School of Computer Science and Mathematics

6200COMP Project
Project Specification Form

Complete this page and write your specification starting on the next page using the headings provided. This template is to be used to provide the initial outline for your project. It does not count toward the final assessment, rather it is to help you get started with your project. You can change the title or ideas at any time but you should negotiate this with your supervisor.

The **First Draft** should be submitted to your supervisor by **Friday 4th October 2024**.

The final/approved version of the **Project Specification** should be uploaded to Canvas by **Friday 25th October 2024**.

1. Project details

Name	Harrison Kay
Student No	993784
Programme	Computer Science
Supervisor	Gyu Myoung Lee
Initial Project Title	How to optimise productivity and crop quality in agriculture with the assistance of an Internet of Things device
Brief description (up to 100 words)	I will be using IoT devices and sensors in a greenhouse to gain data about crops in the greenhouse, this data then can then be analysed and acted upon using actuators to maximize quality and yield of crop by keeping factors such as temperature and humidity at a known optimal level.

2. Checklist

Meeting	I have met with my supervisor to discuss my ideas	YES
Approval	I have received my supervisor's approval for the specification	YES
Management	I have arranged regular meetings with my supervisor	YES
Ethics	I have discussed ethical approval for the project	YES

Domain	I have agreed which subject areas or problem domain I will be undertaking the project in	YES

Background

This section provides some information about the context for the work including the topics you need to study

Greenhouses are an isolated space in which environmental conditions, such as humidity and temperature, can easily be controlled. To control this environment a person is required to monitor and change the environment manually to meet optimal conditions. The problem with this is that a person cannot be in the greenhouse permanently and may find it difficult to maintain perfectly optimal conditions. My project aims to use an IoT device to constantly monitor the environmental conditions and if they are not optimal, use actuators to automatically fulfil the conditions. This will make the greenhouse a smart greenhouse. The use of an IoT device will minimize the need for a person to attend to the greenhouse, reducing labour costs.

Topics I will need to study will be microcontroller programming, IoT fundamentals and protocols, Sensor technology. IoT actuators. Basic agriculture concepts and greenhouse climate control.

Problem

This section provides a description of some of the computing problems you will tackle in your project

Some of the problems I will face is simultaneously interfacing with multiple sensors to capture consistent and accurate data in real time by digitising analog readings from sensors. In an environment like a greenhouse where the conditions fluctuate accurate data is a must. Furthermore, data from sensors needs to be fine-tuned to avoid noisy, imprecise data.

Also, implementing algorithms to control the actuators based on the sensor data will be a challenge, multiple sensors will need to be constantly read and when data goes above or below a certain threshold an actuator will need to be activated and then deactivated when optimal conditions have been met. Also, efficiency needs to be considered so that actuators don't constantly switch on and off.

The device also needs to have some fault tolerance, if a sensor or actuator fails, the rest of the system still needs to work independent of the faulty sensor/ actuator.

Aims and Objectives

This section provides the general targets (called aims) and specific targets (called objectives) of your project

The main aim of a project like this is to have a fully automated smart greenhouse using an IoT device. Sensor data and actuators need to be used to optimize the conditions in the greenhouse specific to the crop inside. Doing this will give optimal yield, reduce waste of resources, and reduce human hours needed to tend to the greenhouse by means of manual intervention.

Objectives for this project are as follows:

- Environmental condition monitoring, this will involve continuously polling the sensors of the IoT device to gain data on conditions such as temperature, humidity, and light levels.
- This data should be fetched many times a minute to have accurate real time data so that actuators can be activated in a timely manner.
- Automated control, the actuators should activate when data from the sensors reach certain thresholds, for example when temperature is outside of the optimal range for the crop within the greenhouse either a fan should turn on and window should open, or a heater be turned on to return the condition back to optimal range.

Hardware and Software Requirements

If your project has any non-standard requirements, i.e. not just a standard LJMU PC/Internet, then these should be outlined here. If LJMU cannot provide the required support, you should mention how you plan to acquire the hardware and software.

Hardware requirements:

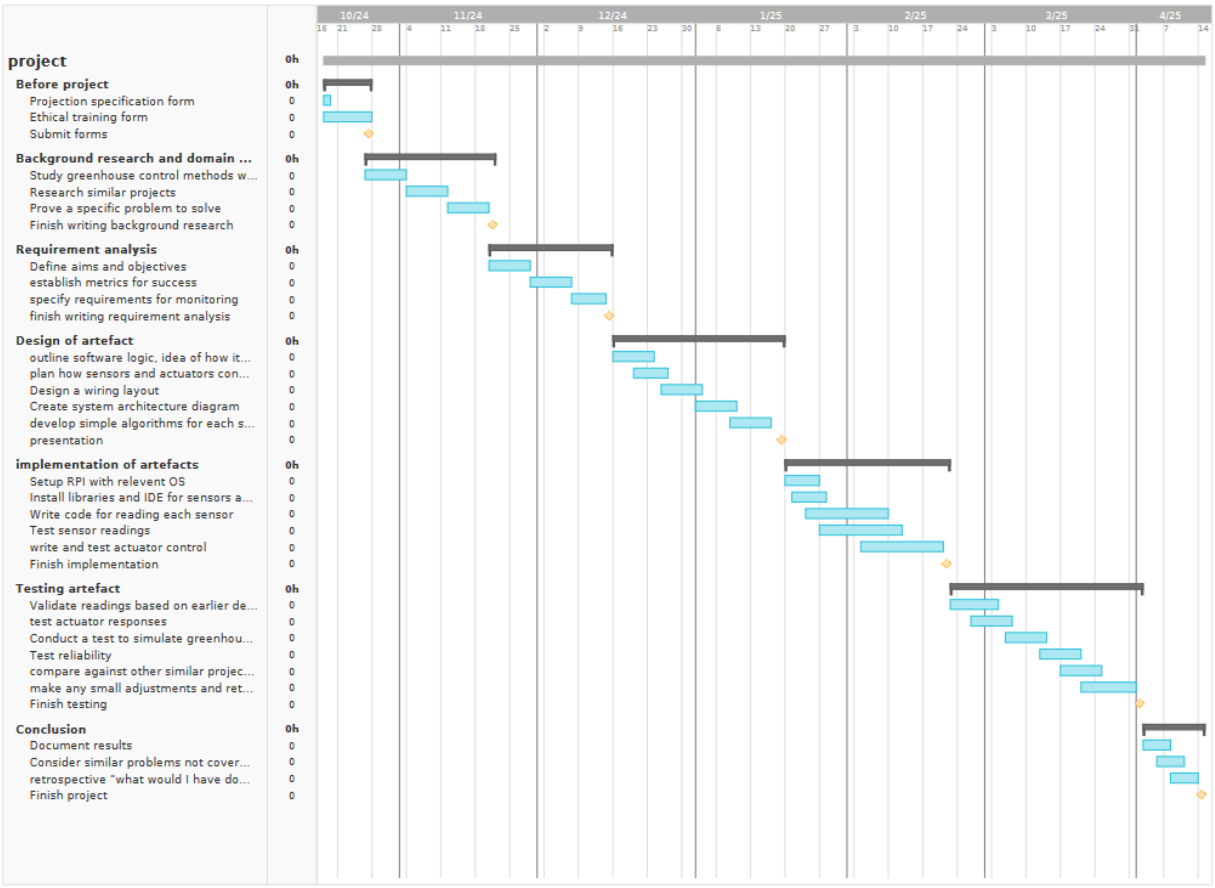
- A central controller such as a raspberry pi or Arduino board.
- Sensors such as temperature sensors, humidity sensors, soil moisture sensors, light sensors, CO2 sensors.
- Corresponding actuators such as ventilation fans, heater, lighting, valves for water flow.
- Relay device to control high power device such as a fan.
- Breadboard, wires, resistors to connect sensors and actuators to the control boards GPIO pins.

Software requirements:

- IoT libraries
- Arduino IDE (if using Arduino board) / Adafruit python libraries (if using raspberry pi)

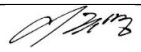
Project Plan

This section should identify the main tasks/phases of the project and their associated timescale in the form of a Gantt chart.



References

You should reference any work that you use

Signature (student)	H. Kay	Date	17/10/2024
Signature (supervisor)	Gyu Myoung Lee 	Date	23/10/2024