

# The Research on Bar Code Technique in Production Management System of Manufacturing Enterprises

Qing YU, Tao ZHOU, Yu ZHANG

School of Management, University of Shanghai for Science and Technology, Shanghai 200093, China

**Abstract**—It is crucial to make efficient information acquisition in manufacturing enterprise. Bar code is the most popular automatic identification and data acquisition technique, due to high acquisition speed, accuracy, abundant information and strong stability advantages has a wide range of applications. Combined with practical experience, this paper focuses on bar code technique with the database Access and C# programming technology, under Visio Studio programming environment, applied to the entire process from work order build to processing and assembling, emphatically expounding the concrete realization of data acquisition, identification and production management system.

**Keyword**—barcode technique; manufacturing enterprise; information system; data acquisition and identification; production management

## 1. Preface

Accompanied with IT entering into high speed development period, manufacturing enterprises can make a choice in the process of informatization from Management Information System (MIS), Enterprise Resource Plan (ERP), Product Data Management (PDM), and Computer Integration manufacture System (CIMS), thereby enhance benefit and management level.<sup>[1]</sup> However, most minor companies are difficult to receive timely, accurate and safe information due to restraint of fund, talents and informazation level, giving rise to unsatisfactory output.<sup>[2]</sup> This especially reflects on data timely acquisition and track. According to concrete conditions of enterprise, bar code technology can improve production efficiency as well as internal ERP management with its high transmission speed, accuracy, abundant information, strong stability and convenient processing.<sup>[3]</sup> This paper puts forward a method which successfully applies bar code technology to real time data acquisition in one manufacturing enterprise.

## 2. Research status of bar code technique

Bar code technique is an advanced technology, extended from middle of twenty century, integrating light, engine, electricity and computer. It is an important measure that automatically acquires data and input computer, solving bottleneck problem in data acquisition, realizing information fast, accurate collection and transmission. Bar code technique is the base of information management system and management automation, so that effectively enhance efficiency of supply chain management.<sup>[4]</sup>

Since 70s year of last century, bar code technique has sprung up in global as a crucial identification and acquisition technique. Internationally, with rapid development, bar code has become the main information technology in the fields of commercial trade, logistics and e-commerce.<sup>[5]</sup> Over the years, automatic identification technology, in the name of bar code, has continuously developed in breadth and depth, which is significant part of information construction. Bar code technique made great influence on manufacturing field in our country. For some minor enterprises, infomatization extent is not yet high that cannot efficiently collect production information timely, even recording data by hand is occurred. Data acquisition is premise for internal infomatization management. Bar code is flourishing in world commodity circulation and gradually becomes an "ID" which presents printed computer language and computer culture for entering international market.<sup>[6]</sup>

It is urgent that how to efficiently acquire, transmit and analyze message. This paper applies bar code technique to the entire process from work order build, processing, assembling, and quality check to shipment, combined with scan, print and other office devices, exploiting a set of information management system matching with minor enterprises.

## 3. System Frame

### 3.1 System software structure

Application of system software is established under Windows program with tool of Microsoft C#, which chooses Microsoft SQL Server and Visio Studio programming environment as database software. This system applies customer/server frame and widespread

CODE128 rule to record material data. Information is contained in CODE128 and input finished after scanning by bar code reader that is a kind of bar code scanner using CCD mode directly connect USB port and computer as a result of inputting scanned data into present dialog box, applied to one dimension bar.<sup>[7]</sup>

### 3.2 Usage of bar code

Following is brief introduction of bar code. Code is range rules of strip and hollow. Common one dimension bar code includes EAN, Code 39, Cross Code, UPC Code, Code128, Code 93 and Coda bar. CODE 128 represents comprehensive characters (number, letter and symbol), which contains longer character length (high density) with indistinct sensitivity for code length and character string. Therefore, it is popular used in enterprise internal management and production process and material control system. As its eminent feature, citing enterprise is applying CODE 128 in this paper. As for parameter of CODE128, author will not illustrate any more herein.

### 3.3 system structure chart

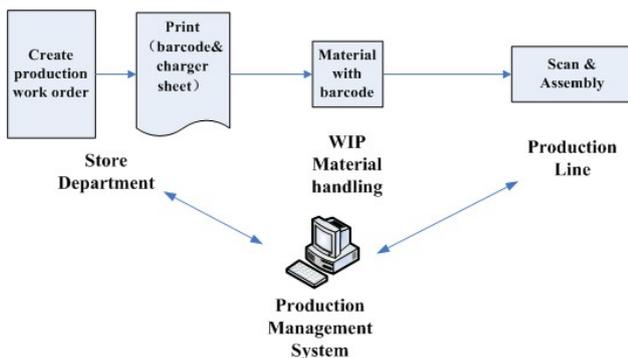


Figure 1 System structure chart

In line with production process, the principle of data acquisition is as follows.

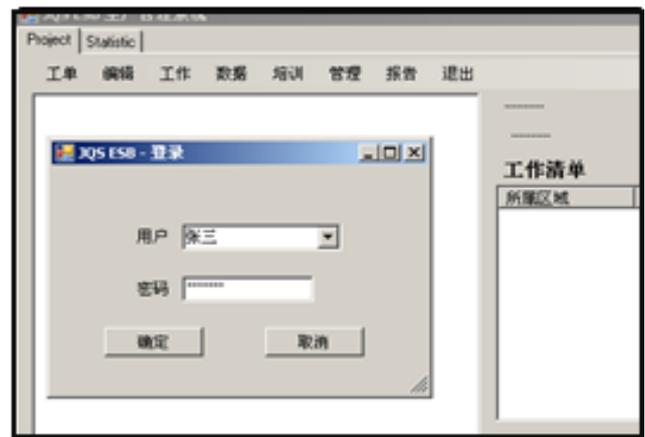
Firstly, work order is built by warehouse department. Warehouse keepers log into production management system and print out material's bar code corresponding to each work order, then stick bar code in related materials by dosing staff.

Then responsible workers dispense materials attached bar code to each production line; operators log in system and open current work order, scan bar code by bar code reader. By this way, it is not only record time for each working procedure, but keep current operators. When processing and assembling are completed, carriers send to take test and make final quality inspection.

At last, controllers can enter into system to select work order and release processing situation in the whole process. It is helpful to get to know working schedule, plan and balance production in real time.

## 4. Process of program realization

### 4.1 User log-in



### 4.2 Set up bar code properties



### 4.3 Convert material number to bar code

```

public static string ConvertTo128(string inputData)
{
    string result;
    int checksum = 104;
    for (int ii = 0; ii < inputData.Length; ii++)
    {
        if (inputData[ii] >= 32)
        {
            checksum += (inputData[ii] -
32) * (ii + 1);
        }
        else
        {
            checksum += (inputData[ii] + 64)
* (ii + 1);
        }
    }
    checksum = checksum % 103;
    if (checksum < 95)
    {
        checksum += 32;
    }
    else
    {
        checksum += 100;
    }
    result = Convert.ToChar(204) +
inputData.ToString() + Convert.ToChar(checksum) +
Convert.ToChar(206);
}
  
```

```
return result;
}
```

### 4.4 Print bar code

Barcode is generated as warehouse keepers input data through information management system, all materials run by program backstage code, which create corresponding bar code appearance and unique one.

#### (1) check and import database information

ItemNumber	Description
Y62884825_L	CONN,PWR-HSG,ST, 2CKTS
Y97331801_L	DEGAS DRIVER #P1229-2/2,
100D420ED11_L	CONTACTOR,420A,110-130V
100D420ED11_L	CONTACTOR,420A,110-130V
1492CJ62_L	Terminal Jumper, 2 Position
1492CJ64_L	4 POLE CENTER JUMPER
1492CJ64_L	4 POLE CENTER JUMPER
1492CJ64_L	4 POLE CENTER JUMPER
1492EAJ35_L	Terminal block end anchor
1492EBJ3_L	End Barrier
1492J4RE_L	TERMINAL BLOCK

#### (2) material number is generated to corresponding bar code



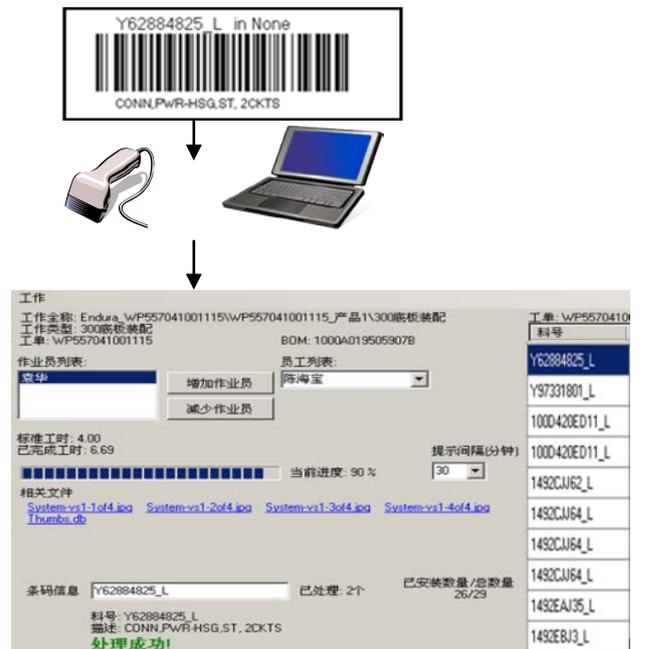
The process of importing data and printing bar code:

```
private void OnFilePrint(object sender, EventArgs e)
{
    try
    {
        if
        (printDocument.DefaultPageSettings.PaperSize.RawKind
        != 9)
        {
            dlgPageSetup.ShowDialog ();
            if (dlgPrint.ShowDialog() ==
            DialogResult.OK)
            {
                printDocument.Print ();
            }
        }
        else
        {
            if (dlgPrint.ShowDialog() ==
```

```
DialogResult.OK)
{
    printDocument.Print();
}
}
catch (InvalidPrinterException ex)
{
    MessageBox.Show(ex.Message,
    "Print Label", MessageBoxButtons.OK,
    MessageBoxIcon.Error);
}
}
```

### 4.5 Coding process of converting bar code to material number

It is common that adopting scanning gun with USB port to read bar code in the market.



```
private void linkLabelDoc_LinkClicked(object sender,
LinkLabelLinkClickedEventArgs e)
{
    Process.Start((string)((LinkLabel)sender).Tag);
    ...
    labelQty.Text = "installed: " +
count.ToString() + "individual";
    labelMessage.ForeColor =
Color.Red;
    labelMessage.Text = "enough
amount installed, no exceed!";
}
else
{
    labelQty.Text = "installed: " +
count.ToString() + " individual ";
```

```

labelMessage.ForeColor = Color.Green;
labelMessage.Text = "handle successfully";
}
    
```

### 4.6 Coding process of deriving excel file

Data is transmitted by excel form, and then make diagrams to visually analyze data, so that clearly get to know current processing information of product.

Group	工单	工作内	标准工	实际工	效率	当前进度	员工编号	开始时间	结束时间
LAK UV	WPPRO0039	配料	4	4.5	0.89	100%	107821	5-Jul	5-Jul
LAK UV	WPPRO0039	装配	26	30	0.87	100%	107562	9-Jul	12-Jul
LAK UV	WPPRO0039	测试	5	2.2	2.27	100%	107361	13-Jul	14-Jul
LAK UV	WPPRO0039	质检	2	1.8	1.11	100%	107125	15-Jul	15-Jul
JET WB	WPJET00175	配料	5	5.2	0.96	100%	107821	6-Jul	6-Jul
JET WB	WPJET00175	装配	30	14	0.36	78%	107566	9-Jul	10-Jul
JET WB	WPJET00175	测试	5						
JET WB	WPJET00175	质检	3						

```

Private void exportToExcelToolStripMenuItem_Click(object sender, EventArgs e)
{
    SaveFileDialog saveFileDialog = new SaveFileDialog();
    saveFileDialog.Title = "import file route";
    saveFileDialog.Filter = "Excel 2002/2003 file (*.xls)|*.xls";
    saveFileDialog.FileName = "ESB" + "_" + DateTime.Now.Year + DateTime.Now.Month.ToString("D2") + DateTime.Now.Day.ToString("D2");
    if (saveFileDialog.ShowDialog() == DialogResult.OK)
    {
        toolStripStatusLabelProcess.Text = "...";
        toolStripProgressBarProject.Value = 0;
        this.Cursor = Cursors.WaitCursor;
        string fileName = saveFileDialog.FileName;
        Excel.Application xlApp;
        Excel.Workbook xlWorkbook;
        Excel.Worksheet xlWorksheet;
        object misValue = System.Reflection.Missing.Value;
        xlApp = new Excel.ApplicationClass(); xlWorkbook = xlApp.Workbooks.Add(misValue);
        xlWorksheet = (Excel.Worksheet)xlWorkbook.Worksheets.get_Item(1);

        xlWorksheet.Cells [1, 1] = "Group";
        xlWorksheet.Cells [1, 2] = "work order";
        xlWorksheet.Cells [1, 3] = "product";
        xlWorksheet.Cells [1, 4] = "working content";
        xlWorksheet.Cells [1, 5] = "standard working hour";
        xlWorksheet.Cells [1, 6] = "actual working hour ";
        xlWorksheet.Cells[1, 7] = "efficiency";
        xlWorksheet.Cells[1, 8] = "current schedule";
        xlWorksheet.Cells[1, 9] = "staff
    
```

```

number";
xlWorksheet.Cells[1, 10] = "start time";
xlWorksheet.Cells[1, 11] = "end time";
int count = 0;
int rowCount = 2;
foreach (TreeNode node in treeViewProject.Nodes)
{
    ...
    ...
    xlWorkbook.SaveAs (fileName, Excel.XlFileFormat.xlWorkbookNormal, misValue, misValue, misValue, Excel.XlSaveAsAccessMode.xlExclusive, misValue, misValue, misValue, misValue);
    xlWorkbook.Close(true, misValue, misValue);
    xlApp.Quit();

    releaseObject(xlWorksheet);
    releaseObject(xlWorkbook);
    releaseObject(xlApp);

    MessageBox.Show("Excel derived successfully.");
    toolStripStatusLabelProcess.Text = "";
    toolStripProgressBarProject.Value = 0;
    toolStripStatusLabelCount.Text = "";
    this.Cursor = Cursors.Default;
}
}
    
```

## 5. Advantages of application of bar code production system

### 5.1 Traditional data acquisition

It is difficult to collect information in the process of entire production before. [8]  
 (1) Mechanical handmade record, disorder management and equivocal responsibility  
 (2) Complicated data integration, more mistakes

### 5.2 Data acquisition by bar code

Efficiently monitor the production process and completely resolve complicated record problem. Computer technology realizes product data acquisition and interactivity, shortening production period and ensure veracity and safety of information, enhancing management efficiency, realizing data network resource sharing. Those mainly reflect as below:  
 (1) Uniqueness. Fixed coding rules make each material possess only identification.  
 (2) Accuracy. Timely tracking product by means of material bar code, collecting processing and assembling data to achieve product trends at any time.  
 (3) Provide dynamic control for workshop supervisors.

Monitoring every running situation in each sector. Only by button of system window “input current data”, processing information will be output in the form of excel text such as assembling schedule, starting time, completed working hours and operators, thereby keep normal operation.

(4) Ensure quality. If product test has some problem, can find responsible operator through bar code data to resolve issues timely. By this way, help to ensure that the product quality of shipment, and for tracking can be checked, shorten the product cycle.

(5) Optimize allocation of resource. Through the barcode query and statistics on the production line of each production areas of the processing and assembling situation, find out the production bottleneck, in terms of machinery equipment and operators, optimize configuration. Consequently, it will improve work efficiency.

## 6. Conclusion

For manufacturing enterprises, application of bar code technology can greatly improve timeliness and accuracy of data acquisition in the process of informationization, effectively reduce enterprise logistics cost, save time and shorten the production cycle. But from equipment inherent cost point of view, the bar code technology is based on the bar code printer, scanner and computer to realize, virtually increase the cost investment of enterprises, and from the production line to the management, the concept for bar code application requires support of all employees to seriously scan processing installation information. Therefore, with regard to minor manufacturing enterprises, bar code technique should be implemented combined with their

management system and actual operating process, in order to radically enhance production efficiency and quality.

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