

1909751

by Alex Williams

Submission date: 17-May-2024 10:20AM (UTC+0100)

Submission ID: 234085471

File name: 11778_Alex_Williams_1909751_183295_2045162590.pdf (2.07M)

Word count: 712

Character count: 2599

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Presentation 2: Project Design, Implementation and Evaluation

Course:	BSc (Hons) Electrical & Electronic Engineering
Module:	SGEL6000 Independent Project
Name:	Alex Williams
University	
Number:	1909751

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FDS

- Agreed and signed by customer
 - Target Areas
 - Performance
 - Safety
 - Environmental
 - Aesthetics
 - Finance
 - Technical
 - No changes to FDS for proof of concept.
- Lessons Learnt
- Main line deployment needs more specific FDS

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How was the FDS Met

- Analysed FDS for equipment limitations/requirements
- Understand the system requirements – referred back before starting a task

Ref:	Description	Notes/equipment needed
P2.3	Change routing destination from HMI	HMI, PLC
P2.2, P3	Displaying information via HMI/Andon lights	Pilot/Andon Light, HMI
E1	Must trigger on demand	Sensor
S1	Isolate when not in use	Isolator
A1	Must fit on training Rig	Size restriction
T1	Parts must be in line with preferred suppliers	Obtained company's supplier list

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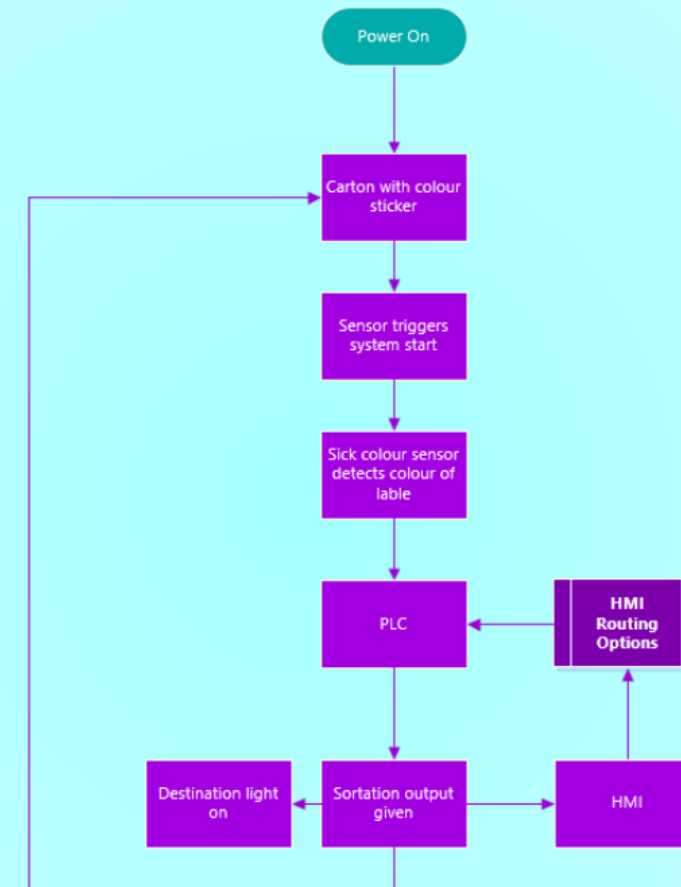
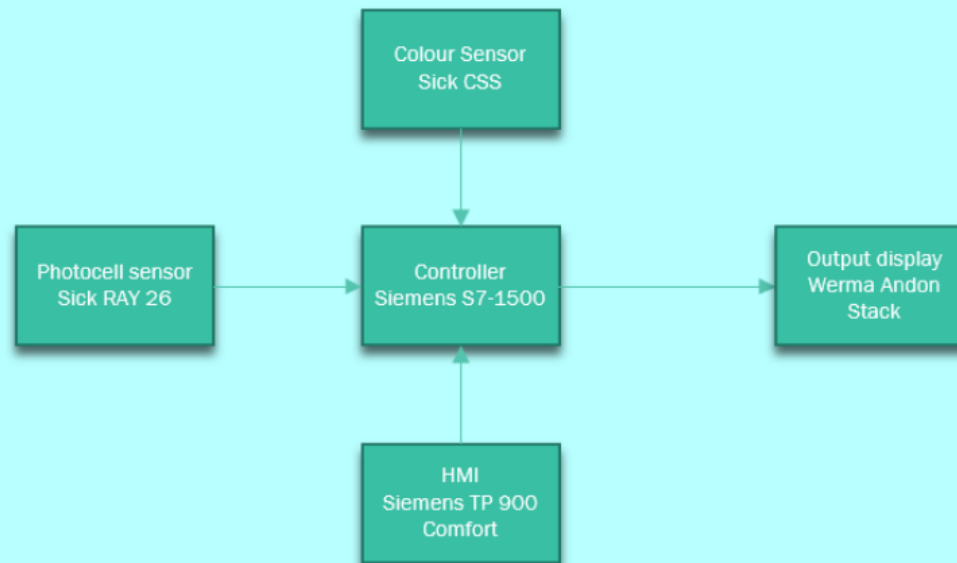
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Design

Ref	Outcome
P1	Must remove manual intervention at step 5 of the Corral system



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Design - HMI

Ref	Outcome
P2.2	The system must show where the carton is being diverted to by means of pilot lights or HMI
P2.3	Be able to change routing destinations from the HMI
T4.1	HMI must have a view only mode
T4.2	HMI must have an operations mode where operations management can select the routing.
T4.3	Must have an engineering mode allowing access to all areas of the HMI such as read rates and maintenance settings.

Routing

	Lane 1	Lane 2	Lane 3	Lane 4
Red	☐ OFF	☒ ON	☐ OFF	☐ OFF
Blue	☐ OFF	☒ ON	☐ OFF	☐ OFF
Green	☐ OFF	☒ ON	☐ OFF	☐ OFF
Yellow	☐ OFF	☒ ON	☐ OFF	☐ OFF

Home

RME

RME

Simulation Mode

Simulation ON

Simulation Sensor Trigger

Lane 1

Lane 2

Lane 3

Lane 4

Kick Out

Fault

Colour 1 Simulation

☒ ON

Colour 2 Simulation

☐ OFF

Colour 3 Simulation

☐ OFF

Colour 4 Simulation

☐ OFF

Kick Out Simulation

☐ OFF

Colour 1

+1

Colour 2

+0

Colour 3

+0

Colour 4

+0

Kick Out

+0

Read Rate

Total

+1.000

Good Quality

+1.000

Bad Quality

+0.000

Read Rate

+100.000

Count Reset

Home

Routing

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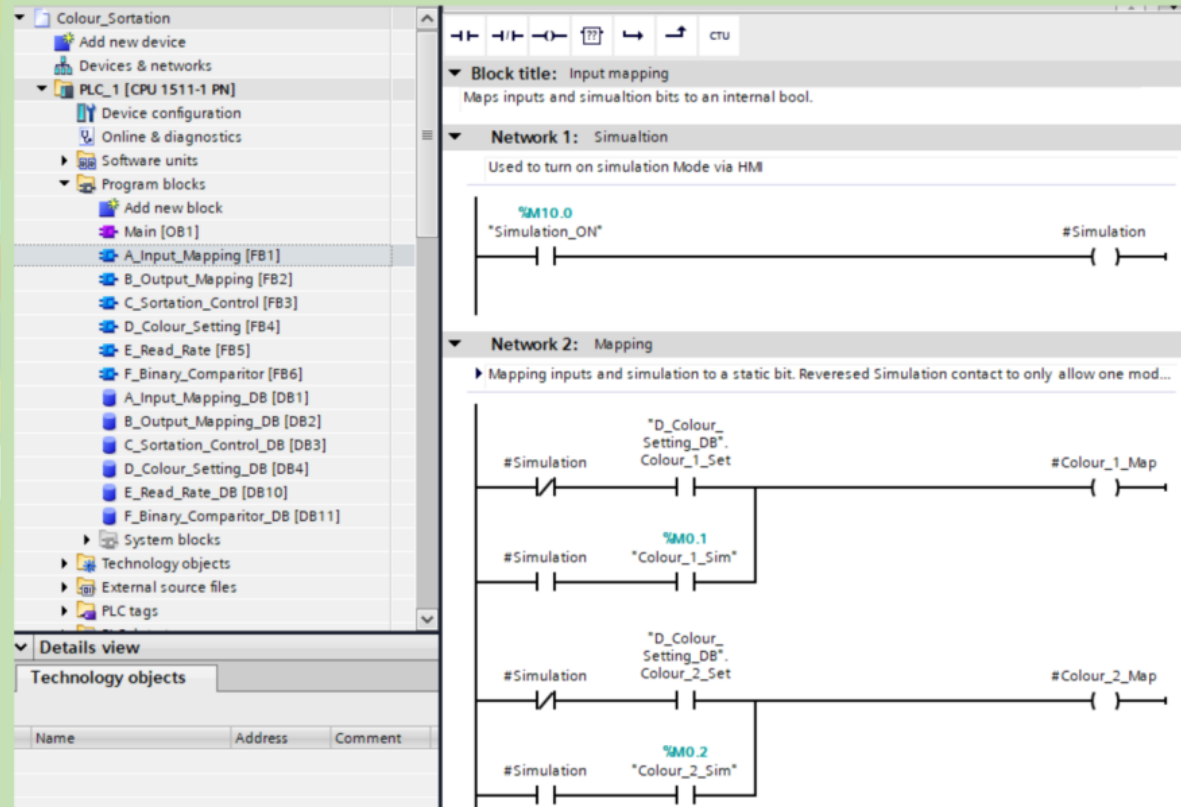
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Construction - Software

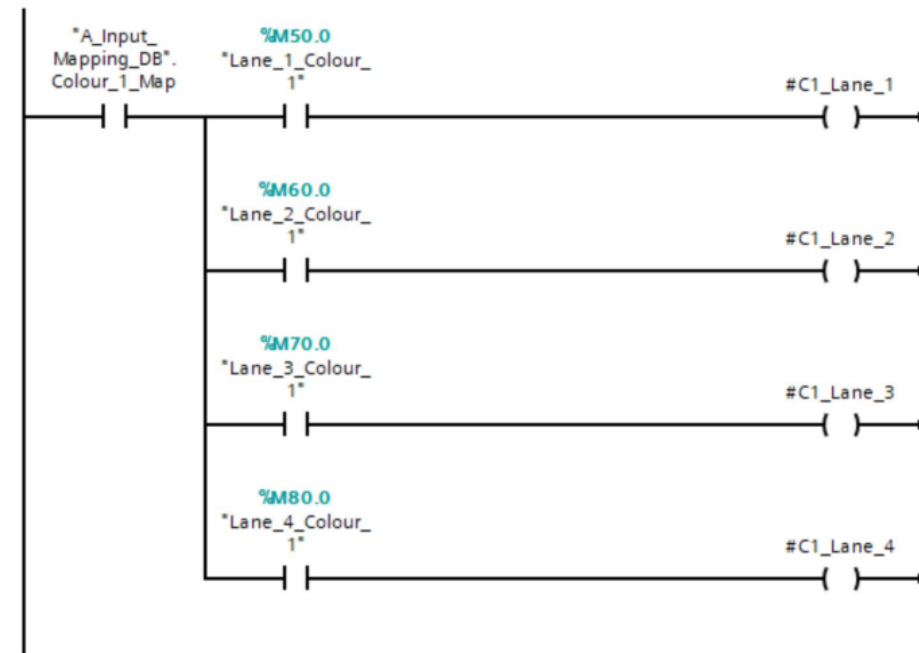


Block title: Sortation Control

Sets conditions for all of the sortation logic

Network 1: Colour 1 Sortation

Sortation Logic for colour 1



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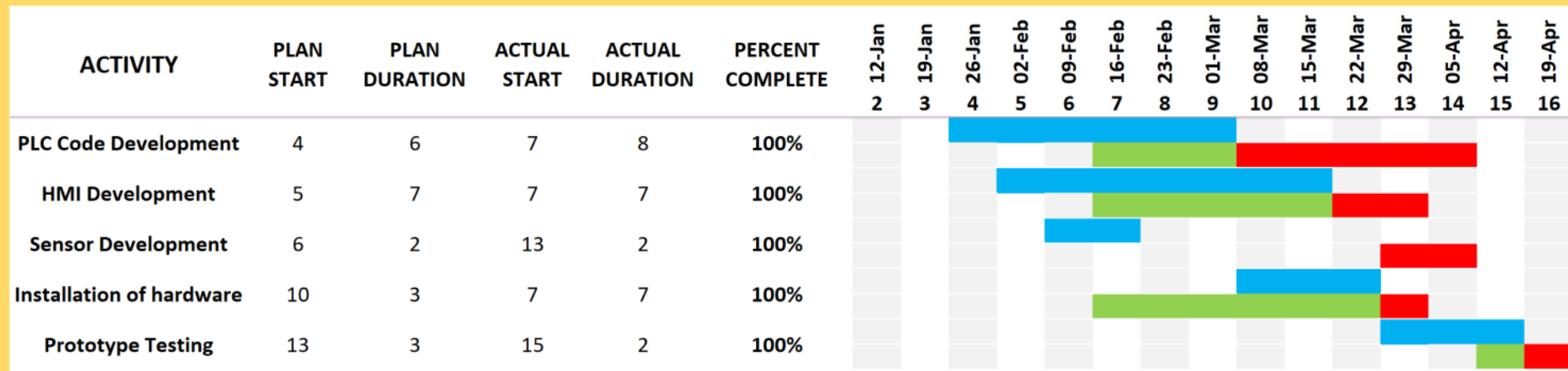
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IO Link Issue

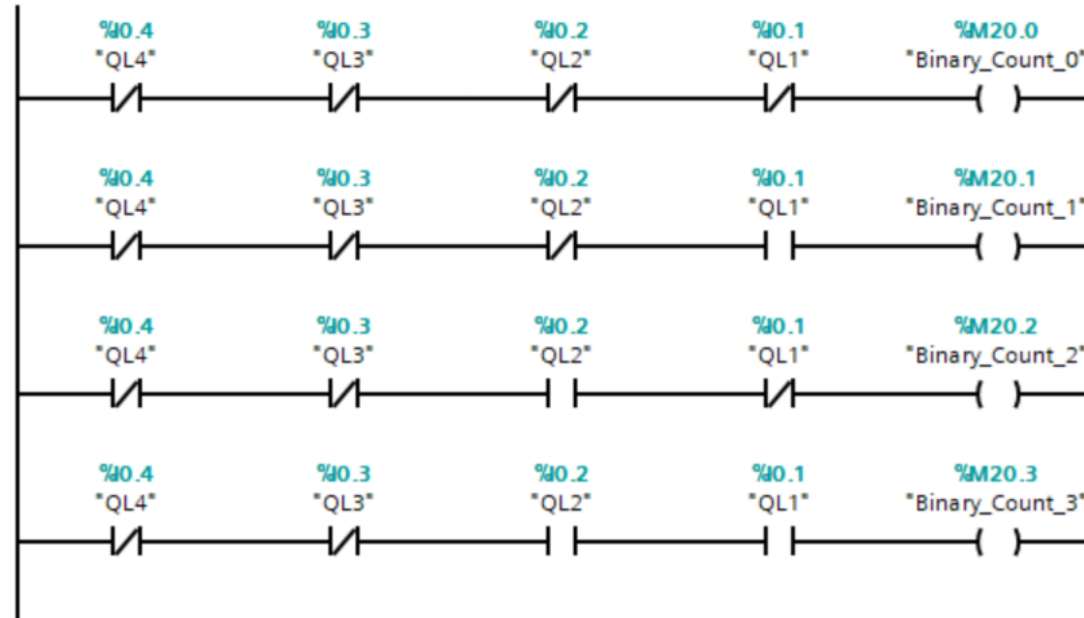
- Communication failure between sensor and PLC
- Missing module
- Hardwire to PLC
- Communication via Binary code
- Each colour was 'taught' into the sensor

Block title: Binary Comparator

▼ Sick sensor inputs colour results via binary code. This block analyses the input in a binary code format.

Network 1: Binary Count 0-3

Analyses binary count for 0-3



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Testing - Simulation

Simulation and Practical Tests

Sim Test No:	Colour	Destination	Simulation Pass/Fail	Practical Pass/Fail
1	Colour 1	1	Pass	Pass
2	Colour 2	2	Pass	Pass
3	Colour 3	3	Pass	Pass
4	Colour 4	4	Pass	Pass
5	Colour 1	2	Pass	Pass
6	Colour 2	3	Pass	Pass
7	Colour 3	4	Pass	Pass
8	Colour 4	1	Pass	Pass
9	Colour 1	3	Pass	Pass
10	Colour 2	4	Pass	Pass
11	Colour 3	1	Pass	Pass
12	Colour 4	2	Pass	Pass
13	Colour 1	4	Pass	Pass
14	Colour 2	1	Pass	Pass
15	Colour 3	2	Pass	Pass
16	Colour 4	3	Pass	Pass
17	No Read	Kick Out	Pass	Pass

A. Williams
Project Manager

J. Williams
Automation Engineer

RME

Simulation Mode
Simulation ON
Simulation Sensor Trigger

Lane 1
Lane 2
Lane 3
Lane 4
Kick Out
Fault

Colour 1 Simulation
Colour 2 Simulation
Colour 3 Simulation
Colour 4 Simulation
Kick Out Simulation

ON
OFF
OFF
OFF
OFF

Colour 1
Colour 2
Colour 3
Colour 4
Kick Out

+1
+0
+0
+0
+0

Total
Good Quality
Bad Quality
Read Rate

+1.000
+1.000
+0.000
+100.000

Count Reset

Home

Routing

Project1_V18.14 ▶ PLC_1 [CPU 1511-1 PN] ▶ Watch and force tables ▶ Lane_2_Routing

	Name	Address	Display format	Monitor value	Modify value	Comment
1	"Lane_1_Colour_1"	%M50.0	Bool	TRUE		Lane 1 colour 1 routing
2	"Lane_1_Activate"	%Q0.3	Bool	TRUE		divert to lane 1
3	"No_Read_Activate"	%Q0.7	Bool	FALSE		no read signal
4	"Alarm_Active"	%Q0.2	Bool	FALSE		alarm active
5		<Add new>				

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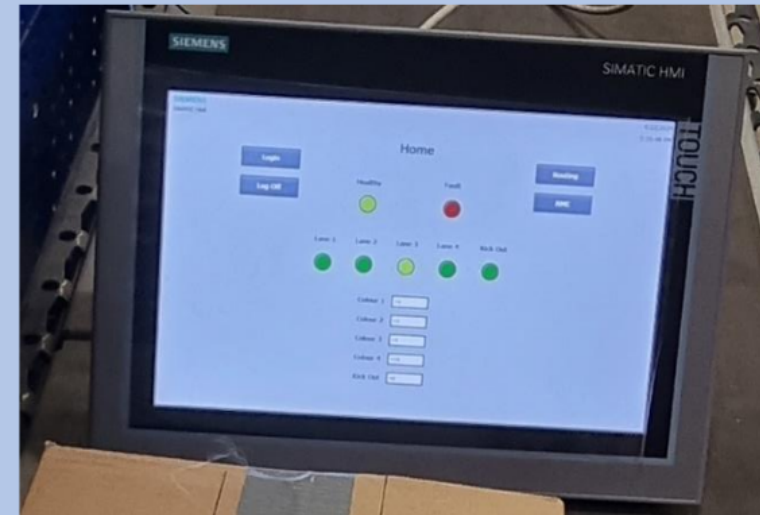
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Testing - Practical



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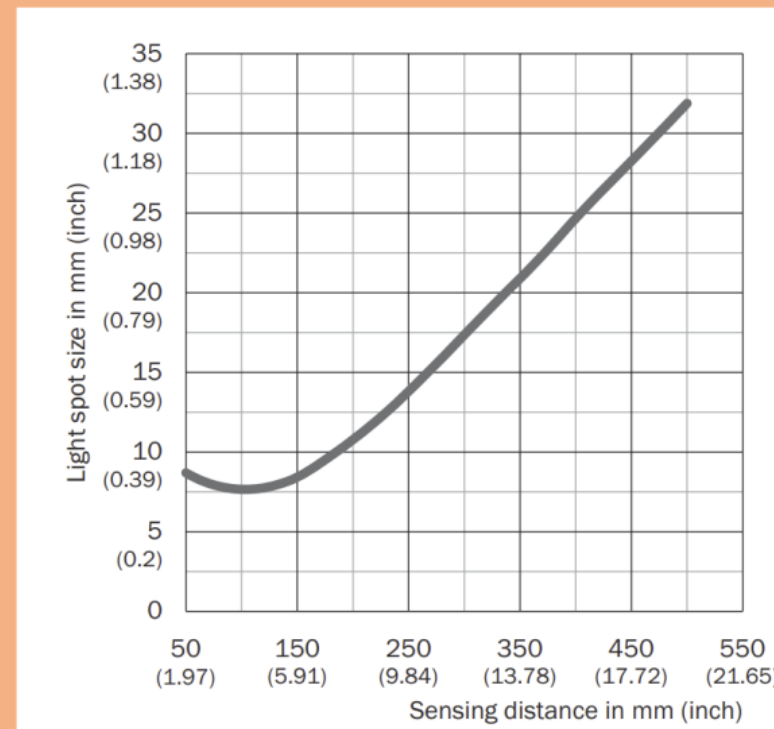
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Analysis

✓ Read rate of 99%

- 1 failed package/no read
- Spot size 30mm
- Label size = 50mm x 30mm



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Evaluation - Test Table

- 20 Tests
- 100% Pass
- Under budget - £3,240
- unexpected costs – HMI

Lessons:

- More detailed FDS
- Specify communication methods
- Don't have and/or specification

Test Number	FDS Reference	Test Description	Expected outcome	Actual Outcome	Pass/Fail
1.	A1	Check prototype fits within training area.	Prototype is within the training area in engineering workshop.	Prototype contained within training area	Pass
2.	T5	Check all cables are identifiable with cable IDs.	All cable IDs are present.	All ID are correct to drawing	Pass
3.	T2	With no faults on the prototype, check healthy signal is shown via pilot lights or HMI	Healthy signal is displayed	Green Andon light on and display on HMI	Pass
4.	T4.1	Attempt to set a routing destination in view only mode	HMI won't navigate to the required page due to permissions	Does not navigate	Pass

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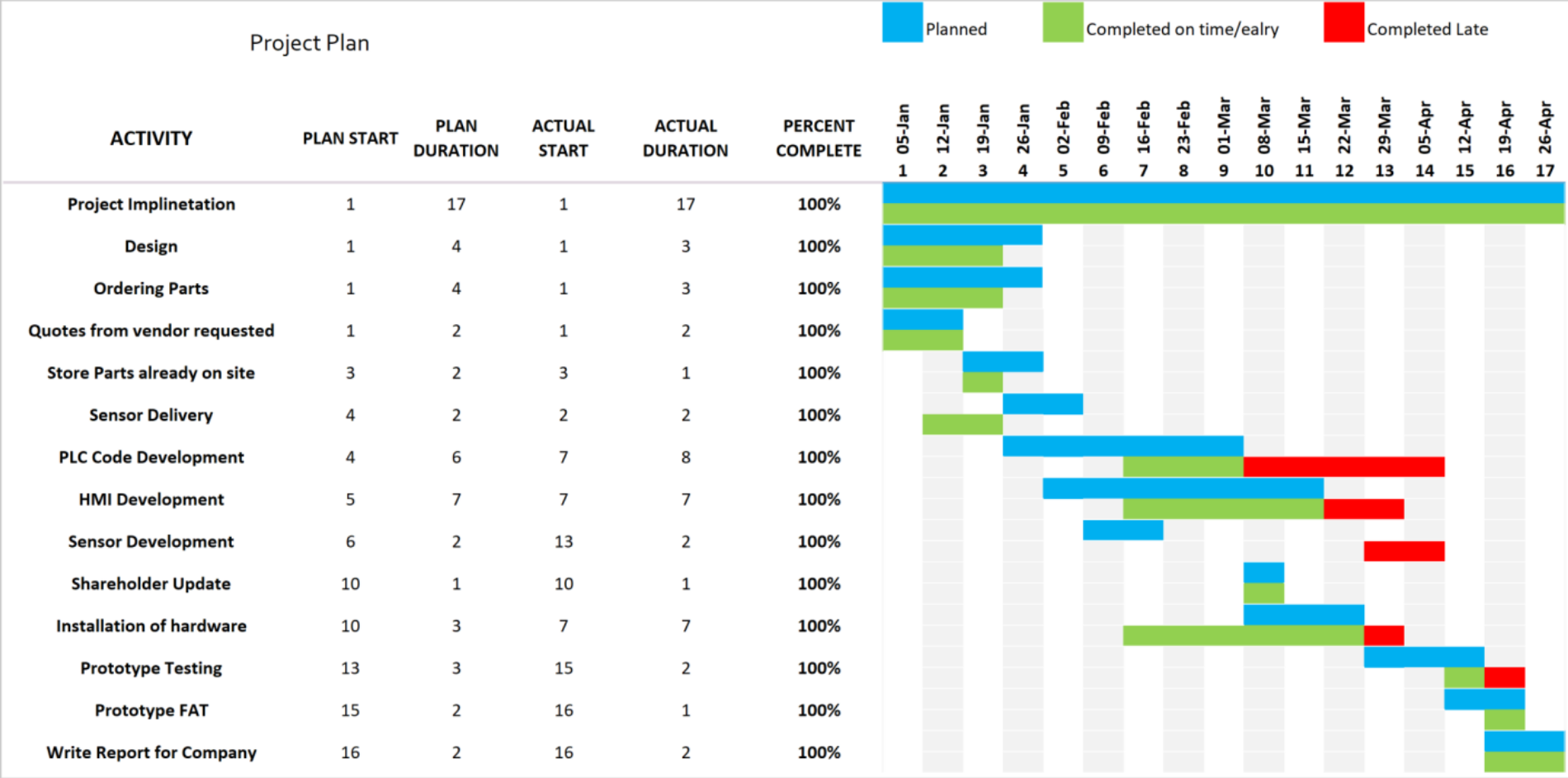
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Management Techniques



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Costing

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Item	Description	Part No	Units	Cost Per Unit	Line Cost	Actual Cost	Note
1	Colour Sensor	1120172	1	£ 558.14	£ 558.14	£ -	Free Issue
2	Bracket	2022718	1	£ 20.91	£ 20.91	£ -	Recycled project
3	Mounting bar	4056052	1	£ 8.85	£ 8.85	£ -	Recycled project
4	Sensor/actuator cable 5m	2095653	1	£ 20.84	£ 20.84	£ 20.84	
5	RAY26 Reflex Array	1221943	1	£ 132.51	£ 132.51	£ -	Recycled project
6	SIMATIC S7-1500, CPU 1511-1 PN	6ES7511-1AK02-0AB0	1	£ 560.80	£ 560.80	£ -	Recycled project
7	SIMATIC S7-1500 DI 32x24VDC HF	6ES75211BL000AB0	1	£ 326.00	£ 326.00	£ -	Recycled project
8	SIMATIC S7-1500 DQ 32x24VDC/0.5A HF	6ES75221BL010AB0	1	£ 464.00	£ 464.00	£ -	Recycled project
9	SIMATIC S7-1500 terminals	6ES75921AM000XB0	2	£ 37.00	£ 74.00	£ -	Recycled project
10	SIMATIC HMI TP700 Comfort	6AV2124-0GC01-0AX0	0	£ 926.00	£ 926.00	£ -	Not Used
10.1	SIMATIC HMI TP1200 Comfort	6AV2124-0MC01-0AX0	1	£ 2,718.16	-	£2,718.16	RME stock
11	Werma Green Andon Light	455-3334	1	£ 42.71	£ 42.71	£ 42.71	RME stock
12	Werma Orange Andon Light	299-4446	4	£ 33.50	£ 134.00	£ 134.00	RME stock
13	Werma Red Andon Light	481-979	1	£ 31.66	£ 31.66	£ 31.66	RME stock
14	Werma Black Andon Siren	184-5132	1	£ 29.20	£ 29.20	£ 29.20	RME stock
15	Power Supply	2866750	1	£ 198.59	£ 198.59	£ 198.59	RME stock
16	RS PRO Blue 0.75 mm²	180-5922	1	£ 27.43	£ 27.43	£ -	Consumable
17	Control Cable, 5 Cores, 0.75 mm²	827-4278	1	£ 65.74	£ 65.74	£ 65.74	
				Total	£ 3,621.38	£3,240.90	

1	Turck TBPB-L1-FDIO1-2IOL	6814053	1	£ 954.99	954.99	£ -	Not Purchased
2	Power Cable	6914146	1	£ 68.03	68.03	£ -	Not Purchased
				Total	1023.02	£ -	

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Recommendation

- IO Link – 24 colours vs 15 in coded.
- Confirmation sensors – IO module
- Use kick out lane as expedited lane
- Design maintenance schedule for main line deployment
- Daily colour check, cleaning routines

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Any Questions?

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FINAL GRADE

GENERAL COMMENTS

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GRADING FORM: NEW CSG-RUBRIC

ALEX WILLIAMS

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1. ENGAGEMENT WITH LITERATURE

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2. KNOWLEDGE AND UNDERSTANDING

 Project design
Good informative slides that depicted the design process. Explanations were clear and confident.
FDS requirements were mostly achieved and discrepancies were explained.
Excellent evidence presented. (7/10)
Project implementation
Excellent explanation given. (7/10)
Response to questions
Very good, clear and fluent. (8/10)

22

22/30

3. COGNITIVE AND INTELLECTUAL

 Testing and analysis of results
Good evidence on slides and explanations were clear and confident. Good argument for simulated testing and relevance to FDS.
Very good list and analysis. (8/10)
Critical evaluation of the project outcomes relating to FDS and constraints
Very good explanation given (7/10)
Conclusions and recommendations
Excellent explanation given (8/10)

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23/30

4. PRACTICAL APPLICATION

 Deployment method, use of material, tools, equipment and techniques in the construction of the project.

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Excellent explanation given of methods employed. (7/10)

Quality of the final product or system

Excellent quality (7/10)

Management of the design process including use of plans, costing spreadsheet

Excellent explanation given (6/10)

20/30

5. TRANSFERABLE SKILLS

 Quality of the presentation slides

Excellent slides (5/5)

Quality of the delivery style

Good but sometimes hesitant (3/5)

8

8/10