

2119240

by Bryn Janes

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Course: HNC Electrical and Electronic Engineering
Module: SGEE4005 Instrumentation and Integrated Automation Systems
Assignment: 1. Instrumentation for Automation Systems *Wrong title*
Name: Bryn Janes
University number: 2119240
Date submitted: //2023 *date?*
Word count: 1550

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1. Work Plan for Lifelong Learning and Risk Assessment

The assignment will be approached by reading the brief and understanding the tasks to be done and follow the correct procedures to get the tasks done correctly, then the risk assessment will be carried out. Use the resources given such as diagrams to help complete the tasks. Begin by investigating the robotic arm and palletiser, provide technical data for the devices to confirm they are Write in the third person Once the risk assessment is completed and have the necessary data sheets, I will then begin the programming of the system.

After completing the Programming procedures and recording the results the next step is to research newer standards and devices to meet the demands of modern manufacturing. Next discuss the effects the subsystems have on environment and society and discuss maintenance and reliability of the system. Now write suitable conclusions and recommendations for improvements that could be made on the System. Figure1 shows how the Risk assessment table will work.

A good work plan

		Severity/Consequence		
		Slightly harmful (1)	Harmful (2)	Extremely harmful (3)
Likelihood	Highly unlikely (1)	Trivial risk (Score 1)	Tolerable risk (Score 2)	Moderate risk (Score 3)
	Unlikely (2)	Tolerable risk (Score 2)	Moderate risk (Score 4)	Substantial risk (Score 6)
	Likely (3)	Moderate risk (Score 3)	Substantial risk (Score 6)	Intolerable risk (Score 9)

Figure1

The Risk assessment table can be found in the Appendix as Figure 2.

These belong in the appendix

Hazard Evaluation			
Hazard Title	Thermal tank		
Description	Boiling water in the tank makes the tank hot enough to burn you		
			
HR – Risk Estimation & Evaluation			
Degree of Possible Harm	12	Possibility of Occurrence	2.5
Possibility of Avoidance	0.75	Frequency of Exposure	2.5
Hazard Rating Number	56.25	Summary Level	low risk

$$HRN = DPH \times PA \times PO \times FE$$

Hazard Mitigation			
Risk Reduction Description	Training on using the system to ensure understanding of how to keep		
	safe while working with boiling water.		
Applied Standards	IEC 62061	ISO13849-1	
HR – Risk Mitigation Evaluation			
Degree of Possible Harm	12	Possibility of Occurrence	1.5
Possibility of Avoidance	0.5	Frequency of Exposure	2.5
Hazard Rating Number	22.5	Summary Level	very low risk
HR – Possible Residual Risk & Mitigation			

Hazard Evaluation			
Hazard Title	Mechanical		
Description	High pressure hydraulics with stored energy don't have a lock on the		
	door and anyone can access it.		
			
HR – Risk Estimation & Evaluation			
Degree of Possible Harm	25	Possibility of Occurrence	1.25
Possibility of Avoidance	2.5	Frequency of Exposure	1
Hazard Rating Number	78.1	Summary Level	moderate risk

$$HRN = DPH \times PA \times PO \times FE$$

Hazard Mitigation			
Risk Reduction Description	Lock with a key that is kept by trained persons.		
Applied Standards	ISO 13849-1:1999	EN62061	
HR – Risk Mitigation Evaluation			
Degree of Possible Harm	25	Possibility of Occurrence	1
Possibility of Avoidance	2	Frequency of Exposure	1
Hazard Rating Number	50	Summary Level	low risk
HR – Possible Residual Risk & Mitigation	I		

Hazard Evaluation			
Hazard Title	Mechanical Hazards		
Description	conveyor where the origin is moving elements and potential		
	consequence is crushing of someone's fingers as the conveyor		
	moves along and your fingers could get trapped under the conveyor.		
HR – Risk Estimation & Evaluation			
Degree of Possible Harm	3	Possibility of Occurrence	2.5
Possibility of Avoidance	0.75	Frequency of Exposure	3
Hazard Rating Number	16.9	Summary Level	very low risk

$$HRN = DPH \times PA \times PO \times FE$$

Hazard Mitigation			
Risk Reduction Description	Install guards around the conveyor		
Applied Standards	IEC 62061	IEC 61508	
HR – Risk Mitigation Evaluation			
Degree of Possible Harm	3	Possibility of Occurrence	0.05
Possibility of Avoidance	0.75	Frequency of Exposure	3
Hazard Rating Number	0.33	Summary Level	negligible risk
HR – Possible Residual Risk & Mitigation			

2. Research

The integrated automation systems such as the robotic arm and conveyor need to cooperate with the safety legislation such as SIL (Safety Integrity Level) where the minimum is SIL1 where you need the integrity to avoid relatively minor incidents and the RRF is $>10<100$. For SIL2 you need the integrity to avoid more serious yet limited Write in the third person result in serious injury to one or more persons. After doing a risk assessment I believe the integrated automation system we are working on needs SIL2. Then if you needed SIL3 you would need the integrity to avoid serious incidents involving a number of fatalities and/or serious injuries (Instrumentation, 2023). There is then PL (Performance Level) which also gives you a rating a,b,c,d and e representing the average probability of dangerous failure per hour, which corresponds to your SIL rating as PL rating 'a' doesn't meet SIL1 rating, b and c are SIL1, d is SIL2, e is SIL3. Using PL is well suited for individual machines rather than large complex facilities as it works with ISO 13849-1 whereas SIL works with IEC 62061 (eaton, 2023).

EN ISO 13849-1	IEC 62061
Applicable to hydraulic, pneumatic and electromechanical systems without restriction.	Only applicable to electrical, electronic and programmable electronic systems.
Applicable to programmable electronic systems with restrictions. Only designated architectures up to PL d.	Use of EN ISO 13849 possible with mixed systems.
Calculation concept based on designated architectures	Any architecture possible.
Suitable for the safety verification of devices and all safety functions using tables.	Suitable for the safety verification of devices and all safety functions using calculations.

All equipment on the integrated automation system we are working on needs to be UKCA and CE marked and then UKCA and CE marked as a system as a whole. As all the equipment on the system we are working on is from different factories they each need a UKCA and CE marks then now they've all been put together to build this integrated automation system, the whole system needs to be marked as a package. To get the UKCA mark you need to comply by giving each product a serial number for identification and the approved body which carried out the conformity assessment procedure, the relevant legislation which the product complies (gov, 2023).

Looking at the internet security for the system, it is very secure as it doesn't allow anyone to access the system from outside the college servers other than the VPN which is secure by the lecturer. The VoT web page accessed through the internet can then only be accessed if you are on college wifi. The college then has a firewall to prevent any unwanted hackers from

Citation Needed

getting into the system, but as it is not an industrial system it is unlikely anyone will want to hack the system as there is no benefit.

3. System Overview and Operation

Looking at the CIM communications, the PLC acting as the master PLC is actually a slave PLC and has master PLCs feeding into acting as slave PLCs and using ProfiNet method which contains a GET-PUT method to move data between the PLCs. These PLCs then talk to four HMI screens used to control the palletiser system.

incomplete Need to add a diagnosis of putget here

Looking at the CIM system, it consists of sensors and actuators. There are 6 proximity detectors at each station where five of which are the binary pattern sensors and the other one will notify if there is a wagon at station. There is also a release piston which lets the pallet move on to the next station once it gets the signal that the pallet is done at that station. There are five stations along the conveyor in total. Starting with the Pneumatic station

There is then a station for the camera inspection. This camera will look at the pallet that arrives and decide what needs to be done with it next such as if there is a stamp on the pallet then it need to go to be dipped in a tank.

System diagram with M2M links are missing.

4. Health and Safety, and the Environment

Write in the third person
The regulations the CIM system does not conform to therefore to make the system safer, you could add more guarding around the conveyor and a barrier to stop people getting too close to the robot as its moving around which would help conform with PUWER.

The boiling water tank needs better covering such as a heat proof cover to conform with regulations requirement G3 in building regulations 2010.

For the hydraulics stored energy that needs a lock to comply with PSSR 2000.

These are environmental problems as if someone is hurt from these then work will be slowed and the efficiency of the system will be reduced as you are being over cautious trying not to get in the way of any of these hazards.

Line spacing should be 1.5

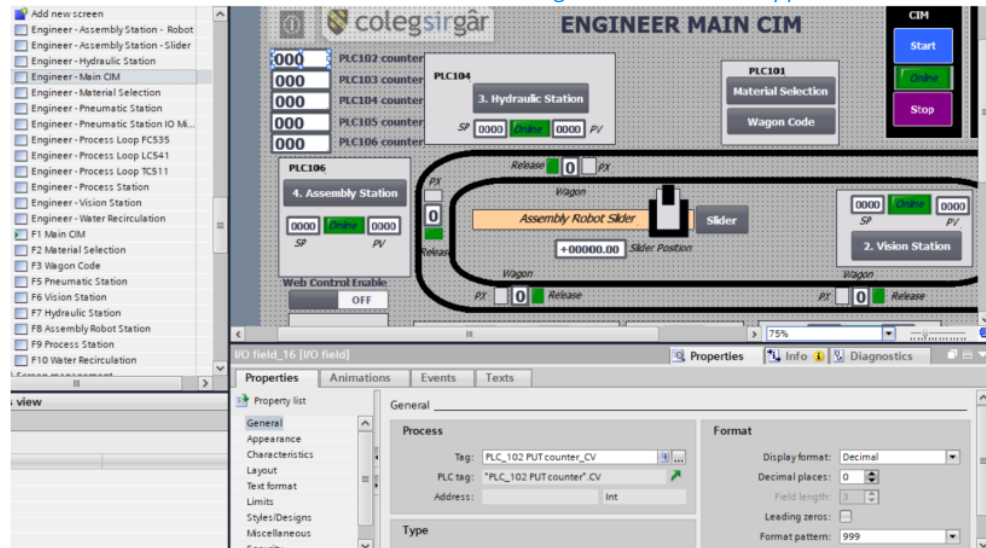
4. Maintenance, Reliability and Commercial Risk

The CIM system has maintenance and reliability requirements such as indicating to the engineer when looking for a problem that the Air is ok and the photobeam is in use through light indicators. There are also light indicators to indicate the handshaking signals sent to and from each PLC which could give the engineer an idea of what could have gone wrong. Then the pages made for the VoT HMI will have Profinet counters which will allow an engineer to keep track of the parts going around the stations which could help find a problem, there is also loop data for FC535, LC541 and TC511 which will give the engineer a good idea of what the loops are doing and could possibly see problem in the data.

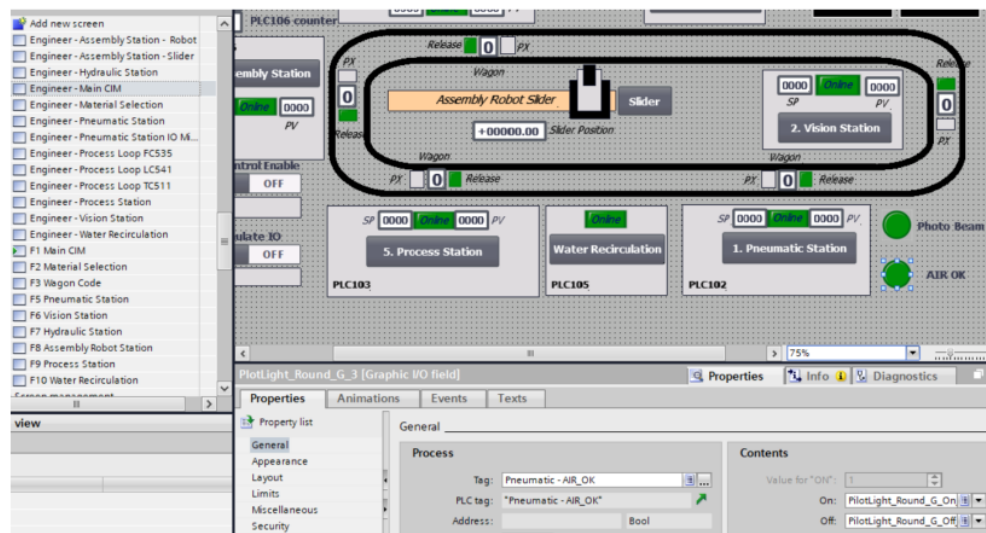
5. Complex System Design – Individual Modifications

Profinet counters for each station

These images should be in the appendix

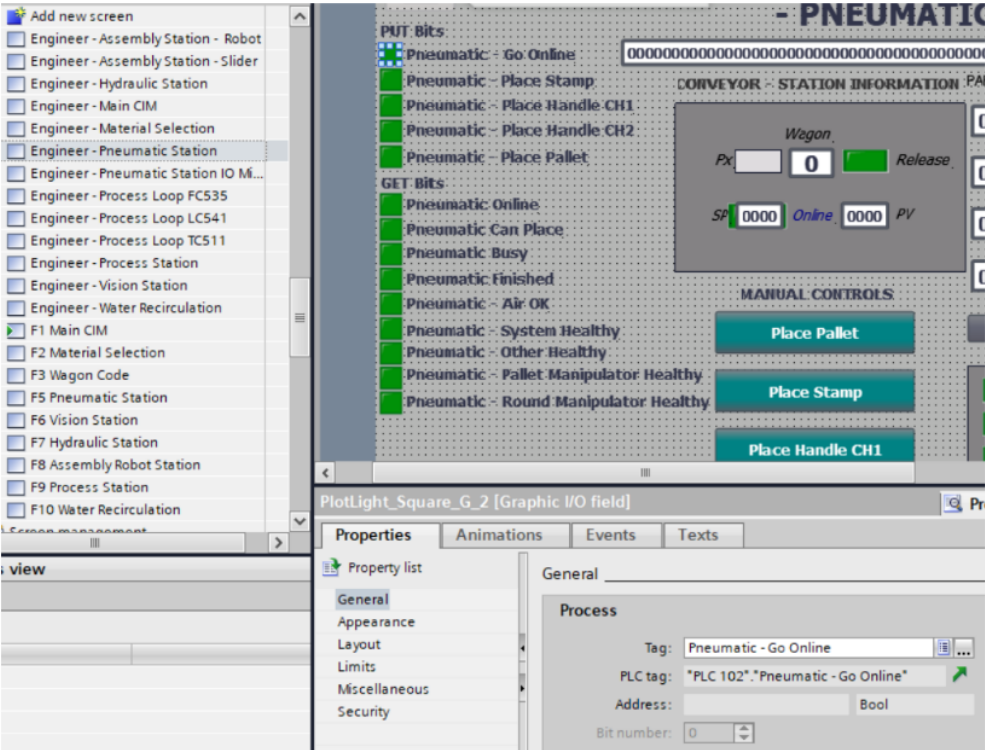


Indicators for Air OK and Photobeam and Assembly robot Slider 0-1320mm

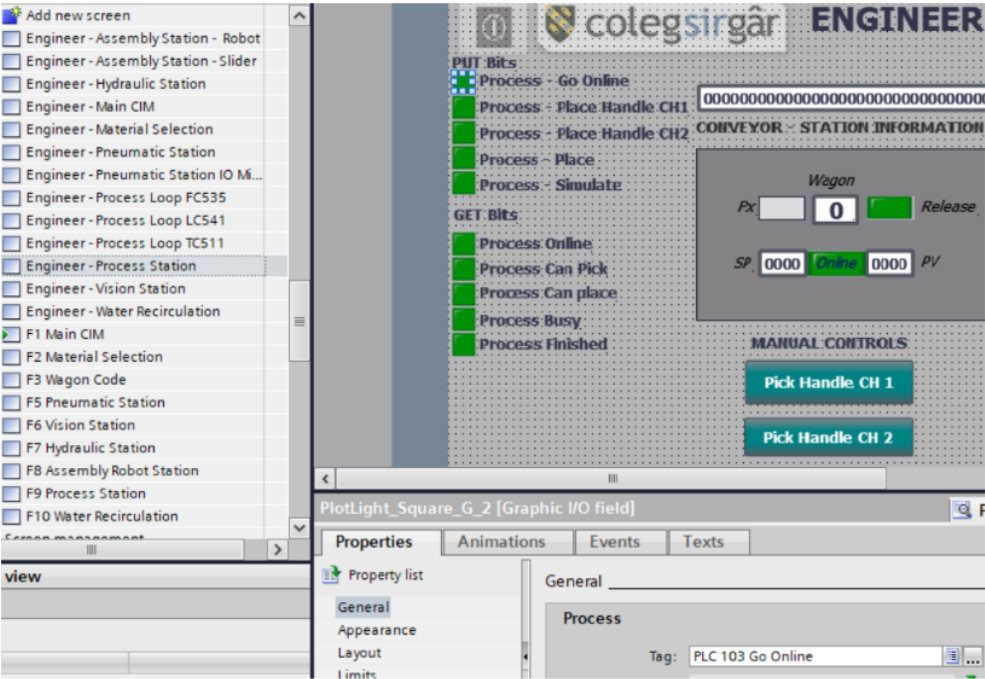


Where is your testing table?

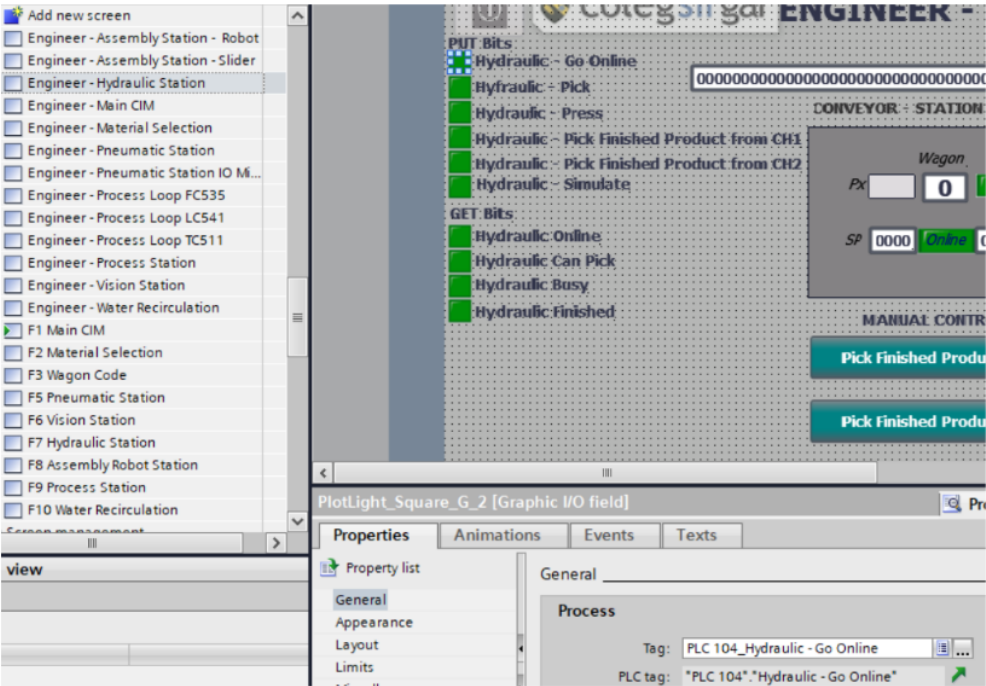
Handshaking signals sent to and from PLC102



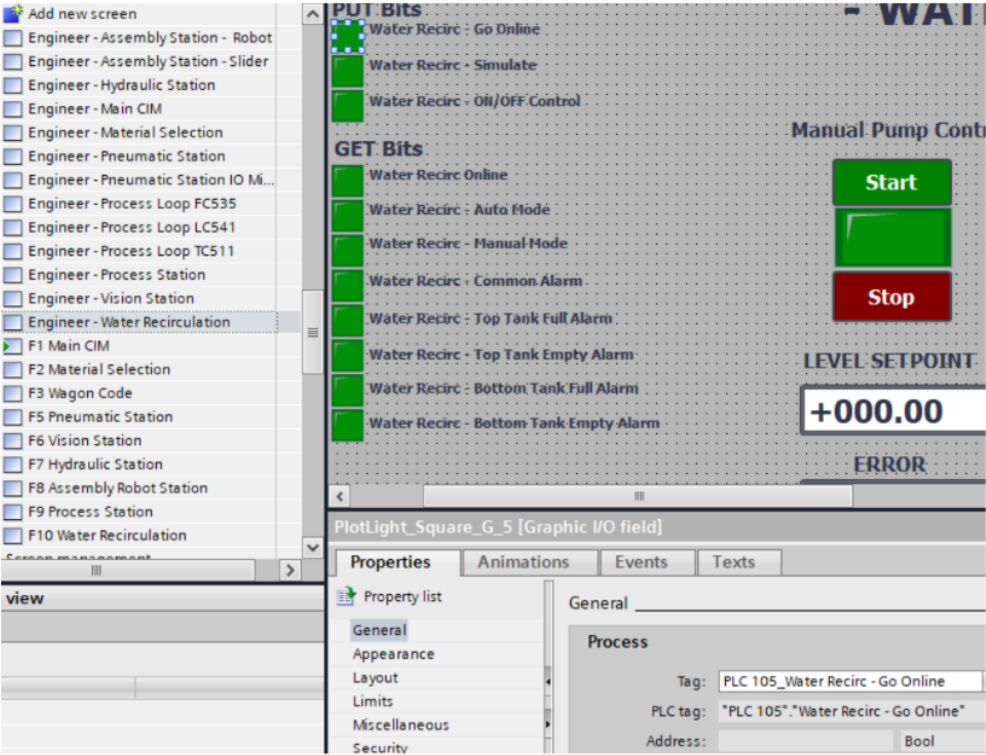
Handshaking signals sent to and from PLC103



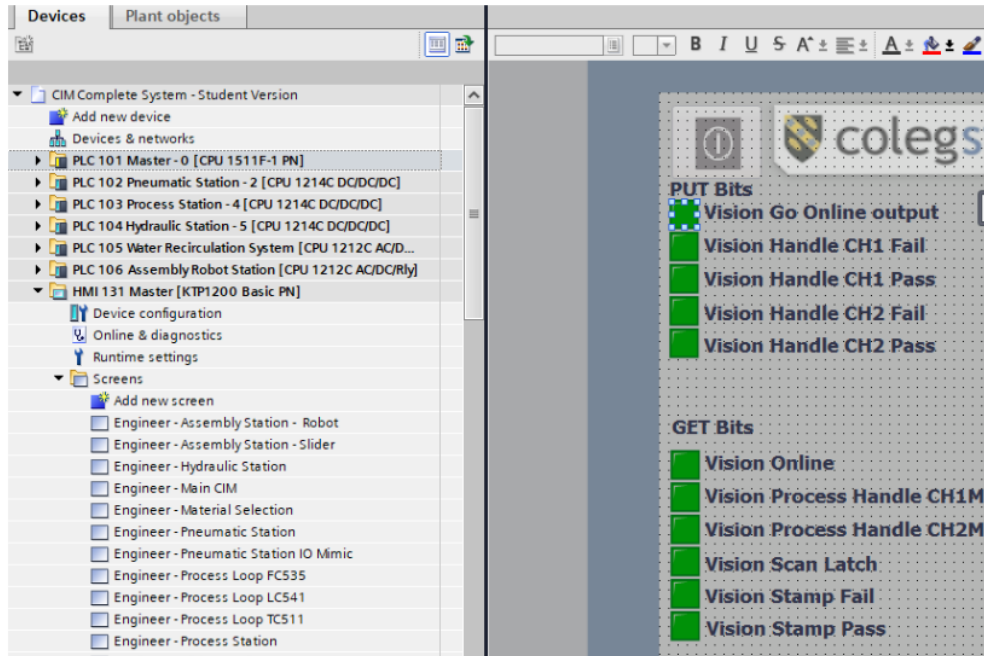
Handshaking signals sent to and from PLC104



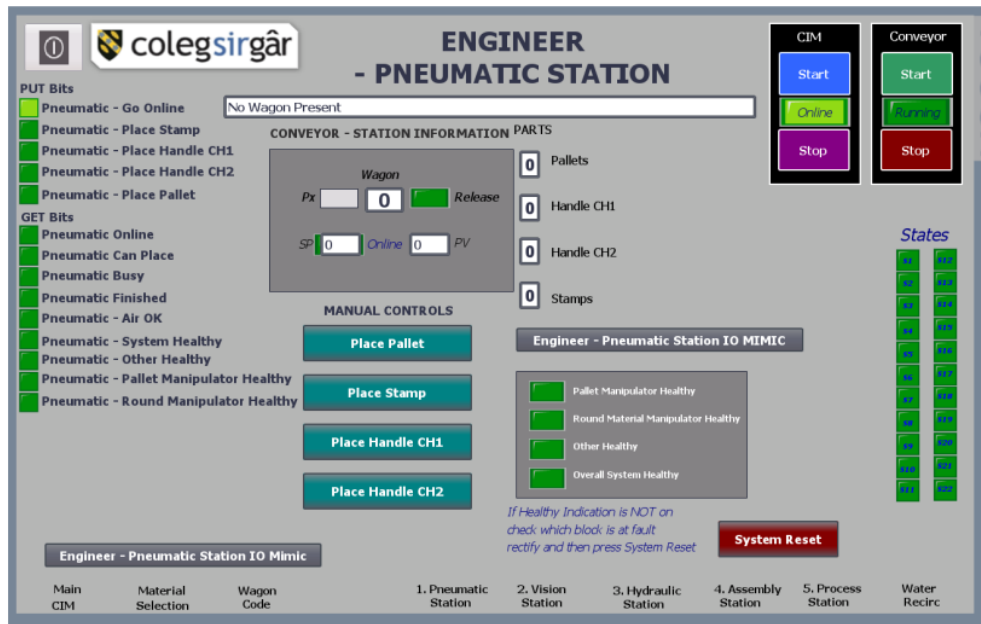
Handshaking signals sent to and from PLC105



Handshaking signal sent to and from vision station.



Simulating, Pressing start turns on 'go online' bit.



I can simulated the bits changing by toggling the get tags, as you can see I have toggled pneumatic online to true so that it lights up on the pneumatic station HMI in the Get Bits list.

32	Get Word 15	Word	30.0	16#0	16#0000
33	Put Bit 0 - Clock test bit	Bool	32.0	false	FALSE
34	Pneumatic Online	Bool	32.1	false	TRUE
35	Pneumatic Can Place	Bool	32.2	false	FALSE

RT Simulator

SIEMENS





ENG
- PNEUMAT

PUT Bits

☒ Pneumatic - Go Online

☐ Pneumatic - Place Stamp

☐ Pneumatic - Place Handle CH1

☐ Pneumatic - Place Handle CH2

☐ Pneumatic - Place Pallet

GET Bits

☒ Pneumatic Online

☐ Pneumatic Can Place

☐ Pneumatic Busy

☐ Pneumatic Finished

☐ Pneumatic - Air OK

☐ Pneumatic - System Healthy

☐ Pneumatic - Other Healthy

☐ Pneumatic - Pallet Manipulator Healthy

☐ Pneumatic - Round Manipulator Healthy

No Wagon Present

CONVEYOR - STATION INFORMATION

Wagon

Px

☒ Release

SP

Online

PV

MANUAL CONTROLS

Place Pallet

Place Stamp

18

Doing the same again for process station.

28	Get Real 2	Real	24.0	0.0	0.0
29	Process TC511 SP	Real	28.0	0.0	50.0
30	Put Bit 0 - clock test bit	Bool	32.0	false	FALSE
31	Process Online	Bool	32.1	false	TRUE
32	Process Can Pick	Bool	32.2	false	FALSE
33	Process Can Place	Bool	32.3	false	FALSE
34	Process Busy	Bool	32.4	false	FALSE

imulator

SIEMENS



colegsirgâr

ENGINEER

PUT Bits

Process - Go Online

Process - Place Handle CH1

Process - Place Handle CH2

Process - Place

Process - Simulate

GET Bits

Process Online

Process Can Pick

Process Can place

Process Busy

Process Finished

No Wagon Present

CONVEYOR - STATION INFORMATION

Wagon

Px

0

Release

SP

0

Online

0

PV

MANUAL CONTROLS

27	Get Word 10	Word	20.0	16#0	16#0000
28	Get Word 11	Word	22.0	16#0	16#0000
29	Get Word 12	Word	24.0	16#0	16#0000
30	Get Word 13	Word	26.0	16#0	16#0000
31	Get Word 14	Word	28.0	16#0	16#0000
32	Get Word 15	Word	30.0	16#0	16#0000
33	Put Bit 0 - clock test bit	Bool	32.0	false	FALSE
34	Hydraulic - Can Pick	Bool	32.1	false	FALSE
35	Hydraulic - Online	Bool	32.2	false	TRUE
36	Hydraulic - Busy	Bool	32.3	false	FALSE
37	Hydraulic - Finished	Bool	32.4	false	FALSE



ENGINEER - H

PUT Bits

- ☐ Hydraulic - Go Online
- ☐ Hydraulic - Pick
- ☐ Hydraulic - Press
- ☐ Hydraulic - Pick Finished Product from CH1
- ☐ Hydraulic - Pick Finished Product from CH2
- ☐ Hydraulic - Simulate

GET Bits

- ☐ Hydraulic Online
- ☐ Hydraulic Can Pick
- ☐ Hydraulic Busy
- ☐ Hydraulic Finished

CONVEYOR - STATION IN

Wagon

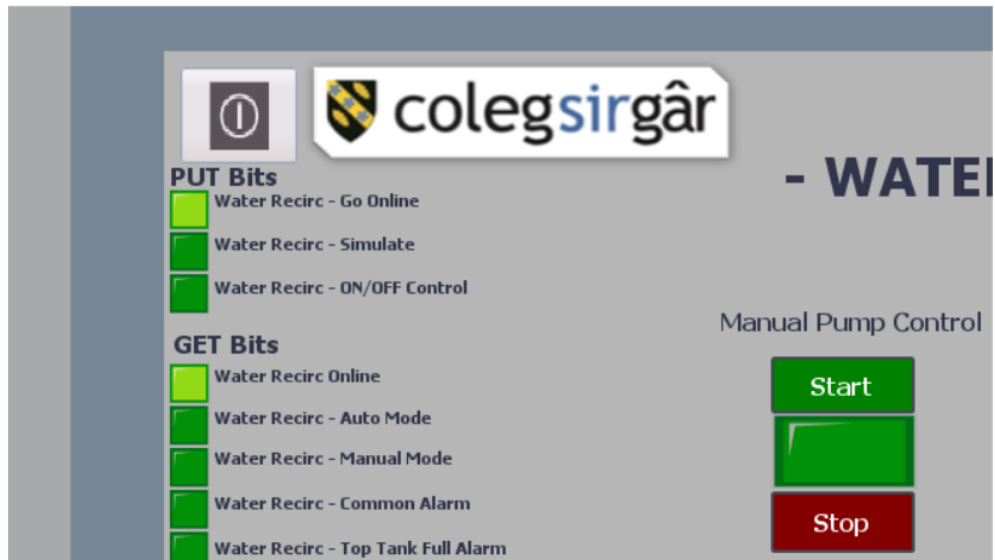
Px
☐

SP
☒ Online

MANUAL CONTROL

	Name	Data type	Offset	Start value	Monitor value	Re
28	Get Word 11	Word	22.0	16#0	16#0000	
29	Get Word 12	Word	24.0	16#0	16#0000	
30	Get Word 13	Word	26.0	16#0	16#0000	
31	Get Word 14	Word	28.0	16#0	16#0000	
32	Get Word 15	Word	30.0	16#0	16#0000	
33	Put Bit 0 - clock test bit	Bool	32.0	false	FALSE	
34	Water Recirc - Online	Bool	32.1	false	TRUE	
35	Water Recirc - Auto M...	Bool	32.2	false	FALSE	
36	Water Recirc - Manual	Bool	32.3	false	FALSE	

Simulator



31	Get Word 14	Word	28.0	16#0	16#0000			☒	☒
32	Get Word 15	Word	30.0	16#0	16#0000			☒	☒
33	Put Bit 0 - clock test bit	Bool	32.0	false	FALSE			☒	☒
34	Assembly Robot Online...	Bool	32.1	false	TRUE			☒	☒
35	Assembly Robot Can P...	Bool	32.2	false	FALSE			☒	☒
36	Assembly Robot Busy...	Bool	32.3	false	FALSE			☒	☒




ENGINEER ASSEMBLY SLIDER

GET Bits

- ☒ Assembly Robot Go Online
- ☒ Assembly Robot - Pick Finished Product or Stamp - TB1
- ☒ Assembly Robot - Pick Handle - TB2
- ☒ Assembly Robot - Pick Fail Stamp or Handle CH1 - TB4
- ☒ Assembly Robot - Pick Fail Handle CH2 - TB6
- ☒ Assembly Robot - Simulate
- ☒ Assembly Robot - Teach Box Manual Mode
- ☒ Assembly Robot - Teach Box Move to Selected Point
- ☒ Assembly Robot - Teach Box Move Left
- ☒ Assembly Robot - Teach Box Move Right
- ☒ Assembly Robot - Teach Box Store Selected Position

PUT Bits

- ☒ Assembly Robot Go Online
- ☒ Assembly Robot - Pick Finished Product or Stamp - TB1
- ☒ Assembly Robot - Pick Handle - TB2

No Wagon Present

CONVEYOR - STATION INFORMATION

Wagon

Px ☒ Release

SP Online PV

Move Sl

Enc

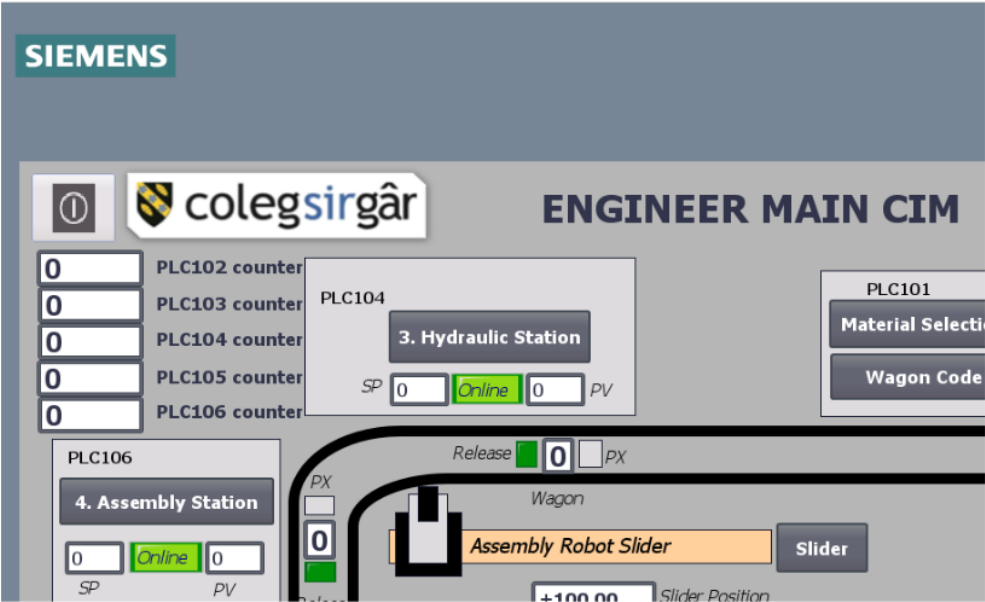
Left

PLC 106 Inputs

- 0 ☒ Encoder
- 1 ☒ RES

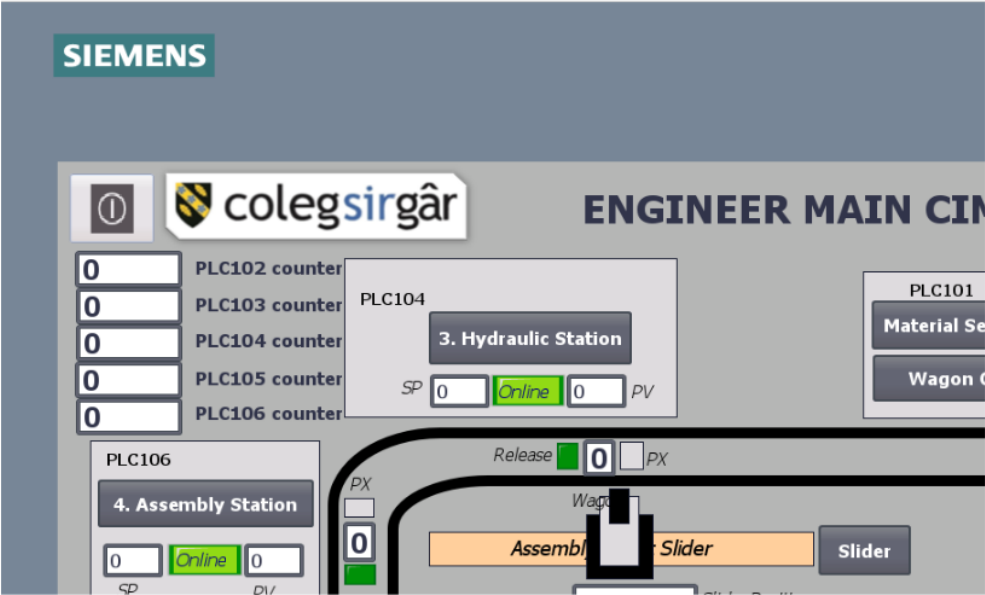
Slider at 100

68		Put Word 5	Word	42.0	16#0	16#0000	
69		Put Word 6	Word	44.0	16#0	16#0000	
70		Assembly Robot Slider Distance Int	Word	46.0	16#0	16#0064	
71		Assembly Robot Slider Distance	Real	48.0	0.0	100.0	
72		Put Real 2	Real	52.0	0.0	0.0	



Slider at 50

66	Put Word 3	Word	38.0	16#0	16#0000
67	Put Word 4	Word	40.0	16#0	16#0000
68	Put Word 5	Word	42.0	16#0	16#0000
69	Put Word 6	Word	44.0	16#0	16#0000
70	Assembly Robot Slider Distance Int	Word	46.0	16#0	16#0032
71	Assembly Robot Slider Distance	Real	48.0	0.0	50.0
72	Put Real 2	Real	52.0	0.0	0.0



6. Complex System Design – Team Modifications

Using the VoT folder we can start building the VoT screens which will be accessed over the internet. Starting off by adding the CV value to the Hydraulic station which is in PLC104 as seen in figure17. We then went on to make the page to show the data for each loop FC535, LC541 and TC511 as seen in figure18,19 and 20. We then went on to finish the Main CIM and proving the profinet working when running the system through VoT as seen in figures 21,22 and 23. We then show the data from the loops working correctly as seen in figure24.

8. Conclusions and Recommendations

To conclude, it is obvious there is room to improve the health and safety of the CIM system as the risk assessment has shown there are several negative points to about the health and safety to be seen. I can also conclude the put and get feedback lights have been configured successfully as can be seen from the testing through simulation and the same goes for the profinet counters, slider animations, Put and Get bits for each station/PLC Air OK light indicator and Photobeam light indicator have all been proven to be working.

Write in the third person

I can recommend to improve maintenance and reliability of the system by adding more feedbacks on the robotic giving a list of what sequence it has been taking to find any re-occurring errors in the system.

Line spacing should be 1.5

Paragraphs should be fully justified text as required in the brief

9. Team Working

We worked well as team and concluded with good results with the VoT showing all the correct data while each of us played equal roles to get the system running.

Use of 11pt Arial, full justification with 1.5 line spacing allows easier reading and marking

10. Citation List

Works Cited

Small range of sources listed correctly

eaton, 2023. *eaton.com.* [Online]
Available at: <https://www.eaton.com/gb/en-gb/markets/machine-building/service-and-support-machine-building-moem-service-eaton/blogs/difference-between-sil-and-pl.html>
[Accessed 25 4 2023].

gov, 2023. *www.gov.uk.* [Online]
Available at: <https://www.gov.uk/guidance/ukca-marking-conformity-assessment-and-documentation#:~:text=the%20product's%20serial%20number%2C%20model,with%20whic>

11. Appendix

Risk	Hazard	Likelihood 1-3	Consequence1-3	Overall Risk 1-9	Risk Level
No guard	moving robotic arm could hit you or trap limbs	1	2	3	Tolerable Risk
No isolation procedure	Live electrical equipment could electricute someone	1	3	4	Moderate Risk
conveyor	clothes could get caught in the conveyor and pull you with it	1	2	3	Tolerable Risk
Heating and chemical tanks	Burn your skin	1	1	2	Trivial Risk
High pressure air supply	Disconnect and knock/hit you	1	1	2	Trivial Risk
Cables running on floor	Could trip on cable and fall	2	2	4	Moderate Risk

Figure17

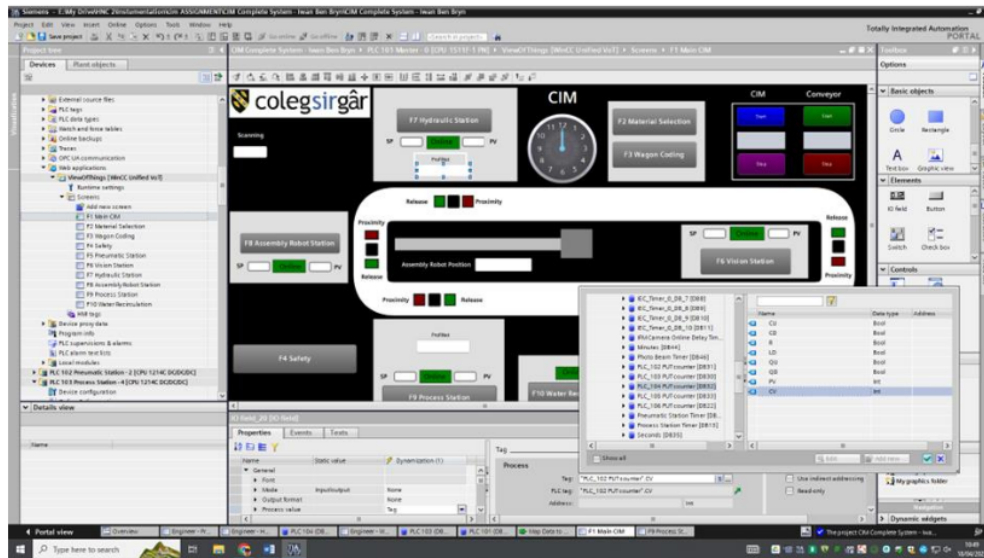


Figure18

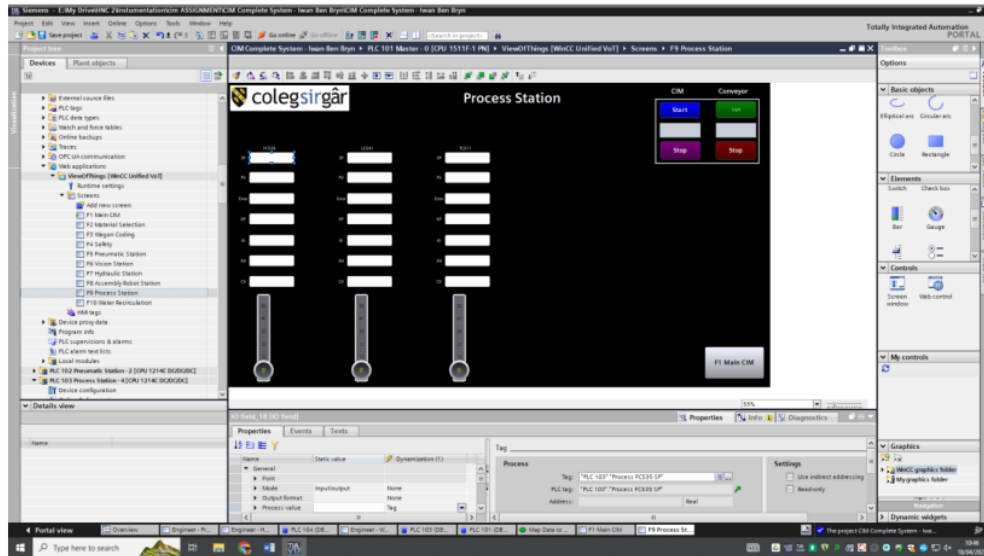


Figure19

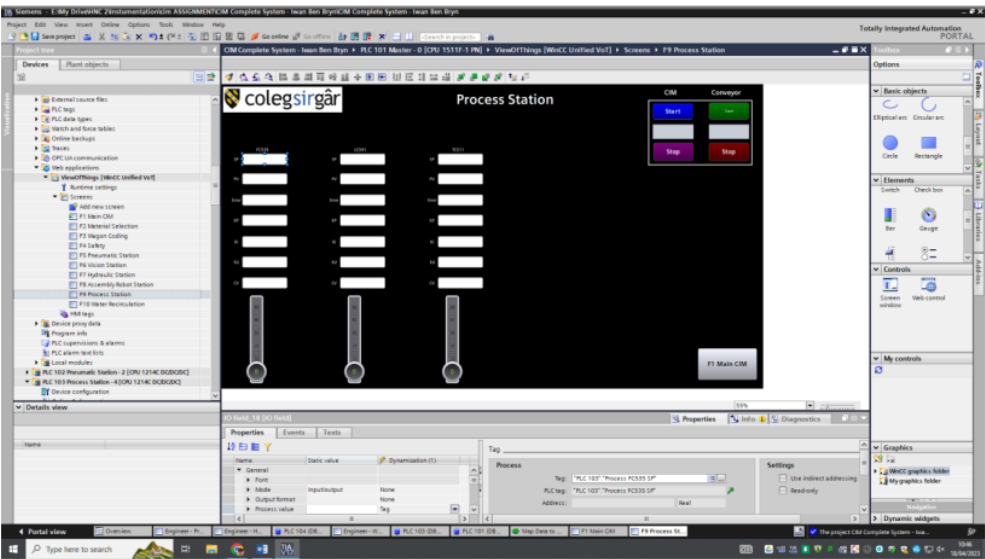


Figure20

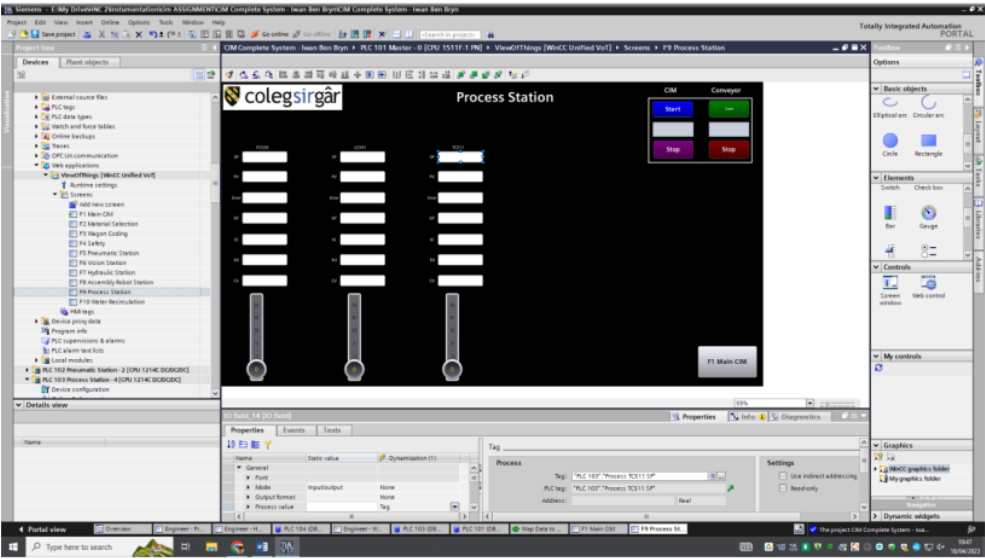


Figure21



Figure22

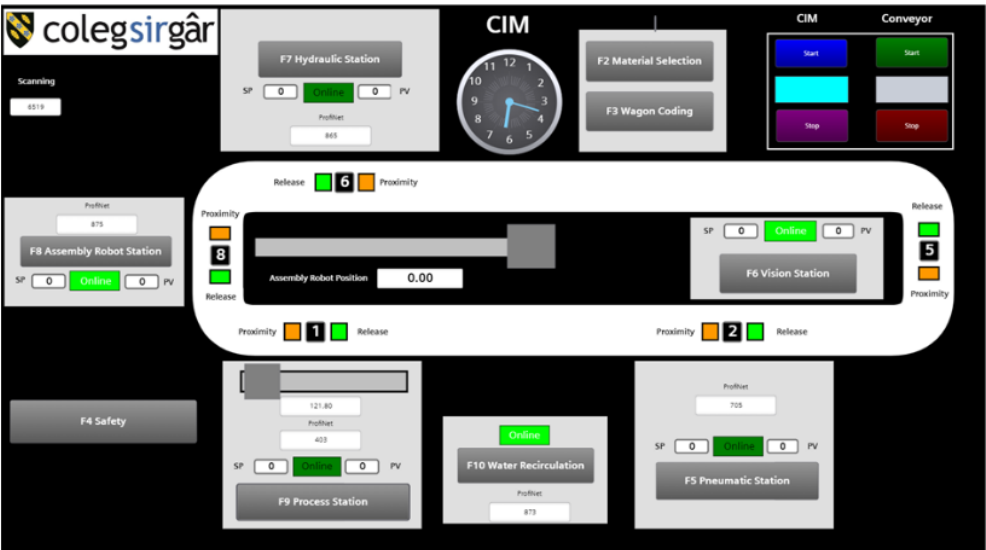


Figure23

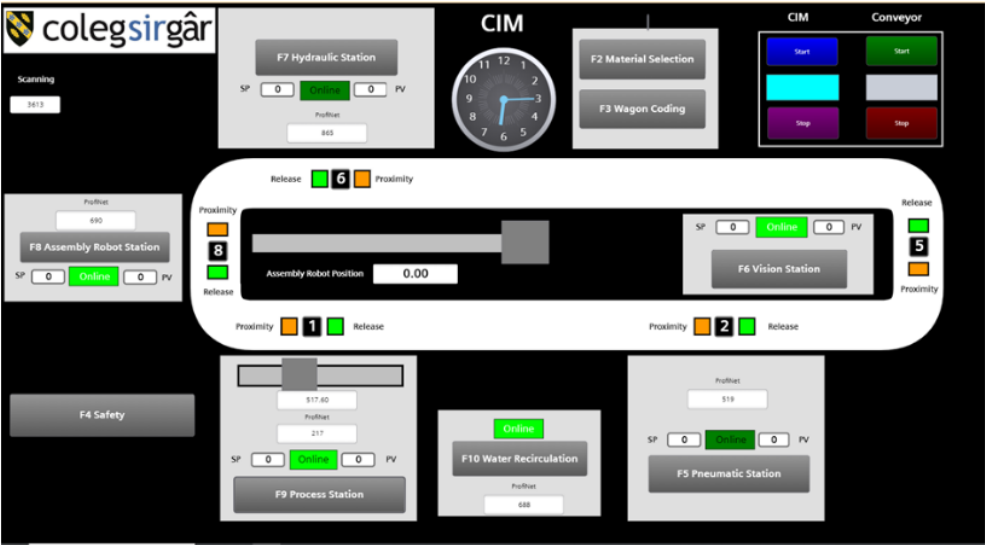
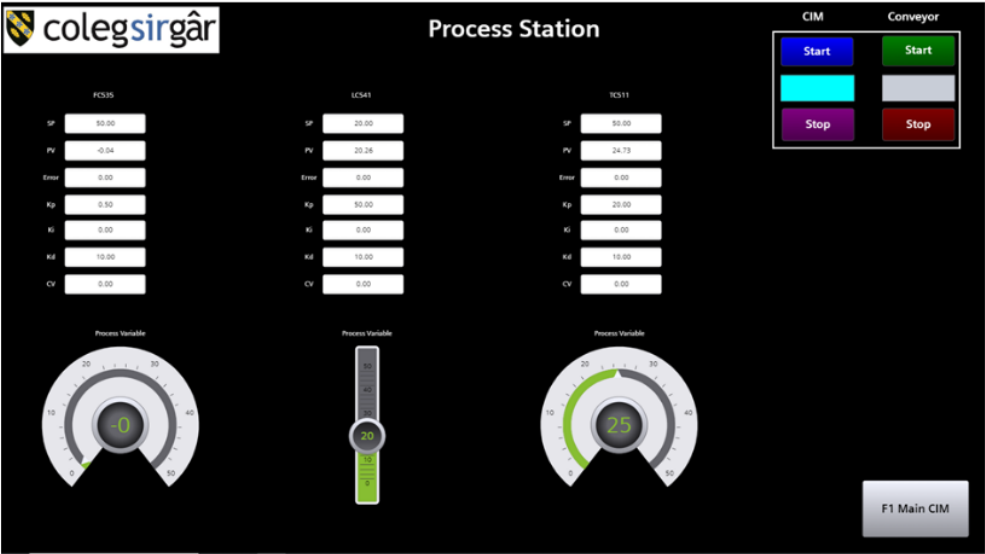


Figure24



Instructor

43 / 100

PAGE 1

Text Comment. Wrong title

Text Comment. date?

PAGE 2

QM

Good Structure

Report is structured exactly as stated in the assignment brief.

PAGE 3

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".

Text Comment. A good work plan

PAGE 4

Text Comment. These belong in the appendix

PAGE 5

PAGE 6

PAGE 7

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".

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".

QM

Citation Needed

Cite Source:

Please use the link below to find links to information regarding specific citation styles:
http://www.plagiarism.org/plag_article_citation_styles.html

PAGE 8

PAGE 9

Text Comment. incomplete

Text Comment. System diagram with M2M links are missing.

PAGE 10

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".

QM

Line spacing should be 1.5

This allows the marker to put comments in between your lines

PAGE 11

PAGE 12

Text Comment. These images should be in the appendix

Text Comment. Where is your testing table?

PAGE 13

PAGE 14

PAGE 15

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".

QM

Line spacing should be 1.5

This allows the marker to put comments in between your lines

QM

Paragraphs should be fully justified text as required in the brief

QM

Use of 11pt Arial, full justification with 1.5 line spacing allows easier reading and marking

Your presentation could be improved making the text easier to read and mark. Your tutor will then be able to add comments between lines

Text Comment. Small range of sources listed correctly

GRADING FORM: NEW CSG-RUBRIC

BRYN JANES

43

1. ENGAGEMENT WITH LITERATURE



The research section has some evidence of reading from a small range of sources cited and listed correctly using the Harvard method as seen in sections 2 and 10. 7/20

7

2. KNOWLEDGE AND UNDERSTANDING



Some knowledge and understanding demonstrated in all report sections and particularly sections 3, 4 and 5. 8/20

8

3. COGNITIVE AND INTELLECTUAL



Some evidence of analysis through testing but no testing table for results, with brief conclusions and recommendations. 8/20

8

4. PRACTICAL APPLICATION



Some evidence of practical work both with individual system modifications with simulation and with team work on VoT web server mods. 10/20

10

5. TRANSFERABLE SKILLS



A good work plan and risk assessment. Some explanation of team working. Report is well structured, and sometimes correctly presented. Good clear diagrams. Word count not exceeded. You must learn to write in the third person. /20

10