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PLC-SCADA Based Automated Logistics Warehouse Management System

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Abstract **-** This paper is based upon use of PLCs(Programmable Logic Controllers)and SCADA(Supervisory Control and Data Acquisition)for the purpose of automatic material handling inside the warehouse and the logistics industries . Involvement of manpower has various disadvantages and so automating the process will curb all the demerits The implementation of this system would reduce the work done by humans to about 90% and thereby resulting in the increase in work/process speed.

I. INTRODUCTION

Automation is the use of control systems and information technologies to reduce the need for human work in the production of goods and services. In the scope of industrialization, automation is a step beyond mechanization. Automation greatly decreases the need for human sensory, mental requirements and saves time as well.

II. CASE STUDY:

Here we take up the case of logistics industry which involves the transfer of goods from one place to another. The success of the **logistics industry** depends on the promptness with which the products can be delivered to a particular destination or to a client. Time and location are two factors which can either make or mar the logistics industry. The logistics industry is governed by technology, integration, globalization.

Logistics involves the integration of information, transportation, inventory, warehousing, mat erial handling, and packaging, and often security. Today the complexity of production logistics can be modeled, analyzed, visualized and optimized by plant simulation software, but is constantly changing. This can involve anything from consumer goods such as food, to IT materials, to aerospace and defense equipment.

[A] EXISTING SYSTEM:

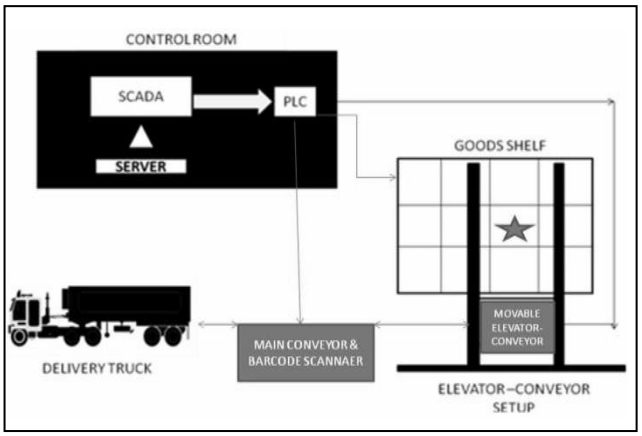
There are various methods involved in handling goods/materials in any industry. Some of them are: by using ***labour force, fork lifts, hydraulic lifts, trolleys*** and many more. But in some form or the other man power is involved it their operation.

The following disadvantages are involved due to this in the present scenario –

- Man power requirement is high.
- Low processing speed.
- Low efficiency.
- Cost of labour is high.
- Inconsistency in production rate.

[B] PROPOSED SYSTEM:

The main objective of this system is to automate the entire warehouse/Logistics industry which can be achieved using PLC and SCADA. All the manual operations are replaced by sending signals from the PLC to the respective devices. The work of storing and retrieval of goods from various places is automatically done by a movable elevator-conveyor setup that is controlled by the PLC.



III. PLC HARDWARE SPECIFICATIONS:

We have chosen **OMRON CP1E** Series Programmable Logic Controllers with the following features.

Type	**DC type**
Model	**OMRON CP1E**
Programming language	Ladder diagram
Instruction types	Basic: 16, application: 34, arithmetic:26, interrupt: 4
Execution time (basic I/O instructions)	1.4 µs min., 3.12 µs average
Avg. number of steps	3000 steps/program
Input (Maximum number of inputs)	16
Output (Maximum number of inputs)	16
Maximum extendable number of I/Os	88
Power supply	24 VDC +10% to -20%
Picture	

IV. SCADA-SOFTWARE SPECIFICATIONS:

We have chosen **wonderware Intouch 10.1** with the following features

- Resolution independent graphics and intelligent symbols that visually bring your facility to life right on your computer screen
- Sophisticated scripting to extend and customize applications for your specific needs
- Real-time distributed Alarming with historical views for analysis
- Built-in, real-time and historical trending
- Microsoft ActiveX controls and .NET controls integration
- Extensible library of over 500 pre-designed 'intelligent' and customizable graphic and object symbols
- Support of Microsoft Remote Desktop Services, Smart Card authentication and Hyper-V virtualization allow highly economic, secure and available systems

V. BASIC DESIGN OF THE SYSTEM :

Firstly we design a matrix of shelves for docking the goods. The goods are stored in the shelves according to their areas of dispatch. The shelves are designed in such a way that they can act as conveyors too. Secondly we construct a movable elevator-conveyor setup placed between a movable frame. The elevator can move along both X and Y axis. It can act as conveyor when triggered. Load cells are placed in the elevator and shelves to sense the absence of goods. Thirdly we construct a main conveyor containing a barcode scanner to scan the goods. The entire process of storing and retrieval of goods is automated by connecting all the units of the system to the PLC located in the control room. The basic design and instructions are fed to the SCADA system to provide a human machine interface.

VI. WORKING :

[A] STORAGE OF GOODS

All the goods are attached with a barcode tag containing the necessary details such as source, destination, weight, sender's details etc… In the case of storing the goods into a particular shelf: The goods are made to move under the barcode scanner located in the main conveyor where it is scanned to determine its target shelf . The goods from the main conveyor are transferred to the elevator which takes them to the target shelf. Due to conveyor conveyer transfer the goods are stored in its target shelf.All these functions are performed by the PLC itself.

[B] RETRIEVAL OF GOODS

In the case of retrieval, the operator from the control room selects the target shelf (refer block diagram) for the transfer of goods .Once the target is fixed the PLC instructs the movable elevator to reach the target shelf. After this the conveyors of both the elevator and shelf begins to run. Now, the goods from that particular shelf is transferred to the elevator conveyor. Next the elevator retraces its path to the main conveyer that delivers the goods to the respective truck via the main conveyor.

VII LADDER LOGIC :

Here a ***ladder logic*** for ***retrieving goods from one target shelf*** is designed. The logic is same for all the

shelves except that the timers have different time periods.

The tagnames are given along with their address for all the inputs and outputs.

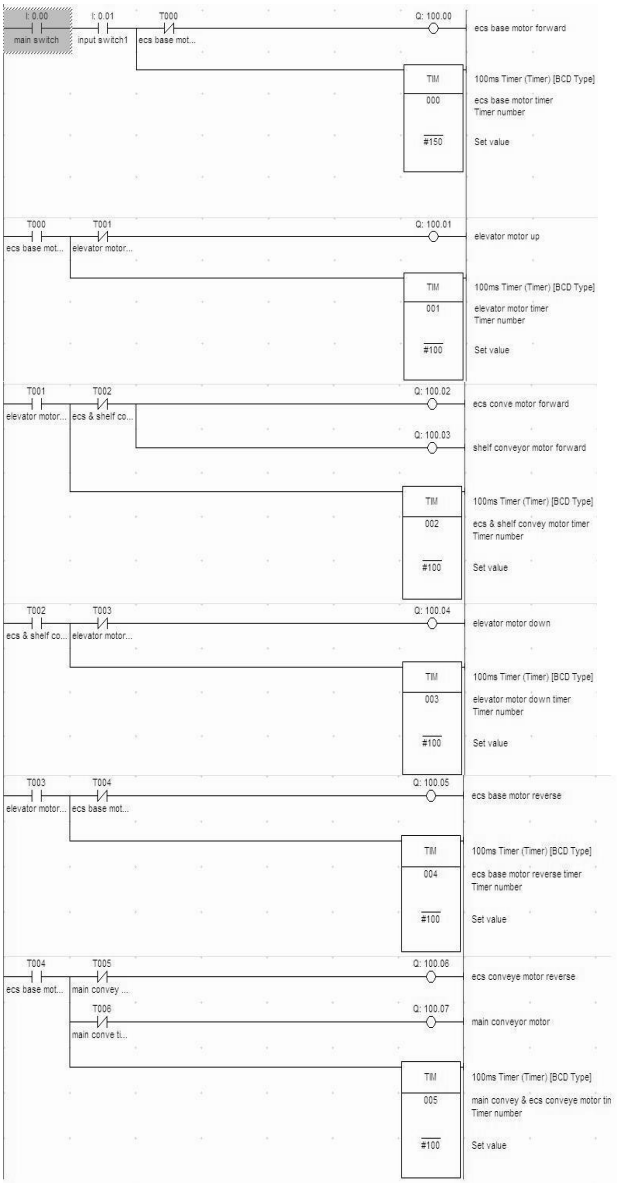
KEY:

0.**XX** - inputs

100.XX - outputs

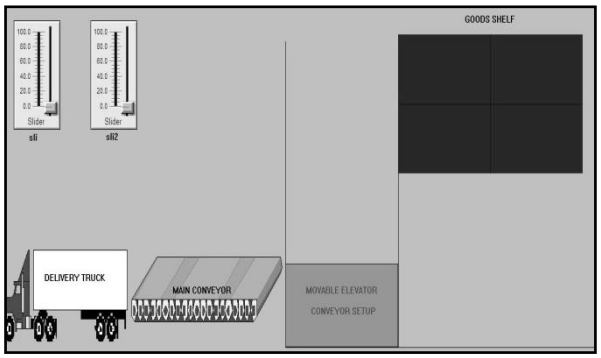
T0XX - timers

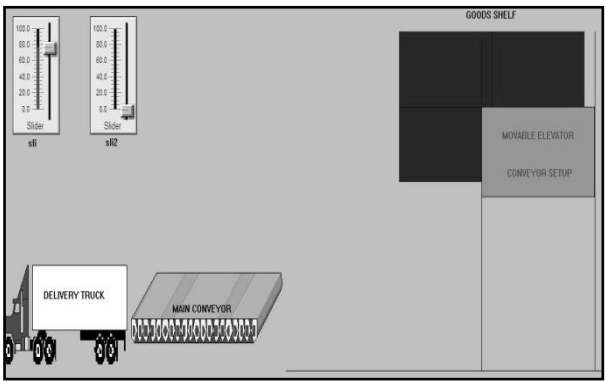
Ecs-elevator conveyor setup

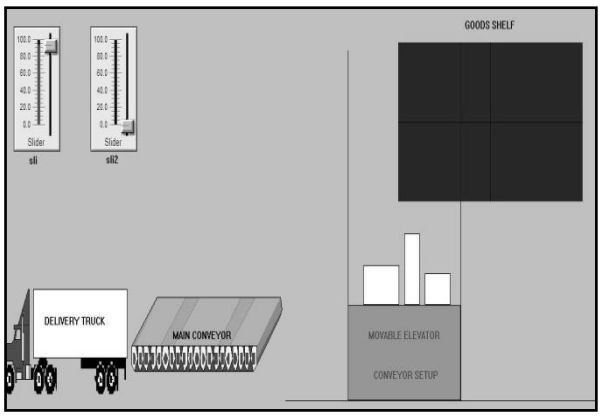


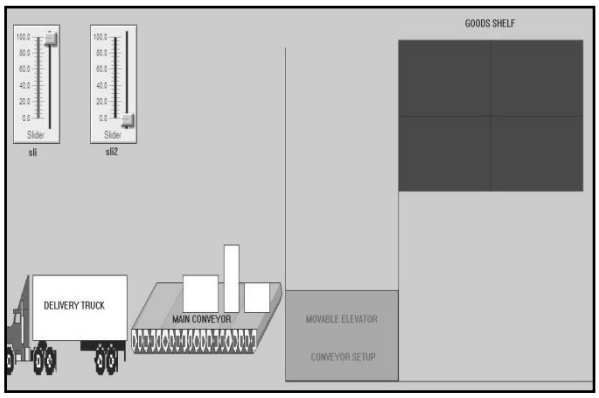
VIII SCADA SIMULATION:

The SCADA simulation representing various stages of the process is shown:









IX. PROS AND CONS:

A. PROS :

- Reduces man power.
- Eliminates labour cost.
- High process speed.
- Better safety.
- One time investment.

B. CONS :

- Engineering cost is high.
- High power consumptions.
- Skilled operators are required for monitory measures.
- Development time is high.

X. FUTURE ENHANCEMENTS

- Green energy for operating various units of the process.
- Automatic billing process based on the weight of the goods.
- The EMF produced in the load cells of the elevator can be used for regenerative action of motors.

XI. OTHER APPLICATIONS

- Mortuaries.
- Food processing industries.
- Smart parking systems.
- Super markets

XII. CONCLUSION:

- Age old conventional methods used in the logistics industry has been eliminated.
- complexity of production logistics has been modeled, analyzed, visualized and optimized by this proposal.

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