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SBVLC: Secure Barcode-Based Visible Light Communication for Smartphones

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Abstract: ***Short range communication technologies are the emerging technology in mobile phone based applications. One of the technologies used in short range communication is Near Field Communication (NFC). These short range communication technologies are used in mobile advertisement, data sharing and contactless payments. For this purposes 2D barcodes are being introduced in mobile applications. Since every front camera enabled mobile phones can able to scan 2D barcodes. In this paper we are going to implement 2D barcodes in mobile phone applications which are very helpful for mobile payments and personal identification. With the help of visual light communication 2D barcodes are displayed on the smart phone screens when we use barcodes. In this paper we designed a color 2D barcode for providing better security features with the help of visible light communication (VLC) between smart phones. In this paper we are going to develop a secure 2D color barcode which secure private information during private data sharing process. Finally our experimental result shows that our proposed system provides better security when compared to normal 2D barcode schemes.***

Keywords: Visible Light Communication (VLC), Near Field Communication(NFC), Barcode, QuickResponse (QR) code, Data Hiding

1. Introduction

A 2D (two-dimensional) barcode is a graphical image that stores information both horizontally as one dimensional bar codes do and vertically. As a result of that construction, 2D codes can store up to 7,089 characters, significantly greater storage than is possible with the 20 character capacity of a uni-dimensional barcode. 2D barcodes are also known as quick response codes because they enable fast data access. 2D barcodes are often used in conjunction with smart phones. The user simply photographs a 2D barcode with the camera on a phone equipped with a barcode reader. The reader interprets the encoded URL, which directs thebrowser to the relevant information on a Web site. This capability has made 2D barcodes useful for mobile marketing. Some 2D barcode systems also deliver information in a message for users without Web access.

Barcodes became commercially successful when they were used to automate supermarket checkout systems, a task for which they have become almost universal. Their use has spread to many other tasks. 2-D bar codes (sometimes called matrix codes) carry information in two directions: vertically and horizontally. Accordingly, 2-D bar codes are capable of holding tens and even hundreds of times as much information as 1-D bar codes. Still, 2-D codes aren't perfect for every application. Because they're more complex than 1-D codes, they require more powerful scanners to decode. What's more, many people are simply unfamiliar with the technology, which hinders widespread adoption. But thanks to the smartphone in your pocket, that may all be about to change.

Based on our security analysis, we develop three secure data exchange protocols that encode information in barcode streams. Such protocols are useful in many mobile applications including private information sharing, secure device pairing, and contactless mobile payment, etc. Three secure communication schemes are:

1) Two-phase message transfer scheme: It is designed for smartphones to opportunistically exchange data such as contacts and photos.

2) Smartphone handshake scheme: It is developed for the standard key-exchange-then-encryption paradigm. The scheme serves as an alternative key exchange protocol to the conventional DH key exchange protocol.

3) All-or-nothing data streaming scheme: It is tailored for secure temporary data transfer without the key exchange phase.

Color Barcode for Mobile Applications, 2nd barcodes have gained quality mutually of the key pervasive technologies for mobile applications on good Phones. They will be used as shortcuts to computer address links, a way to store contact data for simple transfer admission tickets or boarding passes and tokens for retrieving digital data, like public transportation timetables or recent turn out production data, either directly from the barcode itself orthrough a networked info server. Most mobile applications use black-and-white 2nd barcodes that carry solely a restricted quantity of encoded knowledge. With exploitation a lot of colors here are able to store most quantity of knowledge within.

Conventional 1D codes store up to 20 decimal digits, the QR code is able to store from several dozen to several hundred times more data than 1D.QR codes can handle a large variety of data, such as numeric and alphabetic characters, binary, Kana, Kanji, and Hiragana (Japanese) symbols and control codes. One symbol can encode up to 7,089 decimal digits if the input is represented by decimal digits.

2. Literature Survey

Keng T. Tan and Douglas Chai [1] proposes over the past few years, 2D barcodes have gained popularity as one of the key pervasive technologies for mobile applications on smartphones. they will be used as shortcuts to uniform resource locator links; a way to store contact information for simple transfer; admission tickets or boarding passes; and tokens for retrieving digital data, like public transportation timetables or recent produce production information, either directly from the barcode itself or through a networked database server.1 Most mobile applications use black-and-white 2D barcodes (such as QR codes or Data Matrix) that carry only a restricted amount of encoded data. Using 2D Color barcode, the color part is employed additional for its visual value than as a way to encode additional data. Two approaches will increase a 2D barcodes data capacity: increasing data cell density by using additional cells among a given symbol size or increasing the offered data symbol space by using additional colors.

Vijaya Lakshmi [2] proposes a 2D color barcode can hold much more information in comparison to a binary barcode. 2D barcode is gaining popularity for mobile applications. When used together with camera phones, the 2D barcode can offer a link between the digital and the real world. 2D barcodes have increasing significance as the presence of high-resolution cameras, joined with the availability of variable data printing, drives increasing amounts of click and connect applications. Barcodes hence, serve as an more and more vital connection between physical and electronic portions, or versions, of documents itself.

A. Grillo, A. Lentini proposes [3] a 2D color barcode can hold much more information than a binary barcode. While a color barcode can hold more information, it makes this vision task unusually challenging because of the varying color balancing in different cameras, poor quality of images taken with current cell phone cameras and webcams, varying lighting conditions, arbitrary rotation of the barcodes in images. They are frequently used in advertising to provide customers with scannable URLs to product websites. In pursuit of increased barcode capacity, novel schemes using color have been proposed.

P. Huang, Y.-T. Chang proposes [4] a secret message is encrypted with combined cryptographic method and then hide the encrypted data in a QR Code TM (Quick Respond Codes). The embedded QR code may be sent to destination or may be saved for future use. QR Codes are mainly used to convey or store messages because they have higher or large storage capacity than any other normal conventional barcodes. In the present work the authors have introduced the encryption technique developed by Nath et.al to encrypt any secret message and then embed inside QR Code. In the encryption method Nath et.al. have used bit-manipulation, byte-reshuffling and generalized modified Vernam Cipher method. The cryptography method used here has been tested on different plain texts and it was found that the method is unbreakable using normal cryptanalysis like frequency analysis, plain-text attack, Differential attack, Brute-force attack, etc. The data is encrypted using a symmetric key, then inserted in QR code, so that data can not be easily retrievable without adequate authorization / permission.

R.Sharmila [5] proposes Short range communication technologies are the emerging technology in mobile phone based applications. One of the technologies used in short range communication is Near Field Communication (NFC). These short range communication technologies are used in mobile advertisement, data sharing and contactless payments. For this purposes 2D barcodes are being introduced in mobile applications. Since every front camera enabled mobile phones can able to scan 2D barcodes. In this paper we are going to implement 2D barcodes in mobile phone applications which are very helpful for mobile payments and personal identification. With the help of visual light communication 2D barcodes are displayed on the smart phone screens when we use barcodes. In this paper we designed a color 2D barcode for providing better security features with the help of visible light communication (VLC) between smart phones. In this paper we are going to develop a secure 2D color barcode which secure private information during private data sharing process. Finally our experimental result shows that our proposed system provides better security when compared to normal 2D barcode schemes.

Suraj Kumar Sahu [6] proposes how QR Codes (commonly known as Quick Respond Codes) used in the field of Cryptography. QR Codes are mainly used to convey or store messages because they have higher or large storage capacity than any other normal barcodes. The paper describes the relation QR Code and cryptography. Since QR Codes have fast response time and have large storage capacity, QR Codes can be used perfectly to send encrypted data (messages) to the receiver. This method will be suitable in any business house, government sectors, and communication network to send their encrypted messagesfaster to the destination. Or a person can even use this method to keep his important documents, like passport number, pan-card id, and social security number, perfectly secured with him all the time, without the information getting leaked to outside world.

3. Existing System

In QR Droid, the sender phone encodes a short message into a QR code and displays on its screen; the receiver uses its camera to capture the QR code and decodes it back to the message. The message can be encrypted with DES algorithm under a common secret key configured by both parties.

4. Proposed System

Color printing uses cyan, yellow. magenta for color reproduction in printing. Color capture devices uses Red, green, blue sensing channels. These are complementary to cyan , yellow , magenta colors. Recently the study of color barcodes provides the information for increase in embedding capacity than monochrome barcodes. All the data are

initially extracted from red, green , blue channels. The CMY colorant channel are also extracted from RGB model parameters. The combination of all these colors provides thecolor code with high embedding capacity. The Figure 1 shows architecture of the proposed work.

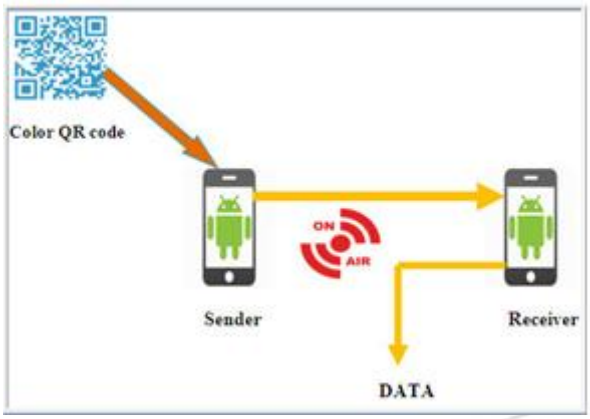

Figure 1: Architecture

1) QR Code generation

QR code generation is the first module of our proposed approach. In that we are going to generate a QR code with added encoding techniques which coverts our original private data into different QR codes. Commonly QR code is an improved encoding technique which means it encrypts a given data as well as compresses the encrypted into reduced size. The size of a given data will be reduced when using an encoding technique. QR code is also performs like an encoding mechanism. QR codes are now used over a much wider range of mobile applications and commercial applications.

2) Embedding phase

In embedding phase embed the data or image in the cover image that is the QR code. The first step in the embedding phase is to generate the desired QR Code. For generating the QR code choose any type of the QR image and type the data now encode the data as a QR image.

3) Sender

Sender is the second module of our proposed color QR scheme concept. In that a user (sender) holds encoded message and image that is a QR code. The sender of one mobile phone stores QR code in their mobile storage and an opposite mobile (receiver) is kept in front of the sender mobile we can get our private information. This process is performed in the sender side only receiver is not involved in the second stage.

4) Receiver

Receivers are plays an important role in our proposed system since receivers are receive their private information through and with the help of an air interface. The sender can show their QR code in their mobile phone the receiver of one mobile displays private information which one is encoded with help of our visible light communication technology. The distance factor between two mobile phones is not taken into account in our notion of visibility. Since in near field communication, nearby devices are only communicated with each other. In our proposed concept two independent devices are communicate through visible light communication in near field communication mechanism.

A 2D barcode only contains a very limited amount of information and hence cannot adopt advanced encryption primitives. Our proposed system uses an 8 bit binary mode for generating QR code. During QR generation we have considered following parameters that are the QR version, error correction level and frame refresh rate. According to our approach compared with the encoding running time, the decoding running time grows slower along with the increase of QR versions. Our proposed system offered high quality QR frame image can be easily decoded with very few errors when compared to our existing concepts.

2D color barcode for secure our private information during data sharing. we can securely share our information between two mobiles with the help of visible light communication without need of any external hardware. Our system achieves high level security and NFC provides a comparable throughput when compared to an existing system. The proposed system can be used for secure device pairing, private information sharing, and secure mobile payment, etc.

5. Simulation Results

Matlab R2015a is used as the platform to perform this task. The word ―HAI is given as the input. In this scheme, the sender will send the message or image, Here consider message and image this is converted to color code. This color code is transmitted to the receiver. The receiver receives the message in the form of color code. This scheme is very secure and prevents eavesdropping and jamming. The color code generated is shown in Figure 2.

Figure 2: Color barcode generated of message 'HAI'

6. Conclusion

Color barcodes are used to increased the system throughput and provides high level security, prevents eavesdropping and jamming. It is also used for private information sharing, secure device pairing. In terms of barcode design, by taking advantage of more colors, some new color barcodes are

proposed to increase the capacity for robust data transmission between smartphones.

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