

A Novel Wireless Barcode Print-And-Scan System Based on Android

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Abstract: EAN/UPC barcode is widely used in commodity production, logistics and warehouse operation. In this paper, a novel wireless barcode print-and-scan system is proposed for both fast and convenient product management. In our proposal, the system is implemented as an application on an Android phone, and controls barcode printer via WiFi or Bluetooth connection. Barcode can also be scanned using the same App, which provides a unified platform for barcode related service.

1. Introduction

As the global economic growing, world market is overflowed with all kinds of products. A universal commodity coding system is urgently needed for product identification and information tracking [1]. EAN/UPC is one of the most used barcode systems for commodity, which can be found on every single product [2].

Barcode management system consists of both printing and scanning system [3]. In the printing process, traditional barcode printer relies on PCs and uses wired connection, such as Ethernet or USB interface to control the printer to print the barcode, which is inefficient and not versatile.

In this paper, a wireless barcode print-and-scan system is proposed for fast and convenient product management. An application is implemented for Android phone for barcode printing and scanning, which uses wireless connection such as WiFi or Bluetooth to control barcode printer.

The rest of this paper is organized as follow: Section II summarizes some of the related work, our system is proposed in Section III, experiment and results are given in Section IV and Section V concludes the paper

2. Related work

Codesoft is a popular barcode design and printing software [4], which is widely used in various fields such as production and publishing. It can only print pre-designed label files or data from a fixed data source. However, some printing requires dynamic label generation. To solve this problem, Codesoft developed an automatic printing control that can be used in many other programming languages with VB.

A barcode printing system is developed by DELPHI language [5], in which the C/S architecture is adopted. The back-end database is implemented using SQLSERVER. It can also be easily converted to B/S.

A code scanning system based on mobile intelligent terminal device is proposed in [6], which has impressive scanning ability and is not affected by environmental and human factors. The system changes the traditional scanning method, which is not only complex in hardware structure, but also relies on computer equipment.

Further study on the symbolic structure of one-dimensional barcode, the system uses Ethernet controller DM9000A chip design out of the network transmission module of peripheral interface circuit. By using the NEC2501 device to realize the photoelectric conversion, the hardware basis is realized for automatically collecting barcode information. The system selects MDK as the software development platform and choses UCOS as the embedded operating system [7], designs and implements the functions of relevant modules, including serial communication module, scanning gun module, USB module, network transmission module.

The design based on barcode technology is suitable for printing and packaging industry warehouse management system. It can realize the digitization and information management of the warehouse materials of printing and packaging enterprises, make the warehouse materials management timelier, more accurate and more efficient, and reduce the labor intensity and inventory cost of related personnel [8].

3. Proposed system

3.1 System Overview

The overall architecture of the system is shown in Fig. 1. Service is the bridge connecting barcode and the database. Producers upload the data, save it to the database, then our system queries the data in the database by calling the interface function from the server. Producers register their accounts on the app, connect their Android phones to the printer, print the barcode which is formed before. Consumers can scan the barcode and get information after they register their own accounts.

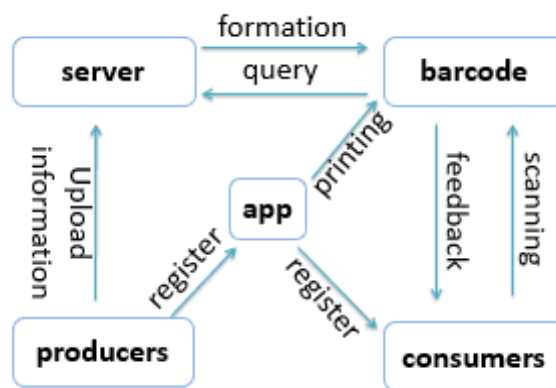


Figure 1. system overview

3.2 Barcode Image Generation

EAN code is the global commodity barcode, it includes EAN-13 code and EAN-8 code. The number of digits directly determines the coding capacity of the barcode; thus, our system adopts EAN-13 code design barcode, and uses open source Zxing package to implement the generation of EAN barcode [9]. Zxing is Google's open source Java library for generating and parsing barcodes and QR codes in multiple formats. As an official library, Zxing-Android considers a wide variety of situations, including multiple parsing formats, sorting of parsed results, long periods of inactivity and auto-destruction. Therefore, in actual use, system needs to customize the using requirements according to its own situation, and makes appropriate modifications to the official library.

The following steps are required when using Zxing to generate barcode.

Set the encoding format and fault tolerance level. To facilitate the browsing of later encoding data, the encoding format adopts the international common "utf-8" format, and the fault tolerance level is the highest H level.

Import encoding parameters, including encoding type, generate image width and height, additional parameters of encoding and other data to generate BitMatrix. Encoding content, that is, EAN code formed by the existing data in the database before; select the code type as barcode; Set the image width and height to 3x2cm; BitMatrix represents a two-dimensional matrix of a bit array, and its internal implementation is achieved by using a one-dimensional int type 32-bit array. Each row starts with a new int, and if the number of columns is not a multiple of 32, there will be any bit use in the last int value of the row. Also, for better conversion, the bits are sorted from the smallest bit of the int value.

According to the above generated BitMatrix, make pixels are black and white and generate Bitmap. Bitmap is internally implemented in C programming language, so it can't be intuitively seen. BitMatrix uses a one-dimensional int array, and an int value represents the color of a point [10].

Draw the text. After obtaining the Bitmap of the barcode, the next step is to draw the text and the barcode together. The drawing process can be divided into two parts: the first part is to draw the Bitmap of the barcode, and another is to draw the text. A new layer is created firstly before drawing the Bitmap of the barcode, the width of this layer is the width of the barcode graph, which is obtained by `bcbitmap.getWidth()`. After that, add the height of the text drawing area.

3.3 Printer Driver Implementation

To implement barcode printing system, it's necessary to develop wireless barcode printer driver. This system uses Android Studio IDE version 3.0, redevelops the existing wireless label printer's native driver on the market, and realizes the barcode printing system based on Android phone.

Printer manufacturers generally provide driver library functions for secondary development. Taking Jiabo as an example, it provides the barcode printer programming interface package TSCLIB. In the TSCLIB library, some printing driver functions are provided, such as: *Openport(a)*, to specify the output port of the computer; *Setup(a,b,c,d,e,f,g)*, sets the label width, height, printing speed, printing concentration, sensor category, gap/black mark, vertical spacing, gap/black mark offset distance; *Printlabel(a,b)*, printlabel content; *Sendcommand(command)*, send built-in instructions to barcode printer; *Clearbuffer()*, clears the internal cache of the printer. These functions are also involved in the development of barcode printing drivers in this system.

3.4 Barcode Scanning

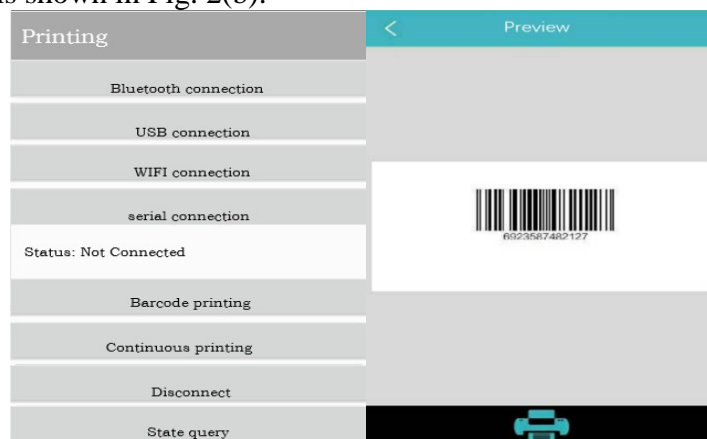
Use Zxing package implementation of barcode scanning. The Zxing package should be firstly introduced into gradle, the code of `compile 'com.google.zxing:core:3.3.0'` is added to the project of `build.gradle`. Only the core package of Zxing is integrated here, because the core package contains a series of algorithms such as analyzing barcode, and the package is small enough.

Call Zxing scan page. The parameter of the `setBarcodeImageEnabled(true)` is set to true to get the path to the scanned barcode in the activity's callback.

Integrate CameraView. Returning to the home page of the project, the CameraView produced by Google is downloaded directly and added to the project. At this point, all the configuration for the project is completed.

4. Experiment and results

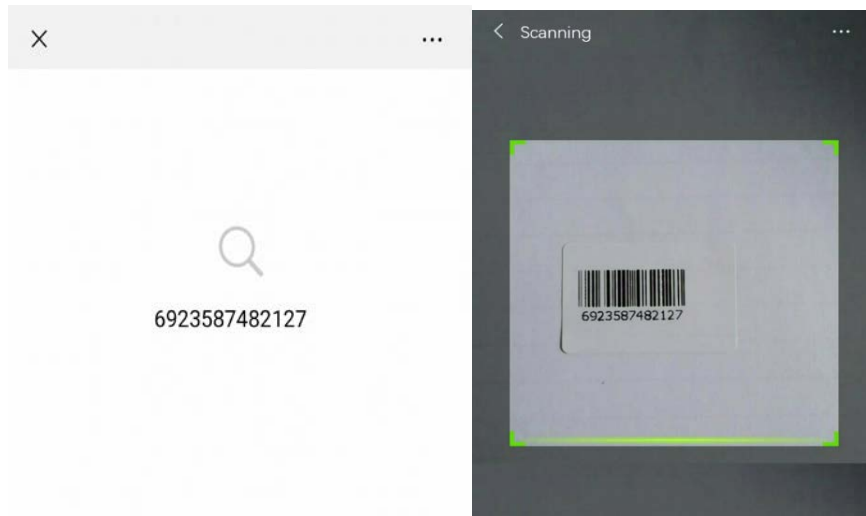
The entire system is developed on the Android Studio IDE version 3.0 and the application is run on the Android phone with version 6.0.1. Users register accounts on the application, connect the mobile phone and printer by WiFi or Bluetooth, and print the barcode. After many error-free barcodes printing tests, the effective connection distance is 5 to 8 meters. A series of tests also verifies the integrity and stability of the system functions. Thus, using Android phone as terminal, can be printed anytime and anywhere, which provides great convenience for manufacturers and improves work efficiency. The printing interface is shown in Fig. 2 (a), and the previewing interface of generated barcode is shown in Fig. 2(b).



(a) Printing interface (b) Preview of generated barcode

Figure 2. Connecting and printing interface

After printing the barcode, our system can also scan barcode for EAN-13 code, and retrieve product information from server database. The scanning interface is shown in Fig. 3(a), and the retrieved information is illustrated in Fig. 3(b).



(a) Scanning interface (b) Retrieved information

Figure 3. Scanning and information interface

5. Conclusion

This paper proposes a new type of wireless barcode printing and scanning system, which realizes the fast and convenient product management and gets rid of the traditional way of printing on the computer. This system uses the library in c/s architecture to manage many data information, the Zxing package, an open source java class library, to implement the generation and scanning of barcode, the driver library function to realize the secondary development of printer driver, the development of APP to provide its application program, improve its function. Each module joints adjustment, integration, debugging, makes the system more stable. The system is implemented as an application on Android phone, controlling the barcode printer through WiFi or Bluetooth connection, and using the phone as the terminal to control the ENA barcode printing. The application can also scan barcodes and feedback information.

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