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Automation of Solvent Barrel Handling System using PLC

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***Abstract*—The Existing process is manual handling of solvent barrels from Unloading Area to Bulk Storage Area.There are a no of disadvantages in manual handling system like Human errors and Repeatability of process. In Mass Production Scenario there is a requirement of accuracy and Quality.The above features can be attained by Automation of Solvent barrels by using PLC.**

***Keywords*— Automation, Conveyor system, PLC, HMI, solution Preparation Vessel , Turntable conveyor.**

I. INTRODUCTION

The project deals with automation of solvent barrels moved from Unloading area to Bulk Storage Area in Pharmacautical industry.Intially the solvent barrels are moved using manual handling methods using Barcode Scanner.During Manual Handling there are few disadvantages like fault barrel movement into the slot provided for Unloading.

II. OBJECTIVES

A. To Decrease Spillage loss while moving the drums from Unloading Area to c by implementing conveyors, since the solvents costs are more. Spillage decreases the overall productivity.

B. Decrease of Human effort and errors in production by Automation.

III. METHODOLOGY

A. The barrels with different solvents are pasted with respective barcodes are placed on Platform.

B. Barrels are scanned by using barcode scanner and placed on to the conveyor system.

C. The barrel with the respective solvent is moved to the specific unloading points from where it is pumped to Solution Preparation Vessel in which Solution is Prepared.

D. The above Process is Automated by using Conveyors, Barcode Scanner, Conveyor Turn table, Capacitive Proximity Sensor, Limit Switch with Micrologix 1100 programmable logic controller using RSlogix software, which offers variety of expansion options and has user-friendly software.

A. PLC SYSTEM

There are five basic components in a PLC system:

1)The PLC processor or controller
2)I/O (Input /Output) modules
3)Chassis or backplane
4)Power supply
5)Programming software that runs in a PC
6)Network Interface

Programming Software: Software mainly runs on a PC is required to configure the program PLCs. Different products may require different programming software. Software allows programs to be written in several different languages.

Network Interface. Most PLCs have the ability to communicate with other devices. These devices include computers running programmingsoftware and collecting data about the manufacturing process, a terminal that lets an operator enter commands into the PLC, or I/O that is located in a remote location from the PLC. The PLC will communicate to the other devices through a network interface.

The PLC architecture is divided into three parts:

A. **CPU :**It is the brain of PLC system .It consists of the microcontroller, Memory IC with necessary circuit to store and retrieve information from the memory.
The purpose of CPU is to monitor status or state of input device, scan and solve the logic of a user program and control ON or OFF state of output device.

B. **Memory**: The type of RAM (Random Access Memory) normally used is CMOS (Complementary Metal Oxide Semiconductor) to store the program.

C. **Input/output:** Input is the one through which signal is send and result is observed at the Output.

PLC architecture design can be an open architecture design or a closed architecture design. An open architecture design allows the system to be connected easily to any device and also to programs developed by other manufacturers. A closed architecture which is also known as proprietary system is one whose design makes it more difficult to connect with other devices or programs developed by other manufacturers. When working on a proprietary PLC system, all hardware and software that is used should be compatible with the PLC.

Programmming in PLC:

The PLC program is written in a software application in a Personal Computer,Then downloaded in to the PLC using cable or with a network. The International standard IEC 61131-3 defines five programming languages for programmable control systems: FBD (Function block diagram), LD (Ladder diagram), ST(Structured text, similar to the Pascal programming language), IL (Instruction list) and SFC (Sequential function chart).PLCs usually communicate with HMI (Human-Machine Interface) MMI's (Man Machine Interface) and GUI (Graphical User Interface).

PLC Software

The PLC software is manufacturer dependent and even when the manufacturer is the same, it may vary for the different models of the same brand. In this project the PLC manufacturer like Allen Bradley the software may vary for its PICO Controller models and other models. For example, the software used for these controllers is PICO Soft whereas for its higher models it is RSLogix. Moreover, the HMI Interface may also vary for the different controllers.

Program Scan

During each operating cycle, the processor reads all the inputs, intakes these values, and energizes or de-energizes the outputs according to the user program dumped in the PLC. This process is known as a program scan cycle.

Servo Drive

The servo drive receives the signal provided by the motion module and translates this signal into motor drive commands. These commands can include motor position, velocity, and/or torque. The servo drive provides power to the servo motors in response to the motion commands. The turn table contains servodrive which makes the turntable to take the required amount of turning angle.

Servo Motor

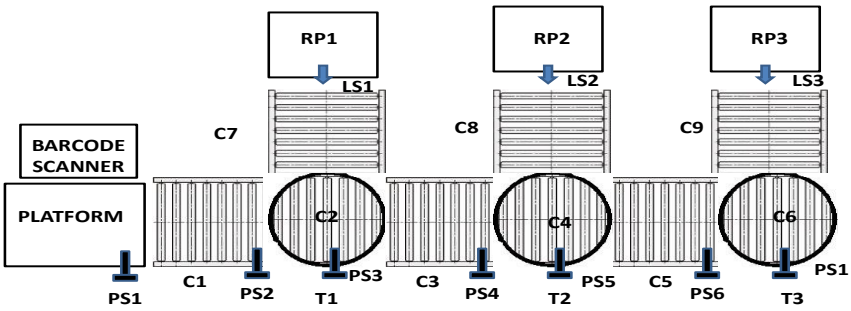
The servo motors represent the axis being controlled.
The servo motors receive electrical power from their servo drive which determines the motor shaft velocity and position.
A PLC program consists of rules that make logic relation between inputs and outputs of the controller. Basically it uses logic operands: AND, OR, negation. The structure of the rules is IF…THEN…ELSE. The PLC reads all field input devices via the input interfaces. Executes the user program stored in application memory, then, based on whatever control scheme has been programmed by the user. Turn the field output devices on or off, or perform whatever control is necessary for the process application. The PLC resolves the program rule by rule (sequential execution). The PLC operates in a synchronous way i.e. inputs does not change under a scan cycle.

The control system

A complete control system is made up of a combination of PLCs, networks, I/O, terminals and software. All the components work together to form a complete control system. The control system is the system that is responsible for the control of the process. This is the system that includes the PLC.

Process Description:

The barrels with barcode are scanned by using a barcode scanner. The scanned barrels are placed on conveyor1. The proximity sensor placed at starting of conveyor senses the barrel and actuates the conveyor. As soon as the Barrel reaches the next conveyor the second proximity sensor senses the presence of barrel and actuates the next conveyor and stops the previous conveyor. The Barrel with specified tag name is moved to the refill point according to the ladder logic program in the plc. The conveyor turn table is used to sort the barrels according to the barcodes printed on the barrels. The barrel with specified barcode reaches the Refilling points. The barrel position is sensed by using limit switches placed at the refill point and the conveyor is stopped.The changes in the process can be done by using HMI.



CONVEYOR-TURNTABLE LAYOUT

Fig:1.1 conveyor turntable layout

1) C-conveyor motor
2)T-Turn table
3)PS-Proximity sensor
4)LS- Limit Switch
5)RP-Refilling Points

Components Used in Project:
1)Inductive proximity sensor
2) Limit switch
3) Barcode scanner
4) Conveyor system
5) Turn table

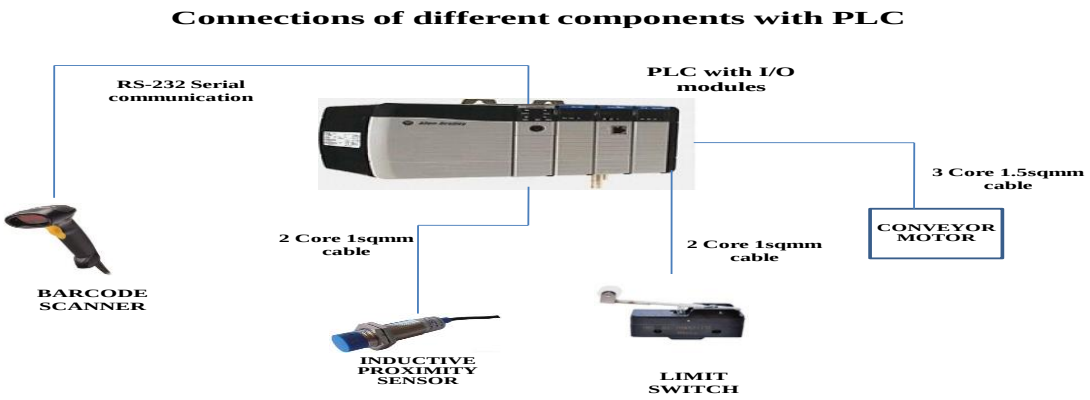


Fig:1.2 Connections with different components

PLC SIMULATION

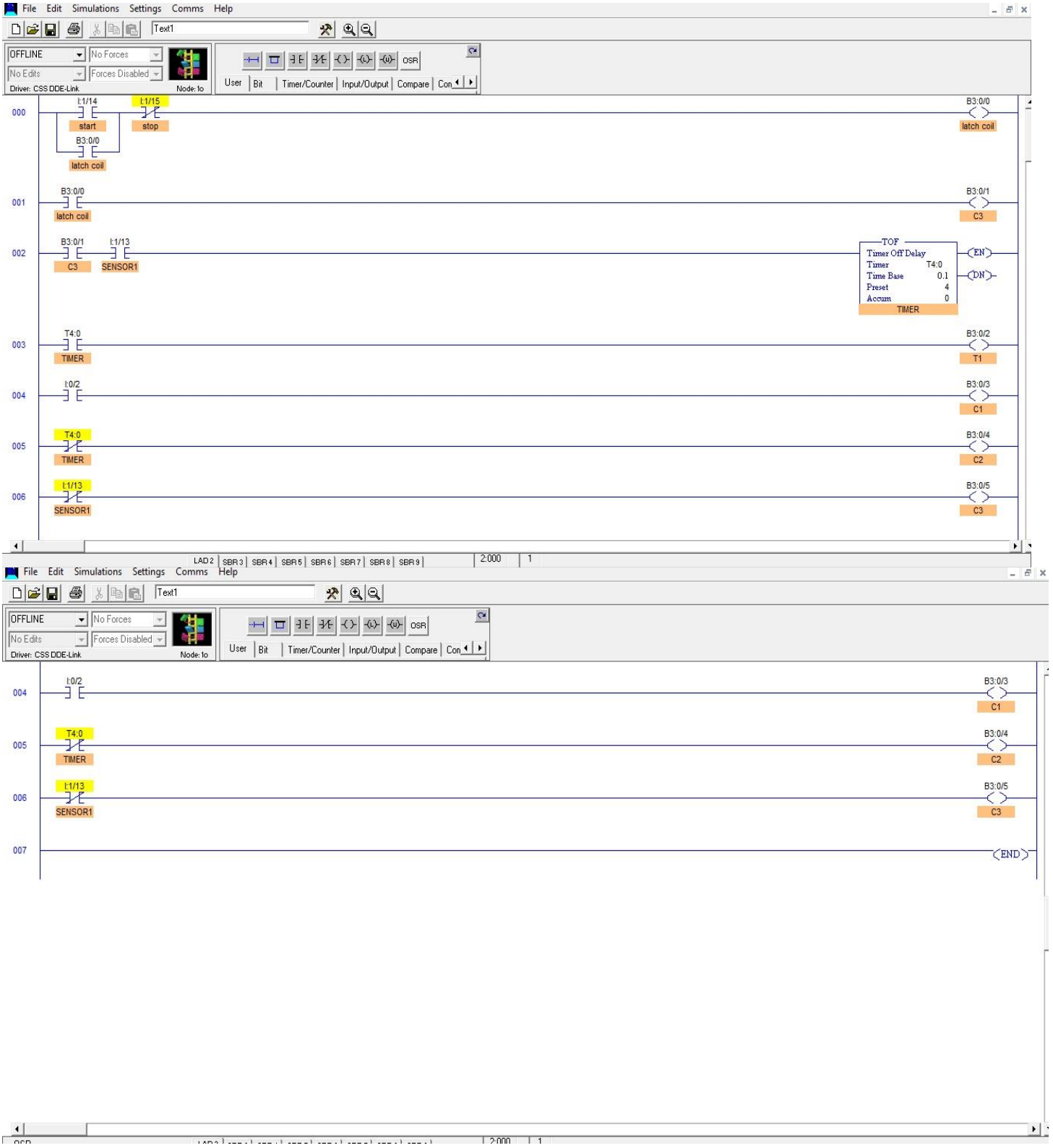


Fig:1.3 PLC SIMULATION

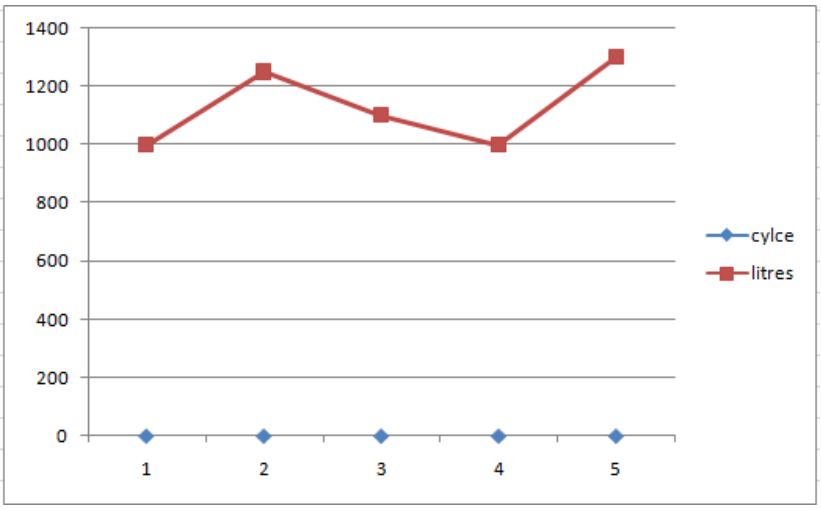
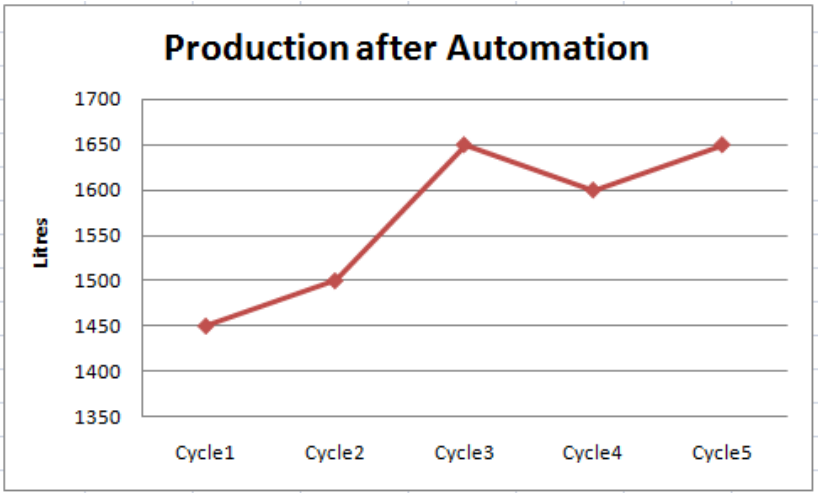


Fig:1.4 Production with manual handling methods



Fig;1.5 Production after automation

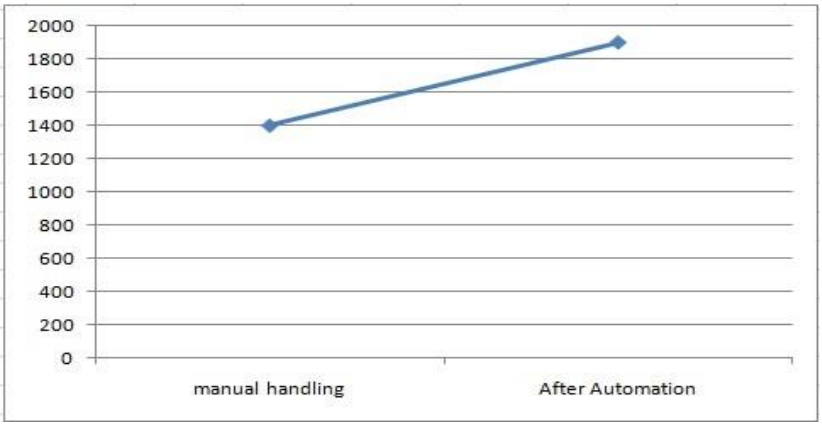


Fig:1.6 Comparsion of production units with manual and Automation methods

IV. CONCLUSION

By using PLC in industries we can increase the production, quality and quantity. energy saving, less maintenance & accuracy is good when compare to other automation like relay logic control and micro processor.With Introduction of Automation we can increase the production rate and thereby Increase the Productivity and decrease Spillage Losses caused in Manual Handling Methods.

V. REFERENCES

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