

PLC Based Automation of DMF Assembling Machine

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ABSTRACT: This paper introduces an assembling machine using Programmable Logic Controller (PLC) in automation industry. The main aim of the paper is to design and develop a small and a simple assembling machine using PLC software and E-PLAN tool. PLC technology have been increasing rapidly and proving its role in automation beneficially. PLC software is used to control and automate the assembling process. The result was made fully automated in the assembling system. In addition to that, this system is able to decrease product time and increase the product rate as compared with traditional manual system. The purpose of this paper is to develop an automation technique using Programmable Logic Controller.

KEYWORDS: PLC, HMI, Assembling, Machine.

I.INTRODUCTION

The manually operating assembling machine is automated with the help of conveyor assembly. In traditional process, humans are used in operating for assembling the parts. This engages the person with time consuming efforts taken to assemble the parts. The proposed system will reduce the human efforts required to assemble the parts. An existing manually operated assembling system is automated using PLC. The software used for designing the assembling system is AUTOCADD and the PLC is programmed using ladder programming using Simatic manager/Totally Integrated automation software. The parts are clamped and assembled with the help of Pneumatic cylinders, hydraulic cylinders, servo motors. The proposed paper states that the time required for assembling the parts to make a single DMF component is very less when compared to time required for manual operation and can track the status of assembling process with help of RF-ID's which are used in the pallets.

II.LITERATURE SURVEY

Automation is the upcoming technology which is mostly used in various industry for increasing speed, accuracy and effectiveness of the production and also to reduce industrial accidents. This project is about assembling the child parts in conveyor assembly to make a single DMF component. safety light curtains are used for safety purposes. Separate machines(stations) are used for assembling so that I time consumption will be less. Human workforce is used in filling and manufacturing industries in the existing system. Mohitdevshrivastav[1]. They used PLC for Traffic control. In this work they use load cell for weighting vehicles. Akshaydeshmukh.[2]. They have used and implement fire detection for security purpose in ships using PLC. Darshil[3] developed PLC based elevator system for colour sensing capabilities for material handling in industrial plant. In this system they used PLC for controlling the elevator and used some sensors to give input to the PLC.

III.EXISTING METHODS

Earlier Humans were used for assembling the parts and some assembly machines are used in industry for assembling parts, but those machines differ in characteristics like speed, size, cost and the materials or

components used in the machine but safety ensurement was not there and controlling those machines was a tedious task.

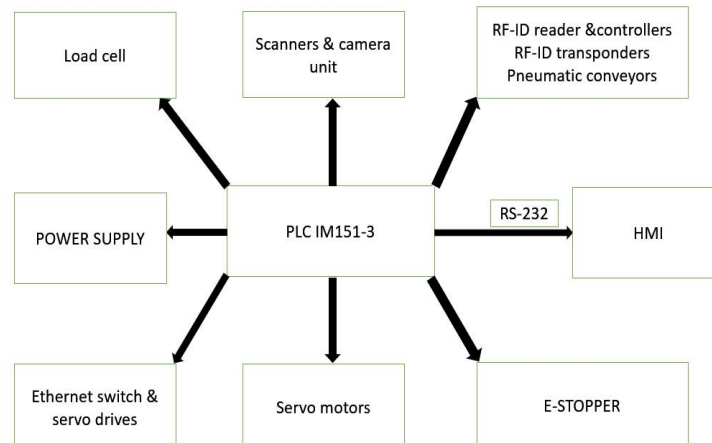
IV.DRAWBACKS OF EXISTING METHODS

Earlier we used stepper motor for material movement operations which is cost efficient and had good efficiency, but stepper motors when used in high speed operations, controlling operations are bit complicated. In earlier days, some parts are assembled manually in some stations. due to lack of consciousness of humans, accidents may occur and sometimes major accidents which may lead the company to big loss and human loss also occurs. Safety ensurement was missing in olden days. Earlier humans were used in some stations like welding, loading of some secondary parts, and errors may occur due to lack of consciousness and rejections done by the humans are not that much efficient. This will lead to issues between manufacturer and client. Wiring of cables was the big issue in previous assembly machines, any faulty connection may damage whole system.

V.PROPOSED METHOD

In the proposed system, cables were used for connecting the inputs. Separate stations are designed to perform assembling process so that time rate will be reduced. The system is totally an automated system with the aid of automatic machines. It is mainly used increase the speed and accuracy and there is rejection of damaged parts accordingly.

VI. HARDWARE



Block diagram consists of-

- 1) PLC
- 2) HMI & RS-232
- 3) Camera & Scanner
- 4) E-stoppers
- 5) RF-ID reader & controllers
- 6) RF-ID transponders
- 7) Pneumatic conveyors
- 8) Loadcell

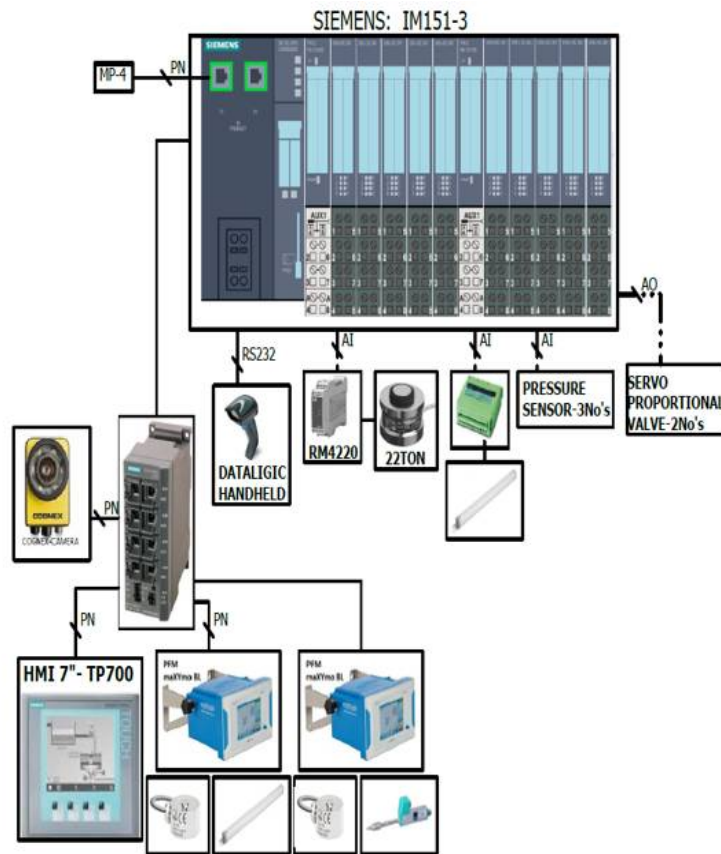


Fig 1. Vision Inspection Station

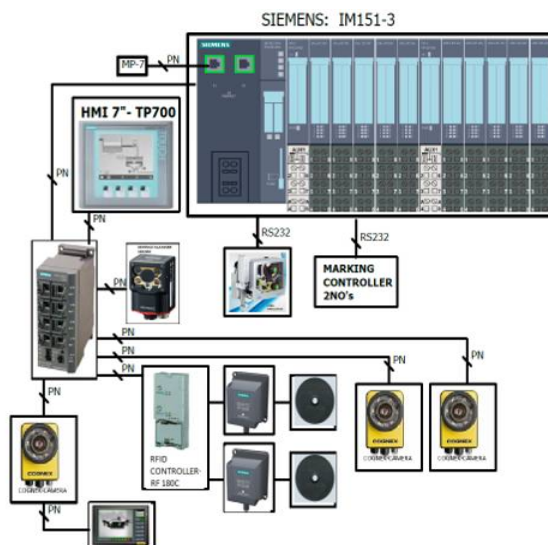


Fig 2. Labelling and ink injecting station

VII.HARDWARE DESCRIPTION

Hardware consists of two parts, first consisting of software which contains ladder logic programming which is used to program PLC that controls the whole process of the project step by step according to input data sequence. Second is the hardware part which consists of conveyors and pallets used to transport the assembled parts to next-next stations, and RF-ID readers are used in tracking the status. Initially the parts are loaded manually by the humans into the pallets and the loaded pallets are moved to next-next stations through conveyors. secondary parts are then assembled to the pallets. In each station the status is been tracked by the RF-ID readers and several RF-ID's are connected together and all together controlled by RF-ID controllers. Each station is designed in such a way to complete the task in 40-45 seconds. Loadcells and different devices like LVDT are used in tracking the force as well the position of servo motors which are used to assemble the parts in pallets. vision inspection system plays an important role here, because humans make error in finding the damages, quality, structure, shape and final outcomes and hence so, camera are used in checking the outcomes of the final product and there by rejections are done. vision inspection system works well with user defined dimensions and compare the values and rejections are done accordingly. vision inspection cameras are used at two or more stations in order to reject the damaged ones earlier. Labeling station is the last station where logo's or any special markings to be printed are done. Robots, pick and place robots are used for internal movements inside the station. Stepper motors are used for speed operations and are used for any lifting operations if required. Safety plays a major part in this project, stations are designed in such way that if any emergency / accidents happen whole stations are stopped easily. HMI (human machine interface) is useful to humans and guides the workers in assembling the parts in pallets.

VIII.SOFTWARE

Programmable Logic Controller or PLC is an intelligent system, which was introduced in the instrumentation and control industry for replacing relay-based logic. Now days, better I/O handling capabilities and more programming elements have been added along with improvement in communication. Basics of a PLC function is continuous scanning of a program. The scanning process involves three basic steps.

STEP1: TESTING INPUT STATUS

First the PLC checks each of the input with intention to see what status on or off. In other words, it checks whether a switch on a sensor etc., is activated or not. The information that the processor obtains through this step is stored in memory in order to be used in the following steps.

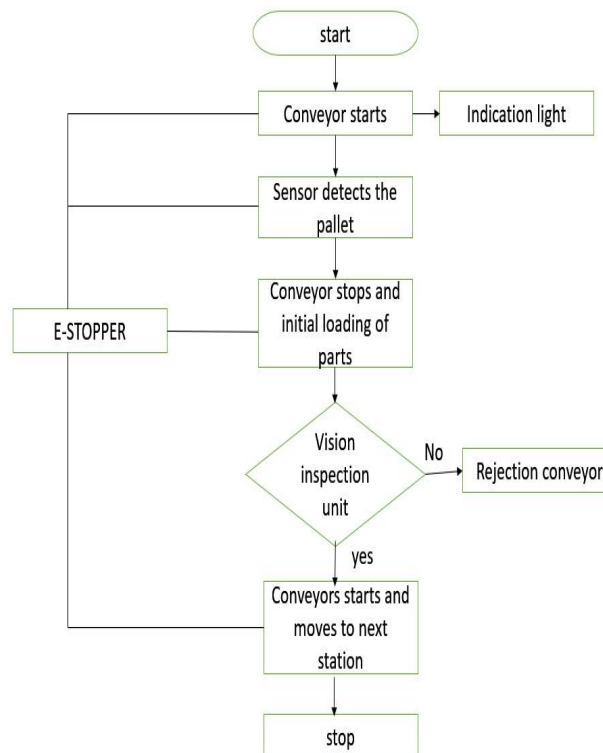
STEP 2: PROGRAMMING EXECUTION

Here a PLC executes a program instruction based on the program and based on the status of the input has obtained in the preceding step, and accordingly action is taken. The action might be activation of certain outputs and the results can be stored in memory to be retrieved later in the following steps.

STEP 3: CHECKING AND CORRECTION OF OUTPUT

Finally, a PLC checks up outputs and adjust it as per need. Changes are carried out based on the input status that had been read during the first step and based on the result of the program execution in step two Following execution of step three is done and PLC returns a beginning of the cycle and continually repeats these steps. Scanning time = Time for performing step 1+ Time for performing step 2+ Time

IX.FLOWCHART



X. COMPONENT DESCRIPTION

LOAD CELL

Load cell is used to measure the weight of the object. The magnitude of the signal is directly proportional to the force being measured. A load cell is nothing but a transducer which is used to create an electrical signal. The various types of load cells include hydraulic load cell, pneumatic load cell and strain gauge load cell. Digital load cell is fast, precise and reliable. An intelligent load cell is the heart and soul of our packaging, filling and weight check.

PLC

Programmable logic controller is used for control different processes in industry, automotive, intelligent buildings and other applications. A programmable logic controller is a digital computer used for automation of electromechanical processes. The term logic is use primarily concerned with implementing logic and switching operation. Input devices e.g. switches and output devices e.g. motors, being controlled are connected to the PLC. A PLC works by continually scanning a program. Scan cycle consist of three important steps.

1. Check input status
2. Execute program
3. Update output status

The programming language of PLC is the Ladder logic diagram.

LADDER LOGIC DIAGRAM

Ladder logic was originally a written method to document the design and construction of relay racks as used in manufacturing and process control. It is also known as contact symbology. It is used to develop software for PLC used in industrial control application. Ladder logic is the main programming method used for PLC. Contacts are those which stand between the power supply and coils. Based on opening and closure of the contact the power is allowed to pass through the coils. The normally open (NO) is true when the input or output status bit controlling the contact is 1. The normally closed contact (NC) is true when the input or output status bit controlling the contact is 0.

HMI

It is the interaction between the user and the machine at a given task. These allow control system to be much more interactive. The basic purpose of an HMI is to allow easy graphical interface with a process. It is also known as Man Machine Interface (MMI). HMI is much more specific to manufacturing and process control system. It provides the visual representation of a control system and provides real time data acquisition. It is mainly used in computerized simulation.

RS-232

PLC communications facilities normally provide the serial transmission of information. RS 232 is used in short distance computer communication. It is an asynchronous communication method. RS 232 is simple and universal.

XI. RESULTS

In industry the production speed should be high because the demand of the product is more.

	Time taken	Production rate
Existing method (single station)	1 min	
Proposed method (single station)	40 secs	
Existing method (total station)	27 min	81 p/m
Proposed method (total station)	18 min	108 p/m

XII.CONCLUSION

This paper is about an efficient assembling of child parts in conveyor assembly in order to increase the production rate with automated machines to control the assembling process and assembling area of an industry. The proposed system has done by implementing the new technique called HMI for touch screen which helps humans to get an idea of what to do in the machine and with the safety light curtains. Proposed method has more production rate and as well as can avoid human errors and can control the industrial accidents.

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