

1708159

by Jonathon Williams

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Presentation 2 – Project Design, Implementation and Evaluation

Course: BSc (Hons) Electrical & Electronic Engineering
Module: SGEL6000 Independent Project
Name: Jonathon Williams
University Number: 1708159

Introduction

- Customer – E-commerce and logistics company
- Location – Swansea
- Reduce waste streams identified in TPM (waiting & movement)
- Safety, sustainability and wider issues

Functional Design Specification

- Agreed with the Customer
- Specific Deliverables:
 - Performance
 - Safety
 - Environmental
 - Aesthetics
 - Finance
 - Technical
- Reviewed during project design and implementation – minimal changes

Table 1: FDS Considerations

Reference	Criteria	Considerations
P1.1	Line must accept minimum of 500 totes per hour	Drive rollers must run at a minimum of 11 m/min to achieve this.
P1.2	Work-out (Pack-line) will run at 80 ft/min with a ramp time of 0.5s	Existing control of old line has these settings
P2	System must highlight faults and be presented to the engineering team via pilot	Signals will be included in hardwired signal exchange. (Appendix A)

Design Solution

- FDS P2, signals exchange between two PLCs.
- Hardwired I/O to do physical handshaking
- Hardware selected on functionality, consideration to other on-site hardware and security. - Siemens S7-1500 PLC.

- International Standards Organisation define control parts of system machinery in ISO 13849-1 and IEC 61508. Within this standard, it defines the reliability rating and stop categories.

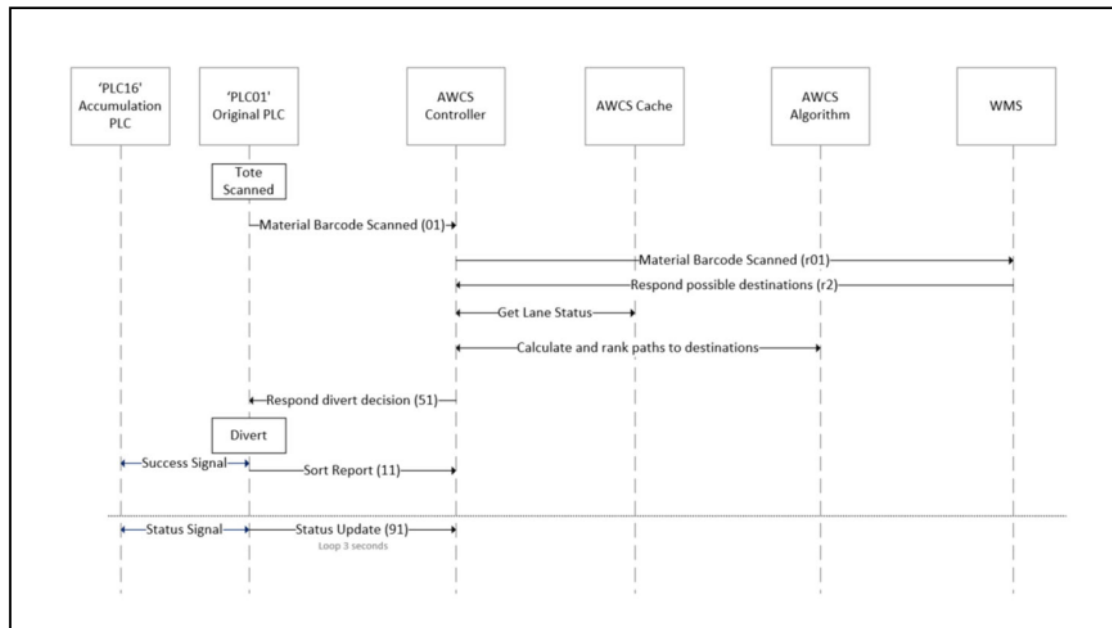
Stop Category	Description
Stop Category 0:	Uncontrolled stop - stopping by immediate removal of power to the machine actuators (i.e. uncontrolled stoppage).
Stop Category 1:	A controlled stop with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved.
Stop Category 2:	A controlled stop with power left available to the machine actuators.

(International Electrotechnical Commission [IEC], 2021)

Technical Literature

- Research using documents produced by SIT Technik – warehouse OEM
- Telegram structure & standard blocks

Integer value	Description
0	Operational, not (part) full
1	Lane 50% Full
2	Lane full 75 %
3	Lane full 100%
4	Deactivated (switched off)
5	Error



Construction Phase - Software

```

//--- IF-Signale von SLAN000
A "I_BO_SA_SLAN_000_PTS"
= #I_BO_SA_SLAN_000_1_PTS

A "I_BO_SA_SLAN_000_FgTP"
= #I_BO_SA_SLAN_000_1_FgTP

A "I_BO_SA_SLAN_000_Zone1OK"
= #I_BO_SA_SLAN_000_Zone_1_OK
A "I_BO_SA_SLAN_000_Zone2OK"
= #I_BO_SA_SLAN_000_Zone_2_OK

A "I_BO_SA_SLAN_000_Pull50"
= #I_BO_SA_SLAN_000_1_Pull_50
A "I_BO_SA_SLAN_000_Pull75"
= #I_BO_SA_SLAN_000_1_Pull_75
A "I_BO_SA_SLAN_000_Pull100"
= #I_BO_SA_SLAN_000_1_Pull_100

1117.4 -- A2018-0118-01+SLAN_000 Conveyor - Drive running
#I_BO_SA_SLAN_000_1_PTS -- Drive running

1117.5 -- A2018-0118-01+SLAN_000 Conveyor - Index allin
#I_BO_SA_SLAN_000_1_FgTP -- Index allin (Start release TP)

1117.6 -- A2018-0118-01+SLAN_000 Conveyor - Zone 1 OK
#I_BO_SA_SLAN_000_Zone_1_OK -- conveyor from transfer table to inclusion

1117.7 -- A2018-0118-01+SLAN_000 Conveyor - Zone 2 OK
#I_BO_SA_SLAN_000_Zone_2_OK -- conveyor in the straight section along to

1117.0 -- A2018-0118-01+SLAN_000 Conveyor - 50N Pull
#I_BO_SA_SLAN_000_1_Pull_50 -- 50N Pull

1117.1 -- A2018-0118-01+SLAN_000 Conveyor - 75N Pull
#I_BO_SA_SLAN_000_1_Pull_75 -- 75N Pull

1117.2 -- A2018-0118-01+SLAN_000 Conveyor - 100N Pull
#I_BO_SA_SLAN_000_1_Pull_100 -- 100N Pull

//--- Transport Transfer zum Ziel "44"=SLAN000
A #I_BO_Status_Ziel_0041_Ziel_44
A #I_BO_SA_SLAN_000_1_FgTP
AM #I_TP_54003_54061_D_BO_Transport
= #I_BO_StartFreigabe

A #I_BO_Halten_TP_auf_Transf_54_01_03
= #I_BO_Annahmedung

CALL #Transp_54003_SLAN_000
IH_IH_Mode_Befehl :=0
IH_IH_Aktabestand_VV_VV :=0
IH_IH_Hinweis_VV_VV :=0
IH_IH_Loesche_VV_VV :=0
IH_IH_Hinweis_VV_VV :=0
IH_IH_Minute_VV_VV :=0
IH_IH_Minute_VV_Durchford :=0
IH_IH_Timeout_Transport :=100 // 60s
IH_BO_StartFreigabe :=#I_BO_StartFreigabe
IH_BO_Reset_Befehl :=FALSE
IH_BO_Annahmedung :=#I_BO_Annahmedung
IH_BO_Minute_VV_SLAN000_Bill_3_D_BO_HV_Fix_L8
IH_BO_Durchf_Loeschen :=TRUE
OUT_BO_ges_Fix_Transport :=#I_TP_54003_SLAN_000_D_BO_ges_Fix_Transport
OUT_BO_TpEndeOnTimeout :=#I_TP_54003_SLAN_000_D_BO_TpEndeOnTimeout
OUT_BO_Transport :=#I_TP_54003_SLAN_000_D_BO_Transport
OUT_BO_Durchfordern :=#I_TP_54003_SLAN_000_D_BO_Durchfordern
OUT_IH_Zachler_Abstand :=#I_TP_54003_SLAN_000_D_IH_Zachler_Abstand
OUT_IH_Zachler_Loesche :=#I_TP_54003_SLAN_000_D_IH_Zachler_Loesche
IO_BO_Stop_Transport :=
IO_OUT_Antrieb_eigener :="DB_Antriebe",_540_01_01 // Antrieb Transfer
  
```

SCADA

- OPC-UA Server connect to S7-1500
- Read a single DB and internal mapping to write to it.
- “Optimise block access”
- Dynamic fields on the SCADA



Testing

- Simulation

"Flk_Transport_3..."	%M99.0	Bool	TRUE	☐	Transport Flank
"TpEndeOhneTim..."	%M99.2	Bool	FALSE	☐	Transport Timeout
"Transport_308"	%M99.3	Bool	TRUE	☐	Activate Transport
"Durchfoerdem..."	%M99.4	Bool	FALSE	☐	Continue Transfer

"Flk_Transport_3..."	%M99.0	Bool	FALSE	☐	Transport Flank
"TpEndeOhneTim..."	%M99.2	Bool	TRUE	☐	Transport Timeout
"Transport_308"	%M99.3	Bool	FALSE	☐	Activate Transport
"Durchfoerdem..."	%M99.4	Bool	FALSE	☐	Continue Transfer

AWCS Pre-notification Tests

Connectivity: ☒ AWCS ☐ Other Select AWCS host: aff-wcs-cwl1-02 aka.amazon.com
 CWL1 pickingroutercontroller @ aff-wcs-cwl1-02:11011
 pickingroutercontroller @ aff-wcs-cwl1-02:11011

Controls

Barcode:

Directed Labels [[a printer](#)]

Click the label to toggle this

Message Type: ☒ v5[02] ☐ v6[2]

Multiple Destination

Targets: CTRL+Click a lane to target

Options

Load Testing:

Lane Type: ☐ virtual ☒ physical

Processing Order (Last Lane --- Last Scannable --- Next Lane)

SH31 tsX00hrd08t SH32

LOCK Groups

Lanes

SH31
SH32
SH33
SH41
SH42
SH43
ML11

ML12
ML13
ML14
ML15
ML21
ML22
RECIRC

PACKING

Wrangling Loop

Testing Table

- 25 Tests

Test Number	FDS Reference	Test Description	Expected outcome	Actual Outcome	Pass Or Fail
1	A1	Check colour of frame work matches specification	Colours match specification.	Colours match specification.	Pass
2	A2	Check layout of conveyors is as per FDS	Layout of conveyors is as per FDS	Layout as per FDS	Pass
3	A3	Measure height of tote conveyor	Conveyor is 0.75m high	Conveyor is 0.75m High	Pass
4	A4	Measure height pack-conveyor	Conveyor is 1.42m high	Conveyor is 1.42m high	Pass

Testing Issues

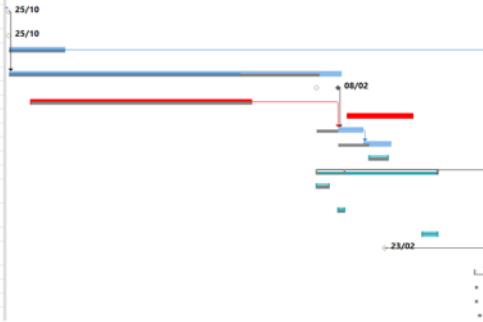
- 2 issues identified

Evaluation and the Wider Issues

- Functional Design Specification achieved
- Variation: UKCA / CE Mark
 - Machinery Directive 2006/42/EG "Local Language Documentation"
- VDF tolerance ± 5 ft/min
- Extra expenditure but under budget because
 - Customer changed workstation locations

Management Techniques

Submit White Paper for approval	7 days	Thu 14/10/21	Fri 22/10/21
Project/White Paper Approved	0 days	Mon 25/10/21	Mon 25/10/21
Orders Placed	0 days	Mon 25/10/21	Mon 25/10/21
AWCS request for new destination	14 days	Mon 25/10/21	Thu 11/11/21
Delivery / Manufacture	75 days	Mon 25/10/21	Tue 08/02/22
Parts Delivered to site	0 days	Tue 08/02/22	Tue 08/02/22
Christmas Peak 2021 Block	49 days	Mon 01/11/21	Mon 10/01/22
Annual Leave	15 days	Fri 11/02/22	Thu 03/03/22
Removal of old line	5 days	Tue 08/02/22	Tue 15/02/22
Accumulation Conveyor Build	7 days	Wed 16/02/22	Thu 24/02/22
Pack Conveyor Build	4 days	Fri 18/02/22	Wed 23/02/22
Software Development	28 days	Tue 01/02/22	Fri 11/03/22
Transfer Table software modification	4 days	Tue 01/02/22	Fri 04/02/22
Telegram Modification Code	2 days	Tue 08/02/22	Wed 09/02/22
Simulation	5 days	Mon 07/03/22	Fri 11/03/22
Hardware Installation completed	0 days	Wed 23/02/22	Wed 23/02/22
Deployment & Commissioning	3 days	Mon 28/03/22	Wed 30/03/22
AWCS Deployment	1 day	Mon 28/03/22	Mon 28/03/22
Line Commissioning	1 day	Tue 29/03/22	Tue 29/03/22
SCADA Deployment	1 day	Wed 30/03/22	Wed 30/03/22



Controls	
Power Supplies	£ 519.40
PLC CPU	£ 960.00
IO Cards	£ 1,472.00
Terminals, contactors, relays, consum	£ 350.00
Panel	£ 500.00
Labour	£ 1,000.00
Drive Cards	£ 2,880.00
Labour Layout Change	£ 1,000.00
	£ 9,481.40
Software	
Internal PLC	£ 1,500.00
Internal AWCS	£ 250.00
Accumulation PLC	£ 1,200.00
	£ 2,950.00
Hardware	
Drive Rollers 445mm	£ 7,200.00
Drive Rollers 720mm	£ 300.00
Slave Rollers 445mm	£ 4,416.00
Slave Rollers 720mm	£ 180.00
Driveboards	£ 1,040.00
Transfer section	£ 2,000.00
Fabrication	£ 10,000.00
Pre-build	£ 30,000.00
transport	£ 700.00
Total stand re-fabrication	£ 1,000.00
	£ 57,364.00
Installation/Commissioning	30000
Sonolux	
Single Phase Power Drop	£ 2,188.00
Date to Nework PLC	£ 599.60
	£ 2,779.60
Spare Parts	8180.1
Site Declaration of Conformity	£ 7,500.00
Total Spend (+VAT)	£ 141,831.72

Recommendations

- HMI
- Industry 4.0 – CBM & predictive maintenance

FINAL GRADE

GENERAL COMMENTS

Instructor

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GRADING FORM: NEW CSG-RUBRIC

JONATHON WILLIAMS

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1. ENGAGEMENT WITH LITERATURE



Section 3: Use of technical literature in final design solution: There is evidence of the use of technical literature in the design of the project particular in terms of standards and regulations. 3/5

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2. KNOWLEDGE AND UNDERSTANDING



Section 1: Introduction: Aims and objectives of the project clearly stated Section 2: FDS: Briefly summarised and outlined clearly Section 3: Advanced knowledge and critical understanding demonstrated in the design of the project: Clearly in evidence during the presentation. All sections: Response to questioning: Very good answers provided, good knowledge and understanding demonstrated. 24/30

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3. COGNITIVE AND INTELLECTUAL



Section 5: Testing and analysis of result: Excellent evidence of thorough testing and analysis of results Section 6: Critical evaluation of the project outcomes and comparison with the FDS: Very clear and thorough evaluation of project outcomes with respect to the FDS Section 8: Overall conclusions and recommendations: Very good recommendations on condition monitoring. 23/30

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4. PRACTICAL APPLICATION



Section 3: Formulation of innovative and creative design solution to the project problem: Well thought out design to met the customer's

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requirements within the constraints imposed by the customer Section 4: Deployment method, use of material, tools, equipment and techniques in the construction of the project: Excellent methods employed to a high standard Section 4: Quality of the final product or system: Top quality outcomes to company standards. Section 5: Use of test equipment and presentation of results of the project: Good evidence provided Section 7: Management techniques and planning, comparison with initial plan: Excellent techniques employed 19/25

5. TRANSFERABLE SKILLS



All sections: Quality of the presentation slides: The slides could have had more appealing graphics and were rather plain. All sections: Quality of the delivery style: The presentation was well delivered in a confident manner. 7/10

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