Design and Fabrication of Pick and Place Robotic Arm by Using Image Processing Method

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Abstract- **This paper presents an application to sort coloured objects with a robotic arm. We have a robotic arm which picks different coloured cubes and sorts them placing in different cups. The colour recognition is made using image recognition with a webcam. The robotic arms are widely used in the industry, but most of them are used in a PTP (Point To Point) trajectory, the moves are learned previously by the robotic arm. Very few robots in the industry are programmed to be smart, or to make decisions. In the future to completely replace the humans with robots, we need robotic arms which can make decisions. One good example for a smart robotic arm can be a robotic arm which can sort objects by colour. This can be used in many factories; one good example can be a pencil factory.**

Index Terms- **Robotics, Pick and place robotic arm, soft catching gripper, manipulator, Servo motor, sorting, webcam.**

I. INTRODUCTION

In the field of industrial robotics, the interaction between man and machine typically consists of programming and maintaining the machine by the human operator. For safety reasons, a direct contact between the working robot and the human has to be prevented. As long as the robots act out preprogrammed behaviors only, a direct interaction between man and machine is not necessary anyway. However, if the robot is to assist a human e.g. in a complex assembly task, it is necessary to have means of exchanging information about the current scenario between man and machine in real time. For this purpose, the classical computer devices like keyboard, mouse and monitor are not the best choice as they require an encoding and decoding of information: if, for instance, the human operator wants the robot to grasp an object, he would have to move the mouse pointer to an image of the object on a computer screen to specify it. This way of transmitting information to the machine is not only unnatural but also error prone. If the robot is equipped with a camera system, it would be much more intuitive to just point to the object to grasp and let the robot detect its position visually. Observing two humans in the same situation reveals another Interesting effect: by detecting the partner's gaze direction the person who points to an object can immediately control whether his intention has been interpreted correctly. If the partner looks at the wrong object, this becomes obvious immediately In a robot system, this function can be implemented by providing the robot with a stereo camera head that actively find the human hand position in work area. To guarantee a smooth interaction between man and machine a task like this requires that the visual processing. In the following, we will describe a system which fulfills these requirements (compare with [1]). Before we go into details about the vision processing methods, we shortly describe our pick and place robot on which we have implemented our method.

II. HARDWARE DESCRIPTION

The main objective of this paper is to visually track the object and transmit the image to remote PC running Lab VIEW software to find out the object dimensions and send the appropriate control signals to the Robotic arm via RS 232 serial communication to pick and place the object at expected location from unknown location. The system can be controlled by Lab VIEW in PC.
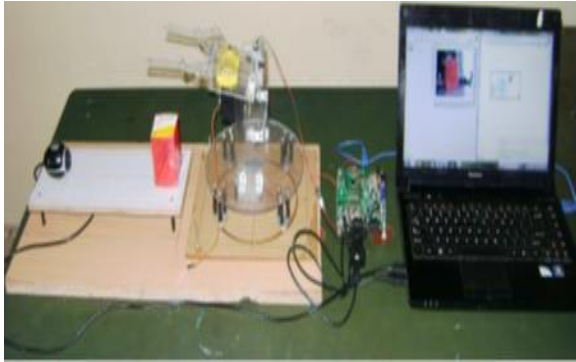
Figure 1. Overall view of Pick and place Robotic Arm assist by LabVIEW Machine Vision

ROBOTIC ARM:-

The overall system of pick and place robotic arm was designed using acrylic sheets. Acrylic sheet is less weight, low cost and easy to cut. The design end effector is very simple. In gripper (end effector) design the standard wheels are used to give support to the whole mechanical assembly. Approximately the gripper weight is 100 grams. The one wheel has connected with servo motor shaft and another wheel has dummy wheel. The rotating the shaft dummy wheel is automatically rotated. The total system was controlled using three servo motors. The servo motor torque is 4Kg.cm. the maximum angle of the servo motor is 180 degrees.
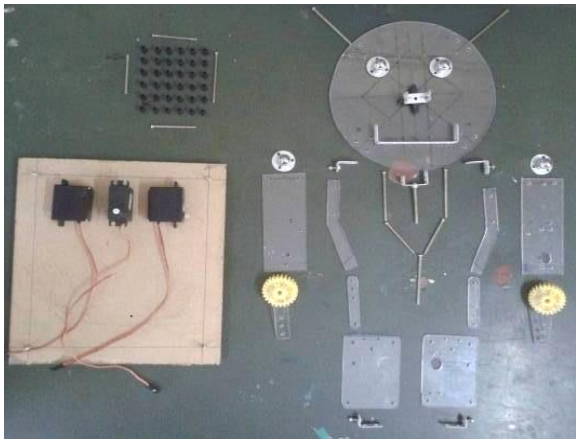

Figure 2.Components of Pick and place Robotic Arm

BASE:-

The figure 3 shows the base of the robotic arm. The four caster wheels are used to connect the round shape of the acrylic sheet. The base is connected to one servo motor and used to rotate the total system of arm. The length and width of the round shape acrylic sheet is 19.7cm and 9.2cm.

Figure 3. Base of Robotic Manipulator

GRIPPER:-

The figure 5 shows the gripper (end effector) of the robotic arm. The gripper is used to pick the object. The maximum gripper open is 9.3 cm for 180 degrees and close position is 1.0 cm for 0 degree. The gripper is connected one servo motor and used to pick and place the object.
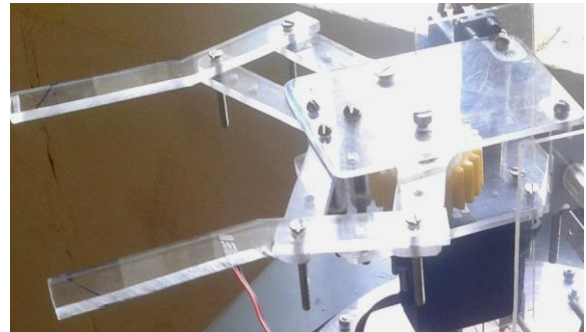

Figure 4. Gripper of Robotic Manipulator

DESIGN OF ROBOTIC MANIPULATOR:-

The complete system of robotic arm was designed using three servo motors. The servo motor is used to join the each link of the arm. The total weight of the system is 500 grams and total height is 19 cm.
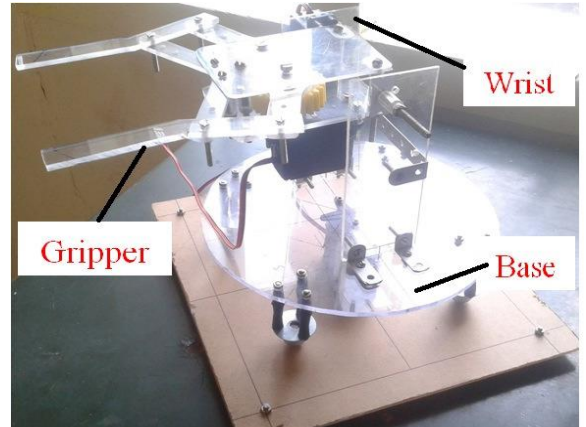

Figure 5. Robotic Manipulator

III. APPLICATONS

- The Fixed Manipulators or Robotic Arms find numerous applications[7] in industrial, domestic, material handling, medical, and hazardous environments. Some major applications are listed below:-
- Industry: Pick and Place Robots are extensively used in automotive industries for assembly, process automation, painting,spot welding, precision milling etc.
- Medical: Robots assist doctors in precision surgery.
- Hazardous Environments: Pick and Place Robots are used in environment, which is either hazardous (eg., radiation) or not accessible.
- Space Exploration: Pick and Place robots are used in rovers for manipulation to carry out tasks in outer space. They are also used for robot assisted maintenance of space station.
- Education: Pick and Place Robots are used as teaching aids.
- Museums:Pick and Place Robots form an attractive exhibit in museums.

IV. ADVANTAGES

The main advantages of the proposed approach rely on the high discriminatory capacity of the object classes and on the high degree of parallelism, capable of processing large amounts of material on production lines. The use of modern electronic systems also allows high operative speed, easy calibration and flexibility (due to a programmable sorting algorithm) to the required classification features. It has high efficiency with higher quality of sorting. It has high sensitivity and ability to distinguish between the objects. It will be always better than human sorting. Some of the prominent advantages are-

- High efficiency: the sorting speed can be very high.
- High precision: the margin of error can be reduced to great extent.
- This type of sorter can be used for various objects or vegetables of different colors. Also suit to select pears, orange and other fruits of this kind.

- High degree of intelligence if used with PLC control. The machine with a high degree of intelligent , can control it.
- Good quality and low failure rate with long life.
- Reliable operation and maintenance.

V. CONCLUSION

Fully functional sorter machine can be implemented by using a structure of parallel and independent channels in order to increase the overall throughput which results with a forecasted performance. The project can work successfully and separates different objects using sensors. The sensor handling systems which drive the pick and place robot to pick up the object and place it into its designated place can work if accurately designed. There are two main steps in sensing part, objects detection and recognition. The system can successfully perform handling station task, namely pick and place mechanism with help of sensor. Thus a cost effective Mechatronics system can be designed using the simplest concepts and efficient result can be observed.

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BIOGRAPHY

Basically We Belongs To Nagpur District Of Maharashtra. Now We Are In Final Semester Of B.E. Mechanical Engineering, KDK College Engineering, Umrer, Nagpur. And Our Final Semester B.E. Project Topic Is "DESIGN AND FABRICATION OF PICK AND PLACE ROBOTIC ARM BY USING IMAGE PROCESSING METHOD