Design Control of Factory Conveyor System

By Siemens S7 V15.1 WinCC RT Professional

Introduction:

The concept here is to program controls for the operation of factory conveyor system and a tracking system for packets or products with RFID sensor in a factory. I start with structuring the PLC tags using Struct and UDT to organize the PLC tags like Input, Output, and system parameters so that it will be easy for any person to understand the program. My job is to write a program that operates the conveyor and controls the Analog devices and create a data base of the packets that are coming in the factory. I have also designed an HMI that will allow the operators to interact easily and effectively with system.

Project Description:

The above-mentioned project is divided into two sub-sections one is programming of PLC and other is designing of an HMI screen for easy and effective interaction. Here we will discuss programming section first. In this section I have programmed my logics in three different languages and they are LAD, FBD, and SCL and all these languages provide same result. Below I am describing main organizational block (main OB) which is a medium of interaction between CPU and all the program blocks.

❖ Main organization block (main OB) consists of all functions and function blocks they are:

1) Program language selection: - In this I have programmed the logic such that if in the range of 1 to 3 value is chosen by energising "LAD_Lang bit", "FDB_Lang bit", and "SCL_Lang bit" then in "Program_Lang bit" the values from above-mentioned range is moved and desired language will activate. If the value moved in "Program_Lang bit" is out of the above-mentioned range then by default Ladder (LAD) language will be activated.

2) Conveyor logic program: - It is a function block and consists of four different sections and they are as follows:

2.1) Read block: - It is a function in which the tags of data block are read from PLC tags as an input for PLC and the purpose of this block is to simply organize the tags in structured way.

2.2) Conveyor logic block: - This block is a function block where I have programmed the logic for control panel of conveyor system such as start, stop, E-stop, speed control of motor of conveyor via potentiometer, direction control of conveyor (forward and reverse direction), light indication for forward and reverse direction, and stack light indication (red light for error, green light for working condition, and orange light for maintenance of conveyor and Analog devices). In this function block there is one more function block "Logic for RFID tags and read/write information from RFID tags" and this block contains time logic for RFID (current time as well as write current time if not correct), buffer logic in which I have programmed my logic such that if "start_loggibg bit" is energised then we can check the validity of the tags i.e. the tag should not be already registered and should not be empty or has some information and also create data base of the packets like which packets has entered inside the factory and at what time so that we can track the packets location. In my logic if we want to clear the information in the tag, we can do that by energising "Clear_Buffer bit".

2.3) Error in Conveyor system: - It is also a function block which includes four different error conditions like error due to time delay of packets, error due to overspeed of conveyor motor, error due to overweight of packets, and common error.

2.4) Alarm Conditions in Conveyor system: - This function block also includes four different alarm conditions which is Alarm due to time delay, overspeed of motor, overweight of packets, and emergency stop.

2.5) Write: - It is a function in which the PLC tags are write from the tags of data block as an output for PLC and the purpose of this block is to simply organize the tags in structured way.

❖ For designing an HMI, I choose WinCC RT Professional (HMI screen) in which I have create four different screens with navigation i.e. any screen can be selected any time from the previous screen and also exit app switch which will stop runtime of HMI.
The four different screens are:

1. **System Control Panel** - Show program language, alarm indicators, important process values, high-level system controls (like a Start, Stop, and E-Stop button), direction control indication for conveyor motor (forward and reverse), and Screen navigation buttons.

2. **System Configuration** - Give the Operator controls over all devices to include manual setpoints for Analog devices. Also display the status / values of inputs signals. You may also want to show alarm indicators (not notification bits) for any devices that may be inhibited.

3. **Alarm Management** - Show alarm history, alarm reset and silence buttons, and indicators which show the presence of alarm bits (just notifications).

4. **Conveyor Overview** - Show a graphical representation of our system with relevant process values appearing at their points of collection. You can decide where exactly those may be when not clear.

Conclusion:

As per the required specification I have programmed the control of factory conveyor system in three different languages (LAD, FBD, and SCL) on Siemens S7 V 15.1 TIA portal. I have also designed the HMI system on PC system (WinCC RT Professional) for the ease of operator to visualize and understand the connection and how the conveyor system is operating, so that the operator can implement the same on real system. Finally, my factory conveyor system was tested and it runs successfully.