The T-shirt visualizes the *Gorga Simarogung-Ogung* motif and *Gorga Simata Ni Ari (Matahari)* motif, predominantly using black, red, and white to avoid being overly conspicuous.

(a)   (b)   (c)

Fig 3. (a) T-Shirt design front and back views, (b) QR Code *Gorga Simarogung-Ogung*, (c) QR Code *Gorga Simata Ni Ari (Matahari)*.

3)   Third T-Shirt: Batak Simalungun Local Ethnic

The design concept for the third T-shirt involved a creation process that considered various design perspectives and the current needs of the Batak Simalungun local ethnic. This T-shirt features the logo of Politeknik Negeri Media Kreatif, redesigned North Sumatra ornaments, QR Codes, and typography as decorative elements with aesthetic value, making the design more appealing and visually pleasing. Additionally, the design reflects the ancestral heritage of the Batak Simalungun local ethnic. The T-shirt visualizes the *Gorga Desa Na*

Uwaluh (Bindu Matogu), Gorga Suleppat motif, and *Gorga Ambulu Ni Uwou (Jombut Uwou)* motif, predominantly using black, red, and white to avoid being overly conspicuous.

(a)   (b)   (c)

Fig 4. (a) T-Shirt design front and back views, (b) QR Code *Gorga Desa Na Uwaluh (Bindu Matogu)* and *Gorga Suleppat*, (c) QR Code *Gorga Ambulu Ni Uwou (Jombut Uwou)*.

4) Fourth T-Shirt: Karo Local Ethnic

The design concept for the fourth T-shirt involved a creation process that considered various design perspectives and the current needs of the Karo local ethnic. This T-shirt features the logo of Politeknik Negeri Media Kreatif, redesigned North Sumatra ornaments, QR Codes, and typography as decorative elements with aesthetic value, making the design more appealing and visually pleasing. Additionally, the design reflects the ancestral heritage of the Karo local ethnic. The T-shirt visualizes the *Gerga Tapak Raja Sulaiman* motif and *Gerga Desa Si Waluh* motif, predominantly using black, red, and white to avoid being overly conspicuous.

(a)   (b)   (c)

Fig 5. (a) T-Shirt design front and back views, (b) QR Code *Gerga Tapak Raja Sulaiman*, (c) QR Code *Gerga Desa Si Waluh.*

5) Fifth T-Shirt: Batak Pak-pak Dairi Local Ethnic

The design concept for the fifth T-shirt involved a creation process that considered various design perspectives and the current needs of the Batak Pak-pak Dairi local ethnic. This T-shirt features the logo of Politeknik Negeri Media Kreatif, redesigned North Sumatra ornaments, QR Codes, and typography as decorative elements with aesthetic value, making the design more appealing and visually pleasing. Additionally, the design reflects the ancestral heritage of the Batak Pak-pak Dairi local ethnic. The T-shirt visualizes the *Gerga Parsalimbat* motif and *Gerga Desa Siwaluh* motif, predominantly using black, red, and white to avoid being overly conspicuous.

Fig 6. (a) T-Shirt design front and back views, (b) QR Code *Gerga Parsalimbat*, (c) QR Code *Gerga Desa Siwaluh.*

6) Sixth T-Shirt: Melayu Local Ethnic

The design concept for the sixth T-shirt involved a creation process that considered various design perspectives and the current needs of the Melayu local ethnic. This T-shirt features the logo of Politeknik Negeri Media Kreatif, redesigned North Sumatra ornaments, QR Codes, and typography as decorative elements with aesthetic value, making the design more appealing and visually pleasing. Additionally, the design reflects the ancestral heritage of the Melayu local ethnic. The T-shirt visualizes *Ragam Hias Sinar Matahari Pagi* motif and *Ragam Hias Roda Bunga* motif, predominantly using black, yellow, and green to avoid being overly conspicuous.

Fig 7. (a) T-Shirt design front and back views, (b) QR Code *Ragam Hias Sinar Matahari Pagi*, (c) QR Code *Ragam Hias Roda Bunga.*

7) Seventh T-Shirt: Nias Local Ethnic

The design concept for the seventh T-Shirt involved a creative process that incorporated various insights from designers and took into account the current needs of the Nias local ethnic. The seventh T-Shirt design features the logo of Politeknik Negeri Media Kreatif, redesigned Sumatra Utara ornaments, QR Codes, and typography as decorative elements, enhancing the aesthetic appeal to make it more attractive and pleasing to the eye. This design also reflects the heritage of the Nias local ethnic. The T-Shirt visualizes motifs such as *Sora-Sora Nioafi-afi, Sora-Sora Nioiozasai, Sora-Sora Niotalinga Woli-Woli, Sora-Sora Niosolafiga,* and *Sora-Sora Niogama*, predominantly using black, red, and white colors to maintain a subtle yet elegant appearance.

Fig 8. (a) T-Shirt design front and back views, (b) QR Code *Sora-Sora Nioafi-afi* and *Sora-Sora Nioiozasai*, (c) QR Code *Sora-Sora Niotalinga Woli-Woli, Sora-Sora Niosolafiga,* and *Sora-Sora Niogama.*

3.2 Ornaments from Sumatra Utara Registered as HkI

The research outcomes include 14 redesigned ornaments from Sumatra Utara, categorized based on the beliefs of the seven local ethnic in the region. The study also provides an explanation of the visual concepts, meanings, forms, and creation processes rooted in the cultural beliefs of Sumatra Utara's communities. The works registered as intellectual property (IP) are listed as follows:

Table 1. Ornaments from Sumatra Utara Registered as HkI

Title	Certificate Number	Date of Announcement
Ornamen Sirkular Mata Angin dari Tempat Duduk Raja Sulaiman	EC00202449197	June 12, 2024
Ornamen Sirkular Sinar Penerangi Dewi Sri	EC00202449198	June 12, 2024
Ornamen Sirkular Pemersatu Delapan Penjuru dari Arah Mata Angin	EC00202449199	June 12, 2024
Ornamen Sirkular Ikatan Keselamatan Antar Penjuru Sumatera Utara	EC00202449201	June 12, 2024
Ornamen Sirkular Kejayaan dan Kekuatan Sang Raja	EC00202449202	June 12, 2024
Ornamen Sirkular Bunga dibawah Sinar Matahari Pagi	EC00202449203	June 12, 2024
Ornamen Sirkular Karakter Pahlawan dengan Kebulatan Hatinya	EC00202449282	June 12, 2024

4 Conclusion

This research aims to contribute significantly to the preservation of cultural heritage in North Sumatra through the use of modern technology. The recommendations are directed toward preserving North Sumatra ornaments that face the threat of extinction, underscoring the need for QR Codes to facilitate information retrieval on the shapes, colors, and meanings of these traditional designs. The preservation of these ornaments requires urgent attention

from the North Sumatra community, particularly from younger generations, who should play an active role in promoting and introducing them; similar to how batik is embraced and promoted throughout Indonesia and worldwide. It is crucial that North Sumatra ornaments be recognized by future generations as an essential aspect of the region's cultural heritage. The author recommends that the people of North Sumatra incorporate local identity into everyday fashion by showcasing these ornaments in a modern style, especially encouraging the younger generation to adopt North Sumatra ornaments as part of their fashion expression. Wearing T-shirts featuring these designs in other cities or abroad will foster a collective awareness that North Sumatra ornaments deserve attention and preservation. The primary material used is 20s combed cotton, a comfortable and breathable fabric, making it ideal for this purpose. Further exploration includes screen printing techniques to visualize the Politeknik Negeri Media Kreatif logo, 14 North Sumatra ornaments, QR Codes, and typography, enriching the aesthetic elements of white-base T-shirts.

The integration of QR Codes and North Sumatra ornaments on 20s cotton combed T-shirts using screen printing techniques is a first step in preserving the unique ornaments of the seven local ethnic in North Sumatra while fostering interest among young people to learn about and preserve these cultural symbols. The design of seven T-shirts showcases the logo of Politeknik Negeri Media Kreatif, North Sumatra ornaments, QR Codes, and typography in a composition that blends modern and traditional elements to create a contemporary youth fashion style. These designs draw inspiration from the cultural beliefs of the Batak Mandailing, Batak Toba, Batak Simalungun, Karo, Batak Pakpak Dairi, Melayu, and Nias ethnicities, featuring traditional ornaments like *gorga, gerga, sora-sora*, and *Ragam Hias* decorative patterns passed down from their ancestors. This composition is applied to T-shirt designs intended as souvenirs from Politeknik Negeri Media Kreatif PSDKU Medan, while also serving as a means of preserving the cultural legacy of North Sumatra communities. Using screen printing techniques, the white-base 20s cotton combed T-shirts with the logo of Politeknik Negeri Media Kreatif, North Sumatra ornaments, QR Codes, and typography achieve a casual and modern look that feels contemporary rather than outdated.

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