

Automation in Industry for speed control of conveyor belt Drive

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Abstract -- The present era is of automation and smart surveillance systems. Power engineers are more focused on automation of conveyor belts for quality products. Process and manufacturing industries face many problems due to inefficient operation of equipment. Many industries go for manual operation of conveyor belts which results in to hazardous operations. Solution to this is automatic and effective monitoring and operation of conveyor belt, which is proposed in the said work. This Paper represents the speed control of conveyor belt with temperature changes using VFD (Variable Frequency Drive) system operated by PLC-HMI system. The presented work is developed to control the speed of Conveyor belt in kiln with Temperature changes. The system is composed of PLC and touch screen. The hardware and software of the system station is designed by DVP-14SS2 PLC, including the module setting of PLC and its interface wires. After introducing the system design, simulation is made in the software WPLSoft. The simulation results made in the software Kinco HMIware. An attempt has been made to show efficient control of conveyor belt for reliable operation of industrial processes.

Index Terms – Programmable Logic Controller, VFD (Variable Frequency Drive), HMI (Human Machine Interface), DVP-14SS2, Temperature control, Kiln.

I. INTRODUCTION

Automation may be defined as “The technique, method, or system of controlling a process by highly automatic means, as by electronic devices, reducing human intervention to a minimum.” The term automation refers to devices such as automated machinery or other intelligent devices that are used to control and execute some required task. The devices used for automation ranges from small sensors like Proximity sensors, thermocouples to large robots and highly efficient computers.

“The control of industrial machines and process with the help of computer by replacing human operators is known as Industrial Automation.” Automation is used in almost every field on earth. It is used in industry; homes; offices; schools; military applications and in transportation system. The devices employed for automation include different kind of sensors, programmable logic controllers, actuating systems, intelligent control systems, modern control algorithms, robotics, electronic systems and many other devices.

There is a list of tools used for the industrial automation. These tools ranges from HMI by mean on which operator controls the process, to SACDA, used for data acquisition. Different types of industrial automation tools are listed below:

1. Simulator
2. Distributed Control System (DCS)
3. Programmable Logic Controller (PLC)
4. Human Machine Interface (HMI)
5. Supervisory Control and Data Acquisition (SCADA)
6. Batch Management System (BMS)
7. Manufacturing Execution System (MES)
8. Laboratory Information Management System (LIMS)

II. INTRODUCTION TO PROPOSED WORK

A programmable Logic Controller (PLC) is a specialized computer used for the control and operation of manufacturing process and machinery. It uses a programmable memory to store instructions and execute functions including on/off control, timing, counting, sequencing, arithmetic, and data handling. Programmable Logic Controllers (PLC) is used in almost every aspect of industry to expand and enhance production.

List of Main Components

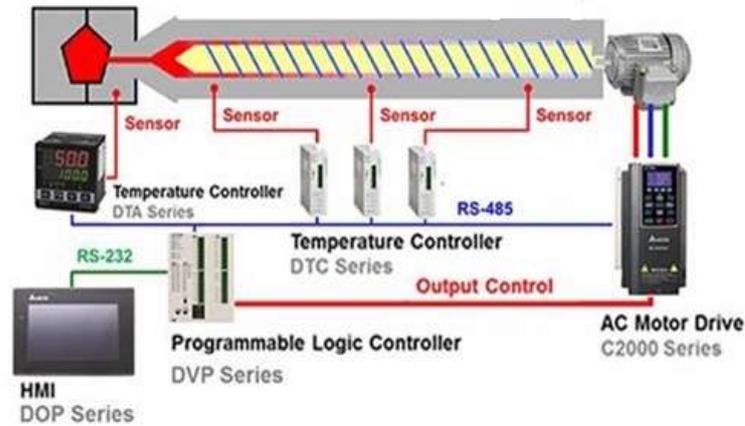
- Conveyor Belt System
- AC Motor
- Sensor
- SMPS (12V DC)
- Programmable Logic Controller (PLCs)
- Human Machine Interface

A **programmable logic controller (PLC)**, or **programmable controller** is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis.

The **Human Machine Interface (HMI)** is the interface between the process and the operators – in essence an operator’s dashboard. HMI is a device or software that allows its user to communicate with machineries and production plants, by translating a huge amount of complex data into accessible information.

In industries, VFD used to control motors speed. With VFD you can obtain desired speed control. In kiln, motor is running with its set speed so rollers are also same. In this paper, normal speed control modify with speed control with temperature base. In this case, we need to measure temperature form kiln and compare with set value. After comparison we get an output which control the speed of motor. When temperature is low our motor speed is low and when temperature is goes to high at that time motor speed is also raise.

Figure 1 Schematic Diagram of Proposed System



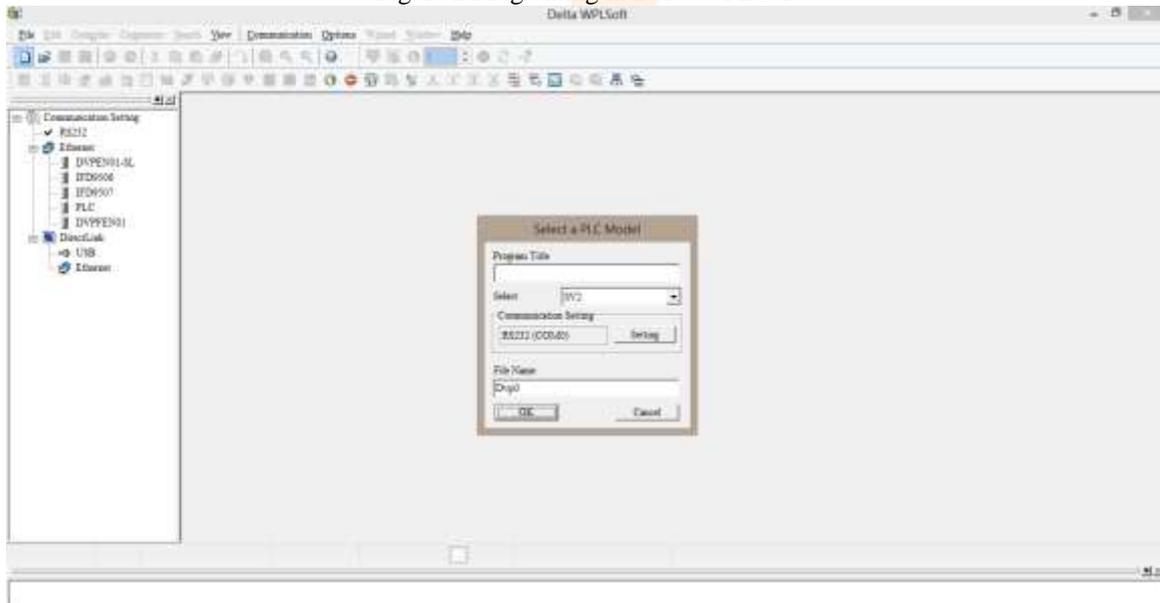
In the Figure 1, Schematic diagram of a proposed system is shown. One motor is drive the conveyor belt in kiln. An electric kiln is a heating chamber used to transform materials at high temperatures. For measure that temperature Thermocouple is use. More than one thermocouple sensors use for precise measurement of temperature. Output of sensors are connected with plc DVP-14SS2. All PLCs are connected with RS-485 cable for data transfer. VFD is connected with output side of PLC. HMI is also connect with RS-232 cable. Sensors sense temperature and send data to PLC. In PLC, that data is compute with given data and generate new data which is send to VFD. So motor is run with kiln temperature. HMI is use for visualisation for all this process and also use as input for reference data.

III. PROGRAMMING

For different PLCs has different software to make ladder programming diagram and simulate with it. The programming device is used to enter the required programme into the memory of the processor. The programme is developed in the programming device and then transferred to the memory unit of the PLC.

DVP-14SS2 is **DELTA PLC** so for DELTA PLC programming software is **Delta WPLSoft software**. WPLSoft software for make whole programme in Ladder Diagram. For transfer that programme in PLC memory, RS-232 cable use also cable use for communication between my PC and PLC.

Figure 2 Programing in Delta WPLSoft



HMI is includes any device or software that allows you to interact with a machine. HMIs also translate data from industrial control systems into human-readable visual representations of the systems. Here HMI is use for visualization representation of conveyor belt panel. For visualization of process we need HMI device or Software so **Kinco HMIware software** is for visualisation of programing in screen.

Figure 3 Kinco HMIware software



Software design of the system is composed of two parts: PLC program design and the programmes for communication of PLC with Drives. In PLC program, there was program about speed control of motor with temperature changes. In Communication of PLC with Drives, it use for communication between PLC and VFD for read/write data.

Figure 4 programming of motor speed control with temperature change

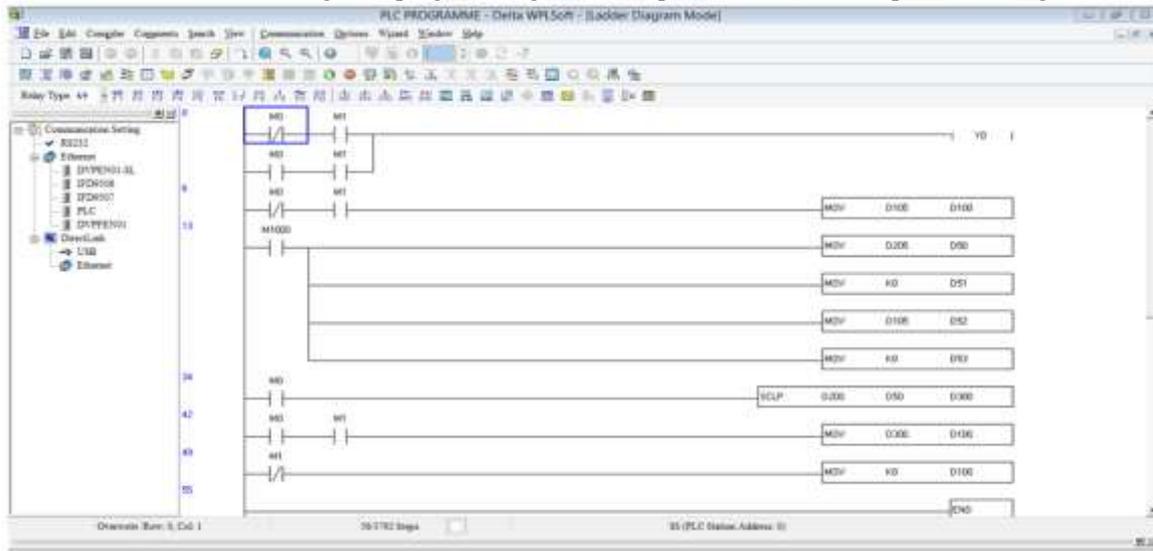


Figure 5 Communication programme for PLC read from VDF

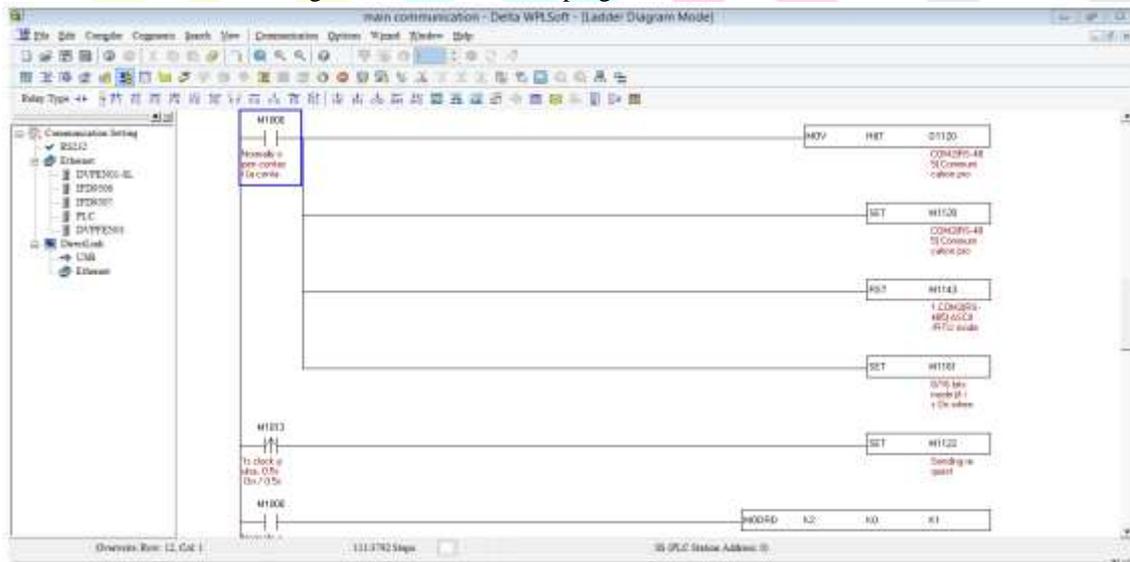


Figure 6 communication programme for PLC write into VFD

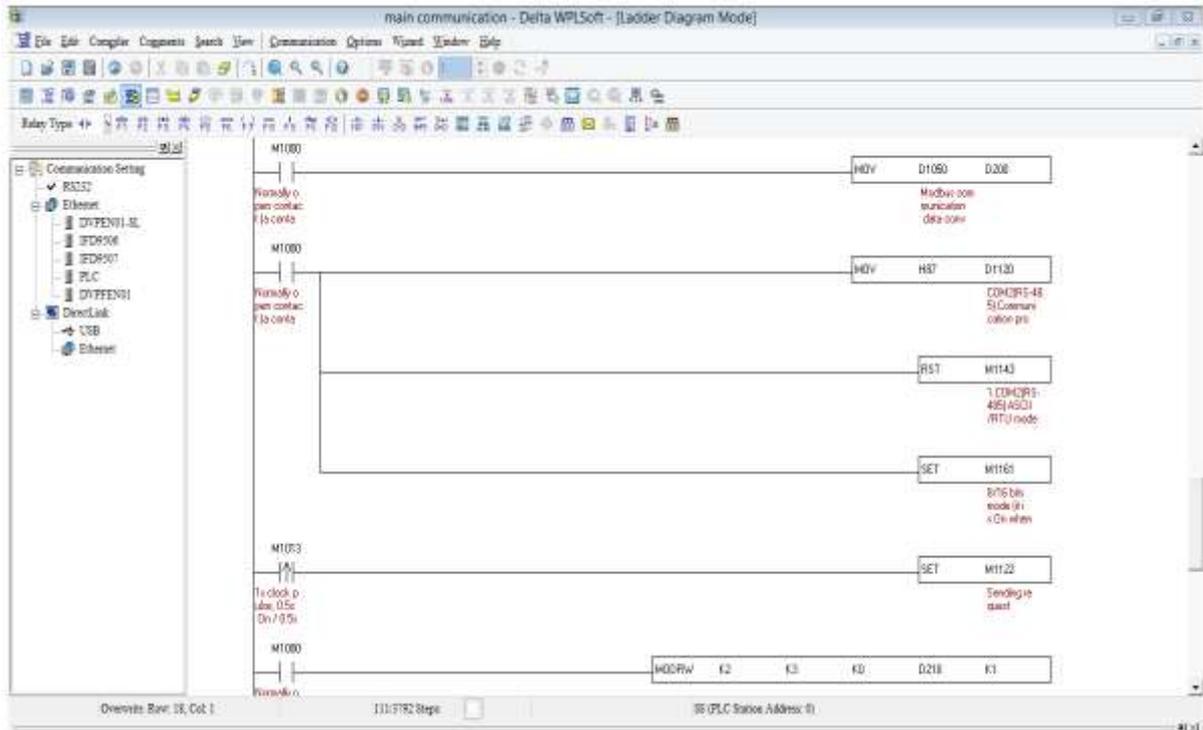
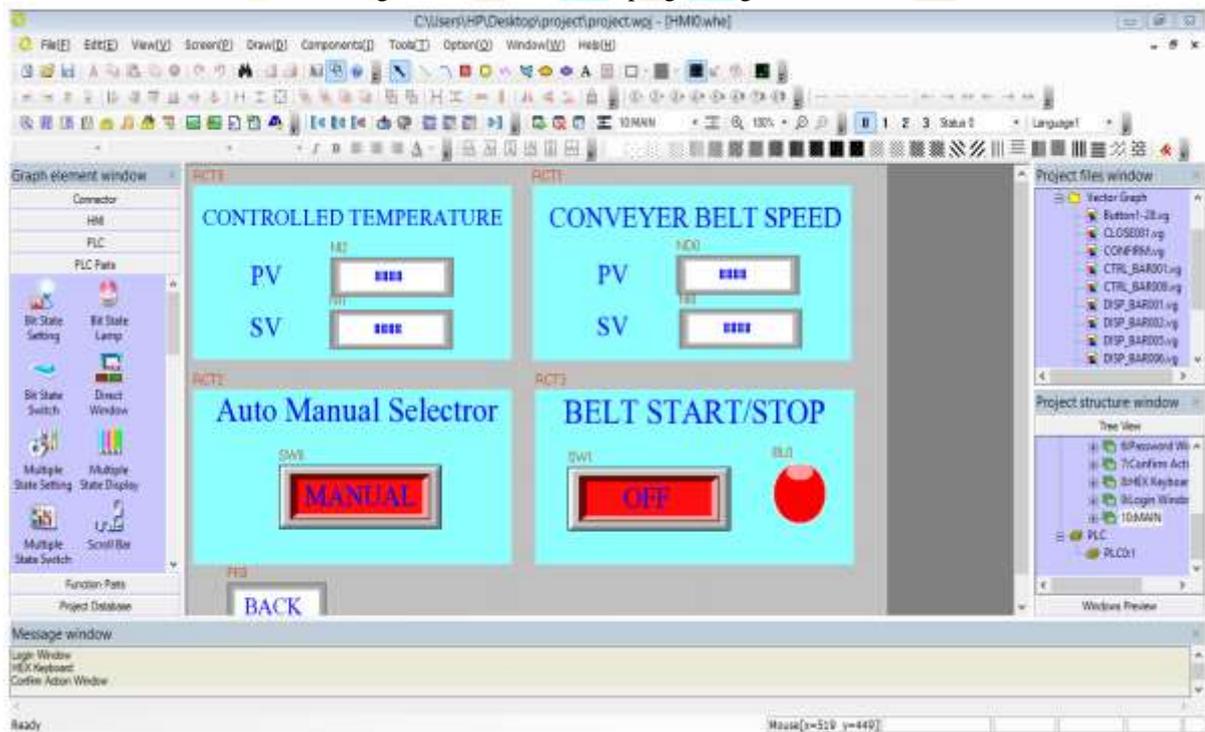


Figure 7 Visualisation of programming in screen.



IV. CONCLUSION

In this paper, the interfacing of AC Motors with DELTA DVP-14SS2 PLC, VFD and HMI is successfully done. The paper represents how to control the speed of Conveyor belt in kiln with Temperature changes. Manual setting of speed is also available so that we can set the speed as per requirement of our task. When Automatic mode is turned on at that time speed of conveyor belt changes with temperature with the help of thermocouple sensors and efficient operation is achieved. When we turn off this mode Belt speed again goes to same as its set value in Drives. After completion of the design, simulations are made in the software of Delta WPLSoft. The simulation results show that system function meets the design requirements effectively.

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