RMIT University

Engineering Capstone Project Part A - OENG1183

OENG118X/COSC250X Engineering & IT Capstone Project

Capstone Project Proposal
Smart Watering System for a Community Garden based on the Water Shooting gun

Student team: Calico

Student name & ID: Truong Tan Gia Huy - s3806881
Nguyen Bao Tuan - s3713061
Nguyen Mau Tung - s3755518
Nguyen Tri Nhan - s3826381
Nguyen Tuan Minh - s3877477

Academic supervisors: Dr. Alexandru Fechete
Dr. Byron Anthony Mason

Company: RMIT Vietnam Sustainability

Industry supervisor: Mrs. Trinh Thi Anh Phuong

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I. ABSTRACT

RMIT Sustainability has requested SSET final-year students to create a "Smart Watering System" as a 2024 capstone project to promote sustainable gardening practices in RMIT's sustainable garden, the Aloe Garden. The watering system should have a water-saving, and innovative setup that can assist garden participants in reducing stress during its use.

This report by the Calico capstone team proposes solutions for RMIT Sustainability, including project context, geography analysis, literature review, and market research. The technology solution focuses on automated integration methods and systems. The system will utilize automated controls, sensor technology to manage water pressure, and water volume, predictive analytics, and remote monitoring. To mitigate plant risks, water will be directed at a target designed by the Calico team instead of directly onto the plant. The water will then be collected in a storage box and released into the garden irrigation system. With a two-semester timeframe (around 6 months), the Calico team has made a budget plan, risk management, and stakeholder communication to ensure the project's completion.

The project aims to promote resource conservation and sustainable innovation, contributing to a greener, more sustainable RMIT. Collaboration with RMIT Sustainability and academic supervisors aims to deliver practical outcomes advancing sustainable gardening practices.

II. PROJECT BACKGROUND AND PROBLEM STATEMENT

2.1. Project Background

RMIT Sustainability takes initiative to build a sustainable community garden within the university campus, named Aloe Garden with a total area of 100 m². 40% of it would be designed as a cabin to host workshops on sustainability, while the remaining 60% would be used as the garden area for students and staff to come closer to nature, through gardening, and other activities to practice the sustainable lifestyle.

To align with their sustainable practices, a smart watering system that can satisfy the sustainable outcomes, and durability of technology, RMIT Sustainability would love to collaborate with SSET to build it. The goal is to have a group of final-year engineering students design a Smart Watering system for the 60 m² garden area that can water plants based on water shooting guns. The goal is to design and simulate a smart watering system by September 2024, aiming to optimize water usage, automate plant care process, and enhance the well-being of garden participants.

a. Location and weather

The project's watering system will be installed in District 7, Ho Chi Minh City, known for its warm and humid weather. The average temperature would be around 30 °C during days, and the temperature would drop slightly at night to around 28 °C. However, recent weather forecasts indicate an average temperature of 36°C. Given that the project implementation falls within the wet season from July to September, temperatures might drop, while humidity rises [1].

b. Land and People

The final land option for the project implementation has not been finalized by the RMIT Sustainability Department. Two promising options are located next to Building 9, and the other is near the subgate of RMIT, neighbouring to Building 8. The campus has a maximum capacity to accommodate approximately 10,000 people, and it is estimated that the land will be utilized by around 100 people.

2.2. Problem Statement

a. Problem identifying

This project has both sustainability challenges, which mainly focus on educating sustainability awareness gap, and engineering challenges. Calico team need to design and implement a prototype of "Smart watering system" by September 2024 for the 60 m² garden, and the system should solve all these engineering challenges below:

- Efficiently water the diverse plants, like vegetables, fruits, herbs, and medicinal plants in the garden.
- Utilize a water gun shooting range to kick start the innovative watering mechanism.
- Include an irrigation plan, and nozzle plan with pumps, pipes, sensors, and automatic water refilling for optimal water management.
- Involve students and staff in a fun and interactive way to water the plant.

b. Importance of Addressing the Problem

Implementing an innovative Smart Watering system by using water guns offers several key benefits:

- Resource Conservation: Minimizing water consumption down 15%, would align with current global challenge and focus. [13]
- Environmental and wellbeing Sustainability: Automation and monitoring reduce overwatering, promoting healthier soil and plant growth while minimizing environmental degradation.
- Educational Opportunities: Engaging with smart technology enhances skills in engineering, environmental science, and sustainability among students and staff.
- Demonstration of Engaging Technological Innovation: RMIT's leadership in implementing innovative solutions inspires wider adoption, driving positive change on a larger scale.[14]

In summary, addressing the engineering challenges of the Smart Watering system promotes resource conservation, environmental sustainability, education, and innovation. By completing this project, it is not only benefit engineering research purpose, but also sustainability practices enhancement and contribute to RMIT Global sustainability commitment.

III. LITERATURE REVIEW AND MARKET RESEARCH

3.1. Literature Review

Our project is to address and solve the practical problem of watering irrigation for community gardens. When compared to automated irrigation technologies, which frequently result in over and under-watering because of their reliance on static schedules, traditional irrigation methods are typically more economical. Hydropoint claims that inefficiencies can waste up to 50% of outdoor water use. This issue is resolved by smart irrigation, which uses sensors and real-time data to determine when to water. A variety of sensors are used by smart watering systems to collect data on environmental conditions in real-time. Soil moisture sensors are a common method to measure the water content in the root zone directly [2]. This enables systems to modify watering according to moisture content instead of following a preset timetable. The main advantage of smart watering systems is that they assist in cutting down on water usage, which lowers the danger of water waste and lowers water expenses for homeowners and property managers. Plants that receive the proper amount of water are healthier and less susceptible to over and under-watering. With scheduled schedules and remote control, it may save even more time while offering convenience.

Typical smart watering systems for community gardens' main components consist of a Controller/Timer, Sensors, Valve, and Irrigation System. Here are some current products and technologies that are designed for watering irrigation:

1. **Rachio 3 Smart Sprinkler Controller:** An all-around effective water-saving option that packs all the interesting linked irrigation capabilities into a convenient, suggested gadget. provide an amazing range of features, including an app's UI. modifying irrigation schedules in response to local weather stations' real-time data. To suit yards of all sizes, variants with 4, 8, and 16 zones are available [3].
2. **Orbit B-Hyve XR Smart Indoor/Outdoor Sprinkler Timer:** a fully functional timer with adjustable zone settings. To reduce water waste, target specific locations and modify the water flow depending on real-time data. available for both indoor and outdoor use in a 16-zone version [4].
3. **Rain Bird GPA-200 Solenoid Valve:** Designed for both business and household use. It is frequently utilized for its exceptional longevity; the pressure-resistant seal was created to withstand the high water pressure typical of many business locations. possesses a strong electrical design, silent operation, long lifespan, and resistance to hostile situations. Therefore, PRS-D pressure regulating module can also be added to GPA-200 Solenoid Valve [5].
4. **Toro Drip Micro Sprays:** These adjustable micro-spray emitters are ideal for watering individual plants or small garden beds. Capable of adjusting flow rate from 0 to 14GPH for any plants that require certain watering needs [6].

These current products are the main components of building and automated watering system, though sensor is an optional component. The entire project area is 100 m^2, using 60 m^2 for planting and the remaining 40 m^2 for a water shooting range. To be implemented in the garden, the project's objective is to construct a working automated watering system for the garden along with shooting range and targets for water shooting, as well as a simulation of a smart watering system. The project team aims to build a functional automatic watering system that is easy to use and affordable, saves money on water bills, and creates a fun water shooting range with various themes.

3.2. Project Solution

To make a functional automated watering system for community gardens, two main types of automatic watering systems suitable for community gardens are Timer-based system and Sensor-based system:

- **Timer-based system:** a low-cost, straightforward choice for an automatic irrigation system. made out of a hose, a solenoid valve, and a basic timer. The irrigation system emitters are controlled by a timer that is connected to a hose or valve. The timer can be programmed to run for a certain amount of time at a specified time of day.
- **Sensor-based system:** An even more sophisticated choice uses sensors to detect and keep an eye on every aspect, such as temperature and moisture. Next, the system will automatically modify the watering schedules by the input from the sensors [7].

The idea for the project is to design an automated drip irrigation system for community gardens using sensor-based system. Drip irrigation systems are a general preference for community gardens due to water efficiency and watering to the root directly. The main water source is from a water reservoir of about 200 litters, that will be used to water 60 m². Controller/timer for watering schedule. A valve connecting to the controller/timer so that it can be opened or closed the valve when reaching certain schedules. The power source for the valve can use a 12 VDC power supply which can be from a car USB charger and car battery, The Controller/timer requires 5 VDC voltage source. Moisture sensors can be used for measuring watering needs based on soil tension level. Water dripping emitters for watering plant roots directly, it is adjustable water flow for each type of plant [8].

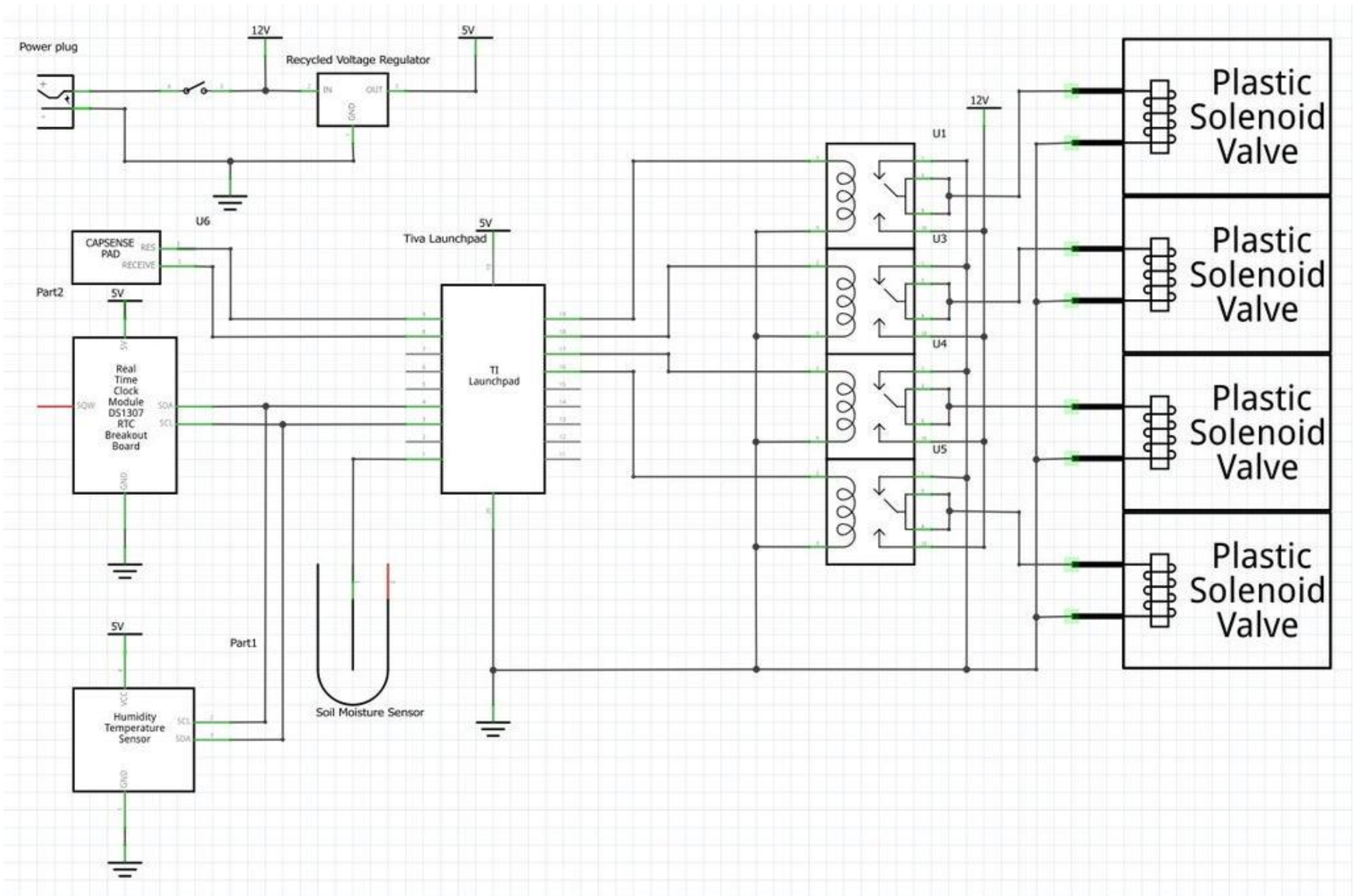

Figure 1: Example of a Time-based Watering System [8]

For 40 m² surface area can be utilized as both equipment storage and a shooting range for water. High-tech water guns are available for separate purchase, saving time over building one from the ground up. Five meters is the maximum range for five shooting targets. The water will be stored back in the reservoir regardless of whether the shooter hits or misses. Upon pressing the button from the shooting range, the stored water from the shooting range will be distributed to the plant watering map. However, since there is a water shooting range that is also used for watering, there may be a problem with plants being overwatered. Therefore, the plan is to create a moisture-based controller that will enable it to start or stop watering depending on the amount of soil tension. The controller will automatically halt the schedules or case scenarios when the shooting range tank's water is released. To avoid overwatering, the button will be suspended from the shooting range when the timetable has been followed or the soil tension level is still low.

How does our project compare to other products?

Compare Orbit and Rachio 3 controllers. In common, both our proposal and existing products have that they strive to be accessible, labor-saving, healthy plants, and water efficient. Our project design is more straightforward and affordable, and it works with any pre-made objects. A 5VDC power supply, an RTC for timing, and a microcontroller might be an Arduino or LaunchPad are the components of a homemade timer. Together, the three parts can create a single, basic controller for a little price. Although modern products on the market now have an app interface, adjustable zones, and range from 8 to 16 zones [3,4], our project may not have an app interface because of the software design's complexity. We might have fewer features than the existing offering. In summary, the need for complete plant watering in a community garden measuring 60 m^2 should be a basic automated system.

IV. SCOPE OF WORK & PERFORMANCE EVALUATION

4.1. Features and Functions

Here is the summary of the features and functions of our smart watering system:

- **User:**

  Role: This user will play the game with water guns which will provide water for the irrigation system.

  Goal: Aim to provide a *fun arcade* game integrating with a smart irrigation system so that the system can attract more people involved.

  - The system will start from the shooting range. Users will use a high-tech water gun to shoot at the target.
  - When the shooting session ends, the user can push the button so that water from the shooting session will be stored in a water storage.
- **Smart Garden Monitor:**

  Role: Control and monitoring the irrigation system.

  Goal: Create a smart DIY irrigation system that helps resources such as energy and water saving.

  - There will be several sensors in each plant section. When the sensors reach a predefined threshold, the system will notify that watering is needed and make the shooting range active.
  - The system will keep track of the water level in the water storage and notify us whether we need to refill the storage.
  - When the storage reaches a predefined threshold. The system will notify and release the water to the pump system.
  - The pump system will then push the water to the watering system.

4.2. Key Technology

To establish a foundational understanding before delving into the specific technologies employed (technology stack), this section outlines the general system architecture and its interaction with the controller.

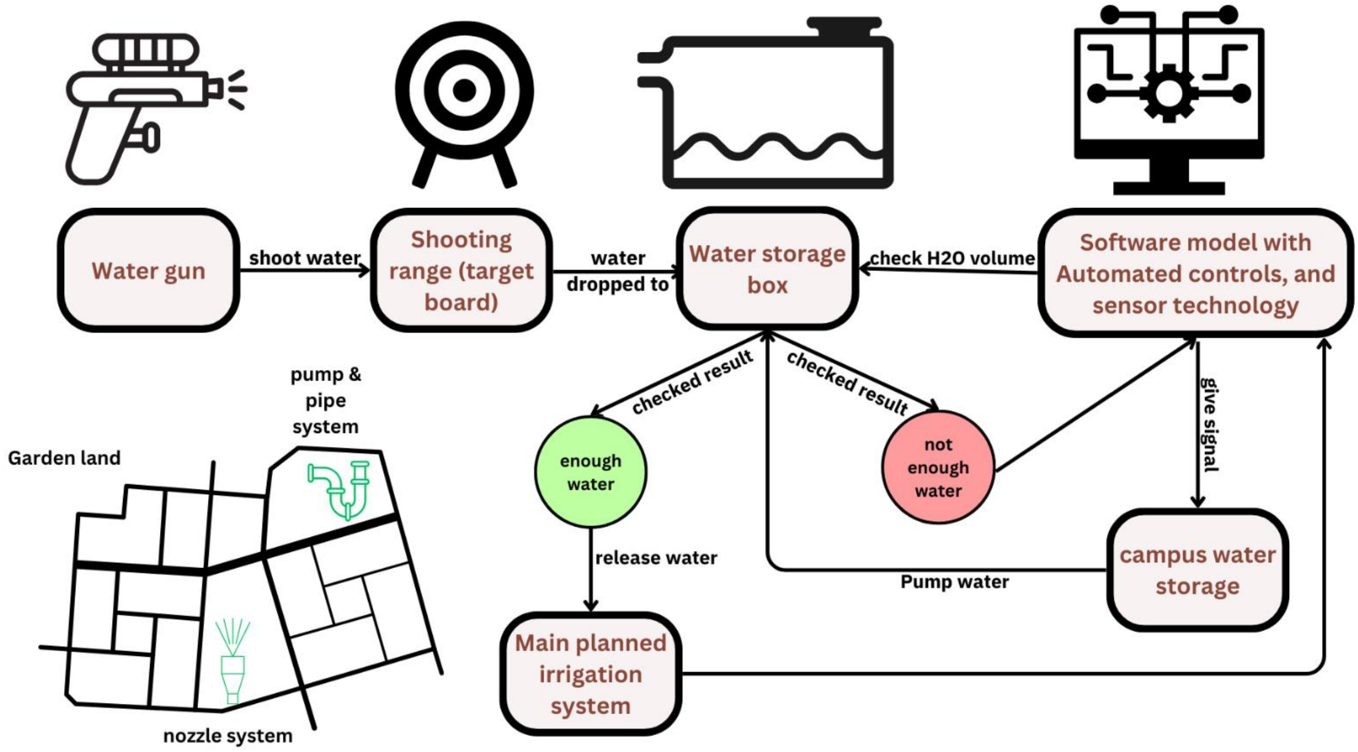

Figure 2: General overview of the system

a. Design

Main components include:

- ***Water Source:*** The starting point. The point where we get water from, for example: well or main water line.
- ***Backflow Preventer:*** Keeping water safe. Think of this like a security guard for your water supply. This equipment keeps the used water from flowing back into the source.
- ***Control Valve and Solenoid Valve:*** An electromagnetic valve is used to control water flow automatically [9]
- ***Sprinkler heads****:* The watering method depends on the sprinkler choice. Spray heads, rotary heads, and drip heads all distribute water differently to suit the area.
- ***Pump:*** responsible for moving water from its source to where it's needed for watering crops or landscapes
- ***Controller/Timer:*** The brain of the operation. This equipment is the mastermind of the system. It acts as a programmable timer setting a schedule of when and how long of watering the plants.

Operations: Water enters the system from the source and flows through the backflow preventer to reach the control valves. The pump then will be activated by the controller, pressurizing the water before it reaches the control system. The controller then sends a signal to a specific valve, prompting it to open and allow water to flow to a designated zone. The sprinkler heads take over from there, distributing the water to your thirsty plants. Finally, after a set time, the controller shuts down the signal, closing the valve and stopping the flow of water in that zone. The pump also deactivates. The process may then repeat for other zones, depending on current system setups and layouts [10].

b. Technology

Automated integration System includes:

Timer: the controller will sync the local time and allow the user to add schedules based on it.

Sensors: we can connect a sensor to the controller [11]. This allows us to automatically adjust watering based on real-time data, going beyond simple timed schedules.

- **Soil moisture sensors:** Monitor conditions and plant health. Data from these sensors informs decisions on when and how much water, which aids in determining whether the plants require additional hydration.
- **Temperature sensors:** Implementing a temperature sensor in the system is beneficial as it enables adjustment of watering schedules based on evapotranspiration rates. For example, during hot weather, plants lose water faster, so the system can compensate by adjusting the watering schedule accordingly.

- **Water level sensors:** By constantly monitoring water levels, sensors can trigger automated shut-off mechanisms when tanks or reservoirs are full. This prevents overflows that can waste water, damage property, and mold growth.
- **Rain sensors:** detect rainfall and can measure its amount like a rain gauge. Utilizing this data alongside soil moisture and temperature sensors can optimize automated watering systems in response to real-time weather conditions.

Solenoid Valve: like on/off switches for your garden water flow. It uses electricity to control water, but make sure your controller can handle them for automatic watering.

Watering system:

- **Drip irrigation:** delivering water directly to plant roots, reducing evaporation and runoff.
- **Spray irrigation:** dispersing water through a fine mist, mimicking the rainfall.
- **Sprinkler irrigation:** using a rotating mechanism or oscillating arm to distribute water in a circular or fan-shaped pattern, mimicking the mist [12].

Table 1: Different types of irrigation system

Irrigation Type	Advantage	Disadvantage	Suitable for
Drip	- Maximizes water saving - Apply to many gardens and various terrains	-Cannot cool the leaves and the plant stem. - Be hard to adjust the volume for each plant section.	Various types of plant systems: borders, flower beds, vegetable patches, greenhouses, and even hanging baskets and potted plants
Spray	-Deliver water to every part of the plants - Simple to regulate the volume for each section of plants.	-Utilise a greater amount of water	Smaller areas such as flower beds, vegetable patches, or individual plants
Sprinkler	- Ensures even watering for the entire desired area. - Requires less irrigation water usage than the spray method.	-Water is prone to evaporation. -Plant roots absorb little water.	Larger areas such as lawns or fields.

In conclusion, sprinklers are generally more suitable for larger areas with their broader coverage, while spray systems are better suited for smaller, more precise watering needs. Unlike sprinklers and spray systems, drip irrigation doesn't distribute water over a wide area or create a mist, focusing instead on delivering water directly to the plant roots so it usually maximizes the saving of water. We are implementing the automatic watering system on a 60m2 garden, it is located outside amidst the constant heat of Ho Chi Minh City. This is a medium-sized garden. It's large enough to accommodate a variety of plants and features. We will try to build an IOT (Internet of Things) project that makes it possible to control and manage the watering strategy. Although we have not got a detailed location plan for the garden, I think drip irrigation is a good choice for our project because it saves resources the most and can be applied to different types of plants.

4.3. Scope of work

Considering all the essential functions and features, we've created the following project scope to define the project's boundaries and deliverables.

Table 2: Scope of work

Scope	Deliverables
Develop and refine an automated prototype model for water and energy efficiency.	Water saving & energy efficiency prototype model - automation function
Create detailed CAD drawings for the shooting range target	Technical drawing - Water gun model, shooting range target
Design a water gun system with volume monitoring and control over the shooting mechanism.	Water gun System - Current volume monitor and shooting mechanism

Plan the location, investment phases, and coverage of the irrigation system.	Irrigation system - location plan, phase of investment plan, coverage radius
Design the nozzle plan, pipe, and storage components' location map of the irrigation system.	Irrigation system - nozzle plan, pipe plan, and storage plan
Prepare a project budget and maintain communication with stakeholders.	Budget and stakeholders contact

4.4. Performance Evaluation

For the evaluation of performance, we first need to define the criteria for the system to work properly and effectively:

- No water will leak out of the pipe during the watering process.
- The sensors work properly.
- The system can notify the user when it waters the plant and show the user the schedule of watering.
- The system works correctly with the timer and sensors' data.

Goal: The system can save more than 15% of the usual usage of resources.

Table 3: Description table of performance evaluation

Criteria	Metric	Benchmark	Description
No water leaks during watering	Percentage of water leakage.	Less than 1% leakage from irrigation pipes.	Observe for any leaks during watering cycles.
Sensors function properly	Sensor accuracy and responsiveness.	Less than 5% of tolerance	Test sensors for accurate moisture detection.
The system notifies the user of watering and displays the schedule	Timeliness and clarity.	Notifications within 30 seconds; clear schedule display.	Verify notifications and schedule functionality.
The system integrates timer and sensor data	Real-time adjustment based on sensor data.	Dynamic schedule changes within 1 minute of sensor input.	Monitor for proper response to sensor data based on timer settings.

V. PROJECT TIMELINE, RESOURCE PLANNING, AND RISK MANAGEMENT

5.1. Project timeline

The project timeline will be delivered within 26 weeks from beginning to end. The timeline contains the following six milestones: Project planning, Irrigation system design, Hardware selection, Control and calibration, Unit testing and validation, and Implementation.

In the project planning milestone, the team will work with the project manager to define the requirements and goal statement of the smart watering system. From that, the team can identify the project scope and deliverables. Then, the team can work on the Irrigation system design milestone. During this stage, the team will conduct intensive research on smart watering systems and water-saving technologies. With the knowledge learned from the research, the team can come up with an irrigation plan and shooting range mechanism. Having the irrigation plan, the team will be able to carry out the Hardware selection milestone. At this stage, the team will evaluate hardware components and select component vendors. Moreover, the team will create the hardware schematic and prototype fabrication. Along with designing hardware components, the team will develop the software functions for the Control and calibration milestone of the automated system. By the end of this stage, the team can perform Unit testing and validation milestones. This milestone will integrate hardware components with firmware and allow the team to validate different watering scenarios data. Finally, for the Implementation milestone, the team will implement the smart watering system in the community garden at RMIT.

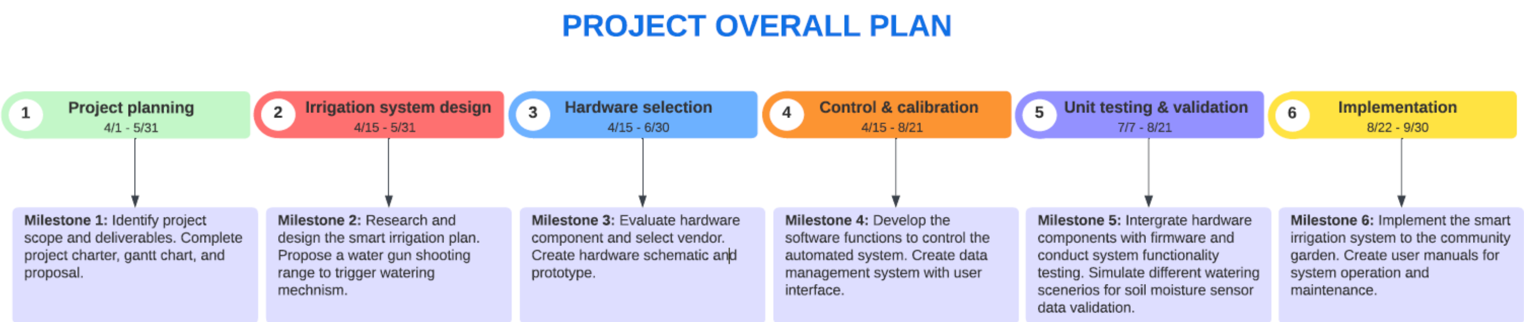

Figure 3: Project overall plan

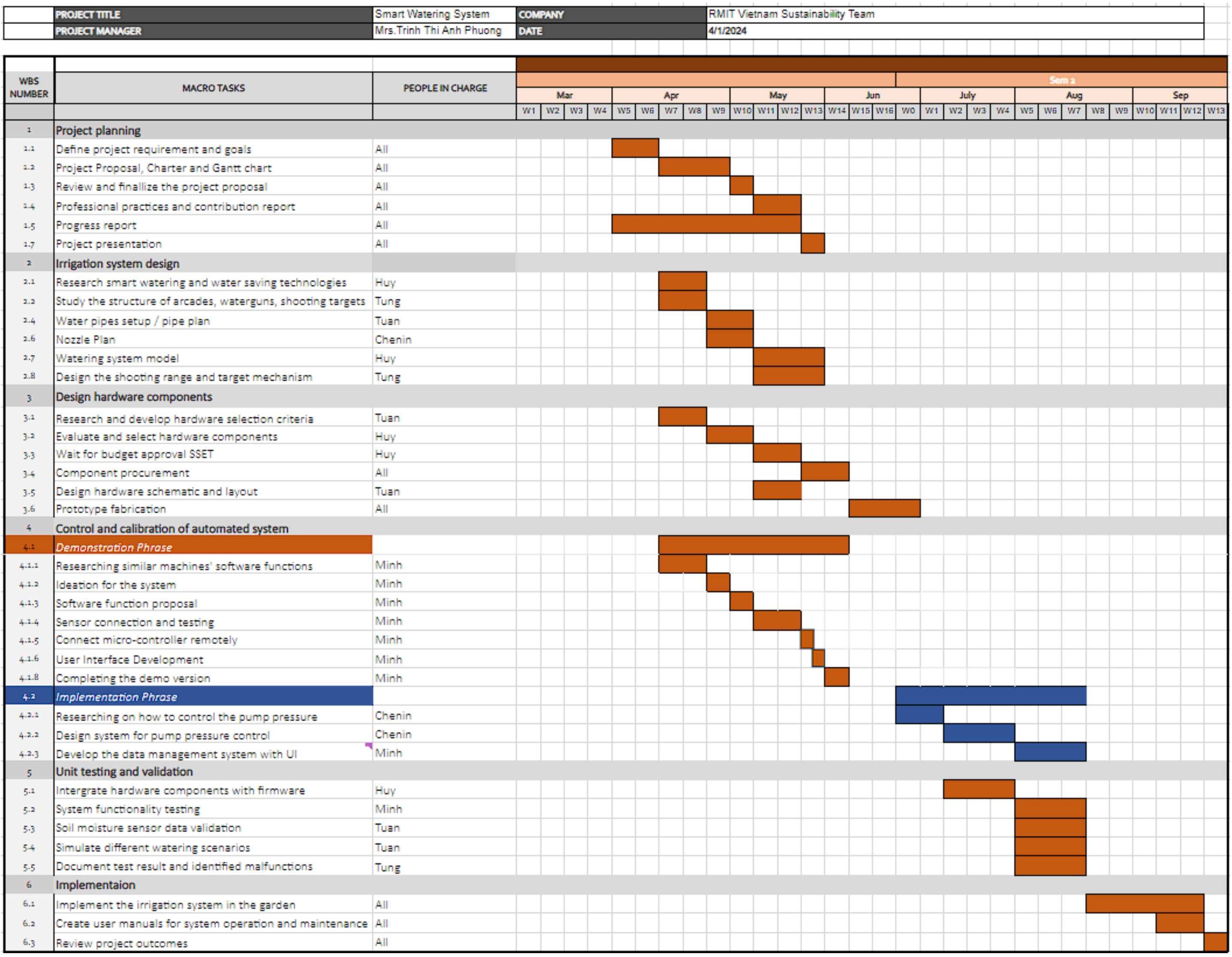

Figure 4: Project Gantt Chart

Because of page limitations, the Gantt Chart cannot be properly displayed in the report. Therefore, the link for the Gantt Chart is included here for better observation: [CAP] CALICO Team Wiki.xlsx

5.2. Resource planning

The resource materials to implement the large-scale project are funded by RMIT Vietnam Sustainability Team, the prototyping model and the 3D printing model of the water gun shooting target would use the fund of 10 million VND from RMIT SSET.

This section outlines the resources required to design and build a prototype automated irrigation system, as well as a water gun shooting range. The selected components are carefully chosen with the criteria to aim for cost-effective, long-lasting, and water-saving.

- **Irrigation System:** this project focuses on the development and demonstration of a small-scale, automated irrigation system prototype, suitable for watering gardens. The team will design a comprehensive model that includes water storage units, pumps, pipe networks, and various watering devices. Students will be responsible for procuring a limited quantity of components to construct a functional prototype, allowing it to showcase its practical application. The project's success will hold potential for future upscaling to a larger area. In such a scenario, RMIT Sustainability Team would provide the necessary components for a larger-scale system.
- **Water Shooting Range:** our team will design and construct a water shooting range, replicating the aesthetic of carnivals or fair arcades. One section of the garden will be reserved to build this shooting range, which will include a high-tech water gun that can deliver sufficient water pressure to shoot into the targets. The targets themselves are designed from scratch by the team. Additionally, a water collection system will be integrated into the ground surface to collect all the used water for sustainability.

The Bill of Materials table below will list all the necessary components required for the construction of the irrigation system model and the water shooting range. The information presented here is for planning purposes only and is subject to change as the design and development process progresses.

Table 4: Bill of Materials

Components	Specifications	Description	Quantity	Price (in VND)
Water Pipes	Garden hose	Direct the water flow across the whole irrigation system	15 meters	119.000
Nozzle	Drip Nozzle	Deliver water directly to the root zone of each plant	10	50.000
Solenoid Valves	Solenoid Valve	Control the flow of water	4	512.000
Water Pump	High power pump for the water supply, low power pump for collecting water from shooting range	Pump water from the tank to the whole system	3	Estimated 1.000.000
Shooting Range	Targets: Laser-cut from ABS plates, assemble by glue	Including shooting targets and backgrounds	1	Estimated 3.700.000
Water gun	Water gun	A high-tech water gun	1	437.000
Electric Wire	Electric Wire	Connect all electrical equipment	5 meters	46.000
Jumper Wire	Male-male, Male-Female, Female-Female, each 40cm long, 40 strands each package Jumper Wire	Connects electronic components of the Time-based watering system	3	90.000
Soil Moisture Sensor	Soil Moisture Sensor	Record the soil humidity	6	420.000
Water Level Sensor	Water Level Sensor	Record the water level of the storage	3	489.000
Rain Sensor	Rain Sensor	Detect the real-time rain	2	184.000
Microcontroller	Raspberry Pi with cover	Controller of the system	1	2.400.000
Inverter	Convert 12VDC to 110V/172V/200V/220V Inverter	Adjust the electric frequency/phase to adjust the water pump	1	210.000
Relay	24VDC to 250VAC/30VDC Relay	Convert energy output from the controller to the source of the pump.	4	121.000

Raspberry Pi power supply	Power supply	Power supply for Raspberry Pi	1	202.000
Total Cost	9.980.000			

5.3. Risk management

Proactive risk management is crucial for the success of every project. Our team has identified a series of potential hazards that could affect the project in order to address them properly and guarantee seamless execution. These risks can be classified into technical risks for the electronics and electrical equipment, external risks such as environmental factors or market fluctuation, and organizational risks which mostly occur internally in our group during the project development.

The following tables outline these risks along with their likelihood of occurrence, possible severity, and suggested mitigation strategies. By taking these risks into account and implementing the corresponding plans, we can minimize their impact and increase the success chance.

Table 5: Technical risks of the project

Risk	Probability	Risk Level	Effect	Action Type
Technical Limitation	Likely	Medium	Do not know how to use the equipment	Do careful research and search for support from technicians
Broken equipment	Likely	High	Delay the project timeline, increase cost	Understand equipment instructions and mechanisms
Technical Errors	Likely	High	Bugs in terms of software or hardware errors	Support from technicians/experts
Lack of Intuitiveness	Unlikely	Medium	Clunky, unclear/confusing structure	Provide a comprehensive plan and design of the system
Voltage source fluctuations	Likely	High	Short circuit or damage to the electronics	Install a voltage regulator or fuse as safety feature

Table 6: External risks of the project

Risk	Probability	Risk Level	Effect	Action Type
Unexpected weather conditions	Likely	High	Heavy rains or extreme heat can significantly impact the system's equipment and watering schedules	Design the system to compensate for the weather
Animal interference	Likely	Medium	Damage components, especially the wiring parts	Chew-resistant wires, animal deterrent products
Water supply disruptions	Unlikely	High	Water pressure fluctuates or hinders watering schedules	Do regular checks, have water containers
Local regulations	Unlikely	High	Local regulations can delay, and fine the project	Design the system to compliant with local regulations and water restrictions
Price sensitivity	Likely	High	Customers hesitated to adopt the technologies due to high cost	Offer competitive and strategic pricing
Customer satisfaction	Likely	High	Customers dissatisfied with the system's performance, complexity, and reliability	Invest in reliable components to ensure system outcomes

Table 7: Organizational risks of the project

Risk	Probability	Risk Level	Effect	Action Type
Project scope drift	Likely	Medium	Unexpected addition of features or functionalities can lead to delays and budget issues	Define a clear project scope from the outset to avoid scope creep
Communication issues	Likely	High	Poor communication with stakeholders can lead to misunderstandings and delays	Foster a culture of teamwork and collaboration within the team and supervisors, meeting schedules
Unrealistic expectations	Likely	High	Frustration and demotivation	Setting achievable project goals and timelines
Insufficient resources (personnel, budget, expertise)	Likely	Medium	Hinder project progress and quality	Allocate resources appropriately
Inefficient Time	Likely	Medium	Delayed or unfinished project	Proper plan and time management
Team members' incidents	Unlikely	Medium	Sickness, accident, or family issue	Well-informed of the situation as soon as possible for the best solution

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VII. APPENDICES

7.1. List of Abbreviations

- ABS – Acrylonitrile Butadiene Styrene plastic
- CAD – Computer-Aided Design
- DIY – Do It Yourself
- GPH – Gallons Per Hour
- IoT – Internet of Things
- PRS-D – Dial Pressure Regulator
- RMIT – Royal Melbourne Institute of Technology
- RTC – Real Time Clock
- SSET – School of Science, Engineering & Technology
- UI – User Interface
- USB – Universal Serial Bus
- VDC – Volts Direct Current

7.2. Calico Team Task division

A To-do List for Calico perform in the first 8 weeks for Capstone project. Task from no.15 to no.22 are related to report writing for this Project Proposal document. In addition, the Action plan session can be found in Calico Team Wiki file for project management

Action Plan

N	Tasks	PIC	Due date	Progress	Guide	Note
1	Gantt chart (Draft 1) for meeting	All	12/04/2024	Completed		
2	Meeting with sustainability on monday 15/4 4pm-5pm	All	15/04/2024	Completed		
3	Change The name in the role forthe lecturers and advisors to full name, for examples: Alex -> dr. Alexandru...	Chenin	22/04/2024	Completed		
4	Working arrangement 20 hours/ week on campus . Asking the sustainability about this.	Huy	10/05/2024	On-going		
5	Add Dr. Byron name in the Project Charter.	Huy	22/04/2024	Completed		
6	Wirte the proposal to submit	All	22/04/2024	Completed		
7	Literature review to research for the irrigation system	Tung	30/04/2024	Completed		
8	Literature review on the Software functions the automate system in the project	Minh	30/05/2024	Completed		
9	Literature review to research for the watering system and watergun shooting range		17/05/2024			
10	Write meeting minute of Week 5-6-7	Chenin	26/04/2024	Completed		
11	Change the Gantt chart timeline so that we make sure that we can focus on what we can do		21/04/2024			
12	Check the content structure of the project Proposal report	Huy	19/04/2024	Completed		We need this to assign members to different parts of the report to write it to submit. Making the structure is improtant because the structure on canvas and in the template file is different, we need to have one common structure of the file to write the proposal together.
13	Adjust the gantt chart Move some prototype making and complete the implementation in semester 2	Huy	22/04/2024	Completed		Gantt Chart task. Just move this to a more suitable time.
14	Send out invitation for the lecturers to join one meeting with Sustainability (Alex reminds us to make the meeting AGENDA, and drive the meeting	Huy		Completed		
15	**Project Proposal**	**All**	**02/05/2024**	Completed		**important**
16	Writing Literature review & Market search, Scope of Work & Performance Evaluation in the report	Minh	**26/04/2024**	Completed		
17	Editing report format and alignment	Huy	**26/04/2024**	Completed		
18	Abstract + Project background & Problem Statement	Chenin	**26/04/2024**	Completed		
19	Project timeline + Risk management	Huy	**26/04/2024**	Completed		
20	Resource planning	Tuan	**26/04/2024**	Completed		
21	Literature review & Market search.	Tung	**26/04/2024**	Completed		
22	**Proofreading the report**	Chenin	**01/05/2024**	Completed		

Figure 5: Task division in Action Plan of team Calico