Smart Indoor Watering System

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INTERFACE CONTROL DOCUMENT

REVISION – 0
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CONCEPT OF OPERATIONS FOR Smart Indoor Watering System

TEAM <43>

APPROVED BY:

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_ Project Leader Date

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Change Record

Rev.	Date	Originator	Approvals	Description
0	9/28/2023	Team		ICD Initial Submission

Table of Contents

List of Tables

1 Overview

This document serves to provide detail into how the Field Sensor Unit will interact with the Main Unit. It lists inputs, outputs, and each system's behavior in response. The document will also explain how subsystems will interact to achieve goals mentioned in the FSR and ConOps documents.

2 References, Applicable Documents, and Definitions

2.1 Applicable Documents

The following documents, of the exact issue and revision shown, form a part of this specification to the extent specified herein:

2.1.1 FSU Applicable Documents

Document Number	Revision/Release Date	Document Title
SWRS176B	Rev. B 02/2015	SimpleLink™ Bluetooth® Wireless MCU datasheet
SWCU117I	Rev. I 02/2015	CC26x0 SimpleLink™ Wireless MCU Technical Reference Manual (Rev. I)
SWRU120D	Rev. D 04/2007	2.4-GHz Inverted F Antenna

2.1.2 MU Applicable Documents

Document Number	Revision/Release Date	Document Title
A5.2	04/2013	BeagleBone Black System Reference Manual
Version 5.1	04/2024	ESP32: Technical Reference Manual

2.1.3 AWS Applicable Documents

Document Number	Revision/Release Date	Document Title
Rev. B	08/2021	DRV8212 Datasheet

2.2 Reference Documents

The following documents are reference documents utilized in the development of this specification. These documents do not form a part of this specification and are not controlled by their reference herein.

IEEE Bluetooth communication standards: IEEE 802.15
Bluetooth Mesh Model 1.0.1
CC2640 SimpleLink™ Bluetooth® Wireless MCU datasheet (Rev. B)
USDA Plants Database
ESP32 Technical Documentation
CC13x0, CC26x0 SimpleLink™ Wireless MCU Technical Reference Manual

2.3 Definitions

BLE	Bluetooth Low Energy
EMC	Electromagnetic Compatibility
FSU	Field Sensor Unit
PCB	Printed Circuit Board
Hz	Hertz
ICD	Interface Control Document
kHz	Kilohertz (1,000 Hz)
mA	Milliamps
MU	Main Unit
UI	User Interface
V	Volts
VDC	Volts Direct Current

3 Physical Characteristics

3.1 Field Sensor Unit

3.1.1 Mass of Field Sensor Unit

FSU mass will be less than 350g.

3.1.2 Size of Field Sensor Unit

The size of an individual FSU will be less than 6 inches in height, 2 inches in width, and 1 inch in thickness.

3.2 Main Unit

3.2.1 Mass of Main Unit

The mass of the Main Unit will be less than 1 kg.

3.2.2 Size of Main Unit

The size of the Main Unit will be less than 5 inches in length, 4 inches in width, and 6.5 inches in height. Since the screen is adjustable, the height can differ between 5 and 6.5 inches.

3.3 Automatic Watering System

3.2.2.5 Size of Automatic Watering System

The size of the automatic watering system will be less than 4 inches in length, 4 inches in width and 4 inches in height. Not including the tubing

3.2.2.6 Mass of Automatic Watering System

The mass of the automatic system will be less than 500g, not including the watering tank.

4 Thermal Interface

4.1 Main Unit Cooling

The BeaglePlay will be secured in the housing, which features cutouts for ventilation. Although this is not necessary for normal operation, it will enhance the unit's efficiency and help prevent the board from overheating under less-than-ideal conditions.

4.2 Field Sensor Unit Cooling

The FSU will not require cooling.

4.3 Automatic Watering System Cooling

The AWS will not require cooling.

5 Electrical Interface

5.1 Maximum Values

Component	Voltage	Current	Power
Field Sensor Unit	3.3VDC	50mA	165mW
Main Unit	5VDC	1A	5W
Automatic Watering System	3VDC	175mA	525mW

5.2 User Control Interface

The user control interface is a web application that communicates the plant data and preferred plant settings based on user preference to the Main Unit.

6 Communications / Device interface Protocols

6.1 Wireless Communications

6.1.1 Bluetooth

The Main Unit and Field Sensor Unit will communicate with each by a BLE protocol.

6.1.1.1 Field Sensor Unit

The Field Sensor Units will communicate with the Main Unit through a BLE bridge attached to MU.

6.1.1.2 Main Unit

The Main Unit will communicate with the Field Sensor Units using BLE protocol through a USB bridge utilizing ESP32.

6.1.2 WiFi

The Main Unit will have a WiFi interface to allow users to connect to the web app through IEEE 802.11 g/b/n standards. Through the web app, plant type, and operating mode can be changed and these settings are sent to the MU via a Wi-Fi connection.

6.2 Wired Communications

6.2.1 PWM Signal

The Field Sensor Unit will communicate with the Automatic Watering System via PWM

6.2.1.1 Field Sensor Unit

The Field Sensor Unit will send the AWS a PWM signal through a MOLEX connector to run the pump at the desired speed and duration.

6.2.1.2 Automatic Watering System

The AWS will receive a PWM signal through a MOLEX connector to run the pump.