

**MINISTRY OF EDUCATION AND TRAINING**

FPT UNIVERSITY

Capstone Project Document

**Dendrobium Orchid Care Solution**

|  |  |
| --- | --- |
| **Group 3** | |
| **Group members** | **Nguyễn Tuấn Sang – SE61499**  **Nguyễn Quang Huy – SE61525**  **Mai Thanh Hiếu – SE61559**  **Huỳnh Quang Đạt – SE61783**  **Trần Hồng Sơn – SE61470** |
| **Supervisor** | **Nguyễn Đức Lợi** |
| **Ext. Supervisor** | N/A |
| **Capstone Project code** | **OCS** |

-Ho Chi Minh City, **Sep 5th 2017**

Table ofContents

[A. Introduction 4](#_Toc496160493)

[1. Project Information 4](#_Toc496160494)

[2. Introduction 4](#_Toc496160495)

[3. Current Situation 4](#_Toc496160496)

[4. Proposed Solution 4](#_Toc496160497)

[5. Functional Requirements 5](#_Toc496160498)

[6. Roles and Responsibilities 5](#_Toc496160499)

[7. Conclusion 5](#_Toc496160500)

[B. Software Project Management Plan 7](#_Toc496160501)

[1. Problem Definition 7](#_Toc496160502)

[1.1 Name of this Capstone Project 7](#_Toc496160503)

[1.2 Problem Abstract 7](#_Toc496160504)

[1.3 Project Overview 7](#_Toc496160505)

[2. Project organization 9](#_Toc496160506)

[2.1 Software Process Model 9](#_Toc496160507)

[2.2 Roles and responsibilities 10](#_Toc496160508)

[2.3 Tools and Techniques 11](#_Toc496160509)

[3. Project management plan 12](#_Toc496160510)

[4. Coding convention 13](#_Toc496160511)

**Definitions, Acronyms and Abbreviations**

|  |  |
| --- | --- |
| **Name** | **Definition** |
| **CCU** | Central Control Unit |
| **HTTP** | Hypertext Transport Protocol |
| **HTML** | Hypertext Markup Language |
| **IOT** | Internet of Thing |

Table 1: Definitions, Acronyms and Abbreviations

# Introduction

## Project Information

* Project name: Dendrobium orchid care solution.
* Project code: OCS
* Project type: Internet of Thing (IoT)
* Start date: 6th-Sep-2017
* End date: 8th-Dec-2017

## Introduction

In this document, we introduce a solution for anyone who likes Dendrobium orchid and others orchid. We bring the technology to their farm and help them reduce the cost.

We build a solution. In this solution we provide the hardware, the software and completely user manual in English and Vietnamese.

We provide the sensor and controller to get the temperature and humidity in the garden. We build a mobile application which has functional like tracking temperature and humidity in the garden and control water provider.

This document also describes our working process in 4 months includes our perspective in the system, component designs and detailed core workflows. We hope the system and our solution will help reduce time to take care the orchid. Also we help who is busy, who is newbie and who is love the orchid but they have inexperienced.

## Current Situation

The most garden dendrobium is operating by people. They can be the farmer or the boss. In this way they follow their experience to take care the dendrobium orchid. The traditional base on human experience. They do not have any machine to measure exactly parameter of environment like humidity and temperature.

There are many other third party have implemented a device fit our system require, but the price is high and all of the vendor are far away from Viet Nam. Some of them does not support or even sell their product outside their country. So we decided to research some embedded system and come up with do-it-yourself solution.

There are some Viet Nam companies which have provided IoT agriculture devices such as : Bach Khoa, HACHI… They also provide IoT system for clean agriculture with the product reached Viet GAP or futher is Global GAP.

## Proposed Solution

Many modern garden in develop country they apply IOT in to their farm. The result is quantity is double. The cost for water, worker and energy was reduce very much.

This solution is provide a system to tracking the garden. This is applied IOT which can control from anywhere have the Internet.

The mobile application also provides the recommendation for user. How to use fertilizer suitable with the weather and the stage in time life of orchid.

This solution use industrial device with high quality and reliability. We provide a HMI monitor to control at the garden and an application for android mobile.

## Functional Requirements

Functional requirements of the system are listed as below:

* Tracking component:
* Define temperature and humidity.
* Compare the current situation with the best situation for orchid.
* HMI component:
* Display the temperature and humidity.
* Control the water provider.
* Notification mobile application component:
* Speaker.
* Water provider component:
* Automation operate.
* Control by mobile application and HMI.

## Roles and Responsibilities

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Full name** | **Role** | **Position** | **Contact** |
| 1 | Nguyễn Đức Lợi | Project manager | Supervisor | [loind@fpt.edu.vn](mailto:loind@fpt.edu.vn) |
| 2 | Nguyễn Quang Huy | Developer | Leader | [Huynqse61525@fpt.edu.vn](mailto:Huynqse61525@fpt.edu.vn) |
| 3 | Nguyễn Tuấn Sang | Developer | Member | [Sangntse61499@fpt.edu.vn](mailto:Sangntse61499@fpt.edu.vn) |
| 4 | Mai Thanh Hiếu | Developer | Member | [Hieumtse61559@fpt.edu.vn](mailto:Hieumtse61559@fpt.edu.vn) |
| 5 | Huỳnh Quang Đạt | Developer | Member | [Dathqse61783@fpt.edu.vn](mailto:Dathqse61783@fpt.edu.vn) |
| 6 | Trần Hồng Sơn | Developer | Member | [Sontqse61479@fpt.edu.vn](mailto:Sontqse61479@fpt.edu.vn) |

Table 2: General Roles and Responsibilities of Member

## Conclusion

* Research Configure and commands a Arduino, **ESP8226 NodeMCU**.
* Researching how to communicate HMI and Raspberry PI 3.
* Communication technique: How about communicate interface; SPI, I2C, UART
* Researching how to pulse width modulation for Pumper.
* Researching software architecture of Raspberry Pi.
* Researching how to operate ESP8226 NodeMCU with sensor.
* Design and implement UI of HMI.
* Design and Implement the Voltage regulator circuit, the display and alarm circuit.
* Use software in design PCB, Schematic such as OrCAD, Eagle, Proteus.
* C , C++ or Java and Android Studio, Python.
* Documentation.

# Software Project Management Plan

## Problem Definition

### 1.1 Name of this Capstone Project

* Official name: Dendrobium orchid care solution.
* Vietnamese name: Giải pháp chăm sóc lan rừng dendro.
* Abbreviation: OCS.

### 1.2 Problem Abstract

* In the present day orchid growing is very popular but still has many difficulties in doing so. Orchid growers have to spend a lot of effort, time and cost but not sure to have a good result as expected. Therefore, there should be a system that can help the orchid grower solve those problems.
* Orchid growers will determine the status of plants difficulty such as how much water should be planted, how many stools...
* They can not know how the Orchid status when they go away.
* Tóm lượt hệ thống ( hệ thống giải quyết được gì , cơ chế hệ thống)

### 1.3 Project Overview

#### 1.3.1 Current Situation

By research other systems, we found some problem current situation below :

* **Integrate with IoT hardware** : Our team did not have too much experience with hardware so that we much research about hardware, mainboard circuit, connecting device with the internet.
* **Orchid information :** The information about the orchid is very important in this project. So we take a lot of time to collect information.
* **Server balancing :** Cause of the cloud server play as collector of system. Then we need to calculate balancing for server to avoid crashing.
* **Human mistake on central controller :** Smart technology is still new knowledge with Vietnamese. Therefor we need to have implement manual instruction in our product for usability requirement.
* **Orchid have long time life:** In fact the orchid needs 6 to 12 months to complete a cycle of time life. So in 4 months of this project we need to analyzing the best for test case.

#### 1.3.2 The proposed system

* After research about Internet of Thing (IoT) concept, we found out that a control center application install into a hardware with network module is capable of interaction between our system and sensors devices. In this document, we use a control center run on Android operation system which have wifi network module. We using flatform CloudMQTT to support user activate and control their control center with a mobile application.
* This system will be include sensors that read humidity and temperature and send data to server . From the results obtained we can develop a processor that providers solutions for orchids growers have the most appreciate way to irrigate or fertilize the orchids without wasting much time , energy and effort wastage.
* We colllect information of orchid form many resource. We build a database to store. This database can maintain and access to provide data for mobile application.
* We build a mobile application. This application access to database and compare with the information from the realtime to give the suitable recommendation.

#### 1.3.3 The Boundaries of the system

The system apply with farm have electric devices and internet that users want to control their farm by smart phone, tablet. The system include:

* Allow the user control devices by control panel screen.
* Allow the user check temperature , humidity.
* Allow the user control devices by groups and schedule them active automatically.
* Give the recommendation about the fertilizer for the user.

The system does not include :

* The mobile application running on other platform except Android OS.
* The feature to maintain hardware.
* The IoT private protocol to against hacker attack.

#### 1.3.4 Future Plans

* There are no perfect solutions to problems, as well as there are no perfect systems. With the inexperience of our team members and the time constrains, our proposed solution and project contains many issues. Below are the problems encountered in this project:
* **Hardware Knowledge**: We are inexperienced with hardware. All the hardware components chosen to be used in this project is based on our familiar with them, or based on the shortest time we need to learn how to use them. So they are only the most appropriate, not the best choice for the project.
* **Security**: Currently, there is few possible problems encountered with RF, as RF is vulnerable to replay attack.
* **Server crash**: All the needed data for the app is stored in the server. So if server crash, all the devices cannot working properly.
* Our future plan is try to solve these problems one by one.
* We will also try to working to implement a sensor to read data , handle situation with suitable, specific options.

#### 1.3.5 Development Environment

##### 1.3.5.6 Hardware requirement



|  |  |
| --- | --- |
| * Component | * Hardware |
| * Mainboard | * Raspberry Pi 3 |
| * Communication | * USB Cable |
| * Sensor Devices | * SHT10 version 2 |
| * Motors | * Pumper |
| * Receive/Transfer data | * RF 315Mhz |
| * Wifi module | * ESP8266 nodeMCU |

Table 3: Central processor

|  |  |
| --- | --- |
| * Component | * Hardware |
| * Mainboard | * Arduino Mini |
| * Sensor Devices | * SHT10 version 2 |
| * Receive/Transfer data | * RF 315Mhz |
| * Notification | * LED |

Table 4: Send/ receive data in a Zone.

##### 1.3.5.7 Software requirement

* Windows XP/7/8/10: operating system for developing and deploying.
* Arduino IDE: Programming main source code.
* Visual Studio: Programing Desktop Application.
* Proteus 8: Used to drawing PCB board.
* Draw.io: Used to create models and diagrams.
* C/C++: used for embedded module.
* C#: windows application.
* Python : receive / send data .

## Project organization

### 2.1 Software Process Model

* This project is developed under Iterative and incremental development model. We apply customized Iterative and incremental development model to capable with current situation in our team. We choose this model because of the following reasons:
* We are still inexperienced and by develop the system through iterations (repeated cycles) and incrementally (in small portions of time), we can learn from our mistakes and apply that knowledge on the next iteration.
* We are researching and developing the system at the same time, so using this model allow us more flexibility to adapt to changes.
* Working with embedded system hides a lot of problems that are unknown in the planning phase until it is too late. With Iterative and incremental development model, we test the system in small portion at a time, therefore reduce risk and build a feature rich and robust system.
* 

Figure 1: Iterative and Incremental development

### 2.2 Roles and responsibilities

|  |  |  |  |
| --- | --- | --- | --- |
| * No | * Full name | * Team Role | * Responsibilities |
| * 1 | * Nguyễn Đức Lợi | * Supervisor, Project Manager | * Specify user requirement * Advisor for ideas and solutions * Give out techniques and business analysis support |
| * 2 | * Nguyễn Quang Huy | * Team Leader, BA Developer, Tester | * Create test plan * Clarifying requirements * Prepare document * Coding * Testing |
| * 3 | * Nguyễn Tuấn Sang | * Team Leader, BA, Developer, Tester | * Create test plan * Diving task for team member * Managing process * Clarifying requirements * Prepare document * Testing |
| * 4 | * Trần Hồng Sơn | * BA, Developer, Tester | * Create test plan * Clarifying requirements * Prepare document * Coding * Testing |
| * 5 | * Mai Thanh Hiếu | * BA, Developer, Tester | * Create test plan * Clarifying requirements * Prepare document * Coding * Testing |
| * 6 | * Huỳnh Quang Đạt | * Developer, Tester | * Create test plan * Clarifying requirements * Prepare document * Coding * Testing |

Table 5: Detail Roles and responsibilities of Member

### 2.3 Tools and Techniques

|  |  |
| --- | --- |
| * Tools | |
| * Operating System | * Windows 7/8/10 & Windows Server 2012 R2 |
| * Developing tool | * Arduino IDE, Visual Studio, * Notepad++, Sublime Text 3 |
| * Source Control | * GitHub |
| * Managing Database | * Google Firebase |
| * Communication tool | * Facebook, Skype, Slack |
| * Model and Diagrams tool | * Draw.io , Software Ideas Modeler, Fritzing, Creately.com |
| * Testing | * Postman |
| * Programing language | |
| * Arduino | * C++ |
| * Application | * C#, JSON |
| * Webserver | * PHP, HTML, JSON, CakePHP 3.4 |

Table 6: Tools and Techniques use in project

## Project management plan

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Iteration | Scope | Evaluation | Activities | Estimated Duration | Assign Responsibilities |
| Initial Iteration | Initial team workplace and identify project scope | A working team environment | * Set up Git Repository with Gitflow * Set up Slack * Set up Trello | 5 days | SangNT,  HieuMT,  HuyNQ,  SonTH,  DatHQ |
| Iteration 1 | Identify boundaries of the system, planning software and hardware. Create a proof-of-concept prototype. | Report 1, Report 2 and a proof-ofconcept prototype | * Introduction document * Software and Hardware Project Management Plan document * Proof-ofconcept prototype | 15 days | SangNT,  HieuMT,  HuyNQ,  SonTH,  DatHQ |
| Iteration 2 | Produce an architectural prototype | Report 3, Report 4 and an architectural prototype | * Software and Hardware Requirement Specification document * Software and Hardware Design Description document * Architectural prototype | 15 days | SangNT,  HieuMT,  HuyNQ,  SonTH,  DatHQ |
| Iteration 3 | Build the product (up to beta release) | Report 5 and a working product (beta release) | * System Implementation and Test document * PCB * Application * Web API Server | 15 days | SangNT,  HieuMT,  HuyNQ,  SonTH,  DatHQ |
| Iteration 4 | Finish the product (full product release) | Report 6 and the completed product | * Software and Hardware User’s Manual document * Product demonstration model | 15 days | SangNT,  HieuMT,  HuyNQ,  SonTH,  DatHQ |
| Final Iteration | Prepare for Demo Day | Final Documentation, Presentation Slide | * Final Document * Mini Document * CD contains all source code * Presentation Slide | 5 days | SangNT,  HieuMT,  HuyNQ,  SonTH,  DatHQ |

Table 7: Project management plan

## Coding convention

* C/C++ Convention
  + C/C++: Using to develop program and solve algorithm on hardware.

Summary:

* Naming Convention:
* Using Pascal case for class name.
* Using Camel case for function, variable’s name.
* The #define and global variable’s name must uppercase and separate by underscore. Ex: GLOBAL\_VARIABLE.
* Commenting Convention:
* Place the comment on the separate line with function.
* Place the comment at the end of the line, which has calculation formula.
* More details about coding conventions for C/C++ language by Google: https://google.github.io/styleguide/cppguide.html