DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
THE UNIVERSITY OF TEXAS AT ARLINGTON

SYSTEM REQUIREMENTS SPECIFICATION
CSE 4316: SENIOR DESIGN I
FALL 2022

PLANT WAYS
SMART PLANTER

SAMUEL RUIZ
KEVIN FLORES
DON BUI
LUIS JAEN
SAMRAT BARAL

REVISION HISTORY

Revision	Date	Author(s)	Description
0.1	10.07.2022	SR,KF,LJ,DB,SB	document creation
1.0	10.17.2022	SR,KF,LJ,DB,SB	complete draft

CONTENTS

LIST OF FIGURES

1 PRODUCT CONCEPT

The product targets plant beginners and people who neglect plant care. Its purpose is to be used as a learning tool and to automate plant care. The sensors system collects data and users would be able to read in data via mobile application. The mobile apps purpose is ease of use of monitoring the plant.

1.1 PURPOSE AND USE

Our product is intended to be left on its own since the plant care is automated and should only be refilled with water periodically. Users can see information about the plant through the application.

1.2 INTENDED AUDIENCE

This product is made for people who like to have plants around their home, but have trouble keeping up with the maintenance. For instance, housewives or househusbands would benefit from this since it would alleviate some of their routine house work, allowing them to focus more on other tasks. College students who are busy with lots of school work would find our product useful as well. The middle-class and above are the classes which this product is geared towards. The Smart Planter is intended for general use, since the system is mostly automated, it's not that complex.
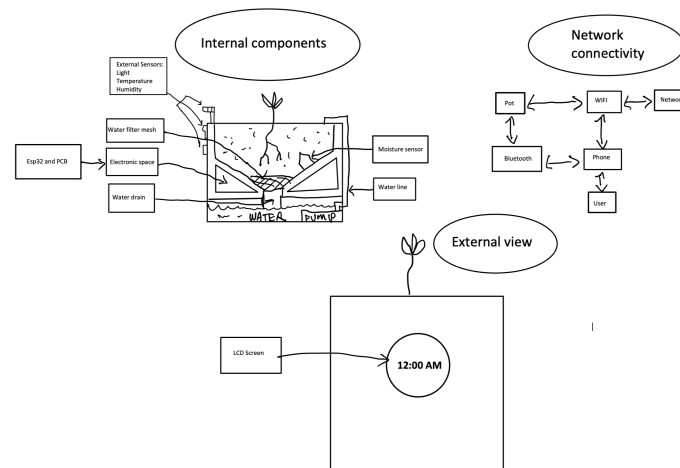

Figure 1: Components of Smart Planter (Hardware and Software)

2   PRODUCT DESCRIPTION

This section provides the reader with an overview of the Smart Planter. The primary operational aspects of the product, from the perspective of end users, maintainers and administrators, are defined here. The key features and functions found in the product, as well as critical user interactions and user interfaces are described in detail.

2.1   FEATURES & FUNCTIONS

The features of the smart planter it well take care the plant by automatic watering the plant. The smart planter well have a sensor that well take in data how much sun light the plant is getting. The smart planter have moisture sensor that well tell when the water pump should turn on, water the plant when the soil is to dry. The smart planter will have a temperature sensor and it will be use for gathering the air temperature data and the smart planter will have humidity sensor, it well be use to gather humidity the surrounding area of the plant. the smart planter pot will have a screen that will display the name of the plant or the time on the screen. All the gather data will store on a data base that could be access to throw the smart planter app, the app will be connected by WiFi. The smart planter should almost look like a regular planting pot with a screen in front of the pot displaying the name of plant or the time on it.

2.2   EXTERNAL INPUTS & OUTPUTS

Data flowing into system

Name	Description	Use
Required Plant Type Name	The name of the plant chosen by user	Programs the planter to recognize the plant type that it's maintaining
Required Humidity	The required humidity levels needed for the plant	Programs the planter to recognize the required humidity settings
Required Temperature	The required temperature needed for the plant	Programs the planter to recognize the required temperature settings
Required Soil Moisture	The required soil moisture needed for the plant	Programs the planter to recognize the required soil moisture settings
Required Light Exposure	The required light exposure needed for the plant	Programs the planter to recognize the required light exposure settings

Data flowing out of system

Name	Description	Use
Current Plant Type Name	The current plant type that's in the planter	Notifies the user the current plant type
Current Humidity	The current humidity levels recorded through the planter	Notifies the user the current humidity level status
Current Temperature	The current temperature recorded through the planter	Notifies the user the current temperature status
Current Soil Moisture	The current soil moisture recorded through the planter	Notifies the user the current soil moisture status
Current Light Exposure	The current light exposure recorded through the planter	Notifies the user the current light exposure status

2.3 PRODUCT INTERFACES

The app will have an account the user logs into, and it will hold all the smart planter pots that the user has registered with app. There is a button the in the app that the user could use to add more smart planters to the account. There is also an account button in the app that lets the user see the user information. The home button will let the user go to the home dashboard.
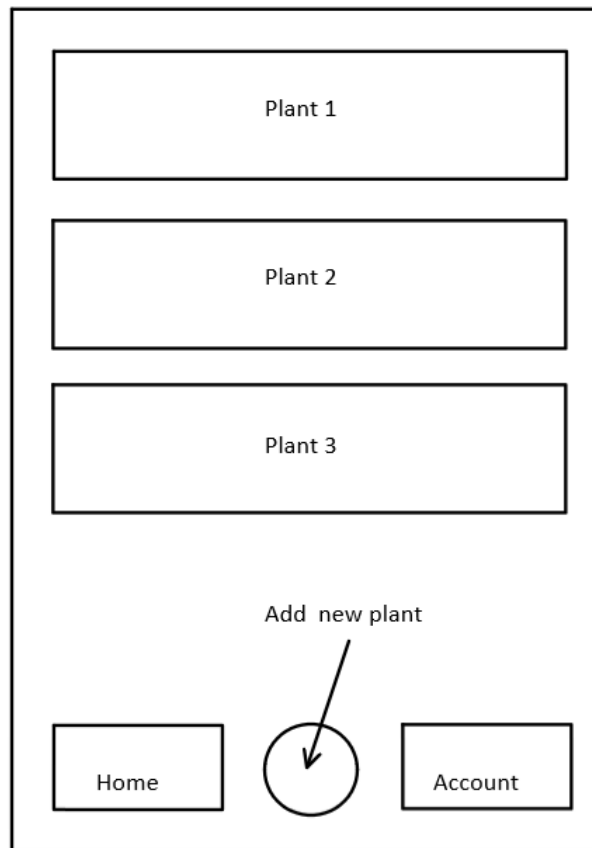
Figure 2: Screen conceptual design

3 CUSTOMER REQUIREMENTS

The SmartPlanter was a student pitched project by Samuel Ruiz. The customer requirements were selected by a group consensus from all the members of the PlantWays team.

3.1 PLANT MONITORING

3.1.1 DESCRIPTION

The Smart Planter should be able to monitor the plants' environmental conditions through sensors. This includes humidity, temperature, soil moisture and light exposure.

3.1.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

3.1.3 CONSTRAINTS

Sensors have the possibility of wear and tear which may require customers to get replacements.

3.1.4 STANDARDS

We will be using the NEC wire color coding standards.

3.1.5 PRIORITY

Critical (must have or product is a failure)

3.2 PLANT POT

3.2.1 DESCRIPTION

The plant pot will be a 3D print design incorporating all the circuitry inside and will be the ideal shape of a regular pot. The design must include designated section to install the plant sensors such as: soil moisture sensor, light sensor, water pump, temperature, humidity sensor, and water tank water level sensor. In addition to these sensors, the design must also include a refillable water tank, a hole for the USB cable, and a button to enable/reset device paring.

3.2.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

3.2.3 CONSTRAINTS

The plant pot design must keep an ideal environment for an indoor plant while taking into drainage into consideration by either ventilation or reusing the water with a filter. The light sensor must be placed in the design in an ideal position where the plant is not covering sunlight.

3.2.4 PRIORITY

Critical (must have or product is a failure)

3.3 LCD SCREEN

3.3.1 DESCRIPTION

The design of the plant pot will have an LCD screen in the front that must include the local time, low water tank notification, and a possible slideshow of sensor data.

3.3.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

3.3.3 PRIORITY

Low (nice to have, will include if time/resource permits)

3.4 SELF WATERING SYSTEM

3.4.1 DESCRIPTION

The SmartPlanter must be self watering. The water pump must activate when the soil moisture indicated the plant needs water and will stop once the sensor indicates the ideal soil moisture is met. The soil moisture parameters can be selected through the mobile application.

3.4.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

3.4.3 CONSTRAINTS

The self watering system should take into account the time of day for watering the plant. Watering the plant in the evenings can cause rot in the plants. The self watering system must be disabled when the water tank is low to prevent damage to the water pump.

3.4.4 PRIORITY

Critical (must have or product is a failure)

3.5 MOBILE PHONE APPLICATION

3.5.1 DESCRIPTION

The SmartPlanter will include a mobile phone application that the user can download and install. The phone application must include a user account creation section before the user is allowed to connect their device.

3.5.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

3.5.3 CONSTRAINTS

User information must be stored in a secure server. The user account must be password protected and user data will never be shared to respect user privacy.

3.5.4 STANDARDS

SB-327 Information Privacy: Connected Devices
Device will be equipped with reasonable security features for IoT devices.

3.5.5 PRIORITY

Critical (must have or product is a failure)

3.6 MOBILE PHONE APPLICATION: DEVICE CONNECTIVITY

3.6.1 DESCRIPTION

The SmartPlanter application must allow the users to pair to their SmartPlanter device and link the device to their local network. The button on the smart planter will allow the device to either begin or

reset device pairing. Once the device is paired and set up, all the paired devices will be displayed on the home screen along with an option to Add New Plant.

3.6.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

3.6.3 STANDARDS

Wi-Fi is the trademark name for any Wireless Local Area Network (WLAN) that follows the IEEE 802.11 standard. It most commonly operates in the 2.4 and 5 GHz ISM Bands, but newer versions also target other frequency bands. Bluetooth® technology is a low-power wireless solution that operates in the 2.4 GHz ISM band.

3.6.4 PRIORITY

Critical (must have or product is a failure)

3.7 MOBILE PHONE APPLICATION: NEW PLANT

3.7.1 DESCRIPTION

The SmartPlanter application must allow users to customize the device sensor data to create the ideal environment for their plant. When the user clicks on customize device, they must be able to search the database for the plant they are planning to grow. Once the correct plant is selected, the ideal sensor data will be transmitted to the SmartPlanter device.

3.7.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

3.7.3 PRIORITY

High (very important to customer acceptance, desirability)

3.8 MOBILE PHONE APPLICATION: CALIBRATE

3.8.1 DESCRIPTION

The SmartPlanter application will include a calibrate option after the device is set up. The user will place the empty plant pot in their ideal house location and select the calibrate option. The SmartPlanter will measure light exposure, temperature, and humidity once an hour for the next 24 hours. After the time is up, the application will provide the user with an average of the measured results along with a list of ideal plants for that location.

3.8.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

3.8.3 PRIORITY

Low (nice to have, will include if time/resource permits)

3.9 MOBILE PHONE APPLICATION: NOTIFICATIONS

3.9.1 Description

The SmartPlanter application should send phone notifications to the user to alert them of the following scenerios: Water tank is running low, plant is not getting enough sunlight, temperature is not ideal, or humidity is not ideal.

3.9.2 Source

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

3.9.3 Priority

Moderate (should have for proper product functionality);

3.10 Solar Power

3.10.1 Description

The SmartPlanter will include a solar panel along with a battery to remove the need for wires.

3.10.2 Source

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

3.10.3 Constraints

Adding solar panels might be ideal for the smart planter but will result in constraints on the sustainability of the battery. Keeping the LCD screen on will drain deplete the battery faster and cause the device to shut down during the night.

3.10.4 Priority

Future (not feasible in this version of the product, but should be considered for a future release)

4 PACKAGING REQUIREMENTS

The smart planter would be fully assembled in a box with a step by step instruction manual on how to set up the pot. The customer will need to download an application for the smart planter via app store in order to interface with the pot. The manual would also include a tech support number and a video link (showing how to set up the pot) if they are unable to set up their smart planter.

4.1 INSTRUCTION MANUAL

4.1.1 DESCRIPTION

The instruction manual will have a step by step process on how to interface with the pot via mobile application. It will also have a contact support number in case they have any trouble setting up. A video link will be provided as well in order to see how to set up the pot.

4.1.2 SOURCE

Samuel Ruiz

4.1.3 CONSTRAINTS

The customer will need WiFi in order to connect the pot to the network.

4.1.4 PRIORITY

Future

4.2 BOX PACKAGE

4.2.1 DESCRIPTION

The smart planter will be stored in a box with different color choices for customers and the logo of Plant Ways.

4.2.2 SOURCE

Samuel Ruiz

4.2.3 CONSTRAINTS

Smart Planter will only be limited to certain colors.

4.2.4 STANDARDS

ISO 55.020 Packaging and Distribution of goods in general

4.2.5 PRIORITY

Future

5 PERFORMANCE REQUIREMENTS

The SmartPlanter must include the following performance requirements to ensure an optimal user experience and to reduce risk of hardware failure.

5.1 STOPPING THE WATER PUMP

5.1.1 DESCRIPTION

When the device measures ideal soil moisture or low water tank levels, the water pump must cease to pump within less than 1ms. This crucial operation must be completed within less than a second to avoid damage to the water pump.

5.1.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

5.1.3 CONSTRAINTS

The sustainability of the water pump will depend on the soil moisture sensor and water level sensor. Faulty sensor data can lead to the damage of the water pump.

5.1.4 PRIORITY

Critical (must have or product is a failure)

5.2 SEARCHING PLANT DATABASE

5.2.1 DESCRIPTION

Users will be able to set up their SmartPlanter but searching for their plant through a search bar. Once the correct plant is found, the sensor settings can be transmitted to the device. The speed of the search is crucial to not have customers waiting more than 30 seconds to complete their search.

5.2.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

5.2.3 CONSTRAINTS

Creating a large database of plants will increase the search time for the user. The prototype SmartPlanter will only support 2-5 house plants but the consumer version will have to support over thousands search results.

5.2.4 PRIORITY

Moderate (should have for proper product functionality);

6   Safety Requirements

We will follow the Laboratory Equipment LOTO Procedures if we use any fabrication equipment for our project. We will also follow the NEC wiring compliance in order for the safety of the customer and to protect any electrical components.

6.1   Laboratory equipment lockout/tagout (LOTO) procedures

6.1.1   Description

Any fabrication equipment provided used in the development of the project shall be used in accordance with OSHA standard LOTO procedures. Locks and tags are installed on all equipment items that present use hazards, and ONLY the course instructor or designated teaching assistants may remove a lock. All locks will be immediately replaced once the equipment is no longer in use.

6.1.2   Source

CSE Senior Design laboratory policy

6.1.3   Constraints

Equipment usage, due to lock removal policies, will be limited to availability of the course instructor and designed teaching assistants.

6.1.4   Standards

Occupational Safety and Health Standards 1910.147 - The control of hazardous energy (lockout/tagout).

6.1.5   Priority

Critical

6.2   National Electric Code (NEC) wiring compliance

6.2.1   Description

Any electrical wiring must be completed in compliance with all requirements specified in the National Electric Code. This includes wire runs, insulation, grounding, enclosures, over-current protection, and all other specifications.

6.2.2   Source

CSE Senior Design laboratory policy

6.2.3   Constraints

High voltage power sources, as defined in NFPA 70, will be avoided as much as possible in order to minimize potential hazards.

6.2.4   Standards

NFPA 70

6.2.5   Priority

Critical

7 SECURITY REQUIREMENTS

The smart planter app will have a login screen that will ask for a username and password in order to login to a specific account. Implementing a login screen will protect a users account from others users. The database will have encryption to protect the user information.

7.1 LOGIN SCREEN

7.1.1 DESCRIPTION

The smart planter app will have login screen prompting for a username and password.

7.1.2 SOURCE

Samuel Ruiz

7.1.3 PRIORITY

Critical

7.2 ENCRYPTION FOR DATABASE

7.2.1 DESCRIPTION

Database will be encrypted in order to protect users information being leaked.

7.2.2 SOURCE

Samuel Ruiz

7.2.3 CONSTRAINTS

The limits to the security of the cloud database we service.

7.2.4 PRIORITY

Future

8 MAINTENANCE & SUPPORT REQUIREMENTS

PlantWays will provide support for the SmartPlanter and any future products by including a department dedicated to providing customer support. This department will include developers from PlantWays and will be stationed locally in Arlington.

8.1 HELP DESK

8.1.1 DESCRIPTION

The SmartPlanter will require a help desk team to continue to provide support for the product. The help desk will include a small team of IT experts who can assist the customer with any issues with the device, identify if the issue is hardware or software related, and issue refunds/returns/repairs.

8.1.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

8.1.3 PRIORITY

Future

8.2 HARDWARE TEAM

8.2.1 DESCRIPTION

SmartPlanter will also include a hardware team to handle device repairs and returns due to hardware failure. Hardware team will identify any possible hardware failure and find solutions.

8.2.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

8.2.3 CONSTRAINTS

If hardware failure is due to customer then no replacements or repairs will take place.

8.2.4 PRIORITY

Future

8.3 SOFTWARE TEAM

8.3.1 DESCRIPTION

SmartPlanter will include a software developer team to handle software related issues and updates. The software team will continue to support the SmartPlanter application for current and future products.

8.3.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

8.3.3 PRIORITY

Future

9   OTHER REQUIREMENTS

Our mobile application will use Flutter SDK in order for our app to be compatible with all platforms like iOS, Android, Windows, and macOS to name a few. We will have to use Dart as our programming language for our application since that is the default for Flutter.

9.1   MUST USE FLUTTER

9.1.1   DESCRIPTION

Flutter will be used to develop the mobile application in order for it to compatible for all platforms.

9.1.2   SOURCE

Samuel Ruiz

9.1.3   PRIORITY

Critical

9.2   MUST USE DART PROGRAMMING LANGUAGE

9.2.1   DESCRIPTION

We will use Dart as our programming language to use the Flutter SDK.

9.2.2   SOURCE

Samuel Ruiz

9.2.3   PRIORITY

Critical

10 FUTURE ITEMS

10.1 SOLAR POWER

10.1.1 DESCRIPTION

The SmartPlanter will include a solar panel along with a battery to remove the need for wires.

10.1.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

10.1.3 CONSTRAINTS

Adding solar panels might be ideal for the smart planter but will result in constraints on the sustainability of the battery. Keeping the LCD screen on will drain deplete the battery faster and cause the device to shut down during the night.

10.1.4 PRIORITY

Future (not feasible in this version of the product, but should be considered for a future release)

10.2 HELP DESK

10.2.1 DESCRIPTION

The SmartPlanter will require a help desk team to continue to provide support for the product. The help desk will include a small team of IT experts who can assist the customer with any issues with the device, identify if the issue is hardware or software related, and issue refunds/returns/repairs.

10.2.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

10.2.3 PRIORITY

Future

10.3 HARDWARE TEAM

10.3.1 DESCRIPTION

SmartPlanter will also include a hardware team to handle device repairs and returns due to hardware failure. Hardware team will identify any possible hardware failure and find solutions.

10.3.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

10.3.3 CONSTRAINTS

If hardware failure is due to customer then no replacements or repairs will take place.

10.3.4 PRIORITY

Future

10.4 SOFTWARE TEAM

10.4.1 DESCRIPTION

SmartPlanter will include a software developer team to handle software related issues and updates. The software team will continue to support the SmartPlanter application for current and future products.

10.4.2 SOURCE

Student pitched CSE Senior Design project specifications by group member Samuel Ruiz

10.4.3 PRIORITY

Future

10.5 INSTRUCTION MANUAL

10.5.1 DESCRIPTION

The instruction manual will have a step by step process on how to interface with the pot via mobile application. It will also have a contact support number in case they have any trouble setting up. A video link will be provided as well in order to see how to set up the pot.

10.5.2 SOURCE

Samuel Ruiz

10.5.3 CONSTRAINTS

The customer will need WiFi in order to connect the pot to the network.

10.5.4 PRIORITY

Future

10.6 BOX PACKAGE

10.6.1 DESCRIPTION

The smart planter will be stored in a box with different color choices for customers and the logo of Plant Ways.

10.6.2 SOURCE

Samuel Ruiz

10.6.3 CONSTRAINTS

Smart Planter will only be limited to certain colors.

10.6.4 STANDARDS

ISO 55.020 Packaging and Distribution of goods in general

10.6.5 PRIORITY

Future

10.7 ENCRYPTION FOR DATABASE

10.7.1 DESCRIPTION

Database will be encrypted in order to protect users information being leaked.

10.7.2 SOURCE

Samuel Ruiz

10.7.3 CONSTRAINTS

The limits to the security of the cloud database we service.

10.7.4 PRIORITY

Future