



A Real Time Tracking System for School Forms Using QR Codes with Watermarking Algorithm

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Abstract: Document tracking is considered crucial, particularly in schools that still use traditional administration methods. Meanwhile, the usage of forms in a school's office, such as the Budget Division, is still necessary and should not be removed as per the school's current policy. As a result, the school should have a solid monitoring system in place to ensure that these forms are stable and reliable. The tracking system is a flexible solution that may be used as a collaboration and communication tool, and it can aid in the construction of a traceable process. The researcher investigates the school's key concerns regarding using paper-based forms, as well as how the school can track its progress and location. The usage of a watermarking algorithm and a QR code-based tracking system was explored in this study. In addition, the structure, applications, security, and strategies for using a QR code are discussed. Existing watermarking technology, according to relevant research, has the opportunity for development in terms of imperceptibility and endurance in the future.

Keywords: QR Code; Tracking System; Watermarking; Algorithm; Budget Forms.

1. INTRODUCTION

It appears to be evident that education is considered a major industry by all governments around the world. As a result, education receives a specific percentage of every country's budget. These funds are required to pay employees, maintain and develop teaching and learning facilities, increase teacher quality and welfare, and deliver the curriculum.

Furthermore, as a result of the fast development of the education system at all levels, education spending has continued to rise. The truth is that the education sector's requirements



and demands are endless. The money available to meet them was limited, necessitating the use of budgeting to prioritize these needs.

For effective implementation of the strategic goals, the school administration relies primarily on a strong budgetary structure. The key to achieving these goals is the establishment of allocation of costs and their execution or implementation. This demands school planning to guarantee that resources are used efficiently. Budgeting is the process of putting together a statement of expected revenue and recommended expenditures. In other words, it's a goal-setting exercise.

The efficient planning and management of school funds by school administrators are critical to the achievement of expected educational goals and objectives, it is then the budget became the document that represents the plan expressed in money and submitted for approval. It takes time because it requires a thorough and methodical examination which should be broken down and shown item by item.

Budgeting decision-making involves several steps, including determining overall spending levels, allocating estimated available resources, preparing and approving budgets, releasing funds, procurement, monitoring and evaluation, and cash management, which is why good budgeting typically requires efficient and effective financial management and execution.

It is considered a time-consuming process. It might take weeks, if not months, to develop, with amounts added and changed as new information becomes available. As a result, the department must aim to create documents that anybody can read, understand, and monitor. If budget workings are unclear and data are not properly labeled, even the approver will struggle to grasp the documents as time passes. Assuming that budgeting documents will be distributed to a wide range of people and it may be tough to trace unless the workings are monitored, ensuring that the documents reached all parties involved.

Everyone involved in the budgeting process had to stick to a set of procedures while remaining flexible. The budget must be administered centrally to keep it balanced. This is the responsibility of the school administration, who ensures that no expenditures are made without prior clearance to bring the entire educational plan to reality. This means that the budget cannot be used to accomplish educational plans and programs if it is not referred to and consulted regularly. All spending in the areas of program organization, staffing, supplies, building and equipment development and maintenance, and other school services should be coordinated through the budget. As a result, budget reviews frequently take longer than necessary.

The paper form is one of the most commonly used instruments in processing connected budget operations in numerous working situations throughout the institution. However, there have been several concerns raised about the usage of paper forms, one of which being the inefficiency with which they are transmitted and monitored. The time it takes for these forms to arrive reach their destination could range from hours to weeks if not properly tracked. Also, with a large number of forms that will be distributed regularly whether manually or even by email platform is prone to be misled or perhaps missing. Not only that, but they may



require additional features or initiative to accurately back up and store the records, as well as maintain track of the forms till they are completed. These considerations will influence the amount of time and effort required to manually update their records daily. That is why document tracking is seen as critical, especially in schools that still rely on traditional management approaches.

As a result, the school should take serious about making these forms secured, they must determine the best method to balance their usage of forms without compromising the controls, confidentiality, and that will improve the efficiency and productivity of the operations. In this connection, effective monitoring may help the school to manage all of the work properly.

The tracking system is a solution that can be used as a collaboration tool as well as a communication tool that is easy to adjust and can help in the establishment of a traceable process. Various tracking systems are now in use all around the world. It is frequently employed to detect and find an object or a person in a timely and sequential manner. Collecting, storing, and distributing data or information is the function involved in this process. As a result, the researcher came up with the concept of looking at other solutions that would be useful in assisting the school in easing the process of keeping track of the current forms. The utilization of QR codes is one that drew the researcher's attention.

Research Elaborations

Background

Various tracking systems are now in use all over the world, it is used to keep track of and locate an object or a person in a timely and orderly manner. However, paper forms are still in use in organizations like schools that still follow traditional management methods, which can sometimes cause problems. Furthermore, paper-based instruments have inherent risks and limits, as well as being costly and time-consuming, data must be manually coded and double-checked for accuracy, as well as carefully monitored, which takes time and increases the chance of human error [1]. Meanwhile, the usage of forms in a school's office, such as the Budget Division, is still necessary and should not be removed as per the school's current policy. Yet, this should be closely controlled so that the allocation of budget requests is not delayed and the need for one's office is not compromised.

Since the school's operations still rely on paper forms, the researcher proposes a workable solution to the problems. A study was conducted to determine the accuracy, reliability, and application of a QR Code [2] that would be used in the manual forms with a tracking system to improve the school's budgeting process. In terms of security and resilience, a QR code watermarking technique is proposed in this research [3].

Objectives

The following are the objectives that have to do with the development of the proposed system:

1. To investigate the usage of a QR code to track the management of hardcopy documents.
2. To create a safe QR code technology using the Watermarking Algorithm.
3. To design a tracking system for managing the documents.



Literature Review

Important information from published sources will be discussed and detailed in this section. The related research will be utilized to build a proposal for the development of a tracking system that uses QR Codes with stronger digital security features to monitor the school's budget forms. A review of the structure, application, security, and solution of the QR code is one of the review's components.

Quick Response Code (QR Code)

Denso Wave, a Japanese company, created the first matrix barcode for the automotive sector, known as a QR code. Because of its superior readability and storage capacity to regular UPC barcodes, the QR Code method has gained popularity outside of the automobile industry. The QR code's features include high data capacity, filth and damage resistance, high-speed scanning, small print-out size, 360-degree reading, and structural application flexibility [4].

QR codes have already surpassed traditional barcodes in some industries due to a variety of advantages such as,

- A basic scan is used to acquire the desired data.
- The demultiplexing data can be accessed and stored on the server by the main user.
- It is quite accurate in terms of image capturing.
- The user can immediately recognize the QR code.
- The database is automatically updated with precision and reliability each time the code is scanned.
- Allows for a quick search and reduces the amount of time spent on tracking [5].

QR Code Structure and Application

QR codes can contain a lot more data on a smaller scale because of their matrix structure which can carry around 7089 numeric and 4296 alphanumeric characters. Different parts of a QR code are designated for specific functions. Function patterns included things like a finder, a separator, a timing pattern, and an alignment pattern. When encoding data, no function patterns should be used. The finder patterns on the symbol's three corners are meant to make it easier to find the symbol's location, size, and inclination.

In addition, its ability to scan in any direction adds to its flexibility. They have a wide range of applications because of their ease of usage. In recent years, government organizations and large corporations have begun to use them for expedited processing [6]. Moreover, vision-based automatic identification technology, which enables smartphones to recognize image codes and deliver a wide range of services, has received a lot of attention. As the number of smart and Web-enabled mobile devices has expanded, the number of creative apps that use QR codes has gradually increased, giving a wide range of applications to make life easier for users [5, 6].

Users who have a smartphone with a camera can scan the QR Code, which can be used to display text, provide contact information, or even open a webpage in the smartphone's



browser. QR Codes can be printed and displayed anywhere a mobile phone user might scan the code [7].

QR Code Generation

A QR code is created using a web-based tool. If you type 'QR code generator' into a search engine, you'll obtain a list of suitable sites. Using the 'QR code generator' webpage, users can design their QR codes. A QR code's quality is quite stable, and it may be used for a long time without deteriorating [8].

For decoding, scanning, and reading a QR code, you'll need a scanner application. These applications can be downloaded for any smartphone with a camera. After snapping a picture of a QR code, the QR code's application procedures begin, and it is then converted into text that can be read. Contact information or the URL of a company's website can be stored in the code. QR codes can be programmed for new applications such as web browsers, instant messaging, email, and even streaming video to create a meaningful and interactive customer experience [9]. Without a machine, humans can't manually decipher QR Codes, but smartphones can do so quickly and easily. The software in their phones decodes the messages and displays, manipulates, or stores the information on their mobile devices.

QR Code Security And Solutions

Mobile phones are also growing more and more like personal digital assistants, capable of much more than just calling. Rapid data transfer will be a necessity in the hereafter. In the future, the link between print media and the internet will be an important phase in the digitization of human civilization, as the number of people using mobile devices to access the Internet will grow exponentially [10].

Despite the fact that QR codes are becoming more widely used, there is still a risk that they may be used maliciously in the marketplace. The potential of a security breach becomes a serious concern when a QR code contains sensitive information or data. Because a QR code only highlights a square barcode with a unique design, people have no notion if it will take them to a respectable site or a malware-infested site. Some of the attacks that may be carried out with modified QR codes are SQL injection, command injection, phishing, fraud, and social engineering [11]. Security has been a major concern and there is a high risk of being targeted by cyber-attacks [12].

Moreover, as more and more technologies become connected to the internet it is becoming increasingly important to protect data privacy or data protection [13]. Internet and communication technology innovations have contributed to the rapid distribution of digital multimedia content. So, there's been a rise in copyright infringement and the need for stronger copyright protection tactics. It's a way of determining who owns digital products and how they're being used illegally [14]. In recent years, the research community has seen much activity in the area of digital watermarking as an additional tool in protecting digital content. Document watermarking was the focus of much of the early work on identifying potential flaws in digital content's intellectual property rights and addressing these issues with early watermarking algorithms [15].



Digital watermarks are bits that are inserted into digital images, audio, or video in order to identify the source and authenticate the information. The purpose of the watermark technique is to seamlessly hide the secret information inside the original message, making it more resistant to attacks. Watermarking approaches have been proposed by certain researchers in recent years [16]. Copyright protection, fingerprinting, authentication, copy control, tamper detection, and data hiding applications such as broadcast monitoring are all examples of digital watermarking applications. For audio, photos, video, graphics, and text, watermarking algorithms have been suggested, and great review papers on multimedia watermarking may be found. Non-lossless reversible watermarking techniques, for example, can be used to ensure that cover media authentication is 100% accurate, which was the initial goal of reversible watermarking solutions [17].

Digital Watermarking

A data hiding technique that embeds a message into a multimedia work such as a picture, text, or other digital item is known as digital watermarking technology.

Watermarks are a type of mark that is regularly applied to paper during the manufacturing process. The producer of the paper is identified by these marks. The digital watermarking technology, like any other data-hiding method, has its own set of requirements for making the digital watermark as robust as possible. These needs include capacity, security, efficiency, and imperceptibility [18].

The following requirements are considered when designing digital watermarking schemes:

- The watermark should be able to withstand a variety of attacks and manipulation procedures.
- The quantity of data can be embedded in a digital format
- If the data is altered or extracted, it should not affect the carrier object.
- If the watermark is applied, it should not affect the content of the carrying object.

The following are the most important applications for which digital watermarking is applied.

1. Protection of digital copyright.
2. Fingerprinting and transaction tracking.
3. Management of digital content.
4. Authentication and verification of digital content.
5. Synchronization System for Broadcasting.
6. Preventing forgery.

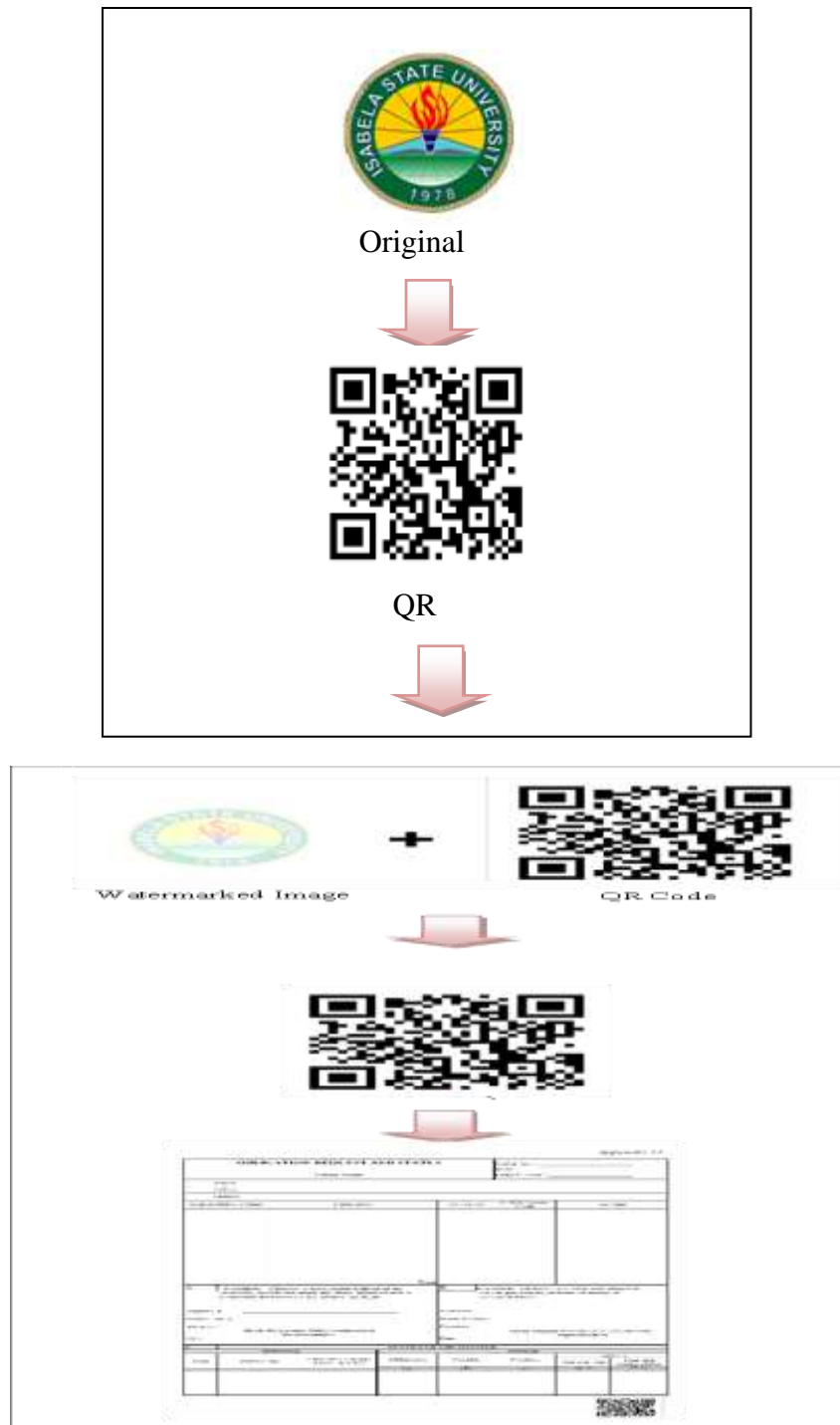
2. RESULT OR FINDINGS

Copyright protection and authenticity have grown more important in the digital world, and many watermarking techniques have been created to ensure this. For a digital invisible watermarking to be inserted into a QR code, different approach was used [19].

Watermarking Process

Meanwhile, a QR code watermarking technique is proposed in this research. The researcher uses an image logo as a watermark. The proposed method's framework is depicted in Figure 1

Figure 1. The framework of the proposed method.





The concept of putting a particular sign, called a watermark, inside a document ensures that the data is permanently linked to a specific piece of copyright information. It's a good approach to keep the data's copyright intact after it's been sent. We're utilizing a QR code which not only hides the information but also makes it simple to scan [20]. Digital watermarking is an important and effective technology for copyright protection and security authentication. As a result, it's become a hot research topic in recent years, especially when it comes to combining digital watermarking technology with two-dimensional code technology [21]. It solves the problem of falsifying by incorporating a digital watermark into a QR code, which provides adequate level of protection and validity.

In addition to incorporating a watermark algorithm into the school's form, a tracking system is taken into consideration. The suggested system tracks and validates the status of school forms in a secure environment, as well as tracking the transit process from the requesting/originating offices to the receiver's division/unit, using QR Code technology [22].

3. CONCLUSIONS

To begin, this study examines the school's key concerns about using paper-based forms, as well as the benefits and downsides of doing so, as well as the structure, applications, security, and solutions for using a QR code. We employ an algorithm and a QR code-based tracking system to track the status and whereabouts of the school's form [23].

The proposed method is imperceptible, secure, and has a high level of integrity. The information is encoded into QR codes that humans cannot read or comprehend using a QR code generator. Any smartphone with a built-in camera, on the other hand, can simply scan the URL included in these QR codes. A new approach that combines QR codes with a watermarking algorithm is given to keep communication secure from unauthorized access [24].

The suggested methodology includes an encoding and decoding operation at the transmitter and receiver. To address the QR code security issue in real-world applications, this study presented a QR code watermarking algorithm [25].

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