REMOTE CONTROL BASED PCB DRILLING ROBOT

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Abstract : There is huge problem while designing and fabricating a pcb board. This project eliminates the effort and time consumed for making a pcb board. Here the work is been carried out automatically just feeding the programming to the arduino system. This can perform much faster and accurate as compared to the humans which also increases the rate of production. The system consists of a Arduino UNO R3 board which is been used to control the servo, micro servo motors. In addition to this we are also using a DC motor and DC motor IC L2930. We are using a gripper to pick and place the pcb board after the completion of work. The gripper and drilling machine both are attachable and detachable at the end effector of the robot to perform the task. We are using a remote to operate the robot in the required position and direction to perform the task. The remote is been controlled by using a IR sensor.

I.   INTRODUCTION

Simple drilling machines like hand-held moveable drilling machines, power feed drilling machines, etc. are quite common, we will realize these machines all over. Often these machines area unit used for drilling a through hole over the job; these machines can't be used for range of machining operations for specific applications. Human force is needed to drill the opening, drilling depth cannot be estimated properly, job may spoil due to human errors, and different size holes cannot be drilled without changing the drill bit. Consumes ton of your time for doing recurrent multiple jobs, these all are the drawbacks. To overcome of these issues, this automated drilling machine is designed which is aimed to drill the holes automatically over a job according to the drilling depth data programmed through a key board. According to our survey report, we came to know that the machine designed here with a drilling machine is quite new, & there is no substitute available in the market.

The main construct of this machine is to drill the holes over specific jobs repeatedly at totally different depths, sequence is maintained. As the machine contains drill motor, the movement is controlled accurately. The mechanical transmission section is controlled with stepper motor, based on the drilling depth programmed through keyboard; the microcontroller restricts the movements of drill motor through stepper motor. Entire process falls under the subject of Mechatronics, & various fields of technologies must be included to full-fill the target. The integration of electronic engineering, mechanical engineering, electrical engineering, & control technology is forming a crucial part in this design. Especially the negative feedback circuit designed with microcontroller plays dominant role during this project work.

The main concept of this project work is to design & develop one special purpose-drilling machine, which can be used to drill the PCB with different depths programmed independently. These types of drill machines area unit a great deal needed within the mechanical workshops, where it is essential for specific job applications. Drilling depth of the motor will be programmed through the potentiometer. The drilling motor is stirred in vertical direction through power feed technology designed with stepper motor. The stepper motor accustomed move the drilling motor upward & downward directions is aimed to drag down the drill motor whereas drilling the opening over the duty. Here some force is applied such the machine will be ready to drill the opening over light-weight metal jobs. Since the project work is considered as prototype module, the stepper motor used here can apply a little force. To drill over serious metals like MS, high power motor with appropriate mechanism is crucial.

1.2 OBJECTIVE:

- ➢ To design and fabricate a PCB using robot having a drilling mechanism at the end effectors.
- ➢ To reduce the human effort and time consumption for manufacturing the object.
- ☐ To perform the task with the help of programming i.e fully automatic.

1.3 Application:

- ➢ Used in manufacturing industries to increase the production.
- ➢ Used for eliminating the heavy manufacturing machines.
- ➢ Used to omit human effort.

2.LITERATURE REVIEW

It is abbreviated as PCB. An electric circuit created by parturition printing tracks of a conductor like copper on one or either side of AN insulating board. This concept was invented in 1936 by Austrian Scientist Pail Eishler. PCB is that the most essential component within the fabrication of equipment. As it is critical that each one electronic parts should connected in a very correct manner to get the planned functions. The way of giving connection is called Networking. This networking to a given circuit are often drained 2 ways that.

A computer circuit board may be a piece of AN insulant, generally made from epoxy, on which a copper foil is bonded. The required circuit pattern by drawing the circuit followed by a action of eliminate and exposed carbon layer. The process is called Etching.

As the growth of physics it composes sort of sorts, sizes, shapes, the concept of board making also faced number of modifications and in various forms.

It is the extended version over double-sided PCB's. In PCB fabrication 2 parameters square measure important.. tracks and number of components, it can be solved by number of layers on which tracks are developed. Prepare range of layers with correct tracks in a very stuff material.

Where overall PCB dimensions no.of arrangement of inter connections are not feasible on double sided PCB. The frequency necessities concern careful management and uniformity of conductor wave ohmic resistance with minimum distortion in single propagation.

The advent of tiny, compact and light weight components, a technique called surface mounting., came into PCB world. However copper clad boards used for this same is same as employed in double sided PCB's. In surface mounting method, drilling holes for inserting components leads is eliminated. So that pad size are often reduced to atiny low space result in high packaging density.

Once the PCB is ready, component leads are positioned on the board surface, than inserting through a hole in previous methods, are soldered properly. The solder joints needs to provide the mechanical attachment of a surface mount component to its PCB in addition to the electrical connections.

Making a PCB is AN involving method that people who square measure concerned in electronic circuit manufacture got to undergo. Not least among its several tasks is that the act of drilling the PCB holes that wants each exactness and patience. Often, the repetitiousness of the task will result in innumerable frustrations among the labourers notably the beginners. Further, the time taken to drill a PCB will have a big result on the assembly potency in mass scale production. Therefore the main goal of this project was to enable beginners in the field to use an automated PCB drilling machine with path planning capability to complete the job efficiently.

The whole project are often divided into 2 areas one is that the bit traversing mechanism and also the alternative is that the path coming up with algorithmic program.

Two forms of mechanical systems are often used for the bit traversing operation. One may be a robotic arm kind of like a SCARA system the opposite may be a mathematician frame system. Almost all PCB edge and drilling systems use a mathematician frame system as against a robotic arm. This is as a result of PCB drilling purpose coordinates square measure typically given in mathematician kind. Furthermore mathematician frame systems modify the carrying of a significant load around a specific pre-defined space additional simply than a robotic arm supported a lever like system. They can also be simply programmed to navigate to some extent with exactness and square measure easier and cheaper to manufacture. However the sole limitation is that they can not move on a curvy linear pathway with ease. This would not be a problem in PCB drilling because the shortest between any 2 points may be a line.

The concept of using a frame within which the drill moves about is seen in previous projects by Yildirim (2003) and Basniaks' PCB milling project (2012) .In our project we have eliminated the requirement of {the 2|the 2} supporting columns for the x axis as seen in these two comes by transferral the complete y axis to constant level as the x axis. This makes the look additional stable and reduces the chance of buckling and also the threads obtaining stuck. Another important decision we had to make was whether we are going to move the board, the drill or both. The two projects cited above both move the drill while Kumpf (2003) in his project moves the board while keeping the drill stationery. The problem we faced with this approach would be that our system would only be able to machine a particular size of PCB boards but in moving only the drill all PCB boards that are smaller than the machine work space could be drilled.

Path planning was the other goal of our project. Path planning optimizes both the distance travelled by the drill as well as the time. Tahir, Abu, Sahib and Herman (2010) in their paper observe the need for optimization in PCB drilling not found in most CNC machines and suggest the use of TSP algorithms as a method to solve the problem. In our project we have employed a TSP solution known as the nearest neighbour solution to give the optimum.

3.principle of working :

Our project may be a CNC machine that carries out operational commands calculated with the help of a computer. Conventional CNC machines are constructed using linear components, such as worm drives, ball races, linear guides and lots of different — not cheap — specialist components. The construction of a linear machine appears very straightforward: simply select the required components in the appropriate sizes, fit them together, and set the computer going. But the devil is in fact within the detail: all the elements should be exactly mounted, parallel, true, and free of play, or else things will grind and jam. Our PCB drilling machine is, as far as function and aims are concerned, exactly like an X/Y/Z-machine. It will handle circuit boards up to two hundred millimeter by 300 mm with an accuracy of 0.03 mm, which is entirely adequate for our application. Because of its light-weight construction it will move very quickly, at almost 80 mm/s. In construction it's essentially completely different from linear machines. Everything is reduced down to two rotating, vertical axles. The only specialist components required are good-quality ball bearings to support these axles without play. In appearance, the machine resembles a record player: within the middle may be a rotating table, on which the workpiece — the circuit board — is fixed. Instead of a cartridge we've a drill, which might be moved up and down. And in precisely an equivalent approach because the pickup arm will reach any purpose on a record, the drill will get to any purpose wherever drilling is needed on the card. As well because the rotating table, there is space for more tool arms, which can all operate practically simultaneously on the same circuit board. The advantages ar that the duty gets done faster, and no tool changes are required. The tool can be a drill, which can be used for drilling holes for the leads of elements, or a milling tool, with which the conductors can be milled away. Drilling knowledge is taken from one's most well-liked card style programin Excellon format: all programs ar capable of outputting this format. Milling knowledge is distributed to the machine within the HPGL plotter management language, allowing any desired cutting path to befollowed. The machine will be connected on to the printer port of a standard laptop while not further hardware.

3.2 Mechanical Block Diagram

LINK
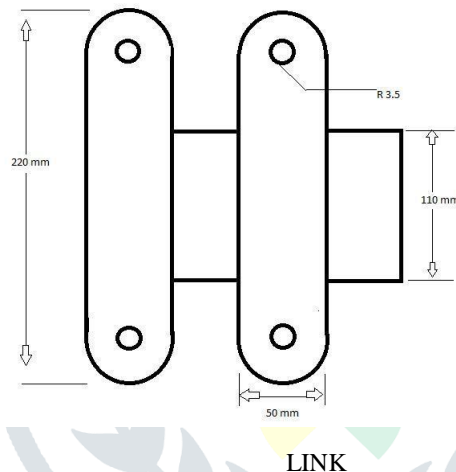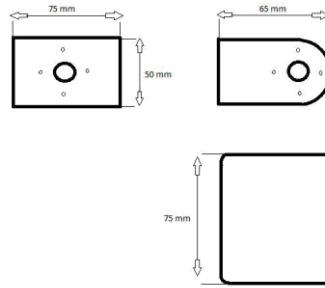
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3.3 ELECTRONIC DESIGN:

CONTROL BOARD

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs .ATmega328-PU Chip 32KB Flash memory,

Controller Specifications

|	
Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

3.4 Controlling Servo Motor:

Servo motor is managementled by PWM (Pulse with Modulation) that is provided by the control wires. There is a minimum pulse, a most pulse and a repetition rate. Servo motor will flip ninety degree from either direction kind its neutral position. The servo motor expects to examine a pulse each twenty milliseconds (ms) and therefore the length of the heart beat can verify however way the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90° position, such as if pulse is shorter than 1.5ms shaft moves to 0° and if it is longer than one.5ms than it will turn the servo to 180°.

Servo motor works on PWM (Pulse width modulation) principle, means its angle of rotation is controlled by the duration of applied pulse to its Control PIN. Basically servo motor is made up of DC motor which is controlled by a variable resistor (potentiometer) and some gears. High speed force of DC motor is reborn into force by Gears. We know that WORK= FORCE X DISTANCE, in DC motor Force is less and distance (speed) is high and in Servo, force is High and distance is less. Potentiometer is connected to the output shaft of the Servo, to calculate the angle and stop the DC motor on required angle
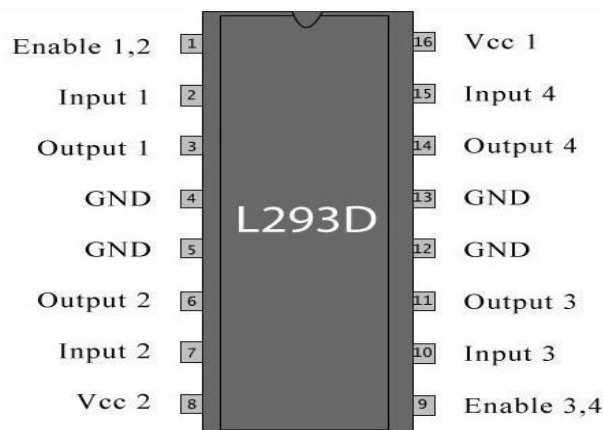
3.5 ELECTRONICS BLOCK DIAGRAM
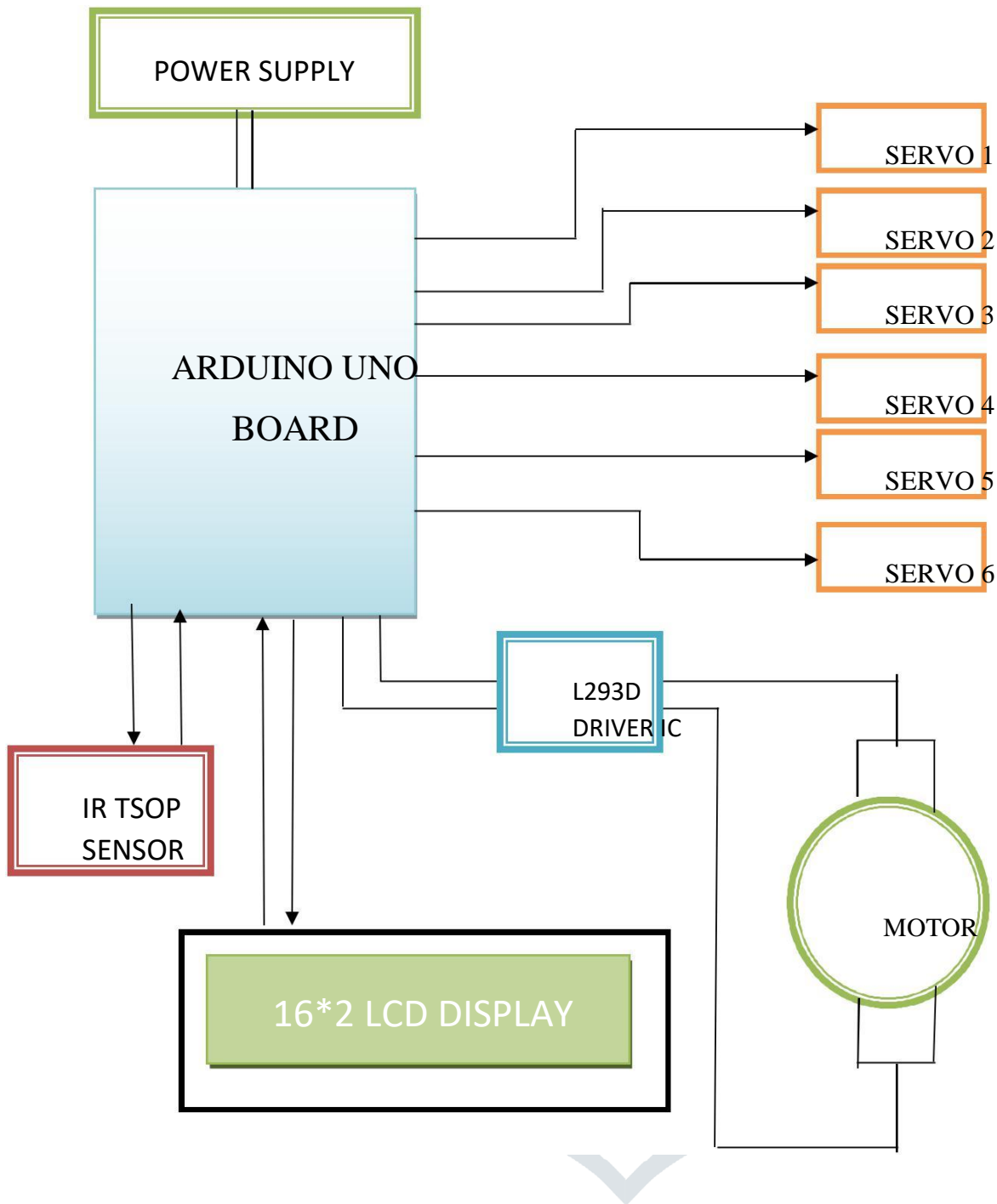
3.6 L293D MOTOR DRIVER IC

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current management signal and supply a higher-current signal. This higher current signal is employed to drive the motors.

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, 2 DC motors may be driven at the same time, both in forward and reverse direction. The motor operations of 2 motors may be controlled by input logic at pins a pair of and ten . Input logic 00 or eleven can stop the corresponding motor. Logic 01 and ten can rotate it in clockwise and anticlockwise directions, severally.

Enable pins one and nine (corresponding to the 2 motors) should be high for motors to begin operational. When associate degree alter input is high, the associated driver gets enabled. As a result, the outputs become active and add section with their inputs. Similarly, once the alter input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

| Enable 1,2	1		16	Vcc 1
Input 1	2		15	Input 4
Output 1	3		14	Output 4
GND	4	L293D	13	GND
GND	5		12	GND
Output 2	6		11	Output 3
Input 2	7		10	Input 3
Vcc 2	8		9	Enable 3,4

3.7 IR REMOTE (TSOP)

The TSOP 1738 is a member of IR remote control receiver series. This IR sensing element module consists of a PIN diode and a pre electronic equipment that square measure embedded into one package. The output of TSOP is active low and it gives +5V in off state. When IR waves, from a supply, with a centre frequency of 38 kHz incident on it, its output goes low.

Lights coming from sunlight, fluorescent lamps etc. may cause disturbance to that and lead to undesirable output even once the supply isn't transmission IR signals. A bandpass filter, an integrator stage and an automatic gain control are used to suppress such disturbances.

TSOP module has an inbuilt control circuit for amplifying the coded pulses from the IR transmitter. A signal is generated once PIN photodiode receives the signals. This signaling is received by associate degree automatic gain management (AGC). For a spread of inputs, the output is fed back to AGC in order to adjust the gain to a suitable level. The signal from AGC is passed to a band pass filter to filter unsought frequencies. After this, the signal goes to a rectifier associate degreed this demodulated output drives an npn semiconductor device. The collector output of the semiconductor device is obtained at pin three of TSOP module

GND   Vs   OUT
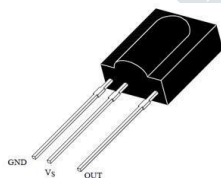
3.8 7806 VOLTAGE REGULATOR IC

7806 is a voltage regulator integrated circuit. It is a member of 78xx series of mounted linear transformer ICs. The voltage supply during a circuit might have fluctuations and wouldn't provide the mounted voltage output. The transformer IC maintains the output voltage at a continuing price. The xx in 78xx indicates the fixed outputvoltage it is designed to provide. 7806 offer +6V regulated power offer Capacitors of appropriate values may be connected at input and output pins relying upon the various voltage levels.
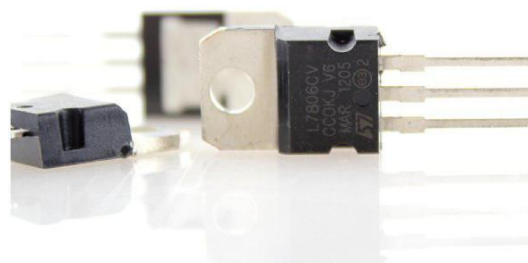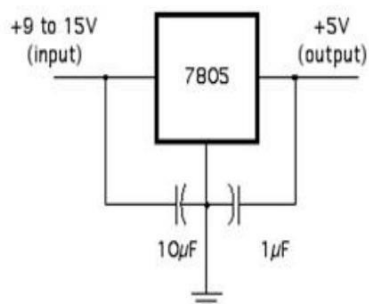
Pin No.	Function	Name
1	Input voltage (5V-18V)	Input
2	Ground (0V)	Ground
3	Regulated output; 6V (5.75V-6.25V)	Output

4.PROGRAM

```
#include <IRremote.h>

#include <Servo.h>

#define plus 0x10

#define minus 0x810

#define plus 0xC10/clockwise rotation button

#define minus 0x210/counter clockwise rotation button


int RECV_PIN = 15;

Servo servo,servo1;

int val;

bool cwRotation, ccwRotation;




IRrecv irrecv(15);


decode_results results;


void setup()
{
```

```
Serial.begin(9600);

irrecv.enableIRIn();

servo.attach(10);

servo1.attach(5);


}
void loop()

{
 if (irrecv.decode(&results)) {

   Serial.println(results.value, HEX);



   irrecv.resume();


   if (results.value == 0x10)

   {

    cwRotation = !cwRotation;

    ccwRotation = false;

   }


   if (results.value == 0x810)

   {

    ccwRotation = !ccwRotation;

    cwRotation = false;

   }


 if (cwRotation && (val != 355)) {

  val++;

 }
 if (ccwRotation && (val != 0)) {

  val--;

 }
  if (results.value == 0xC10)

   {

    cwRotation = !cwRotation;

    ccwRotation = false;

   }
   if (results.value == 0x210)

   {

    ccwRotation = !ccwRotation;

    cwRotation = false;

   }
```

```
 }
 if (cwRotation && (val != 175)) {
  val++;
 }
 if (ccwRotation && (val != 0)) {
  val--;
 }
 if (results.value == 0xC10);
   {
    cwRotation = !cwRotation;
    ccwRotation = false;
   }

   if (results.value == 0xA10
   {
    ccwRotation = !ccwRotation;
    cwRotation = false;
   }
 }
 if (cwRotation && (val != 175)) {
  val++;
 }
 if (ccwRotation && (val != 0)) {
  val--;
 }
 if (results.value == 0xC90);
   {
    cwRotation = !cwRotation;
    ccwRotation = false;
    }

   if (results.value == 0x210)
   {
    ccwRotation = !ccwRotation;
    cwRotation = false;
   }
 }
 if (cwRotation && (val != 175)) {
  val++;
 }
 if (ccwRotation && (val != 0)) {
```

```
   val--;

  }

  servo.write(val);

  delay(5);

}
```

5.CONCLUSION:

This project work has provided United States a wonderful chance and skill, to use our limited knowledge. We gained tons of sensible information concerning coming up with, purchasing, assembling and machining while doing this project work. We feel that the project work is the good solution to bridge the gates between the institution and the industries.

We are proud that we completed the project in the limited time successfully. The REMOTE CONTROL BASED PCB DRILLING ROBOT is working with satisfactory condition.

We are able to understand the difficulties in maintaining the tolerances and also the quality. We have done to our ability and skills making maximum use of available facilities.

In conclusion remarks of the project work, let us add a few lines about our impression project work. Thus we've got developed associate degree "REMOTE management based mostly PCB DRILLING ROBOT" that helps to understand a way to win low value automation..
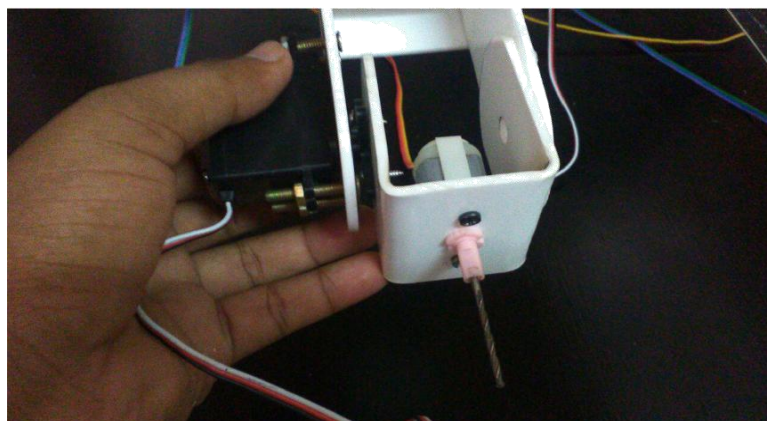
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