# Automatic Product Handling Identification and Sorting Using LabVIEW

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## Abstract

Sorting process remains essential in numerous areas and wide industrial applications such as automated manufacturing industries, libraries, factories, warehouses, pharmacies, supermarkets and many more places. The two types of sorting are manual sorting which is done by hand and automated sorting where a specialized device is used for sorting purpose. Since the automated sorting provides advantages such as reliable, efficient, fast and accurate sorting; automated sorting is preferred over manual sorting. In automated product handling identification and sorting, the mails are sorted automatically using NI LabVIEW image processing.

**Keywords:** LabVIEW, Virtual Instrument, Postal Sorting, Pattern-Based Recognition, Process Handler, Identification, Postal Automation.

## Introduction

The field of Mail (Postal) delivery is exponentially increasing due to e-commerce facilities which has led to the emergence of private deliveries. All the mails and posts are dispatched by the dispatching centre, which are located at the regional areas. The employees in dispatch centers are less, but they share lots of work like arranging, classifying and sorting the mail according to the local area. This consumes a lot of time and energy.The existing system is of manual processing in India and other countries.

There is an emerging trend in sorting industry. The sorting gets automated to save time and money. A recent trend on this application is based on implementing "optical character recognition" in which the characters are recognized and sorted manually. The main drawback of the current system is that, it cannot process the handwritten texts.

In this paper, the "pattern-based recognition" is implemented by scanning bar-code and QR code. The mail handling services like Blue dart, fed ex and other online retailers use QR code and Bar-code to identify the product. In this technique, the Bar-code and QR code is used to identify the location of the post to be delivered.

The major objective of the "automatic process handler" is to minimize the labour in the dispatch centre, implementing a hassle-free solution based on computerized implementation is used to reduce the error occurred in manual process. By this way, we can reduce error and handle the post with better efficiency without any manual delay.

## Review of Literature

The Multi-front Word Recognition system was introduced for postal sorting in [1]-[3]. The posts are identified by Single Character Recognition (SCR). The single line character used to identify the words in the post for four different cases such as upper case, lower case, numerical and lower case with upper case initial. The identification was proposed using the contextual post-processing. [4] Postal automation for mail sorting uses Optical character recognition (OCR) technique which is similar but advanced to Single Character Recognition (SCR), also it is implemented using MATLAB. MATLAB is a Mathematical networking simulation tool. The PIC Microcontroller is used to control servo-motor based on the area to be sorted. Later the mail sorting is implemented in LabVIEW with OCR technique. [5] The major drawback of Optical Character Recognition technique is depending upon the characters it cannot process the handwritten notes, a further fuzzy logic should be implemented for recognizing handwritten notes, this adds complexity to the overall system.

**Proposed System**

The system utilizes the pattern-based recognition sorting using NI LabVIEW, LabVIEW allows user to use both hardware and software. The hardware is mainly implemented in myRIO which stands for my Re-configurable input and output, it is educational hardware that allows user to implement various applications. Fig.1 shows the block diagram of proposed system.

For faster system performance, the posts are placed over a conveyor belt by manual input. the conveyor is driven by the DC Gear motor of 12 V, 60 RPM. The Sharp IR Sensor detects the object by distance and then a camera with high resolution is used to capture the image of the post. The image is processed in LabVIEW by NI IMAQ, which is used for image processing to read the QR code and Bar code from the captured image. By using myRIO, the PWM (Pulse Width Modulation) pulse is generated to control the high torque 360-degree Servo motor for the angles 45, 90, 135 and 180 degrees. The servo motor is fixed to the collecting disc. As the collecting disc rotates to a certain angle the posts fall onto the collecting tray.
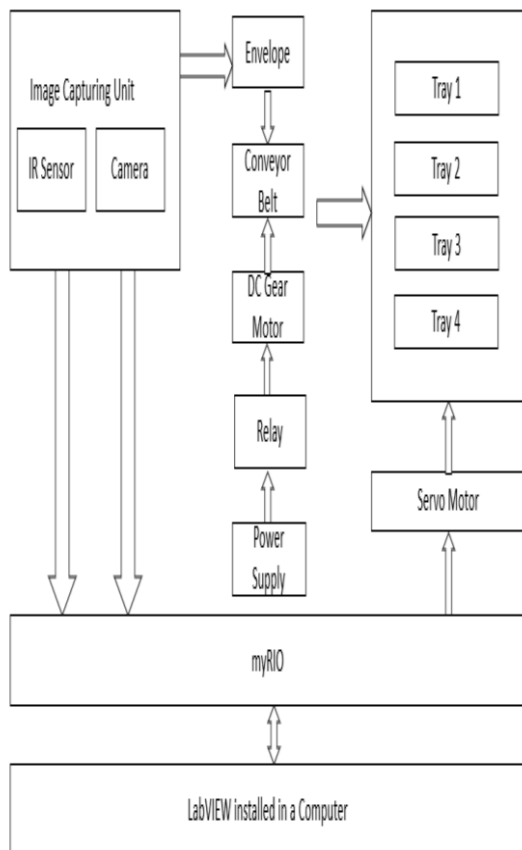


**Fig. 1 Block diagram**
**Hardware Implementation**

The hardware configuration consists of 2 modules they are:

**Module 1**

The function of the module is to detect the object and acquire the image of the object.

This module consists of:
1. Sharp IR Sensor – for object detection
2. High-Resolution USB Camera – for image acquisition of posts

The sensor and Camera are connected with myRIO for executing Image Processing.

**Module 2**

The function of this module is Image processing of acquired Image of the object by the camera and sensor in module 1. This module consists of:

**Conveyor –** for passing the object to the sorter.
**Collecting Unit –** Collecting tray fixed with Servo motor for collecting sorted posts

Module 2 is the output of the project wherein the sorting technique by scanning the QR Code/Bar code is executed.

myRIO

Fig.2 shows the **myRIO**. **myRIO** stands for my Re-configurable Input and Output is educational hardware, developed and manufactured by National Instruments. it is used for image acquisition processing in LabVIEW with the help of NI Vision Acquisition and NI IMAQ the pattern recognition technique is implemented in image processing. myRIO also generates PWM (pulse width modulation) signals to the servo motor to collect the posts. The important specifications are it has 3 ports they are A, B and C ports. The Xilinx Zynq-7010 processor is inbuilt and it supports both FPGA and Real-time in processor speed of 667Mhz with dual processor cores. It also supports an inbuilt wireless IEEE 802.11 b,g,n. There are 40 Digital Input and Output pins, 12 Analogue input pins and 8 analogue output pins. It also supports 8 PWM, 4 encoder pins. For the communication protocol, myRIO supports SPI, I2C and UART protocols. The sampling rate is about 500kSa/s sample with a resolution of 12- bits.

**Sharp IR Sensor**

For object detection Sharp IR sensor is used, GP2Y0A21YK0F is a distance measuring sensor unit, composed of an integrated combination of PSD (position sensitive detector), IRED (infrared emitting diode) and signal processing circuit. Distance Measuring Sensor Unit Measuring distance is from 10 to 80 cm Analog output type.  For the supply voltage 4.5 to 5.5 Volts, the consumption current is about 30 mA.



**Fig. 2 myRIO**

**USB Camera**

USB based camera with resolution of 25 Mega Pixel interpolated is fixed down the stand

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focusing the conveyor to acquire the image of the posts. The camera is connected via USB to myRIO and the image is obtained in LabVIEW.

**Conveyor**

A conveyor is used to pass the post from manual input to the collecting unit. It is driven by the DC gear motor of 12Volts, 60 RPM. The measurements of conveyor belt are about 86cm*23cm (l*b) and it is 15cm above the ground, provided with four side stands.For smooth rotation of the motor, the ball bearing is fixed on the motor. Ball Bearing enables rotational or linear movement while reducing friction and handling stress. The motor selection is based upon torque, by motor, characteristics curve the motor with less rated RPM gives high torque.

Collection unit

Collecting unit consists of collecting trays placed in the wooden disc driven by servo motor.The collecting board turns to a certain angle provided by PWM pulses from myRIO. The MG-995 is a 360-degree high torque servo motor is used for the operation. The operating voltage ranges from 4.8 Volts to 7.2 Volts, it operates at a stall torque about 13kg/cm for 4.8 V supply and 15kg/cm for 6.6V supply.

**Simulation Results**

The LabVIEW is used for software in the Automatic Process Handler. LabVIEW abbreviates Laboratory Virtual Engineering Workbench is a system-design platform developed by National Instruments. It is programmed by using Graphical coding. It is commonly used for data acquisition, instrumentation control and industrial automation.

In the educational hardware myRIO, the IR Sensor and Servo Motor are interfaced to the LabVIEW. Pulse Width Modulation signals are generated in the LabVIEW. For a certain angle of rotation, the duty cycle of the PWM generator is adjusted so that the motor rotates in the appropriate angle of rotation. The VI for processing data by image acquisition is shown in Fig.3.
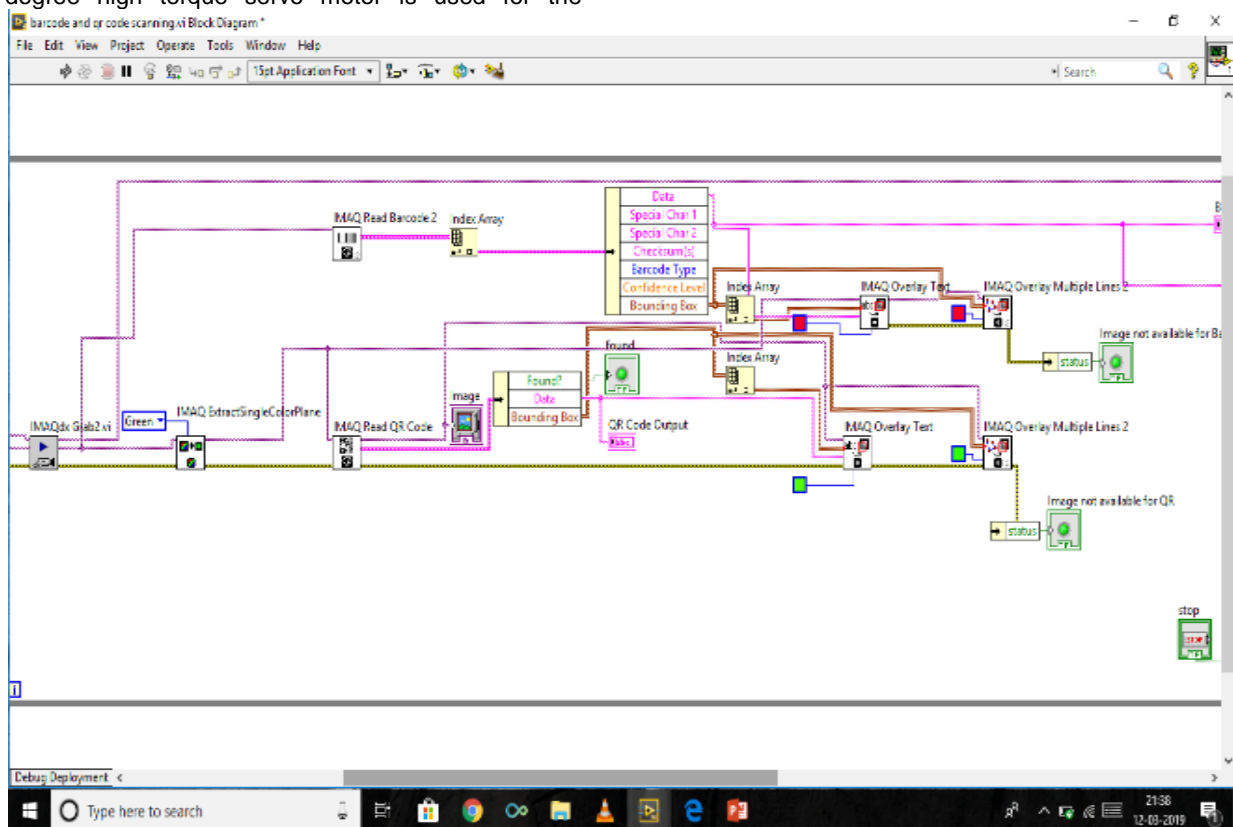


**Fig. 3 Image acquisition by scanning Barcode and QR Code**

Fig. 4 shows the front panel output for the process is given below for the Barcode and QR code recognition using LabVIEW.
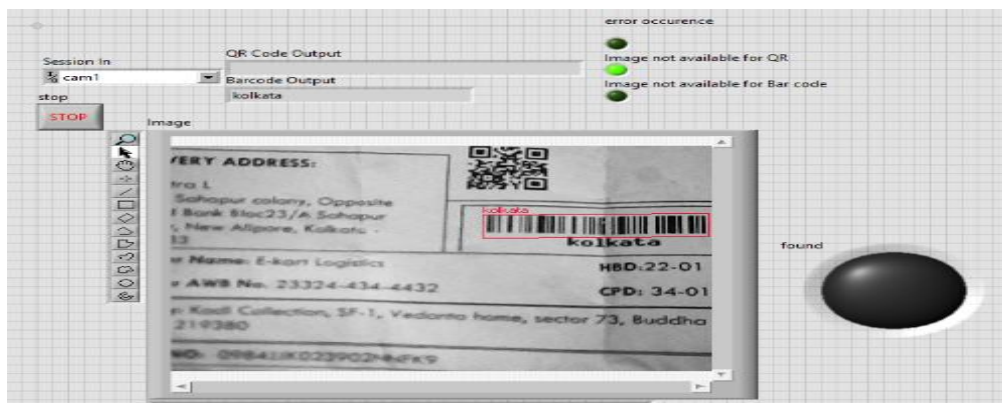
**Fig. 4 Front Panel of Bar code and QR code**

The front panel output for the process is given for the generation of PWM signal to servo motor with the duty cycle of 0.186 from myRIO in LabVIEW. As the mail sorting is based on zonal areas, four areas such as Chennai, Kolkata, Bangalore and New Delhi are taken as example and the duty cycle given for servo motor is given in Table.1.

| S. No. | Place | Angle | Duty Cycle |
|--------|-------|-------|------------|
| 1. | Chennai | $45^0$ | 0.09 |
| 2. | Bangalore | $90^0$ | 0.14 |
| 3. | New Delhi | $135^0$ | 0.186 |
| 4. | Kolkata | $180^0$ | 0.22 |

Table.1 Duty cycle for various area

For further advances, the automated process handler has wide applications with improved features. The hardware implementation is shown in Fig. 5. The hardware detects area based on bar code.



**Fig. 5 Hardware Implementation of Proposed System**

## Conclusion

This paper proposed a novel automatic product handling identification and sorting using LabVIEW. This project sorts mails and parcels automatically using LabVIEW. The proposed system is validated using simulation and hardware implementation. A sorter for main areas can be extended and it can be used to separate for regional areas or it can be able to sort the mails according to domestic delivery and International cargo delivery. For complete automation, the robots used to transport mail from one place to another place in a delivery centre can be operated by pointing its way by QR code recognition.

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