A Flexible Pick and Place Robot with Flexible Hand

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Abstract—**A flexible enveloping grasper is proposed for pick-and-place tasks with low manipulation and task planning complexity for practical applications. The proposed grasper has two main characteristics: self-adaptivity and flexibility. Self-adaptivity means that the proposed grasper can grip an object in a self-adaptive way such that various process complexities (e.g., sensing, force control, and sensor–motor coordination) are significantly reduced. By flexibility, we mean that, by using a flexible material, a stable grip can be implemented to cause increased friction between the grasper and the target object as a result of increased contact area. These two properties help the proposed grasper to minimize internal forces in a passive manner and to achieve successful force distribution with self-adaptivity when performing enveloping grasping. Three sets of experiments were performed with an average success rate of 93.2% in pickand-place tasks.**

In this paper a flexible grasper is used for Robot grasping and pick-and-place task. The main characteristic of this robot that it uses a special flexible grasper to pick and place operations that reduces the use of complex mechanisms that reduces the flexibility of the robot and reduce he constraints of the shape of the objects that can be picked by the robot arm. By using a flexible grasper the friction between the object and the robot arm is being increased. By using this mechanism the success rate of pick and place robots are increased[1][4]

INDEX TERMS— FLEXIBILITY , PICK AND PLACE, FLEXIBLE RUBBER HAND, INTELEGENT ROBOT , PRESSURE SWITCHES

INTRODUCTION

I. Introduction

Before going towords main topic first we see what is robotics?

Robotics is a branch of electronics, mechanical and computer science that deals with design ,construction and operation of robot which is used for automation purpose. Here computer science is used for controlling, sencing and handling purpose.

In this paper we are going to proposed design of an intelligent robot having adjustable rubber hand to perform pick and place task.This robot can be used for grasping any type of objects having various shapes.Figure 1.1 shows the complete block diagram of this system.[1]

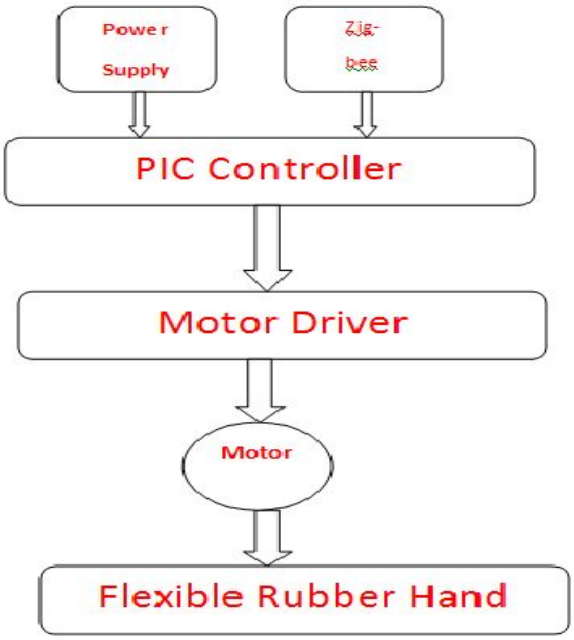

Fig 1.1: Block Diagram of Flexible robot with flexible rubber hand(Receiver Section fixedon Robot)

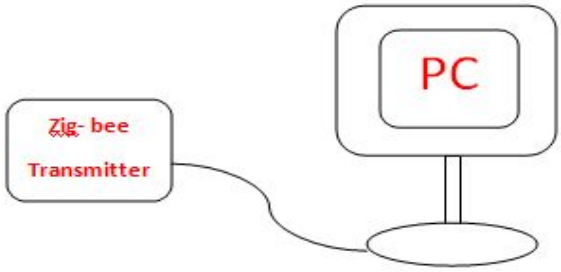

Fig 1.2:Block Diagram Of Control Section

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II.Pick and place arrengment in robot

Pick and place robots take product from one location to another with pinpoint accuracy. Human pick and place applications can require repetitive motion over a long duration resulting in possible ergonomic issues. High-speed pick and place robots can provide increased efficiency as well as decreased production costs and ergonomic issues. High-speed pick and place robots can be mounted on a stand to allow the robots to access their entire working envelope. Product will enter the robotic work envelope after its orientation has been identified by an upstream vision system. Using a custom end of arm tool, the product will be picked and placed by the robot at the desired location. Product can pass/fail inspection based on customer defined specifications for length, straightness, shape, etc.

Pick & place robots are applicable in following applications

1.Fast Assembly – robots can pick parts from incoming conveyor and assemble them onto work pieces carried by an outgoing conveyor with high precision.

2.Inspection and Quality Control – robot visually inspects and picks out defective products moving on a fast conveyor.

3.Fast Packaging – vision spots products spread out on moving conveyor and then the robot transfers them into packaging containers at high speed.

4.Fast Sortation - robot instantaneously picks and separates different types of parts passing through its vision domain[3].

III Hardware parts

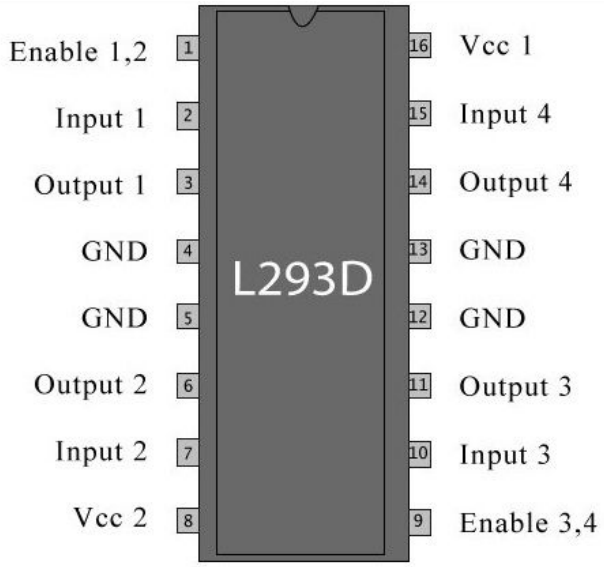
1.1 PIC controller

Microcontroller PIC16F877A is one of the PIC Micro Family microcontroller which is popular at this moment, start from beginner until all professionals. Because very easy using PIC16F877A and use FLASH memory technology so that can be write-erase until thousand times. The superiority this Risc Microcontroller compared to with other microcontroller 8-bit especially at a speed of and his code compression. PIC16F877A have 40 pin by 33 path of I/O.

PIC16F877A perfectly fits many uses, from automotive industries and controlling home appliances to industrial instruments, remote sensors, electrical door locks and safety devices. It is also ideal for smart cards as well as for battery supplied devices because of its low consumption. EEPROM memory makes it easier to apply microcontrollers to devices where permanent storage of various parameters is needed (codes for transmitters, motor speed, receiver frequencies, etc.). Low cost, low consumption, easy handling and flexibility make PIC16F877Aapplicable even in areas where microcontrollers had not previously been considered (example: timer functions, interface replacement in larger systems, coprocessor applications, etc.). In System Programmability of this chip (along with using only two pins in data transfer) makes possible the flexibility of a product, after assembling and testing have been completed. This capability can be used to create assembly-line production, to store calibration data available only after final testing,[4].

1.2 Motor Driver IC L293D

293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC.



1.3 DC Motors

Fig:DC Motor used to construct Robot

12V DC geared motors will be sufficient for most of the robots. Selection of speed (in rpm) depends on the competition. Speed also effects the torque of the motor. Generally for dc motors as speed increases torque decreases.[1][5]

1.4 Pressure Switches

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A pressure switch is a form of switch that closes an electrical contact when a certain set pressure has been reached on its

IV.Pick & Place Process

Pick & Place process is done in following three Steps
1) Planning step
2) Enveloping step
3) Pick & Place step

1) Planning step:

In this step all the planning about pick and place process is completed. E.g. Which object we want to pick? Where we want to place our object? How many weight of that object? Etc.

Properties of an object are unknown in many real cases, and an unstructured working environment has a high degree of uncertainty that can easily cause manipulation errors in positioning and force control. To eliminate these problems and to reach a goal of performing the optimal grasping operations, many researchers have studied grasp planning.

In this section, it is described how the robot simplifies grasp planning tasks to overcome uncertainties and accomplish a successful grasping task. Recall that our goal in this study is to an alternative to optimal grasping with high-cost and well-equipped robotic hands. Thus, as long as a gripping trial of a gripper shows stable grasping performance against uncertain-ties and disturbances and completes a given task, the grasp is considered successful.[4]

2) Enveloping step

In this step according to the weight of the object some instructions are given to the robot through controller. E.g. "Grab" Command is given through the PC, then it will pass to the robot throug given through the PC, then it will pass to the robot through zigbee module. It is given to the controller then controller performs the controlling action on motors.Now motor starts rotating and rubber belt starts adjusting its shape according to shape of object.

The two main tasks in the enveloping phase are the squeezing and sensing of a construction of the force closure. As squeezing proceeds, the robot adapts itself to an object and is being stabilized at some location. This action is attributed to the flexible and compliant materials of the robot skin and palm. Regardless of whether the curvature of the sur-face has contact with the PGP, the object is reoriented in a way that maximizes the contact surface with the robot. Here, the self-stabilization accounts for the fact that a controlling scheme does not need to work out a solution of the corresponding. inverse kinematics problems. Instead, the proposed robot constructs a stable grasp, resulting from its mechanical or embodiment structure.[2]

3) Pick And place step

Actual picking the object and place it to the particular place is done in this step. The arm robot is the crucial part in the pick and place robot. The first stage in the design process is to design the gripper and select the actuator to control it. After that, the arm of robot will be designed to support the gripper without disturbing its operation. The size, length and weight of the gripper will be determined according to the requirement. Normally, the mechanical design of the gripper is based on average adult human. The mechanical design of robotic gripper needed to address the required interaction between the robot and the environment in order to grasp and hold the object securely when executing the operation. For example, to achieve static equilibrium conditions for hold object with three fingers, the three grasping forces must pass through a single point and the angle spacing between two finger forces are two basics grasp configurations - cylindrical and spherical. In cylindrical grasp configuration, two finger are placed so as to oppose the third finger where it useful for grasping prismatic objects[3]

V. Results

Some trials are taken for pick and place tast then following results are obtained. And it is clear that overall success rate of pick and place of all object is above 90%
Following graph shows some trials and its success rate of pick and place.

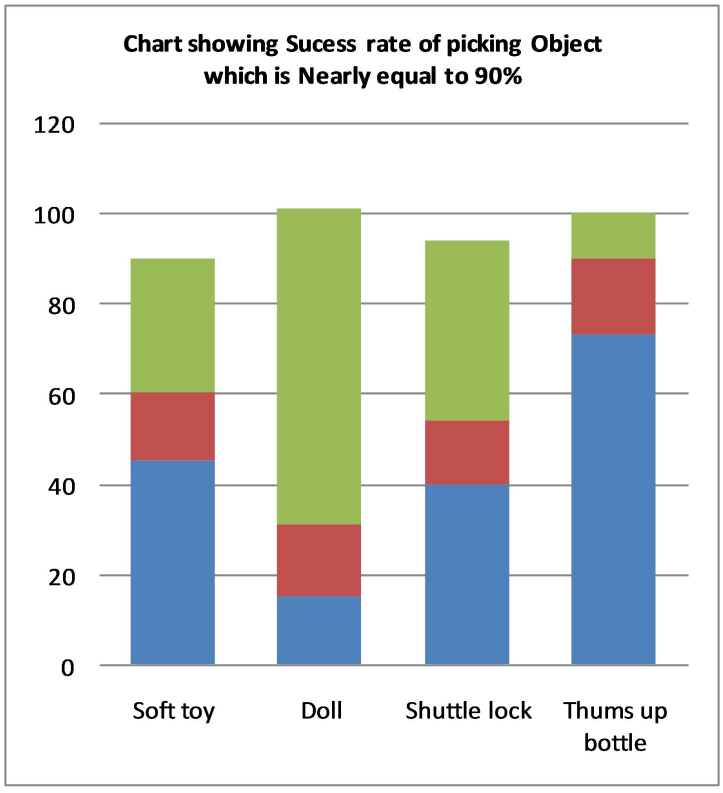

Fig: Graph of Success rate in Pick and place task

Following figure shows the actual photograph of all set up. The commands are given through PC .

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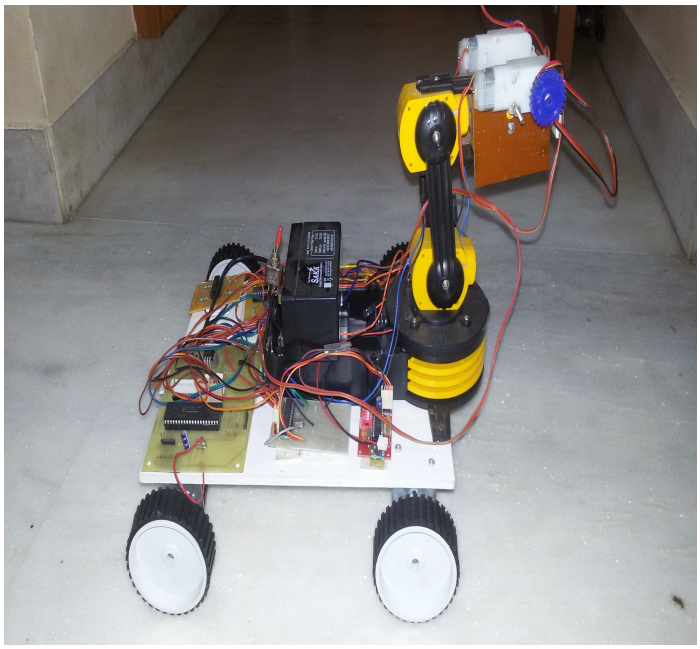

Fig: Actual Photograph of Setup

Conclusion

From all above discussion, we have addressed the issues that prevent current robotic hands from being commercialized and have considered the various approaches taken by many researchers to overcome these difficulties. As an intermediate solution focused on practical application such as with current technology, a simple enveloping robot has been proposed for pick-and-place task, namely, the minimal robot. This robot stably grips various real-life objects with an average of success rates of 93.2% due to its advantageous features of self-adaptivity and flexibility

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