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Auto-Guide Vehicle with Contactless Power Transfer Principle Using PLC and SCADA

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Abstract: AGV systems consist of reliable off-the shelf components. AGV lifts, rotates, and shifts your goods, fetch loads from racks, store products in deep lanes, transport products across long distances, deliver them onto conveyors, etc. An automatic guided vehicle is a mobile robot that follows wires in the floor, or uses vision, magnets or lasers for navigation Automatic guided vehicle systems are fully automatic transports systems using unmanned vehicles. AGVs safely transport all kinds of products without human intervention within production, logistic, warehouse and distribution environments. High demands on manufacturers have left their shipping warehouses in havoc. In addition, human error has a negative effect on safety, efficiency, and quality. AGV operates on contactless power supply principle based on mutual induction. The operation of AGV is fully automated using PLC programming. SCADA is used to control and monitor the machine. PLC and SCADA is communicated using KEP Server software
Keyword: AS/RS, Contactless power transfer principle, mutual induction, PLC and SCADA, Software requirements for PLC and SCADA)

I. INTRODUCTION

A. Scope And Need

The purpose of the project is automating the receiving, storage and retrieving of warehouse items to increase the productivity, improves the efficiency and optimizes your storage space. The AS/RS is helps manufacturers to decrease their manual process in the industry and deploying the ASRS. The main features of this system is automatic storage and retrieval pallet, storage algorithm configuration, diagnostics the status by continuous monitoring and web browser accessible.

The need of this AS/RS are,

1) To improve the efficiency.
2) Reduces the cost and power consumption.
3) Reduces man power and provide more security

The necessity of AS/RS are more dynamic in nature for which new models will need to be developed to overcome the time consumption. ASRS consists of a range of controlled systems for automatically retrieving and storing loads from preferred storage spaces. It is usually used in applications where there is a very high quantity of loads being moved into and out of storage. This system is mainly used for storing and retrieving the unprocessed materials in a manufacturing unit. The main aim of this paper is to build up an automatic system from the present system. The original idea of the article is to help public those who work as operators by designing a system where it is capable of managing the drawer without interference of an operator. The performance of the present system is enhanced by using PLC integration where it coordinates the operation and control of ASRS.

B. Existing System

It is crucial to design an AS/RS in such a way that it can efficiently handle current and future demand requirements while avoiding bottlenecks and overcapacity. Due to the inflexibility of the physical layout and the equipment, it is essential to design it right at once. In schematic view of design issues and their interdependence is presented. It is important to realise that the AS/RS is usually just one of many systems to be found in a warehouse. The true performance of the AS/RS is typically influenced by the other systems as are the other systems' performances influenced by the AS/RS. This is most visible at, but not restricted to, the interplay of systems at the AS/RS' I/O-points. Loads are picked up and dropped off at an I/O-point by the AS/RS. It is the task of, for example, a conveyor system or a set of vehicles to make the connection from the I/O-point to the rest of the warehouse. Delays in one system can cause delays in the other system. Thus, when deciding on the number of I/O-points, their location and their buffer capacity it may be necessary to also look at the other systems' characteristics.

Furthermore, the requirements for the AS/RS may depend on the general environment of the system. In manufacturing environments, the AS/RS primarily needs to provide all required materials in time to make sure that production can continue. Production is leading and should never be halted to wait for AS/RS. In distribution environments, the AS/RS performs or supports the order retrieval process, to make sure that customers' orders leave the facility in time.

1) Block diagram of existing system

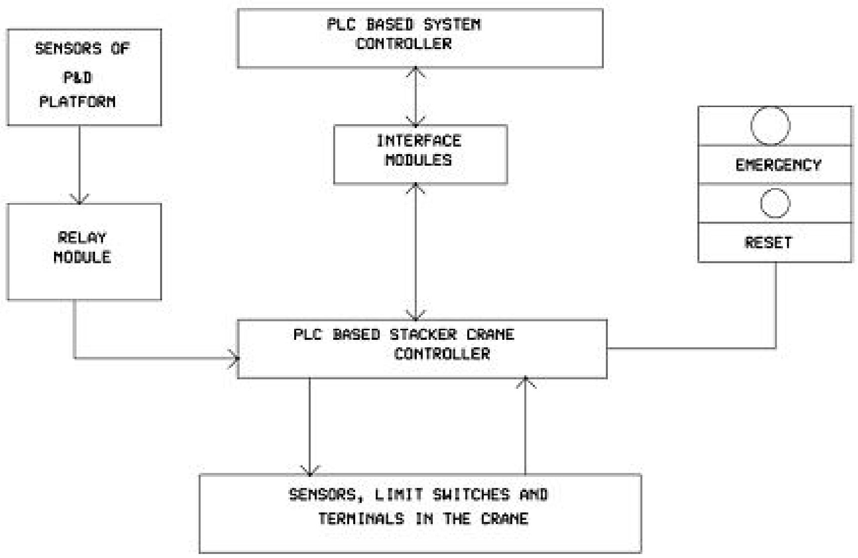


Fig 1.1 Block diagram of existing system

2) Disadvantages Of Existing System

a) more space required for charging stations.
b) man power requirement is more.
c) cost for maintenance is more.
d) buffer vehicles required.
e) charging times are required.
f) delay due to battery change.
g) more noise and abrasion.
h) speed limit should be due to variation in energy connection.
i) less efficiency and more power consumption.

C. Proposed System

When battery operated trolleys are used it has a serious problem in charging and if charge goes off there is an immediate charging unit required and it takes a time delay to bring the operations function successfully. Thus in this project we are enhancing the trolley system by using contactless power transfer system in which no batteries or bus connectors needed to make the trolley operate. Power is being transferred to the trolley through induction principle. Then there will be a system with programmable logic controller for handling automatic storage and retrieval system for mass storage of products and retrieval of products according to the command given and using Supervisory control and data acquisition system to gather the datum and also to command the system about the storage and retrieval system.

All the motors for the conveyor system to carry the materials to the storage place and back again when it is required has variable frequency control which speed up or speeds down according to the command given. Conveyor system functions according to the digital and analogy pulses from the sensors, encoders and through communication protocols.

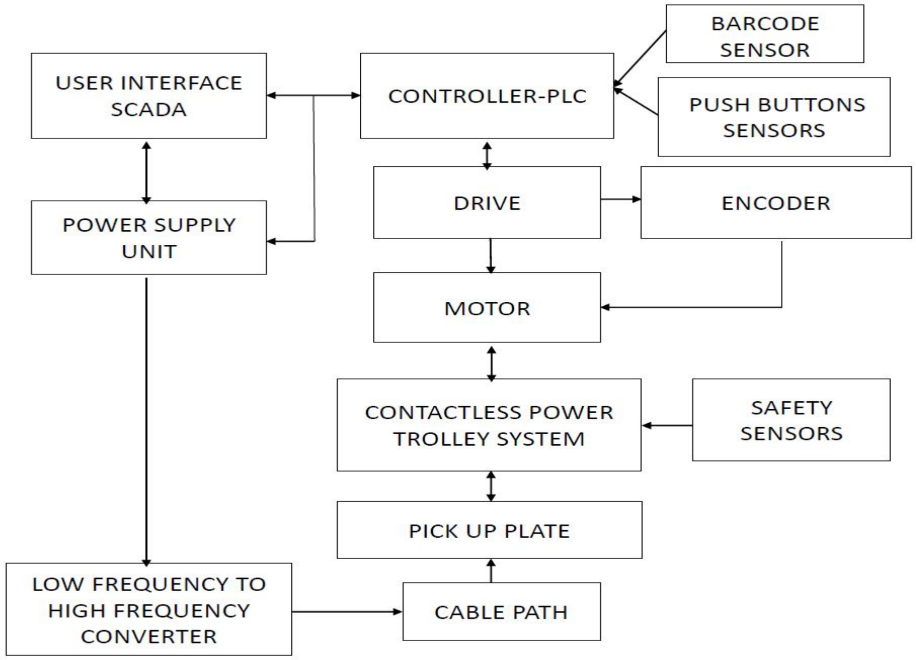


Fig 1.2 Block diagram of proposed system

1) Advantages Of Proposed System

a) no space required for charging stations.
b) 3-shift operation possible - 100% utilization of the vehicles.
c) wear-free and maintenance-free.
d) no buffer vehicles required.
e) no charging times.
f) no downtime due to battery change.
g) no noise, no abrasion.

D. Literature survey

The AS/RS system is used in industries to transports the heavy products. It uses so many technologies by using plc and scada. In the AS/RS system the major problem is safety and power consumption. In the beginning it is controlled by relays after the plc introduced and control the AS/RS system. This system is high power consumption machine, there is no safety in industry. The employees may die due to unsecured trolley machine electricity. Its electricity will pass on the floor and path of trolley

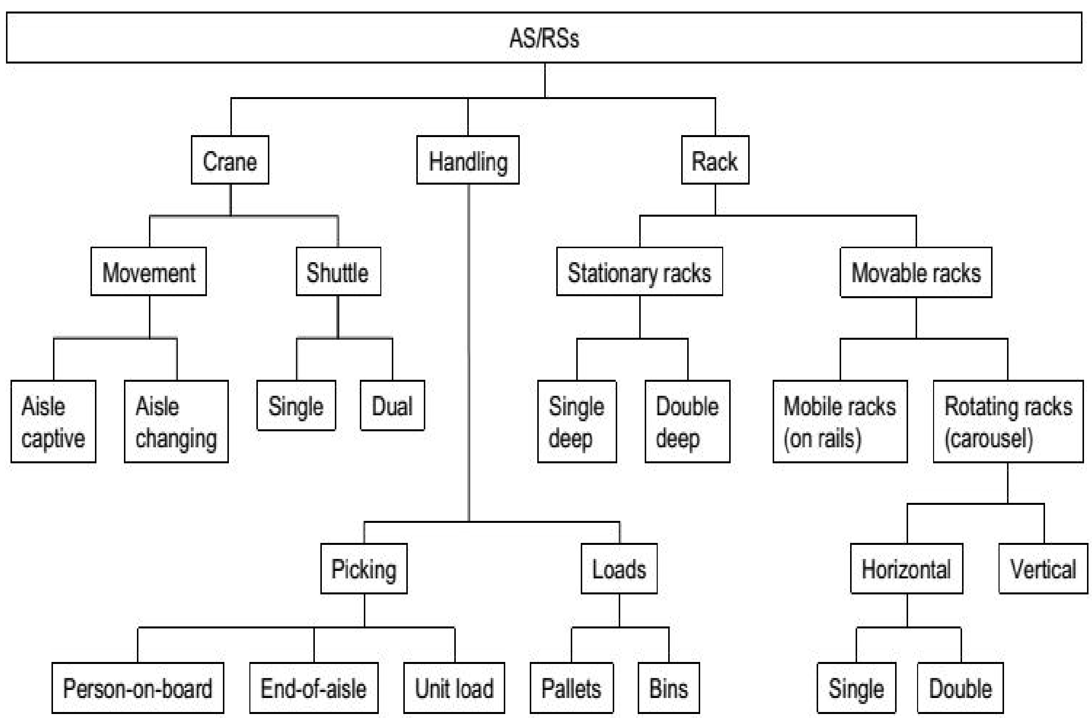
Roodbergen, K.J. and Vis, I.F.A. (2009), A survey of literature on automated storage and retrieval systems. European Journal of Operational Research 1942

It is crucial to design an AS/RS in such a way that it can efficiently handle current and future demand requirements while avoiding bottlenecks and overcapacity. Due to the inflexibility of the physical layout and the equipment, it is essential to design it right at once. It is important to realise that the AS/RS is usually just one of many systems to be found in a warehouse. The true performance of the AS/RS is typically influenced by the other systems as are the other systems performances influenced by the AS/RS. This is most visible at, but not restricted to, the interplay of systems at the AS/RS I/O-points. Loads are picked up and dropped off at an I/O-point by the AS/RS. It is the task for example, a conveyor system or a set of vehicles to make the connection from the I/O-point to the rest of the warehouse. Delays in one system can cause delays in the other system. Thus, when deciding on the number of I/O-points, their location and their buffer capacity it may be necessary to also look at the other systems characteristics. Furthermore, the requirements for the AS/RS may depend on the general environment of the system. In manufacturing environments, the AS/RS primarily needs to provide all required materials in time to make sure that production can continue. Production is leading and should never be halted to wait for the AS/RS. In distribution environments, the AS/RS performs or supports the order retrieval process, to make sure that customer's orders leave the facility in time. In the proposed system the manual operators are not required either to store or retrieve. A Tri-axis Functional ECS is constructed to store and retrieve the materials to/from the storage chambers. The ECS can move in X, Y & Z axis to perform the functions of storage and retrieval. The storage chambers are designed in such a way that they can detect the presence or absence of materials and correspondingly instruct the PLC. The ECS has a base plate to provide the base for the pallets where sensors are provided. Automated storage and retrieval system (AS/RS) is complex in design and fabrication which needs exclusive study of transmitting devices, motors to control movements of the various axes, positioning techniques and feedback control system, power circuitry. Automated storage and retrieval system development is divided in layers i.e. fabrication of the mechanical components and their assembly, the electrical circuitry, the electronic circuitry, programming and interfacing.

II. CHAPTER 2 AS/RS

In a dynamic industrial location, automated guided vehicles do the collection of unprocessed materials or completed products, which has an important role in the improvement of these competitive conditions. The control and speed of production storage delivery systems by means of a classic human operated for lifts and hence the stock data management are more difficult. Therefore, a fully automated storage and retrieval system (ASRS) is implemented in order to find the solutions for all these problems. Recent advances in this technology offer the possibility of drastically reducing the cost of the current system with accurate and fast positioning under a defined degree of automation. The ASRS is an important key part of the rapid logistic system along with the consideration of limited space, high labour cost, requirement of flexibility, expandability quality, reliability, management control. It consists of mechanical equipment, automation control equipment using PLC integration, computer system and it operates under computerised control maintaining an inventory of the stored items for handling the materials which is at a height. Retrieval of items is accomplished by specifying the item type and quantity to be retrieved. The computer determines where in the storage area the item can be retrieved from and schedules the retrieval. It directs the proper automated storage and retrieval machine to the location where the item is stored and directs the machine to deposit the item at a location where it is to be picked up. The MES takes loads into and out of the storage area and move them to the manufacturing floor or loading docks. To store items, the pallet is placed at an input station for the system, the information for inventory is entered into a computer terminal and the AS/RS system moves the load to the storage area, determines a suitable location for the item, and stores the load. This paper aims to develop the functionality of a manually controlled using PLC integration.

A. Classification Of Various As/Rs System



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B. Process Flow Of As/Rs

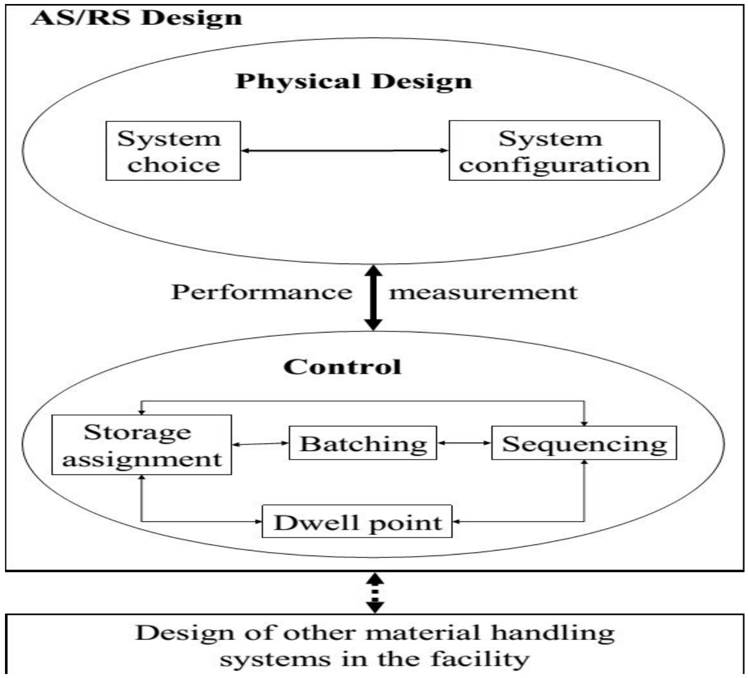

Fig 2.2 Design of an AS/RS system

C. Performance Measurement

In evaluating the design and control rules of an AS/RS several performance measures can be used. Based on the literature overview presented in this paper, we can at least consider the following performance measures:

a) Travel time per request.
b) Number of requests handled per time period.
c) Total time required to handle a certain number of requests.
d) Waiting times of cranes of the AS/RS.
e) Waiting times of products to be stored/retrieved.
f) Number of requests waiting to be stored/retrieved

D. Storage Assignment

Several methods exist for assigning products to storage locations in the racks. Five often used storage assignment policies for AS/RSs are described here in more detail. These rules are,

1) Dedicated storage assignment.
2) Random storage assignment.
3) Closest open location storage assignment.
4) Full-turnover-based storage assignment.
5) Class-based storage assignment.

E. Batching

Suppose we have a number of orders that need to be retrieved from storage in a person-on-board item-picking AS/RS. We could retrieve the orders one at a time or we could try to combine several orders in a single tour of the crane. The latter approach is called batching. Batching problems for person-on-board AS/RSs are quite similar to batching problems for order pickers in warehouses. An advantage of batching is that the length of a tour for a batch of orders is shorter than the sum of the individual orders' tour lengths. However, more effort is needed to keep track of which item belongs to which order or to sort items later on. A limit on the size of a batch is usually determined by the capacity of the crane or an upper limit on the required response time.

As a result, an important decision problem in batching is the determination of the size of each batch in combination with the assignment of orders to these batches such that travel times are minimized

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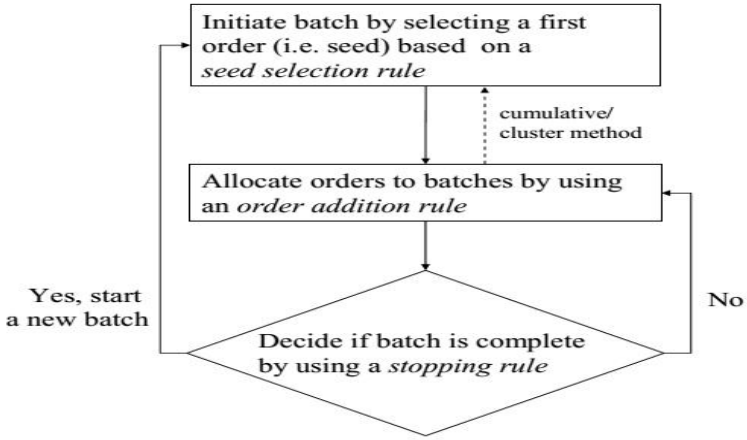

Fig 2.3 Common structure for batching

F. Dwell Point Location

Several methods have been proposed to deal with the decision where to position an idle crane, i.e., how to determine the crane's dwell-point Bozer and White (1984) introduced four simple static dwell-point strategies. It summarises these rules and indicates the resulting one dimensional parking location. Park (1991) showed that the input station rule returns an optimal dwell point if the probability, that the first request after an idle period is a storage request, is at least ½.

G. AS/RS Design Problems

Class of Problems	*Decisions to be made*
System configuration	▪ Number of aisles ▪ Height of the storage racks ▪ Length of the aisles ▪ Equally sized or modular storage locations ▪ Number and location of the I/O-points ▪ Buffer capacity at the I/O-points ▪ Number of cranes per aisle ▪ Number of orderpickers per aisle (if any)
Storage Assignment	▪ Storage assignment method ▪ Number of storage classes ▪ Positioning of the storage classes
Batching	▪ Type of batching (static or dynamic) ▪ Batch size (capacity or time based) ▪ Selection rule for assignment of orders to batches

Class of Problems	*Decisions to be made*
Sequencing	▪ Sequencing restrictions (e.g., due dates) ▪ Type of operation (single or dual command) ▪ Scheduling approach (block or dynamic) ▪ Sequencing method
Dwell point	▪ Type of positioning (static or dynamic) ▪ Location where idle cranes will be placed.

TABLE.1 AS/RS DESIGN PROBLEMS

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III. CHAPTER METHODOLOGY

A. Contactless Power Transfer Priciple

1) *Introduction :* It is otherwise called as Inductive Energy Supply. It is free from wear, maintenance-free and innovative. Thus in this project we are enhancing the trolley system by using contactless power transfer system in which no batteries or bus connectors needed to make the trolley operate. Power is being transferred to the trolley through induction principle.
2) *Contactless Energy Supply Block Circuit Diagram*

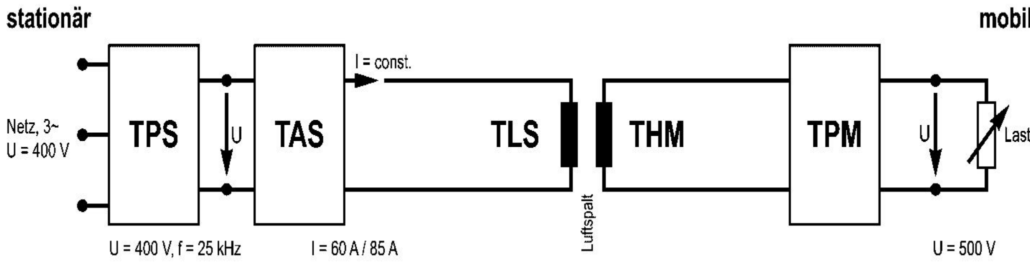

Fig 3.1 Block diagram of contactless transformer

The contactless power transmission is divided into two parts namely,

3) Stationary side
4) Mobility side
5) *STATIONARY SIDE*
a) TPS stationary converter.
b) Energy management.
c) Synchronized frequencies for parallel connection.
6) *MOBILITY SIDE*
a) THM pick-up (1.5-4 kW)
b) TPM mobile converter (modular)
c) Drive controller, DIO etc.
7) *ADVANTAGES*
a) no space required for charging stations.
b) 3-shift operation possible - 100% utilization of the vehicles.
c) wear-free and maintenance-free.
d) no buffer vehicles required.
e) no charging times.
f) o downtime due to battery change.
g) no noise, no abrasion.
h) no speed limit due to constant energy connection.
i) *Efficiency of the individual components*
j) supply unit approx. is 96% ick-up approx. is 96% Mobile converter is approx. is 96% h total without track is 88% The total efficiency of the entire installation predominantly depends on the track losses.
8) *Energy-Efficient Production*

Due to an optimized power cable current, the system allows you to significantly reduce the losses along the track.

$Pv = I^2 \times R$

9) *Energy-Efficiency With Perfectly Balanced System Components*
a) Minimum energy consumption of an AGV system due to
b) Servomotors
c) Optimized system components (supply/current consumers/inverter/motor/gear unit)
d) DC voltage link of the inverters
e) Energy management for energy supply based on individual demand of the respective track segments e.g. Assembly area, buffer area etc.

f) energy management for operational pauses, shift ends etc. with full diagnostics functionality during standby mode.
g) No power losses during the charging process
h) no batteries-> lighter vehicles
i) no charging stations

10) For Optimized Tco

1) It allows you to use series components. Inverters, gear units, motors and brakes are available around the world as standard components.
2) Series spare parts are cost effective and can be delivered quickly.
3) No staff and maintenance required as for batteries, is wear- and maintenance-free.
4) No periodical follow-up cost for replacement batteries and their disposal and increases your plant efficiency.

B. PLC

1) Introduction: A programmable logic controller (PLC), also referred to as a programmable controller, is the name given to a type of computer commonly used in commercial and industrial control applications. PLCs differ from office computers in the types of tasks that they perform and the hardware and software they require performing these tasks. While the specific applications vary widely, all PLCs monitor inputs and other variable values, make decisions based on a stored program, and control outputs to automate a process or machine. The basic elements of a PLC include input modules or points, a central processing unit (CPU), output modules or points, and a programming device. The type of input modules or points used by a PLC depends upon the types of input devices used. Some input modules or points respond to digital inputs, also called discrete inputs, which are either on or off. Other modules or inputs respond to analog signals. These analog signals represent machine or process conditions as a range of voltage or current values. The primary function of a PLC's input circuitry is to convert the signals provided by these various switches and sensors into logic signals that can be used by the CPU. The CPU evaluates the status of inputs, outputs, and other variables as it executes a stored program. The CPU then sends signals to update the status of outputs. Output modules convert control signals from the CPU into digital or analog values that can be used to control various output devices. The programming device is used to enter or change the PLC"s program or to monitor or change stored values. Once entered, the program and associated variables are stored in the CPU. In addition to these basic elements, a PLC system may also incorporate an operator interface device to simplify monitoring of the machine or process.

2) The Functions Of Plc Operating System: Loads the user program from programming devices to program memory.
a) To read status of input devices.
b) To execute user program.
c) To form and update input image table.
d) As per the status of input image table controls the output devices.
e) To provide user-friendly function.

3) Architecture Of Plc

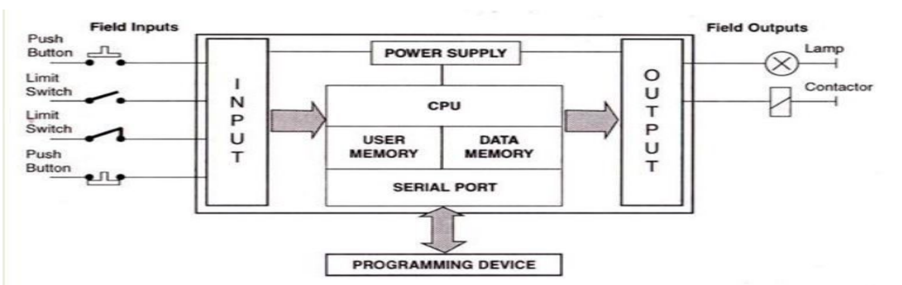

Fig 3.1 Architecture of PLC

A programmable logic controller consists of the following components:

C. Central Processing Unit (CPU)

1) Memory
2) Input modules

3) Output modules and
4) Power supply.

The programming terminal: In the diagram is not a part of the PLC, but it is essential to have a terminal for programming or monitoring a PLC. In the diagram, the arrows between blocks indicate the information and power flowing directions. CPU like other computerized devices, there is a Central Processing Unit (CPU) in a PLC. The CPU, which is the "brain" of a PLC, does the following operations:

5) This function allows a PLC to read the status of its input terminals and energize or deenergize its output terminals.
6) Performing logic and arithmetic operations. A CPU conducts all the mathematic and logic operations involved in a PLC.
7) Communicating with memory. The PLC's programs and data are stored in memory. When a PLC is operating, its CPU may read or change the contents of memory locations scanning application programs. An application program, which is called a ladder logic program, is a set of instructions written by a PLC programmer. The scanning function allows the PLC to execute the application program as specified by the programmer.
8) Communicating with a programming terminal. The CPU transfers program and data between itself and the programming terminal.
9) A PLC"s CPU is controlled by operating system software. The operating system software is a group of supervisory programs that are loaded and stored permanently in the PLC's memory by the PLC manufacturer.

D. Memory

Memory is the component that stores information, programs, and data in a PLC. The process of putting new information into a memory location is called writing. The process of retrieving information from a memory location is called reading. The common types of memory used in PLC's are Read Only Memory (ROM) and Random Access Memory (RAM). A ROM location can be read, but not written. ROM is used to store programs and data that should not be altered. For example, the PLC's operating programs are stored in ROM. A RAM location can be read or written. This means the information stored in a RAM location can be retrieved and/or altered. Ladder logic programs are stored in RAM. When a new ladder logic program is loaded into a PLC's memory, the old program that was stored in the same locations is over-written and essentially erased. The memory capacities of PLC's vary. Memory capacities are often expressed in terms of kilo-bytes (K). One byte is a group of 8 bits. One bit is a memory location that may store one binary number that has the value of either 1 or 0. (Binary numbers are addressed in Module 2). 1K memory means that there are 1024 bytes of RAM. 16K memory means there are 16 x 1024 =16384 bytes of RAM.

E. Input And Output Modules

A PLC is a control device. It takes information from inputs and makes decisions to energize or de-energize outputs. The decisions are made based on the statuses of inputs and outputs and the ladder logic program that is being executed. The input devices used with a PLC include pushbuttons, limit switches, relay contacts, photo sensors, proximity switches, temperature sensors, and the like. These input devices can be AC (alternating current) or DC (direct current). The input voltages can be high or low. The input signals can be digital or analogy. Differing inputs require different input modules. An input module provides an interface between input devices and a PLC's CPU, which uses only a low DC voltage. The input module's function is to convert the input signals to DC voltages that are acceptable to the CPU. Standard discrete input modules include 24 V AC, 48 V AC, 120 V AC,220 V AC, 24 V DC, 48 V DC, 120 V DC, 220 V DC, and transistor-transistor logic (TTL) level. The devices controlled by a PLC include relays, alarms, solenoids, fans, lights, and motor starters. These devices may require different levels of AC or DC voltages. Since the signals processed in a PLC are low DC voltages, it is the function of the output module to convert PLC control signals to the voltages required by the controlled circuits or devices. Standard discrete output modules include 24 V AC, 48 V AC, 120 V AC, 220 V AC, 24 V DC, 48 V DC, 120 V DC, 220 V DC, and TTL level.

F. Programming Terminal

A PLC requires a programming terminal and programming software for operation. The programming terminal can be a dedicated terminal or a generic computer purchased anywhere. The programming terminal is used for programming the PLC and monitoring the PLC"s operation. It may also download a ladder logic program (the sending of a program from the programming terminal to the PLC) or upload a ladder logic program (the sending of a program from the PLC to the programming terminal). The terminal uses programming software for programming and "talking" to a PLC. POWER SUPPLY: PLC's are powered by standard commercial

AC power lines. However, many PLC components, such as the CPU and memory, utilize 5 volts or another level of DC power. The PLC power supply converts AC power into DC power to support those components of the PLC.

G. Programming In Plcs

Early PLCs, up to the mid-1980s, were programmed using proprietary programming panels or special-purpose programming terminals, which often had dedicated function keys representing the various logical elements of PLC programs. Programs were stored on cassette tape cartridges. Facilities for printing and documentation were very minimal due to lack of memory capacity. More recently, PLC programs are typically written in a special application on a personal computer, then downloaded by a direct-connection cable or over a network to the PLC. The very oldest PLCs used non-volatile magnetic core memory but now the program is stored in the PLC either in battery-backed-up RAM or some other non-volatile flash memory. Early PLCs were designed to replace relay logic systems. These PLCs were programmed in "ladder logic", which strongly resembles a schematic diagram of relay logic. Modern PLCs can be programmed in a variety of ways, from ladder logic to more traditional programming languages such as BASIC and C. Another method is State Logic, a Very High Level Programming Language designed to program PLCs based on State Transition Diagrams. Recently, the International standard IEC 61131-3 has become popular. IEC 61131-3currently 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, similar to assembly language) and SFC (Sequential function chart). These techniques emphasize logical organization of operations.

While the fundamental concepts of PLC programming are common to all manufacturers, differences in I/O addressing, memory organization and instruction sets mean that PLC programs are never perfectly interchangeable between different makers. Even within the same product line of a single manufacturer, different models may not be directly compatible.

H. USER INTERFACE

PLCs may need to interact with people for the purpose of configuration, alarm reporting or everyday control. A Human-Machine Interface (HMI) is employed for this purpose. HMI's are also referred to as MMI's (Man Machine Interface) and GUI (Graphical User Interface).

A simple system may use buttons and lights to interact with the user. Text displays are available as well as graphical touch screens. Most modern PLCs can communicate over a network to some other system, such as a computer running a SCADA (Supervisory Control and Data Acquisition) system or web browser.

I. Automotive Industry

1) Reducing Time-To-Customer and Other Costs
2) The automotive landscape is changing. Emerging markets are forcing you to re-think production strategies. The effects of a tight economy and intense competition means you need suppliers to play a larger role in successfully executing the supply chain.
3) Our industrial automation and control solutions span the entire automotive supply chain and can help you address these challenges while staying focused on improving quality, reducing costs, increasing responsiveness and ultimately improving time-to-customer throughout your supply chain.
4) By combining our integrated architecture with proven automotive manufacturing solutions, you get accurate, event-driven information about materials, operations and finished-product requirements and the ability to deliver and receive the right components, in the right quantities, at exactly the right time and place. The result: faster time-to-customer for the entire industry.

5) Your requirements are unique. So are our solutions. We listen to you then apply our resources to build cost-effective, results-based solutions for the automotive industry. We are committed to your success. Whatever your automation challenges, you'll find the answer by partnering with us.

J. Beverage Industry

1) You are striving for consistent quality regardless of where your product is manufactured or distributed, while under continuous pressure to respond quicker than your competitors to changes in consumer demand during continued consolidation in the industry.

2) Our focus on beverage production optimization addresses these issues and every phase of your operation so you can meet cost, quality, flexibility and regulatory challenges across the entire life cycle - from raw materials through final shipment.
3) Because of the diversity of beverage production processes, it can be challenging for you to meet customer demand, document regulatory compliance and identify production inefficiencies. Through our domain knowledge and production experience, we offer a variety of solutions to help you satisfy your demanding consumers and retailers.
4) We understand the beverage industry, and can help you turn our solutions and services into a competitive advantage. Your requirements are unique, so whatever production challenges you have, partnering with us will help you overcome them.

K. Entertainment Industry

1) Increasing the Safety, Reliability and Profitability of Your Venue Whether we're controlling a roller coaster racing at 120 miles per hour, protecting an investment in valuable exotic creatures, or providing secure transportation to ski runs, our components and systems meet your automation challenges to increase your safety, reliability and profitability.
2) From the initial conceptualization of the system architecture through the implementation and commissioning of a specific solution, we will receive the skills and experience to fulfil your project requirements through: Superior support, everything from integrated engineering and support solutions on multi-vendor platforms, to software and MRO asset management services.
3) Global parts availability for localized support.
4) Depth and breadth of products.
5) Migration with easy upgrades to the newest technology to protect your investment long-term.
6) Essential Components with exceptional value to give you the assurance that the machines and systems you build will have the optimum levels of quality and performance.
7) Integrated Architecture for seamless integration of control, communication, and visualization across multiple platforms.

L. Packaging Industry Deliver Greater Speed And Accuracy To Meet Urgent Demands

1) Fiercely competitive markets are driving your customers to offer an exhaustive breadth of products. That means packaging equipment must be flexible enough to keep up with frequent line changes and scalable enough to handle the introduction of new products.
2) At the same time, customers demand customization with greater speed and accuracy and shortened lead times.
3) We help you meet these challenges through a single hardware and software solution and programming templates and tools.
4) Everything we offer, from components to turnkey systems, is designed to save time and reduce your customers' total cost of ownership. And our support doesn't stop there.
5) Through remote diagnostics, predictive maintenance and a network of global support, we can help your customers — no matter where they put their packaging machines to work.

M. Basic Instructions Of Plc

1) Be aware that specific nomenclature and operational details vary widely between PLC manufacturers, and often implementation details evolve from generation to generation.
2) Often the hardest part, especially for an inexperienced PLC programmer, is practicing the mental ju-jitsu necessary to keep the nomenclature straight from manufacturer to manufacturer.

N. positive logic (most plcs follow this convention)

1) True = logic 1 = input energized.
2) False = logic 0 = input NOT energized.

O. Normally Closed

1) (XIO) - examine If Open.
2) This instruction is true (logic 1) when the hardware input (or internal relay equivalent) is NOT energized.

P. Output Enable

1) (OTE) - Output Enable.
2) This instruction mimics the action of a conventional relay coil.

Q. On Timer

1) (TON) - Timer ON.
2) Generally, ON timers begin timing when the input (enable) line goes true, and reset if the enable line goes false before set point has been reached. If enabled until set point is reached then the timer output goes true, and stays true until the input (enable) line goes false.

R. Off Timer

1) (TOF) - Timer OFF.
2) Generally, OFF timers begin timing on a true-to-false transition, and continue timing as long as the preceding logic remains false. When the accumulated time equals set point the TOF output goes on, and stays on until the rung goes true.

S. Limitations And Successor Languages

1) Ladder notation is best suited to control problems where only binary variables are required and where interlocking and sequencing of binary is the primary control problem. Since execution of rungs is sequential within a program and may be undefined or obscure within a rung, some logic race conditions are possible which may produce unexpected results; complex rungs are best broken into several simpler steps to avoid this problem. Some manufacturers avoid this problem by explicitly and completely defining the execution order of a rung, however programmers may still have problems fully grasping the resulting complex semantics.
2) Analog quantities and arithmetical operations are clumsy to express in ladder logic and each manufacturer has different ways of extending the notation for these problems. There is usually limited support for arrays and loops, often resulting in duplication of code to express cases which in other languages would call for use of indexed variables.
3) notations As microprocessors have become more powerful, such as sequential function charts and function block diagrams can replace ladder logic for some limited system.

IV. CHAPTER 4 SCADA

A. Introduction

SCADA (Supervisory Control and Data Acquisition) system refers to the combination of telemetry and data acquisition. It consists of collecting information, transferring it back to a central site, carrying out necessary analysis and control, and then displaying this data on a number of operator screens. The SCADA system is used to monitor and control a plant or equipment. Control may be automatic or can be initiated by operator commands. As such, it is a purely software package that is positioned on top of hardware to which it is interfaced, in general via Programmable Logic Controllers (PLCs), or other commercial hardware modules.

SCADA systems are used not only in most industrial processes: e.g. steel making, power generation (conventional and nuclear) and distribution, chemistry, but also in some experimental facilities such as nuclear fusion. The size of such plants range from a few 1000 to several 10 thousand input/output (I/O) channels. However, SCADA systems evolve rapidly and are now penetrating the market of plants with a number of I/O channels of several 100 K: we know of two cases of near to 1 M I/O channels currently under development.

SCADA systems used to run on DOS, VMS and UNIX; in recent years all SCADA vendors have moved to NT. One product was found that also runs under Linux.

B. Telemetry

Telemetry is usually associated with SCADA systems. It is a technique used in transmitting and receiving information or data over a medium. The information can be measurements, such as voltage, speed or flow. These data are transmitted to another location through a medium such as cable, telephone or radio. Information may come from multiple locations. A way of addressing these different sites is incorporated in the system.

C. Data Acquisition

Data acquisition refers to the method used to access and control information or data from the equipment being controlled and monitored. The data accessed are then forwarded onto a telemetry system ready for transfer to the different sites. They can be analog and digital information gathered by sensors, such as flow meter, ammeter, etc. It can also be data to control equipment such as actuators, relays, valves, motors, etc.

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D. Potential Benefits Of Scada

The benefits one can expect from adopting a SCADA system for the control of experimental physics facilities can be summarised as follows:

1) A rich functionality and extensive development facilities. The amount of effort invested in SCADA product amounts to 50 to 100 p-years!

2) The amount of specific development that needs to be performed by the end-user is limited, especially with suitable engineering.

3) Reliability and robustness. These systems are used for mission critical industrial processes where reliability and performance are paramount. In addition, specific development is performed within a well-established framework that enhances reliability and robustness.

4) Technical support and maintenance by the vendor.

For large collaborations, as for the CERN LHC experiments, using a SCADA system for their controls ensures a common framework not only for the development of the specific applications but also for operating the detectors. Operators experience the same "look and feel" whatever part of the experiment they control. However, this aspect also depends to a significant extent on proper engineering.

5) What are the differences between SCADA and DCS? : Similar to the SCADA systems are the Distributed Control Systems (DCS). The DCS is usually used in factories and located within a more confined area. It uses a high-speed communications medium, such as local area network (LAN). A significant amount of closed loop control is present on the system. The SCADA system covers larger geographical areas. It may rely on a variety of communication links such as radio and telephone. Closed loop control is not a high priority in this system.

E. Hardware architecture

One distinguishes two basic layers in a SCADA system: the "client layer" which caters for the man machine interaction and the "data server layer" which handles most of the process data control activities. The data servers communicate with devices in the field through process controllers. Process controllers, e.g. PLCs, are connected to the data servers either directly or via networks or fieldbuses that are proprietary (e.g. Siemens H1), or non-proprietary (e.g. Profibus). Data servers are connected to each other and to client stations via an Ethernet LAN. The data servers and client stations are NT platforms but for many products the client stations may also be W95 machines.

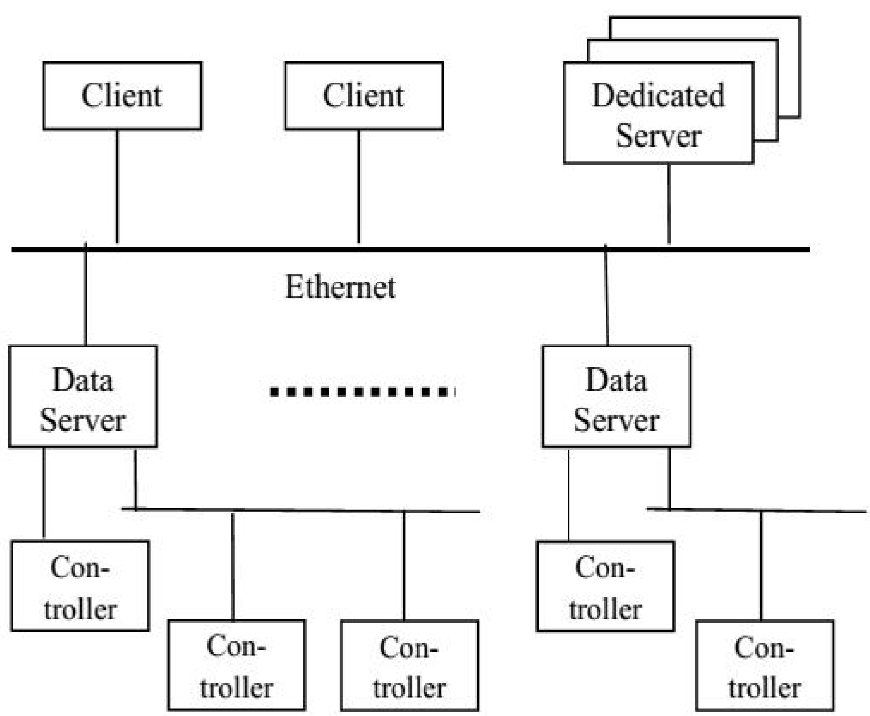

Fig 4.1 Hardware architecture of SCADA

1) *Interfacing*

a) *Application Interfaces / Openness*

The provision of OPC client functionality for SCADA to access devices in an open and standard manner is developing. There still seems to be a lack of devices/controllers, which provide OPC server software, but this improves rapidly as most of the producers of controllers are actively involved in the development of this standard. The CERN-IT-CO group is currently evaluating OPC.

The products also provide An Open Data Base Connectivity (ODBC) interface to the data in the archive/logs, but not to the configuration database. An ASCII import/export facility for configuration data, A library of APIs supporting C, C++, and Visual Basic (VB) to access data in the RTDB, logs and archive. The API often does not provide access to the product's internal features such as alarm handling, reporting, trending, etc.

b) *Database:* The configuration data are stored in a database that is logically centralised but physically distributed and that is generally of a proprietary format. For performance reasons, the RTDB resides in the memory of the servers and is also of proprietary format. The archive and logging format is usually also proprietary for performance reasons, but some products do support logging to a Relational Data Base Management System (RDBMS) at a slower rate either directly or via an ODBC interface.

c) *Scalability:* Scalability is understood as the possibility to extend the SCADA based control system by adding more process variables, more specialized servers (e.g. for alarm handling) or more clients. The products achieve scalability by having multiple data servers connected to multiple controllers. Each data server has its own configuration database and RTDB and is responsible for the handling of a sub-set of the process variables (acquisition, alarm handling, archiving).

d) *Redundancy: The* products often have built in software redundancy at a server level, which is normally transparent to the user. Many of the products also provide more complete redundancy solutions if required.

2) *Functionality:* Users are allocated to groups, which have defined read/write access privileges to the process parameters in the system and often also to specific product functionality

3) *Access control:* MIMI: The products support multiple screens, which can contain combinations of synoptic diagrams and text. They also support the concept of a "generic" graphical object with links to process variables. These objects can be "dragged and dropped" from a library and included into a synoptic diagram. Most of the SCADA products that were evaluated decompose the process in "atomic" parameters (e.g. a power supply current, its maximum value, it's on/off status, etc.) to which a Tag-name is associated. The Tag-names used to link graphical objects to devices can be edited as required. The products include a library of standard graphical symbols, many of which would however not be applicable to the type of applications encountered in the experimental physics community.

4) *Report Generation:* One can produce reports using SQL type queries to the archive, RTDB or logs. Although it is sometimes possible to embed EXCEL charts in the report, a "cut and paste" capability is in general not provided. Facilities exist to be able to automatically generate, print and archive reports.

F. *Modules And Software Requirement*

1) *PLC*

a) BRAND: DELTA

b) MODEL: DVPEX2

c) I/O NUMBERS 8 DI, 6 DO, 2 AI, 2AO.

d) MEMORY I/O: M0 - M4095

e) INPUT: SOURCE

f) OUTPUT: TRANSISTER

2) *SCADA*

a) OMMUNICATION: KEP Server

b) BRAND: INVENSYS INC., (NOW TAKE OVER BY SCHNIDER)

c) NAME: INTOUCH WONDERWARE VERSION: 9.5. 37

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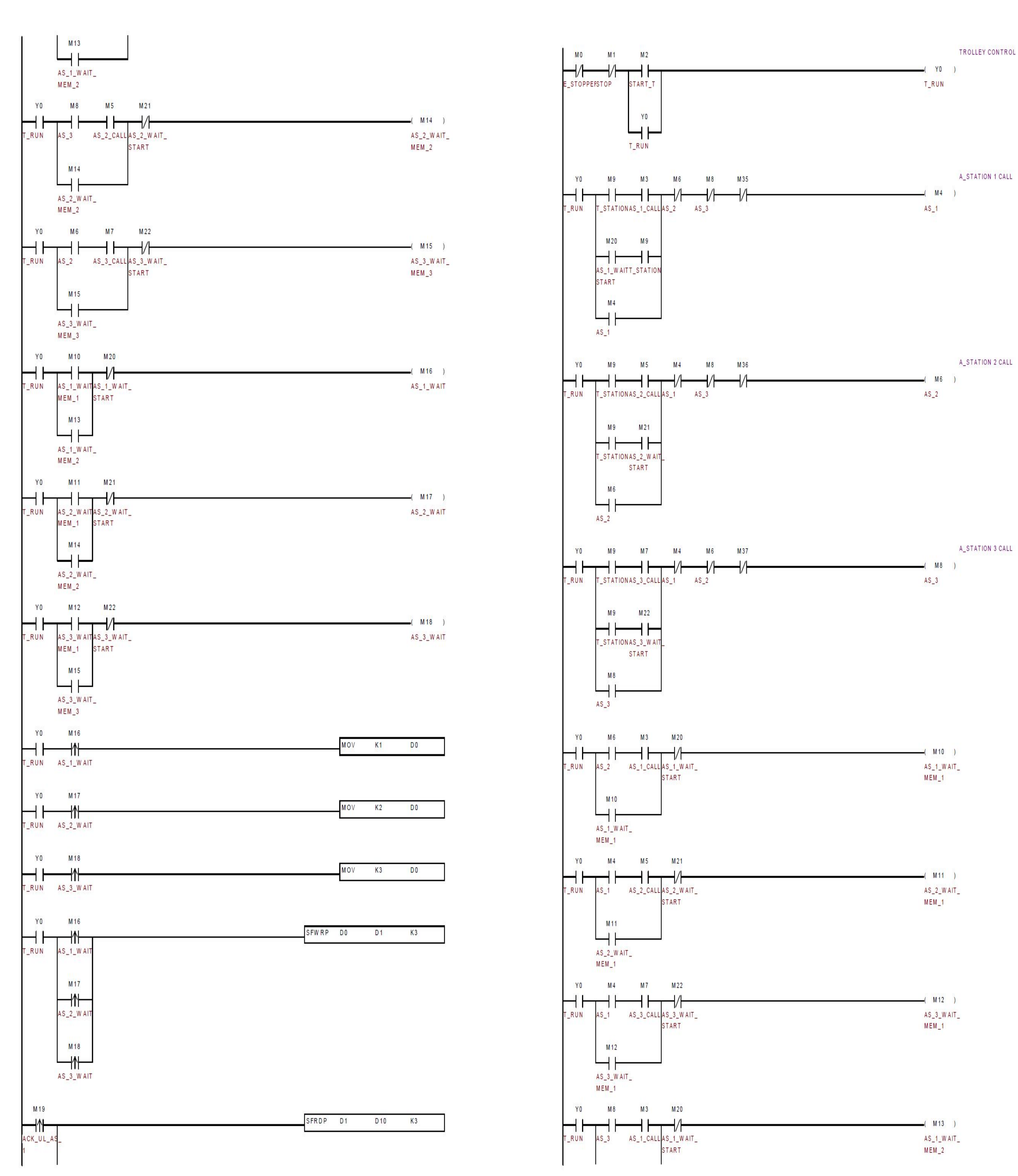
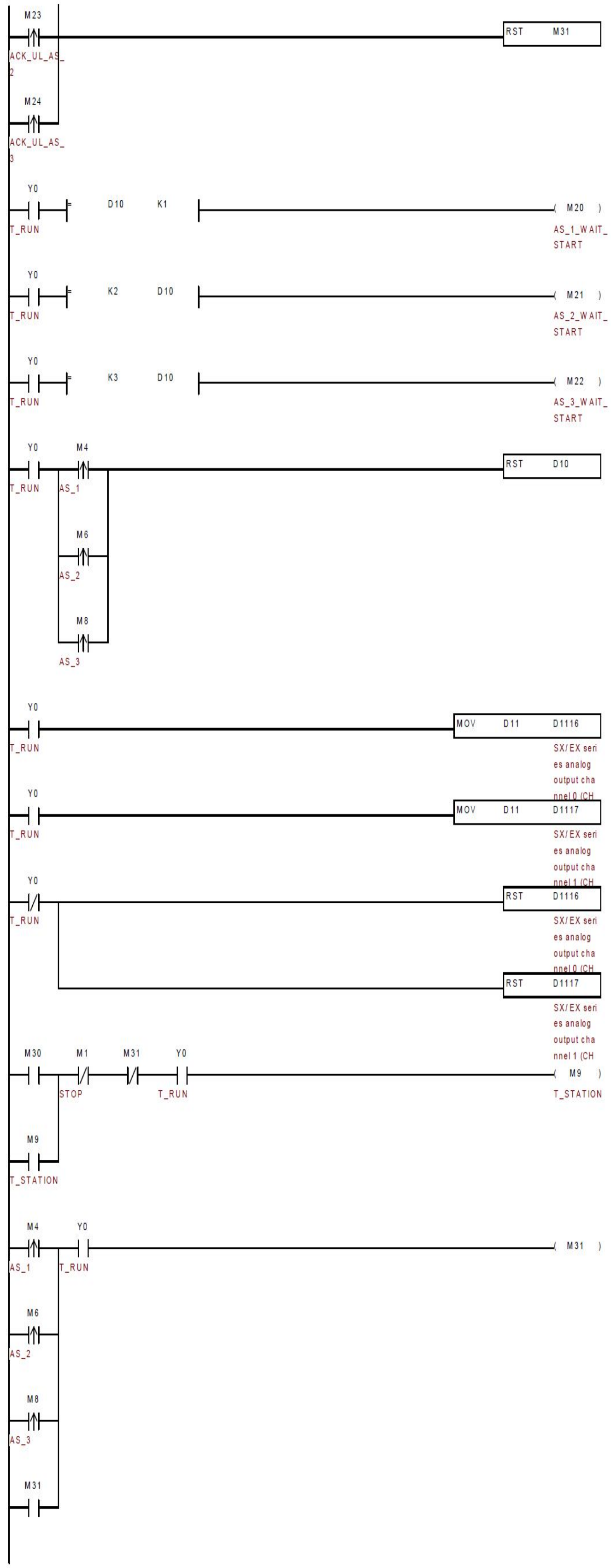
G. CHAPTER 5




M23
ACK_UL_AS_2
RST M31
M24
ACK_UL_AS_3
Y0
T_RUN
= D10 K1
M20
AS_1_WAIT_START
= K2 D10
M21
AS_2_WAIT_START
= K3 D10
M22
AS_3_WAIT_START
M4
AS_1
RST D10
M6
AS_2
M8
AS_3
MOV D11 D1116
SX/EX series analog output channel 0 (CH
MOV D11 D1117
SX/EX series analog output channel 1 (CH
RST D1116
RST D1117
M30
M1
STOP
M31
M9
T_STATION
M31

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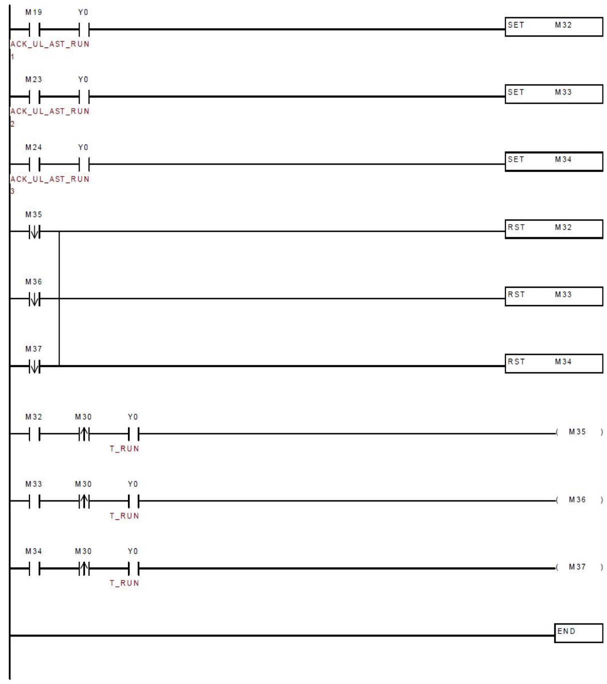
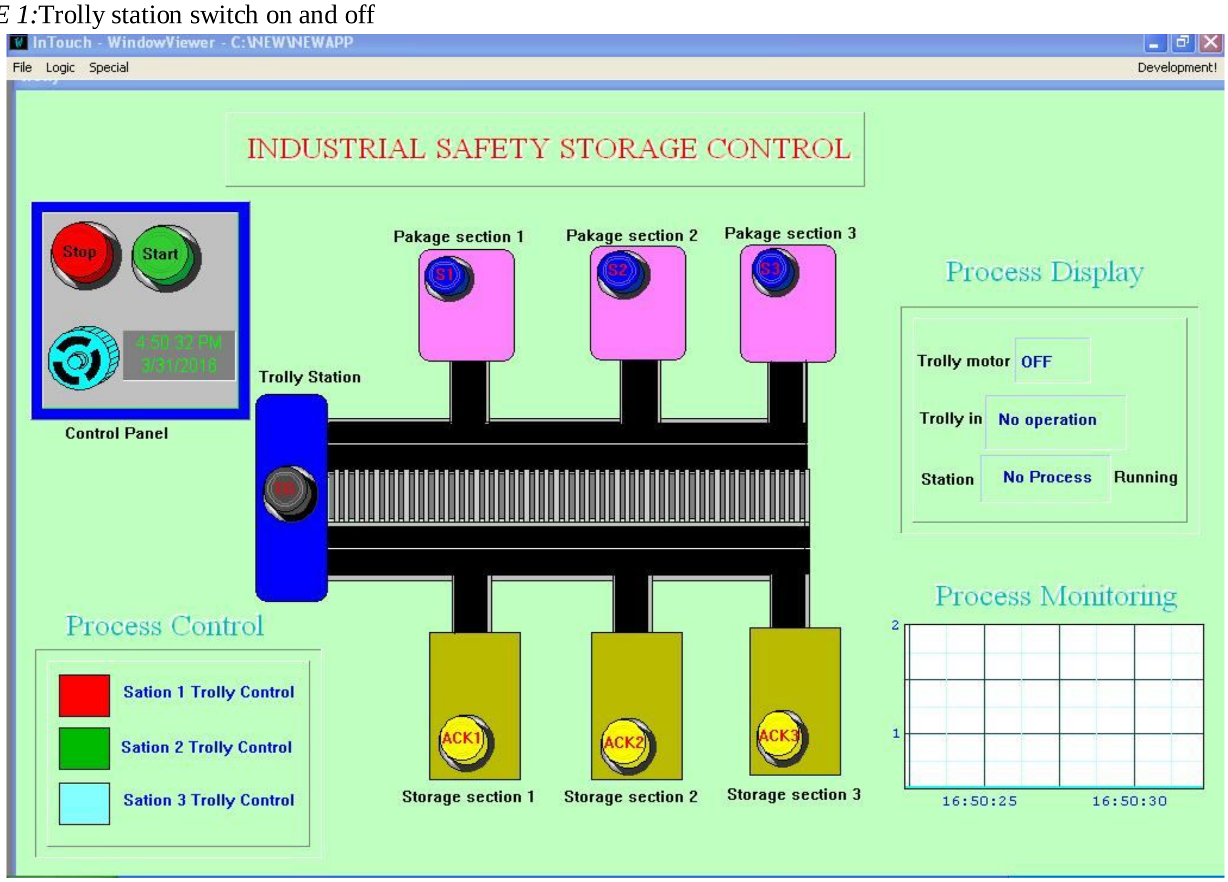


*H. CASE 1:*Trolly station switch on and off



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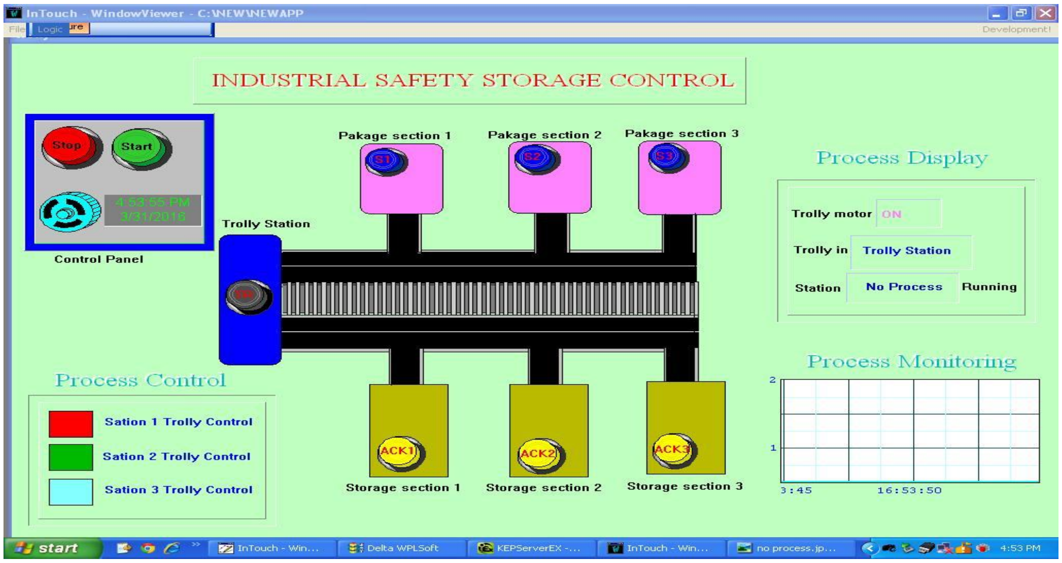
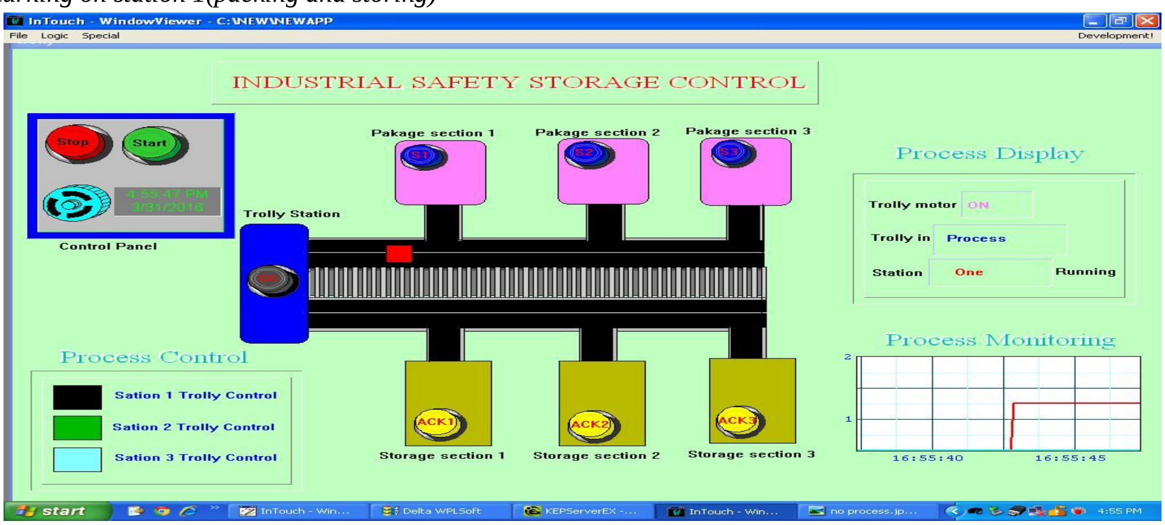
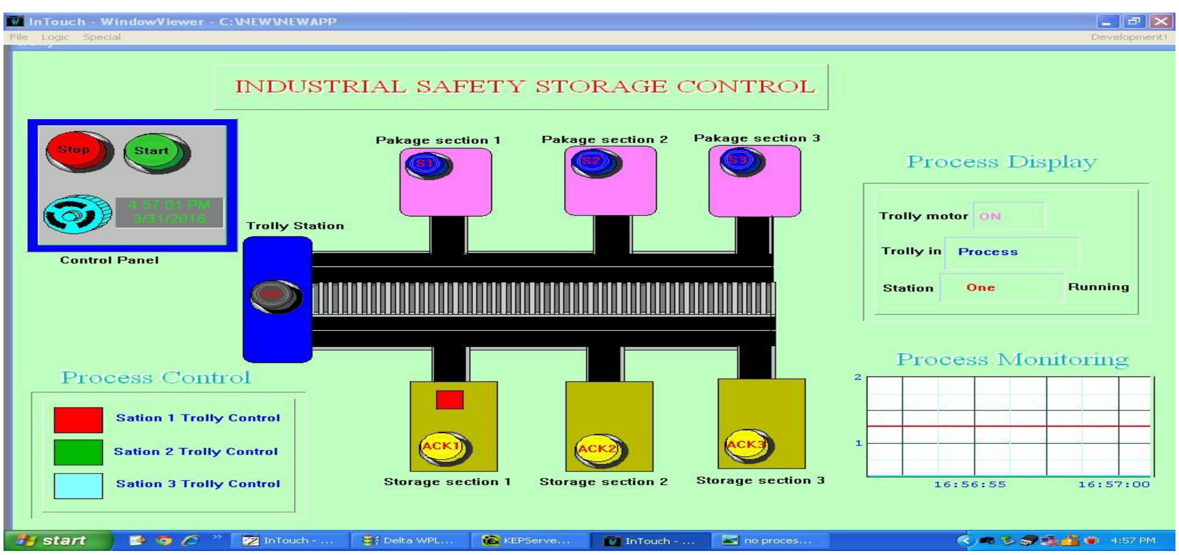
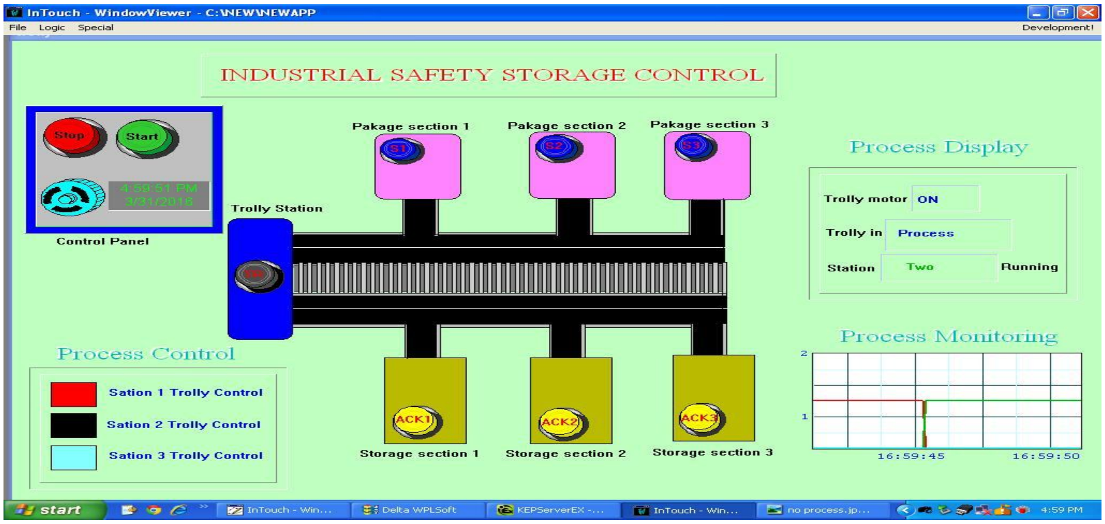


I. *Case 2:turning on station 1(packing and storing)*





J. Case 3: Section 2 Starting After Finishing Section 1



1) Start on (green) -> agv on
2) Trolley station on -> trolley goes to station
3) Station 1 on ->trolley goes to station 1 pick's up the load and store in storage station 1 and then return back to trolley station
4) Same operation is done for station 1 and 2
5) If any station is switched on in between the process, interupt occurs and it is sent into waiting state
6) Process depends on fifo process
7) Stop on (red)->agv off

V.RESULTS AND DISCUSSION

A. Overview Of Results

The simulated output shows the difference between the existing system and the proposed system with respect to the selection of random forwarder. The x-graph output shows the difference of performance between the systems. The factors considered for the performance comparison are data efficiency and power consumption.

B. Program

When the start push button (M2) is set on the motors starts running, the trolley in the station is indicated by pressing (M9). When station 1 switched on (M3) and station 2 and 3(M6 and M8) in station 1 is called. Similar condition will be followed when station 2 station 3 is called. When station 1 is switched on and at the same time station 2 or 3 is called station 2 or 3 will go under waiting state which is the same for all the process switched on at the same time and it is shown in the memory (M10, M11, M13, M14, M15, M16, M17). The process which is called first is operated depending on rising edge given first by stations, data registers increase according to the rising edge and depending upon the first come first serve basis, trolley will operate. When all the process is over M31 will be switched ON trolley station will be OFF. In order to shut down the entire operation stop (M1) is switched ON.

VI. CONCLUSION

Automated storage and retrieval system (AS/RS) is complex in design and fabrication which needs exclusive study of transmitting devices, motors to control movements of the various axes, positioning techniques and feedback control system, power circuitry. Automated storage and retrieval system development is divided in layers i.e. fabrication of the mechanical components and their assembly, the electrical circuitry, the electronic circuitry, programming and interfacing. The AS/RS system is implemented by using the contactless power transfer principle to provide security in the industry to improve the work progress without affecting the surroundings. The implemented system will achieve the efficiency more than 92% by the simulated output.

VII.FUTURE WORK

To improve the efficiency by reducing the amount of power consumption and provide the secured AS/RS system. In future, the control of the system will try to provide the remote and working without feeding of instruction. Here SCADA and PLC is implemented in order to do automated works in proper and sequence manner. And in order to control the speed of the machine VFD can be used along with PLC and SCADA in AGV

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