

Object Sorting Robot Using Image Processing

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Abstract—

In many Industrial application systems object sorting based on different criteria. The colour can be one of the criteria. Object Sorting Robot using image processing is operating using ARM 7. For the detection of colour, it uses image processing technique. This robot has robotic arm which is used for the function of pick and place, and its arm can move in a vertical direction. This paper presents a object sorting system solution based on colour with the application of image processing. Image is captured in real-time by a webcam and then image processing is used for identification of colour and information out of it. This information is processed for picking the object on the basis of colour and place at particular position. The Project deals with an automated material handling system. The aim of the project is classify the objects based on its colour.

Keywords—ARM7, image processing, robotic arm, dc motor.

INTRODUCTION

The challenging thing is how to improve existing sorting system which consists of four tasks as identification, processing, selection and sorting with a new image processing feature. In this new project named object sorting robot using image processing, robot is used for pick the object and place objects in required places with respect to its colour. This project include three main important tasks, which are tracking object, object search based on colour, and navigation. The project involves image processing that detect the object's colour and according to particular colour sends the signal to the ARM. The ARM sends signal to circuit which drives the various motors of the robotic arm to pick the object and place it in the specified location. Based upon the detection, the robotic arm moves to the desired location, place the object and comes back to the original position. MATLAB software is used to achieve the goal of this project. MATLAB

software is consist a lot of image processing library which is use for object detection based on colour. Coding of this project is done in MATLAB software and it shall be efficient to achieve our goal.

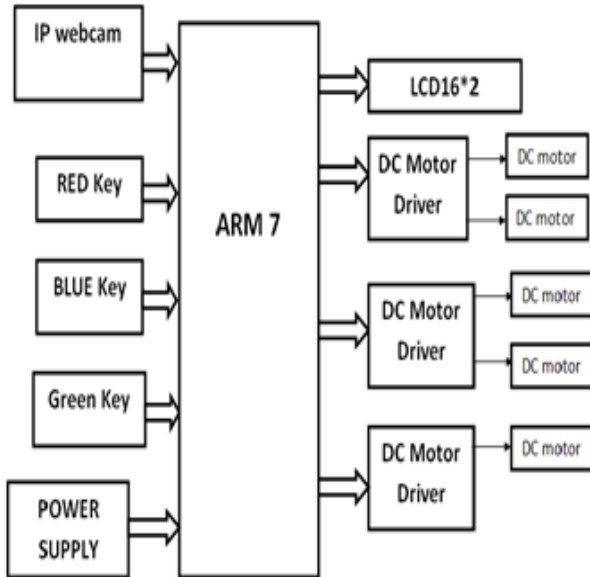
LITERATURE SURVEY

Traditionally, the object sorting process was done by the operator manually. However, this method has some disadvantages such as increase in the cost of the product, slow, and inaccuracy due to the human mistake. Previously quality inspection, sorting, assembly, painting, packaging etc. were done manually. But after the rapid involvement of the field of robotics, the automation industry has undergone a complete makeover and the technology of object recognition is used for such work.

In many packaging industries, color object counting and sorting is the major task that needs to be done. Traditionally, the object sorting process was done by the manually. However, this method has some disadvantages such as increase in the cost of the product, slow, and inaccuracy due to the human mistake. Existing sorting methods are used to set of inductive, capacitive and optical sensors do differentiate colour.

Photodiode based color sensors are attached with this robot system for detecting the color of the perticular object. They measure color based on an RGB color model. A large percentage of the visible spectrum can be created using these three colors[1] but the disadvantages of this kind of system is sensor sensitivity range or affection of environmental conditions. In some existing systems of sorting, objects are placed on conveyor belt and according to movement of belt objects are get sorted[3][4], but the disadvantage of this type of system is object which are not present on belt are not considered in sorting process.

BLOCK DIAGRAM



PROPOSED SYSTEM

Image sensing using MATLAB is used in system for detecting the colour of the object. Microcontroller is the central processing unit, used to control all the functions of other blocks in this robot system. When any particular key is get pressed, MATLAB using camera is start detecting that particular colour object. Microcontroller takes or read data from colour from MATLAB software and controls all the other functions of the system by manipulating these data. Microcontroller control the motor on the robotic arm to pick a particular colour object, as per the signal from image processing microcontroller can understand the colour of the object, it control the arm motor to move towards the specified location, again control the gripper motor to release the object into that particular location.

Microcontroller cannot drive a motor directly, so a motor driver is used here. The motor drive section accept the low level signal from the ARM controller and to provide sufficient voltage and current excitation to the motor. Motor driver is require to provide an interface between the 5V logic signal from the microcontroller & the high current high voltage power is used to drive the motor, because motor is an electromechanical device, which converts electrical energy to rotation or mechanical energy. For this energy conversion large amount of current is required. This amount of

energy cannot be provided by the microcontroller. Therefore motor interface is used here. The motor drive section should be able to accept all the low level logical signal from the microcontroller and to provide necessary voltage and current excitation to the motor. Motor is used to drive the robotic vehicle.

DC motors are well suitable because which have lesser rpm like 30 or 45 and have sufficient torque which is able to drive the all kind mechanical load. A 12V motor is preferable because which can be easily connected to 12V battery. Hence we use dc motor for drive the robotic vehicle. LCD display is used for the purpose of displaying the status of the robotic system. LCD module is a dot matrix liquid crystal display.

SYSTEM COMPONENTS

1. ARM 7(LPC 2138)-

The LPC2138 is heart of this system. It an ARM7TDMI-S based high-performance 32-bit RISC Microcontroller with 512KB on-chip Flash ROM and In-System Programming (ISP), In-Application Programming (IAP). Every other system components are connected to each other by using LPC2138.

2. DC MOTOR AND DRIVER-

DC motors are used to physically drive the robot as per the requirement provide by MATLAB software. The dc motor works on 12v. To drive a dc motor, we need a dc motor driver IC known as L293D. This dc motor driver is capable of driving 2 dc motors at a time. To protect the dc motor from a back EMF generated by the dc motor when it changing the direction of rotation, the dc motor driver have an internal protection suit. We can also provide the back EMF protection circuit by connecting 4 diode configurations across each dc motor.

3. LCD

LCD is used in a project to visualize the output of the application. We have used 16x2 LCD which indicates 16 no. of columns and 2 rows. So, we can write 16 characters in each line. Therefore total 32 characters we can display on 16x2 LCD.

LCD is also used in a project to check the output of different modules interface with the ARM controller. Thus LCD plays an important role in a

project to see the output and to debug the system module in case of system failure in order to rectify the problem.

4. Camera

Web camera E-20 MP is used to capture images of coloured objects. These images are used by MATLAB for detection of colour and according to the basis of that colour objects are sorted.

It has 20 MP resolution, excellent quality, and it gives clear, sharp, still picture and it has adjustable lens.

5. MATLAB

The robot system describes a visual sensor system used in the field of robotics for identification and tracking of objects. The program designed to detect and capture an object through a PC-based camera using MATLAB software. It describes image capturing, processing technique, followed by an introduction to actual robotic application to track the object using the serial COM port of the computer.

The whole system of making a robot to follow an object can be divided into four blocks: image acquisition, processing image, decision making, motion control.

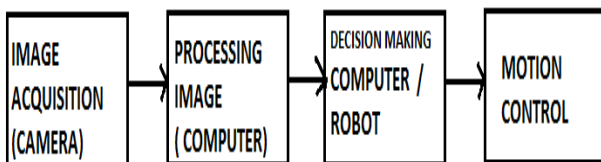


Fig 1-block diagram of robotic vision and control system

Image acquisition can be achieved with a computer-based camera or digital video camera. This device will capture the image and send it to the processor for further processing in the computer.

Image processing involves conversion of RGB coloured image into grayscale images, setting threshold levels and setting of cut-off values to remove noise from the binary image.

Decision making is done with the help of software program.

Motion control through either software or constant monitoring by the operator.

APPLICATIONS

- In small scale or large scale industries to sort out products based on the colour.
- In any type of departmental store.
- In malls and small shops.
- In various industries to sort the bottles or boxes or bags of various sizes such as medicine and wine industry.
- In food industries to identify the rotten or damaged fruits.
- Artificial robotic intelligence.
- It is used in garbage classifier to separate biodegradable, non-degradable, metal pieces, and plastics based on color.

ADVANTAGES

- High precision: the margin of error can be reduced to a great extent.
- This type of sorting robot can be used for various objects or vegetables of different color. Also suitable to select pears, apples and other fruits of this kind.
- It gives a high degree of intelligence if used with PLC control. The machine with a high degree of intelligence can control it.
- Good quality level.
- Low failure rate with long life.
- Reliable operation and maintenance.
- High accuracy.

RESULT

This paper presents design, development as well as construction of the robotic arm using image processing, which can pick and sort out objects on the basis of different colour.



Fig 2 - construction of robotic arm

The aim of this project is to design a fully functional robotic arm which can sort different coloured objects and this target can be achieved successfully.

CONCLUSION

The conclusions drawn from results given by object sorting robot using image processing are as follows,

1. An image processing approach for object colour detection and object sorting has been successfully implemented.
2. Implemented robot system gives accurate result for three basic coloured objects as Red, Green and Blue.
3. With the help of some software changes this robot system can be used to sort out different colour combination of basic specified colour.
4. Due to use of image processing in MATLAB for colour determination, manual efforts are reduced which produces result in improving accuracy as well as saves money and time.

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