



# ENG103 Introduction to the Internet of Things

## Task 3 Project Instruction and Guideline

### Overview

This document provides information about the requirements for Task 3. The project instructions give a brief description of what you need to achieve and offer a standard project to help you get started. Alternatively, you can implement your own IoT project (with tutor approval). The guidelines cover how to deliver your project's outcomes, including the presentation and report.

The project is a group assignment, allowing teams of up to **4 members**. *Although it's a team effort, each student must submit an individual report outlining their contribution to the project and complete a peer assessment of other members' contributions.*

If you need assistance in forming a team, please let us know by week 9. Project work will begin in Week 9 onwards, or once you have chosen your project to implement. We have 3 weeks for implementation (Weeks 9, 10, and 11).

**The project is worth 50% of the total grade.** It consists of a project presentation and a report. The project presentation is worth 15%, and the report is worth 35%. Please see section Task 3 Guideline for more information.

### Learning objectives

- Apply hardware and sensors learned in the course to solve real-world problems.
- Integrate relevant technologies into your project.
- Create IoT applications/systems by configuring and modifying existing work.
- Design and develop a project to effectively deliver findings and outcomes.

### Generative AI use

*Please read the following and make sure you follow the rules and instruction.*

### **Open Use (AI co-created)**

**Use of generative artificial intelligence (AI) is permitted to be used as a ‘co-pilot’ for this assessment task. However, you must acknowledge how you used the AI tools.**

Note that generative AI tools can generate incorrect or misleading results so make sure you use them with care and critical judgement. Your final submission should be supported by credible, academic sources, appropriate for your context. You are responsible for the accuracy of any information that you submit as part of an assessment.

**If generative AI was used in the preparation of this assessment, please include the following information:**

- I acknowledge the use of <insert the name of the AI tool/s> in this assessment for <list the way/s in which you used AI>.

You must list what you used generative AI for. Failing to acknowledge this may result in academic misconduct.

Please refer to the *UniSC Student Portal* for information on [Using generative artificial intelligence \(AI\) tools](#) and the *Library* on [How to acknowledge the use of artificial intelligence](#).

# TASK 3: Instructions

## Project Description

The IoT project allows you to apply your knowledge beyond the weekly materials and workshops. With a foundational understanding of Raspberry Pi and an exploration of several key technologies—including design principles, hardware, software (OS and programming languages/libraries), networking, the web, and cloud computing—you will build an interesting project that could potentially solve real-world scenarios or be applied in your area of interest. The project will involve the design, implementation, and configuration of a novel solution.

You can choose **one of the three projects** listed below or propose your own IoT project (Open IoT Project). Regardless of your choice, you are required to create a program that implements your solution. Your project must include both standard features and some advanced features. You are encouraged to innovate with your advanced features, but you should discuss and get approval from your tutor before including them in the project. You must incorporate what you have learned from the weekly workshops, which cover hardware, software, networking, the web, and cloud computing, among other topics.

There are a few important points to consider when implementing your project:

- **Purpose:** Your project should have a clear purpose. Think about **why** someone would want to use your project and **what** problem it aims to solve. It's important to focus on creating something meaningful and purposeful, rather than just building a project without a specific goal in mind.
- **Use of Raspberry Pi:** Your IoT project should utilize Raspberry Pi computers. There are various guidelines and tutorials available online to assist you.
- **Use of Hardware:** Use a few sensors and components (e.g. LED, Temperature sensor or Heart rate sensor etc.)
- **Communication:** Your project should involve communication, such as TCP/IP networking or web-based interactions, to ensure it functions as a smart device/application/system.
- **Safety:** Your project must not use mains-level voltages and must be safe to operate.

You are not allowed to use past work, reuse other assignments, or use your own previous work (self-plagiarism) or that of others to develop this project. Any work taken from others must be correctly cited and referenced, or you will be penalized.

## Standard Projects

Please **review the project hardware and guidelines (Week 9 materials)** in order to implement the standard project. All materials are provided to help you get started with the real project. Make sure you look at the learning materials and incorporate your knowledge from week 1 into your project. You are now in charge of your own project, so make sure you understand what you are trying to achieve. Sometimes, you may need to use your own judgment to decide whether you need to install new libraries or operating systems.

For a team who is looking for higher grades such as Distinctions or High Distinction, you should aim to implement one or more of the advanced features.

### 1. Personal Health and Wellbeing System

#### Overview

An IoT project that allows users to monitor vital health data such as heart rate (BPM, beats per minute) and blood oxygen level (SpO2). This convenient and portable IoT project can be done at home. Users can view data trends over time, such as heart rate and SpO2 levels.

#### Standard Features

- Measure and display heart rate and blood oxygen level in real-time.
- Alert users if their heart rate or SpO2 exceeds specified thresholds by blinking a red LED rapidly; otherwise, a stable green LED will light up.
- Incorporate a push button to record heart rate and SpO2 data and save it to the cloud.
- Schedule to save historical data daily through the cloud.

#### Advanced Features

- Implement user registration or login for viewing data, etc.
- Allow users to view health data through a web interface, keeping all data in the cloud.
- Apply Ngrok for web technologies to enable visualization of personal health data anywhere, anytime.

### 2. Intelligent Home Environment Control

#### Overview

Intelligent Home Environment Control is a smart system designed to automate and manage various home devices based on user activity and environmental conditions. This system aims to enhance convenience, energy efficiency, and overall home comfort by intelligently adjusting settings and responding to changes in the home environment.

#### Standard Features

- Presence detection using ultrasonic distance. If it detects the movement, trigger the LEDs light green to be on. For example, Yellow is no movement detect [you can design]
- Alert the user if the temperature and humidity level are in specified categories e.g. if the temperature in the room is too hot, cold, moderate etc. Same as humidity level
- Use push button to control LEDs light in the room. If no one in the room turn off the light.
- Use push button to record all the activity mentioned above in the cloud.

## Advance Features

- Allow user to control and monitor home devices through web-based dashboard.
- Allow the system to send email or notify if no one at home.
- Integrate other device (e.g., USB camera or others that you may have)

## Useful Resources

- Send email: <https://realpython.com/python-send-email/>
- Slack notification: <https://raspberrypi-guide.github.io/programming/send-slack-notifications>
  - <https://www.raspberrypi.com/news/create-your-own-slack-bot-with-a-raspberry-pi-pico-w/>
- Telegram control <https://pimylifeup.com/raspberry-pi-telegram-cli/> (No longer work)
- Temperature logging <https://www.raspberrypi-spy.co.uk/2015/06/basic-temperature-logging-to-the-internet-with-raspberry-pi/>

## Open IoT Project

You can choose this option to pursue your own Open IoT Project based on your interests and develop IoT applications and systems for it. Your choice must be approved by the tutor, must not be based on any current work you are developing, and must demonstrate a broad range of the technologies and hardware discussed in this class. **If you decide to implement your own IoT project, you must find tutorials that can guide you to achieve your project outcomes.**

The Open IoT Project must be judged to have a complexity and level of effort at least equal to that of the Standard IoT Project. Students choosing the Open IoT Project should understand that while the rubric's terms and criteria serve as guidelines, the overall intent and spirit of the rubric will also influence grading.

### For example:

#### 1. Smart Garbage Monitoring System

Ideas: Install ultrasonic sensors in garbage bins to measure the fill level. The data is sent to a central server, which alerts the user when a bin needs to be emptied, optimizing collection routes.

#### 2. Security and Intruder Detection System

Ideas: place ultrasonic sensors at entry points to detect motion or presence. When an intrusion is detected, the system can trigger an alarm and send notifications to the user's smartphone.

## Useful Ideas or Resources for Project

There are more guidelines in the week 9-11 materials on Canvas under the Week 9-11 module. The following are some examples:

**Agriculture:** Capture plant health with NDVI and Raspberry Pi

<https://projects.raspberrypi.org/en/projects/astropi-ndvi/0>

**Smart home Assistant:** <https://www.home-assistant.io/installation/raspberrypi> Your own smart home.

**Core electronic project** <https://core-electronics.com.au/projects>

**Project list** <https://github.com/thibmaek/awesome-raspberry-pi>

**Memory box display a photo of scan finger print**

<https://www.raspberrypi.com/news/memory-box-displays-a-photo-of-whoever-scans-their-fingerprint/>

**Machine Learning-powered EV charger availability detection with Raspberry Pi Pico W**

<https://www.raspberrypi.com/news/machine-learning-powered-ev-charger-availability-detection-with-raspberry-pi-pico-w/>

**Official Raspberry pi project** <https://projects.raspberrypi.org/en/projects/raspberry-pi-getting-started>

**GPIO music box** <https://projects.raspberrypi.org/en/projects/gpio-music-box>

**Web app**

<https://blog.hubspot.com/website/what-is-web-app>

**AI and Machine learning**

Ai for young educator <https://www.raspberrypi.org/blog/ai-machine-learning-data-science-education-seminars/>

## TASK 3: Guideline

The project is worth 50% of the total grade. It consists of a project presentation and a report. The project presentation is worth 15%, and the report is worth 35%. Please see the following details as a guideline.

### Part A: Project demo [15%]

The project demo is required as part of the evidence of successful demonstration the IoT project. This demo will be occurred during **your schedule class in week 12**. This is a snapshot of your report that you will showcase the project that you have implemented.

Please accompany power point slides for your presentation and should briefly explain what you have done and implemented.

The presentation should be **within 5 – 10 minutes only**. There is a guideline, below, to help you get started with your PowerPoint presentation that showcases your IoT Project. You can use the prompts to guide and support you. Please adapt them to suit your own needs and ensure that the message you deliver is understood by the general user or audience.

- **Introduction**
  - Tell us what your project is about? what is the purpose and what you try to solve?

- **Background & motivation**
  - Why you choose this project? What motivate you?
- **Methodology**
  - Any design principles that you apply? you should apply the design principle for your project.
  - Are you employing any software development lifecycle? e.g, Design principles? agile method, waterfall method etc?
- **Result & Discussion**
  - Show us your implementation and how it works?
  - Experimentation? Result?
- **Conclusion and Future Development**
  - The main summary of your project and future improvement

## Part B: Project Report [35%]

The project report should tell the us that you have learnt and implemented technologies studied in this course. There are three main technologies discussed in the course including **hardware, software, networking**. Please use the following questions as prompts to guide you and get your creative design/implementation. You can use the prompt(s) to best guide you and support you.

### 1. Project specification and motivation

- Provide a concise project objective and motivation of your project context in real world application.
- Guide to demonstrate project specification
  - What is the goal of the project?
  - What is the motivation?
  - How this benefit to the real-world context?
  - Any applications that utilised this project before? And how your project improves or enhance this to drive solve a real-world problem?

### 2. Hardware design & configuration

- Provide a concise hardware design & configuration
- Guide to demonstrate hardware design & configuration
  - What is your hardware Architecture?
  - What is the hardware you are using with the IoT project?
  - Why do you design to use this hardware? And provide hardware specification
  - Are there any alternatives that we could use?
  - Describe how hardware relates to the technologies we introduce in the course
  - What experimentations have you done? What are the results? Have you done any testing?
  - What challenges you have faced? How could you solve or mitigate the challenges? What could be done better?

### 3. Software and Networking design

- Provide a concise Software and Networking design

- Guide to demonstrate Software and Networking [Similar to hardware but in the context of software and networking]
  - What is your software/networking Architecture? And how this may link to hardware architecture above?
  - What is the software and networking you are using with the IoT project?
  - Why do you design to use this software and networking? And provide software and networking specification/design/implementation
  - Are there any alternative software and networking that we could use?
  - Describe how software and networking relate to the technologies we introduce in the course
  - What experimentations have you done? What are the results? Have you done functional testing? Or any test cases that you employ? Etc.
  - What challenges you have faced? How could you solve or mitigate the challenges? What could be done better?

#### **4. Conclusion and Future work**

- Summarise the main reflection of the project.
- Give a final comment or judgement on the project and make some suggestions for future improvement.

#### **5. Reference**

- You should provide reference list here. We encourage you to reference work that you use throughout the project.
- You can use APA style or other style suggested in Referencing Guides and Academic integrity [here](#). (Make sure in-text citations and the reference list are included.)