Automatic material management system using PLC

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ABSTRACT-This project is based upon use of PLCs (Programmable Logic Controllers) for the purpose of automated material handling. Currently many researches works have been done on the subject of material handling. However their approach seems to be less complex and cost lesser. In this research we proposed an automated material handling which is easy to implement and cost effective. Material handling equipment is all equipment that relates to the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal. Material handling equipment is the mechanical equipment involved in the complete system. Material handling equipment is generally separated into four main categories:- storage and handling equipment, engineered systems, industrial trucks, and bulk material handling. Over the last decade our world has changed dramatically due to the growing phenomenon of globalization and revolution in automation there is tremendous demand on companies to improve the quality and provide reliable delivery dates through effective and efficient coordination of production and distribution activities. Robotics has emerged as an enabling technology. An industrial robot is a reprogrammable multifunctional manipulator designed to move materials, parts, tools or special devices through variable programmed motion and performance of variety tasks. A robot recognizes the need for company to conserve resources while adding value to the product. In this project we have been used electric motors and structure, power transmission system for material handling purpose. This trolley can be implanted on rough surface to carry material and drop at a specific area.

I. INTRODUCTION

Automation has brought several drastic changes in manufacturing over the past century. These changes include increase in overall productivity and profitability of a manufacturing system. Development of electronics (transistors and microchips) led to a jump in control technology and precision of various instruments. This laid a path for efficient and cost effective manufacturing processes. Automation of manufacturing systems requires integration of various fields such as mechanical, control and electronic systems, and computers .Automation in various forms constitutes the backbone of most major industries. It has become a significant part of defense, medical, aerospace and automotive industries, materials processing and handling, manufacturing, and consumer products to meet the increasing demand for the production volume and product variety. In the manufacturing industry, automation in material handling has increased the overall profitability of the product with an improvement in the quality and productivity of the system. This is primarily due to two reasons. First, automation reduces the total production cycle time, and second, it helps smooth flow of raw materials and finished products to their desired location with little or no human interference. The whole system has good compatibility and compact structure. It is easy to install, and the line running is stable in the actual production. The labor intensity is greatly reduced for workers, so it has a high degree of automation. On the basis of ensuring the quality, it improves product efficiency, and brings great economic benefits to the production side.

2. SOFTWARE USED

2.1 LADDER LOGIC TECHNIQUE

Ladder logic is used to develop software for Programmable Logic Controllers (PLCs) used in industrial control applications. The name is based on the observation that programs in this language resemble ladders with two vertical rails and a series of horizontal rungs between them Ladder logic has contacts that make or break circuits to control coils. Each coil or contact corresponds to the status of a single bit in the programmable controller's memory. Unlike electromechanical relays, a ladder program can refer any number of times to the status of a single bit, equivalent to a relay with an indefinitely large number of contacts. So-called "contacts" may refer to physical ("hard") inputs to the programmable controller from physical devices such as pushbuttons and limit switches via an integrated or external input module, or may represent the status of internal storage bits which may be generated elsewhere in the program. Each rung of ladder language typically has one coil at the far right. Some manufacturers may allow more than one output coil on a rung. Rung Input: Checkers (contacts)

— [ ] — normally open contact, closed whenever its corresponding coil or an input which controls it is energized. (Open contact at rest) — [\] — normally closed ("not") contact, closed whenever its corresponding coil or an input which controls it is not energized. (Closed contact at rest)
Rung Output: Actuators (coils)— ( ) — normally inactive coil, energized whenever its rung is closed. (Inactive at rest)
— (\) — normally active ("not") coil, energized whenever its rung is open. (Active at rest). The "coil" (output of a rung) may represent a physical output which operates some device connected to the programmable controller, or may represent an internal storage bit for use elsewhere in the program.

Logical AND

```
------[ ]--------------[ ]----------------( )
   Key Switch 1      Key Switch 2        Motor
```

The above realizes the function: Door Motor = Key Switch 1 AND Key Switch 2.This circuit shows two key switches that security guards might use to activate an electric motor on a bank vault door. When the normally open contacts of both switches close, electricity is able to flow to the motor which opens the door

Logical OR

```
--+-------[ ]-------+-----------------( )
   Switch 1                  Unlock

  +-------[ ]-------+
   Switch 2
```

The above realizes the function: Unlock = Interior Unlock OR Exterior Unlock. This circuit shows the two things that can trigger a car's power door locks. The remote receiver is always powered. The unlock solenoid gets power when either set of contacts is closed.

Basic Timers & Counters

Many times programs will call for action to be taken in a control program based on more than the states of discrete inputs and outputs. Sometimes, processes will need to turn on after a delay, or count the number of times a switch is hit.

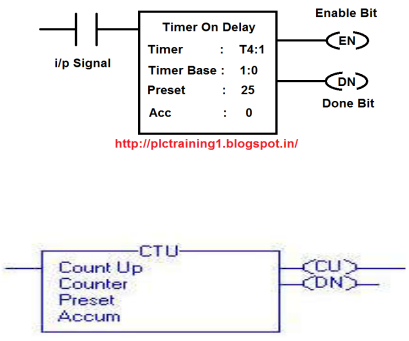

Fig.1. Timers and Counters

To do these simple tasks, Timers & Counters are utilized. On-Delay Timer (RTO) A timer is simply a control block that takes an input and changes an output based on time. There are two basic types of timers. There are other advanced timers, but they won't be discussed in this report. An On-Delay Timer takes an input, waits a specific amount of time, allows logic to flow after the delay. An Off-Delay Timer allows logic to flow to an output and keeps that output true until the set amount of time has passed, then turns it false, hence off-delay
A counter simply counts the number of events that occur on an input. There are two basic types of counters called up counters and down counters. As its name implies, whenever a triggering event occurs, an up counter increments the counter, while a down counter decrements the counter whenever a triggering event occurs. Figure shows the typical graphical representation of an Up Counter

3. COMPONENTS

3.1 PLC

A **PROGRAMMABLE LOGIC CONTROLLER** (PLC) is an industrial computer control system that continuously monitors the state of input devices and makes decisions based upon a custom program to control the state of output devices.

Almost any production line, machine function, or process can be greatly enhanced using this type of control system. However, the biggest benefit in using a PLC is the ability to change and replicate the operation or process while collecting and communicating vital information.

Another advantage of a PLC system is that it is modular. That is, you can mix and match the types of Input and Output devices to best suit your application.

Fig.2. PLC Module

Features

Part Number: FX1N-14MR-ES
PLC Series: FX1N
Manufacturer: Mitsubishi
Our part number: FX1N14MRES/UL
Number of Digital Inputs: 8
Input Voltage: 100-240 VAC
Number of Digital Outputs: 6
Output Type: Relay
Supply Voltage: 100-240 VAC
Height (mm): 90
Width (mm): 90
Depth (mm): 75
Weight (kg): 0.45

3.4 DC MOTOR

Fig.3. DC Motor

100RPM 12V geared drive DC motor. Reliable in use. Available in different standard sizes. There is grip on shaft to connect a wheel with the help of nuts and threads.

Features:

Motor Type	**:**	DC with Gear Box, Metal Gears
Shaft Type	**:**	Circular 6mm Dia with Internal Hole for coupling, 23 mm shaft Length
Maximum Torque:		~4 Kg-cm at 12V
RPM	**:**	10 RPM at 12V
Max Load Current:		~ 450mA at 12V-10RPM

Table No.1

3. Limit Switch

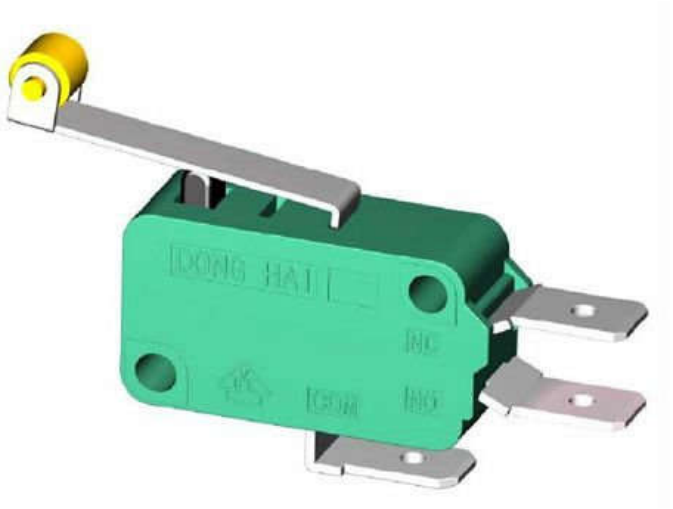

Fig.4. limit switch

Model: SV-166-1C25
Actuator Type: Long Hinge Roller Lever
Rating: 3-16A 250VAC
Action Type: Momentary
Contact configuration : SPDT 1NO 1NC

3.7 Relay

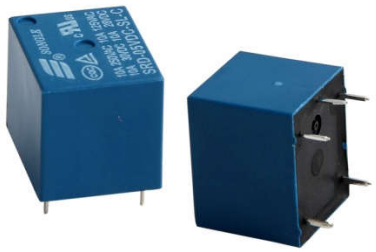

Fig.5. Relay

Relays are act like a NO NC switches. They can be operated by giving from control pulse. Or can by operating manually by operating mechanism. Relay consist a coil. Coil gets charged by control pulse cause for relay operation. Relay acts as switching device between PLC and application.

4. BLOCK DIAGRAM

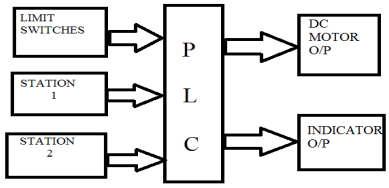

Fig.6.Block diagram

5. WORKING

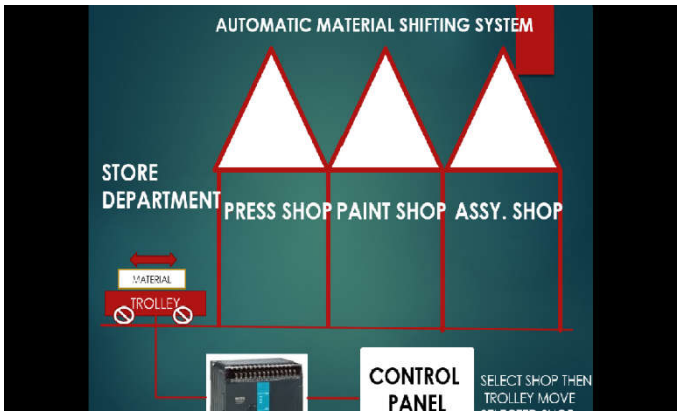

Fig.6. Basic block diagram

In the above fig we can see the basic block diagram of automatic material management system using PLC. In this system we are using six limit switches which are placed at every station and on trolley. As the system is fully automatic so no operator or driver is required .For this project we need a special track on which this trolley will run. This track will be placed on ground or shop floor. From the fig we can see that the material is to be shifted from store department to other department so for operation first material is loaded on trolley, a limit switch is already provided on trolley. So as soon as signal is send form the receiving station trolley will starts moving toward the required shop .As soon as trolley is reached to its destination the goods removed and trolley automatically comes at original position. If any hurdle is there in the track the trolley will be stopped automatically because of the sensors accident chances eliminated. No human is required for driving the trolley so there is no human losses. The system accuracy is more and also less time consumption as compared to other system. Hence production will be fast with less loss.

6. Estimation of the project

Table No.2. Estimation of project

Sr. No.	Material	Cost
1	Mitsubishi FX1N FX1N-14MR-ES	8000
2	Aluminum channel	500
3	Motors	320
4	Limit switch	1500
5	Pvc box 8x10 inch	150
6	Buzzer	15
7	Push button	130
8	Relay	200
	Total	10815

7. Literature Survey

7.1 Existing system

In all type of sectors like automobile, processing, pharmaceutical, fertilizer etc. material handling is unique. All material initially come's in store unit. Where material amount checked. Then the store department inform to various departments, then those require a material they issued it from store unit. Material shifting happen by using tool. There are different material shifting tools as.

1] HYDRUOLIC PALLET
2] BATTERY STACKERS
3] VERIUS TYPE OF TROLLYS
4] DISEL FORKLIFT
5] BATTERY PORETED FORKLIFT

7.2 Need of project

We face some problem like

MATERIAL DAMAGE- All above trolley need proper path for transferring material but some time path is uneven, so this can create chance of material damaging.

LATE DELIVERY -Late delivery of material takes place because of human error.

MAINTANANCE -Above trolley need more maintenance due to improper operating, over speeding, uneven path etc.

CHANCE OF ACCIDENT-Above all trolley's move on path or shop floor. If the trolley is not handled properly it can cause chances of accident. So by using the automatic material management system we can reduce this all problems.

8. APPLICATIONS OF MODEL

1. In Industries
2. In mall

9. CONCLUSION

This system will act as cost effective for material shifting. And it also reduce the requirement of labor. Thus it is truly time saving method.

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