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A BRIEF OVERVIEW OF PICK AND PLACE ROBOTIC ARM IN REAL LIFE

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***Abstract*— Nowadays, technology is creating within the same direction in line with rapidly increasing of human needs. This report paper highlights the different perspectives of a robotic arm after looking into a few successful research papers on controllers. Robotic arms are being utilized in industries to play down the human errors and increase efficiency, productivity, accuracy of the operations taking put. One of the foremost vital advantages of introducing Robotic arm in Industries is that it can work in crucial conditions like high temperatures, pressures where it's risky for people to work. Since a controller comes under Flexible Automation, they can be updated and modified easily. We have referred a few research papers which have been experimentally verified to watch the diverse types of controllers used and different methodologies used by different authors to decide the degrees of freedom of a manipulator used for the picking of an object and placing it at specified position. Thus, knowledge acquainted after referring all these papers, will help in Designing the Robotic arm.**

***Keywords*— Robotic Arm, Controller, Arduino Uno, Sensor, Motor Driver.**

i. INTRODUCTION

In today's world, robots and humans are working hand-in-hand for completion of their assigned task. An assistance robot is a robot which is self-governed and can work independently to perform the given tasks. Industries, military undertakings, medical sector are some of the fields where these robots are now being used. Working in assignments involving high temperatures or tasks like defusing bombs, handling molten metal might be fatal for people. Hence, Robots can replace humans to perform these kinds of dangerous tasks.

A Robotic arm is basically a machine which is very similar to a human hand, it consists of a combination of links attached in series or parallel. It can be controlled by programming it to perform a specific task. Now a day's robotic arm is used in industries for works and make the work easier for humans.

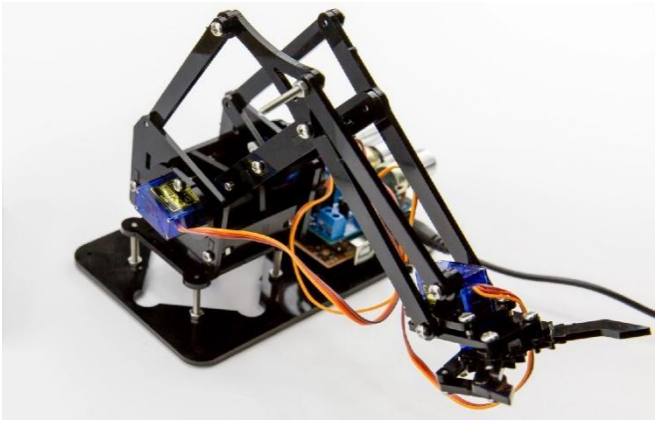


Figure (1): Robotic Arm

A robotic arm can be said to be a typical example for articulated robot A robot consisting of an arm having at least 3 rotary joints is termed as Articulated. It is used in die casting, assembly operations, fettling machines, gas welding, arc welding and spray painting. This type of robot has many advantages like super structural flexibility, compatible with other robots operating in common workspace, high rotation

speed. However, it has low accuracy and resolution because of rotary joints and positional errors, counter balancing difficulties due to the large and variable torque, high chance of collision and dynamic instability due to higher moment of inertia and gravity.

A typical pick and place robotic arm has the following components:

- Links and joints
- Actuators (Servo motors)
- Controller (Arduino Uno)
- End-effector (Gripping)
- Sensor (Bluetooth receiver)

Robots are used in different fields such as industrial, military, space exploration, and medical applications. These robots could be classified as manipulator robots and cooperate with other parts of automated or semi-automated equipment to achieve tasks such as loading, unloading, spray painting, welding, and assembling. Generally, robots are designed, built and controlled via a computer or a controlling device which uses a specific program or algorithm. Programs and robots are designed in a way that when the program changes, the behavior of the robot changes accordingly resulting in a very flexible task achieving robot. Robots are categorized by their generation, intelligence, structural, capabilities, application and operational capabilities.

ii. PROJECT SCOPE AND METHODOLOGY

- Review robotic arm mechanism
- Design a robot arm with grippers and kit
- Implement the mechanical part of arm robot
- Implement the electronic part of arm robot
- Test the arm robot movements based on human movements via Arduino Uno

Here the diagram shows the scope and methodology of this project, starting from the revision of different load shedding techniques to validate the proposed scheme experimentally.

Figure (2): Scope and methodology of arm robot

The proposed idea of this project is to develop and design Pick and Place Robotic Arm which can be controlled by using PLC. The idea was to design an automated system for industrial purpose so that could be able to control it from anywhere and at any time. 1st motor was situated at gripper position, 2nd motor used for up-down movement of arm, 3rd motor used for rotation of arm and 4th motor was used to operate conveyor.

INTERFACING WITH THE COMPUTER:

The user interface is where interaction between humans and machines takes place in the realm of industrial design for HMI. The objective of human-machine interaction at the user interface is successful machine operation and control, as well as input from the machine that assists the operator in operating choices. The mechanism by which users interact with a machine is known as a user interface. Hardware (physical) and software (logical) components both make up the user interface. There are user interfaces for many different systems, which enable:

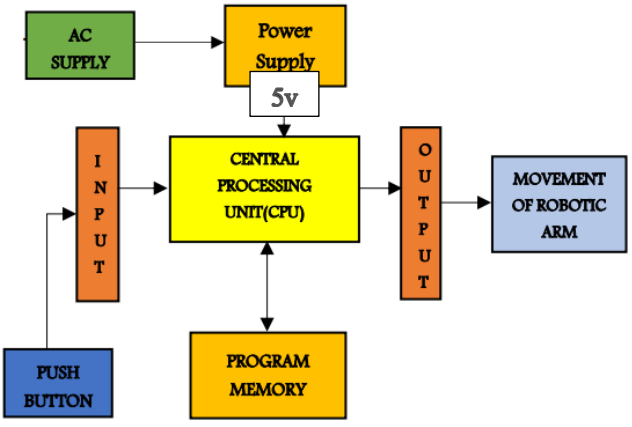
- input that enables people to control a system
- output that enables the system to show the results of the users' modification

iii. PROPOSED SYSTEM AND MECHANICAL DESIGN

We have used two push buttons to control the operation of the system. They are:

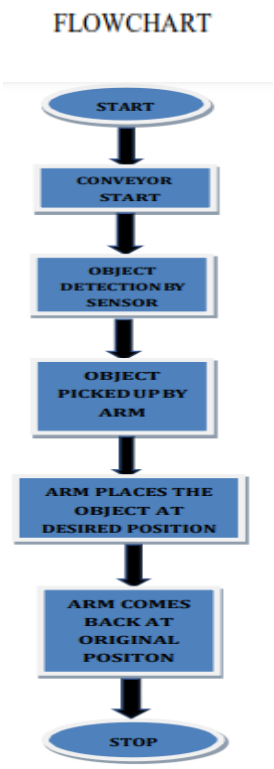
- START: When this push button is pressed, system will start.
- STOP: When this push button is pressed, system will stop.
- We have used robotic gripper for pick and place.

BLOCK DIAGRAM -



The project's distilled fundamentals are represented by the block diagram. Here, the pick-and-place robotic arm block diagram is as illustrated in fig., which only illustrates how the robotic arm functions as a whole. Following are the

components of the block diagram: PLC, Power supply, Sensors, and Input switch. Decisions are made using program memory and then sent to the output devices through output channels in accordance with the status of the inputs. The switches, PLC, and output device shown in the fig. The system in this instance needs a 230VAC power source, which is converted to 24V by a PLC. In the project, a Mitsubishi FX5u PLC is utilized. Here, the program is kept in program memory and operates in accordance with its input and output modules.



Robotic Arm Mechanical design

In designing machine components, it is necessary to have a good knowledge of many
subjects such as Mathematics, engineering mechanics, strength of materials, theory of
machines, and Engineering Drawing. Machines are always the same, they have combination
of linkages, gears, belts and other mechanics and by which we make a complete mechanism to
achieve a certain task.

Choosing a robot's dimensions and workspace arrangement based on the requirements is the first stage in the design process. Making decisions about each actuator's specifications is the next phase. The base,

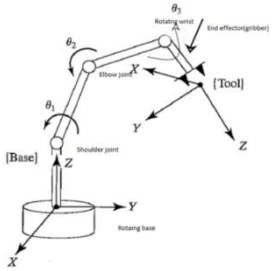


Figure (3) : Robot Arm Diagram

which is the robot's bottommost component, is where the arm is connected. In order to preserve the robot's overall balance when collecting an object, it is necessary to note that the base should be somewhat hefty. Servo motors are used to move the robot physically, despite the excellent notion of employing stepper and gear motors. The servos' benefit is that they may be set up to automatically return to their starting position.

iv: HARDWARE SECTION

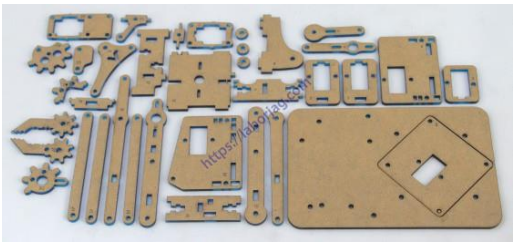
- **Arduino Uno** is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

- **20W Hot Melt Glue Gun** with 7mm Glue Sticks Mini Industrial Heat Temperature Thermo Electric Repair Portable Tools.

- **Dual shaft DC geared motor** which gives good torque and rpm at lower voltages. This motor can run at approximately 170 rpm when driven by a single Li-Ion cell. It is most suitable for light weight robot running on small voltage. Out of its one shaft can be connected to wheel

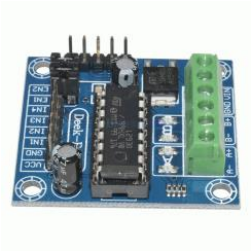
- DC 11.1V 3 Slot 3 Series 18650 **Battery Holder** High Quality Battery Box Battery Case With 2 Leads And Spring CE RoHS Certification.

- Robot Learning Kit, **Robotic Arm Kit**, Acrylic Mechanical Robot Arm Claw Clamp DIY Assembly Educational Accessory Kit.

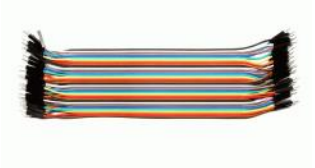


- When we saw this chip, we quickly realized what an excellent add-on this would be. Using only two pins, control 16 free-running PWM outputs! I2C input, control 16 PWM output, we can control the 16 way **servo motor**.

- **Arduino Motor Drive Module** is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors .To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic,allowing operation at a lower voltage and internal clamp diodes are included. This device is suitable for use in switching applications at frequencies up to 5 kHz.



- These premium **male to male jumper wires** are 7" long. They have 0.1" male header on both end. They can be installed next to each other on standard pitch 0.1" header. 40 jumper wires in 4 set of each of ten rainbow color. You can always pull the ribbon wires off to make individual jumpers, or keep them together to make neatly organized wire harnesses.This is a set of 40 connected male-male dupont jumper wires. The wires can all be used together or easily peeled apart individually or in sections. They fit snug next to each other on a breadboard, when placed with the silver side out because the side with the silver showing through the black connector is standard breadboard spacing (2.54mm) compared to 2.25mm on the other side.



- The HC-SR04 is an excellent low-cost **ultrasonic sensor** that works really well with Arduino micro-controllers. These sensors are very easy to use. First connect the VCC and GND pins to the Arduino's +5V and GND pins. Next connect the Trigger and Echo pins to two digital pins on the Arduino, perhaps pins 2 and 3 for example.

- This is a set of 40 connected **male-female dupont jumper wires.** The wires can all be used together or easily peeled apart individually or in sections. They fit snug next to each other on a breadboard, when placed with the silver side out because the side with the silver showing through the black connector is standard breadboard spacing (2.54mm) compared to 2.25mm on the other side.

v. COST ANALYSIS

Equipment	Quantity	Cost (Taka)
Arduino uno	1	1100
SG90 servo motor	4	600
Robotic arm acrylic	1 set	1500
Adapter	1	140
M-M, F-M, F-F cables	3 set	200
Others	-	2000

- Total cost 5500

vi. Advantages and Applications

Advantages:

- Accuracy and Pick and Place Robots: Robots are outfitted with wide reaches and slim arms, steady repeatability and precise tooling – all of which allows them to be extremely accurate. This high precision capability makes them a good match for pick and place applications .

- Flexible Pick and Place: One of the main advantages of robotics is flexibility. Pick and place robots are easily programmable. They are able to accommodate multiple changes in product shape and type. In addition, robots provide a high level of movement flexibility.

- Increase Consistency with Pick and Place: Pick and place robot systems have the ability to improve product quality and cycle time. Robotic movements are regulated, so the results are always the same. Quality is improved because of this regularity. Furthermore, this consistency allows the processes to take place.

- Robots are Space-Efficient: Because they are designed with compact bases, pick and place robots are ideal if you are looking to conserve floor space. Robots can be programmed to move within strict work envelope limits – leading to even better use of space.

- Robots Maximize Safety: Pick and place applications can be physically demanding. They are labour-intensive, repetitive, and monotonous. Depending on the weight and size of a part, moving it from one place to another can be very demanding work. Pick and place robots are unaffected by the stresses of the application. They are able to work without taking breaks or making mistakes.

- Save with Pick and Place Robots: Incorporating pick and place robots can effectively cut your costs. Robotic precision and reliability allow for less wasted material and more efficient use of time. Plus, the initial investment in robots is quickly recouped – making pick and place robots an extremely cost-effective solution.

- Cost-Effectiveness: The afore-mentioned features combine to lend a high degree of costeffectiveness to such systems. Cost effectiveness also accrues from the fact that pick and place systems empower businesses to take up orders in bulk and thus aid business expansion and also reap the benefits of large-scale production.

Applications:

- Welding: This is the procedure of fusing two pieces of metal together using molten weld metal.

- Cutting: This is the process of using mechanical or thermal energy to form a work piece into a certain size or shape.

- Assembly: This is the process of attaching components to a base unit (such as placing components on a printed circuit board) or joining components to create a single entity.

- Material handling: This is the process of loading and unloading pieces from one station while packing them into a compartment (box).

vii. CONCLUSION

After putting in a lot of effort, we now have "PICK AND PLACE ROBOT" as a functional system. It will really be

the users' best buddy. It is incredibly user-interactive and simple to use. As is common knowledge, material handling operations use robotic arms.
Even yet, there is still a lot of functionality that needs to be added, and we will undoubtedly take the time to do so.
We have been exposed to user-friendly environments during this time. We gained knowledge of teamwork, time management, and how to interact with professionals in the business world as a result.
The ultimate goal is to create a robotic arm that can securely lift delicate objects. The force sensor will serve as the input sensor, the computer or microcontroller will serve as the controller, and the controller will drive the stepper motor. The arm will use a closed loop control method. The application that would control the drive circuit was created using C++. Once finished, the arm will significantly aid in automating the demining procedure. We can only hope that this will increase the efficiency with which displaced persons may be moved.

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