BSc Computer Science

Module: Physical Computing and Internet-of-Things (IoT)

Coursework: Midterm Assessment - IoT Project Proposal

Submission Deadline: Midterm

Your overall total word count should not exceed 1500 words (Weighted at 30% of final mark for the module)

Coursework Description

In this mid-term INDIVIDUAL report, you will be developing a proposal for a physical computing and internet-of-things (IoT) project. You will then build, implement and evaluate the system based on this proposal in the end of the term submission.

Your proposal should consist of **THREE PARTS**:

PART 1: Background Research

For the background research, choose **ONE** of the following areas which relate to Climate Change and Sustainability.

1. RECYCLE MORE: How can IoT devices encourage individuals to recycle more in daily life? (i.e., smart bins, recycling sorter, reuse bags, …)
2. WASTE LESS: How can IoT devices support reducing food waste, overcooking, over shopping and, etc...?
3. PLANT CARE: How can IoT devices support (indoor/outdoor) plants to receive optimum water for soil moisture, temperature, light, fertilizer and, etc.?
4. ENVIRONMENT CARE: How to monitor pollution levels in your area and encourage walking over driving using IoT Rewards?

The questions next to these four areas of Climate Change and Sustainability are there to help you tailor your investigation and propose an IoT solution.

Once you have selected **ONE** of the four areas, you will need to investigate, document and reformulate your findings. After you have investigated your selected area, you will need to cover the following in your report:

- What are the problems you are trying to solve?
- What are the current solutions?
- How does one solution differ from one and another?
- How are these solutions developed technically and their strengths/weaknesses?
- Analyse: so what? is it practical? do we really need it? any side effects? etc

Please see the report guidelines section to help you structure your report.

PART 2: Project Proposal

For the proposal, you should come up with an idea for a system you are going to physically build and program in the second coursework, which you will do in the second half of the term (not now!).

The write-up for the proposal must contain the following elements:

- Holistically describe the system and the key components,
- Justify the real-world applications for the project,
- List key non-/functional requirements,
- Design implementation plan (i.e., use case diagram, transitions diagrams, UI design etc.)
- Testing strategy (i.e., hardware/software testing, test setup, test cases, input type, expected outcome).

The proposed project must meet the following constraints:

(1) A maximum of 3 ESP-based microcontrollers nodes can be used for the project.
(2) A minimum of 3 sensors and/or actuators should be used per node.
(3) All source code should be compliable and developed using Arduino IDE ONLY.
(4) All ESP-based microcontrollers nodes should be in-/directly linked.
(5) All ESP-based microcontrollers nodes should have a dashboard and respond to REST-based HTTP requests in a JSON format.
(6) Supporting external libraries for Arduino IDE and commercial devices such as Smart Speakers (i.e., Alexa or Google Home) and one Raspberry Pi can be used but NOT mandatory.
(7) Project-specific sensors and actuators outside the prerequisite kits can be purchased at their own cost but should be limited to a total of 3 components ONLY. Consult with the tutor if you require more.

PART 3: Development Progress

Once you have selected your project idea, performed a literature review and identified the functional and non-functional requirements of your proposed system, start building a prototype as soon as possible.

The requirement for part three is to briefly indicate the progress made so far on developing the prototype. Suitable screenshots and images from your phone/camera can be included in the appendices.

Write no more than 250 words max for this part.

Please note: we do not expect you to have completed any code or functionalities at this stage.

Deliverables and Submission Guidelines

- Only one document in an MS Word or PDF format is required to be submitted which contains the three parts requirements for the proposal.

- The submission should consist of no more than 1500 max words.

Report Guidelines

A general report structure might look like the table below. However, this table is for illustrative purposes only and your titles and orders of the sections can change based on your project.

Title page *	This page should include your project title, module/course details, author details, date of submission, and etc.
Abstract *	Provide an overview of your report. This includes introducing the background of your project, problem context, findings from your literature review, your proposal and implementation progress made so far.
TOC, LOF, LOT *	Include a table of content (TOC), a list of figures (LOF) and a list of tables (LOT) created throughout the document.
Introduction	Provide a background of the IoT based project and the problem you are setting out to address. Include aims and objectives which set clear goals and concise and appropriate challenges which are measurable. Aims should be specific, with your objectives building up a bigger picture of what you hope to do. Goals and operations should be clearly specified. The theme of usability is key. This section should set out the measuring criteria for your work and your presentation will be judged in relation to these aims and objectives.
Methodology	A short description of how you are going to perform your literature review, what sources will you utilize, list any hypothesis or assumptions you may have and provide a clear scope of the project.
Literature review	This is a critical section of your report where you present your findings on existing approaches, systems, and tools that are in-/directly linked to the problem context and critically review their advantages and disadvantages. At the end of the section, synthesis and highlights the challenges faced by the stakeholders and briefly discuss your proposal to reduce or mitigate the problems.
Proposal	Introduction of the IoT based project proposal based on your findings in the literature review. Provide justifications of the proposed project with a conceptual description of the key components of the projects and what their role will be. You can use diagrams such as use cases and overall system architecture diagrams to present a holistic view of your project. List functional and non-functional requirements.
System Design Documentations	This section is dedicated to providing technical descriptions and design decisions taken when selecting a particular method from a software and hardware development perspective, i.e., what microcontrollers, how many sensors and actuators types, and which communication protocols are adopted and why?
Test Plan	A short discussion of the testing strategy and example actual tests cases.
Implementation Progress	A brief overview of progress made in implementing your proposed non-/functional requirements with pieces of evidence such as taking screenshots or images of your circuit.
References *	List all academic resources that you have used for this report. This could be books, conference or journal papers, magazine articles, and creditable websites in the reference style recommended from the instituted. You can use reference management tools such as desktop applications (i.e., Mendeley or Zotero) or online websites to automatically generate the list of references.
Appendices *	Include any other material relevant to your project i.e., facts and figures, screenshots or images of your project implementation.

*Please note, sections with * are not part of the word count.*

Assessment Criteria

First deliverable	**1500 words max -** *excludes the title page, acknowledgement, abstract, table of contents, list of figures, list of tables, reference list and appendices.*	**Marks** (/30)
Area	**Criteria**	
Description of the IoT-based Project Proposal	No abstract, introduction of the project and overall aims and objectives were provided.	0
	Some attempt to provide abstract, the introduction of the project and overall aims and objectives provided. However, limited justification of the IoT based project is provided.	1
	An adequate level of description, aims and objectives and justification of the IoT based project provided.	2
	A strong level of understanding, project description, aims and objectives and justification of the IoT based project provided. The core features were clearly described and justified.	3
	An excellent grasp of the problem context and logical reasoning presented to investigate and develop the IoT based project. The core features are clear and novel applications to the problem presented.	4
Methodology	No evidence or mention of methodology.	0
	Limited understanding of how to start the investigation, methods to employed, resources that will be used and rough plan presented.	1
	Good understanding of qualitative and quantitative research methods presented, investigation methods, key resources that will be used were identified and a rough plan was presented.	2
	An excellent understanding of qualitative and quantitative research methods presented, investigation methods, key resources that will be used were identified and a rough plan was presented.	3
Literature review Identifying and critically reviewing academic studies or relevant sources in the selected IoT based project topics. Based on findings in the literature review, a rationale for the proposal is developed.	No literature review was conducted.	0
	Limited topics covered in the literature review with some references.	2
	Vague or incomplete descriptions of existing projects presented with little critical analysis of features and technologies used or reference back to the goal of this investigation.	4
	At least five existing projects were critically analysed, technologies and features adapted were reviewed with strengths and weaknesses. A summary that provides highlights with some limitations or alternative methods/technologies with reasonable justification is presented.	6
	Excellent review of existing projects with suitable academic references is presented with identification of strengths and shortfalls in the current systems and proposing a suitable IoT-based solution.	8
	An outstanding review of exiting projects with a clear and novel idea or alternative methods to address or reduce the impact of the problem area using IoT-based solutions.	10
Project Proposal Typically identify system features, key users and write use cases or equivalent.	No conceptual or technical overview of the proposed project is presented. No clear non-/functional requirements were formulated.	0
	Some attempt to link findings from literature review and proposed IoT based solutions. The rationale and description of the proposed approach are vague. A list of non-/functional requirements is formulated but unclear.	1
	Key features and components of the proposed IoT project are conceptually described with suitable diagrams and clear non-/functional requirements.	2
	Excellent description of proposed IoT solution with a logical rationale and sufficient depth to the technologies that will be employed.	3

System design documentation Indicative design plan of the proposed system, i.e., sensors & circuit diagrams, UML, Use cases, UI design etc.	No technical description of system design plan on how to develop the proposed IoT solution.	0
	Some description of the technical details of the system design plan on how to develop the individual nodes for the proposed IoT solution.	1
	Well-described technical details of the system design plan and strategy on how to develop the proposed IoT solution. A reasonable attempt of using diagrams to illustrate the system use cases, node circuit diagrams, and UI design was provided but with limited description.	2
	Excellent system design planning document with a list of prerequisite hardware/software components, tools and libraries that will be used for the proposed IoT system. Suitable diagrams such as circuits diagram, UI, and data flow between multiple IoT nodes is presented.	3
Indicative test plan A short discussion of the testing strategy and example actual tests cases.	No details on the evaluation strategy were provided to test the proposed IoT system.	0
	Some testing strategies were discussed but limited or no test plan was developed in relation to non-/functional requirements. Missing test cases, input data/action, expected and actual results.	1
	A reasonable testing strategy was discussed and justified with the developed requirements. The test plan shows core test cases being tested with input data/action, expected and actual results.	2
Implementation report Max 250 words	No prototype development summary was presented.	0
	Limited overview of the system development progress provided. Some attempts with annotations of the hardware/software system with a brief projected future plan included.	1
	Well-documented system progress supported with some screenshots and pictures as evidence. A rational plan was put forward to complete the rest of the non-/functional requirements.	2
Report Structure and Presentation	The report is poorly structured with major spelling, grammar mistakes, and inappropriate written style. Missing abstract, acknowledgements, table of contents, page numbers, referencing etc.	0
	A good logical report structure with minor spelling, grammar mistakes, and a suitable written style. The report also makes a good attempt to include abstract, acknowledgements, table of contents, page numbers, referencing, etc for better readability. Good use of diagrams to convey complex ideas more clearly.	1
	An excellent presentation of the report with appropriate written style to guide and keep the reader engaged. All figures and tables are captioned, source referenced and cross-referenced and discussed in the report. A diverse academic source of references was used.	2
	Exceptionally well-crafted and well-written report. Energetic and clearly conveys details efficiently with a good balance of textual, graphical and supporting documents in the appendices.	3