

Mobile enabled citizen services through 2D Barcodes

Barcode is used to encode data for variety of purposes. 2D barcode can be used in e-governance applications to benefit the Government and the citizen at large. The 2D barcode is readable using mobile camera, web camera and scanners alike. As the mobiles have the GPRS/3G connectivity to Internet, the barcode encoded with the details of any ID card, driving license, ration card, certificate etc. can verify the details through the Internet. Thus anywhere, anytime service can be enabled to the citizen to know the status of the transaction.



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BARCODE is meant for encoding data in an image which can commonly seen on the cover of all products. Scanning of barcode with barcode reader reveals the detailed information on particular product. Presence of barcode has eradicated the presence of counterfeit to a large extent. One dimensional barcodes, which has been in use since mid 1970, a combination of bars and spaces, store data in a series of lines of various width. Each bar and space represent different character. Here the information are stored horizontally.

Two dimensional barcodes are represented as a image with different geometric patterns such as squares, dots, and hexagons where storage happens both vertically and horizontally. Scanning and decoding of this type barcode needs 2D compatible scanner. 2D barcode technology should be considered as a complement to traditional 1D scanning technology and not its replacement.

One of the amazing aspects of two-dimensional symbols is their potential durability. To sabotage the readability of a conventional 1D symbol, one only has to add another bar to the beginning or end of the symbol or draw a line through the symbol, parallel to the stripes. This throws off the checks and makes the symbol unreadable. By comparison, many degrees of redundancy can be built into a 2D symbol. While it makes the symbol somewhat larger, the remaining symbol is remarkably secure. Reports indicate that inspite of minor deliberate attempts on 2D

Today the usage of 2D barcode is being exploited by the marketing segment and the manufacturing industry. 2D barcode can be effectively used as a low cost tool for knowing the current status of their request submitted to Government, eliminating forgery, locational information in open and secured way for variety of applications which touches Government, Enterprises, Business people and any citizen.

symbols with holes, black marker and tearing, the symbol remains readable.

Though there are so many symbolologies such as Maxicode, Aztec, Watercode, Minicode etc, 2D barcodes with open standards are preferable for its reliability and interoperability. Some of the examples for 2D Matrix symbolologies of open standard are detailed below.

DataMatrix: DataMatrix is a 2D matrix code with modules arranged either in a square or rectangular pattern. The symbol consists of data regions which contain modules set out in a regular array. Each data region is delimited by a finder pattern, and this is surrounded on all four sides by a quiet zone border (margin). Each symbol has even number of rows and even number of columns. The size of square shaped symbols ranges from 10X10 to 144X144 and ranges from 8X18 to 16X48 for rectangular shaped symbols. Datamatrix 2D barcode

ISO/IEC 16022:2006 specification can be obtained from
<http://datenfreihafen.org/projects/iec16022.html> (GPL)
<http://www.libdmtx.org/> (LGPL)

PDF417: Developed in 1992 by symbol Technologies, PDF417 is a multi-row, variable length "stacked" symbology. It is composed with a stack of 3 to 90 rows. A PDF417 symbol consists of 17 modules arranged into four bars and four spaces. PDF417 uses Reed Solomon error correction. In order to recover the complete content of the document and genuineness, linear barcodes such as PDF417 is widely used with encryption. The rectangular length and width of the barcode will increase based on the size of the encrypted data.

The QR Code: The Quick Response Code (QR Code) is yet another 2D barcode where the information stored can be a text, URL or other data. It is called as Quick Response Code because they enable fast data access. The symbol of QR code consists of black modules arranged in a square pattern. It also includes three levels of error detection. The squares in the bottom left, top left, and top right corners are locator patterns.

QR Code ISO/IEC 18004:2006 spec-



Varying content encoding with 2D barcodes

ifications can be obtained from
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=43655

TWO DIMENSIONAL BARCODE USAGES

The content that is encoded in the 2D barcode can vary depending on the requirement. It can contain an URL so that when read through mobile camera one can go online and reach the website to know more details. The content can be an offline content having the serial number, name card etc. details generally used in the manufacturing industry to identify the product, batch number etc. The content can have the latitude and longitude, the GPS coordinates to point a location.

ONLINE METHODS

The usage can be broadly classified into online and offline usages. Online

methods contain either an URL or encrypted ID which can be read using the Javamidlet on mobiles or Client/Applet using a web camera. In case of mobiles the server can be reached through GPRS/3G and in case of Client/Applet using a web cam the server can be reached through LAN/WLAN/SWAN/broadband. In case of URL the browser becomes the client program to fetch the details and in case of encrypted-ID, there will be a client program/Applet to decode and connect to the server and give the necessary information.

The encryption can be done in variety of ways such as direct URL+ID, Direct URL+Encrypted ID, Encrypted ID, etc. Accessing rights also differs for each method. Few methods are open for the entire citizen, few for authenticated citizen, some only for department officials, etc. The verification devices to be used are mobile camera, Desktop/laptop connected with web camera, flat-bed scanner, and barcode reader.

OFFLINE METHODS

Print copy content authentication - Offline -- Manual method/Automated method are the different methods used here and the accessing rights goes to Closed User Group (CUG) of Department officials. The verification devices to be used are mobile camera, Desktop/laptop connected with web camera, flat-bed scanner, and barcode reader. Again offline methods contain the encoded information either with encryption or without encryption. Inventory slips, ID cards, Manufacturers details etc. are the

The Comparison on the three open standard barcodes is placed below

2D Barcodes		QR Code	PDF417	Data Matrix
Type		Matrix	Stacked Bar Code	Matrix
Data Capacity	Numeric	7,089	2,710	3,116
	Alpha Numeric	4,296	1,850	2,355
	Binary	2,953	1,018	1,556
	Kanji	1,817	554	778
Main Features		Large capacity small printout size, High Speed scan	Large Capacity	Small printout size



Decoding 2D barcodes using mobile camera

(HCCBTM) which can have three times the density of PDF417/DM is used for high capacity requirement.

APPLICATIONS OF 2D BARCODE TECHNOLOGY

The applications such as land records, telephone connection, water connection, passport, ration card, election ID etc. can be encoded in the 2D barcode. Some of the applications implemented using 2D barcode with the support of NIC, Tamil Nadu are listed below.

a) Kalaingar Vettu Vasathi Thittam Beneficiary identity: A secured encrypted ID is used as a 2D barcode to eliminate forgery of allotment orders of Government of Tamil Nadu. Here barcodes are encrypted so that no one other than department people can read it.

b) E-district Citizen Certificates: To eliminate forgery, a secured encrypted ID is used as a 2D barcode on certificates like Community, Nativity, No graduate, Income and Deserted woman.

On reading the 2D barcode at left hand side of each certificate the user can trace out all the information about the citizen updated earlier in the particular URL.

c) Usage of 2D barcodes also benefited the Micro Small and Medium Enterprise department which deals with small scale industries, especially works on authenticity of license issued to the small scale entrepreneur.

d) A proof of concept has been demonstrated to help the traffic police to identify the counterfeit license. The moment the traffic police scans the 2D barcode on a driving license the details displayed from the server proves the authentication of the license. The application also facilitates to book an offense on the road using the mobile and the offense details are stored on the server for any time analysis/monitoring.

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know applications using the offline methods.

The color 2D barcode can be deployed for high capacity online and offline requirements. The color 2D barcode can have photos, images, digitally signed information etc. Color 2D Barcodes are also in existence for offline use. High Capacity Color Barcode

UPCOMING ICT EVENTS

International Conference on e-Government and e-Governance

Ankara, Turkey

11th March, 2011

<http://www.icegeg.info/>

2011 International Conference on Control, Robotics and Cybernetics

New Delhi, India

19th -20th March, 2011

<http://www.icrc.org/>

25th Skoch Summit - Reinventing India: Shifting to Demand Side Governance

New Delhi, India

25th March, 2011

http://www.skoch.in/index.php?option=com_content&view=article&id=1212&Itemid=1678

International Conference on Computer Supported Education and E-Learning

Katmandu, Nepal

1st -2nd April, 2011

<http://www.ols.org.np/iccs2et2011/>

Conference for eDemocracy 2011

Krems, Austria

5th - 6th May, 2011

<http://www.donau-uni.ac.at/en/department/gpa/telematik/edemocracy-conference/edem/vid/14978/index.php>

7th International Conference on Web Information Systems and Technologies

Noordwijkerhout, Netherlands

6th - 9th May, 2011

<http://www.webist.org/>