Generating EAN-13 Standard Barcodes

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Abstract: *Barcode is worldwide used; its popularity can be attested by its use in all parts of our life. A barcode is an optical machine-readable representation of data relating to the object to which it is attached. This Paper is being developed to provide a platform to ease the process of tracking the orders which are being undertaken by the company and also provides proper security for the data in order to avoid unauthorized access using EAN 13 standard barcodes.*

Keywords: EAN, UPC, Barcode, GS1, GTIN, JAN, Country Code, Manufacturer Code, Product Code, Checksum digit, Inventory.

1. Introduction

Inventory management is a backbone for almost all enterprises, to define the growth, survival or the success of a business. Inventory management is the systems and processes of maintaining the appropriate level of stock in a warehouse. The activities of inventory management involves in identifying inventory requirements, setting targets, providing replenishment techniques and options, monitoring item usages, reconciling the inventory balances, and reporting inventory status. This paper depicts the EAN13 standard barcode insertion in each product ordered.

Tracking products which are orders with bar codes is a highly effective method for preventing errors in the first place. Using bar coding for inventory management prevents mistakes, improves data safety and adds efficiency to day to day operations in the company. Bar code labeling and sample tracking is proven to reduce sample identification and data entry errors. EAN (European Article Number) barcodes are printed on most of the available consumer products and are normally used at the supermarket checkout to allow a fast billing. The EAN barcode itself contains an eight or thirteen digit number. EAN barcodes are well standardized, cheap, and already widely used and accepted.

This Paper deals with generating EAN (European Article Number)-13 Standard Barcode for inventory control and for order tracking.

2. Literature Survey

There are two main types of barcodes which are used in enterprises: linear (1D) and two-dimensional (2D).The usage of first one is much chipper and simple but it can present smaller number of human readable codes. Linear barcodes are used widely and there is a lot of types of them like: UPC, CodaBar, Code 25, 39, 128, , European Article Numbering - EAN, etc. There is a lot area for use of barcode technology like: inventory management, stock control, manufacturing, patient identification, drug identification, purchased items scanning, work orders scanning, equipment tracking, document management, entertainment (tickets with barcode) etc. EAN13 barcode is used as a standard in most European countries.

An EAN-13 barcode (originally European Article Number, but now renamed International Article Number even though the abbreviation EAN has been retained) is a 13 digit (12 data and 1 check) barcoding standard which is a superset of the original 12-digit Universal Product Code (UPC) system developed in the United States. The EAN-13 barcode is defined by the standards organization GS1.

The 13 digits in the EAN-13 barcode are grouped as follows:
- The left group: Digits 2-7. The left group also encodes digit 1, through a scheme of odd and even parity.
- The right group: Digits 8-13, digit 13 is the check digit.

The EAN-13 barcodes are used worldwide for marking products often sold at retail point of sale. The numbers encoded in EAN-13 bar codes are product identification numbers, which are also called Japanese Article Number (**JAN**) in Japan. All the numbers encoded in UPC and EAN barcodes are known as Global Trade Item Numbers (GTIN), and they can be encoded in other GS1 barcodes.

The figure below shows a typical EAN-13 barcode.

Country Code:
The Country Code is a 2 or 3 digit number, which is used to identify the country that assigned the manufacturer code. All EAN-13 barcodes that begin with "0" are UPC-A barcodes.

Manufacturer Code:
The EAN Manufacturer Code is a variable length number. Typically, 5 digit codes are assigned to companies, however, some companies do not produce enough products to warrant a 5 digit product code, and in such cases the EAN will issue Manufacturer Codes longer than 5 digits.

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Product Code:
The manufacturer is free to assign its own product codes, but they must make sure that each product code is unique within their product codes. The product codes can be as few as 3 digits long, or as long as 5 digits depending on the length of the country and manufacturer codes.

Checksum Digit:
The checksum digit is calculated using the country code, manufacturer's code, and the product code. The odd numbers starting with the right most digits are multiplied by 3 and added to the sum, while the even numbers are simply added to the sum. The reason for the EAN-13 check sum being calculated in reverse order (starting with the right most digit and considering it as being odd instead of even) is for compatibility with UPC-A barcodes. The modulus of 10 is then taken of the summed total. This is subtracted from 10, and the modulus of 10 is taken again.

For example: EAN-13 001234567890
Country Code: 00
Manufacturer's Code: 12345
Product Code: 67890
The last or right most digit is '0' and is considered odd, so multiply it by 3, the second right most digit '9' is even so just add it, etc.

$(0 * 3) + 9 + (8 * 3) + 7 + (6 * 3) + 5 + (4 * 3) + 3 + (2 * 3) + 1 + (0 * 3) + 0 = 85$
$85 \% 10 = 5$
$((10 - 5) \% 10) = 5$

Symbol Size:
The specifications for the EAN-13 barcode specify the nominal size as 37.29mm wide and 25.93mm high. Based upon this nominal size, the EAN-13 barcode can be scaled by a magnification factor of 0.8 to 2.0. Scaling the barcode will produce a barcode between the minimal allowable size of 29.83mm wide by 20.74mm high and the maximum allowable size of 74.58mm wide and 51.86mm high.

Digit Patterns:
Each digit in a EAN-13 bar code is composed of a series of two spaces and two bars. Each digit is drawn within a space that is 7 modules wide. In addition to the 13 digits, which make up a EAN-13 barcode, the barcode symbol also has two quite zones, a lead block, a separator, and a trailing block. Each quite zone is 9 modules wide, the lead and trailing blocks are a series of lines and spaces in the format of bar, space, bar. The separator is signified by the sequence space / bar / space / bar / space.
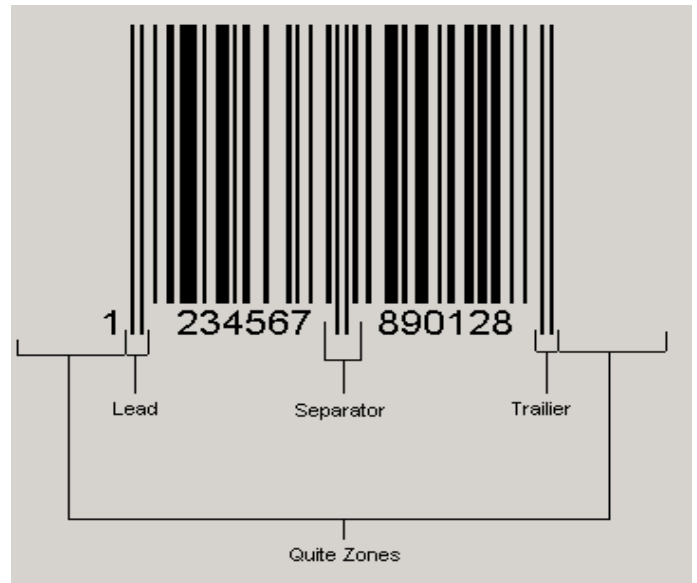
Where 0 represents space and 1 represents bar

3. Methodology

The following is the methods to generate EAN 13 standard Barcode.

Algorithm : CalculateChecksumDigit()
Input :
    sTemp: this.CountryCode + this.ManufacturerCode + this.ProductCode
 iSum : sum of no of odd or even numbers
 iDigit : sum of no of odd numbers * 3 + sum of no of even numbers.
Output : Checksum Digit
Method:

```
// Calculate the checksum digit here.
 for (int i = sTemp.Length; i >= 1; i--)
 {
iDigit = Convert.ToInt32(sTemp.Substring(i - 1, 1));
if (i % 2 == 0)
{ // odd
iSum += iDigit * 3;
}
else
{ // even
iSum += iDigit * 1;
}
}
```

Drawing Barcode:

```
System.Drawing.Graphics
g=this.picBarcode.CreateGraphics();
g.FillRectangle(new
System.Drawing.SolidBrush(System.Drawing.SystemColors.
Control),new
Rectangle(0,0,picBarcode.Width,picBarcode.Height));
ean13.Scale                                            =
(float)Convert.ToDecimal(cboScale.Items[cboScale.Selected
Index]);
ean13.DrawEan13Barcode(g,  new  System.Drawing.Point(0,
0));
```

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```
txtChecksumDigit.Text = ean13.ChecksumDigit;
g.Dispose();
```

Creating Bitmap:

```
ean13.Scale =
(float)Convert.ToDecimal(cboScale.Items[cboScale.Selected
Index]);
System.Drawing.Bitmap bmp = ean13.CreateBitmap();
this.picBarcode.Image = bmp;
```

Nominal Values for Drawing Barcode:

```
private string[] _aOddLeft = {"0001101","0011001",
"0010011","0111101","0100011","0110001","0101111",
"0111011","0110111", "0001011" };
```

```
private string[] _aEvenLeft = { "0100111", "0110011",
"0011011","0100001","0011101","0111001","0000101",
"0010001", "0001001", "0010111" };
```

```
private string[] _aRight = { "1110010", "1100110",
"1101100", "1000010", "1011100", "1001110", "1010000",
"1000100", "1001000", "1110100" };
```

Convert to Digit Pattern:
This function takes the individual numbers of the manufacturer code, and the product number, and converts them to the string representation of the barcode graphics.

```
private string ConvertToDigitPatterns(string inputNumber,
string [] patterns)
{
 System.Text.StringBuilder sbTemp = new StringBuilder( );
 int iIndex = 0;
 for( int i = 0; i < inputNumber.Length; i++ )
 {
 iIndex = Convert.ToInt32( inputNumber.Substring( i, 1 ) );
 sbTemp.Append( patterns[iIndex] );
 }
 return sbTemp.ToString( );
}
```

Drawing the Barcode:
The code excerpt below uses the Ean13 class to draw a EAN-13 barcode in a picture box control

```
private void DrawEan13( )
{
 System.Drawing.Graphics g =
this.picBarcode.CreateGraphics( );

 g.FillRectangle(
 new
System.Drawing.SolidBrush(System.Drawing.SystemColors.
Control),
 new Rectangle(0, 0, picBarcode.Width, picBarcode.Height));

 // Create an instance of the Ean13 Class.
 upc = new Ean13( );
```

```
upc.CountryCode = "12";
upc.ManufacturerCode = "34567";
upc.ProductCode = "89012";
upc.Scale =
(float)Convert.ToDecimal(cboScale.Items
[cboScale.SelectedIndex]);

 upc.DrawEan13Barcode( g, new System.Drawing.Point( 0,
0 ) );

 g.Dispose( );
}
```

4. Conclusion

Thus by following the above study, the Barcode can be generated using the programming methodology and can be included as a plugin in any part of a project which is more related to inventory control. The aim of doing this article is to know exactly how the concept of barcode works and how it can be generated without much error.

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