PNEUMATIC PICK AND PLACE ROBOT

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ABSTRACT

The system demonstrates pneumatic pick and place robot controlled by using Arduino Uno R3 with relay. It is an articulate or jointed arm configuration type of, 4 DOF pneumatic pick and place robot. Solenoid valves are used to control the movement of the cylinders. The main purpose of robot is to pick out the product on moving conveyor.**Keywords:** Articulate robot, Pneumatic cylinder, Solenoid valve, Arduino Microcontroller.

I. INTRODUCTION

Robotics is anintegration of mechanics, electronics and information technology. The automation plays important role to reduce human efforts in most of the regular and frequently carried works. The pneumatic system has gained a large amount of importance in last few decades and is due to its accuracy and cost. Pneumatic power can be utilized to achieve pick and place mechanism. The system make use of four pneumatic actuators to achieve the purpose.Directional control valves control the direction of air, in order to control the movement of the cylinder piston. The complete movement will be held together by the series of linkages and joints. The whole setup is controlled by Arduino Uno R3 microcontroller.

II LITERATURE REVIEW

Since many years' replacement of human work with mechanization and automation are in practice. It is observed and been proved that the robots are faster and more effective than human work. Robot is an electromechanical device or contrivance that can be used for self-governing tasks. Currently many robots are utilized for tasks that are so tough or hazardous for the humans for apply undeviatingly such as picking and allocating the objects withal, it can be utilized to automate the perpetual tasks that can give alongside extra precision.

Rajgure S.D et al [2018] has reviewed the modeling 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.[1]

VishakhaBorkar and Andurkar G.K [2017], has developed pick and place Robot for industrial applications. The design is carried out on a low-cost robot platform for development of pick and place the things.There is establishment of both wireless communication between the mobile robot and the remote base station, and serial communication between the remote base station and the GUI application. The base station requires the serial communication with the GUI application and also needs to be hardwired with the radio packet controller.[2]

Hardik A. Modi, et al has design the system for pick and place of machine components of CNC-Lathe. Automation is termed as the use of different control systems such as numerical control, programmable logic control or another industrial control system in concern with computer applications or information technology to manipulate all the industrial machinery and processes, thus reducing the need for human intervention. Automation plays a dominant role in the world economy these days and in daily application in industries.[3]

Harish K ,Megha D , Shuklambari M , Amit K , Chaitanya K Jambotkar,Presented Pick and Place Robotic Arm Using Arduino [1]. In this paper a system of pick and place robot is designed using arduino which is implemented via RF signal. Here, the input signal or controlling signal is given from a wireless play station, which is interfaced with the microcontroller by a RF receiver module. When the signal issent from the play station it is decoded in the controller and proper controlling signal is sent to actuators (dc motors or servo motor) in the system.[4]

III WORKING PRINCIPLE

The compressed air from the compressor at the pressure of 4 to 5bar is passed through a pipe connected to the four solenoid valves with their inputs. Solenoid valve has two outputs and one input. The solenoid valves are actuated with control of Arduino Uno R3. The air entering into the input goes to the two output of the solenoid valve, by programming using Arduino microcontroller, the specific actuation of the pneumatic cylinder is performed.

IV IMPLEMENTATION

1.Articulate (or) Jointed arm type

It is similar to the configuration of a human arm. It consists of a vertical column that swivels about the vase using a T-joint. Shoulder joint (R-joint) is located the top of the column. The output link is an elbow joint (another joint). It gets three rotary joints and three wrist axes which forms into 6 DOF.
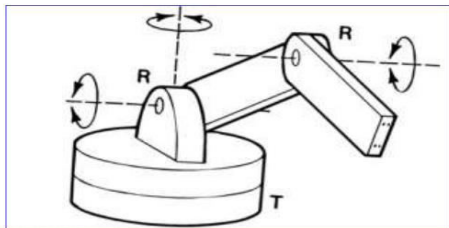
Jointed-arm body-and-arm assembly (TRR).

Fig.1 Articulate (or) Jointed arm

2. Gripper

A gripper is a device which enables the holding of an object to be manipulated. Just like a hand, a gripper enables holding, tightening, handling and releasing of an object. A gripper is just one component of an automated system. A gripper can be attached to a robot or it can be part of a fixed automation system. Here, we used a gripper made of mild steel material.

3. Pneumatic system

In pneumatic systems compressors are used to compress and supply the necessary quantity of air. Basically, a compressor increases the pressure of a gas by reducing its volume as described by gas laws. Pneumatic systems use a centralized air compressor which is considered to be an infinite air source. The compressed air is dried to reduce the humidity and dew point. This is known as primary air treatment. Then it is stored in a receiver. From this, the pressurized air treatment. Then it is stored in a receiver. From this, the pressurized air can be piped from one source to various locations. The air is pipe to each circuit through an air filter to remove the contaminants which might harm the pneumatic components such as valves and cylinders. The air then flows through pressure regulator which reduces pressure to the desired level for the particular circuit application. Since air is not a good lubricant, pneumatic system requires a lubricator to inject a fine mist of oil into the air discharged from the pressure regulator. This prevents the wear of parts in the pneumatic components. The air is supplied to the pneumatic actuator, through various pneumatic valves. After necessary work is done in the actuator, the air is exhausted. Since pneumatic systems exhaust air directly into the atmosphere, they are capable of generating excessive noise. Therefore, mufflers are mounted on the exhaust ports of valves and actuators to reduce the noise.

V COMPONENTS AND THEIR PROCESS

1.Double acting cylinder

The force exerted by the compressed air moves the piston in two direction in a double acting cylinder. The double acting cylinder produces less force during retraction, because the piston rod's cross-sectional area is subtracted from the piston area under pressure. They are used particularly when the piston is required to perform work not only in the advance movement but also on the return movement. In principle, the stroke length is unlimited, although buckling and bending must be considered before we select a particular size of piston diameter, rod length and stroke length.
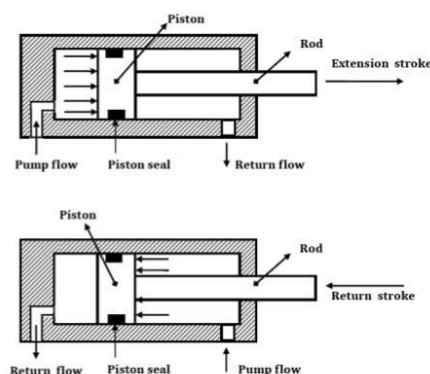
Fig.2 Double acting cylinder

2. Arduino Uno r3

Arduino Uno R3 is one kind of ATmega328P based microcontroller board. It includes the whole thing required to hold up the microcontroller; just attach it to a PC with the help of a USB cable, and give the supply using AC-DC adapter or a battery to get started. The term Uno means "one" in the language of "Italian" and was selected for marking the release of Arduino's IDE 1.0 software. The R3 Arduino Uno is the 3rd as well as most recent modification of the Arduino Uno. Arduino board and IDE software are the reference versions of Arduino and currently progressed to new releases. The Uno-board is the primary in a sequence of USB-Arduino boards, & the reference model designed for the Arduino platform.

Fig.3 Arduinouno r3

3. Relay

The relay is the device that open or closes the contacts to cause the operation of the other electric control. It detects the intolerable or undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area. Thus protects the system from damage.

Fig.4 Relay

4. Solenoid valve

A solenoid valve, also known as an electrically-operated valve, is a valve that uses electromagnetic force to operate. When an electrical current is passed through the solenoid coil, a magnetic field is generated which causes a ferrous metal rod to move. This is the basic process that opens the valve and it works either directly or indirectly on the air.Solenoid valves eliminate the need for manual or pneumatic control of a pneumatic circuit and only require an electrical input (and air pressure for piloted valves) to operate, this makes them easy to program and install in a wide variety of applications.
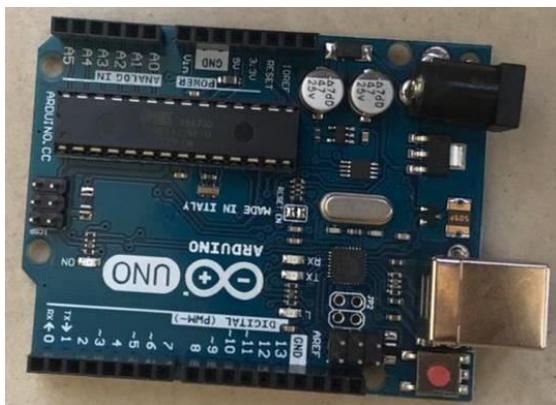

Fig.5 Solenoid valve

VI DESIGN

The design process is made with the help of designing software Autodesk Fusion 360. Each and every component was designed individually and they are assembled after all the design of the individual components gets completed. The dimensions for the individual components were given after an the standard dimension of the components and also the availability of the components. Availability of the components is also one of the most important factors must be considered while designing the setup.
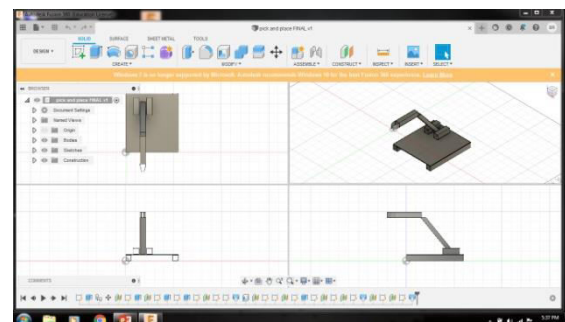
Fig.6 Frame design

The top view, front view and side view of the frame shown in fig.6.

VII EXPLANATION

Here, we use 220v AC solenoid Direction control valve for controlling pneumatic actuation.So, we cannot control the solenoid valve directly as the Arduino require only 5 v supply.So, we use Relay as controller switch for Solenoid valve and the relay is controlled by Arduino.
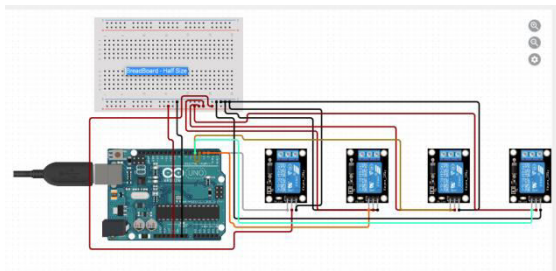

Fig.7 Circuit diagram

Fig.8 Circuit connection

Here the inputs are given to the digital pin number 10,12,7,8 and the other endsare given toIN of relay. The GROUND of the relayare connected to the negative end and VCC of the relay are connected to the positive end.Another end of the relay has NO, NC, COMMON. NO are connected to power supply.Connection from the solenoid valve connected to power supply.Correspondingly, COMMON are connected to the another end of the solenoid

valve.When the Arduino receive signal, it ON the relay with some interval of time and then it OFF the relay and (it depends upon the program given to Arduino).Whenever, the relay ON, it gives signal to the corresponding solenoid valve for the actuation of cylinder.

Fig.9 Complete setup

VIII RESULT AND DISCUSSION

We made pick and place robot model using arduinouno r3 microcontroller with relay and solenoid valve. The total work volume of the robot is 0.011m^3 and it will lift upto the weight of 500g. The working of our robot is good and it works on the way, we programmed using arduino microcontroller. The robot we made is used for pick objects like bottles, fruits, etc. In future, we will remodel our robot in bigger size with more features which will be used for wider applications in industries.

FEATURES	DESCRIPTION		
LOAD CAPACITY	500g		
WEIGHT	5kg		
WORK VOLUME	0.011m^3		
RANGE OF MOTION	BASE	64°	
	UPPER ARM	58°	
	LOWER ARM	90°	
	WRIST (YAW)	68°	

Table.1 Salient features of robot

IX CONCLUSION

Present work we made a pick and place robot for transfer of parts from one place to anotherand this was achieved with the help of pneumatics and electronics systemhas been successfully completed and all the objectives are met.

X REFERENCES

[1] AdemolaAbdulkareem, O. Ladenegan, A.F. Agbetuyi and C.O.A. Awosope, (February 2019), "Design And Implementation of a Prototype Remote-Controlled Pick And Place Robot" International Journal of Mechanical Engineering and Technology (IJMET) Volume 10, Issue 02, pp. 235-247.

[2] AyokunleA.Awelewa, Samuel O. Majekodunmi, Isaac A. Samuel, (October 2013) IJENS "Development of a Prototype Robot Manipulator for Industrial Pick-and-Place Operations".

[3] Er. R.K.Rajput, "Robotics and Industrial Automation", S. Chandn Publications, 2014.

[4]Harish K, Megha D, Shuklambari M, Amit K, ChaitanyaKJambotkar,(December 2017), "Pick and Place Robotic Arm Using Arduino"International Journal of Science, Engineering and TechnologyResearch (IJSETR) Volume 6, Issue 12. ISSN: 2278 -7798.

[5] JamshedIqbal, Razaul Islam, and Hamza Khan.(July 2012), "Modelling and Analysis of a 6 DOF Robotic Arm Manipulator".Canadian Journal on Electrical and Electronics Engineering Vol.3, No. 6.

[6] Prof.S.N.Teli1 ,AkshayBhalerao 2 ,SagarIngole 2 ,Mahesh Jagadale 2 , KiranKharat 2 (March-2017). "Design and Fabrication of Pneumatic Robotic Arm" International Journal of Scientific & Engineering Research, Volume 8, Issue 3.

[7]Santosh,Manoj, AkshayPeddarajula, Abhishek R Shetty (June 2016) "Design and Fabrication of Pneumatic Arm for Pick and Place of Cylindrical Objects", International Journal of Latest Technology in Engineering, Management & Applied Science (IJLTEMAS) Volume V, Issue VI, | ISSN 2278-2540.

[8] ShaliniPukkella , Dr. V. Suresh Babu, Dr. K. M. Abubacker,(Aug 2020). "Design and Development of Pick and Place Arm Robot" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 08.