

Multi-Purpose Robotic Arm

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Abstract- The survey conducted by us deals with many different kinds of robots that are readily available in the market as a means to ease the burden of daily life. The study even includes the fields where and how robots could be used effectively. This project hence is based on various researches to perform and tackle real-life problems on an everyday basis. This project deals with the advancement of a pick and places robotic arm which has a pneumatic gripper that could be able to identify the product, sort them according to requirement and even place them. This type of robotic arm could be used in the assembly line of the Packing department and Material handling. It could be even used as a third hand in laboratories, Hospitals, Shops, Banks, Government Offices, etc.

Keywords- DOF, Arduino, Servomotor, Pneumatic-gripper, Camera.

I. INTRODUCTION

Even in the 21st century, the involvement of a high amount of workforce in mediocre work, and various departments including material handling, packing department, material sorting, hospitals, Government Office, etc. All of these require a good amount of manpower, high capital and time consumption are also greater. The robotic arm would ensure a reduction in cost, time, and human efforts.

Our robotic arm manipulator is easily programmable and has a very similar function as a human arm. Various links of the robotic arm are connected at joints with help of servos to produce the desired output. The processing unit i.e Arduino is capable to control each actuator effectively. The end effector is a pneumatic gripper so that it could be able to lift any kind of object consisting of any shape that a mechanical gripper may not. It would even provide work repeatability which in turn would increase precision. The advanced multipurpose robotic arm with a pneumatic gripper will ensure the reduction of human hardship.

The advanced multipurpose robotic arm with a pneumatic gripper holds the promise to bring huge benefits for users, industry, and society by integrating the capabilities of a mechanical robot arm with Arduino, servo motors, camera, pneumatic gripper, and concepts of machine learning. Our

robotic arm can be used by everyone and everywhere. It is easy to set up and even easy to control.

II. RELATED WORK

1) DESIGN AND ANALYSIS OF AN ARTICULATED ROBOT ARM FOR VARIOUS INDUSTRIAL APPLICATIONS

The Articulated robotic arm is designed using basic formulae from the strength of materials, modeled using a commercially available 3D modeling tool, Solid Works, The Model is used for analysis using ANSYS, taking into account the various critical loads acting on the base arm alone.

2) DESIGN OF 6-AXIS ROBOTIC ARM

The main context of this paper is the design of a 6-axis robotic arm that resembles a human arm. This arm consisted of manipulators which performed various motions including pitching, rolling, and yawing. V-Rep software was used for the manufacturing of the robotic arm as it provided efficient usage in Torque calculations and simulation.

3) REVIEW ON DEVELOPMENT OF INDUSTRIAL ROBOTIC ARM

This paper clearly showed that its movements are precised, accurate, very easy to control, and user-friendly to use. This robotic arm control method is expected to overcome the problem such as placing or picking of the hazardous substance.

4) SMART ROBOTIC ARM

This is a research study on a smart robotic arm that provides technical information and an introduction about it. Real-time problems were kept in mind during the creation of this robotic arm. This study includes the work of robotic arms and in which field they can be used. This arm was used to overcome some of the real-time problems like lifting heavy and very hazardous substances that one may face in our daily life.

5) VACUUM GRIPPER- AN IMPORTANT MATERIAL HANDLING TOOL

In this paper, efforts were taken to create a gripper for handling various object of different dimensions. The robotic manipulator consisted of Vacuum Gripper which is worked on the Bernoulli Principle. It helped in achieving pressure difference between the product and gripper creating a vacuum. It helps in lifting even flat objects.

6) DESIGN AND MANUFACTURING OF A PROTOTYPE OF LIGHTWEIGHT ROBOTIC ARM

The main purpose of this project is the development of a prototype of a lightweight robotic arm. It focused on the type of material to be used for decreasing the weight while maintaining the strength.

III. PROPOSED WORK

The working principle of ‘multi-purpose robotic arm’ is as follows:

- The camera module is used to capture the image of the object it is labeled and can be recalled any time as per requirement.
- IR sensor ensures whether the object has reached the desired location so that further proceeding could be performed
- Once the object is sensed by the IR sensor, it sends information to the Arduino.
- The Arduino sends the command to the camera to sense the object and to give the input.
- The system recognizes the pattern of the object using camera and image processing and then sends the command to Aurdino.
- Once the input is collected by the Arduino it, commands the servos and gripper.

The combined effect of the servo and gripper helps us to mobilise the object by lifting it from initial position and placing at the required position as commanded by the Arduino.

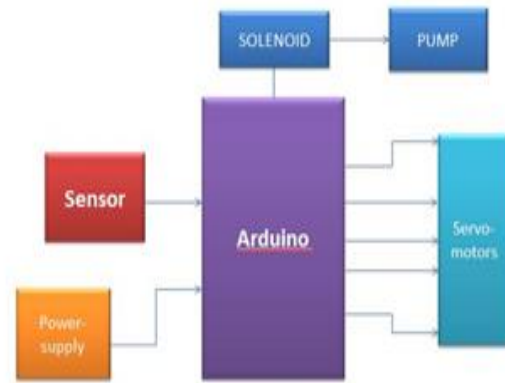


Fig 1: Proposed Architecture

IV. HARDWARE REQUIREMENT

1) Arduino:-

Arduino is a programmable electronic circuit board i.e micro-controller which helps users to create interactive electronic gadgets, which can read different inputs process them, and give required outputs. (figure 2)

2) Servo Motors:-

It is a simple electric motor that acts as a rotary actuator or linear actuator which allows for precise control of angular and linear position, velocity, and acceleration. It can be easily controlled with the help of servomechanism.(figure 3)

3) Vacuum gripper:-

A vacuum gripper is a device that works when negative pressure is created, It helps to provide the ability to lift, hold, and move. This creates a benefit over mechanical gripper as it could be used to lift any smooth shape easily.(figure 4)

4) DC Air Pump:-

The DC air pump is composed of an inlet valve and the outlet valve, those are used to direct the airflow, the piston is used to generate the airflow. When the piston is pulled up, the air is sucked up into the pump through the inlet as a result negative pressure is created. (figure 5)

5) Solenoid valve:-

A solenoid valve is an electronically controlled device that is used to control the fluid direction, flow rate, etc. Solenoid valve works on the basis of

an electromagnet. The magnetic field can switch the solenoid on or off as required by the user (figure 6)

6) Camera:-

The camera module is used as an input device that could sense the object. The camera can consider various parameter as pattern, shape, color, etc. Hence more accuracy and variety in an object can be achieved.



Fig 2:- ARDUINO



Fig 3:- SERVMOTOR

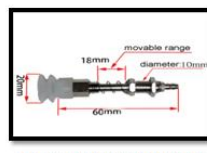


Fig 4:- VACUUM GRIPPER

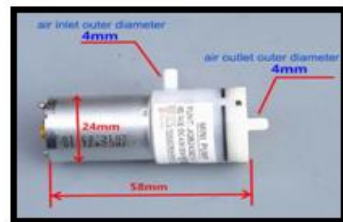


Fig 5:- DC AIR PUMP

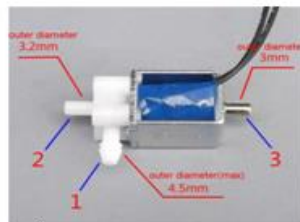


Fig 6:- SOLENOID VALVE

V. SOFTWARE REQUIREMENT

ARDUINO IDE:-

Arduino Integrated Development Environment (IDE) is open-source software that makes it easy to write, compile, and upload the code to the micro-controller. It runs easily on any operating system and covers a wide range of Arduino boards. It contains mainly a two-part editor and compiler. The code written is known as a sketch and supports both C and C++ language. (Fig 8:- Arduino IDE).



Fig 8:- ARDUINO IDE

ML.NET:-

ML.net is a free machine learning framework provided by Microsoft, it helps in achieving different machine learning API. It is used to build various types of machine learning applications in C#.

VI. CONCLUSION

- The robotic arm is capable of identifying the product, picking it from the stack, and placing it at the correct place.
- This product helped in achieving a continuous and automated process by reducing dependence on human work, cost, and time.
- It was successful in increase the output and make optimum use of every possible minute.
- With the help of the camera module, it became easy to identify a wide range of products.

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