DESIGN AND SIMULATION OF PICK AND PLACE ROBOTIC ARM

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Abstract -This research paper represents the design and implementation of a pick and place robotics arm using IDE (Integrated Development Environment) software.Currently ,Robotic arms are being used in industries to minimize the human errors and increase efficiency ,productivity.This project aims to develop a robotics arm that can be used in manufacturing to automate the process of picking and placing objects to the desired position.The design and programming of robotic arms have evolved significantly over the years , with the use if IDE software becoming increasingly common. This paper provides an overview of the design process , construction and programming of the arm .The final prototype is tested in the simulated environment to evaluate its performance and efficiency.

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Key words: *Pick and place robotic ,servo motor,Gripper,Arduino.*

INTRODUCTION

Robotic arms have become an official part of a modern manufacturing and assembly lines .They came automate repetitive tasks,improves efficiency and reduce errors.The objective of this project is to design and implement a pick and place robotic arm using IDE software .The arm will be capable of picking up objects of varying sizes and shapes and placing them accurately in a desired location.To facilitate the design process ,engineers and designers often use Integrated Development Environment (IDE).IDE software provides comprehensive platforms for designing ,building and testing robotic arms,allowing designers to create and stimulate virtual models of the arm and its movements.This software also enables designers to optimize their design,identify potential issues and make necessary adjustments before physically building the arm.

The paper presents the design process ,construction and programming of the arm using IDE software.

DESIGN:

The design of the robotics arm is based on a 4-axis system that allows it to move in 4 different directions.The arm consists of a base ,shoulder, elbow and wrist ,each of them can rotate to achieve the desired movement .The arm is constructed using aluminium profiles,servo motors and gears,The design is to ensure that the arm is lightweight,compact,and sturdy.The gripper is designed to be adjustable to accommodate different object sizes.

Fig. 1: Complete experimental setup

CONSTRUCTION:

The construction of the robotic arm involves assembling the components according to the design specifications .A Simple pick and place robotic arm consist of two rigid bodies on a moving base ,connected together with rotary joint .A rotary joint is the one which provides rotation in 360 degrees around any one of the axes.The bottom or the base is attached to the wheels which provides linear movements .The components used to construct pick and place robotic arm are chassis,wheels,motors,battery,RF receiver and transmitter module driver,Arduino UNO,Robotic claw.

ARDUINO UNO:

Fig. 2: Arduino uno

The Arduino Uno board features 14 digital input/output pins, six analog input pins, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. The digital pins can be used for both input and output, and can be configured as either a digital input or a digital output. The analog pins can be used to read analog signals, such as sensors, and convert them to digital values.The Arduino Uno board is widely used in a variety of applications, including robotics, automation, home automation, and internet of things (I o T) projects. It is also popular in educational settings, where it is used to teach programming and electronics to students of all ages.

MOTOR DRIVER L298N:

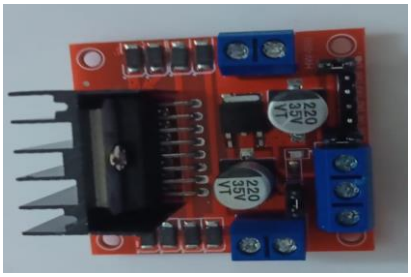


Fig:2

The L293D is a popular motor driver IC (integrated circuit) that allows control of two DC motors in both directions (forward and reverse) using a micro-controller. It has four input pins for controlling the motor direction and speed and four output pins for driving the motor coils. The L293D also has built-in diodes for protecting the motor and driver from voltage spikes generated by the motor's inductance. The IC is commonly used in various applications such as robotics, toy cars, and industrial automation. Its simplicity and low cost make it a popular choice among hobbyists and engineers.

GRIPPER:

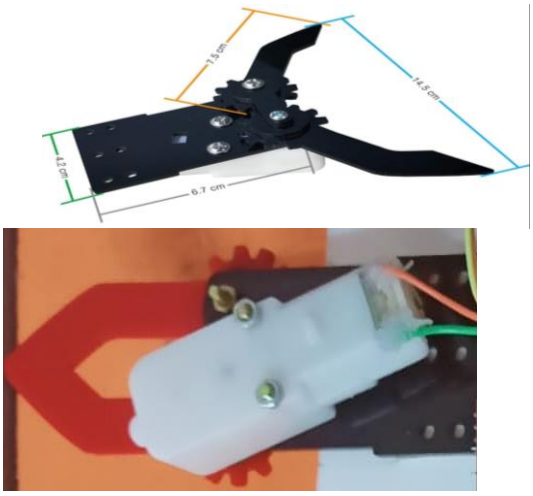


Fig. 3: Gripper

Basically our model grip or claws was built by fiber as prototype which close and disclose by the help of its operator. Its length was 6.7 cm and its expanded up to 4.5 cm and its width was 4.6 cm while the thickness was up to 2mm and also it capable of to hold the weight of 200g as prototype..

FR TRANSMITTER AND RF RECEIVER:

Fig. 4: FR receiver module

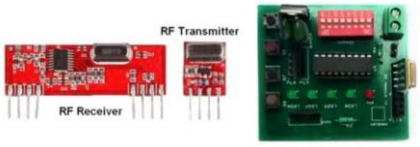


Fig. 5: RF transmitter module

RF TRANSMITTER MODULE: RF transmitter modules are commonly used in various applications, such as wireless remote controls, wireless alarm systems, and wireless data transmission systems. They can transmit signals over short distances (a few meters) to long distances (several kilometers), depending on the power of the transmitter and the frequency used.

RF RECEIVER MODULE: An RF (Radio Frequency) receiver module is an electronic component that receives signals wirelessly transmitted by an RF transmitter. It is commonly used in remote control systems, wireless communication systems, another applications that require wireless communication

BO MOTOR:

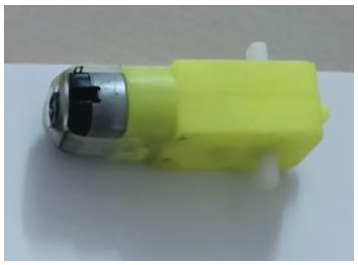


Fig 6: BO Motor

A BO (Brushed DC) motor is an electro-mechanical device that converts electrical energy into mechanical energy. It consists of a rotating armature (rotor) and a stationary set of coils (stator) that produce a magnetic field. Brushes and a commutator are used to transfer electrical power to the armature, causing it to rotate.

PROGRAMMING:

The programming of the robotic arm is done using IDE software .The software allows for the control of the motors and gripper using graphical user interface .The arm is programmed to move in a specific sequence .The arm is programmed to move in a specific sequence to pick up objects from one location and place them in another place.The software is optimized to ensure that arm moves efficiently and accurately

The arm is tested in assimilated environment to ensure that it performs as expected .

IDE SOFTWARE:

IDE software is used to program the robotic arm, allowing it to perform the desired tasks. The software provides a graphical user interface that allows the user to control the movements of the arm. The software is optimized to ensure that the arm moves efficiently and accurately. IDE software has become increasingly popular due to its ease of use and flexibility.

CONTROL CIRCUIT:

Our system has the following control panel as it can be seen that operating arm and Arduino UNO,motor driver L298N act as the driver and main functional for the given robotic arm pick and place is Arduino UNO ,when power between 3V TO 12V is applied the Arduino UNO starts the program code and after that R.F transmitter generates the signal to the device or its controller hence once the signal is received by the remote then again the remote send the signal to its R.F signal receiver .Finally the received signal is converted by Arduino UNO to machine language and operation is executed .

Fig. 7:control circuit

METHODOLOGY:

The method which is used in designing and constructing the robotic claw or gripper are based on the operational characteristics and features of the micro-controllers, stepper motors, the electronic circuit diagram and most importantly the programming of the micro-controller and stepper motors.

The block diagram of our work model is as shown in figure,

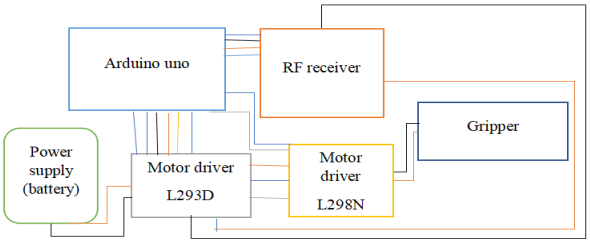
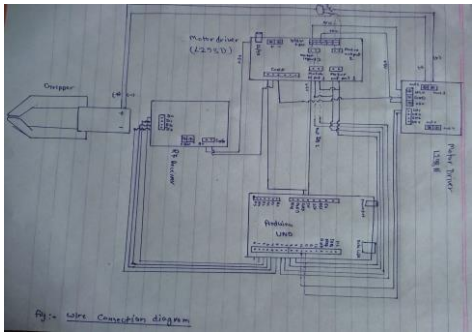


Fig. 12:Block Diagram

When the power is supplied (9 to 12) volts using power adapter or battery. We can operate It's power is applied to the motor driver (L293D) with the help of battery source and also using adapter of the +9 to +12 Volt of the 2.5 ampere current.From motor driver the power is provided to the other components like Arduino uno,here we know RF receiver motor driver (L298N) and gripper from the motor driver (L293D) the power of 5 Volt is given to the original we know RF receiver is the also connected to the motor driver (L293D) to the next power source of the 5 Volt to the operator for the motor driver(L298N) power is given by the motor driver A2938 of the +12 Volt and +5 Volt with the connection of ground or negative pin the gripper is connected to the motor driver L298N 4 operating it's gripper and various loads are picked in this way.

LITERATURE REVIEW:

Several studies have investigated the design and programming of pick and place robotic arms using IDE software .Kadam and Patil (2015) designed a pick and place robotic arm using b IDE software and tested it in a simulated



environment .The results showed that the arm was capable of performing the desired task efficiently and accurately.Alvin and Khan (2015) developed a robotic arm using Arduino and IDE software and evaluated its performance .The result showed that the arm was capable of archiving high precision and accuracy. Al-Salman and Al-Mahfoudh (2017) designed and simulated a robotic arm using IDE software and solid-works . The simulated showed the arm was capable of performing the desired tasks with high efficiency and accuracy.Al-Rahbi and Al-Maawali (2020) designed a pick and place robotic arm using MATLAB and IDE software and evaluated its performance .The results showed that the arm was capable of achieving high precision and accuracy . [Rajgure S.D et al [2018]] He has reviewed the modelling of pneumatic robotic arm for automation in two machines, for material handling purpose. The review was between the two machines namely extrusion and belt grinding machine. It was commanded to design the pneumatic arm to pick and place the cylindrical object like steel bars. It has presented forward and inverse kinematics of robot arm and reveals that a robotic arm can be manufactured by using cellular titanium and nano crystalline aluminium in order to ensure less weight. In some of the work PLC program are used to control the arm robot, but it needs more costs, skill and knowledge to make it and connecting to the arm

RESULTS AND DISCUSSION:

Our team were successfully accomplish the functionally defined .A working sample of robot which is capable of rotate 360 and also pick and place heavy equipment,can work in hazardous environment with the

help of wireless device .Here the Arduino UNO play the main role for robot processing the signal and also converting the code at the same time.

There are four buttons which assist it operator to control the pick and place robot

* " On" button active the system while 'off button make it in sleep mode

*Start\Stop;

The soft gripper was designed to be more flexible and adaptable than traditional rigid grippers, allowing it to pick up and manipulate objects of different shapes and sizes. The study also used simulation software to test the arm's performance in different scenarios, including picking up and placing objects of various shapes and sizes. The results of the study showed that the soft gripper was effective in picking up and manipulating objects of different shapes and sizes, making it a versatile tool for a wide range of applications.

Overall, the results of recent research on the design of pick and place robotic arms have significant implications for automation and robotics. The use of soft grippers, bio-mimetic design, and modular design can help to improve the versatility, flexibility, and adaptability of robotic arms, making them more effective tools for a wide range of application

CONCLUSION:

The design and programming of pick and place robotic arms using IDE software have become increasingly popular due to their ease of use and flexibility. Several studies have investigated the design and performance of pick and place robotic arms using IDE software, with the results showing that these arms are capable of achieving high precision and accuracy. IDE software has become an essential tool in designing and programming robotic arms, allowing for efficient and accurate movement. Future research could investigate the use of machine learning and artificial intelligence algorithms in designing and programming pick and place robotic arms to improve their performance and adaptability.

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