Selmo

Analysis Process Sorter

This document describes the implementation of a demo plant using the Selmo method and is divided into five main areas:

1. Structuring the system:
   The plant is called **a "plant"** and is divided into one or more hardware zones **according to its safety requirements**. The control sequences are mapped in separate sequences to ensure clear and structured process modeling.

2. Activity analysis:
   The basic position of the machine defines the initial situation for the automatic sequence, which is activated by a defined start signal. Moving components, such as cylinders or motors, are monitored by sensors in order to precisely control the process steps.

3. Technology analysis:
   The essential technical components are explained, including **actuators, sensors, drives and operating elements** that are necessary for controlling the plant.

4. Functional analysis:
   The control of the movement sequences is described in detail. The interactions between the individual components and their monitoring by sensors and control logic are considered.

5. Process modeling in Selmo Studio:
   For implementation in Selmo Studio, it is recommended to use the preparatory tutorials in the **Selmo Knowledge Base**. In addition, tips are given on the structured modeling of the demo system in the Selmo Studio as well as on the optimal use of the Selmo functionalities.

For more information on the Selmo analysis process, visit our Knowledge Base.

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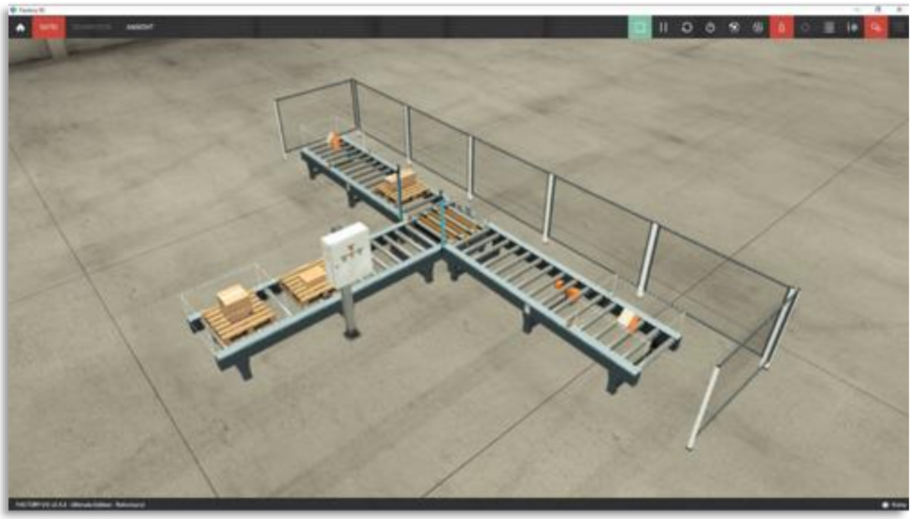
1. Structuring the system



The **structuring of the plant** is carried out according to Selmo's principles, whereby the stations and processes are divided into logical units (hardware zones and sequences).

The structure of the system is divided as follows:

Plant: The entire sorter is called a "plant", which includes the complete plant.

Hardware Zone: The sorter is modeled as a hardware zone, as the entire plant only covers one protection area. Therefore, there is no need to implement multiple independent hardware zones.

Sequence: The process of the sorter is modeled in 4 independent sequences. There is a process for the feeding, one for the transfer unit and one each for the removal of the parcels on the left and right.

The sequence of the sorting system is divided into four sequences that represent the entire sorting process:

HWZ-1:

- **Sequence 1: Loading Conveyor:** Provision and transport of the pallet to the transfer unit.
- **Sequence 2: Transfer unit:** Detection and sorting of the pallet.
- **Sequence 3: Unloading Conveyor left:** Removal of a large package by means of a left conveyor belt.

- **Sequence 4: Unloading Conveyor right:** Removal of a small package by means of a left conveyor belt.

2. Activity analysis

An essential part of the process analysis is the definition of the **home position**, which ensures that all modules are correctly positioned and ready for operation. The basic position of the plant is defined as follows:

Sensors B1 to B9 monitor that no parcel is on the sorting line.

The clear definition of the basic position is essential, as it forms the basis for the safe start of the system. Only when the basic position has been clearly defined can the actual **automatic process** be described and implemented.

The automatic sequence of the system can be started by pressing the S1 button. After starting the system, the B1 sensor monitors whether a package is present. This package is then transported to the B3 and B4 height sensors, which filter whether it is a large or small package. Then the Transver Conveyor M2 is switched on, which transports the parcels to the Pallet Sensor B2. Based on the decision of the height sensors B3 and B4, it is then decided whether the right transport conveyor M5 or the left transport conveyor M4 should be started. After the pallet has been ejected, the respective conveyor belt M6 or M7 is started and transports the pallet to the respective remover B7 or B8. This process is repeated until the stop button S2 is pressed.

3. Technology analysis

Engine:

The components are each driven by electric motors, which are optimally adapted to their speed and power via gearboxes. Drum drives are often used in which the motor is integrated directly into the drive drum to save space. These are switched on and off via the individual outputs Mxx. The motors have no speed control or operating status monitoring.

Start-Button:

The start button is used to start the process. It is configured as a normally open contact, i.e. in idle mode, the voltage to the controller is interrupted and logic "0" is generated at the corresponding input. When the button is pressed, logic "1" is generated by passing on the voltage.

Stop Keys:

The stop button is used to interrupt the process. It is configured as a normally open contact, i.e. in idle mode, the voltage to the controller is interrupted and logic "0" is generated at the corresponding input. When the button is pressed, logic "1" is generated by passing on the voltage.

Sensors:

The sensors are proximity switches that detect objects without touching them. They usually work with magnetic, capacitive, inductive or optical principles to detect the presence of an object in its detection area.

Light barrier:

The photoelectric sensor is an optoelectronic sensor that detects objects by monitoring a beam of light that travels from a transmitter to a receiver. If the light beam is interrupted or reflected by a part, the sensor registers the presence of the object.

LED:

The LED is an electronic component that converts electrical energy into light. The abbreviation LED comes from the English "Light Emitting Diode". The LED´s are used to illuminate the buttons.

Emergency Stop Button:

The emergency stop button is a safety mechanism installed in the device to immediately stop operation in dangerous situations, thus preventing injury or damage. By pressing the emergency stop button, the elements are shut down and the process is interrupted. It is configured as an NC, i.e. in idle mode the voltage is passed on to the controller and logic "1" is created at the corresponding input. When the button is pressed, logic "0" is created by interrupting the voltage.

4. Functional analysis

This is followed by the functional analysis, in which the operation of the individual components and stations as well as their control requirements are examined in detail. The aim is to define the necessary functions in order to implement the previously developed process efficiently and precisely.

The sorter model is a sorting system that sorts the parcels according to size and transports them accordingly to the right or left for picking.

Feed:

The pallets with the packages are transported via an M1 conveyor belt to the sensors for height determination B2. If the position on the transfer unit B5 is free, the pallets are moved to it via the M2 motor. If the transfer unit is not free, stop at B1 and wait until the B5 sensor is not activated.

Transfer and altimetry:

When the pallet has been detected at B2, the B3 and B4 height sensors detect whether it is a small or large package and the pallet is transported to the right or left to the appropriate outfeed conveyor. Either the M4 or M5 engine is started and waited until the pallet has been detected by the B6 or B8 light barriers.

Transport:

Once the pallet has been detected at the B6 or B8 input sensors, the corresponding M6 or M7 conveyor is started and the pallet is transported to the B7 or B9 output sensor.

Connection:

- The start button (S1) and the stop button (S2) are wired as normally open contacts and deliver a 0 signal when not actuated.
- The sensors (B1-B9) provide a 1 signal when the parts are detected.
- The emergency stop button (S3) is wired as an NC and provides a 1 signal when not actuated.

Ein-/Ausgangsbelegung

Die Ein- und Ausgänge des Modells sind wie folgt belegt (die Bezeichnung Ein- bzw. Ausgang bezieht sich dabei jeweils auf die angeschlossene Steuerung):

Eingang Nr.	Factory IO	PLC-Variablenname		Beschreibung
1	S1	I_Start	:BOOL;	S1 Start
2	S2	I_Stop	:BOOL;	S2 Stopp
3	S3	I_Estop	:BOOL;	S3 Not-Aus
4	B1	I_Pallet_Present	:BOOL;	B1 Palette vorhanden
5	B2	I_Pallet_Sensor	:BOOL;	B2 Paletten Sensor
6	B3	I_Low_Sensor	:BOOL;	B3 Sensor niedrig
7	B4	I_High_Sensor	:BOOL;	B4 Sensor hoch
8	B5	I_Part_on_Transferunit	:BOOL;	B5 Teil auf Transfereinheit
9	B6	I_Left_Entry	:BOOL;	B6 Links Eingang Sensor
10	B7	I_Left_Exit	:BOOL;	B7 Links Ausgang Sensor
11	B8	I_Right_Entry	:BOOL;	B8 Rechts Eingang Sensor
12	B9	I_Right_Exit	:BOOL;	B9 Rechts Ausgang Sensor

Ausgang Nr.	Factory IO	PLC-Variablenname		Beschreibung
1	M1	O_Conveyor_Entry_ON	:BOOL;	M1 Förderer Eingang EIN
2	M2	O_Conveyor_Transfer_forw_ON	:BOOL;	M2 Transfereinheit vor. EIN
3	M3	O_Conveyor_Transfer_backw_ON	:BOOL;	M3 Transfereinheit rück. EIN
4	M4	O_Conveyor_Transfer_left_ON	:BOOL;	M4 Transfereinheit links EIN
5	M5	O_Conveyor_Transfer_right_ON	:BOOL;	M5 Transfereinheit rechts EIN
6	M6	O_Conveyor_left_ON	:BOOL;	M6 Förderer links EIN
7	M7	O_Conveyor_right_ON	:BOOL;	M7 Förderer rechts EIN
8	L1	O_Start_LED	:BOOL;	L1 Start-LED
9	L2	O_Stop_LED	:BOOL;	L2 Stopp-LED

5.Process Modeling in Selmo Studio

Relevant tutorials for the model are presented in the next chapter. To get an in-depth insight into the Selmo Studio, you can take the course "Sequence Logic Modelling - The New Way of PLC Programming - Start Now!". These tutorials will support you in practical application and deepen your understanding of working with the Selmo Studio.

To be able to carry out the course, all you have to do is click on the following link and book the course for free.

Link: Sequence Logic Modelling - The new way of PLC programming - Start now!

For a better overview and detailed analysis, the process model should be viewed directly in Selmo Studio, where the logic layer and the system layer are fully visible and comprehensible.

Before you move on to the practical implementation, you should also look at the instructions in the help center. This documentation will provide you with important basics and helpful tips for working in the Selmo Studio.

After reviewing the documentation, you can test the downloaded process model in real time. You can start the simulation of the plant and check the interaction between the process model and the digital twin. Use the created document as an aid to implement what you have learned independently in Selmo Studio.

Good luck with the practical application!