Faculty of Computing, Engineering and Science

Assessment Brief

Module Title: Advanced Integrated Computing Devices

Module Code: IS3S687

Module Leader/Tutor: Nathan Thomas/Paul Jarvis

Assessment Type: Practical Coursework 1

Assessment Title: Internet of Things (IoT) Design Case Study using the Raspberry Pi

Weighting: 50%

Word count/duration/equivalent: 1000 words plus working prototype

Submission Date: 23.59 on Friday 1st November 2024

Return Date: Friday 29th November 2024

## Assessment Description

**Assessment Task:**

You are required to create a case study of an Internet of Things (IoT) system. The case study must contain two deliverables:

1. A written report in which you must present a scenario which may benefit from an IoT solution, using the Raspberry Pi and associated external sensors via the GPIO. You must describe the context of your scenario and propose your solution.
2. A prototype of your system based entirely on the sensors included in the CrowPi kits. You must submit your Python code and provide a demonstration of your working prototype.

The scenario must be realistic and feasible but could be in any context. For example, it could be based within a home or office to improve living standards or help protect the elderly; it could be based in a public space to help monitor the environment; or any other context of your choice.

Examples of potential solutions might include a burglar alarm, a baby monitor, an environment monitor, a remote device control system, etc.

The prototype should not be a fully-fledged system that can be used in a full-scale context, but should be a proof-of-concept version that demonstrates how the system could potentially operate.

**1. The Written Report**

The written report should be approximately 1000 words in length (20% either side, ie. 800-1200 words) and must include the following sections:

* **Introduction**: An introduction to your document that concisely sets out the topic of your case study and the aims and content of the rest of your report.
* **Scenario**: An explanation of your scenario and the nature of the challenges that exist in your chosen context. You should then outline your proposed IoT solution and highlight the benefits it will bring to your chosen scenario. Identify the types of sensors and output devices that would be required and the role that they would play as part of your system. *Note that these devices do not necessarily need to feature on the CrowPi, here you should be discussing a full-scale version of your solution.*
* **Visual Representation:** A visual layout or schematic diagram to show where IoT equipment would be placed in a full-scale version of your system. For this you can make use of a free planning tool such as those discussed in class (eg. RoomSketcher) or alternatively use Microsoft Word, Powerpoint or take a photo of a hand-drawn image. You should overlay some images, or icons to represent the IoT hardware.
* **User Interface:** An explanation of a suitable IoT User Interface for a smartphone or other device that will allow your system to be monitored and/or controlled. What information will the interface provide to users and what will it allow the user to do? You should include a mock-up screenshot of your interface. An example of such an interface can be seen here: <https://www.openhab.org/> Again, this can be created using a suitable graphics package or hand-drawn.

Where necessary you should include references and citations, presented in line with the USW Harvard Referencing Guide. Your report should be formatted to good academic standards (table of contents, page numbers, headings etc).

**2. The Prototype**

Your prototype system must be implemented entirely using a CrowPi kit as used in class. It should make use of the CrowPi sensors and/or outputs to replicate the system proposed in your written report, on a smaller scale.

The implementation must make use of at least three sensors and/or output devices that will operate in a complementary way to produce a useful system.

As a prototype, the system you create does not necessarily need to include all features of your proposed IoT solution as described in the written report. For example, your proposed system might entail use of an output device that is not included in the CrowPi, so you might substitute this with a text output to the CrowPi display. Or the proposed system might require multiple sensors, some of which are unavailable, so an alternative sensor could be used, or the sensor could be left out of your prototype system (assuming other sensors are implemented).

You must submit your Python code and provide a demonstration of your working system. No marks are awarded for the prototype without a demonstration.

**Hints for achieving better grades:**

* Do not feel constrained by the features on the CrowPi when proposing your solution. Your written report might refer to sensors or outputs that are not available on the CrowPi, but can be substituted or left out of your prototype implementation.
* However, you should choose a scenario and solution that allows you to demonstrate your skill at using the CrowPi, so think carefully about which sensors are available and would allow you to create a viable prototype.
* When creating diagrams and visuals, don’t worry too much about using professional software. A photo of a hand-drawn picture that clearly shows the content you are intending to represent will suffice, although it is still important that any visual content is detailed and presented to a high standard.
* Use references to support your proposed solution. As far as possible, don’t copy/paste material verbatim from existing sources; paraphrase into your own words. Whether you are quoting verbatim or paraphrasing, cite and reference your sources using the USW version of the Harvard System. A description is available at: <https://library.southwales.ac.uk/collections-subject-guides/referencing/>
* Take care of the word count and do not miss out on marks for writing too much or too little. Keep the writing concise. If your report is too verbose or unfocused then you are likely to lose marks. Try to avoid unnecessary jargon, explaining complex terminology where it is used.
* Look carefully at the assessment criteria to ensure you are covering aspects that will be needed to earn marks. Do not forget to include all sections that are set out in this assignment brief or you will miss out on potential marks.
* Take care to maintain Academic Integrity. Avoid plagiarising, colluding, or other types of Academic Misconduct. Details of these are provided here: <https://studyskills.southwales.ac.uk/academic-misconduct/what-academic-misconduct/>
* If in doubt about any aspect of this assignment, ask your lecturer for clarification.

A video can be found on the Assessment tab on Blackboard, providing additional guidance.

## Guidance on Format of Assessment

Note: Students are reminded **not** to include this assignment brief with the assignment submission.

Referencing must be completed in line with the USW Harvard style, as outlined here: <https://library.southwales.ac.uk/collections-subject-guides/referencing/>

## Learning Outcomes Assessed

LO1: To demonstrate a critical understanding of integrated computing device functionalities and the technologies associated with the Internet of Things (IoT).

LO2: To analyse the requirements and design an appropriate implementation of an IoT system using integrated computer technologies.

## Marking Criteria/Rubric

Note: All grades are provisional until they are ratified by the exam board

|  |  |  |
| --- | --- | --- |
|  | **Criterion** | **Grade Awarded** |
| **Written Report (total 50%)** | Brief introduction 5% | /5 |
| Scenario 15% | /15 |
| Visual Representation 10% | /10 |
| User Interface (UI) 10% | /10 |
| Referencing 10% | /10 |
| **Prototype: Demonstration Required (total 50%)** | Input devices 15% | /15 |
| Output devices 15% | /15 |
| Code 10% | /10 |
| Usefulness 10% | /10 |
| **Total** | | % |

Detailed Rubric:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Fail | Narrow Fail | 3rd Class / Pass | Lower 2nd Class / Pass | Upper 2nd Class / Merit | 1st Class / Distinction |
| **Written Report** | | | | | | |
| Brief introduction 5% | * A missing or very superficial explanation of the topic of your case study * Aim and/or content of the report are not stated | * An unclear or inappropriate explanation of the topic of your case study * Aim and/or content of the report are unclear or inappropriate | * A basic explanation of the topic of your case study * Aim and content of the report are stated | * An explanation of the topic of your case study although it may lack clarity * Aim and content of the report set out although it may lack clarity in places | * A clear explanation of the topic of your case study although it may be too verbose or lack some relevant detail * Aim, content and conclusions of the report set out clearly although it may be too verbose or lack some relevant detail | * A concise and comprehensive explanation of the topic of your case study * Aim, content and conclusions of the report concisely and comprehensively set out |
| Scenario 15% | * A missing or very superficial explanation of a scenario * A missing or very superficial explanation of a proposed IoT solution * The types of sensors and output devices that would be required in your solution are not stated or very superficially stated | * An unclear or inappropriate explanation of a scenario that may lack detail or not identify the challenges it encompasses * An unclear or inappropriate explanation of an IoT solution, that may be unsuitable for the scenario or lack significant detail * The types of sensors and output devices that would be required in your solution are inexhaustive or unclearly stated | * A basic explanation of a crude scenario and the challenges it encompasses that may lack some detail * A basic explanation of a crude IoT solution that may lack some detail * The types of sensors and output devices that would be required in your solution are stated | * An explanation of a simple but appropriate scenario and the challenges it encompasses * An explanation of a simple but appropriate IoT solution that identifies its benefits * The types of sensors and output devices that would be required in your solution are identified and explained | * A clear explanation of a realistic scenario and the potentially complex challenges it encompasses * A clear explanation of a realistic and non-trivial IoT solution that identifies its benefits * The types of sensors and output devices that would be required in your solution are identified and explained with some justifications | * A thorough and clear explanation of an innovative scenario that highlights the complex challenges it encompasses * A thorough and clear explanation of an innovative IoT solution that highlights and justifies its benefits * The types of sensors and output devices that would be required in your solution are identified and explained with clear and thorough justifications |
| Visual Representation 10% | * A missing or very superficial visual representation of your system layout | * An incomplete or inappropriate visual representation of your system layout | * A crude visual representation of your system layout that may lack some detail | * A visual representation of your system layout that is basic but covers all relevant features to some extent | * A clear and well-presented visual representation of your system layout that covers all relevant features | * A clear and innovative visual representation of your system layout that covers all relevant features thoroughly |
| User Interface (UI) 10% | * A missing or very superficial explanation of the UI of your system * Missing or very superficial mock-up screenshot design | * An incomplete or inappropriate explanation of the UI of your system * Unclear or inappropriate icons and elements used in a mock-up screenshot design | * A crude explanation of the UI of your system that may lack some detail * Minimal icons and elements used in a understandable mock-up screenshot design | * An explanation of the UI of your system that is basic but covers all relevant features sufficiently * Appropriate icons and elements used in a basic mock-up screenshot design | * A clear and intuitive explanation of the UI of your system * Appropriate icons and elements used in a clear mock-up screenshot design | * A clear, thorough, consistent and intuitive explanation of the UI of your system * Appropriate icons and elements used in an intuitive and innovative mock-up screenshot design |
| Referencing 10% | * Sources used are not cited at all in text * Evidence not used or lacks relevance * No citation style * Reference list absent or includes very many errors or absences | * Sources used are not cited where appropriate in text * Evidence used does not support points that are made * Citation style is not based on USW Harvard Referencing guidelines or includes many errors or absences * Reference list is not based on USW Harvard Referencing guidelines or includes many errors or absences | * Sources used are cited where appropriate in text, although incorporation is obtrusive (disrupting writing or too many direct quotes) * Evidence is used but usually replaces rather than supports discussion * Citation style is based on USW Harvard Referencing guidelines although there are several errors and/or absences * Reference list is based on USW Harvard Referencing guidelines although there are several errors and/or absences | * Sources used are cited where appropriate in text, with most evidence paraphrased appropriately * Evidence is used and usually supports discussion * Citation style is based on USW Harvard Referencing guidelines although there are some errors * Reference list is based on USW Harvard Referencing guidelines although there are some errors | * Sources used are cited where appropriate in text, with evidence paraphrased appropriately * Evidence is used to reinforce discussion * Citation style is based on USW Harvard Referencing guidelines with only minor errors * Reference list is based on USW Harvard Referencing guidelines with only minor errors | * Sources used are cited where appropriate in text, with evidence paraphrased appropriately and unobtrusively allowing the writing to flow * Evidence is used to reinforce discussion and always supports analysis * Citation style is based on USW Harvard Referencing guidelines with no errors * Reference list is based on USW Harvard Referencing guidelines with no errors |
| Prototype | | | | | | |
| Input devices 15% | * No input devices work at all | * At least one input device is used that works, potentially erratically or inaccurately. Contributes to fewer than three inputs/outputs overall | * At least one input device is used that works appropriately. Contributes to at least three inputs/outputs overall | * Two input devices are used that work appropriately. Contributes to at least three inputs/outputs overall | * Three or more input devices are used that work appropriately. Used in conjunction with at least one output device. | * Three or more input devices are used that work in combination in a non-trivial manner. Used in conjunction with at least one output device. |
| Output devices 15% | * No outputs at all | * Outputs to the screen only, or to one output device that works, potentially erratically or inaccurately. Contributes to fewer than three inputs/outputs overall | * At least one output device is used that works appropriately. Contributes to at least three inputs/outputs overall | * Two output devices are used that work appropriately. Contributes to at least three inputs/outputs overall | * Three or more output devices are used that work appropriately. Used in conjunction with at least one input device. | * Three or more input devices are used that work in combination in a non-trivial manner. Used in conjunction with at least one input device. |
| Code 10% | * Code does not work, lacking any functionality | * Code does not work fully although there is some functionality | * Code works but is poorly presented * Code lacks comments | * Code works and is adequately presented * Code includes minimal or unclear comments | * Code works and is well presented * Code includes clear comments | * Code works and is presented efficiently and neatly * Code includes clear and thorough comments |
| Usefulness 10% | * Does not represent the proposed solution | * Represents the proposed solution but lacks useful functionality | * Represents a crude version of the proposed solution | * Represents a basic but useful version of the proposed solution | * Represents a useful version of the proposed solution that is simplified to a minor extent | * Represents a realistic and useful version of the proposed solution |

## Submission Details

You must submit:

* An electronic copy of a Word document that contains your written report via the Blackboard Turnitin link. Hard copies are not required.
* Python code for your prototype via the Blackboard link. Hard copies are not required.
* You must provide a demonstration of your working prototype following submission. Timeslots for demonstrations will be arranged in liaison with your lecturer.

## What happens next?

Your marked assessment should be available 20 working days after submission. However, please be advised that this may be subject to change in the event of Bank Holidays, University Closure or staff sickness. If there is something about the feedback you have been given that you are unclear about, please see your module tutor.

## Feedback Method

Feedback will be emailed to you.

## Late Submission

The assessment submission slot on Blackboard will remain open after the deadline has passed. If it necessary for you to submit your work late then you should submit your work through the same method and inform your lecturer when you have done so. Your work may then be assessed, if appropriate.

## Retrieval in the Event of Failure

Resit assessments opportunities will be available in the summer if appropriate. This assessment is eligible for In Year Retrieval.

## Extenuating Circumstances

[https://advice.southwales.ac.uk/a2z/extenuating-circumstances](https://advice.southwales.ac.uk/a2z/extenuating-circumstances/)

## Referencing, Plagiarism and Good Academic Practice

[https://advice.southwales.ac.uk/a2z/referencing-plagiarism-and-good-academic-practice](https://advice.southwales.ac.uk/a2z/referencing-plagiarism-and-good-academic-practice/)

## Learning Support Resources

[https://studyskills.southwales.ac.uk](https://studyskills.southwales.ac.uk/)

## Your Assessment Queries

Assessment related queries should be raised in class ideally. It may be possible to offer additional individual support on request. Contact your lecturer to arrange this if necessary.

## Student Checklist

Ensure you complete all of the following elements:

|  |
| --- |
| Written Report containing all sections as detailed in the marking criteria |
| Python code |
| Perform a demo of your prototype |