

Review Paper on Advanced Pneumatic Gripper System

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Abstract— This paper proposes a simple approach of Advanced Pneumatic Gripper System, Nowadays robot becomes an important machine due to its increasing use in industry. To improve work efficiency of the robot, gripper has been designed as a mechanical hand and integrated with the robot. It is used to grasp and place a material, tool or part from one site to another site. The gripper becomes an essential part of a robot and it is widely used in the automation field. Today, two-jawed gripper more and more frequently used in assembly tasks. It is totally different compared to gripper with a vacuum-based electromagnetic and gripper with electromagnets. Two-jawed gripper required mechanical force and gripper application to move the jaws to grasp an object. Generally, the industrial robot gripper is a specialized device. It can only used to grip the object which similar in size, shape and weight of the repeated assembly process. In case, to grasp the objects which are different in size, shape and weight, manpower is needed to control the industrial robot gripper manually. Therefore, sensors and control systems are play a major role in improving the automated gripper. The sensor will attach at the gripper to detect the position of objects to pick up and the environment, the data which detected by the sensor will send to the computer. While the computer control system of the gripper will analysis the data and adjust its subsequent action according to the actual state. 2 Gripping force is a contact force per unit gripping area to clamp the object. There are various kinds of properties object such as thin wall, soft and fragile. Different type of object required different degree of gripping force to clamp. The computer control system would able to find the suitable gripping force to hold the objects and avoid deformation. The contribution of gripper shall not only restricted to the industries, likewise the use of gripper shall broaden to the daily life of the household. Thus, to design a proper gripper is important. Other than multitasking ability, criteria such as simplicity, user-friendly, durability, reliability, low cost and low maintenance shall take consider in designing a proper gripper.

Keywords: Advanced Pneumatic Gripper System

I. INTRODUCTION

Now-a-days for automation for material handling, industries are using robotic arms which are highly efficient and increases productivity. There are different types of gripper mechanisms found in industries like mechanical gripper, electromagnetic, hydraulic and pneumatic gripper. Pneumatic grippers are gaining interest of designers for end effectors of robot because of their easy to handle and low maintenance. Grippers are the mechanical interface between robot and its environment. Without it robot cannot perform pick and place activity. Robotic gripper has the capability to grasp definite objects and then reposition it to desired place. The robotic gripper has two basic parts

- 1) Manipulators
- 2) End effectors

Manipulators are the working arm of the robot which helps to manipulate end effectors. Generally, these are connected with replaceable end effectors so that flexibility of robot increases. End effectors are the devices which are connected to end of robotic arm. End effectors are so designed to act as wrist of a robot which will interact with material to be handled. System flexibility greatly depends upon these end effectors. Material used for these end effectors is light weight and can be reused in future. End effectors include Sensors Tools, Drills, Grippers, Magnets, Welding guns, Screw drivers. If robot has to perform pick and place activity end effectors must be a gripper. Grippers are the main functional end effectors. This paper concentrates on material handling in stamping and forging industry on mechanical press machine to reduce cycle time. In stamping and forging industry sheet metal parts are manufactured by punching, piercing, blanking, coining, embossing, bending, flanging. Here we are working on pneumatic grippers. The pneumatic grippers fit in our aspects of design as it is moderate in cost, easy to reproduce. The accessories required are less for pneumatic gripper.

The industrial robots are one of the most important devices for better, modern and safer automation. Requirements of today's manufacturing industries are very high. To meet the requirements of the market many companies decide to use industrial robots for better and cheaper products. The industrial robots can perform work in many areas of the industry e.g. pick and place objects, cutting, drilling and many more. There are several advantages of using industrial robots in manufacturing.

A. Objective

This project aims to Design and fabricate pneumatic arm for pick and place of cylindrical objects. The handling of materials and mechanisms to pick and place of objects from lower plane to higher plane and are widely found in factories and industrial manufacturing. There are number of pneumatic arms are available which consists of so many mechanisms hence becomes expensive. The designed pneumatic arm consists of two cylinders, a shaft works with lead screw mechanism capable of converting motion of piston to rotational motion of arm with help of using compressed air.

The designed processes are carried out based on integrated information of kinematics dynamics and structural analysis of the desired robot configuration as whole. The highly dynamic pneumatic arm model can be easily set at intermediate positions by regulating the pressure using the flow control valve. It can be used in loading and unloading of goods in a shipping harbor as the movement of goods is done from lower plane to higher plane

B. Pneumatic Gripper System

Pneumatic technology deals with the study of behaviour and applications of compressed air in our daily life in general and manufacturing automation in particular. Pneumatic systems use air as the medium which is abundantly available and can

be exhausted into the atmosphere after completion of the assigned task.

A typical Robotic Vehicle is capable of traveling over various terrains and traversing obstacles. In one embodiment, the design in this work, includes a Robotic arm of five Degree of Freedom with its base resting directly on top of the vehicle, a body having four drive wheels coupled to the ends thereof. The wheels are selectively powered to propel the vehicle. The design methodology involves the hardware, software part and implementation of both designs. A prototype of the Remote Controlled "Pick and Place" Robotic vehicle was built to validate design specifications. The results obtained were very satisfactory.

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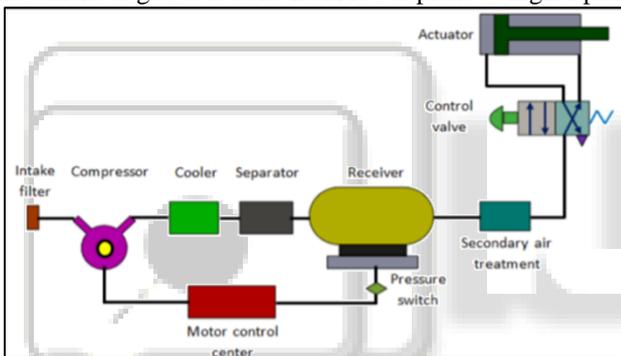


Fig. 1: Parts of Pneumatic System

Important components of a pneumatic system are shown in Fig.

- 1) Air filters: These are used to filter out the contaminants from the air.
- 2) Compressor: Compressed air is generated by using air compressors. Air compressors are either diesel or electrically operated. Based on the requirement of compressed air, suitable capacity compressors may be used.
- 3) Air cooler: During compression operation, air temperature increases. Therefore coolers are used to reduce the temperature of the compressed air.
- 4) Dryer: The water vapour or moisture in the air is separated from the air by using a dryer.
- 5) Control Valves: Control valves are used to regulate, control and monitor for control of direction flow, pressure etc.
- 6) Air Actuator: Air cylinders and motors are used to obtain the required movements of mechanical elements of pneumatic system.
- 7) Electric Motor: Transforms electrical energy into mechanical energy. It is used to drive the compressor.
- 8) Receiver tank: The compressed air coming from the compressor is stored in the air receiver.



Fig. 2: Pneumatic grippers

C. Air Treatment Stages

For satisfactory operation of the pneumatic system the compressed air needs to be cleaned and dried. Atmospheric air is contaminated with dust, smoke and is humid. These particles can cause wear of the system components and presence of moisture may cause corrosion. Hence it is essential to treat the air to get rid of these impurities. The air treatment can be divided into three stages as shown in Fig

To prevent any damage to the compressor, the contaminants present in the air need to be filtered out. This is done by using inlet filters. These can be dry or wet filters. Dry filters use disposable cartridges. In the wet filter, the incoming air is passed through an oil bath and then through a fine wire mesh filter. Dirt particles cling to the oil drops during bubbling and are removed by wire mesh as they pass through it. In the dry filter the cartridges are replaced during servicing.

The wet filters are cleaned using detergent solution. As the air is compressed, the temperature of the air increases. Therefore the air needs to be cooled. This is done by using a cooler. It is a type of heat exchanger. There are two types of coolers commonly employed viz. air cooled and water cooled. In the air cooled type, ambient air is used to cool the high temperature compressed air, whereas in the water cooled type, water is used as cooling medium. These are counter flow type coolers where the cooling medium flows in the direction opposite to the compressed air. During cooling, the water vapour present will condense which can be drained away later.

II. LITERATURE REVIEW

Grippers are subsystems of handling mechanisms which provide temporary contact with the object to be grasped. They ensure the position and orientation when carrying and mating the object to the handling equipment. Pretension is achieved by force producing and form matching elements. The term "gripper" is also used in cases where no actual grasping, but rather holding of the object as e.g. in vacuum suction where the retention force can act on a point, line or surface. There are many types of work pieces with different shapes and sizes to be handled. So, it is impossible to design a universal gripper suitable for all work pieces. The majority of the researches in the area of grippers utilize electric or pneumatic

actuators and two parallel fingers. Electrically actuated grippers generally utilize DC or stepper motors to provide the motive force. Transmission systems like ball screws, gears, pulleys or other mechanical linkages are necessary to convert the motion of the actuator to the finger motion, adding to the complexity, size and weight of the gripper assembly. A gripper can be considered more important than the robot, because without a gripper robot cannot handle anything. Grippers vary by form and task that they can perform.

The grippers used in industry are generally task oriented grippers. They are manufactured for a single task and they can only handle the objects which have similar properties like geometry, weight etc. The task oriented grippers are preferred because they are used in mass production where handled objects do not vary; the cost and the reliability of the gripper are of vital importance in industrial use. The usage area of a robot in industry is increased by using a single gripper with modular fingers or using multiple grippers which can be replaced easily. In past, the grippers had been developed and produced for a single task to be performed. But, the latest technological developments gave opportunity for more developed universal gripping devices. These are called dexterous robot hands. Generally these hands were not used in industry now because of the high cost and complexity. Compared to the dexterous hands, usage of a task oriented gripper is much more feasible. They are cheap and more reliable. Also, multipurpose grippers (dexterous hands) are not preferred in industries with mass production and handled work pieces do not change. Although the capability of handling different shaped object is higher for multipurpose grippers, the handling capacity is very low compared to task oriented grippers.

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III. FUTURE SCOPE

Since old age man is always trying to gain more and more luxurious. Man is always trying to develop more and more modified technique with increasing the aesthetic look and economic consideration. Hence there is always more and more scope. But due to some time constraints, and also due to lack of funds, we only have thought and put in the report the following future modifications-

- 1) It can be made hydraulically power operated by installing the gear oil pump at the place of air compressor and pneumatic cylinder arrangement.

- 2) It can be made rack and pinion operated or spring and lever operated, by replacing the pneumatic circuit by rack and the pinion arrangement by the square threaded screw and nut arrangement.
- 3) The place where there is scarcity of the electricity the electric motor operate compressor is replaced by an I.C. Engine installed compressor. Thus in future there are so many modifications, which we can make to survive the huge global world of competition.

IV. CONCLUSION

[1] Above is the Future model of pneumatic machine on which the drilling, cutting etc operation is achieved by Pneumatic system and it eliminates all the problem faced by conventional operation process. [2] This pneumatic multi-operation Machine is to be presented for increasing their productivity as well as quality of job. [3] It also gives the detailed description of machine mechanism and their different main parts of machine. The manual controlled machine is converted into automatic machine by using various pneumatic devices as discussed in the paper. [4] The results indicate that operating time is saved to a greater extent. Thus the output will be more and even the human intervention is minimized.

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