

Presentation 1 Project Definition, Research and Quality Planning

by Richard Harrison

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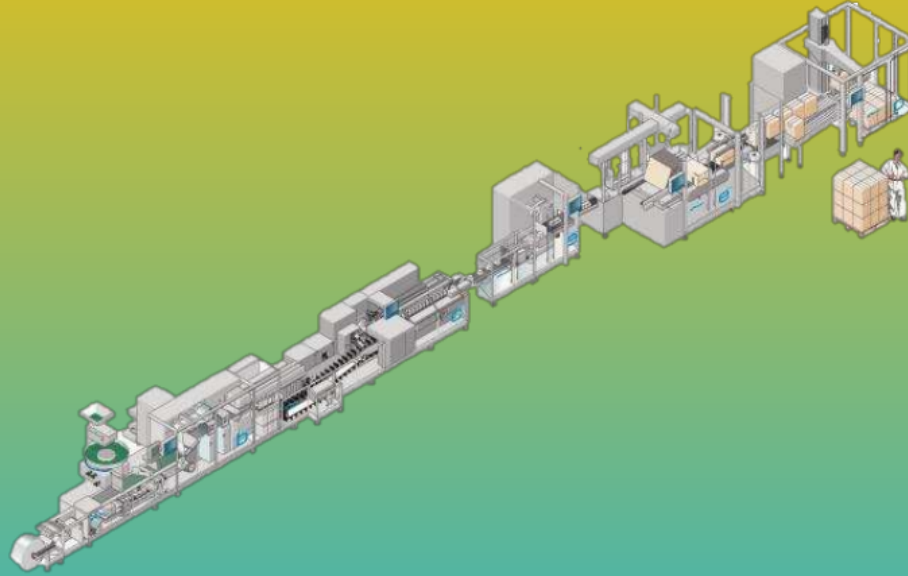
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1. SCADA remote monitoring system



Presentation 1: Project Definition, Research and Quality Planning

Module: SGEL6000 BSc (Hons) Electrical and Electronic Engineering

Name: Richard Harrison



2. Problem definition

Current issues:

- Paper records are subject to human error, causing inaccuracies
- Take up large amounts of physical space
- Breakdowns must be reported manually
- Overall reduced power + running efficiencies

Solution: A remote-monitoring system to monitor the line running in real time, record uptime/downtime/stoppages and produce this information on a HMI accessible through company server

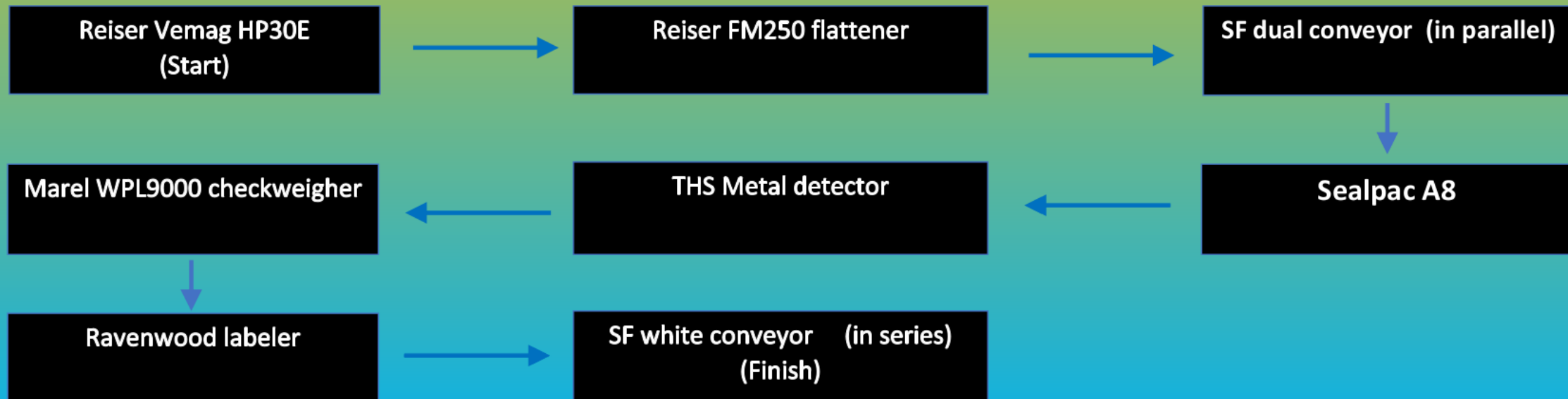
Solution advantages:

- Highly accurate records
- Very little physical space used
- Breakdowns reported automatically
 - Increased power + running efficiencies
- Reduced wasted paper



3. Background + line layout

- **Where?** Meat processing and packaging factory
- **Scope?** Single production line with various different machines from multiple manufacturers.
- **Main objective?** Trial the possibility of using remote monitoring systems on-site.
- **If successful?** Integrate system into other lines.



4. Constraints, Risks, Health/safety + Ethics

Constraints:

- Connection capabilities, only a few machines can communicate through ethernet
 - Line must not rely upon SCADA to run
- Time window for work to be done must be agreed upon

Risks to project:

- Current plans to re-organise the entire layout of the factory floor.
- Global chip shortage creating shortages of supply in parts E.g. SCADA module

Health + Safety and how to reduce risks to each other:

- Electric shock (lock-off, test for dead)
 - Wearing correct PPE (Food safe)
- Tools (check for damage prior to work)
- Communication (When working as a team)

Ethics:

- Those involved must identify and reduce risks to both themselves and others
 - Minimise impact on environment (reduce wasted power + paper)



5. Functional design specification (FDS)

Deliverables:

- The HMI screen must show a schematic/block-diagram-type representation of the line along with the state of each machine (Green for running/Red for stopped), Run-rates for the day/shift as percentages, total downtime in case of faults.
- The system must be connected to the company servers and viewable through a company gateway.
- All cabling must be off the floor and secure, modules should be inside their machines cabinets and junction boxes must be IP67 rated.
- The line must be able to run without the system in case it itself, develops a fault.



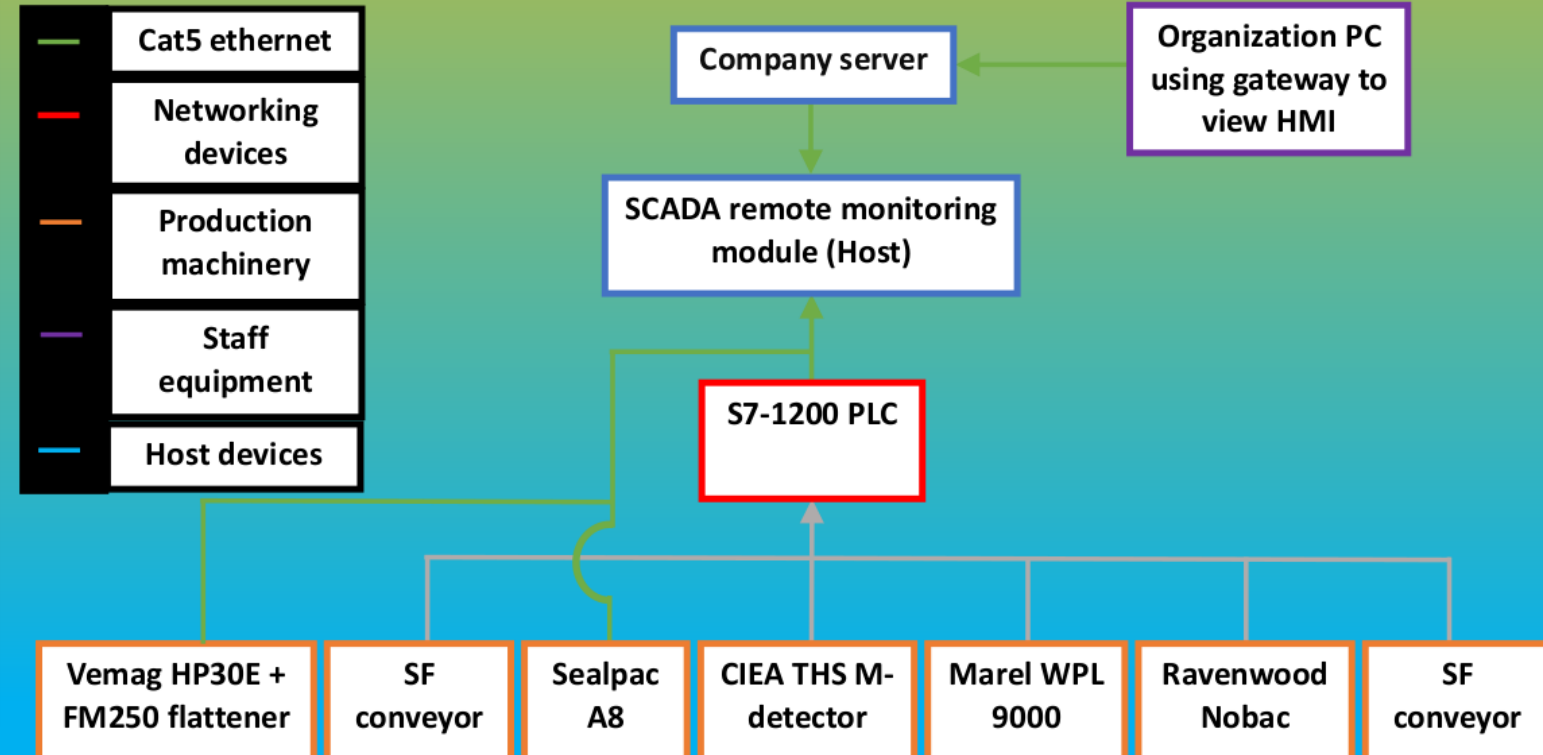
6. Potential solutions

- **Siemens Scalance + PCS7 hosted £39.9k**
 - + Expandable + potential additional functions
 - + Secure networking (VPN built in)
 - Expensive + complex to setup
 - System requires specific software on each PC accessing it.
- **SITRANS RD500, OPC server pool + WinCC runtime £35.5k**
 - + Large datalogging capacity up to 2GB
 - + Notification via email, SMS, or FTP
 - Expensive + susceptible to interference (Wi-fi)
 - Requires the most changes to machinery
- **SCADA hosted + PLC £31.4k**
 - + Easily integrate multiple different devices (highly adaptable)
 - + Least expensive
 - Cannot develop further functionality past monitoring

Chosen solution: SCADA hosted

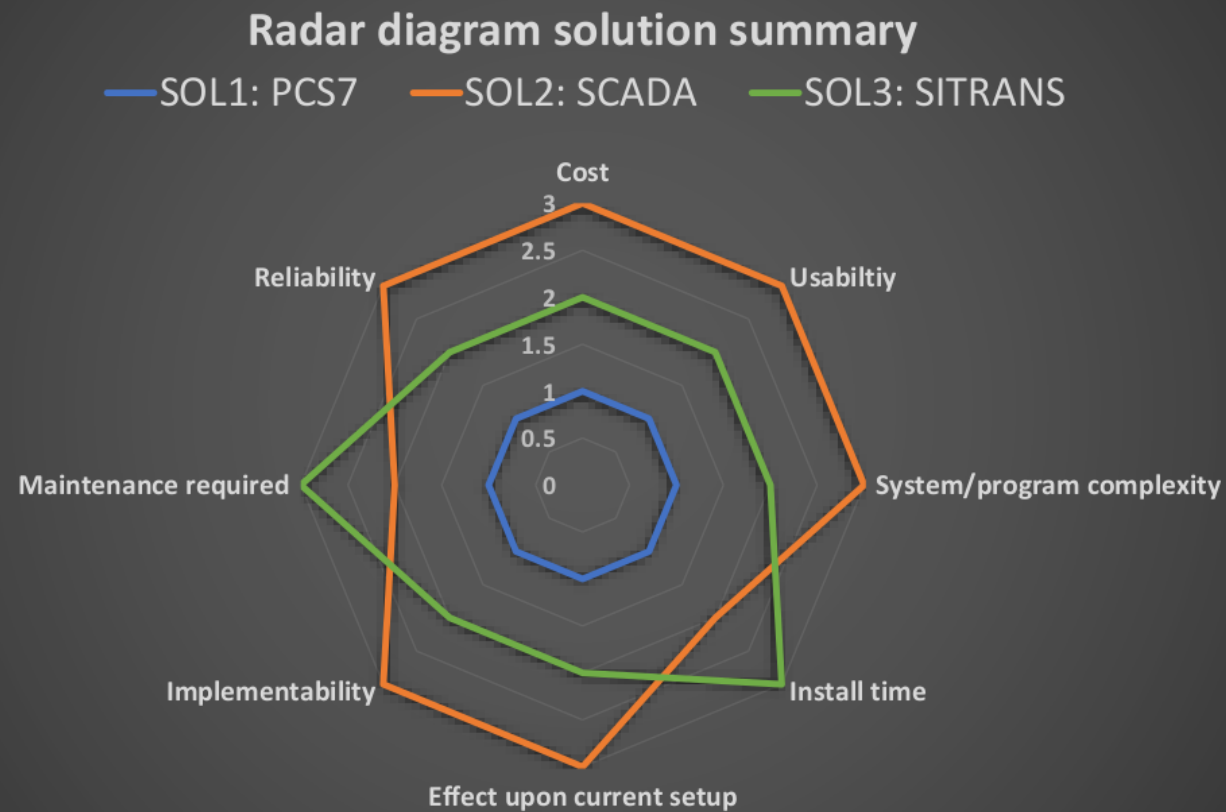
Reasoning:

- Most cost-effective pricing
- Increased reliability
- Simplicity to use
- Less downtime needed for installation
- No need for extra software installs on company computers
- Vastly greater compatibility with existing machines
- Less necessary modifications.



7. Radar diagram comparison

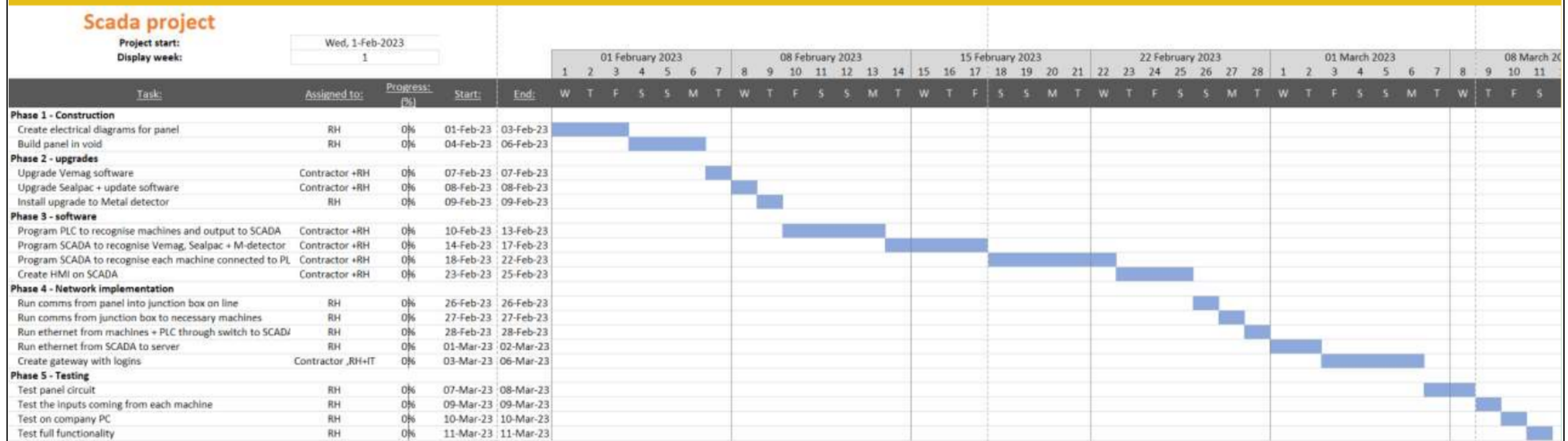
- ❖ **PCS7** – Highly specialised + most additional functionality
- ❖ **Sitrans** – Least maintenance + fastest install
- ❖ **SCADA** – Easiest and simplest to use, reliable + best all-rounder



8. Test planning

FDS item No:	Test description	Expected outcome	Actual outcome	Pass/Fail	Evidence reference
4.1.1	Stop and start multiple machines.	HMI shows machine status changing. Run rates, downtime etc are recorded.			
4.1.2	Stop and start each machine in turn.	On HMI, machine must show green when running and red when stopped.			
4.1.3	Only run individual machines.	Each machine should be able to run individually.			
4.1.4	Use a company PC to log into the HMI through a gateway.	Able to access the HMI by logging in and viewing the production line.			
4.1.5	Have line washed down as done typically.	Cat5 junction boxes must be dry inside after washing.			
4.1.6	Turn off the SCADA system.	Production must be able to run as normal.			
4.1.7	Create a fault on each machine in turn.	Each machine must appear on HMI in fault (RED), in turn.			
4.1.8	Create faults on the line.	HMI must have a page recording the recent machines in fault.			

9. Planning



- (To complete by Feb 6th, 2023) Build panel to house main system components such as SCADA unit and PLC and fit in void.
- (To complete by Feb 9th, 2023) Necessary upgrades to existing machines to be finished and software updated.
- (To complete by Feb 25th, 2023) PLC + SCADA programming completed, and HMI screen created.
- (To complete by Mar 6th, 2023) Install communications from machines to panel, install ethernet + create gateway.
- (To complete by Mar 11th, 2023) Complete testing of the system including Panel, HMI + gateway.

10. Work breakdown structure (planning)

No:	Task type	Task description	Deliverables	Work package	Person(s) responsible	Deadline
1			Planning			
1.1	Identify issue	Assess how line could be monitored better	Issues and ways of improving are identified	Assess line layout, ask management and production about potential problems, identify future plans for the line	Richard Harrison	01/12/2022
1.2	Create FDS	Produce FDS for customer to view	Show what is needed for the project to be a success with budget and timescale included	Provide project outcomes, measurable performance parameters, features to be included, Produce a budget and timescale for project	Richard Harrison	15/12/2022
1.3	Produce + assess solutions	Provide 3 solutions and decide upon best option	Provide a detailed solution which best suits the project	Detail 3 potential solutions, assess each solution, budget each solution, compare each solution + decide upon which suits best	Richard Harrison, Dylan Jones	20/12/2022
1.4	Create planning documents	Create Gantt chart, risk assessment and costing spreadsheet for parts required	Produce predicted costs for the project, a risk assessment + detailed Gantt chart showing how the project will play out	Produce risk assessments, Gantt charts, a detailed predicted cost breakdown + milestones to be achieved	Richard Harrison	01/01/2023

11. Work breakdown structure (Design)

No:	Task type	Task description	Deliverables	Work package	Person(s) responsible	Deadline
2	Design					
2.1	Order materials/Parts	Using costing spreadsheet, order necessary parts/materials	Have parts/materials ready and waiting for start date	Order each part listed on the costing spreadsheet, check in company stores + make sure parts arent already in stock.	Richard Harrison, Malcolm Green, Dylan Jones	10/01/2023
2.2	Create drawings	Create drawings for SCADA panel in void + cabling to each machine	Have a layout and plan for SCADA panel	Create wiring diagrams of SCADA panel broken down into power, PLC communications, SCADA communications	Richard Harrison, Stuart Hall	15/01/2023
2.3	PLC/SCADA requirements	Determine SCADA/PLC I/O + software requirements	Pre-determine I/O requirements ready for implementation	Ensure SCADA + PLC units have correct software and sufficient I/O	Richard Harrison, Contractor	20/01/2023
2.4	Implementation paperwork	Work permits for contractors	Have permits approved + ready for contractors prior to their arrival on-site	Have contractors cleared for arrival on-site and permits prepared	Richard Harrison, Dylan Jones	25/01/2023

12. Work breakdown structure (Implementation part 1)

No:	Task type	Task description	Deliverables	Work package	Person(s) responsible	Deadline
3	Implementation					
3.1	SCADA panel	Build SCADA/PLC panel as-per drawings, mount in roof void + connect up power	Have Panel completed, ready for connecting to machines	Fit MCB, PSU, SCADA unit, PLC, I/O module, DIN-rail terminals, isolator, ethernet hub + glands into panel. Mount panel in void	Richard Harrison, Stuart Hall	03/02/2023
3.2	Machine upgrades	Install required upgrades to pre-determined machines (see Gantt chart)	Reiser Vemag, Sealpac A8 + M-detector ready for connecting to SCADA	Install software upgrades to Reiser Vemag (meat processor) + Sealpac A8 (Vacuum sealer). Install M-detector comms board	Richard Harrison, Contractors	09/02/2023
3.3	PLC program	Create PLC program to translate basic machine run signals into something SCADA can use	Have panel PLC ready for connecting to line	Programme PLC to recognise inputs from 2 conveyors + check-weigher as run signals then relay that to the SCADA module	Richard Harrison, Siemens contractor	13/01/2023
3.4	SCADA program	Create SCADA program and HMI	Have SCADA ready for connecting to PLC + machines	Programme SCADA module to recognise input from Vemag, Sealpac, M-detector + PLC. Create HMI interface	Richard Harrison, Contractor	25/01/2023
3.5	PLC communications	Run communications from machines to PLC	Machine communications connected to PLC	Connect 2 conveyors + checkweigher into panel PLC	Richard Harrison	27/02/2023

13. Work breakdown structure (Implementation part 2 + Commissioning)

No:	Task type	Task description	Deliverables	Work package	Person(s) responsible	Deadline
3.6	SCADA communications	Run SCADA ethernet communications to machines	Vemag, Sealpac + M-detector machines connected to SCADA via Cat5	Using Cat5, connect Vemag, Sealpac, M-detector + PLC to the SCADA unit through ethernet hub	Richard Harrison	28/02/2023
3.7	Company network integration	Connect setup to company server + create gateway login	SCADA connected to company server + HMI available through gateway	Run Cat5 from SCADA to company server, create IP, gateway+ login for HMI	Richard Harrison, IT	06/03/2023
4	Commissioning					
4.1	Verify drawings	Make sure all drawings are correct	Make sure all drawings are correct	Check through completed panel and communications to machines on-line to check the circuit matches the diagram	Richard Harrison, Stuart Hall	09/03/2023
4.2	Complete testing	Using Factory acceptance test, complete functional + compliance testing	Ensure a fully functional system	Follow the factory acceptance test created in FDS + ensure full functionality	Richard Harrison, Ben Davies	11/03/2023
4.3	Complete paperwork + sign-off	Fill out QA documents + project sign-off	Ensure company is happy with the result	Complete sign-off documentation, QA acceptance documents, Permit sign-offs	Richard Harrison, Dylan Jones	11/03/2023

14. Progress so far

All planning is completed and project is awaiting relocation of production line so work can begin.

Questions?

Presentation 1 Project Definition, Research and Quality Planning

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

62/100

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GRADING FORM: NEW CSG-RUBRIC

RICHARD HARRISON

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1. ENGAGEMENT WITH LITERATURE

2. KNOWLEDGE AND UNDERSTANDING

 Project background and problem definition (6/10) Project constraints, risks, health and safety (4/10)
Response to questions (7/10) Total = 17/30

17

3. COGNITIVE AND INTELLECTUAL

 Functional Design Specification (7/10) Test planning (7/10) Project Planning and management methods (6/10) Total = 20/30

20

4. PRACTICAL APPLICATION

 Review of Solutions (6/10) Justification of final solution (7/10) Total = 13/20

13

5. TRANSFERABLE SKILLS

 Quality of the presentation slides (7/10) Quality of the delivery style (5/10) Total = 12/20

12