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Pick and Place Robotic Arm Using Arduino

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ABSTRACT: In recent years the industry and daily routine works are found to be more attracted and implemented through automation via Robots. The pick and place robot is one of the technologies in manufacturing industries which is designed to perform pick and place operations. The system is so designed that it eliminates the human error and human intervention to get more precise work. There are many fields in which human intervention is difficult but the process under consideration has to be operated and controlled this leads to the area in which robots find their applications. Literature suggests that the pick and place robots are designed, implemented in various fields such as; in bottle filling industry, packing industry, used in surveillance to detect and destroy the bombs etc. The project deals with implementing a pick and place robot using Arduino- UNO for any pick and place functions. The robotic arm implemented has two degrees of freedom. Many other features such as line follower, wall hugger, obstacle avoider, metal detector etc can be added to this robot for versatility of usage.

KEYWORDS: Arduino UNO, Robotic-arm, Automation

I. INTRODUCTION

Since many years people try to replace human work with machines. Machines called robots are faster and more effective than people. The term robotics is practically defined as the study, design and use of robot systems for manufacturing. Robots are generally used to perform unsafe, hazardous, highly repetitive, and unpleasant tasks. Many elements of robots are built with inspiration from the nature. Construction of the manipulator as the arm of the robot is based on human arm. The robot has the ability to manipulate objects such as pick and place operations. It is also able to function by itself. The development of electronic industry robot system technology has been expanded increasingly. As one such application, the service robot with machine vision capability has been developed recently. In this highly developing society time and manpower are critical constraints for completion of task in large scales. The automation is playing important role to save human efforts in most of the regular and frequently carried works. One of the major and most commonly performed works is picking and placing of jobs from source to destination. Present day industry is increasingly turning towards computer-based automation mainly due to the need for increased productivity and delivery of end products with uniform quality. The inflexibility and generally high cost of hard-automation systems, which have been used for automated manufacturing tasks in the past, have led to a broad based interest in the use of mechanical arm capable of performing a variety of manufacturing functions in a flexible environment and at lower costs. The use of Industrial mechanical arm characterizes some of contemporary trends in automation of the manufacturing process. However, present day industrial mechanical arm also exhibit a monolithic mechanical structure and closed-system software architecture. They are concentrated on simple repetitive tasks, which tend not to require high precision. The pick and place mechanical arm is a human controlled based system that detects the object, picks that object from source location and places at the desired location. For detection of object, human detect presence of object and move machine accordingly.



Fig. 1 Design

II. COMPONENTS

1. Arduino Uno

Arduino board designs use a variety of microprocessor and controllers. The boards are equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits. The arduino board having serial communications interfaces, including Universal Serial Bus (USB) which also uses for loading programs from personal computers to the board. The microcontrollers are typically programmed using a dialect of features from the programming language C and C++.

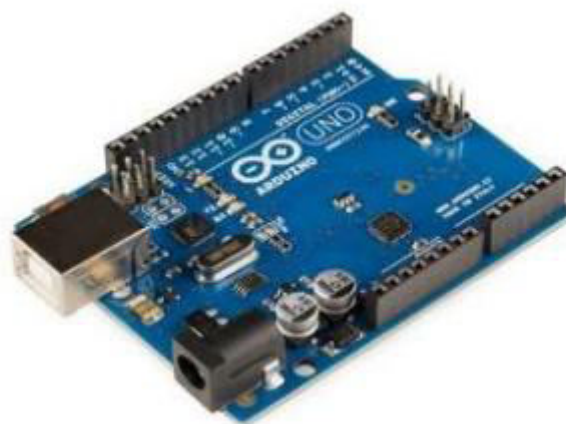


Fig. 2 Arduino Uno

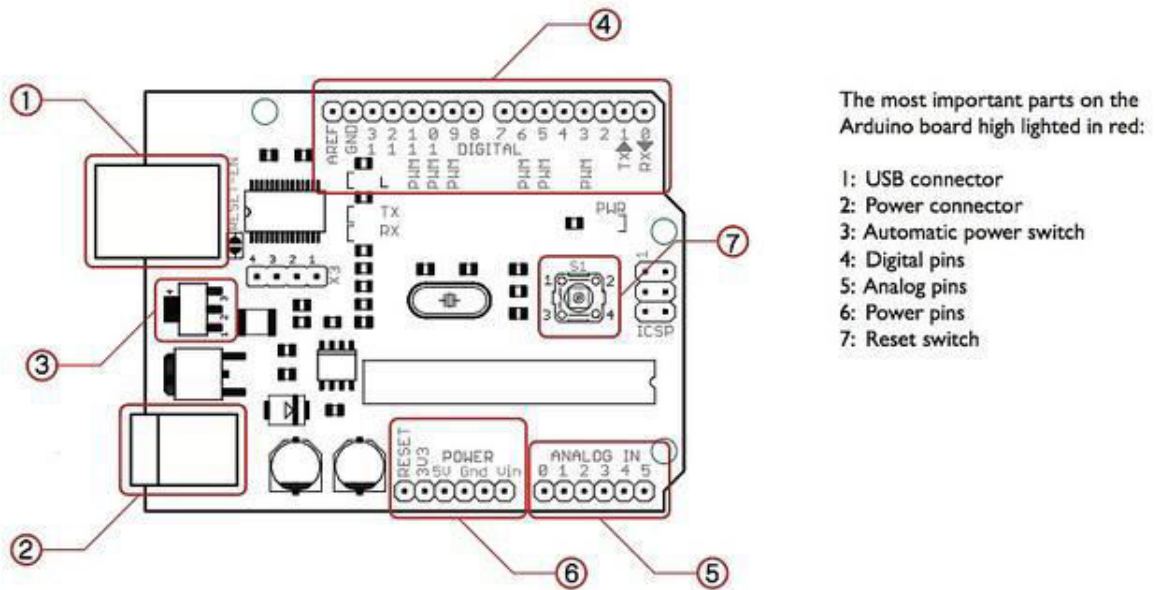


Fig. 3 Arduino Uno Block Diagram

Servo motor

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing. A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.



Fig. 4 Servo motor

The motor is paired with some type of position encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops. The servo turn rate, or transit time, is used for determining servo rotational velocity. This is the amount of time it takes for the servo to progress a set amount, usually 60 degrees. For example, suppose you have a servo with a transportation time of 0.17sec/60 degrees at no load, this means it would take nearly half a second to rotate an complete 180 degrees.

Mechanical Gripper

A mechanical gripper is used to grip the objects and hold it while transferring it from its location to the destination. The gripper has its inbuilt mini servo in it so it can open or close its jaws to grip the objects. The gripper is made from the acrylic by the LASER cutting operation .the shaft of the servo is fixed to the end of first jaw which meshes with the gear on the second jaw. As the motor rotates the gear rotates and this in turn rotates the gear in mesh and the jaws open or close to release or holds the objects. A gear link is attached to a servomotor which is meshes with another geared link to provide a smooth action of gripping of different objects according to their sizes the movement of both of figures of the grippers is synchronize well to hold the object.



Fig. 5 Mechanical Gripper

Jumper Wire

A jumper wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.



Fig. 6 Jumper wire

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

III. PROGRAMMING

Programming of the Pick and place Robot is to be done using a suitable Programming Language. The Robot is to be interfaced with the computer by the programmed software, which will guide the robot to do its job for which it is been programmed. There are numbers of various programming languages available now a day in the market, so the appropriate programming language is to be selected for the programming purpose and the programming is to be done.



```
File Edit Sketch Tools Help
Robot_Arm_vst
#include <Servo.h>

Servo myservo1; // create servo object to control a servo
Servo myservo2;
Servo myservo3;

int potpin = 0; // analog pin used to connect the potentiometer
int val; // variable to read the value from the analog pin

void setup()
{
  myservo1.attach(9); // attaches the servo on pin 9 to the servo object
  myservo2.attach(10);
  myservo3.attach(11);
}

void loop()
{
  val = analogRead(potpin); // reads the value of the potentiometer (value between 0 and 1023)
  val = map(val, 0, 1023, 0, 180); // scale it to use it with the servo (value between 0 and 180)
  myservo1.write(0);
  delay(1000);

  val = analogRead(potpin); // reads the value of the potentiometer (value between 0 and 1023)
  val = map(val, 0, 1023, 0, 180); // scale it to use it with the servo (value between 0 and 180)
  myservo3.write(0);
  delay(1000);
}
```

Done compiling
Sketch uses 2402 bytes (7%) of program storage space. Maximum is 32256 bytes.
Global variables use 56 bytes (2%) of dynamic memory, leaving 1992 bytes for local variables. Maximum is 2048 bytes.

Fig. 7 Arduino Interface

IV. MECHANICAL LINKS

The movement from the servo motor to the tool holding assembly or gripper is transmitted through the various linkages. The design of linkages is such that the power is transmitted with minimum load on the servo motor .the linkage design is made very light weight by using the proper material. The basic concept behind using the links instead of rigid parts is to avoid waste of energy required to perform the motion of the arm. The links in the arm are made from the wooden.

V. APPLICATIONS

The characteristics of a robotic arm are: - its extension: how far from its base it can operate - its positioning: can it control its wrist position, orientation, with what precision, what speed - the tools and objects it can carry o Therefore they can be used as: Painting (cars) - soldering (cars) - access unevenly placed parts (for scanning, selecting...) - pick and place (most industries, a lot for food industry). - act in a human-designed environment: send the arm on a mobile base to a damaged/radioactive building and use the arm to open the door and manipulate the tools (by itself or remote controlled)



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