**MINISTRY OF EDUCATION AND TRAINING**

**FPT UNIVERSITY**

Capstone Project Document Orchid Care System

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**Supervisor** Phan Duy Hùng

**Capstone Project code** OCS

- Hanoi, 08/2020 -

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**CHAPTER 1: INTRODUCTION**

**1.1. Project Information**

Project name: **Orchid Care System**

➢ Project code: **OCS**

➢ Project group name: **OCS Team**

➢ Project type: **Android Application**

➢ Business domain: **Online Customer Service**

➢ Timeline: **18/05/2020 – 02/09/2020**

**1.2. Project Team**

**Team Member**

*STT Full name Student ID Phone Email Role* 1 Phạm Văn Phóng SE05232 0349856004 phongpvse05232@fpt.edu.vn Leader 2 Nguyễn Thị Hạnh Ly SE05332 0929190061 lynthse05332@fpt.edu.vn Member 3 Phạm Gia Khánh SE05335 0966503512 khanhpgse05335@fpt.edu.vn Member 4 Vũ Trường Sơn SE05951 0398150707 sonvtse05951@fpt.edu.vn Member

5 Phùng Tuấn Thanh SE04200 0971480683 thanhptse04200@fpt.edu.vn Member *Table 1- 1 Team member of Orchid Care System project*

**Supervisor**

*STT Full name Phone Email Role*

1 Phan Duy Hùng 0975597339 hungpd2@fe.edu.vn Lecturer *Table 1- 2 Supervisor of Orchid Care System project*

**1.3. Motivation idea**

**1.3.1. Demand for Orchids**

Today, the standard of living in big cities like Hanoi and Ho Chi Minh City is quite high, this is the reason of increase in beauty demand. As expected and summarizing

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the preliminary report of 2019 on the income survey, the average income per capita in Hanoi will reach over $5000/year and reach $9000 in Ho Chi Minh City.

With the rising economic life and stable income, the demand for beauty also increases, especially the need for home decoration. Home decoration has many ways to do, using flowers is a simple and extremely effective decoration. In recent years, home decoration with orchids has become extremely popular because orchids are beautiful and not too difficult to care for.

There are many types of orchids with different colors, beauty and prices. An orchid basket can cost from a few tens of thousands dong to hundreds of millions dong depend on type. However, the average price of a basket of orchids is only a few hundred thousand dong, so it's easy to use lan as a simple way to beautify.

Demand for orchids on the market today is very large, market research shows that, at the center of reputable orchids can sell from several hundred to several thousand baskets each day. This demand is concentrated mainly in big cities. People that grow orchids in Hanoi is very popular, in other cities like Ho Chi Minh City, the demand is lower because the climatic conditions are not really suitable for the habitat of flowers.

**1.3.2. Normally process**

Normally, if a person wants to grow orchids to beautify, he will go to the flower shop to buy. It is possible to purchase pre-grown flower baskets or new nursery varieties to take care of from the first stages. After that, they must take care of the flowers very carefully. This process is quite time consuming and laborious.

Orchids are grown by hanging baskets or clinging to the woody stems. Finding an ideal place to place flowers is also a job to note. If taken care of incorrect or unreasonable condition, orchids will not flower or be death.

**1.3.3. Difficulties in growing orchids**

The difference between the habitat of flowers before and after being bought is the first problem to solve. In some orchids sensitive to weather and temperature, even a small change can cause the plant to wither or die. Therefore, grasping the ecological characteristics and growing conditions of orchids is a problem that definitely needs to be addressed first.

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If you are new to orchids, taking care of flowers is also a difficult problem when he has no experience in caring for a new plant. It takes a lot of patience to take care of a tree that is judged to be quite fastidious.

The next problem when looking for orchids is the location of orchids. Orchids can be hung on baskets or attached to the trunk of wood, but for large cities, when the habitat is not too spacious, finding a place to orchids is also a problem with not only one. but a lot of people want to grow flowers. And to find an ideal place to put orchids is even harder.

Besides, the cost to grow flowers is also an issue. The orchid planting does not stop at buying. We need to fertilize, buy care tools ... The more flower baskets we have, the more costs will increase. Moreover, to have a satisfactory flower pot, the large amount of money to buy and take care of orchids is a sure thing to do.

For people living in the city, being busy all day is definitely too familiar. Lan is a plant that does not need much care but if you are too busy with work and you forget it for only a few days, or even just for a day, the orchids may be death. So the lack of time is such also a difficulty for orchids.

**1.4. Existing Research/System**

**1.4.1. Maka**

Maka is an automatic watering system that has been established and developed for over 5 years ①. Maka has made continuous progress in providing solutions, designing and installing automatic watering systems for many customers in Ho Chi Minh City and some neighboring provinces .

Maka has many advantages such as controlling the irrigation system via the internet and mobile applications. Automatic watering timer and there are many solutions for smart watering. Besides, there are also many disadvantages such as depending on electricity and internet, only watering and watering the tree at a set time, without knowing exactly when the tree needs watering.

Some pictures of Maka products:

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*Figure 1. 1 Maka system*

**1.4.2. ATA TDW-02**

Remote control of watering by phone (with timer) is a very special set of products besides using the function of controlling and turning on/off the irrigation system to open the solenoid valve completely from wherever you are ②. In addition, the product also integrates an extremely smart automatic timer.

Products that control the irrigation system via the internet and mobile applications. But when there is no internet connection or no application, it is impossible to determine when the tree needs watering and the current product only supports the watering function of the tree.

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*Figure 1. 2 ATA TDW-02 system*

**1.5. Proposed System**

**1.5.1. Proposal**

After learning about the popular bonsai varieties in big cities as well as in the countryside, orchids are one of the most popular and planted plants, not only because of their beauty. It is also a flower that exudes elegance, nobility and more vitality than other flowers.

Although a flower with long-lasting vitality, to care for it, caregivers need to be very meticulous in every detail such as light, temperature, humidity and the most important factor is the environment. orchids in urban areas without conditions such as in forests,...

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Therefore, those who are busy with work but have a passion for playing orchids are difficult to take care of them. To solve this problem, Orchid Care System - OCS has been satisfying the needs of orchid enthusiasts, helping to improve the environment so that orchids can grow best.

Based on the above useful studies, it is found that embedded system + fuzzy + mobile/cloud can make a convenient product. OCS will start with the use of IoT technology and Fuzzy algorithms, the technology will help growers regulate the living environment suitable for orchids and allow users to track details via Application Mobile with information. The number is measured by the sensor and can also control the modules that execute at its discretion through the Application. All devices can connect fully automatically to the most convenient for users.

**1.5.2. System Function**

Orchid Care System have two main functions:

- Measure temperature, test light, measure pH, humidity

- Manage many trees, each tree has its own profile, can add tree data, edit data, delete tree data.

All function details will be described in Software Requirement Specification (SRS) document.

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**CHAPTER 2: PROJECT MANAGEMENT PLAN**

**2.1. Project Initial**

**2.1.1. Description**

Project name **Orchid Care System**

Project code **OSC**

Project type **Embedded System and Android application**

Project category **Auto care system**

Business type **Online Customer Service**

Project instructor **Phan Duy Hùng**

Project manager **Phạm Văn Phóng**

Time line **18/05/2020 – 02/09/2020**

*Table 2. 1 Project description*

In this project, we will develop an android application name called Orchid Care System, our project helps those who need to take care for orchid, they can control system to water the orchid, monitor the status of the tree about temperature, light, pH, humidity, collect the data of tree, analyze, each tree has its own profile. User can add tree data, edit data, delete tree data.

**2.1.2. Definitions , Acronyms, and Abbreviations**

In this project, the abbreviations are listed in the following table:

*ID Acronym Definition*

1 SRS Software Requirement Specification 2 App Application

3 PSM Product System Management

4 OS Operating System

5 GUI Graphic User Interface

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6 DB Database

7 OCS Orchid Care System

8 UserSomeone who interacts with the mobile phone application

ESP8266EX integrates antenna switches, RF

balun, power amplifier, low noise receive

9 ESP8266 10 IoT

amplifier, filters and power management

modules. The compact design minimizes the PCB size and requires minimal external

circuitries.③

A system of interrelated computing devices, mechanical and digital machines provided with unique identifiers (UIDs) and the ability to

transfer data over a network without requiring human-to-human or human-to-computer

interaction.④

*Table 2. 2 Definitions and Acronyms*

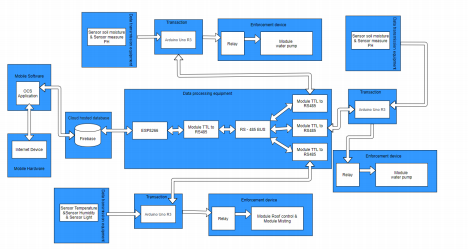
**2.1.3. Product Perspective**

This system will consist of two parts: one mobile application and external electronic components such as the sensor ESP8266. The mobile application will be used to track details with parameters that the sensor measures such as brightness, environmental temperature, air humidity, soil moisture, regular pH, and can also control the execution modules at its discretion through the application. All devices can connect fully automatically to the most convenient for users.

The sensor ESP8266 requires a wifi connection to be able to send the necessary information. ESP8266 measures parameters and sends it when there is a change from the environment or when requested by the user.

Firebase will be used to store and get the data. It updates data from the sensor controller or from the controller module. With the changes measured by the sensor, the controller will make the comparison. If there is an abnormality, it will notify by sending the message to the clients. When firebase receives a request to retrieve data, it will retrieve the user's data and display it on the screen of the application.

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*Figure 2. 1 Block Diagram*

**Entity Description**

*ID Name Description*

1 Internet Device Phone network transceiver

2 OCS ApplicationCollect data and give control commands for OCS Embedded

3 Firebase Data warehouse

4 ESP8266Process, collect, transmit information from Sensor and control Modules

5 Module TTL to RS485 Convert signal from UART TTL to RS485 6 RS - 485 BUS Communicate between devices 7 Arduino Uno R3Read signals, manage sensors and control motors

8 Relay Toggle execution module

9 Sensor soil moisture Sensor measures soil moisture 10 Sensor measure PH Sensor measures PH

11 Sensor Temperature Sensor measures temperature 12 Sensor Humidity Sensor measures humidity

13 Sensor Light Sensor measures light

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14 Module water pump Pump

15 Module Roof control Roof

16 Module Misting Nebulizer

*Table 2. 1 Entity description*

**2.1.4. Scope**

The scope of this project is prototype a OCS, includes both hardware and software. The final product must satisfy the following specifications:

*Specification Description*

Using Wifi as connection methodUse wifi network to communicate between ESP8266 and Android app.

Automatically measure the intensity of natural light

Automatically measure the ambient temperature

Automatically measure the humidity of the air

Automatically measures the intensity of natural light through light sensors. Automatically measure the ambient temperature through the temperature sensor.

Automatic measurement of air humidity through the air humidity sensor.

Automatically measure soil moistureAutomatically measure soil moisture through soil moisture sensor.

Automatically measure the pH of the soil

Automatically measure the pH of the soil through a pH sensor.

Adjust the brightness accordingly Use motor 775 to adjust the canopy. Cooling surroundings Use a nebulizer kit for cooling. Watering and nutrients Use water pump module.

Send environment data to the Android app

Control by ESP8266 / Android app

Using firebase as an intermediary to exchange data between OCS bot and Android application.

ESP8266 receives data from the sensors and then controls the execution modules and sends data to firebase.

The Android app syncs data from firebase and transmits user commands to firebase

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for ESP8266 to process.

*Table 2. 2 Scope of OCS project*

**2.1.5. Standard Objectives**

✔ The project must be finished before 02nd September 2020 ✔ The final application covers the requirements in the capstone project phase

**2.1.6. Milestone and Deliverables**

*No Milestones Deliverables Delivery Date* 1**Finalize idea of product, and**

**project plan**Report 1, Report 2 19/05/2020 2**Finish User Requirement**

**Specification collection**Report 3 30/05/2020 3 **Finish design of the product** Report 4 15/06/2020 Source code,

4**Finish code, test (unit and integration)**

5 **Finish system test**

Unit test,

Integration test in Report 5

System test report (remaining part of Report 5)

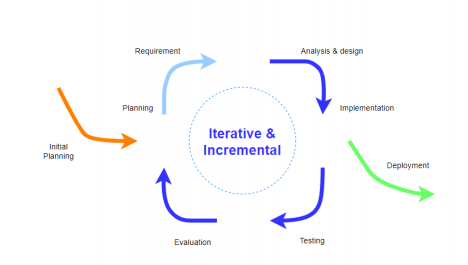
20/08/2020 25/08/2020

6 **Deploy the product** Report 6 30/08/2020 7 **Closing the project** Final Report 02/09/2020 *Table 2. 3 Milestone and deliverables*

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**2.2. Project Organization**

**2.2.1. Software Process Model**

*****Figure 2. 2 Iterative and Incremental Software Process Model*

This project uses the Iterative and Incremental Software Process Model. The Iterative and Incremental Software Process Model is mostly used when the scope of the project is big, the major requirements are defined clearly, some more details will be added later in software development. By using this software process model, we break down the developing system task into series of smaller tasks which will be completed separately, allowing us to take advantage of what was learned during development of earlier parts of the system. In addition, the iterative model is easier than other models when the issues are discovered. They are fed back to the team, and solutions will be found while the project is still in development, Also, this model has these useful advantages:

∙ Some main functions can be developed early & quickly.

∙ Testing and debugging during smaller iteration is easy.

∙ More flexible - easy & less costly to change if having.

∙ Easier to manage risk because risky pieces are identified and handled during its iteration.

∙ Iterations may be run simultaneously. A design team starts the next iteration while the current one is under test.

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∙ The project team learns from the first iteration and may use best practices and experiences in the next iterations.

∙ Suitable for any small and medium products.

**2.2.2. Roles and Responsibilities**

*****Figure 2. 4 Team organization*

***Organizational Structure***

*Role Responsibility*

Responsible for leading the team and managing the

whole project, planning, defining scope, developing

Project Manager Technical Leader

schedules, analyzing and managing risks, generally responsible for keeping the project team focused on the right goal

Responsible for choosing and deciding what technologies should be used, as well as for overseeing the work being done by other developers

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Business Analysis

Responsible for analyzing business, processes, and systems, refers to the skills, technologies and collect customer comments. Business analytics focuses on developing new insights and understanding of business performance-based on data and statistical methods.

Tester Leader & Document LeaderResponsible for carrying out tests and documentation

Responsible for server-side web application logic

Back-end Developer

and integration of the work front-end developers do.

Front-end DeveloperResponsible for implementing visual elements that users see and interact within a web application**.**

*Table 2. 4 Organizational structure*

***Project Team Members***

*Team Member Roles*

Phạm Văn Phóng Project Manager, Back-end developer, Front-end developer, Technical leader

Nguyễn Thị Hạnh Ly Business Analysis, Tester

Phùng Tuấn Thanh Front-end developer, Tester

Vũ Trường Sơn Front-end developer, Tester

Phạm Gia Khánh Back-end developer, Tester

*Table 2. 5 Project team members*

**2.2.3. Tools and Techniques**

***Tools***

**Project management tools** Tortoise SVN

**Document tools** Microsoft Office

**UML tools** Mockingbot.in, draw.io, moqups.com **IDEs** Arduino IDE, Android Studio

**DBMS** Firebase

**Source code version control** SVN

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**Testing Tools** Wireshark, Proteus, Google Chrome, Robotium **Communication Tools** Facebook, Google Meeting, Email

**Deployment Tools** Firebase CLI

**Files Management Tools** Google Drive, SVN

*Table 2. 6 Tools and techniques*

***Techniques***

∙ **Application:**

Programming languages: Java

Cloud: Firebase

∙ **Hardware:**

Programming language: C/C++

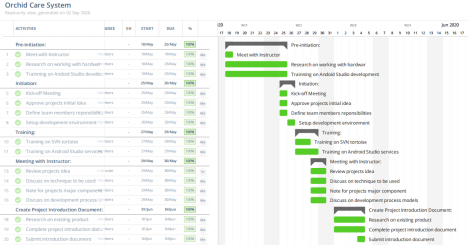
Communication: RS485

Cloud: Firebase

**2.3. Project Management Plan**

**2.3.1. Project Schedule**

To deploy this project effectively, according to this schedule, we will follow the each tasks in project

*Figure 2. 5 Project schedule plan*

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*Figure 2. 6 Project schedule plan*

**2.3.2. Communication Management**

**Communication between members**

**- *Weekly meeting schedule:***

We divided the project into two systems: OCS Application and OCS electronic components.

Each system will be divided into a series of small tasks. The tasks will be recorded at Excel and SVN then estimate the time depending on the difficulty and workload of each member doing. The leader will have the task of assigning to the team members according to the capacity of each person. All members met each other on Google meeting several times/week. During each meeting, each member will report their work during that week, the status of the task (slow, punctual or fast).

If there is a problem that a member can solve, then all members will discuss and find the best solution for that problem. After that, the project manager will assign new tasks to each member for the next week.

Everything in the meeting will be written by a secretary in the meeting minutes.

**- *Unscheduled meeting:***

If someone has an important problem that want to be solved immediately, we will have a meeting for discussion. Each subsystem has a development team with different schedules. At the beginning of the working week, each team will have an independent meeting to inform others: What did I do yesterday? What will I do today, this week? At the same time, the development team will continue to

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communicate with each other throughout the day to exchange what is missing or wrong for the best quality product. In this way, the team will have a great understanding of what has been done and what's left.

**- *Communication channel*:**

Our main communication channels are a face-to-face meetings, Email, Google meeting, Facebook. However, we sometimes can make a phone call or instant message if someone has a problem.

**Communication with supervisor**

**- *Face-to-face meeting:***

Weekly on every Friday evening to make sure that supervisor can keep tracking of the team’s progress.

**- *E-mail*:**

Gmail is the fastest way to get advice and document checking form supervisor.

**- *Mobile Phone*:**

Is used to get time and place arranged for the meeting every weeks.

**- *Facebook Group*:**

Report daily work.

**- *Google Meeting*:**

In case of inconvenient movement, Google meeting is used to communicate directly with the supervisor.

**Meeting plan**

**- *The meeting is not regulated:***

If someone has an important problem that he wants to resolve immediately, we will have a meeting to discuss, usually through some online channels: Slack, Facebook or Phone.

Communication channel:

• Face-to-face meeting

• Email: track of important task

• Google meeting: online meeting

• Facebook Messenger, mobile phone, chatting

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**Meeting minutes**

**Meeting/Project**

**Name Orchild Care System**

**Date of Meeting Time**

**Meeting Called by Location**

**Note Taker Time Keeper**

**Supervisor**

**1. Meeting Objective**

**2. Attendance**

**Name Roles E-mail Phone 3. Done task**

**4. New task**

**5. Risk & difficultly**

*Table 2. 7 Meeting minutes template*

∙ Meeting objectives: Report and evaluate the work completed last week, for the first week, members will report on ideas and agreements on the technologies used in the project.

∙ Attendance: Members present at the meeting.

∙ Done tasks: Tasks that have been completed after the supervisor reviews. ∙ New task: New tasks are assigned to members along with deadline.

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∙ Risk & difficultly: The risks and factors affecting the project next week will be reviewed and streamlined.

**2.3.3. Risk and Issue Management Plan**

The project manager works with the project team and ensures that risks are actively identified, analyzed, and managed throughout the life of the project. Risks will be identified to publish your content as early as possible in the project so as to

minimize their impact. The steps for accomplishing this are outlined in the following sections. The PM will serve as the Risk Manager for this project.

**Risk management**

**- *Risk Categories***

The table below is some Risk Categories may be had in this Project

*Category Sub-Category Acronym & Abbreviation* Requirement Definition T-RD

Technical

Technology T-T Quality T-Q

Management Human Resources M-HR *Table 2. 8 Risk categories*

**- *Risk register***

*No Name Risk Category Root Cause Probability Impact*

1 R1 2 R2

Project team don’t meet the deadline on time.

Requirement changed while project is being processed.

M-HR T-RD

Members lack of

responsibility. Lack of management.

SRS is not provided all information about user requirement such as: lack of

customer’s

requirement,

High High Medium High

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3 R3Distracted

membersM-HR

Lack of skill and

misunderstand customer’s

requirement

Undisciplined and habit of the team member, loose management

Member doesn't

Medium Medium

4 R4 5 R5

knowledge for a specified

work

Project team member

misunderstand’ s requirement

T-T

T-RD

have enough time to learn/improve

needed skills

In the beginning, team member

doesn't clear the requiremen

Conflict among team

Medium Medium Low High

6 R6Spirit goes

downM-HR

7 R7Poor unit test

and test caseT-Q

members/working alone/meet a difficult problem.

Team member does not clearly

understand about system.

High Low Medium High

*Table 2. 9 Risk register*

**- *Risk respond***

Risk in project cannot be avoid, so we must respond with risk suitably to continue the project conveniently. The table below is some risk responds which team project will response to risk.

*No Name Mitigation Plan Contingency plan Fallback plans Status*

1 R1

Make rules and

penalties for the member who misses the deadline.

Working overtime to complete tasks on time.

Reduced time of another task to

requite.

Active/Solved

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2 R2

SRS should be

reviewed carefully by PM and Supervisor. Always do

brainstorming

carefully to design detail system. Hold all meeting and make minimize effort to change and improve design by

requirement

changes.

Team members will have meetings with supervisor to

analyze the

requirement

changes and make a specific action to resolve that

problem.

Giving rules and penalties for

Meeting

customers to discuss about making that

requirements or no.

Working

Active/Solved

3 R3Talk and encourage work completion.

Each team members

must study to

members who are not focused and affect the work progress.

Technical leader needs to support carefully for team members in group

overtime to complete

tasks on time.

Discuss with the supervisor about

Active/Solved

4 R4 5 R5

understand the technology,

framework that is needed for project.

Members have to read requirement specification and related document carefully.

to increase

required skill and knowledge. Review complete task to make comment for team members.

Making sure that any

miscommunication would be resolved.

technical, may change to

another easy technical or not.

All team

members will take a time

together to fix requirement and adjust

Active/Solved Active/Solved

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6 R6Warm-up by teambuilding.

Each member needs

Project

Management

should talk to a member who gets the problem and helps that member solves the problem. Testing carefully, spend a lot of time

project on the right way

Giving that member’s

problems for the supervisor solve the

solution.

Ask for other member who

Active/Solved

7 R7

to do research and work carefully.

on testing.

Improve the testing skills of members.

have more skill to help.

Active/Solved

*Table 2. 10 Response to risk*

**- *Probability and impact***

High R6 R1

Medium R4 R2,R7

*Probability*

Low R7 R5 Low Medium High

*Impact*

*Table 2. 11 Probability-Impact*

The probability and impact of occurrence for each identified risk will be assessed by the project manager, with input from the project team using the following approach:

***Probability***:

∙ High – Greater than probability of occurrence.

∙ Medium – Between and probability of occurrence.

∙ Low – Below probability of occurrence.

***Impact:***

∙ High – Risk that has the potential to greatly impact project cost, project schedule or performance.

∙ Medium – Risk that has the potential to slightly impact project cost, project schedule or performance.

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∙ Low – Risk that has relatively little impact on cost, schedule or performance ***Closing Risk:***

Closing Risk could be closed in four cases:

∙ When the time of a risk happening is over.

∙ When the scope of a project is amended and a risk becomes irrelevant (avoided). ∙ When a risk is addressed well and reduced to acceptable level. ∙ Risk closure at the direction of the Project Manager.

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**CHAPTER 3: SOFTWARE REQUIREMENT SPECIFICATION**

**3.1. User Requirement Specification**

**3.2.1. Introduction**

OCS has only one actor: User.

User: a person who has system account and uses it to take care of Orchids by smartphone.

**3.2.2. User Requirement**

Below are basic function requirements of each actor

**User:**

❖ Register

❖ Login

❖ Logout

❖ Smart Config

❖ Manage Orchid Profile

⮚ View list default profile

⮚ View list custom profile

⮚ View profile detail

⮚ Search profile

⮚ Add/Delete All profile custom

⮚ Edit/Delete a profile custom

❖ Manage System

⮚ View basket detail

⮚ Add/Edit/Delete a basket

❖ Manage Devices

⮚ View list slaves

⮚ Check connection

⮚ View slave detail

⮚ Set Active/Deactive

❖ View attributes of an active basket

❖ Get Notification

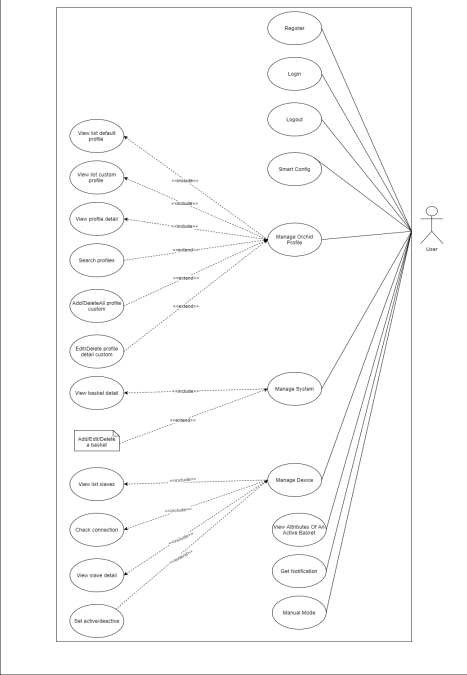
❖ Manual Mode

**3.2. System Requirement Specification**

**3.3.1. Functional Requirments**

***Use case diagram***

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*Figure 3. 1 System use case diagram*

***Use case Detail***

*Use Case No.*

*Group of function Function Glossary* User

UC01 RegisterUser registers a new account on system

UC02 Login User logs into the system User logs out of the

UC03 Logout

account and their session is terminated.

UC04 Smart ConfigurationUser configs system by scanning QR code

UC05

View list default profiles

User views list default orchid profiles

UC06View list custom profiles

User views list custom orchid profiles

UC07 View profile detailsUser views each orchid profile details

UC08 Search profile User searches for profiles Manage Orchid

Profile

UC09 Add a custom profile User adds an orchid profile

UC10Delete all custom profiles

UC11Edit a custom profile detail

UC12Delete a custom profile

User deletes all custom orchid profiles

User edits each custom orchid profile

User deletes each custom orchid profile

UC13 Manage System View basket detailUser views details of each orchid basket

30

UC14 Add a new basketUser adds a new basket in system

UC15 Edit a basketUser edits each bakset details

UC16 Delete a basket User deletes each basket

UC17

View list slavesUser views list slaves in system

UC18 Check connectionUsers checks the

Manage Slaves

connection of the device

UC19 View slave detailUsers views each slave details

UC20 Set active/deactive User turns on or off the device

UC21View Attributes Of An Active Basket

User views all attributes of each actice orchid basket

UC22 Get NotificationUser gets all notifications about system

User uses the manual

UC23 Manual Mode

*Table 3. 1 System use cases detail*

***Register Use case***

**USE CASE 1 SPECIFICATION**

mode instead of automation mode

**Use-case ID** UC01 **Use-case Version** 1.0 **Use-case Name** Register **Author** LyNTH **Date** 16/06/2020 **Priority** High

**Actor User**

31

**Summary**Actor creates a new account by email

**Goal** Create a new account

**Triggers**- Actor clicks the underlined word “Đăng ký”

- Actor is currently not logged in

**Pre-Conditions**

**Post-Conditions**

**Main Success Scenario Alternative Scenario**

- User device is connected to internet

- The account is registered on system

- Actor is automatically logged into the application

- System shows success message then redirected to Home screen 1. Actor clicks to the underlined word “Đăng kí” on Login Screen

then Application is moved to Register Screen.

2. Actor fills out information into the required form and click “Đăng kí” button.

3. System shows success message then redirected to Home screen. 1. Actor clicks to the underlined word “Đăng kí” on Login Screen then Application is moved to Register Screen.

2. Click “Đăng ký với Google” button to register.

**Exceptions**- Exc1: At step 2, actor lacks one of required information:

32

→ Application displays error

message and the account is not

registered

- Exc2: At step 2, the email was

used:

→ Application displays error

message and the account is not

registered

**Relationships** UC02

BR1: Account sign up by email

BR2: Account’s requirement

**Business Rules *Login Use case***

information: email, password

BR3: Each email is used for only one

account

**USE CASE 2 SPECIFICATION**

**Use-case ID** UC02 **Use-case Version** 1.0 **Use-case Name** Login

**Author** LyNTH **Date** 16/06/2020 **Priority** High

**Actor User**

**Summary** Actor logs into the system **Goal** Login to OCS Application **Triggers** - Actor opens the application

33

**Pre-Conditions**

**Post-Conditions**

**Main Success Scenario**

- Actor is currently not logged in - Actor has already registered an account

- User device is connected to internet

- Actor logs in with a section - System shows success message then redirected to Home screen 1. Application is automatically moved to Login Screen then Actor fills out information into the required form and click “Đăng nhập” button.

2. System shows success message then redirected to Home screen.

**Alternative Scenario**1. Click “Đăng nhập với Google” button to login.

- Exc1: At step 1, actor lacks one of

required information:

→ Application displays error

message and actor cannot login

- Exc2: At step 1, actor enters

**Exceptions**

incorrect credentials:

→ Application displays error message and actor cannot login - Exc3: At step 1, account doesn’t exist:

→ Application displays error message and actor cannot login

**Relationships** UC01

34

**Business Rules** BR1: Account sign up by email

***Logout Use case***

**USE CASE 3 SPECIFICATION**

**Use-case ID** UC03 **Use-case Version** 1.0 **Use-case Name** Logout

**Author** LyNTH

**Date** 16/06/2020 **Priority** Low **Actor User**

**Summary**Actor logs out of the account and their session is terminated.

**Goal** Logout from OCS Application

**Triggers** - Actor is done using the application - Actor is currently logged in

**Pre-Conditions**

**Post-Conditions**

**Main Success Scenario**

- User device is connected to internet

- The account is logged out - System shows success message and Screen is redirected to Login screen.

1. Actor opens the main menu on the top left of home screen then clicks “Đăng xuất” option. 2. System shows confirmation popup then actor clicks “Ok” button.

35

**Alternative Scenario** N/A

- Exc1: At step 2, actor click “Hủy”

**Exceptions**

button:

→ the account is not logged out

**Relationships** UC02

**Business Rules** N/A

***Smart Config Use case***

**USE CASE 4 SPECIFICATION**

**Use-case ID** UC04 **Use-case Version** 1.0 **Use-case Name** Smart Config

**Author** LyNTH

**Date** 16/06/2020 **Priority** High **Actor User**

**Summary** Actor configs by scanning qr code

**Goal**Configure the application with hardware successfully

**Triggers**- Actor clicks “Cấu hình thông minh” option in the main menu

- Actor is currently logged in

**Pre-Conditions**

- User device is connected to internet

**Post-Conditions**- System shows success message and Screen is redirected to “Hồ sơ

36

**Main Success Scenario**

hoa Lan” screen.

1. Actor opens the main menu on the top left of home screen. 2. Actor clicks “Cấu hình thông minh” option then “Quét QR code” screen is showed.

3. Actor moves QR code recognition box on this screen to QR code/Bar code of the ESP.

4. Actor connects the phone to the emitting ESP's wifi

**Alternative Scenario** N/A

- Exc1: At step 3, the QR code is not

in the correct format of the system:

→ Configure failed

- Exc2: At step 3, wifi’s password is

**Exceptions**

incorrect:

→ Configure failed

- Exc2: At step 3, connect the other wifi instead of ESP’s wifi:

→ Configure failed

**Relationships** UC02

BR4: The QR code must be in the

**Business Rules**

***View list default profiles Use case***

correct format of the system BR5: Actor must connect the phone to the emitting ESP's wifi

**USE CASE 5 SPECIFICATION**

**Use-case ID** UC05 **Use-case Version** 1.0

37

**Use-case Name** View list default profiles **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary** Actor views list default profiles

**Goal** View list default profiles

**Triggers**- Actor clicks “Hồ sơ” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions Post-Conditions**

- User device is connected to internet

- Screen is redirected to “Hồ sơ hoa Lan” screen with list default profiles.

**Main Success Scenario**1. Actor clicks “Hồ sơ” symbol in the bottom bar

1. Actor clicks “Hồ sơ mặc định”

**Alternative Scenario**

option in the submenu of “Hồ sơ hoa Lan” screen

**Exceptions** N/A **Relationships** UC02 **Business Rules** N/A

38

***View list custom profiles Use case***

**USE CASE 6 SPECIFICATION**

**Use-case ID** UC06 **Use-case Version** 1.0 **Use-case Name** View list custom profiles **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary** Actor views list custom profiles

**Goal** View list custom profiles

**Triggers**- Actor clicks “Hồ sơ” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions**

**Post-Conditions**

**Main Success Scenario**

- User device is connected to internet

- Screen is redirected to “Hồ sơ hoa Lan” screen with list custom profiles.

1. Actor clicks “Hồ sơ” symbol in the bottom bar

2. Actor clicks “Hồ sơ của bạn” option in the submenu

**Alternative Scenario** N/A **Exceptions** N/A

39

**Relationships** UC02

**Business Rules** N/A

***View profile details Use case***

**USE CASE 7 SPECIFICATION**

**Use-case ID** UC07 **Use-case Version** 1.0 **Use-case Name** View profile detail **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary** Actor views profile details

**Goal** View profile details

**Triggers**- Actor clicks “Hồ sơ” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions**

**Post-Conditions**

**Main Success Scenario**

- User device is connected to internet

- Screen is redirected to “Hồ sơ chi tiết” screen with the selected profile

1. Actor clicks an orchid profile that is supposed to view details in list profile

40

**Alternative Scenario** N/A

**Exceptions** N/A

**Relationships** UC05, UC06

**Business Rules** N/A

***Search profiles Use case***

**USE CASE 8 SPECIFICATION**

**Use-case ID** UC08 **Use-case Version** 1.0 **Use-case Name** Search profiles **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary**Actor searches profiles by profile name

**Goal**View list profiles that is filtered by the name entered

**Triggers**- Actor clicks “Hồ sơ” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions**

- User device is connected to internet

**Post-Conditions**- List filtered profiles is displayed in “Hồ sơ” screen

41

**Main Success Scenario**

1. Actor clicks “Tìm kiếm” icon on the top right of “Hồ sơ” screen then the “Tìm kiếm” input text is displayed

2. Actor enters the profile name that is supposed to view

**Alternative Scenario** N/A

**Exceptions** N/A

**Relationships** UC05, UC06

**Business Rules** BR6: Search by profile name

***Add a custom profile Use case***

**USE CASE 9 SPECIFICATION**

**Use-case ID** UC09 **Use-case Version** 1.0 **Use-case Name** Add a custom profile **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary** Actor adds a new custom profile

**Goal** A new custom profile is added

**Triggers**- Actor clicks “Hồ sơ” symbol in the bottom bar

42

**Pre-Conditions**

**Post-Conditions**

**Main Success Scenario**

- Actor is currently logged in - User device is connected to internet

- System shows success message and Screen is redirected to “Hồ sơ hoa Lan” screen with list custom profiles.

1. Actor clicks “Hồ sơ của bạn” option in the submenu

2. Actor clicks “Thêm mới một hồ sơ” option in the submenu then “Thêm mới một hồ sơ” screen is displayed

3. Actor fills out information into the required form

4. Actor clicks button “Lưu”

**Alternative Scenario** N/A

- Exc1: At step 3, actor lacks one of

required information:

→ Application displays error

message and the custom profile is

not added

- Exc2: At step 3, actor fills out

incorrect information:

**Exceptions**

→ Application displays error message and the custom profile is not added

- Exc3: At step 4, actor clicks button “Hủy” instead of button “Lưu”: → The custom profile is not added and Screen is redirected to “Hồ sơ” screen with list custom profiles

43

**Relationships** UC06

BR7: The custom profile’s required

information: profile name,

parameters of all attributes

**Business Rules**

***Delete all custom profiles Use case***

BR8: The parameters is required “min”value < ”max” value

BR9: The new profile is added into list custom profiles

**USE CASE 10 SPECIFICATION**

**Use-case ID** UC10 **Use-case Version** 1.0 **Use-case Name** Delete all custom profiles **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary** Actor deletes all custom profiles

**Goal** All custom profiles are deleted

**Triggers**- Actor clicks “Hồ sơ” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions Post-Conditions**

- User device is connected to internet

- System shows success message and Screen is redirected to “Hồ sơ hoa Lan” screen without list custom profiles.

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**Main Success Scenario**

1. Actor clicks “Hồ sơ của bạn” option in the submenu

2. Actor clicks “Xóa tất cả” option in the submenu then “Xóa tất cả hồ sơ của bạn” popup is displayed 3. Actor clicks button “OK”

**Alternative Scenario** N/A

- Exc1: At step 3, actor clicks button

“Hủy” instead of button “OK”:

**Exceptions**

→ The list custom profiles is not deleted and Screen is redirected to “Hồ sơ” screen with list custom profiles

**Relationships** UC06

**Business Rules**BR10: Only list custom profiles can be deleted

***Edit a custom profile Use case***

**USE CASE 11 SPECIFICATION**

**Use-case ID** UC11 **Use-case Version** 1.0 **Use-case Name** Edit a custom profile **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary** Actor edits a custom profile

45

**Goal**A custom profile is editted successfully

**Triggers**- Actor clicks “Hồ sơ” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions**

**Post-Conditions**

**Main Success Scenario**

- User device is connected to internet

- System shows success message and Screen is redirected to “Hồ sơ chi tiết” screen of the editted profile.

1. Actor clicks “Hồ sơ của bạn” option in the submenu

2. Actor clicks the profile that supposed to be editted

3. Actor clicks “Chỉnh sửa” option in the submenu

4. Actor re-enters information of the selected profile

5. Actor clicks button “Lưu”

**Alternative Scenario** N/A

- Exc1: At step 4, actor lacks one of

required information:

→ Application displays error

message and the custom profile is

**Exceptions**

not editted

- Exc2: At step 4, actor fills out incorrect information:

→ Application displays error message and the custom profile is not editted

46

- Exc3: At step 5, actor clicks button

“Hủy” instead of button “Lưu”:

→ The editted information is not

saved and Screen is redirected to

“Hồ sơ” screen with list custom

profiles

**Relationships** UC06

**Business Rules**BR11: Only list custom profiles can be editted

***Delete a custom profile Use case***

**USE CASE 12 SPECIFICATION**

**Use-case ID** UC12 **Use-case Version** 1.0 **Use-case Name** Delete a custom profile **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary** Actor deletes a custom profile

**Goal**A custom profile is deleted successfully

**Triggers**- Actor clicks “Hồ sơ” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions**

- User device is connected to internet

47

**Post-Conditions**

**Main Success Scenario**

- System shows success message and Screen is redirected to “Hồ sơ” screen of list custom profiles without the deleted profile. 1. Actor clicks “Hồ sơ của bạn” option in the submenu

2. Actor clicks the profile that supposed to be deleted

3. Actor clicks “Xóa” option in the submenu then “Xóa hồ sơ này” popup is display

4. Actor clicks button “OK”

**Alternative Scenario** N/A

- Exc1: At step 4, actor clicks button

“Hủy” instead of button “OK”:

**Exceptions**

→ The selected custom profile is not deleted and Screen is redirected to “Hồ sơ” screen with list custom profiles

**Relationships** UC06

BR10: Only list custom profiles can

**Business Rules**

***View basket details Use case***

be deleted

BR15: Profiles that are in use in orchid baskets cannot be deleted

**USE CASE 13 SPECIFICATION**

**Use-case ID** UC13 **Use-case Version** 1.0 **Use-case Name** View basket details **Author** LyNTH **Date** 16/06/2020 **Priority** High

48

**Actor User**

**Summary** Actor views basket details

**Goal** A basket details is displayed

**Triggers**- Actor clicks “Quản lý hệ thống” option in the main menu

- Actor is currently logged in

**Pre-Conditions**

**Post-Conditions**

**Main Success Scenario**

- User device is connected to internet

- Screen is redirected to “Quản lý hệ thống” screen with the selected basket details

1. Actor clicks “Quản lý hệ thống” option in the main menu

2. Actor clicks the basket that supposed to be displayed

**Alternative Scenario** N/A **Exceptions** N/A **Relationships** UC14 **Business Rules** N/A

***Add a new basket Use case***

**USE CASE 14 SPECIFICATION**

49

**Use-case ID** UC14 **Use-case Version** 1.0 **Use-case Name** Add a new basket **Author** LyNTH

**Date** 16/06/2020 **Priority** High **Actor User**

**Summary** Actor adds a new basket

**Goal** A new basket is added

**Triggers**- Actor clicks “Quản lý hệ thống” option in the main menu

- Actor is currently logged in

**Pre-Conditions**

**Post-Conditions**

**Main Success Scenario**

- User device is connected to internet

- System shows success message and Screen is redirected to “Quản lý hệ thống” screen with the selected basket details

1. Actor clicks “Quản lý hệ thống” option in the main menu

2. Actor clicks “Thêm mới” option in the submenu then “Thêm mới giỏ Lan” screen is displayed

3. Actor fills out information into the required form

4. Actor clicks button “Lưu”

**Alternative Scenario** N/A

50

**Exceptions**

- Exc1: At step 3, actor lacks one of required information:

→ Application displays error message and the basket is not added

- Exc2: At step 3, actor fills out incorrect information:

→ Application displays error message and the basket is not added

- Exc3: At step 4, actor clicks button “Hủy” instead of button “Lưu”: → The new basket is not saved and Screen is redirected to “Quản lý hệ thống” screen

**Relationships** UC02

BR12: There are only 2 active basket

BR13: Basket’s requirement

information: name, time interval,

**Business Rules**

***Edit a basket Use case***

configuration, general slave, private

slave

BR14: General slave, private slave,

configuration must be active

**USE CASE 15 SPECIFICATION**

**Use-case ID** UC15 **Use-case Version** 1.0 **Use-case Name** Edit a basket **Author** LyNTH **Date** 16/06/2020 **Priority** High

**Actor User**

51

**Summary** Actor edits information of a basket

**Goal** A selected basket is editted

**Triggers**- Actor clicks “Quản lý hệ thống” option in the main menu

- Actor is currently logged in

**Pre-Conditions**

**Post-Conditions**

**Main Success Scenario**

- User device is connected to internet

- System shows success message and Screen is redirected to “Quản lý hệ thống” screen with the default basket details

1. Actor clicks “Quản lý hệ thống” option in the main menu

2. Actor selects a basket that is supposed to edit information 3. Actor clicks “Chỉnh sửa” option in the submenu then the information is enable to edit

4. Actor edits information

5. Actor clicks button “Lưu”

**Alternative Scenario** N/A

- Exc1: At step 4, actor lacks one of

required information:

→ Application displays error

**Exceptions**

message and the editted basket’s information is not saved

- Exc2: At step 4, actor fills out incorrect information:

52

→ Application displays error

message and the editted basket’s

information is not saved

- Exc3: At step 5, actor clicks button

“Hủy” instead of button “Lưu”:

→ The editted basket’s information

is not saved and Screen is

redirected to “Quản lý hệ thống”

screen

**Relationships** UC13

BR12: There are only 2 active basket

BR13: Basket’s requirement

information: name, time interval,

**Business Rules**

***Delete a basket Use case***

configuration, general slave, private slave

BR14: General slave, private slave, configuration must be active

**USE CASE 16 SPECIFICATION**

**Use-case ID** UC16 **Use-case Version** 1.0 **Use-case Name** Delete a basket **Author** LyNTH **Date** 16/06/2020 **Priority** High

**Actor User**

**Summary** Actor deletes a basket **Goal** A selected basket is deleted

53

**Triggers**- Actor clicks “Quản lý hệ thống” option in the main menu

- Actor is currently logged in

**Pre-Conditions**

**Post-Conditions**

**Main Success Scenario**

- User device is connected to internet

- System shows success message and Screen is redirected to “Quản lý hệ thống” screen with the default basket details

1. Actor clicks “Quản lý hệ thống” option in the main menu

2. Actor selects a basket that is supposed to delete

3. Actor clicks “Xóa” option in the submenu then the confirmation popup is displayed

4. Actor clicks button “OK”

**Alternative Scenario** N/A

- Exc1: At step 4, actor clicks button

“Hủy” instead of button “OK”:

**Exceptions**

→ The selected is not deleted and Screen is redirected to “Quản lý hệ thống” screen

**Relationships** UC13

**Business Rules** N/A

***View list slaves Use case***

**USE CASE 17 SPECIFICATION**

**Use-case ID** UC17 **Use-case Version** 1.0

54

**Use-case Name** View list slaves **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary** Actor views list slaves

**Goal** List slaves is displayed

**Triggers**- Actor clicks “Thiết bị” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions**

- User device is connected to internet

**Post-Conditions**- Screen is redirected to “Quản lý thiết bị” screen with list slaves

**Main Success Scenario**1. Actor clicks “Thiết bị” symbol in the bottom bar

**Alternative Scenario** N/A

**Exceptions** N/A

**Relationships** UC04

**Business Rules** N/A

55

***View slave details Use case***

**USE CASE 18 SPECIFICATION**

**Use-case ID** UC18 **Use-case Version** 1.0 **Use-case Name** View slave details **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary** Actor views slave details

**Goal**The details of a selected slave is displayed

**Triggers**- Actor clicks “Thiết bị” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions**

- User device is connected to internet

**Post-Conditions**- Screen is redirected to “Chi tiết thiết bị” screen with slave details

1. Actor clicks “Thiết bị” symbol in

**Main Success Scenario**

the bottom bar

2. Actor clicks a slave that is supposed to view details

**Alternative Scenario** N/A **Exceptions** N/A

56

**Relationships** UC17

**Business Rules** N/A

***Check connection Use case***

**USE CASE 19 SPECIFICATION**

**Use-case ID** UC19 **Use-case Version** 1.0 **Use-case Name** Check connection **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary**Actor checks connection of a selected slave

**Goal**System shows message “Đã được kết nối” or “Chưa được kết nối”

**Triggers**- Actor clicks “Thiết bị” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions**

- User device is connected to internet

**Post-Conditions**- System shows message “Đã được kết nối” or “Chưa được kết nối”

1. Actor clicks “Thiết bị” symbol in

the bottom bar

**Main Success Scenario**

2. Actor clicks a slave that is supposed to check connection 3. Actor clicks button “Kiểm tra kết

57

nối”

**Alternative Scenario** N/A

**Exceptions** N/A

**Relationships** UC18

**Business Rules** N/A

***Set active/deactive Use case***

**USE CASE 20 SPECIFICATION**

**Use-case ID** UC20 **Use-case Version** 1.0 **Use-case Name** Set active/deactive **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary**Actor sets active/deactive for a selected slave

**Goal** The status is saved

**Triggers**- Actor clicks “Thiết bị” symbol in the bottom bar

58

**Pre-Conditions**

- Actor is currently logged in - User device is connected to internet

**Post-Conditions** - The status is saved

1. Actor clicks “Thiết bị” symbol in

the bottom bar

**Main Success Scenario**

2. Actor clicks a slave that is supposed to set status

3. Actor clicks switch “Hoạt động” to change status (active/deactive)

**Alternative Scenario** N/A

**Exceptions** N/A

**Relationships** UC18

**Business Rules**BR16: The module's state must follow the slave state

***View attributes of an active basket Use case***

**USE CASE 21 SPECIFICATION**

**Use-case ID** UC21 **Use-case Version** 1.0 **Use-case Name** View attributes of an active basket **Author** LyNTH

**Date** 16/06/2020 **Priority** Normal **Actor User**

59

**Summary**Actor views attributes of an active basket

**Goal**All attributes of an active are displayed

**Triggers**- Actor clicks “Trạng thái” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions**

- User device is connected to internet

**Post-Conditions** - The status is saved 1. Actor clicks “Trạng thái” symbol

**Main Success Scenario**

in the bottom bar

2. Actor clicks a basket that is supposed to view details

**Alternative Scenario** N/A

**Exceptions** N/A

**Relationships** UC14

**Business Rules**BR17: Only active baskets are displayed in “Trạng thái” screen

***Get notification Use case***

**USE CASE 22 SPECIFICATION**

**Use-case ID** UC22 **Use-case Version** 1.0 **Use-case Name** Get notification **Author** LyNTH

60

**Date** 16/06/2020 **Priority** Normal **Actor User**

**Summary** Actor gets notification from system

**Goal**Notifications are sent to user through application

**Triggers**- Actor clicks “Thông báo” symbol in the bottom bar

- Actor is currently logged in

**Pre-Conditions**

- User device is connected to internet

**Post-Conditions**- Screen is moved to “Thông báo” screen with list notifications

**Main Success Scenario**1. Actor clicks “Thông báo” symbol in the bottom bar

1. Actor clicks the notification bar

**Alternative Scenario**

on the top of any screen when it displays

**Exceptions** N/A

**Relationships** UC02

**Business Rules** N/A

***Manual mode Use case***

**USE CASE 23 SPECIFICATION**

**Use-case ID** UC23 **Use-case Version** 1.0

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**Use-case Name** Manual mode

**Author** LyNTH

**Date** 16/06/2020 **Priority** High **Actor User**

**Summary** Actor uses the manual mode

**Goal**The manual mode is used instead of the automation mode

**Triggers**- Actor clicks “Chế độ thủ công” option in the main menu

- Actor is currently logged in

**Pre-Conditions**

- User device is connected to internet

**Post-Conditions**- The manual mode is set up successfully

1. Actor clicks “Chế độ thủ công”

option in the main menu

2. Actor turns on/off modules and

enters value on/off as desired

**Main Success Scenario**

3. Actor clicks “Cài đặt” symbol in the top right of screen

4. Actor enters min/max value of each attribute in manual

notification setting screen 5. Actor clicks button “Lưu”

**Alternative Scenario** N/A

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**Exceptions**

- Exc1: At step 2, actor lacks of required information:

→ The manual mode is set up unsuccessfully

- Exc2: At step 3, actor lacks of required information:

→ The manual mode is set up unsuccessfully

- Exc2: At step 3, actor enters incorrect information:

→ The manual mode is set up unsuccessfully

- Exc3: At step 4, actor clicks button “Hủy” instead of “Lưu”:

→ The manual mode is set up unsuccessfully

**Relationships** UC02

BR18: Setup module screen has

required information: On, Off

BR19: Value of On < value of Off

**Business Rules**

**3.3.2. Non-functional Requirements *Security***

BR20: Manual notification setting screen has required information: min, max

BR21: Value of min < value of max

Orchid Care System use Firebase authentication.

***Availability***

Orchid Care System use microservice architecture to improve time availability. ***Usability***

User interface of Orchid Care System is simple, clear and easy to use. ***Performance***

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Orchid Care System use microservice architecture to improve performance. ***Maintainability***

Orchid Care System use microservice architecture to decrease maintenance costs.

**CHAPTER 4: SYSTEM DESIGN**

**4.1. Purpose**

The document gives development team the overview and detailed design of our system’s architecture. It will explain what the system’s architecture is, and how they should be implemented. There are 4 main parts:

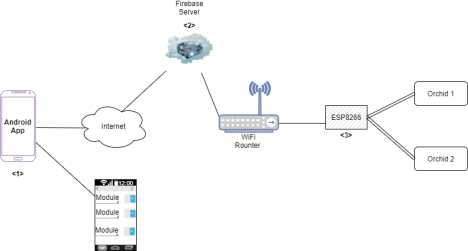
❖ System Architecture Design

❖ Hardware Design

❖ Firmware Design

❖ Software Design

**4.2. System Architecture Design**

*****Figure 4. 1 OCS architecture overview diagram*

***The Hardware (ESP8266)***

ESP8266 receives data from the sensors and then controls the execution modules and sends data to firebase.

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The sensor ESP8266 requires a WiFi connection to be able to send the necessary information. ESP8266 measures parameters and sends it when there is a change from the environment or when requested by the user

***The Firebase Server***

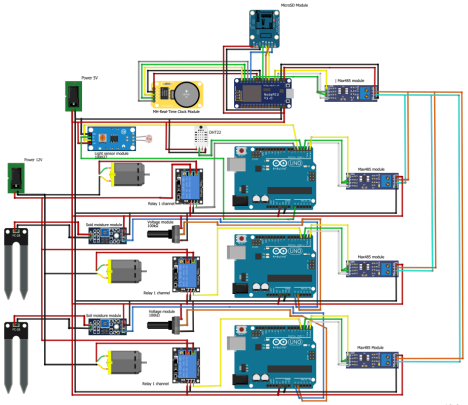
The firebase server is where the data will be stored: user’s profile, account, orchid’s information … It updates data from the sensor controller or from the controller module. With the changes measured by the sensor, the controller will make the comparison. If there is an abnormality, it will notify by sending the message to the clients. When firebase receives a request to retrieve data, it will retrieve the user's data and display it on the screen of the application.

***The Andoid App***

The Android app syncs data from firebase and transmits user commands to firebase for ESP8266 to process. The mobile application will be used to track details with parameters that the sensor measures such as brightness, environmental temperature, air humidity, soil moisture, regular pH, and can also control the execution modules at its discretion through the application. All devices can connect fully automatically to the most convenient for users.

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**4.3. Hardware Design**

*****Figure 4. 2 OCS hardware design*

Modular designs such as water pumps, nebulizers, roof controllers, sensors such as lighting, temperature, humidity, pH and some protective devices, increase connectivity. Described in the picture above. Modular devices such as water pumps, nebulizers, and roof controls are powered the same way. Sensors like light, temperature, humidity and microcontrollers like arduino, relay, voltage module, max485 module, ... are powered on 5V. The execution modules (pumps) are powered by 12V and the devices are connected via rs485 bus.

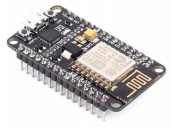
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Using Esp8266 as a processor because it has a wifi connection function, supports firebase data warehouse connection, helps control and transfer data information to users conveniently, but the price of esp8266 is cheap and easy to buy.

Using the Arduino and max485 modules forms a network model that helps to transmit information without interruption and increases the distance of information transmission from the sensor to the processor and from the processor to the execution module.

***Hardware devices***

*Name Image Information*

NODE MCU ESP8266 ⑤ 

Arduino 

Uno R3 ⑥

• Microcontroller: ESP-8266 32-bit • Clock Speed: 80 MHz

• USB Converter: CP2102

• USB Connector: Micro USB • Operating Voltage: 3.3V

• Flash Memory: 4 MB

• Digital I/O: 11

• Analog Inputs: 1

• Communications: Serial, SPI. I2C and 1-Wire via software libraries • Wifi: Built-in 802.11 b/g/n

• Used for getting parameter to send to firebase

∙ Microcontroller: ATmega328P ∙ Clock Speed: 16MHz

∙ Operating Voltage: 5V

∙ Digital I/O: 14

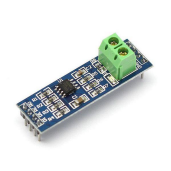
∙ Analog Inputs: 6

∙ Flash Memory: 32 KB

(ATmega328P)

0.5 KB is used by the bootloader ∙ EEPROM: 1 KB (ATmega328P) ∙ SRAM: 2KB (ATmega328P)

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Module TTL RS485 

⑦

Module MicroSD ⑧ 

∙ Used for reading signals, managing sensors and controlling motors Operating Voltage: 5V

Use MAX485 Interface chip

Use differential signaling for noise immunity

Distances up to 1200 meters

Speeds up to 2.5Mbit/Sec

Multi-drop supports up to 32 devices on same bus

Red power LED

Used for converting Serial UART signal to RS485 communication using MAX485 IC

∙ Control Interface: A total of six pins (GND, VCC, MISO, MOSI, SCK, CS), GND to ground, VCC is the power

supply, MISO, MOSI, SCK for SPI bus, CS is the chip select signal pin ∙ 3.3V regulator circuit: LDO

regulator output 3.3V for level conversion chip, Micro SD card supply

∙ Micro SD card connector: self bomb deck, easy card insertion

∙ Positioning holes: 4 M2 screws positioning holes with a diameter of 2.2mm

∙ Used for reading and writing through the file system and the SPI

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Module

RTC

DS1307 ⑨

Humidity &

Temperatu

re Sensor/

Module

DHT22 ⑩

***Command Format***

interface driver

∙ Main IC: RTC DS1307 + EEPROM 

AT24C32

∙ 56-byte, battery-backed,

nonvolatile (NV) RAM for data

storage

∙ Two-wire serial interface

∙ Voltage: 5V

∙ Optional industrial temperature

range: -40°C to +85°C

∙ Available in 8-pin DIP or SOIC

∙ Used for storing time date data and

other information, automatically

adjusted when time changes

∙ Power Supply: 3.3V – 6V DC 

∙ Output Signal: digital signal via

single-bus

∙ Sensing element: Polymer capacitor

∙ Operating range: humidity 0-

100%RH; temperature 40~80Celsius

∙ Humidity hysteresis: +-0.3%RH

∙ Long-term Stability: +-0.5%RH/year

∙ Sensing period: Average 2s

∙ Interchangeability: 4 pins packaged

and fully interchangeable

∙ Used for easily connecting and

communicating with

Microcontroller to carry out

ambient temperature and humidity

measurement applications

*Table 4. 1 Hardware devices*

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In the Master/Slave model, the data format for transmission and reception between Master and Slave is designed as follows:

***The Data Transfer from Master to Slave***

Case 1 :

The data transfer from Master to Slave has 5 fields:

[I] [ID] [CMD] [State] [F]

[I]: Start a transmission frame from the Master

[ID]: logical ID, between 100 – 999

[CMD]: a character that indicates the action

Enable master as transmiter

“I” start request Master

“slaveID” Slave ID

“S” request slave to receive data

“F” end request

wait util data send

[State]: 0 ⬄ False

[F]: End of transmission frame

Enable master as receiver

Case 2 :

The data transfer from Master to Slave has 7 fields:

[I] [ID] [CMD] [State] [T] [TimeExcute] [F]

[I]: Start a transmission frame from the Master

[ID]: logical ID, between 100 – 999

[CMD]: a character that indicates the action

Enable master as transmiter

“I” start request Master

“slaveID” Slave ID

“S” request slave to receive data

“F” end request

wait util data send

[State]: 1 ⬄ True

[T]: Time Command

[TimeExcute]: Time

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[F]: End of transmission frame

Enable master as receiver

**The Data Transfer from general Slave to Master**

The data transfer from Slave to Master has 4 fields:

[i] : Start a transmission frame from the Slave

[ID]: “slaveID” Slave ID

[Data]:

Transfer data received from sensors to the Master according to: Enable Slave as transmiter

“i” start request Master

“SLAVE\_ID”

“Humidity”

“Tempareture”

“Light”

“,”parameter separator

Data to be transmitted

“f” end request

[F]: End of transmission frame

Enable Slave as receiver

**The Data Transfer from private Slave to Master**

The data transfer from Slave to Master has 4 fields:

[i] : Start a transmission frame from the Slave

[ID]: “slaveID” Slave ID

[Data]:

Transfer data received from sensors to the Master according to: Enable Slave as transmiter

“i” start request Master

“SLAVE\_ID”

“,”parameter separator

Data to be transmitted

“f” end request

[F]: End of transmission frame

Enable Slave as receiver

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All commands are summarized in Table:

*Command Meaning Result*

**I** Start request Master

**B** Both roof control and misting

**R** Turning on roof control

**F** End request

**M** Manure/Misiting

**SLAVE\_ID** Slave ID

**I** start request Master

**S** request slave to receive data Data from sensor *Table 4. 2 Commands description*

**ESP8266** ⬄ **Firebase** ⬄ **OCS Application**

**a) Update ESP 8266 State**

[Host][ProjectName][UID][Path][Data]

[Host]: Provides fast and secure storage for web applications, static and dynamic content, and microservice.

[ProjcetName]: ocsfpt-98 - name of project implementation

[UID]: User id

[Path]:

“States/esp8266”

“log”

“slave”

[Data]: “esp8266\_time” Timestamp data type

**b) Log**

[Host][ProjectName][UID][Path][LogID][Data]

[Host]: Provides fast and secure storage for web applications, static and dynamic content, and microservice.

[ProjectName]: ocsfpt-98 - name of project implementation

[UID]: User id

[Path]: log

[LogID]: Timestamp data type

"1592282457" confirm wifi connection

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"1592282519" configuration start

[Data]: String data type

"1592282457" String data type

"1592282519" String data type

**c) Slave**

[Host][ProjectName][UID][SlavePath][slaveID][DataID][Sensor][DataSensor] [Host]: Provides fast and secure storage for web applications, static and dynamic content, and microservice.

[ProjectName]: ocsfpt-98 - name of project implementation [UID]: User id

[SlavePath]: slave

[SlaveID]: logical ID, between 100 – 999

[DataID]: Each id has different data

[Sensor]:

"humidity": sensor for measuring air humidity

"lightIntensity": Light Sensor

"temperature": sensor for measuring air temperature

"pH" : PH sensor

"soilMoisure": sensor for measuring soil moisture

[DataSensor]: sensors have the FLOAT data type

**d) Commands**

[Host][ProjectName][UID][Path][Data]

[Host]: Provides fast and secure storage for web applications, static and dynamic content, and microservice..

[ProjectName]: ocsfpt-98 - name of project implementation [UID]: User id

[Path]: Comnands

[Data]: String

“ChangeMode”: String

“ChangeProfile”: String

“ChangeTimeInterval”: String

“reConfig”: String

**e) Notification**

[Host][ProjectName][UID][Path][Data]

[Host]: Provides fast and secure storage for web applications, static and dynamic content, and microservice.

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[ProjectName]: ocsfpt-98 - name of project implementation

[UID]: User id

[Path]: Notification

[Data]: Contains the message ids and each one contains different information **f) Orchid Basket**

[Host][ProjectName][UID][Path][DataID]

[Host]: Provides fast and secure storage for web applications, static and dynamic content, and microservice.

[ProjectName]: ocsfpt-98 - name of project implementation

[UID]: User id

[Path]: OrchidBasket

[DataID]: Each id has different data and contains a different slave list - “slaveList”:

+ Id, name, shareable

+ Module( nebulizer, roof)

**g) Orchid Profile Custom**

[Host][ProjectName][UID][Path][DataID]

[Host]: Provides fast and secure storage for web applications, static and dynamic content, and microservice.

[ProjectName]: ocsfpt-98 - name of project implementation

[UID]: User id

[Path]: OrchidProfileCustom

[DataID]: Each id has different data

- “attprofile”:

+ Name, min, max

- “autoMode”

- “imgSrc”

- “name”

- “shareable”

**h) Permission**

[Host][ProjectName][UID][Path][Data]

[Host]: Provides fast and secure storage for web applications, static and dynamic content, and microservice.

[ProjectName]: ocsfpt-98 - name of project implementation

[UID]: User id

[Path]: Permission

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[Data]: “OrchidBasketActive”

**i) Manual**

[Host][ProjectName][UID][Path][Data]

[Host]: Provides fast and secure storage for web applications, static and dynamic content, and microservice.

[ProjectName]: ocsfpt-98 - name of project implementation [UID]: User id

[Path]: Manual

[Data]:

- “model”

o “nebulizer”, “pump1”, “pump2”, “roof” contain:

▪ clock: active, timeOff, timeOne

▪ state

- “setting”

o “humiditty”, “light”, “moisture”, “ph”, “temperature” contain: ▪ max

▪ min

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**4.4. Firmware Design**

*****Figure 4. 3 Firmware Architecture of OCS*

To be more specific, this model will be described fully in the figures below:

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*Figure 4. 4 State “start” diagram*

After power is turned on, firmware enters its first state: “Start”. In this state, it will start the electronics like esp8266, sensor, arduino, module, rs485.

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*Figure 4. 5 State “start” diagram*

Firmware checks Wifi connection between ESP8266 and local network. 

*Figure 4. 6 State “Setup Transmission” diagram*

Firmware Arduino and RS485 are designed to connect according to network model to increase transmission distance and reduce signal interference.

The above state diagrams of firmware architecture described clearly how the firmware behaves in OCS.

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**4.5. Software Design**

**4.5.1. UI Design**

There are list of all screen of OCS project:

***Waiting screen***

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*Figure 4. 7 Welcome to OCS screen*

***Login Screen***

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*Figure 4. 8 Login screen*

***Home Screen***

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*Figure 4. 9 Status screen*

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