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# REVIEW ON DESIGN AND FABRICATION OF AUTO LOADER AND AUTO CATCHER PRESS MACHINE

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**Abstract --**

The Press Machine is a project that is designing a new way to improve the previous press machines in industries which has a few weaknesses in safety while operating processes. The new press machine is a project to improve previous press machine which have weakness in safety while operating it. This matter creates a lot of problem and at the same time the operators and technician have the higher risk to have an accident in industries. The solution for this problem is a development of a new program of machine which running same operation but the machine is more safety and easy to setup when machine pressing the radio panel using external timer. This machine controlled by the Programmable Logic Controller (PLC). It consists of 6 pneumatic cylinders which each cylinder has their own function. This project contains in 2 parts first one is autoloader and another one is auto catcher. The autoloader will place the hot billet into the lower die of press and the auto catcher will catch the finished product and place it onto the conveyor.

***Key Words*:** DCV, FCV, FRL Unit

## I. INTRODUCTION

Mechanical is the branch of engineering science & Technology related to machinery, and their design, manufacture, application, and structural disposition. Robotics is related to electronics, mechanics, and software. Robotics research today is focused on developing systems that exhibit modularity, flexibility, redundancy, fault-tolerance, a general and extensible software environment and seamless connectivity to other machines, some researchers focus on completely automating a manufacturing process or a task, by providing sensor-based intelligence to the mechanical arm, while others try to solidify the analytical foundations on which many of the basic concepts in robotics are built.

This project is study about the design and fabricates of Auto-loader and Auto-catcher which shows capability to design more than one concept and fabricate the machine using a variety of machine Other than that, it is important to studies on pneumatic and forging presses which are the main topic for this project. So, at the end of this project, student will be practicing on how to build and steps to follow to complete the requirement for this project.

Present day industry is increasingly turning towards computer-based automation mainly due to the need for increased productivity and delivery of end products with uniform quality. The inflexibility and generally high cost of hard-automation systems, which have been used for automated manufacturing tasks in the past, have led to a broad-based interest in the use of Pick and place robots capable of performing a variety of manufacturing functions in a flexible environment and at lower costs.

Auto-loader and Auto catcher is a human controlled based system that detect the object, picks that object from source location and places at desired location. For detection of object, human detect presence of object and move machine accordingly. Using pneumatic systems is economical and environmentally friendly, as air is inexpensive, plentiful and easily compressed and stored in tanks.

## II.Literature Review

1.Kensuke Harada,Tokuo Tsuji,Kazuyuki Nagata, Natsuki Yamanobe has
studied "The proposed lanner automatically determines the pose of an object that is stably placed near a user assigned point on the environment surface. In our proposed method, first the polygon models of both the object and the environment are clustered, with each cluster being approximated by a planar region. The position/orientation of an object placed on the environment surface can be determined by selecting a pair of clusters one from the object and the other from the environment. We furthermore conduct several tests to determine the position/orientation of the object, namely the Convexity Test, the Contact Test and the Stability Test. We demonstrate that, by using the polygon model of the environment that is obtained by means of conversion of the point cloud, we can determine the position/orientation of an object and can thereby realize a pick-and-place task." [Faculty of Information Science and Electrical Engineering, Kyushu University, Fukuoka 819-0395, Japan, 2014]

2. Chung Yik Lau, Almon Chai has studied "the design of an anthropomorphic robotic hand of low-budget, achieving basic grasps similar to the human hand. The hand has an anthropomorphic design with 16 degrees of freedom (DOFs). With 14 Mckibben style pneumatic air muscles (PAM) implemented as the power actuator of the tendon-driven fingers, the actuator offers the robotic hand a compliant, soft grasp for manipulating objects in open-loop control. Besides, this work reports the force transmission layout that enables under actuation which allowed the use of fewer actuators to control the DOFs of the hand. The performance of the hand was accessed through testings using power and precision grasps. A robotic hand is a multi-fingered object manipulation end effector that involves the integration of different engineering expertise like mechanical, electrical, and control. Motivated by the great potential robotic hands hold aas a human substitution in difficult situations, scientists throughout the world have been researching in this field since the 1980s. The state-of-art of contemporary anthropomorphic dexterous robotic hands offers human kind assistance in tasks that are considered unachievable, ranging from tedious routine tasks to upper extremity prosthetics. Nature has always been a source of inspiration for engineering designs. As it is desired to develop a robotic hand to mimic the appearance and grasps of the human hand, hence it is reasonable to choose the human hand as the basis of designing the robotic hand."[Swinburne University of Technology, 93350 Kuching, Sarawak, Malaysia (IRIS 2012)]

3. Nwokomah Wilson Gosim,Tarig Faisal,Assadi,Mahmud Iwan has studied "Industrial robot is widely used in small and medium workshops, however, the robot cooperating with other devices are important aspect for achieving the full autonomous system. This paper reports on the development of line follower mobile robot correlated with ABB industrial robot manipulator. The line follower mobile robot is a prototype model design and fabricated for material handling purpose. Thus, hardware components as well as software programming are concurrently developed with each other. Meanwhile, a specific microcontroller for the line follower robot associated with the ABB main controller is developed. A sensory system also attached for completing the operational loop. Experimental

operation shows fully successful for the developed system. Hence, ABB industrial robot could incorporates further in low cost fully automation system."[International Symposium on Robotics and Intelligent Sensors 2012 (IRIS 2012)]

4. Yong Zhang, Student Member, IEEE, Brandon K. Chen, Student Member,

IEEE, Xinyu Liu, Student Member, IEEE, and Yu Sun, Senior Member,

IEEE has studied "a robotic system that is capable of both picking up and releasing micro objects with high accuracy, reliability, and speed. Due to force-scaling laws, large adhesion forces at the micro scale make rapid, accurate release of micro objects a long-standing challenge in micromanipulation, thus representing a hurdle toward automated robotic pick-and-place of micrometer-sized objects. The system employs a novel micro electromechanical systems (MEMS) micro gripper with a controllable plunging structure to impact a micro object that gains sufficient momentum to overcome adhesion forces. The performance was experimentally quantified through the manipulation of 7.5–10.9μm borosilicate glass spheres in an ambient environment. Experimental results demonstrate that the system, for the first time, achieves a 100% success rate in release (which is based on 700 trials) and a release accuracy of 0.45±0.24μm. High-speed, automated micro robotic pick-and-place was realized by visually recognizing the micro gripper and microspheres, by visually detecting the contact of the micro gripper with the substrate, and by vision-based control. Example patterns were constructed through automated micro robotic pick-and-place of microspheres, achieving a 4 speed of 6 s/sphere, which is an order of magnitude faster than the highest speed that has been reported in the literature. [IEEE TRANSACTIONS ON ROBOTICS, VOL. 26, NO. 1, FEBRUARY 2010]

5. A. Che Soh, S.A. Ahmad, A.J. Ishak and K. N. Abdul Latif Department Electrical and Electronic of Engineering, University Putra Malaysia, 43400 Serdang Selangor, Malaysia has studied "Adjustable gripper for robotic system that is capable in identifying shape and size of an object is needed in many applications especially for picking and placing operation. This is due to some of the grippers' design are limited only to one specific shape or size that make picking and placing operation difficult. To hold different size or shape, the user needs to replace gripper which are more time consuming and more expensive. To address this problem, an adjustable gripper for robotic system has been proposed for picking and placing operation. The main objective is to design a robust gripper that can perform easier and faster picking and placing operation for multiple shapes and sizes objects. This adjustable gripper for robotic system can to improve the picking and placing operation in manufacturing field introducing more outputs without the needs to."[INTERNATIONAL JOURNAL ON SMART SENSING AND INTELLIGENT SYSTEMS, VOL. 5, NO. 4, DECEMBER 2012]

## III. PROBLEM STATEMENT

Design and Fabrication of Auto-catcher and Auto-loader for press automation.

- To increase the efficiency of the plant
- To reduce the work load
- To reduce the production cost
- To reduce the production time
- To reduce the material handling
- To reduce the fatigue of workers
- To achieve good product quality
- Less Maintenance
- To reduce man power.
- For mass production

For mass production of the product, the machining operations decide the sequence of machining. The machines designed for producing a particular product are called transfer machines. The components must be moved automatically from the bins to various machines sequentially and the final component can be placed separately for packaging. Materials can also be repeatedly transferred from the moving conveyors to the work place and vice versa. Nowadays almost all the manufacturing process is being atomized in order to deliver the products at a faster rate. The manufacturing operation is being atomized for the following reasons. This project will focus on build of Auto-

catcher and Auto-loader with using a pneumatic system. Therefore, automation system also can help small company to use auto loader than using manual loading.

## IV. NEED FOR AUTOMATION

Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics forms an attractive medium for low cost automation. The main advantages of all pneumatic systems are economy and simplicity. Automation plays an important role in mass production.

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## V. OBJECTIVES

The main objectives of this project study are to design and fabricate a simple autoloader and auto catcher that used pneumatic system. The outcomes of this project study will be:

- To design mechanical system of pick and place arrangement.
- To design a pneumatic system of automation.
- To fabricate an auto loader and auto catcher through several fabrication techniques

## VI. PNEUMATIC SYSTEM

Pneumatic systems use pressurized gases to transmit and control power. As the name implies, pneumatic system typically use air (rather than some other gas) as the fluid medium because air is safe, low cost and readily available fluid. It is particularly safe inn environments where an electrical spark could ignite leaks from system components.

There are several reasons for considering the use of pneumatic systems instead of hydraulic systems. Liquids exhibit greater inertia than do gases. Therefore, in hydraulic systems the oil is a potential problem when accelerating and decelerating actuators and when suddenly opening and closing valves. Liquids also exhibit greater viscosity than do gases. This results in larger frictional pressure and power losses. Also, since hydraulic system use a fluid.

## VII. Pressure Regulating Components

Pressure regulating components are formed by various components, each of which has its own pneumatic symbol:

**Filter** – can remove impurities from compressed air before it is fed to the pneumatic components.

**Pressure regulator** – to stabilize the pressure and regulate the operation of pneumatic components

**Lubricator** – To provide lubrication for pneumatic components.

**(a) Execution component**

(i) Single acting cylinder :- A single acting cylinder has only one entrance that allows compressed air to flow through. Therefore, it can only produce thrust in one direction. The piston rod is propelled in the opposite direction by an internal spring, or by the external force provided by mechanical movement or weight of a load.

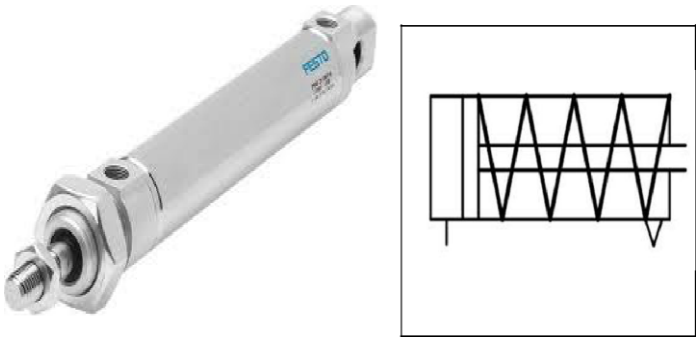


Fig. Single acting cylinder

(ii) Double acting cylinder

In a double acting cylinder, air pressure is applied alternately to the relative surface of the piston, producing a propelling force and a retracting force. As the effective area of the piston is small, the thrust produced during retraction is relatively weak. The impeccable tubes of double acting cylinders are usually made of steel. The working surfaces are also polished and coated with chromium to reduce friction.

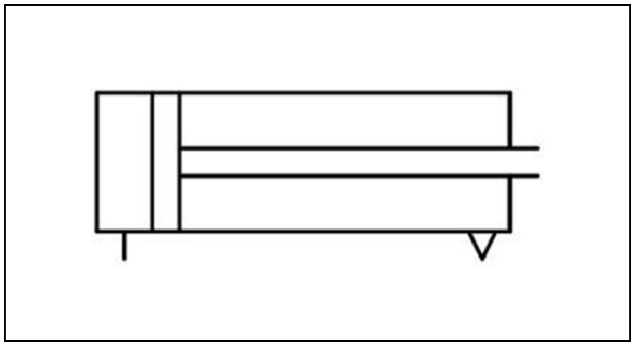


Fig.3.2 Double acting cylinder

**(b) Directional control valve**

Directional control valves ensure the flow of air between air ports by opening, closing and switching their internal connections. Their classification is determined by the number of ports, the number of switching positions, the normal position of the valve and its method of operation. Common types of directional control valves include 2/2, 3/2, 5/2, etc. The first number represents the number of ports; the second number represents the number of positions. A directional control valve that has two ports and five positions can be represented by the drawing in Fig. 8, as well as its own unique pneumatic symbol.

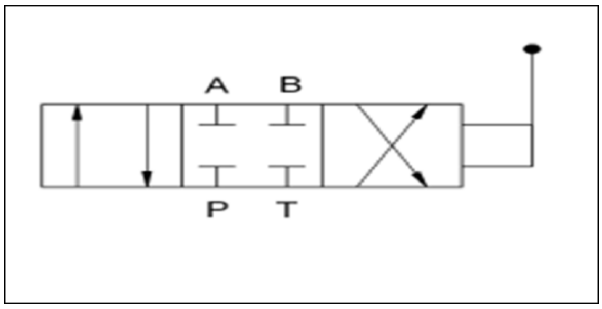



Fig.3.3 Directional control valve

## VIII. INTRODUCTION TO PRESSES

A power press is a machine that supplies force to a die used to blank, form, or shape metal or non-metallic material. Thus, a press is a component of a manufacturing system that combines the press, die, material, and feeding method to produce a part.

Presses are composed of frame, bed, or bolster plate and a reciprocating member called a ram or slide, which exerts force upon work material through special tools mounted on the ram and bed. Energy stored in the rotating flywheel of a mechanical press (or supplied by a hydraulic system in a hydraulic press, or supplied by pneumatic cylinder in a pneumatic press) is transferred to the ram to provide linear movement.

## IX. INTRODUCTION TO FORGING

Forging is process of plastically deforming metal or alloy to a specific shape by a compressive force exerted at elevated temperature by some external agency like hammer, press, rolls, dies or by an upsetting machine. Bolts, nuts, nails, cams, crank shafts, connecting rods, axles etc. are produced by forging.

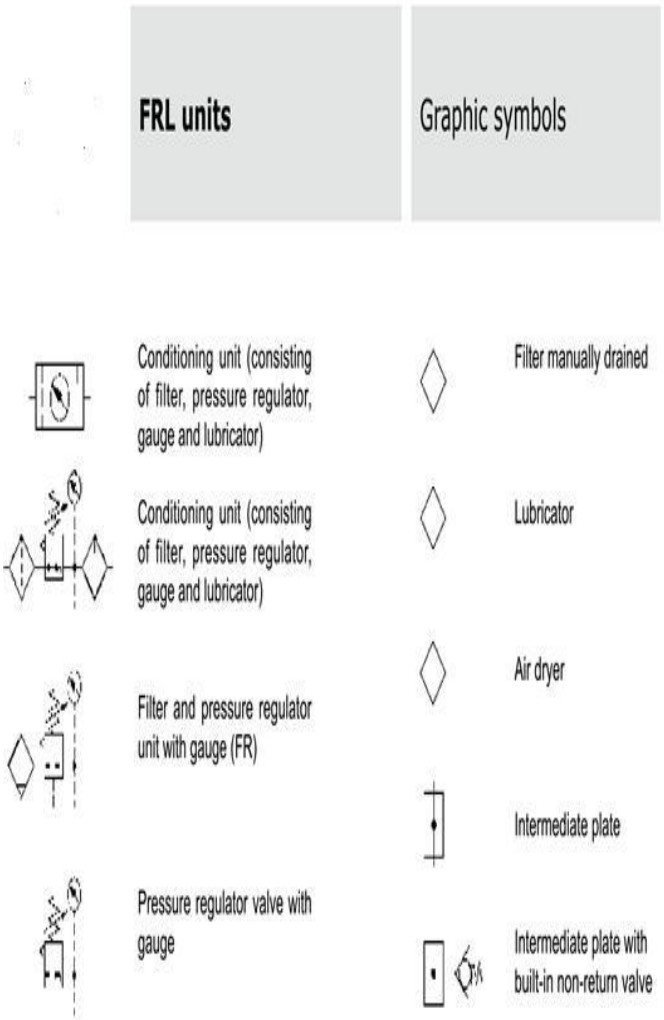
## X. FRL UNIT

Once the air is compressed it is necessary to process it in order to improve its quality. The air quality is measured in classes according to ISO-8673-1 standard where the type of contamination that could affect pneumatic equipment life:

- quantity of water particles dissolved in the air.

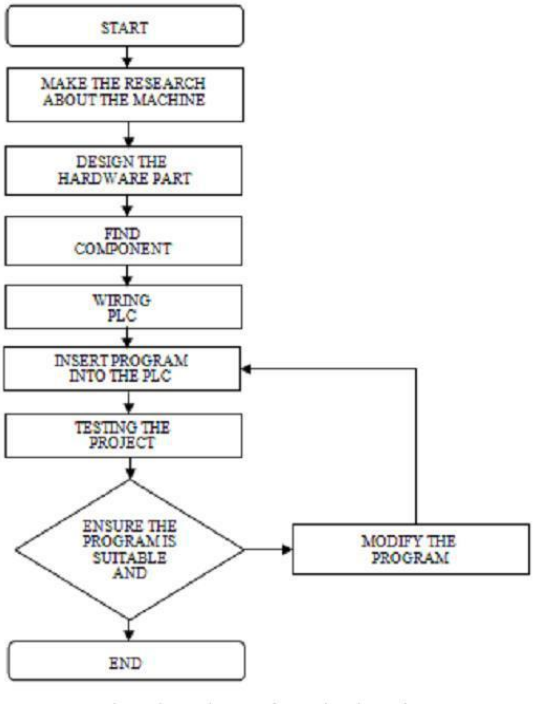
-quantity of oil particles dissolved in the air.

-quantity of solid particles in the air.

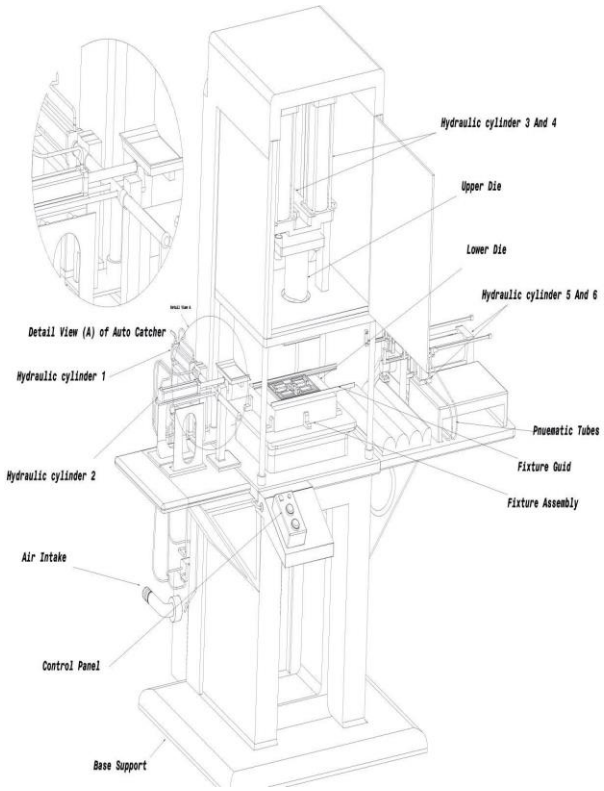



## XI. DESIGN AND WORKING

### 1.Flow Diagram of Methodology




### 2.Block Diagram of Press Machine



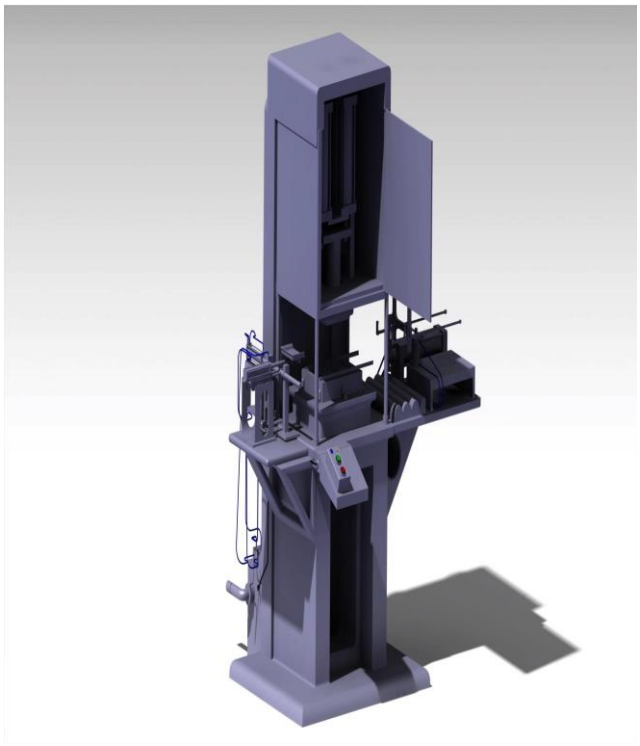


Fig. CREO design with rendering for press machine with autoloader and auto catcher.

## Working: -

**Working of Autoloader-** The autoloader consists of 4 pneumatic cylinders. The arrangement of the cylinders is shown in photo. At first vertical cylinder will actuate so that it will move the assembly in downward direction after that horizontal cylinder will help to grasp the hot metal after grasping the metal vertical cylinder will move upward then remaining two cylinders will actuate such that one cylinder will give horizontal motion to assembly and other will give angular motion to arm and the gripper will drop the hot metal into the lower die. And the press will operate and the forging process will be completed.

**Working of Auto catcher**- After completion of forging process the auto catcher will start working it will catch the finished product into tray and place it on the conveyor. It is very simple in construction only 2 cylinders are used. One will push the other cylinder horizontally. The arm with tray is connected to second cylinder. This cylinder gives the angular movement to arm to catch the product. The physical touch sensor is used to give feedback so that the next cycle is processed.

## XII. ADVANTAGES, DISADVANTAGES

**ADVANTAGES: -**

**Quality: -** Industrial automated mechanical arm has the capacity dramatically improve product quality. Applications are performed with precision and high repeatability every time. This level of consistency can be hard to achieve any other way.

**Production: -** With mechanical arm, throughput speeds increase, which directly impacts production. Because an automated mechanical arm has the ability to work at a constant speed without pausing for breaks, sleep, vacations, it has the potential to produce more than a human worker.

**Safety: -**Mechanical arm increase workplace safety. Workers are moved to supervisory roles where they no longer have to perform dangerous applications in hazardous settings.

**Saving: -**Improved worker safety leads to financial savings. There are fewer healthcare and insurance concerns for employers. Automated mechanical arm also offer untiring performance which saves valuable time. Their movements are always exact, minimizing material waste.

**DISADVANTAGES: -**

**Expense: -** The initial investment to integrated automated robotics into your business is significant, especially when business owners are limiting their purchases to new robotic equipment. The cost of robotic automation should be calculated in light of a business' greater financial budget Regular maintenance needs can have a financial toll as well.

**ROI**: Incorporating industrial robots does not guarantee results. Without planning, companies can have difficulty achieving their goals.

**Expertise:** Employees will require training program and interact with the new robotic equipment. This normally takes time and financial output.

**Safety:** Robots may protect workers from some hazards but in the meantime their very presence can create other safety problems. These new dangers must be taken into consideration.

## XIII.CONCLUSION

From the research and findings made in this project, it showed that this press machine is able to press the component and device, push it to pick up unit then it will be hold by the pickup unit before it placed on the target place. There are few suggestions and improvements that can be carried out for this press machine. The system is suggested to be built with larger size of machine as the Press components. It will give more power to press the devices. Secondly, usage of the cylinder of electric type or hydraulic type is recommended to be as the future study. Another suggestion is to use the digital timer for the machine as the digital timer can show the user about the timer of the operation more clearly than analogue timer. After model testing the result of the testing will be checked. The time reduction after automation, increased safety etc.

In conclusion, we would like to conclude that the production time is reduced and production rate rate is increased.

## XIV. Result

| Observations | Manually | Automatically |
|---|---|---|
| Production time | 90 sec | 40 sec |
| Production Rate | 710 Units | 1500 Units |
| Men needed | 3 | 1 |

## XV. REFRENCES

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"DEVELOPMENT OF AN ADJUSTABLE GRIPPER FOR ROBOTIC PICKING AND PLACING OPERATION" [ INTERNATIONAL JOURNAL ON SMART SENSING AND INTELLIGENT SYSTEMS, VOL. 5, NO. 4, DECEMBER 2012]

[2] Yong Zhang, Student Member, IEEE, Brandon K. Chen, Student Member, IEEE, Xinyu Liu, Student Member, IEEE, and Yu Sun, Senior Member, IEEE has studied "Autonomous Robotic Pick-and-Place of Micro objects" [ [IEEE TRANSACTIONS ON ROBOTICS, VOL. 26, NO. 1, FEBRUARY 2010]

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[4] Devendra Chaudhari, Girish Patil has studied "SIFT Based Approach: Object Recognition and Localization for Pick-and-Place System" [Volume 3, Issue 3, March2013]

[5] Kensuke Harada, Tokuo Tsuji, Kazuyuki Nagata, Natsuki Yamanobe, Hiromu Onda has Studied "Validating an object placement planner for robotic pick-and-place tasks" [Robotics and Autonomous Systems 62 (2014) 146–1477]