ICA Specification

Module Title: **Internet of Things**	Module Leader: **Jie LI**
	Module Code: **CIS3011-N**
Assignment Title: **An IoT application design, development, and demonstration**	Deadline Date: **02 May 2025 (Friday)** Feedback: **04 June 2025 (Wednesday)**
	Deadline Time: **4:00 pm**
	Submission Method: **Online via Blackboard** ☒ TU Online ☐ Middlesbrough Tower ☐

Online Submission Notes:

• Please follow carefully the instructions given on the Assignment Specification
• When Extenuating Circumstances (e.g. extension) has been granted, a fully completed and signed Extenuating Circumstances form must be submitted to the School Reception or emailed to scdtassessments@tees.ac.uk.

Central Assignments Office (Middlesbrough Tower M2.08) Notes:

• All work (including CDs, etc.) needs to be secured in a plastic envelope or a folder and clearly marked with the student's name, number and module title.

• An Assignment Front Sheet should be fully completed before the work is submitted.

• When an extension has been granted, a fully completed and signed Extension form must be submitted to School Reception or emailed to scdtassessments@tees.ac.uk.

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1. Module Learning Outcomes

The following provide the learning outcomes for 'Internet of Things' ICA.

Personal and Transferable Skills:

1. Communicate clearly and professionally the results and evaluation of building a sensor network.
2. Use evidence-based decisions when selecting technologies and software to provide communication with low-level firmware on embedded devices.

Research, Knowledge and Cognitive Skills:

3. Demonstrate a comprehensive knowledge of the key concepts of IoT and its enabling technologies.
4. Develop software to facilitate higher-level data processing of data obtained from IoT devices, evaluating how well it meets specified requirements.

Professional Skills:

5. Design and build (or simulate) a simple sensor network based on Internet of Things technology, considering potential professional and ethical issues associated with the network's operation.
6. Discuss and make informed comments on emerging areas of the Internet of Things, demonstrating an understanding of the social, environmental, and commercial context.

2. Use of AI

No use of (generative) AI is allowed for all aspects of the ICA. If it is suspected AI has been used, then offending students will be referred for Academic Misconduct.

For programming work a comment should be placed at start of the program which contains

- Student name and ID
- Declaration that AI has not been used

3. Research and References

Students are free to research how to complete ICA tasks. If a student does use code as taught on the module, then the relevant code must be referenced. For a program this is done by comments before the relevant code, stating:

- URL or Harvard reference for the source of the code
- Explanation of what the code does

If the reference or explanation are unsatisfactory then no marks will be awarded for the relevant code.

Citations and References should be in the 'Cite Them Right' (Harvard) Reference Style. Visit https://libguides.tees.ac.uk/learning_hub/home for more information.

4.   ICA Brief

You need to design, develop, and demonstrate an IoT application and make a report of the process (approx. 4000 words). This is a mixed report, a combination of 70% group and 30% individual work (counts 100% of your overall marks).

5.   Problem Domain and Scenario

IoT can be used in various domains, including Healthcare, Smart City (i.e., smart home), Smart Transportation (i.e., driverless car, connected car) and Industry 4.0. Please form a **group of 3-4 people** and select a problem from the following domains:

- Healthcare

- Industry 4.0

- Smart City

- Smart Transportation

- any other domain you prefer

and design, develop and demonstrate an IoT solution for the problem.

Please use the following example problem scenario to understand the problem type and scope (Note: you are not allowed to use this specific scenario in your ICA).

SmartHealth Ltd. is a Teesside based smart healthcare company. This company offers onsite services to their patients or clients. SmartHealth was introduced to IoT and its potential benefits in healthcare by your company (where you work as an IoT expert), a healthcare IoT solution provider. SmartHealth is interested in extending its business by remote healthcare services, and they contacted your company in this regard. Your company has assigned you to design, develop, and demonstrate a remote monitoring system for elderly and chronic disease patients, especially a fall detection and reporting system using IoT.

6.   Your Tasks, Mark & Mapped Learning Outcomes

Task ID	Task description	Mark (%)	Learning outcome
1	Identify and formulate your problem from the selected domain: • Select your application domain. • Identify a problem/service and describe the problem. (group task).	5	PS1, PS3
2	**Proposed IoT-based Solution:** Propose an IoT solution for the identified problem (group task). Here you need to discuss how an IoT can solve or improve an existing solution. • Adoption of an existing solution to your problem (4-5%) • Improved version of an existing solution to your problem (6-8%) • Innovative solution (9-10%)	10	PS1, PS3
3	**Design:** Identify the necessary technologies with justification needed for an IoT solution of the identified problem and briefly discuss them (group task). Following are the hints for the task: • Sensing layer technologies (minimum 3 sensors) • Transport layer technologies • Application layer technologies • An architecture of the IoT solution	10	PTS7, RKC1
4	**Development:** Develop the IoT solution that will include the following functionalities (group & individual task: overall work is group, but each of you needs to lead one component that is worth 10% or more): • A sensing layer that senses and processes the sensed data (10%). For this task, you will need hardware. • A transport or communication layer that communicates the data to the cloud/Internet (5%) • Select an IoT platform with justification and connect your data to an IoT platform (i.e., Azure IoT) (10%) • Process data using AI & visualise the results (10%) • Use the processed data to make decisions or transform business processes (5%)	40	RKC3, RKC4

5	**Demonstration:** demonstration of the developed IoT solution to the module team: • Fully working solution (15%) • Partially working solution (1-14%) ○ Example: All sensors and data gathering working (5%)	15	PTS3
6	Discuss the social, economic, and ethical issues linked to your selected domain due to emerging IoT solutions (individual tasks).	10	PS3
7	Write the report clearly and professionally (i.e., using references) regarding technical issues in an IoT network and your selected problem area (individual task).	10	PTS3

7.   Deliverable and Deadline

You should submit your report as a **Word or PDF document** online (Blackboard) by the **02 May 2025 (16:00PM).**

- **Report: Individual** submission
- **Artefact or demonstration: one submission** from each group.

8.   Extensions

If you feel that your circumstances warrant an extension, and that you would benefit from one, you **must speak to Jie Li or Mohammad Razzaque before the deadline**.

Note:

- There must be a genuine reason for requiring an extension, simply *needing more time* is not an acceptable reason.

- As a group work, think about if the extension will affect other group members.

- An extension request after submission deadline will need to be submitted to the school and require supporting evidence.

9. Assessment Criteria

Marks will be assigned as in the following table.

Task	70%+	60-69%	50-59%	40-49%
1	An excellently defined and formulated problem of the selected domain.	A well-defined and formulated problem of the selected domain.	A fairly defined and formulated problem of the selected domain.	Incomplete definition and formulation of the problem of the selected domain.
2	Innovative solution with excellent presentation.	Improved version of an existing solution with good presentation.	Adoption of an existing solution with good presentation.	Adoption of an existing solution with fair presentation.
3	All three-layer technologies are identified and excellently presented with an architecture diagram.	Two-layer technologies are identified and well presented with an architecture diagram.	One-layer technologies are identified and satisfactorily presented with an architecture diagram.	Lack of layer-wise technologies identification and poorly presented with an architecture diagram.
4	A complete development of the solution with all the mentioned components and an excellent discussion of the process.	An incomplete development of the solution with one missing component and a good discussion of the process.	An incomplete development of the solution with two missing components and a good discussion of the process.	An incomplete development of the solution with three or more missing components and fair discussion of the process.
5	Demonstration of a fully functional solution to the identified problem.	Demonstration of a partially working solution to the identified problem with one missing component.	Demonstration of a partially working solution to the identified problem with two missing components.	Demonstration of a partially working solution to the identified problem with three missing components.
6	An excellent discussion of the social, economic, and ethical issues linked to the selected domain due to emerging IoT solutions.	A good discussion of the social, economic, and ethical issues linked to the selected domain due to emerging IoT solutions.	A fair discussion of the social, economic, and ethical issues linked to the selected domain due to emerging IoT solutions.	An incomplete discussion of the social, economic, and ethical issues linked to the selected domain due to emerging IoT solutions.
7	A very clear and readable report, with excellent structuring, good use of grammar, and referencing.	A clear and readable report, with good structuring, good use of grammar, and referencing.	The report is readable but with minor errors. Some use of relevant source material and referencing.	A readable report, with major errors in writing, structure, or referencing.

10. Feedback and Advice

For feedback and advice on your progress, consult the module tutors during the scheduled sessions. In addition, you can email *both* tutors (jie.li@tees.ac.uk / m.razzaque@tees.ac.uk).

11. Supplementary Resources

1. The following links to existing datasets could be useful:
    a) https://www.kaggle.com/data/46933
    b) https://hub.packtpub.com/25-datasets-deep-learning-iot/
    c) https://www.quora.com/Where-can-I-find-a-good-Internet-of-Things-dataset
2. The following link can be useful for your own image set generator:
    a) https://debuggercafe.com/create-your-own-deep-learning-image-dataset/
3. The following link code would be useful for a synthetic sensor data generator:
    a) https://github.com/makinarocks/Mandrova
4. The following book will give you some hints on how to use existing datasets in your IoT project, especially using deep learning.
    a) https://www.amazon.co.uk/Hands-Deep-Learning-IoT-applications/dp/1789616131