Automated Object Detection and Sorting

Aashay Bane[1] Avinash Panicker[2] Nandan Naik[3] Rakesh Malviya[4] Dr.A.M.Salsingikar[5]
[1,2,3,4]U.G. Student [5]Associate Professor
[1,2,3,4,5]Atharva College of Engineering, Mumbai, India

Abstract— In many industries object sorting techniques uses maximum advantages of imaging technologies such as hyper spectral technique. In today's world, application of image processing in many industrial purposes has proven its acceptance and supremacy. Because of multi-level nature design of object sorting algorithms is a challenging pattern recognition problem. Objects represented by sets of pixels per spectra in hyper spectral images are to be allocated into pre-specified sorting categories. This Project illustrates the designing of two-stage algorithms of sorting, learning to distinguish individual pixels per spectra and combining the decisions of per pixel into a single per object outcome using MATLAB software. The Project provides a case-study on designs of algorithms in a real-world industrial sorting problem using webcam. Depending upon the previous knowledge of image sorting techniques, four algorithms are studied. Assuming the ideal system, the sorting accuracy as well as the algorithm execution speed is estimated. We discuss the accuracy or speed of different algorithms.

Key words: Automated Object Detection, Object Sorting

I. INTRODUCTION

In today's world industries are developing at a very high rate therefore we need to also concentrate on the inner features of its success. The main objective in making of this project is the proper sorting of objects, according to its industrial usage. Sorting conveyer belt's shape is designed to illustrate sorting materials mechanism depending on their shape.

In initial conditions of conveyer belt all the motors are running where motor 1 in the first conveyer belt stops the over assembling of materials being placed on the conveyer belt and motor 2 for sorting. The camera will click the picture and identifies the shape of the object and do the sorting as per the need. The object detection is done by shape recognition by extracting edges of the captured image by using shape detection. Object detection is one of the early steps of the object detection systems. In sorting objects such as aluminum cans, iron cans, flammable cans, the images obtained only one object and having detected object using combination of sharpening and edge detection method.

The 2nd part of the project is mechanical actuator which pushes the object of desired shape from the conveyer belt and keeps aside while allowing other shape object to pass through conveyer belt.

To push the object from conveyer belt the conveyer belt is made to stop at desired place and accurate timing. At that time the actuator pushes the object which is on the conveyer belt.

We are using MATLAB the image processing software and microcontroller to sense object size. Ultrasonic receivers can either use amplified signals going to the A/D of the MCU, or comparing them to a reference, creating a simple pulse train entering the MCU. Thus by using fully automated system required time for the sorting is decreased to the greater extent to make the proposed system fast, accurate, economical, robust and cost efficient.

A. Objectives:

1) Sorting objects depending upon the shape
2) Providing automation to the process
3) Designing easy and simplified operational system
4) Counting and displaying the number of the objects

II. BLOCK DIAGRAM

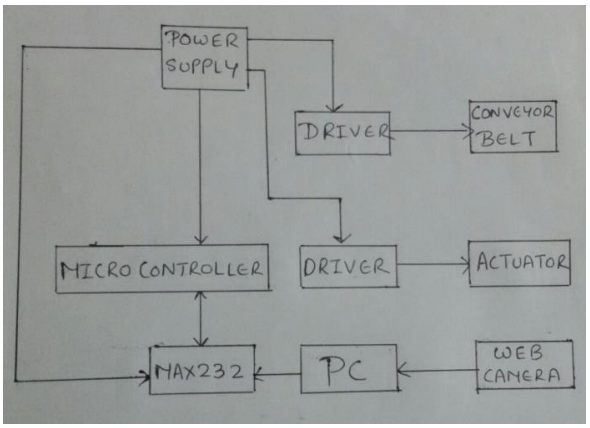

Fig. 1: Block Diagram

A. Block Diagram Description:

Microcontroller P89V51RD2 is the heart of the entire system and used for analysis of data. It will capture all the data fed by users and will do the comparison with standard data entered by system operator. The various devices connected to the system are camera, two pair of IR sensor, display module, two DC motor, a conveyor belt, power supply module. Camera is input sensor which is connected to PC. Camera captures real time images of objects. There is PC with MATLAB software installed is connected to Micro-controller by using RS232 cable. LCD display is connected to Micro-controller to display object count. Driver IC is driving DC motor. There are two DC motors are used to drive conveyor belt. Conveyor motor receives power and signal from the supply through control circuit and rectifier. The control circuit consisting of a potentiometer will give access to the user to manually control the speed of conveyor belt by the regulatory knob. A conveyor belt consists of two or more pulleys, with a continuous loop of material the conveyor belt that rotates about them. Out of these two DC motors one is used as driver pulley and other is used as idler pulley.

Two types of power supply are required to drive this system. One is used to drive Micro-controller and other is used for driving DC motor. Micro-controller is interfaced with PC using RS232 cable. Two pair of IR sensors is used to detect of object at two different positions on the conveyor belt. If object doesn't match with the original object then a pulse will be given to actuator which will reject the false-imaged object. Camera is placed at exactly centre of the conveyor belt.

III. WORKING

A. Object Placement:

It is first part of the system in that all objects which we have to be sort are placed on the conveyor belt. We have to place objects of different shapes on the conveyor belt. Object placement should be done as one object get sorted after that another object is placed on the conveyor belt. After placing an object on the conveyor belt then start conveyor belt for further processing.

B. Capture Image:

The conveyor belt stops moving and takes stable position. The web camera used in this case will be overhead and it will take the snapshot of the object for shape sensing purpose. With the help of camera real time image of an object is taken. This image should be good quality and which is send to PC with MATLAB software.

C. Image Processing:

1) Important terms related to image processing

- Pixel: Pixel is the basic of an image. A pixel is the tiniest possible image that can be detected on your screen.
- Binary Image: An image that composed of mainly black and white pixels.
- Grey scale Image: It carries intensity values ranging from a minimum (absolute black) to a maximum (absolute white) and in between varying shades of grey. Typically, this range is between 0 and 255. Representation of an Image in MATLAB: An image in MATLAB is stored as a 2D matrix (of size m x n). Where each element of the matrix represents the intensity of light/color of that particular pixel, hence, for a binary image, the value of each element of the matrix is either 0 or 1 and for a grey scale image each value lies between 0 and 255.

The system receives an image stream on its input. Objects, present in the stream, are captured and each object is classified into one of the pre-specified sorting categories. In this study, we assume a perfect object detector of the object. We focus on the design of the object classifier.

D. Personal Computer:

The personal computer is used in our project for shape detection using image processing. The image is captured by web camera is given to P.C. It takes the image and processes it according to the shape detection algorithm in matlab to identify the shape of the object. Once the shape of the object is detected it gives necessary signal to the microcontroller to take further action .P.C. acts as a link between microcontroller and the web camera and it is having all the software part such as Main GUI, matlab, etc.

E. DC Motor:

Fig. 2: DC Motor

30RPM Centre Shaft Economy Series DC Motor is a DC geared motor with high quality low cost. It has gears made from steel and pinions to ensure longer life and better wear and tear properties. The output shaft rotates in a plastic bushing. The whole

assembly is covered with a plastic ring. The gears are fixed on hardened steel spindles polished to a mirror finish. Gearbox is sealed and lubricated with lithium grease and require no maintenance. From inside the motor is screwed to the gear box. Motor gives 30 RPM at 12V but motor runs smoothly from 4V to 12V and gives broad range of RPM and torque. Specification below gives fairly good idea of the motor's performance in terms of RPM. No load current as a function of voltage and stall torque, stall current as a function of voltage.

1) Specifications:

- DC supply: 4 to 12V
- RPM: 30 at 12V
- Total length: 46mm
- Motor diameter: 36mm
- Motor length: 25mm
- Brush type: Precious metal
- Head gear diameter: 37mm
- Head gear length: 21mm
- Output shaft: Centered
- Shaft diameter: 6mm
- Shaft length: 22mm
- Gear assembly: Spur
- Motor weight: 105gms

IV. ADVANTAGES

1) Man power is condensed
2) Economical technology
3) A broad scope for future advancement
4) Can be programmed to detect irregular shapes
5) The object size need not to be fixed
6) High efficiency
7) High speed of operation.
8) High precision: margin of error can be reduced to great extent.
9) High degree of intelligence.
10) Low failure rate with long life.
11) Reliable operation and maintenance.
12) Fully automatic operation.

V. APPLICATIONS

1) In small scale and large scale industries.
2) To sort the products based on the various parameters.
3) Can be used in store department.
4) In malls and small shops (e.g. hardware)
5) In medicals and industries producing wines or alcohol to sort the bottles of various sizes
6) In food industries to identify the rotten fruits

VI. FUTURE SCOPE

The proposed system will be a small scale version, so for a large scale production the number of actuators or robotic arms, length of conveyor and cameras system can be made according to requirement. To pick large and heavy objects and sort them effectively advance design of robotic arm can also be used. Generally image capture is a big challenge as there is a chance of high unpredictability due to the external lighting conditions. For collecting object from conveyor system such as fruits, cans or such objects a robotic arm can be used also there is variation in the weight and size of a object so further design can be modified for collecting objects stably. Accuracy, efficiency and speed of the system can be further improved by using advanced ARM processors for the same purpose. Automatic Trolley system can be designed to supervise the sorted objects to their predefined locations.

VII. CONCLUSION

The Automated Object Sorting System can be developed with a vision to decrease the human efforts and make broader use of such systems in Manufacturing and Packaging Industries where there is a need to sort objects and then perform operations on them. The system also proves to be cost efficient since it eliminates the manpower required to manage the object queue and also to sort the objects.

ACKNOWLEDGEMENT

We would like to acknowledge our sincere thanks to Dr.A.M.Salsingikar for taking time from his busy schedule to provide us with a great deal of help, support and encouraged us to work diligently at every aspects of our project. His views have always been equitable striking perfect balance between encouragement and constructive criticism. His constructive tips and suggestions helped us a lot to build a project from an idea. We have been benefiting a lot from his immense knowledge and experience. We are also thankful to our Principal, HOD and all the staff members of the Electronics and Telecommunication department who have provided us various facilities and guided us to develop a very good project idea. Our project at various stages has entailed us to seek help from variety of individuals; we would like to thank each one of them for their forbiddance and guidance. Finally we would like to thank our friends and Teachers for constantly supporting and encouraging our efforts.

REFERENCE

[1] Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay "The 8051 Microcontroller and Embedded System Using Assembly and C" 2nd Edition, Pearson Education, Thirteenth Impression
[2] Rafael c. Gonzalez and Richard e. Woods, "Digital Image Processing," 2nd Edition, Pearson Education, pp. 166,191,443 - 458, 488-490, Fifth Reprint 2000
[3] A. Collet, D. Berenson, S. S. Srinivasa, and D. Ferguson, ―Object recognition and full pose registration from a single image for robotic manipulation,‖ International Conference on Robotics and Automation (ICRA), pp. 48–55, May 2009
[4] MathWorks India - Image Acquisition and Processing Using MATLAB - MATLAB Webinar
[5] www.datasheet4u.com
[6] www.engineeringgarage.com
[7] www.projecttopics.com
[8] www.sciencebuddies.com
[9] http://www.mathworks.com
[10] http://www.tutorialspoint.com/matlab/