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Two-Dimensional Bar Codes

The biggest advance in bar code technology in recent years

Before beginning a discussion on two-dimensional bar code symbols, some clarifications must be made regarding one-dimensional symbols...



Typical bar code symbols, like the one at the left, obviously have both height and breadth. To most people, they'd be considered a two-dimensional object. So, why do we refer to them as one-dimensional bar code symbols? Because, when read, it is only the *width* of the bars and spaces that is taken into account—the height of the bars is only to give the symbol some built-in redundancy. Typical bar code symbols, therefore, are only read in one dimension.

One other important aspect of one-dimensional bar code symbols is that they seldom represent more than a dozen characters. Therefore, the bar code does not contain any data, per se. Rather, the bar code represents the *key* to a record in a database, where related information is stored. The best example is a car licence plate which, by itself, doesn't mean much but, when entered into a motor vehicle database, can access all sorts of information regarding the car it is attached to.

Two-dimensional (2D) symbols turn these two preclusions topsy turvy. Data are encoded in both the *height and width* of the symbol, and the amount of data that can be contained in a single symbol is significantly greater than that stored in a one-dimensional symbol. In fact, *over a thousand alphanumeric characters* can potentially be placed in a single symbol the size of a large postage stamp!

Obviously, the main advantage of using 2D bar codes is that possibly a large amount of easily- and accurately-read data can "ride" with the item to which it is attached. There are new applications being created for 2D bar code technology every day. A few examples are at the conclusion of this document.

The reading (scanning) of 2D codes is accomplished using different scanners than those made to scan 1D symbols. Two strategies are currently utilized. The first, and most common, utilizes a moving laser beam scanner that not only sweeps back and

forth across the symbol, but also up and down in what is termed a "raster" (Z-shaped) pattern. Alternately, CCD (charge coupled device) or imager scanners are utilized. These scanners use an array of photosensors to either scan the image in its entirety, or rely on the operator to sweep the scanning beam manually over the entire symbol. (A CCD or imager, for those not familiar with the technology, forms the heart of a video or digital camera or the "sending" mechanism of a fax machine.)

One of the amazing (and beneficial) 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 balances built into the decoding algorithms of a 1D bar code decoder 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. We have experimented with vandalizing 2D symbols with holes, black marker and tearing. The symbol has remained readable through all of this abuse!

Two-dimensional scanners were far more expensive than 1D scanners when introduced in 1994. Recent microprocessor developments have brought the cost of 2D scanners down to about 125% of the cost of a comparable 1D scanner. Also, advancing decoding algorithms have made scanning quicker and easier and provided even greater readability of excessively-damaged symbols.

There are a number of two-dimensional symbologies in growing use today. They fall into two categories: matrix and stacked. An explanation of each is best done visually through the examples below—the difference is obvious.

Two-dimensional bar code symbologies represent one of the biggest advances in the field of Automated Data Collection in the past few years. With advancements in technology, with smaller and faster processors, it can only get better. However, when analysing any potential data collection system, the advantages must be weighed over the added costs. 2D bar code technology should be thought of as one that is complementary to the traditional 1D scanning technology, not its replacement.

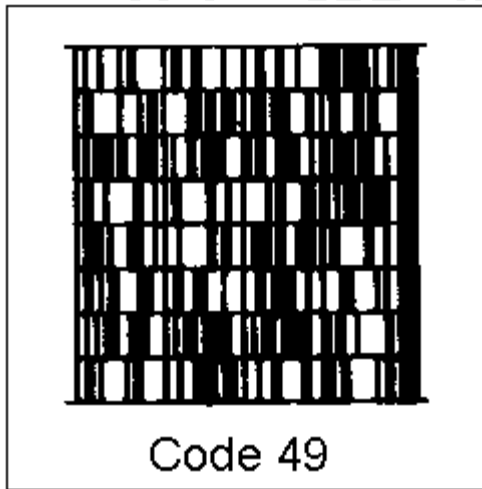
Here are some example applications for 2D scanning:

Packing List - Trading partners agree on a standard methodology for encoding shipping information in a 2D symbol, attached to a shipped order. Order data (PO number, shipping date, product codes, quantities, etc.) can automatically be entered into the receiver's receiving computer terminal in a couple of seconds.

Driver's Licence - The driver's name, address, licence number, expiry date and driving restriction codes are encoded in a 2D symbol that is printed on the operator's licence. Police officers, car rental agencies, hotels (you name it!) can easily enter in information regarding the licence holder, with the possibility of a mis-keyed character virtually nil!

Patient Record - On a hospital patient's chart record is a 2D symbol, encoding their name, health care number, doctor's name, date of admission, allergies, etc. When direct care is given to the patient, the caregiver or doctor records the action by scanning the bar code. Also, the bar code is scanned when medication is administered and the possibility of giving a patient the wrong medicine is virtually eliminated.

2D Stacked Symbolologies – Examples



2D Matrix Symbolologies – Examples

