

2225871

by Hugo Davies

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Course: HNC Electrical and Electronic Engineering.
Module: SGEE4004 Programmable Logic Controllers.

Assignment: 1. Pick and Place Robot.

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Good Structure

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1. Work Plan for Lifelong Learning

Why have you not planned your work?

2. Research

Research was carried out into three different types of PLC from Allen Bradley. The different PLCs are called MicroLogix, CompactLogix and ControlLogix. (Instrumentation Tools, ND) Correctly cited

MicroLogix – This tends to be used for smaller control systems and is used where less i/o's are required compared to the other two. (Instrumentation Tools, ND)

CompactLogix – This PLC is often used for medium control systems and is typically used in machine control and packing system. (Instrumentation Tools, ND)

ControlLogix – The ControlLogix PLC is typically used for large scale projects such as batching and motion control systems. (Instrumentation Tools, ND)

Comparison table

incomplete

Test	MicroLogix	CompactLogix	ControlLogix
Digital I/O Points	32		
Analogue I/O Points	6		
Cost			
Software	RSLogix 500	RSLogix 5000	RSLogix 5000

3. Hardware Investigation and I/O List

This is a good list

In the table below shows the I/O list

%I0.0	UP sensor
%I0.1	DOWN sensor
%I0.2	OPEN sensor
%I0.3	CLOSED sensor
%I0.4	IN sensor
%I0.5	OUT sensor
%I0.6	RIGHT sensor
%I0.7	LEFT sensor
%I1.0	X10 pushbutton
%I1.1	X11 pushbutton
%I1.2	X12 pushbutton
%I1.3	X13 toggle switch
%I1.4	X14 toggle switch
%I1.5	OBJECT sensor
%Q0.0	DOWN solenoid
%Q0.1	UP solenoid
%Q0.2	CLOSE solenoid
%Q0.3	OPEN solenoid
%Q0.4	OUT solenoid
%Q0.5	IN solenoid
%Q0.6	LEFT solenoid
%Q0.7	RIGHT solenoid

where is your explanation of the hardware

4. Program Design and Explanation

Write in the third person

Memory elements were used as a substitute for the actual inputs so that we could simulate the program before it was put forward to the actual robot. This was to ensure the program didn't have any errors and could be efficiently used for the final project.

5. Simulation Testing

Below the testing table can be found.

Where is your evidence?

Task	Expected Result	Actual Result	Pass / Fail	Evidence
Simulate Mode	When in simulate mode, the PLC will be able to run the automatic sequence and use the manual mode without being connected to an actual robot.	The simulate mode work and able to use all of the features of the PLC without being connected to an actual machine.	Pass	
Start Button	When pressed the PLC will hold a memory bit and start the automatic sequence 2 seconds later	When pressed the PLC held a memory bit and the sequence started after the 2 second timer had elapsed.	Pass	
Manual UP	When being simulated, when the manual Up button is pressed the solenoid LED will be illuminated until it is met with the sensor.	When the up button is pressed the solenoid light lit up until the sensor light illuminates to the say the simulation timer has elapsed.	Pass	
Manual Down	When being simulated, when the manual Down button is pressed the solenoid LED will be illuminated until it is met with the sensor.	When the Down button is pressed the solenoid light lit up until the sensor light illuminates to the say the simulation timer has elapsed.	Pass	
Manual In	When being simulated, when the manual in button is pressed the solenoid LED will be illuminated until it is met with the sensor.	When the In button is pressed the solenoid light lit up until the sensor light illuminates to the say the simulation timer has elapsed.	Pass	
Manual Out	When being simulated, when the manual Out button is pressed the solenoid LED will be illuminated until it is met with the sensor.	When the Out button is pressed the solenoid light lit up until the sensor light illuminates to the say the simulation timer has elapsed.	Pass	
Manual Left	When being simulated, when the manual Left button is pressed the solenoid LED will be illuminated until it is met with the sensor.	When the Left button is pressed the solenoid light lit up until the sensor light illuminates to the say the simulation timer has elapsed.	Pass	
Manual Right	When being simulated, when the manual Right button is pressed the solenoid LED will be illuminated until it is met with the sensor.	When the Right button is pressed the solenoid light lit up until the sensor light illuminates to the say the simulation timer has elapsed.	Pass	

Manual Open	When being simulated, when the manual Open button is pressed the solenoid LED will be illuminated until it is met with the sensor.	When the Open button is pressed the solenoid light lit up until the sensor light illuminates to the say the simulation timer has elapsed.	Pass	
Manual Close	When being simulated, when the manual Close button is pressed the solenoid LED will be illuminated until it is met with the sensor.	When the Close button is pressed the solenoid light lit up until the sensor light illuminates to the say the simulation timer has elapsed.	Pass	
Pause Button	When in Automatic mode the sequence should stop when the pause button is pressed	The sequenced stopped as expected when the pause button was pressed	Pass	
Continue button	When Paused in Automatic mode the sequence should continue when the continue button is pressed.	When the continue button was pressed the sequence carried on from the step it was on	Pass	
Stage 1	Upon start-up it should simulate the sequence and illuminate the solenoid and sensor lights. As it moves into the home position.	When being simulated in automatic mode the sequence began when the start button was pressed. The solenoid lights lit up when moving to show that it was simulating the sequence in order of how it would move into the home position.	Pass	
Stage 2	It should move from the home position, pick up from zone 3 and drop off at zone 4	When being simulated it would show the step number and the solenoids and sensors would light up and show that the automatic sequence is being followed.	Pass	
Stage 3	It should pick up from zone 2 and drop off at zone 3	When being simulated in auto mode the step number would update with each step of the sequence and the solenoid and sensor light were matching up with what it would do if it was connected with an actual pick and place machine	Pass	

Stage 4	It should pick up from zone 1 and drop off at zone 2 then return to the home position.	When it was being simulated the solenoid and sensor lights were showing the simulation was working as the machine would have done if it was actually connected and finally finished in the home position ready for the next cycle.	Pass	
Auto Button	Will change from manual mode to auto mode with the press of the button	Switched from manual mode to auto mode ready for the sequence to begin	Pass	
Manual button	Will change from auto mode to manual mode with the press of the button	Switched from auto mode to manual mode so the manual HMI request buttons will work.	Pass	
Step counter	Should count the steps taken in the automatic sequence	Whilst testing the 4 stages of the automatic sequence it was counting each step correctly	Pass	

6. Practical Testing

Where is your evidence?

Task	Expected Result	Actual Result	Pass/Fail	Evidence
Press Start button	PLC Holds memory of start and begins after 2 seconds	PLC didn't hold memory, button required to be held for 2 seconds	Fail	
Manual Up	When button held activates solenoid to move in the UP direction until sensor is met	The button was held, and the robot moved in the UP direction until the sensor was met.	Pass	
Manual Down	When button held activates solenoid to move in the DOWN direction until sensor is met	The button was held, and the robot moved in the DOWN direction until the sensor was met.	Pass	
Manual In	When button held activates solenoid to move in the IN direction until sensor is met	The button was held, and the robot moved in the IN direction until the sensor was met.	Pass	
Manual Out	When button held activates solenoid to move in the OUT direction until sensor is met	The button was held, and the robot moved in the OUT direction until the sensor was met.	Pass	
Manual Left	When button held activates solenoid to move in the LEFT direction until sensor is met	The button was held, and the robot moved in the LEFT direction until the sensor was met.	Pass	
Manual Right	When button held activates solenoid to move in the RIGHT direction until sensor is met	The button was held, and the robot moved in the RIGHT direction until the sensor was met.	Pass	
Manual Open	When button held activates solenoid to move in the OPEN direction until sensor is met	The button was held, and the robot Claw moved in the OPEN direction until the sensor was met.	Pass	
Manual Close	When button held activates solenoid to move in the CLOSE direction until sensor is met	The button was held, and the robot Claw moved in the CLOSE direction until the sensor was met.	Pass	
Pause Button	When in Automatic mode the sequence should stop when the pause button is pressed	When the pause button was pressed the sequence stopped.	Pass	

Continue button	When Paused in Automatic mode the sequence should continue when the continue button is pressed.	When the continue button was pressed the automatic sequence carried on from where it was paused from	Pass	
Stage 1	Upon start-up it should start the sequence and illuminate the solenoid and sensor lights. As it moves into the home position.	When it started up it moved into the home position showing the solenoid and sensor lights on the HMI	Pass	
Stage 2	It should move from the home position, pick up from zone 3 and drop off at zone 4	During stage 2 it picked up the roll from zone 3 and dropped it off at zone 4. It also updated the object counter on the HMI	Pass	
Stage 3	It should pick up from zone 2 and drop off at zone 3	During stage 3 it it picked up the roll from zone 2 and moved it to zone 3.	Pass	
Stage 4	It should pick up from zone 1 and drop off at zone 2 then return to the home position.	During stage 4 it picked it up from zone 1 and dropped it off at zone 2. It then moved back to the home position and updated the object counter on the HMI	Pass	
Auto Button	Will change from manual mode to auto mode with the press of the button	When pressed it moved from manual mode to auto mode and the auto light illuminated.	Pass	
Manual button	Will change from auto mode to manual mode with the press of the button	When pressed it moved from auto mode to manual mode and unlit the auto light.	Pass	
Step counter	Should count the steps taken in the automatic sequence	As it moves through the sequence it was constantly up to date.	Pass	

7. Discussion, Conclusions and Recommendations

8. Team Working

Working as a team helped produce a good outcome by being able to combine our knowledge and resources to produce a good program which enables the robot to function without errors. The program we used was Zeeshan, his program worked well with the robot but the memory for the object sensor didn't work. This was the only test that it failed on.

9. Citation List

Correct method of listing.

Instrumentation Tools, ND. TYPES OF ALLEN BRADLEY PLCS. [Online]

Available at: <https://instrumentationtools.com/types-of-allen-bradley-plc/#>

[Accessed 7th January 2023].

Rockwell Automation, nd. MicroLogix 1400 Series PLC Systems. [Online]

Available at: <https://www.rockwellautomation.com/en-gb/products/hardware/allen-bradley/programmable-controllers/micro-controllers/micrologix-family/micrologix-1400-controllers.html>

[Accessed 7th January 2023].

Rockwell Automation, nd. CompactLogix 5480 Controllers. [Online]

Available at: <https://www.rockwellautomation.com/en-gb/products/hardware/allen-bradley/programmable-controllers/small-controllers/compactlogix-family/compactlogix-5480-controllers.html>

[Accessed 7th January 2023].

Rockwell Automation, nd.. [Online]

Available at:

[Accessed 7th January 2023].

Where is your ladder code?

Good SCL program code but where is your SFC chart?

10. Appendix

```
IF ("Auto Mode" = 0) OR ("FirstScan" = 1) THEN
  "Step" := 0;
  "Next_Step" := 0;
END_IF;

CASE "Step" OF
  0:
    "UP Auto request" := 1;
    IF "UP sensor" = 1 THEN
      "Next_Step" := 1;
      "UP Auto request" := 0;
    END_IF;

  1:
    //Step 1 is the robot moving to the home position
    "LEFT Auto request" := 1;
    "OUT Auto request" := 1;
    "OPEN Auto request" := 1;
    IF ("LEFT sensor" = 1) AND ("OUT sensor" = 1) AND ("OPEN sensor" = 1) AND ("Start
Sequence" = 1) THEN
      "Next_Step" := 2;
      "LEFT Auto request" := 0;
      "OUT Auto request" := 0;
      "OPEN Auto request" := 0;
    END_IF;

  2:
    //Step 2 is the start of Stage 1 (moving from Zone 3 to 4)
    "RIGHT Auto request" := 1;
    IF "RIGHT sensor" = 1 THEN
      "Next_Step" := 3;
      "RIGHT Auto request" := 0;
    END_IF;

  3:
    "DOWN Auto request" := 1;
    IF "DOWN sensor" = 1 THEN
      "Next_Step" := 4;
      "DOWN Auto request" := 0;
    END_IF;

  4:
    //Step 4 Grabs the Object from Zone 3
    "CLOSE Auto request" := 1;
    IF "CLOSED sensor" = 1 THEN
      "Next_Step" := 5;
      "CLOSE Auto request" := 0;
    END_IF;

  5:
    "UP Auto request" := 1;
    IF "UP sensor" = 1 THEN
```

```

    "Next_Step" := 6;
    "UP Auto request" := 0;
END_IF;

6:
    "IN Auto request" := 1;
    IF "IN sensor" = 1 THEN
        "Next_Step" := 7;
        "IN Auto request" := 0;
    END_IF;

7:
    "DOWN Auto request" := 1;
    IF "DOWN sensor" = 1 THEN
        "Next_Step" := 8;
        "DOWN Auto request" := 0;
    END_IF;

8:
    //Step 8 Opens the Grabber to leave the object in zone 4
    "OPEN Auto request" := 1;
    IF "OPEN sensor" = 1 THEN
        "Next_Step" := 9;
        "OPEN Auto request" := 0;
    END_IF;

9:
    //Step 9 is the start of stage 2 (moving from Zone 4, Picking
up at Zone 2 and dropping off in Zone 3)
    "UP Auto request" := 1;
    IF "UP sensor" = 1 THEN
        "Next_Step" := 10;
        "UP Auto request" := 0;
    END_IF;

10:
    "OUT Auto request" := 1;
    IF "OUT sensor" = 1 THEN
        "Next_Step" := 11;
        "OUT Auto request" := 0;
    END_IF;

11:
    "LEFT Auto request" := 1;
    IF "LEFT sensor" = 1 THEN
        "Next_Step" := 12;
        "LEFT Auto request" := 0;
    END_IF;

12:
    "DOWN Auto request" := 1;
    IF "DOWN sensor" = 1 THEN
        "Next_Step" := 13;

```

```

    "DOWN Auto request" := 0;
END_IF;

13:                                //Step 13 Grabs the Object from Zone 2
    "CLOSE Auto request" := 1;
    IF "CLOSED sensor" = 1 THEN
        "Next_Step" := 14;
        "CLOSE Auto request" := 0;
    END_IF;

14:
    "UP Auto request" := 1;
    IF "UP sensor" = 1 THEN
        "Next_Step" := 15;
        "UP Auto request" := 0;
    END_IF;

15:
    "RIGHT Auto request" := 1;
    IF "RIGHT sensor" = 1 THEN
        "Next_Step" := 16;
        "RIGHT Auto request" := 0;
    END_IF;

16:
    "DOWN Auto request" := 1;
    IF "DOWN sensor" = 1 THEN
        "Next_Step" := 17;
        "DOWN Auto request" := 0;
    END_IF;

17:                                //Step 17 Opens the Grabber to leave the object in zone 3
    "OPEN Auto request" := 1;
    IF "OPEN sensor" = 1 THEN
        "Next_Step" := 18;
        "OPEN Auto request" := 0;
    END_IF;

18:                                //Step 18 is the start of stage 3 (moving from Zone 3, Picking
up at Zone 1 and dropping off in Zone 2)
    "UP Auto request" := 1;
    IF "UP sensor" = 1 THEN
        "Next_Step" := 19;
        "UP Auto request" := 0;
    END_IF;

19:
    "LEFT Auto request" := 1;
    IF "LEFT sensor" = 1 THEN
        "Next_Step" := 20;
        "LEFT Auto request" := 0;

```

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END_IF;

20:
  "IN Auto request" := 1;
  IF "IN sensor" = 1 THEN
    "Next_Step" := 21;
    "IN Auto request" := 0;
  END_IF;

21:
  "DOWN Auto request" := 1;
  IF "DOWN sensor" = 1 THEN
    "Next_Step" := 22;
    "DOWN Auto request" := 0;
  END_IF;

22:                                     //Step 22 Grabs the Object from Zone 1
  "CLOSE Auto request" := 1;
  IF "CLOSED sensor" = 1 THEN
    "Next_Step" := 23;
    "CLOSE Auto request" := 0;
  END_IF;

23:
  "UP Auto request" := 1;
  IF "UP sensor" = 1 THEN
    "Next_Step" := 24;
    "UP Auto request" := 0;
  END_IF;

24:
  "OUT Auto request" := 1;
  IF "OUT sensor" = 1 THEN
    "Next_Step" := 25;
    "OUT Auto request" := 0;
  END_IF;

25:
  "DOWN Auto request" := 1;
  IF "DOWN sensor" = 1 THEN
    "Next_Step" := 26;
    "DOWN Auto request" := 0;
  END_IF;

26:                                     //Step 26 Opens the Grabber to leave the object in zone 2
  "OPEN Auto request" := 1;
  IF "OPEN sensor" = 1 THEN
    "Next_Step" := 27;
    "OPEN Auto request" := 0;
  END_IF;

```

```
27:    //Step 27 Raises the robot back into the home position ready for the next sequence
      "UP Auto request" := 1;
      IF "UP sensor" = 1 THEN
        "Next_Step" := 2;
        "UP Auto request" := 0;
      END_IF;
    END_CASE;
    "Step" := "Next_Step";
```

Instructor

34/100

PAGE 1

Text Comment. you should declare it here

Text Comment. Left align your title page next time

PAGE 2



Good Structure

Report is structured exactly as stated in the assignment brief.

Text Comment. where are your page numbers?

PAGE 3

Text Comment. Why have you not planned your work?

PAGE 4



Correctly cited

Citation method conforms to Harvard standard, well done.

Text Comment. incomplete

PAGE 5

Text Comment. This is a good list

Text Comment. where is your explanation of the hardware

PAGE 6

QM

Write in the third person

Don't refer to your self as I, me, my or others as you etc. Avoid personal references. If absolutely necessary, refer to self as "the author".

PAGE 7

Text Comment. Where is your evidence?

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PAGE 10

Text Comment. Where is your evidence?

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PAGE 15

QM

Correct method of listing.

You have listed your sources correctly according to the Harvard method.

PAGE 16

Text Comment. Where is your ladder code?

Text Comment. Good SCL program code but where is your SFC chart?

PAGE 17

PAGE 18

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PAGE 20

HUGO DAVIES

34

1. ENGAGEMENT WITH LITERATURE

-  A brief research section with some evidence of reading from a limited range of sources cited and listed correctly using the Harvard method. Table of comparison is incomplete. 6/20

6

2. KNOWLEDGE AND UNDERSTANDING

-  Little knowledge and understanding demonstrated in your research findings, hardware investigation and program design explanations. A good IO list. 6/20

6

3. COGNITIVE AND INTELLECTUAL

-  Some simulation and practical test results analysis but no evidence to prove any tests were carried out. No discussion and conclusions/recommendations. 7/20

7

4. PRACTICAL APPLICATION



Good SCL program code but no SFC chart and no ladder code included. Good simulation and practical testing table with good presentation of results but no evidence supplied. 7/20

7

5. TRANSFERABLE SKILLS



Brief explanation of team working. Report is well structured. Word count not exceeded. Some sections are empty and you must learn to write in the third person. 8/20

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