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Customizable Context Specific Information Guide

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Abstract - *The following paper proposes an interaction method that relies on QR codes to provide context specific information about various objects of interest like museum exhibits, product packaging where it is important to preserve the original integrity of the viewer's experience without omitting useful information and in cases where the product dimensions restrict the amount of textual information that can be printed on the print medium.*

Key Words: QR Codes, Android SDK, Human Computer Interaction, Augmented Reality

1. INTRODUCTION

QR Codes are an efficient information encoding format originally designed for the automotive industry in Japan. A QR Code is a two dimensional graphical encoding format similar to a barcode. The QR code is known for its fast readability and greater storage capacity compared to traditional graphical encoding formats. As a result, the QR code was immediately used outside the automotive industry. It found uses in product tracking, item identification, time tracking, document management and general marketing.

The current project hopes to make reusable QR codes that encode context specific information about artefacts even if the amount of space is limiting. It utilizes local caching of descriptive information about the object of interest. The QR code is scanned and results in a unique identifier that corresponds to a particular data entry either on the cloud or locally. This allows for significantly small QR Codes and adds versatility to the type of information that can be stored in the QR code.

Since the same QR codes can be reused the information it stores can be changed to suit the needs of the user and use case. Formats that could now be stored in the QR Code include, large quantities of text, multiple hyperlinked URLs, images.

2. CURRENT TECHNOLOGIES

Current technologies that are used to guide users in and around various locations such as museums, tourist destinations, sites of cultural significance include, handheld audio players that act as audio guides, custom hardware that display information about the exhibit or establishment on screens, mobile apps that display floor plans and other information. These are used to assist and enhance the user's experience without the need of a human intermediary. Aids such as these provide the user with much needed context when travelling and coming across different languages.

2.1 Drawbacks

The proposed project acts as a replacement for the existing technologies. The earlier technologies that act as context guides lack in several ways. Most importantly:

2.1.1 Hardware Requirement – These technologies require custom hardware that needs to be specifically manufactured for every institution and for different purposes.

2.1.2 Lack of Customization – There is no customization of user experience available with these devices or methods. They convey a pre specified set of information.

2.1.3 Lack of diversity of information – These devices contain information in limited number of media types. For example, audio guides can only be used to listen to audio. Display screens can only be used to deliver visual content.

2.1.4 Expensive – These devices and techniques involve the expenditure of huge sums of cash and require security measures to avoid theft.

3. QR CODES

The QR code system was invented in 1994 by Denso Wave. Its purpose was to track vehicles during manufacturing; it was designed to allow high-speed component scanning. They can now be used to store vCard information, open URIs and/or compose email or text messages. QR

QR Code is an open code. This entails that the code can be designed and used by anyone. It is used not only in Japan, but also in countries all over the world. As rules for its use were stipulated and the code was standardized, its use spread further. In 1997, it was approved as an AIM standard to be used in the automatic identification industry. In 1999, it was approved as a standard 2D code by the Japan Industrial Standards and made a standard 2D symbol on the Japan Automobile Manufacturers Association's EDI standard transaction forms. Still more, in 2000 it was approved by the ISO as one of its international standards. At present, the use of the QR Code is so widespread that it is no exaggeration to say that it is used everywhere in the world.

3.1 Design

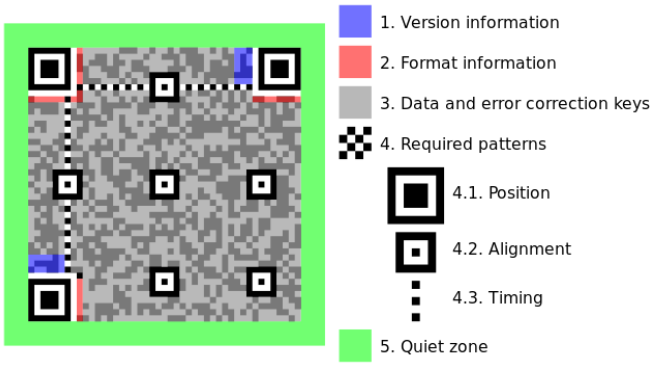

Fig- 1 : QR Code Design

QR codes were designed to be detected by 2D image sensors and then analyzed by a program. The program first identifies three distinctive squares and a fourth smaller square to normalize the image for size, orientation ad angle of viewing.

The individuals of the image are then converted into binary 0 or 1 values and validated. The number of rows and columns are decided by the version number.

3.2 Error Correction

QR codes have support for error correction which means that they can be read despite damage or dirt. The Reed-Solomon Code is used to develop the correction coding for the different codewords used in the graphical representation.

Various levels of correction are available. These have different levels of recoverability.

Error Correction Capability	
Level L (Low)	7%
Level M (Medium)	15%
Level Q (Quartile)	25%
Level H (High)	30%

3.3 Versions

The different versions of QR codes specify changes in format and size. They are of 40 different types and together with error correction they decide the storage capacity of a code.

The maximum size of a QR code is version 40 with 177x177 pixels. With the lowest amount of error correction, level L, it can store up to 7089 numeric characters.

3.4 Contents

QR Codes are capable of storing a variety of contents. The most commonly encoded content type is a URL which is a special string of text that is recognizable by URL readers and thus can trigger an action, namely, opening the URL in a browser.

The different known and documented formats of content commonly found when decoding QR codes are:

3.4.1 URL – Readers should open the URL in the device's web browser when decoding a URL. It is probably desirable for a reader to display the URL and ask the user whether to proceed, so that the user may see the URL before accessing it.

3.4.2 E-mail address - Readers should open a blank e-mail message to the given address.

3.4.3 Telephone numbers - Readers should invoke the device's dialer, if applicable, and pre-fill it with the given number, but not automatically initiate a call.

3.4.4 Contact information – Information in the form of vCard which follows the MECARD format. Readers should open a new address book entry, populated with the given data, and prompt the user to add a new contact.

3.4.5 SMS - Readers should open a new SMS message, ready for the user to compose and send it.

3.4.6 Geographic information - A reader might open a local mapping application like Google Maps to this location and zoom accordingly, or could open a link to this location on a mapping web site like Google Maps in the device's web browser.

4. ZXing LIBRARY

Zxing or "Zebra Crossing" is an open-source, multi-format 1D/2D barcode image processing library implemented in Java, with ports to other popular languages.

ZXing supports a multitude of different types of barcode formats in addition to the original one dimensional barcode. It also supports other 2D formats such as Data Matrix barcodes.

5. PROPOSED ARCHITECTURE

The current project proposes an application that assists users in a much better manner compared to existing guide technologies. The application is called *PocketGuide* and it utilizes QR code tagging to tag artifacts with a uniquely assigned identification number that can later be used to fetch related information from a local datastore or from the cloud.

5.0.1 Custom Login Screen – A custom login screen to log user sessions.

5.0.2 QR code scanner – A simple QR code scanner to scan a QR tag that results in the identification number.

5.0.3 Local data store – A local data store which stores information about the artefact in varying levels of difficulty and diverse media types.

5.0.4 REST framework – A REST framework to query the cloud for any changes in information or to add new information to the listing.

5.1 Datastore

The application utilizes a local SQLite database instance that is created and verified during first program execution. On updates the databases are checked and updated as required. The databases created are *UserInfo* and *ArtefactInformation.*

The User info table stores important user information like login information and other personal details to assist the functioning of the app.

The second table is the *ArtefactInformation* table. It stores the context information of the artefacts such as

- Date of Installation
- Artefact Name
- Artefact Id
- Artefact History
- Related Media such as images, videos and audio information

Examples include paintings such as the *Mona Lisa*, context information would be painter name, approximate age, required cultural information such as location and public appeal.

5.2 Updating

Updating the datastore is an important part of the architecture. The datastore can be edited by system admins from the backend. The information is cached in the cloud in servers that allow admins access to the table information. The information can be verified and checked for integrity by them directly. The update occurs whenever there is a change in the online info dump version number. The app uses polling to identify if there is a change. In case of a version change the information in the database is then updated by the application after fetching changes in the records. This way the data is not constantly fetched thereby minimizing data use.

5.3 FrontEnd

The front end for this application is a simple android application [1] which is used to display the information in a user-friendly manner. The users will be able to first login. This facilitates the application to calculate user attendance and other forms of usage analytics. The front end allows for new registrations as well.

The QR code scanner acts as the most important part of the application. It scans the tag information close to the artefact.

The QR Code results in a unique artefact id which can be used to fetch local information from the database. This information can be displayed according to user preferences in terms of

- Language
- Difficulty
- Type of Desired Information

5.4 QR Code

The QR code is usually attached near the artefact in an accessible manner [2] such that it doesn't interfere with the user's viewing experience.

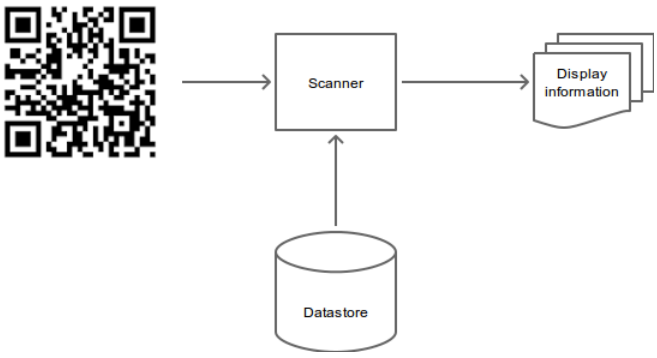

Fig- 2 : Scanner Architecture [3][4]

5.5 Architecture Diagram

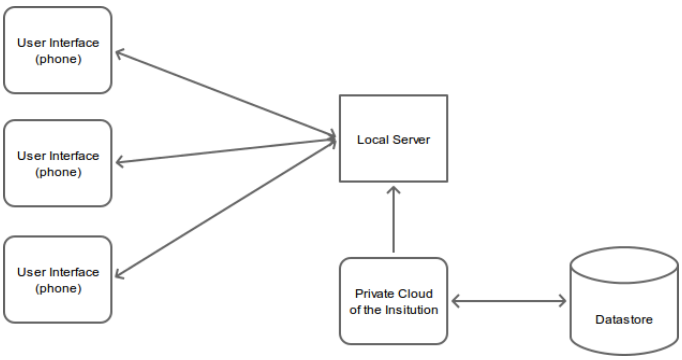

Fig- 3 : System Architecture of proposed solution [5]

6. CONCLUSIONS

The above proposed project hopes to improve Context Information about Artefacts and provide better alternatives to the existing projects.

6.1 Customizability

The proposed idea is completely customizable as the same QR codes can be used again for changed content. The QR code doesn't need to be completely reprinted for updates. The information can also be repurposed for different institutions and also for different set of artefacts.

6.2 Cost Effective

As no custom hardware needs to design specifically for the proposed solution the cost of setup and maintenance is effectively minimized.

6.3 Personalization

The project allows for the complete personalization of the content displayed depending on user preferences like, content difficulty selected, relevance of information, related information and language.

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