Coursework Assignment 2nd sit

6E7V0012 Sensors and Industrial Internet of Things

This is an assignment for students on Level 7 of the following courses: -

MEng (Hons) Electrical and Electronic Engineering
MSc Smart Systems Engineering

In this assessment you will demonstrate your knowledge and understanding of industrial Internet of things paradigm and how this can be applied to a given scenario to improve processes in relation to perceived effectiveness, integration, safety, (cyber)security, scalability, constraints, uncertainty, and risks.

We hope that you enjoy doing this assignment. It is an opportunity for you to demonstrate how well you can apply your engineering knowledge to solve real world societal issues and help create a lower carbon future.

Links

The Moodle Support Page includes the support video, submission details, answers to frequently asked questions (FAQ), and the latest version of this document.

Software tools: This unit is based on the use of the Siemens Insights Hub software. This video-resource allows you to access and use the software package required for the assessment in this unit when working off-campus.

Contacts

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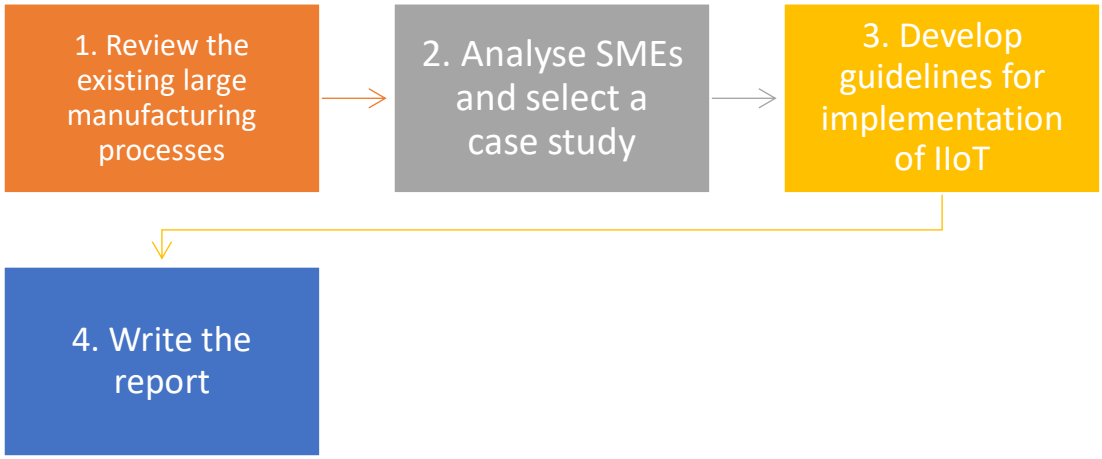
Coursework Assignment 2nd sit

6E7V0012 Sensors and Industrial Internet of Things

Contents

Workflow



Plan a realistic schedule of work to complete this assignment on time and to a high standard.

Recommended deadlines to complete each sub-task:

1. 03/07/2024
2. 15/07/2024
3. 22/07/2024
4. 29/07/2024

This assignment is for 60 of your unit mark, and we expect you to spend up to 43 hours working on it.

The Assignment Support video will talk you through the workflow and help guide your plan for success.

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Brief context and overview

In the Industry 4.0 era we are seeing the trend of large manufacturing companies rapidly embracing the challenges of Industrial Internet of Things (IIoT)and are currently working intensively on the introduction of the corresponding enabling technologies. On the other hand, Small to Medium-sized Enterprises (SMEs) face the hurdle of possessing neither financial nor human resources to systematically investigate the potential and risks for introducing IIoT.

The reality is that in most countries SMEs form the backbone of the economy, they account for the largest share of the gross domestic product and are important employers. In this context, the challenges, opportunities, and requirements of IIoT need to be analysed specifically for SMEs, hence paving the way for the digital transformation of traditional SMEs into smart factories.

Task 1: Industrial Process Analysis

You are required to study some existing large industrial manufacturing processes and then analyse how the manufacturing company embraced and implemented IIoT using Industrial internet of things. You will be required to analyse the existing solutions in terms of sensing capabilities, data exchange architecture, security and IIoT capabilities.

Task 2: SME case study for integration with Industrial Internet of Things

You will then select a UK based manufacturing SME as a case study to investigate the inherent challenges and hurdles for the implementation of IIoT.

1. As part of this task, you will need to assess the readiness level of the company to introduce IIoT in their processes.
2. You will need to map the SMEs current manufacturing processes.
3. For each process asses the readiness level for implementing IIoT and highlight the challenges

Task 3: Guidelines for SME for the implementation of Industrial Internet of Things

In this task you required to create a guideline for the implementation of IIoT in the SME based on your findings in Task 1and Task 2. This should include

1. Propositions for intro of IIoT in various processes
2. Upgrading of any software and hardware equipment
3. Addition of communication capabilities to enable connectivity.
4. Addition of sensing and actuation capabilities and controllers for automation
5. Financial analysis for the implementation of IIoT (e.g cost of upgrades and equipment, reduction in workforce etc.)
6. Recommendations to improve upon the process in relation to perceived effectiveness, integration, safety, (cyber)security, scalability, constraints, uncertainty, and risks.

Task 4: Produce a Technical Report

You are required to write a technical report on your findings. The report should be within 12 - 15 A4 pages excluding the Appendix section.

At Pass threshold

To meet the threshold requirement, you will have to describe the process, connectivity capabilities, software and hardware, the sensors involved and the data exchange system currently in place and evaluate its effectiveness. You will also have to provide recommendations improving upon the existing system using IIoT technologies and justify your solution. Provide a description of the sensors included in the system along with a short explanation of the principles behind their operation. Support your statements and choices with references to theory and best practice.

Above pass threshold

To gain extra credit, the proposed solution should be comprehensive and its analysis thorough:

Possible things to include are:

- Explore the addition of additional sensing systems that would benefit the process.
- Addition of sensors and connectivity for legacy equipment and systems
- Provide an appropriate network design complete with a detailed diagram including any edge/gateway devices.
- Explore the potential of including edge devices in your design and justify your decision.
- Identify key sensor data that can be remotely monitored. Explain the data types and any processing requirements.
- Give an example of what the dashboard for remote monitoring would be like.

Advanced features could include: -

- Exploring the potential for predictive maintenance and explaining how this could be implemented.
- Explore the application of Big Data to the solution
- Explore the application of AI/ML for historical analysis and prediction
- Discussing what access to the system and data each role would have (e.g. machine operator, automation engineer, developer, manager etc.)
- Discuss the suitability of the various APIs that are available when creating the dashboard.

Supporting Learning Resources and Activities

Lecture notes	Example Case Study	Xcelerator Academy

Assessment Notes

- The case study while comprehensive might be lacking detail in certain aspects of the problem description. In those cases, you are allowed to make assumptions based on what is the industry standard.
- Make sure you justify your review of the existing process and the suitability of your improvements based on best practice and theory. Reference your sources.

Use numbered captions for the figures and tables that you will include in your work.

Deliverables

This assessment deliverable will be an individual technical report that should be within 12 - 15 A4 pages excluding the Appendix section.

Your report should address the following key points: -

- Introduction
  A short introduction about Industry 4.0, IIoT and the benefits of digitalisation.

- Industrial Process analysis
  Analyse how large manufacturing companies embraced and implemented IIoT.

- SME case study analysis
  Review of the existing system in terms of how data is exchanged and the utilisation of its sensing capabilities for monitoring the process and providing insightful information to the operators.

- Guidelines for SMEs to implement IIoT
  Provide comprehensive guideline for SMEs to implement IIoT by the addition of new sensing, actuation, controllers, hardware, and software or by improving upon the existing sensing, communication and data analysis and visualisation systems.

- Appendices (excluded from page count)
  Include all supporting information such as any technical documents, cost analysis and datasheets.

Your report should include references to support your design/conclusions. (use the MMU Harvard Referencing Those can be books, journal/conference papers and/or technical reference sources, e.g. manufacturer's datasheet, industrial standard, etc.
The University Library has an online tutorial to help you find good quality reference sources and a guide on how to use them correctly in your document using the MMU Harvard referencing style.

Assessment

Formative Feedback

Members of the teaching team and will answer queries about the assignment during the timetabled Workshop classes and in the drop-in Surgery sessions (see your personal timetable for details). Advice given during these sessions and feedback on any work you present will not count towards your final grade.

Outside timetable sessions, please email questions to the Teaching Team, the Support Tutors or your Personal Tutor. The teaching team will **not** use their office hours to provide one-to-one or small group assignment support, but a selection of emailed questions, and questions asked during the timetabled classes will be added to the assignment's FAQs page.

What is being assessed?

Learning outcomes		Evidence
Unit Learning Outcomes	2. Appraise how the Industrial Internet of Things (IIoT) uses data exchange and analysis for enabling improvements in manufacturing efficiency, productivity and safety.	Report
	3. Discuss the applications and implications of sensors in contemporary manufacturing and assess new developments in relation to their capabilities and limitations.	Report
Assessment Criteria	USD2 Demonstrate a high degree of professionalism* e.g. initiative, creativity, motivation, professional practice and self-management. AHEP4 Outcomes evidenced: M5	
	USD3 Express ideas effectively and communicate information appropriately and accurately. AHEP4 Outcomes evidenced: M17	
	USD6 Articulate an awareness of the social and community contexts within their disciplinary field. AHEP4 Outcomes evidenced: M5 and M10	

To pass this assessment you have to fully achieve the unit learning outcomes by completing all the tasks and submitting the deliverables to an adequate standard.

Your grade will be determined by how well you meet the assessment criteria (see the detailed grading criteria for this assignment, below).

This assignment will be marked out of 100 and contributes 60% of overall unit grade.

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Assessment Grading Criteria

Deliverable →	Report (Task 1)	Report (Task 2)	Report (Task 3)
Weighting →	40%	30%	30%
Grade range ↓	Demonstrate a high degree of professionalism* eg initiative, creativity, motivation, professional practice and self-management.	Manage their professional development reflecting on progress and taking appropriate action	Articulate an awareness of the social and community contexts within their disciplinary field
86%-100%	There is evidence of the ability to work autonomously and creatively with reference to professional standards and values, reflecting critically on their own professional practice.	A creative and credible vision of themselves and their professional futures is meticulously presented.	The social and community contexts of the implementation of Industrial IoT are meticulously evaluated in developing action plans, articulating conclusions and making recommendations of relevance to theoretical development and/or practical application
70%-85%	There is evidence of the ability to work autonomously and imaginatively with reference to professional standards and values, reflecting critically on their own professional practice.	A novel and feasible vision of themselves and their professional futures is presented	The social and community contexts of the implementation of Industrial IoT are critically evaluated in developing action plans, articulating conclusions and making recommendations of relevance to theoretical development and/or practical application
60%-69%	There is evidence of the ability to work autonomously with reference to professional standards and values, reflecting critically on their own professional practice.	Demonstrate a fully worked vision of themselves and their professional futures	The social and community contexts of the implementation of Industrial IoT are analysed carefully in drawing conclusions and making recommendations
50%-59%	There is evidence of the ability to work with reference to professional standards and values, reflecting critically on their own professional practice.	Demonstrate a vision of themselves and their professional futures	The social and community contexts of the implementation of Industrial IoT are considered critically in drawing conclusions and making recommendations
45%-49%	There is evidence of a limited attempt to work as an autonomous professional who reflects on their own professional practice	A limited vision of themselves and their professional futures is presented.	There is partial or limited identification of the social and community contexts of the implementation of Industrial IoT in drawing conclusions and making recommendations
20%-44%	There is limited evidence of any attempt to work as an autonomous professional who reflects on their own professional practice	There is insufficient development of a vision of themselves and their professional futures	There is limited or incorrect identification of the social and community contexts of the implementation of Industrial IoT in drawing conclusions and making recommendations
0%-19%	There is little or no evidence of working as an autonomous professional who reflects on their own professional practice	No clear vision of themselves and their professional futures is presented	There is little or no identification of the social and community contexts of the implementation of Industrial IoT in drawing conclusions and making recommendations

Re-assessment

Note that opportunities to repeat assignments are not automatically provided, and when they are, the marks obtained may be capped. For more information about the regulations, please contact the Student Hub.

Coursework Assignment 2nd sit

6E7V0012 Sensors and Industrial Internet of Things

If you think you are at risk of failing this assignment, please seek advice as soon as possible inform your Personal Tutor or the Support Tutors – with enough notice, there are many ways in which we can support you and help you to get back on track.

Appendix

Summary of AHEP-3Learning Outcomes Evidenced

M5	Design solutions for complex problems that evidence some originality and meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health and safety, diversity, inclusion, cultural, societal, environmental, and commercial matters, codes of practice and industry standards.
M10	Adopt a holistic and proportionate approach to the mitigation of security risks
M17	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used.