QR Codes and Other Symbols Seen in Mobile Commerce

This section describes bar code symbols frequently encountered in mobile commerce campaigns. Properties and typical applications for each are listed. One symbology, the QR Code, is widely and successfully employed. The term is often used as a generic for a matrix bar code, but this usage is incorrect should be avoided.

All symbologies included have been specified as international standards. Although other symbologies are in active use, it is strongly recommended that only symbologies recognized as international standards be chosen for a campaign.

The section also identifies significant factors to be considered in reproducing the symbols on display objects such as signs, posters, books, and magazine advertisements. For more detailed information, see **For More Information** in the **Introduction** section.

One-Dimensional (Linear) Symbologies

    EAN/UPC

    GS1 DataBar Stacked

Two-Dimensional (Matrix) Symbologies

    QR Code

    Aztec Code

    Data Matrix

Symbol Reproduction Considerations

One-Dimensional (Linear) Symbologies

Bar codes in their most familiar format — a series of varying-width parallel bars and spaces — have been with us for more than 35 years. These linear, or 1D, symbologies (one-dimensional as opposed to two-dimensional bar codes discussed below) continue to be the most widely used optical recognition technology. Well over 100 encodation schemes or symbologies have been invented over the years, with roughly 20 reaching international standardization.

- The use of these symbologies (e.g., EAN/UPC, GS1 DataBar™) has produced significant improvements in the supply chain, from manufacturer through distributor and retailer to the consumer, by enabling the identification of products and packages of products
- Because one-dimensional bar code symbologies are typically more limited in the amount of information that can be encoded, the applications using them are usually restricted to product identification or properties
- The two linear symbologies most applicable to mobile commerce are described below

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EAN/UPC

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Properties

- EAN/UPC is the familiar one-dimensional bar code symbology used throughout the supply chain worldwide for identification of product units
- This symbology was developed in the early 1970s to improve inventory control and speed checkout in grocery stores
- The EAN/UPC is capable of encoding 13 numeric characters in the main body of the symbol and either 2 or 5 numeric characters in the add on
- This capacity precludes encoding larger amounts of information
- This symbology is published as ISO/IEC 15420:2009

Applications

- Because the presence of EAN/UPC bar codes is so widespread, there is significant potential for consumer mobile device applications using them
- On the other hand, because the EAN/UPC symbol is solely the data carrier for a product item identifier provided by industry organizations (GS1 or national ISBN agencies), the applications are limited to naming a product, describing it, or providing important information related to it
- To build consumer confidence, developers using the EAN/UPC in an application other than product item identification (e.g., price comparison lookups, product details) are cautioned to ensure that information provided is obtained from trusted data sources
- EAN/UPC bar codes may be printed on product labels and packaging at a size that is difficult for many mobile device cameras to resolve and decode
- As indicated, price comparison lookups based on product or shelf label bar codes are an application using this symbology

Stacked Bar Code Symbologies

Stacked bar code symbologies are often referred to as 2D (two dimensional) codes, but they are literally one-dimensional codes that are configured one on top of the other in horizontal layers. These symbologies evolved from several 1D codes (e.g., Code 128) that were stacked to create the multi-row symbologies.

GS1 DataBar Stacked

(01)00614141999996
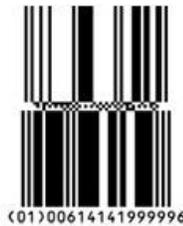
Properties

- GS1 DataBar Stacked is the symbology currently most applicable to mobile commerce
- The symbology is a variation of the GS1 DataBar Symbology that is stacked in two rows and is used when the normal linear symbol would be too wide for the application. GS1 DataBar was formerly referred to as Reduced Space Symbology (RSS)
- The symbol is employed in two versions: a truncated version used for marking small items and a taller omnidirectional version designed to be read by omnidirectional scanners. The taller omnidirectional version is depicted above
- It is used to encode the product GTIN (Global Trade Item Number)
- This symbology specification is part of ISO/IEC 24724-2006 (Reduced Space Symbology)

Applications

- GS1 DataBar is appearing as the product identification for loose produce and random weight products (such as meat and cheese) in grocery stores
- The advantage of this symbol -- small size -- may pose a challenge in terms of being read by consumers because the size may be too small for a mobile device camera to resolve and decode
- The symbol is solely the data carrier for a product item identifier. The identifier is provided by industry related organizations (GS1 or national ISBN agencies), which do not exercise control over actions taken by mobile device applications based on the identifier
- To build consumer confidence, developers using the identifier in an application other than product item identification (e.g., price comparison lookups, product details) are cautioned to ensure that information provided is obtained from trusted data sources

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Two-Dimensional (Matrix) Symbologies

The need to encode more information in a smaller space has driven the development, standardization, and growing use of two-dimensional (2D) bar codes. Where traditional one-dimensional (1D) bar codes act as a license plate to reference information stored in a database, 2Dbar codes can fulfill the same function while taking up significantly less space and fulfilling other functions as well.

Significantly, 2D bar codes can function as the database itself, assuring complete portability for 2D labeled items.

General Properties

- Two dimensional bar code symbologies encode information in both horizontal and vertical directions, hence the name "two dimensional"

- The most common form of 2D codes is known as a "matrix" symbology

- In general, these symbologies offer higher data densities than stacked codes, and they can encode much more information in a much smaller space than one-dimensional bar code symbologies

- Matrix symbologies resemble a chessboard and the location and color of the "squares" or cells encodes data; the shape of the symbol can be square, hexagonal, rectangular or circular

- Data is encoded via the relative positions of light and dark areas

- Encoding schemes use error detection and correction techniques to improve reading reliability and enable reading of partially damaged symbols

- Matrix codes are scalable and well suited for small identification marks on products. Since they offer orientation-independent scanning, they are well suited as conveyor-scannable symbols on shipped packages

- Matrix symbols require a two dimensional CCD imaging device (camera) for decoding. Thus they can be "read" by mobile devices that include a camera and appropriate software

Frequently Observed Appearances

- Typically, 2D symbols appear in magazines and newspapers, on advertising signs, on bus and subway posters, and even on business cards

- These symbols also appear on book covers and are inserted into the text of books

- When a URL is encoded, the mobile device application accesses the corresponding website and directs activity by the device's browser as indicated

- The activity may be providing consumer information of a promotional or informative nature; it may enable consumers to take action, such as purchasing a product or tickets for transportation or events

- Manufacturers frequently apply 2D symbols to products for manufacturing control purposes; although the symbols are visible to consumers, they are not intended for consumer use

- Representative 2D matrix symbologies frequently observed in mobile commerce are described below

QR Code

Properties

- QR Code is a 2D matrix symbology created in Japan in 1994. "QR" is an abbreviation of "Quick Response"
- The QR Code was designed to directly encode the Japanese Kana-Kanji character set in addition to ASCII and other character sets
- QR Code is a two-dimensional matrix symbology containing dark and light square data modules and it has position detection patterns on three of its four corners
- A two-dimensional imaging device such as a CCD camera is necessary to scan the symbology
- This symbology specification is published as ISO/IEC 18004:2006

Applications

- Although the QR Code symbol was developed for tracking parts in manufacturing, using the symbol to support innovative consumer applications, which began in Japan, is now widely and successfully employed in many other parts of the world
- QR Code is approved to encode passenger and flight details on airline Bar Coded Boarding Passes (BCBP) read at airport gates and security checkpoints

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AZTEC Code

Properties

- Aztec Code is a two-dimensional matrix symbology invented in 1995 and designed for marking small items using a wide variety of printing and marking technologies
- It consists of dark and light square data modules and has a finder pattern of concentric square rings centered on a single dark module located in the center of the symbol
- A two-dimensional imaging device such as a CCD camera is necessary to scan the symbology
- This symbology specification is published as ISO/IEC 24778:2008

Applications

- Aztec Code is approved to encode passenger data and flight details on airline Bar Coded Boarding Passes (BCBP) read at airport gates and security checkpoints
- It is used by several national railroads in Europe on self-printed tickets and on mobile devices
- It is used on some identification cards to encode biometric information
- It is ideally suited for use on hospital patients' wrist bands
- It is also well suited for mobile commerce applications

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Data Matrix

Properties

- Data Matrix is a two-dimensional symbology that had its origin in the 1990s; it was designed to encode relatively large amounts of data in a small space using the then new CCD technology
- Data Matrix ECC200 is the open system version in widespread use today, supplanting most other (proprietary, closed loop) versions
- It is comprised of dark and light square data modules and has a finder pattern of two solid lines and two alternating dark and light lines on the perimeter of the symbol
- A two-dimensional imaging device such as a CCD camera is necessary to scan the symbology
- This symbology specification is published as ISO/IEC 16022:2006

Applications

- A major use of Data Matrix is in Direct Part Marking (DPM) of small items with unique identifiers
    - In pharmaceutical packaging, production identification, batch number, and expiration date are typically encoded
    - On physical parts, manufacturer ID, part number, and a unique serial number are typically encoded
- A variation of Data Matrix ECC200, known as GS1 DataMatrix, is approved for limited use in accordance with GS1 System specifications and guidelines for encoding product identification in GTIN (Global Trade Item Number) format
- GS1 DataMatrix also permits encoding a wide range of secondary attributes, such as expiration date, lot/batch number, and unique item serial number
- Data Matrix codes are part of a new traceability drive in many industries (e.g., aerospace, pharmaceuticals, medical/surgical instruments) where quality control is tight and a black market exists for counterfeit parts
- It is one of the symbologies that can be used to represent postage accepted by the United States Postal Service and other national postal services
- Data Matrix is approved to encode passenger data and flight details on airline Bar Coded Boarding Passes (BCBP) read at airport gates and security checkpoints
- It is also well suited for mobile commerce applications

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Symbol Reproduction Considerations

Specific requirements for successful bar code symbol reproduction are beyond the scope of this presentation. The requirements vary widely depending on the layout of the display object and the material on which the symbol is reproduced. General considerations that are important in most designs are listed below.

Designers of display objects are encouraged to contact experienced bar code providers for assistance in the design origination process. Providers who have participated in developing these "symbol reproduction considerations" are listed in **For More Information** in the **Introduction** section.

Symbol Placement

- The location of the Bookland EAN symbol on a book is critical; it must be found quickly at point of sale and by stationary automated scanners (For more information, see Barcoding Guidelines for the U.S. Book Industry on www.bisg.org)
- In contrast, placement of a 2D symbol (such as QR Code, Data Matrix, etc.) for consumer empowerment on display objects, including books, is much less critical
- Consumers can (and do) maneuver their mobile devices, so they can usually capture an image of the code whatever its placement
- Nevertheless, symbols intended for consumer capture must be easy to find and recognize
- They must be sized and printed appropriately to assure a positive consumer experience
- A symbol must also be appropriately separated from any other bar code(s) on the display object

Symbol Readability

The original 2D bar code image must be:

- Encoded accurately, in accordance with established specifications, and generated in high resolution

The reproduced image must be:

- Sized large enough to ensure a quick and successful scan
- Printed by a process and on a material capable of yielding a precise image
- Printed in a color contrasting appropriately with the background color; using black elements on a white background is generally best

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