Häme University of Applied Science (HAMK)

A report on **"Work 02 - Conveyor Control"**

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by

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Introduction

This report describes the design, how the implementation done by our group , and operation of a motor control and sorting system using programmable logic controllers (PLC). Actually, the system automates the process of sorting plastic and metal items based on sensor inputs, utilizing solenoid to direct materials step by step. Besides, the system includes wastage management and light signaling to show several conditions during operation. We already created a HMI with live data records. The project was carried out as part of a group assignment and add the functionality and fault handling requirements outlined in the project specifications.

System Description

The system describes multiples subsystem, each responsible for given tasks. The main functionalities include such as motor control, edge detection for sensor inputs, sorting plastic and metal items, wastage management, and light signaling.

Motor Control

The motor control functionality is responsible for starting and stopping the two motors (M1 and M2) simultaneously.
Start Condition: The motor starts based on a trigger from either the physical start button (GVL.bStart_B1) or a global start signal (GVL.start).
Stop Condition: The motor stops upon receiving a stop signal from either a physical stop button (GVL.bStop_B2) or a global stop signal (GVL.STOP).

Edge Detection

Rising edge detection is used to identify transitions from low to high in the signal levels from sensors (bs1 to bs5). These edge detections are critical to triggering the sorter system and managing wastage.
A specific trigger function is employed for each sensor, ensuring that the system responds accurately to sensor inputs.

Plastic Sorter Control

The system uses bs1 sensor to detect plastic items. Upon detection, if the plastic item count (P_COUNT) is below a specified limit (P_LIMIT), the system activates the solenoid (GVL.bA1) to sort the plastic item.
A timer (TimerP01) is used to control the duration for which the solenoid is open, ensuring proper handling of each item.

Metal Sorter Control

When both bs1 and bs2 sensors detect an item, the system identifies it as metal and activates the corresponding solenoid (GVL.bA2).
The metal item is counted, and the solenoid remains open for a specific duration controlled by a timer (bA2Timer).

Wastage Management

The system manages waste through detection by the bs4 sensor. If no valid final product is detected by bs5, the item is considered waste.
If the item is determined to be waste, the solenoid (GVL.bA3) is activated to handle it, whileboth sensors (bs4 and bs5) are reset after the operation.

A timer ensures the solenoid is only open for the necessary period to prevent unnecessaryenergy use.

Light Signaling

A blinking light is used to indicate the detection of waste items. The light turns on when the wastage is identified and turns off after a delay.

Functionality Details

Motor Control

The motor is controlled using logical conditions:

Start: When either the start button (GVL.bStart_B1) or the global start signal (GVL.start) isactive, both motors are activated (GVL.bMotor_M1 and GVL.bMotor_M2).

Stop: When either the stop button (GVL.bStop_B2) or the global stop signal (GVL.STOP) is pressed, the motors are deactivated, and the system is halted.

Edge Detection

Rising edge detection on sensors (bs1 to bs5) ensures the system reacts only when thesignal transitions from low to high.
This prevents false triggers from random signal fluctuations.

Plastic Sorter Control

Plastic detection is handled by the bs1 sensor. If plastic is detected and the count is below P_LIMIT, the plastic sorting solenoid is activated.
A delay timer (TimerP01) controls the solenoid activation to ensure proper sorting.The plastic item count is incremented with each successful sorting operation.

Metal Sorter Control

When both bs1 and bs2 detect an item, it is sorted as metal, and the metal sorter solenoid is activated.
Timers are used to control solenoid activation, ensuring the system handles each item correctly and avoids mis-sorting.
The metal item count is updated after each successful sort.

Wastage Management

When the bs4 sensor detects an item that does not qualify as a valid final product, it isconsidered waste.
The waste sorting solenoid is activated and a timer ensures the solenoid is active only forthe required period.
The waste count is incremented after each waste item is processed.

Testing and Result

Plastic Sorting

Test: Items passed through bs1 but not bs2 were sorted as plastic.

Result: The solenoid activated correctly, and plastic items were sorted within the specifiedlimits.

Metal Sorting

Test: Items passed through both bs1 and bs2 were sorted as metal.

Result: The solenoid was activated, and metal items were counted correctly.

Wastage Management

Test: Items detected by bs4 but not recognized as final products were processed as waste.Result: Waste was correctly sorted, and the waste count incremented.

Light Signaling

Test: The light system responded to both final product sorting and waste detection.

Result: The light blinked for waste and stayed on briefly for final products.

Conclusion

The motor control and sorting system effectively incorporates all necessary features, such as motor control, edge detection, plastic and metal item sorting, waste management, and light signaling. Extensive testing has been carried out to guarantee dependable performance and efficient handling of faults with HMI display too. The project illustrates the successful application of PLC systems inautomation settings for sorting and waste management purposes.