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Research Paper

An Image Sharing Technique Using QR Code Through Cloud for Mobile Devices

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Abstract

Image sharing is a very important task in the digital communication. Images of various resolutions are transferred every moment electronically. Cloud computing and associated security concerns motivate every increasing research in this field. This paper is about an image sharing technique using the famous Quick Response (QR) Code which is very popular now. We have a web application also associated with this.

Keywords: *QR Code; Encryption; Communication; Image Transfer; Image Sharing; Cloud Computing*

1. Introduction

The word communication means sending messages/ information from one place to another. People use computer, mobile phone, etc. to send email, SMS, MMS and to chat. The most used methods of popular communication are chat, SMS and email, in that order. Communication is perfect if the intended message is delivered to the expected recipient. Before inventing the electromagnetic telephone, the mechanical telephone was used to transmit messages through pipes or other physical media. In the year 1804 Electrochemical telegraph was invented by Catalan Polymath and scientist Franciso Salva Campillo. Baron Schilling invented the electromagnetic telegraph in 1832. With Sir William Fothergill Cooke, the era of the commercial production electrical telegraph commenced. Attempts were made to reduce the cost of telegraph transmission by sending multiple messages through the same wire by frequency modulation. The birth of the speaking telegraph was attributed to these attempts [5].

After fixed wire telephone, cordless telephone was used. The user could roam or walk and talk but only within a certain distance inside the house. The first mobile telephone device which was wireless was used in a car, on 17th June 1946 in St. Louis, Missouri [5].

In the early 1960s transmission networks were upgraded. Digital telephone system was improved by having more capacity and quality of the network and also it had the End-to-End analog telephone networks [17].

Internet Protocol telephone (Voice Over Internet Protocol) is a very fast development in network technologies. There are two major disadvantages for internet protocol. The first is the power outage which can occur during an emergency or disaster, when the phone is most needed. Secondly in the Internet Protocol, the telephone address is registered in one local area. If the user shifts his/her residence, he/she has to transfer the Internet Protocol address Location [3].

Martin Cooper, father of the Cell phone said "As I walked down the street while talking on the phone, sophisticated New Yorkers gaped at the sight of someone actually moving around while making a phone call". He was a Motorola researcher who invented the hand held phone and did the research to make the device from 1 kg to 16 oz in the year 1983 [1]. The advanced mobile phones can be classified according to different generations.

- Zero Generation (0G) services namely MTS (Mobile Telephone Service)
- First Generation (1G) analog cellular network (using signals)
- Second Generation (2G) digital cellular network (sound waves into numerical)
- Third Generation (3G) broadband data services (transports multiple signals and traffic types)

Fourth Generation (4G) Native – IP networks (voice, video, conference, etc.). [12]

2. Image Processing

Images can be converted to data and then they can be processed through various transmission techniques. In the processing of the images, even videos, audios etc. can also be replaced by the images. They are treated as 2D signals to apply robust transmission techniques [14, 16].

Techniques have been developed to the extent of transmitting a 3D object in the form of image in such a way that all vital information of the object is captured and transmitted. Facial image extractors do this work of faces with well developed processes [5, 6, 11].

3. Sharing Techniques

Mobile phone is used to make calls and receive calls in a wide geographic area. Mobile phones are used more by the people because of their portability, wireless, easy access, user friendliness etc. Advance softwares can be installed in the mobile. Mobile devices are built with good number of useful applications [15, 16]. Using different devices, images can be shared. Sharing of images means images can be viewed by different users from anywhere through their devices. There are several methods in sending images through mobile phones. Image, video and audio sharing appli-

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cations are on the rise since the invention of collaborative softwares.

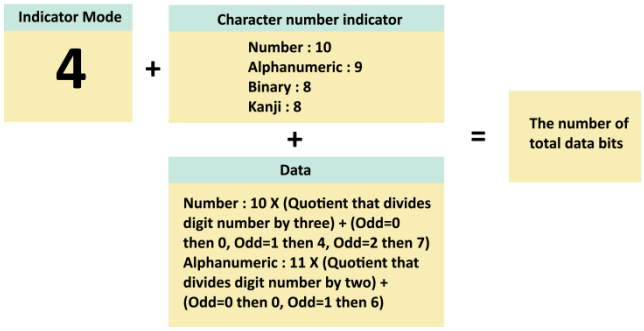


Fig. 1: Characteristic Calculation

4. QR Code

The Quick Response (QR) Code patented by the Japanese s Denso Wave is a 2D matrix analogue of bar code. The original purpose of it was tracking vehicles during manufacturing process. It was used for TOYOTA industries since 1994. Due to is ever increasing popularity, in Japan it has been moved from automotive industry to advertising, marketing, billboard etc. [8, 13]

Barcodes have the information of a particular product but it can contain only 20 numerical digits whereas QR code can store up to 7089 characters. Depending on the input of alpha-numeric byte/binary and kanji/kana the storage capacity is estimated [7]. QR code has vertical and horizontal dimensions. They have square like appearance and their storage capacity is more compared to the bar code [7]. QR code has information (contains data) in all the four corners, whereas in the bar code data will be only on one side. There are 40 versions of QR Codes and has a different module configuration. The module refers to the black and white dot's that makeup QR Code. The largest storage capacity is for version 40 and error correction level L. From the version 1 (21 x 21) up to version 40 (177 x 177), the module configuration spans. The kind of each character is calculated in Figure 1 [7].

The are five consecutive procedures in the processing of QR Code Detection proposed by Ohbuchi *et al.*[10] They are:

1. Pre-processing
2. Detecting corners roughly
3. Defining the three marked corners
4. Detecting the fourth corner which has no mark.
5. Scanning of the code to create the size normalized and bi-level code image. [10]

Inverse perspective transformation is done by the formula

$$u = \frac{C_0 x + C_1 x + C_2}{C_6 + C_7 + 1},\ v = \frac{C_3 x + C_4 x + C_5 x}{C_6 + C_7 + 1}$$

where in *uv* co-ordinate is original image coordinate which is deformed and *xy* coordinate is the normalized coordinate. To obtain coefficients we use $C_0 \sim C_7$.[10]

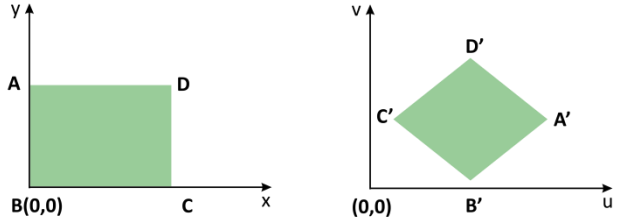


Fig. 2: Inverse Perspective Transformation

The input image has a deformed shape because of being captured from the embedded camera in the mobile phone device.

Pre processing consists of the input image from the camera interface has the YUV colour space components (luminance and chrominance) and Y component (the luminance) which has 8-bit (256 level) grey scale data for image processing.

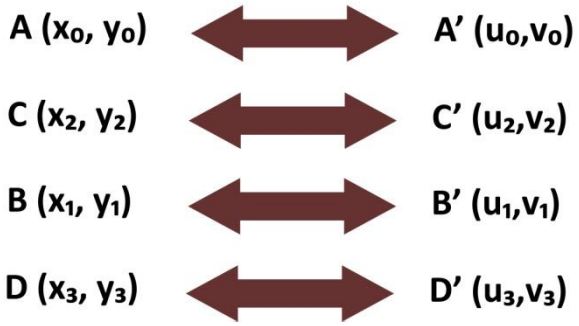


Fig. 3: Transformation of the four corners.

Three steps of image processing are:

a. Histogram calculation to define the threshold of black-white boundaries.
b. Resizing of original image.
c. Recognizing QR code area and filtering for area dilatation.

QR code is used in diverse utilities. It can store more things but requires only small printout region. The spanning speed is relatively high. It also has data robustness with physical damage resistance to a very top degree [2]. This image reorganization and processing of QR code, which was developed by DENSO, is known as a kind of 2D barcode. The features of this code symbol are large capacity, small printout size and high speed scanning [7]. In mobile phones QR code has omni-direction readability and error correction capability. These advantages help mobile phones adopt QR code. Through mobile phones, QR codes are used as assistance in payments, ticket booking, advertisements and mostly in URL recognition [2].

The conventional approach is to extract a barcode from the image of a uniform and even background. [10] However, in the real circumstance, the light condition of the image taken from the camera phone is uneven, and the background of the image is not uniform. Therefore, the traditional schemes suffer from accurate issues in the real environment. An image with uneven light in a non-uniform background taken from camera phones, the problem is to remove the bad light condition and extract the QR code to improve the correctness of the recognition. By obtaining the quality-improved image, we can transform the gray-level image into the binary image. Furthermore, we adopt page segmentation procedure in order to reduce the non-uniform background to several blocks. Then we get edge representation of every block. In addition, we use finder patterns of the QR code and Intersection-based Corner Detection to find the QR-code position [2].

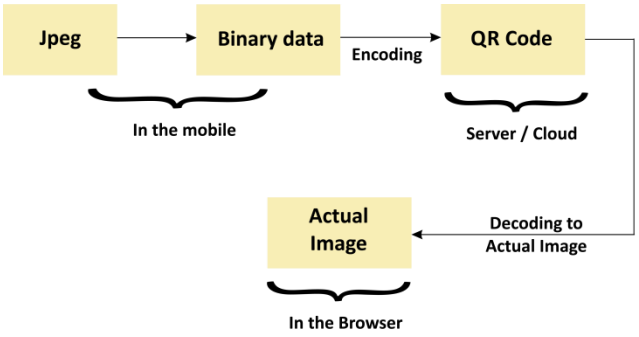


Fig. 4: Process

The pre-processing of the QR code is a complex task, the proposed design aims to reduce the complexity of the system in order to adapt it for running in a cell phone. Thus, every module of the proposed system has been developed paying attention to its efficiency. The image processing pipeline is divided into several modules, which are designed to solve individual problems [9].

5. The Image Sharing Technique

The image taken by the camera is in the form of JPEG file converted to binary. In the server the Jpeg image is converted to binary. In the server the Binary image is converted to QR Code and it is saved – This is Encoding. (See Figure 4)

When we browse the Result page the Encoded QR Code decodes to the actual image.
In the server Databases the following details are recorded.

i. User Details
ii. Mobile Details
iii. Log Details

We also ensure Mobile Theft Prevention and have Android – 2.2 & above OS. The user does the following initially.

i. Open webinhub/MobileTheftDetection
ii. Then register
iii. Then you can login
iv. Add – mobile details like: (See Figure 5)

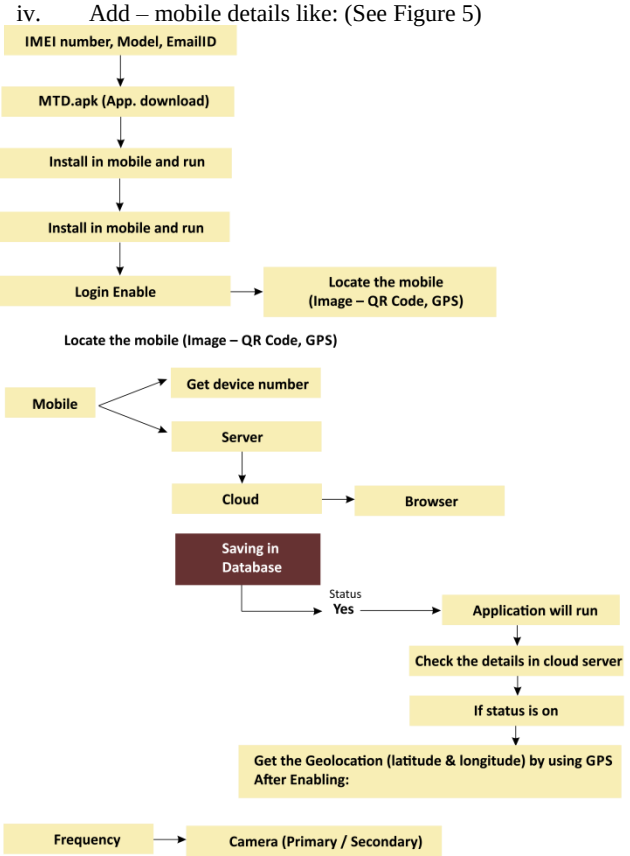


Fig. 5: Example of an image with acceptable resolution

5.1. Advantages

1. It is a unique procedure using QR Code
2. Captured image is directly saved in cloud server; it is not saved in the mobile devices. This is a major advantage, that the person who has stolen cannot know about this and so the charges of detecting it are not possible.
3. Converted QR Code image is less than the actual image.
4. Rest of the MTD show only geolocation. In this study we can see the geolocation with the google map and the captured image.
5. Anyone can use this application going to specific URL.
6. This is a web based application so anyone can access through laptop, tablet, notepad or desktop.

5.2. Disadvantages

1. Encoding and decoding process of the image captured to actual image saving and retrieving is slightly prolonged.
2. The QR Code will only accept approximately 2000 numeric character, so the captured actual complete image cannot be seen so only a part of the image is seen.
3. Internet connection is needed.

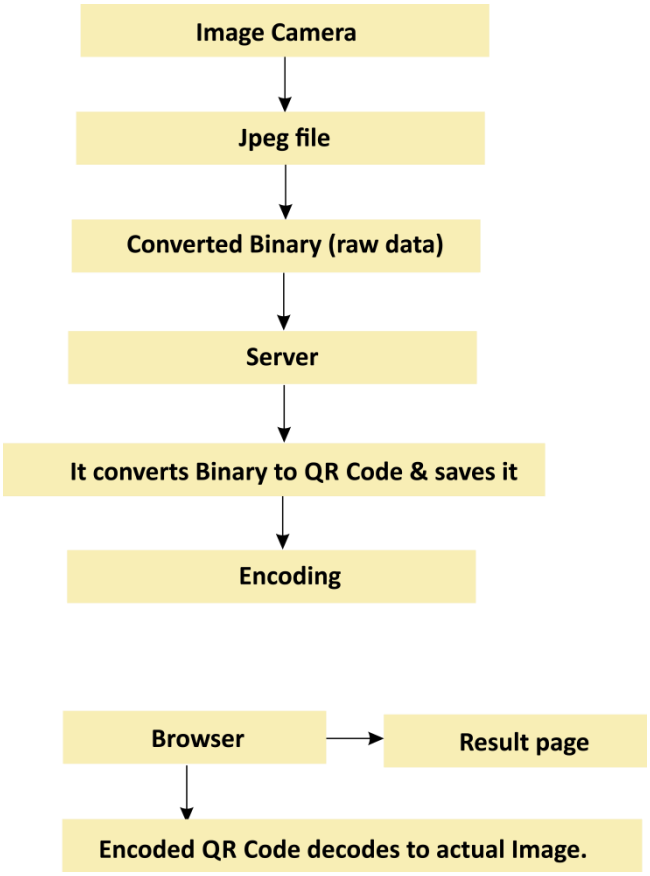


Fig. 6: Encoding and Decoding

6. QR Code Image Sharing Technique

6.1. Existing System

The existing systems used in the device are the basic techniques to backup the device with lot of manual operations involved. The system does not provide a secured channel through which data can be sent. In the previous system user cannot use camera through web and also transmit photos to web. There is no QR code implementation for accessing through the web the misplaced mobile's location details with an image.

6.2. Limitations of the Existing System

- Slow rate of transfer
- Lot of manual operations
- Weak security mechanism
- Less user friendly
- Provides only feature like backup and auto – sync
- There is no QR Code implementation for user access
- Does not exist the theft or misplaced mobile's location details with an image process

6.3. Proposed System

The proposed system can be used in any smart device. The aim of the application is to create an interface between the application and the end user. This application helps the user to perform camera operation, locking of device and transmission of image through web. The application can also extend with features like

we can access the transferred image using QR Code and tracking of device in real time.

6.4. Benefits of the Proposed System

- Faster rate of transfer
- Efficient and consistent
- Interactive customer interface
- Authentic Security mechanism
- Provides better and improvised features like Camera, Device Lock, Transmission of image, QR Code access and also track the geolocation of the device with an image.

6.5. Tools Survey

6.5.1. Software

Adobe Flash Builder, PHP, HTML, CSS, MYSQL

6.5.2. Features

- User can access easily using QR Code
- Geolocation of mobile with captured image from that mobile camera
- Easy to design
- Easy interface
- More components in presenting
- Interactive customer interface
- Authentic Security mechanism
- Provides better and improvised features like Camera, Device Lock, Transmission of image, QR Code access and also track the Geolocation of the device with an image.

6.6. Functional Requirements

6.6.1. Product Perspective

Flash Mobile application will be able to provide an easy and fast rate of transfer. It will facilitate the user to perform camera operation and transfer the image to the web. It should be operation system independent.

6.6.2. Product Functions

The functions performed by the application are:

- Each time when connected to the server the device gets synchronized with server.
- User can perform camera operations
- In-case user looses the device they can lock the phone remotely.
- User can also transmit the message from web to phone
- Can record the voice using microphone
- Track the device using Geolocation in real time

6.6.3. User Characteristics

Only the end user can access system by providing correct credentials. Misuse, unauthorized access, hacking of the product etc. are restricted by this process.

6.6.4. General Constraints

Server capacity is a major constraint. As the number of users increases, the server will move to a down state. It will be an uphill task to establish and maintain personal firewall and real-time updating. But with this, the network will be relatively slow.

6.6.5. User Interfaces

The user can have an access to the administrator account for updating her/his data of device, backup her/his device , perform camera operations and lock her/his device.

6.6.6. Assumptions and Dependencies

Application should be combatable Android 2.2 or more with a minimum of 1 GHZ CPU. When the network traffic is high, server should work efficiently even countering a power cut.

6.6.7. Hardware Interfaces

The external hardware interfaces may be PCs or laptops with uninterrupted internet connectivity.

6.6.8. Software Interfaces

The Operating Systems can be anything that supports TCP/IP protocols and have browser with flash player installed in it.

6.6.9. Performance Requirements

The PCs of Pentium 4 machines can give optimum performance of the application. It also must be with a good storage capability.

6.6.10. Attributes

The attributes of the product are:

- Current and archive database.
- Ease in accessing data.
- Personal firewall.
- Facilitating end user with updating his/her account, by downloading or uploading of data.
- Useful in any smart device. The aim of the application is to create an interface between the application and the end.

6.7. Hardware Requirements

For Computer System / Laptop

- **Operating System :** Developed on Microsoft Windows 7
- **Processor :** Intel Core I5
- **Software :** Browser

For Mobile

- **Operating System :** Android 2.2 Or Later
- **Processor :** 1ghz Or More
- **Software :** Adobe Air

6.8. Software Requirements

- **Front End** : Adobe Flash Builder (For Mobile)
- **Front End** : Php, Html, Css (For Web)
- **Back End** : Mysql
- **Design** : Photoshop

7. The Algorithm

Step 1: Start the process
Step 2: Check the logging user is new user or existing user
Step 3: If the user is new, then he want to register his mobile details for logging the application.
Step 4: The registered user can login with his credentials.
Step 5: Enter the mobile IMEI number and enable the theft mobile detection status as true
Step 6: Once user registered his mobile details successfully, then he can download the mobile application software.

Step 7: The downloaded application will be installed in the mobile device.
Step 8: While installing the application in mobile device it asks some functional devices to access like camera, GPS.
Step 9: After successfully installed application it will start to send the information to cloud database server.
Step 10: Installed application will check that device IMEI number status is enable or disabled.
Step 11: If it's enabled then it starts the process
Step 12: Open the camera and take one snapshot and gets the current geolocation details of the device
Step 13: The device is send the captured image and geolocation details to cloud server database
Step 14: Mobile application frequently in time interval, it updates the captured image and geolocation details to cloud server database
Step 15: In internet browser we can see these updated records with the captured image, geolocation details and date time of the record updated in server.
Step 16: In result page user can see the geolocation details in Google map with the present address of the mobile device, captured image and date time. (See Figure 7 for the flowchart).

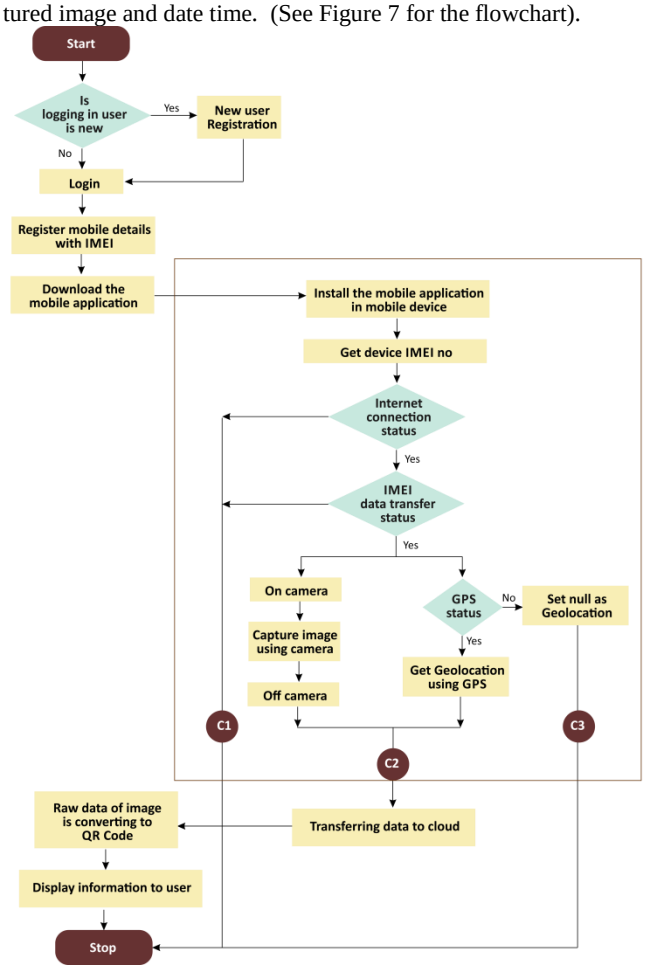


Fig. 7: Example of an image with acceptable resolution

8. Test Cases

The server and client applications have been tested for various cases with respect to establishment of connection, performing operation and connection termination. Testing performed thus ensures the overall quality of both the applications. The testing of the model can by done using an ordered ideal intuitionistic fuzzy software quality model proposed by Kalyathankal *et al*.[4]

For each operation in between the client and server, a connection needs to be established successfully followed by instruction and termination of connection. The server needs to constantly send the instruction value to the specified mobile device with the help of database. Client also needs to identify the type of data arrived like requests or responses and it has to identify and act necessary action according to the type of the requests.

- Test whether the client is connected.
- Test whether the phone has Wi-Fi Manager.
- Presence of connection problem.
- Test whether the correct IP address is entered.
- Test whether the correct password is entered.
- Test whether correct IMEI address is entered.
- Test whether the phone is in wireless network range.

9. Conclusion

This is a mobile application which helps in real time tracking of device from anywhere through the internet and also independent of platform. This application uses wifi network for its operation and is compatible with latest systems available in the market. This has also got some disadvantages like it drains the battery very fast as wi-fi is used. Further, it cannot be used without Adobe Flash Air application pre installed. If there is no connectivity to internet it is impossible to track the device and perform the operations. Looking towards the future, this system can also be enhanced in many ways like it can allow file transfer between the mobile and system with the storage in cloud. Tracking the phone is by real time map through geo-location. In our research, we have used cloud computing, QR Code and geo-location. By installing software (platform independent mobile application) we can locate a lost mobile with the help of the inbuilt camera. It can be used to store data of mobile device and helps in accessing it from any part of the world via internet. It can also remotely administrate the mobile by operations like device lockup and data backup. This mobile application requires Android 2.2 and above and is compatible with the latest handsets available.

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