Design and Development of Automatic Lifting System for Injection Moulding Machine Using PLC

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Abstract— The main motive of our idea is to reduce the workload of an employee and to acquire a well handled product from a plastic injection molding machine with help of PLC automation. Before our project, the product from the molding machine falls down for a height of about three feet from ground level, making the product improper handling also makes the employee to bend down to pick the product several times a day which also reduces the weariness of that person. Thus using our idea, the output of the molding machine is handled properly and the weariness of an employee is reduced considerably.

Keywords—injection molding machine, automatic lifting system, pneumatic system, PLC

I. INTRODUCTION

Nowadays PLC automation are being used in most of the places for an automation work to be done continuously this PLC in our project is all about lifting of an product from the injection molding machine. This helps to reduce the antiqueness of employee and increase the quality of the output from the molding machine where the lifetime is increased by proper handling of the product.

II. EASE OF USE

A. Injection molding system

It is also known as an injection press, is a machine for manufacturing plastic products by the injection molding process. It consists of two main parts, an injection unit and a clamping unit. Injection molding machine molds can be fastened in either a horizontal or vertical position. The majority of machines are horizontally oriented, but vertical machines are used in some niche applications such as insert molding, allowing the machine to take advantage of gravity. Some vertical machines also don't require the mold to be fastened. There are many ways to fasten the tools to the platens, the most common being manual clamps (both halves are bolted to the platens); however hydraulic clamps (chocks are used to hold the tool in place) and magnetic clamps are also used. The magnetic and hydraulic clamps are used where fast tool changes are required.

B. Automatic lifting

Lift tables can come in a vast array of configurations and can be built to suit various highly specialized industrial processes. The most common lift table design incorporates hydraulic cylinders and an electrically powered pump to actuate the lifting mechanism. Lift tables can also be driven by pneumatic sources, trapezoidal-threaded screw drives and push chains or by hydraulic foot pump when the load is not heavy. Lift tables can be mounted in a pit for floor-level loading, especially useful for access by manual pallet-pump trucks and the mobility impaired or wheelchair users.

In our project we use pneumatic system for lifting the desk from ground level to easy to pick height

C. Pneumatic system

Pneumatic systems used in industry are commonly powered by compressed air or compressed inert gases. A centrally located and electrically powered compressor powers cylinders, air motors, and other pneumatic devices. A pneumatic system controlled through manual or automatic solenoid valves is selected when it provides a lower cost, more flexible, or safer alternative to electric motors and actuators.

D. PLC

A programmable logic controller (PLC), or programmable controller is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis. They can be

designed for multiple arrangements of digital and analog inputs and outputs, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory.

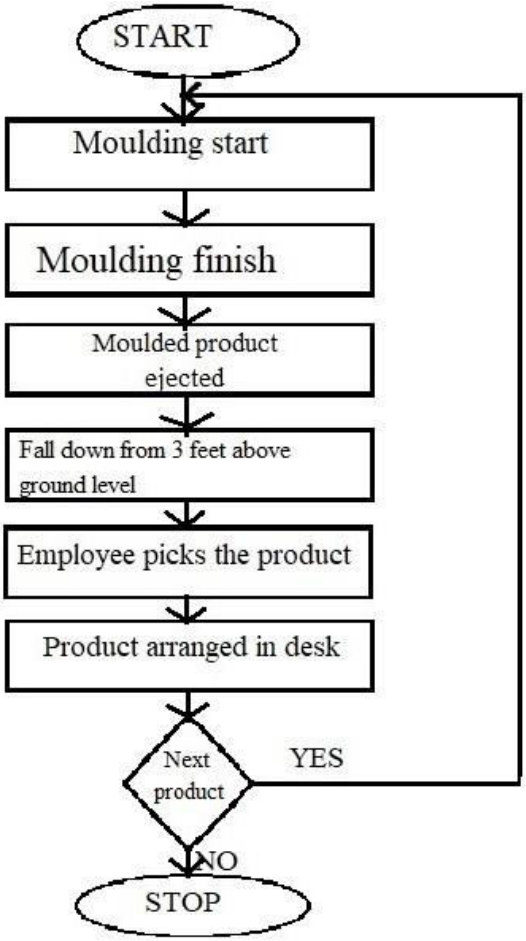
More recently, PLCs are programmed using application software on personal computers, which now represent the logic in graphic form instead of character symbols. The computer is connected to the PLC through usb, ethernet, rs-232, rs-485, or rs-422 cabling. The programming software allows entry and editing of the ladder-style logic. In some software packages, it is also possible to view and edit the program in function block diagrams, sequence flow charts and structured text. Generally the software provides functions for debugging and troubleshooting the PLC software, for example, by highlighting portions of the logic to show current status during operation or via simulation. The software will upload and download the PLC program, for backup and restoration purposes. In some models of programmable controller, the program is transferred from a personal computer to the PLC through a programming board which writes the program into a removable chip such as an eprom.

III. EXISTING METHADOLOGY

The existing system used is, when the product is done by the machine the the product will be ejected by the machine with a force making it to fall to ground from above 3 feet from ground and the picking up of the product from the ground is done manually by the employee assigned for that machine. This makes the product of the machine to be handled in improper manner tending it to damage and small scratches along its body, this system also makes the employee to bend down several times a day to pick the product resulting in health issues.

A. *Moulded product*

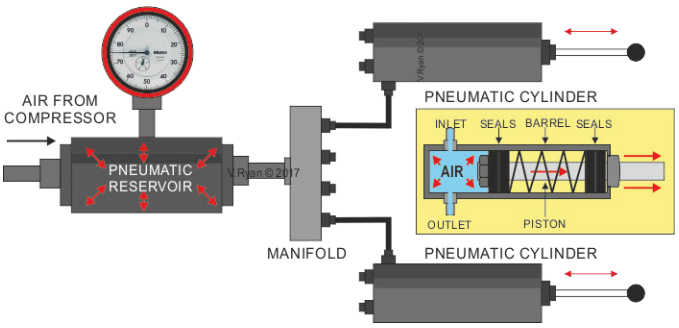
The moulded product from the moulding machine is ejected with a force. The product falls down from the height of 3 feet and then hits the ground with force. This damages the product severly and reduces the overall quality of the product. This also affects the sales of the product due to the decreased quality of the moulded product which also affects the sales.



The flowchart clearly defines the process on how the moulded product is handled. The product when arranged in desk the next product falls down from the moulding machine. The process keeps repeating until the required quantity of the product is attained or when the moulding machine is turned off.

IV PROPOSED SYSTEM

PNEUMATICS:



Pneumatic systems work with the help of compressed air. Certain characteristics of compressed air have made this medium quite suitable for use in modern manufacturing and production plants. Wide availability of air, compressibility of

air, fire proof characteristic of the medium, high degree of controllability, comparatively cheaper in cost are some of the features of pneumatic systems.

Air which is available naturally is invisible, colourless, odourless and tasteless. Main constituents of air by volume are 78%nitrogen, 21%oxygen, %carbon dioxide and other gasses including some amount of water vapours. Air which is a mixture of various chemical elements follows the gas law, like any other perfect or ideal gas. A compressor will compress the naturally available air to required range, which then can be used in the pneumatic systems.

ADVANTAGES OF PNEUMATICS:

- Simplicity of design and control—Machines are easily designed using standard cylinders and other components, and operate via simple on-off control.
- Reliability—Pneumatic systems generally have long operating lives and require little maintenance. Because gas is compressible, equipment is less subject to shock damage. Gas absorbs excessive force, whereas fluid in hydraulics directly transfers force. Compressed gas can be stored, so machines still run for a while if electrical power is lost.
- Safety—there is a very low chance of fire compared to hydraulic oil. Newer machines are usually overload safe

INPUTS TO THE PLC:

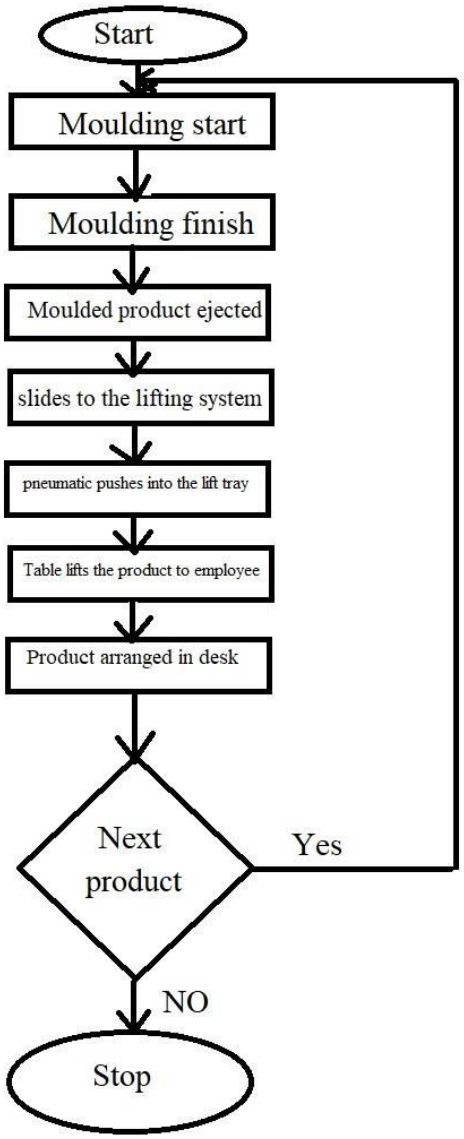
Input	Description
X0	Auto/Manual Selector Switch
X1	Cycle Start Push button
X2	Reset Push button
X3	Component Presence Sensor
X4	Cylinder 1 Forward read switch
X5	Cylinder 1 Reverse read switch
X6	Cylinder 2 Forward read switch
X7	Cylinder 2 Reverse read switch
X8	Cylinder 1 Forward in Manual
X9	Cylinder 1 Reverse in Manual
X10	Cylinder 2 Forward in Manual
X11	Cylinder 2 Reverse in Manual

OUTPUTS TO THE PLC:

Output	Description
Y0	Cylinder 1 Forward Valve 24v DC
Y1	Cylinder 1 Reverse Valve 24v DC
Y2	Cylinder 2 Right direction 24v DC
Y3	Cylinder 2 Left direction 24v DC
Y4	Home indication lamp 24vDC

Our project is a combination of PLC, automatic lifting system and molding machine. This enables the reduction of employee work load and making of good product with its increased quality of handling. Our idea is to use sensors, pneumatic system, drifters controlled by PLC to make the product from the molding machine to drift down to the lifting table and to be lifted to 3 feet height above ground level and once picked up by the employee then it starts the process again in a cycling process.

FLOWCHART:



When Pneumatics based PLC is introduced to the existing system, the product when gets ejected from the moulding machine falls down to the sliding rack. Then the Pneumatics based Flipper pushes the Moulded product to

the lift tray. When the product is in the lift tray, the Pneumatics based Lift operates and the moulded product is raised to the top for the employee reach. Then the moulded product is taken from the lift by the employee and it is arranged in the desk. This assures the quality of the product and makes it easy for the employee to access the product.

CONCLUSION:

Thus by using our system, the main motive of saftying and obtaining a good quality product is achieved with less man power spend to it, using PLC. The main motive of our idea is to reduce the workload of an employee and to acquire a well handled product from a plastic injection molding machine with help of PLC automation. Before our project, the product from the molding machine falls down for a height of about three feet from ground level, making the product improper handling also makes the employee to bend down to pick the product several times a day which also reduces the weariness of that person. Thus using our idea, the output of the molding machine is handled properly and the weariness of an employee is reduced considerably.

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