System Test Plan

for the

KNEAD Example System

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DOCUMENT CHANGE HISTORY

The following table is a simple list of released revisions sent for review. Records of reviews and the review artifacts are saved with reviewer information in the The KNEAD Projectartifact repository.

Change Record

Date	Version	Author(s)	Change Reference
25 Feb 2024	P1	Lewis Collier	1st draft version
02 May 2024	v0.1	Zachary Steinberg	1st draft version
06 May 2024	v1.0	Zachary Steinberg	Final version

Each subsequent "section" outlines changes in each release.

Items in this version that are marked with change bars have been modified from the most recent previous version (e.g. P3 changes from P2) or are new as of the current revision. A list of all changed items may be found in the Index section under the heading "All Changes This Version".

Draft P1 Preliminary version of this document.

Draft v0.1 Draft Version for Design Assignment 2.

Final Version v1.0 Final Version for final Project.

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CHAPTER 1

Scope

This document provides the System Test Plan (STP) for the Garden Control System, which is known as GCS. These engineering tests provide the multistage plan for testing of the GCS, which follows Appendix A of DOD-STD-2106 (Navy) [1].

1.1 Identification

The GCS, described in this document shall be known as GCS version 1.0.

1.2 System Overview

The Garden Control System will be able to measure moisture levels and control irrigation in raised garden beds. The purpose for GCS is to maintain ideal gardening and growth conditions for fruits, vegetables, and other garden plants throughout a growing season. The goal for GCS is to automate the watering process for DIY gardeners. GCS will monitor temperature, moisture levels, and additionaly environmental factors to determine when to water the plants. Garden Control System is being developed by Zachary Steinberg and sponsored by University of Maryland Graduate Engineering. The operator and maintaner of GCS will also be Zachary Steinberg. The GCS will be operated outside along raised garden beds. GCS is designed to be used by home gardeners. It is not intended for industry. GCS will be controlled by a Raspberry Pi Pico W microcontroller board.

Figure 1 shows the development kit used for the GCS system. This diagram shows the

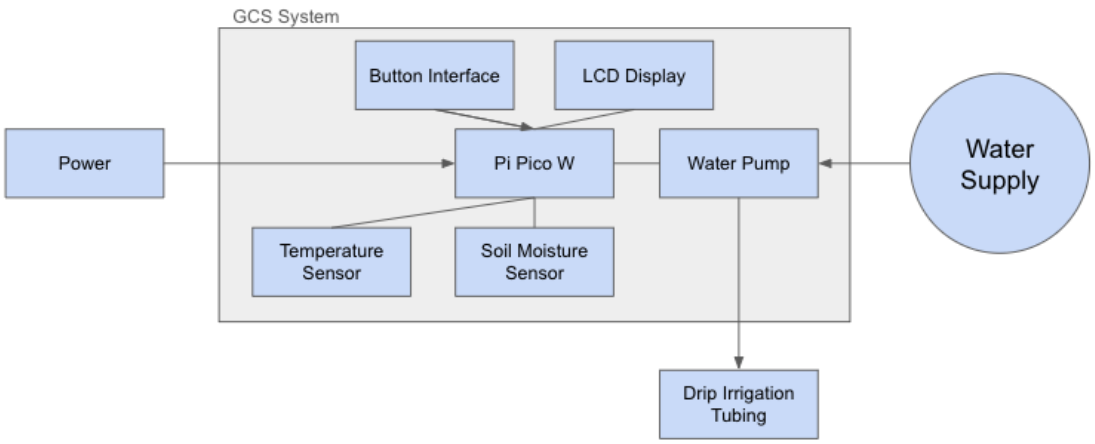

Figure 1: System Overview for the Garden Control System

major external interfaces that provide the capabilities of GCS. As are shown, the GCS can

monitor and maintain a garden system through it's environmental sesnors and control of a water pump.

1.3 Document Overview

This section provides information about this document's security/privacy considerations, contents, structure, and version information.

1.3.1 Security and Privacy Considerations

This document is not subject to CUI restrictions.

This document format is based upon the guidance in the STP DID [2]. The test planning is documented following the guidelines of ISO-12207 (Software Life Cycle Process) [3] and MIL-STD-498 (Software Development and Documentation) [4], from which ISO-12207 originated. This document follows the listed STP sub-section order.

Section 1 provides an overview of the system and this document.

Section 2 lists general and application-specific reference documents as well as glossary terms and acronyms.

Section 3 summarizes the test environment(s).

Section 4 identifies the tests to be performed.

Section 5 outlines the test schedules.

Section 6 provides any applicable requirement traceability.

Section 7 if needed, lists any general notes as may be applicable.

Appendices if needed, provide additional information as may be needed.

1.3.2 Document Version Information

This document was produced in LaTeX and *BibLaTeX/Biber*. The editing and document preparation were performed using MiKTeX version 2.9 with the build option [LaTeX ⇒ PS ⇒ PDF]. The LaTeX*svn-multi* package was used to glean SVN tracking information, when files are stored in an "SVN" version control system. The style `KNEADdocument` was used to provide the LaTeX and *BibLaTeX/Biber* formatting details.

CHAPTER 2

References

This section provides a list of referenced items for this document.

2.1 Acronyms and Abbreviations

This section defines acronyms and abbreviations used in this and related documents.

Table 1: Acronym Definitions

Acronym	Definition
GCS	Garden Control System
UMD	University of Maryland
MAGE	Maryland Applied Graduate Engineering
ENPM	Engineering Professional Masters
End of acronym definition table	

2.2 Glossary and Definitions

This section defines glossary terms used in this and related documents.

Table 2: Glossary Terms and Definitions

Glossary Term	Definition
Communications	Communication is information transfer, among users or processes, according to agreed conventions.
Customer	The local government project lead who is acting as a general manager for the sponsor to ensure that the contractor team executes the project according to stakeholder goals.
Raised Garden Bed	Raised-bed gardening is a form of gardening in which the soil is raised above ground level and usually enclosed in some way.
Drip Irrigation	Drip irrigation is a method of watering plants by slowly dripping water through pipes with holes into the soil, either buried or slightly above ground.
End of glossary terms table	

2.3 Referenced Documents

This section lists the referenced documents for this document. The references are categorized into two categories:

External Documents not directly associated with this project.

Project Documents that are directly associated with this project.

2.3.1 External Documents

[1] US Department of Defense. *Department of Defense Design Criteria Standard – Development of Shipboard Industrial test Procedures*. July 31, 1986.

[2] DI-IPSC-81438. *Data Item Description for System Test Plan*. Dec. 31, 1994.

[3] IEEE and EIA. *Software life cycle processes*. Mar. 1998.

[4] MIL-STD-498. *Military Standard Software Development and Documentation*. Dec. 31, 1994.

2.3.2 Project Specific Documents

CHAPTER 3

Test Environments

This section describes the test environments to be used for testing the system.

3.1 WiFi Packet Test

This section identifies and describes the WiFi Packet Test test environment. This test environment will verify and validate that the Raspberry Pi Pico W has successfully connected to the internet.

3.1.1 Software Items

The software items needed for the WiFi Packet Test Test Environment are a Python script that opens a socket and sends data packets to a device connected to the internet.

3.1.2 Hardware and Firmware Items

The hardware and firmware items needed for the WiFi Packet Test Test Environment are a Raspberry Pi Pico W that has been configured to connect to the internet.

3.1.3 Other Materials

There are no other materials needed of the WiFi Packet Test.

3.1.4 Installation

The installation steps required for the WiFi Packet Test Test Environment are:

- Installing a WiFi connection script on the Raspberry Pi Pico W.
- Running the Python script to send packets across the WiFi network.

3.1.5 Personnel

The personnel planning for the WiFi Packet Test Test Environment is the user of the Raspberry Pi Pico W.

3.1.6 Orientation Planning

The orientation planning for the WiFi Packet Test Test Environment is that the tester must know the WiFi SSID and password for the WiFi network. Additionally, the tester must know the IP address for the Raspberry Pi Pico W.

3.1.7 Tests to be Performed

The tests to be performed for the WiFi Packet Test Test Environment will be a WiFi packet test.A socket will be opened and packets will be sent across the network to a specified IP address. The IP address must be the IP address for the Raspberry Pi Pico W.

3.2 Waterproofing Test

This section identifies and describes the Waterproofing Test test environment. This test environment will verify and validate that the Garden Control System meets the IP65 waterproofing requirements.

3.2.1 Software Items

There are no software items for this test.

3.2.2 Hardware and Firmware Items

The hardware items needed for the Waterproofing Test Test Environment are the external casings for the Garden Control System and it's sensors. There are no firmware items needed for this test.

3.2.3 Other Materials

There are no other materials needed of the Waterproofing Test.

3.2.4 Installation

There are no installation steps for this test.

3.2.5 Participating Organizations

The participating organizations for the Waterproofing Test waterproofing test is VTEC Laboratories.

3.2.6 Personnel

There are no personnel requirements for the Waterproofing Test test.

3.2.7 Orientation Planning

There are no orientation planning requirements for the Waterproofing Test test.

3.2.8 Tests to be Performed

The tests to be performed for the Waterproofing Test Test Environment will be waterproofing test to ensure that the external housing for the Garden Control System meet the minimum IP65 waterproof rating. VTEC Laboratories will perform the waterproofing test.

3.3 Environmental Threshold Testing

This section identifies and describes the Environmental Threshold Test test environment. This test environment will verify and validate that the Garden Control System successfully activates the GCS irrigation system during active watering mode.

3.3.1 Software Items

There are no software items for this test.

3.3.2 Hardware and Firmware Items

The hardware items needed for the Environmental Threshold Test Test Environment are a water pump, temperature sensor, soil moisture sensor, and a Raspberry Pi Pico W. The firmware items needed for the Environmental Threshold Test Test Environment is firmware that monitors the temperature and soil moisture data and triggers the water pump once

environmental thresholds have been met.

3.3.3 Other Materials

There are no other materials needed of the Environmental Threshold Test.

3.3.4 Installation

There are no installation steps for this test.

3.3.5 Participating Organizations

There are no participating organizations for the Environmental Threshold Test test.

3.3.6 Personnel

There are no personnel requirements for the Environmental Threshold Test test.

3.3.7 Orientation Planning

There are no orientation planning requirements for the Environmental Threshold Test test.

3.3.8 Tests to be Performed

The tests to be performed for the Environmental Threshold Test Test Environment will be to ensure that the temperature and soil moisture sensors operate properly. Once the temperature has crossed the environmental threshold for 5-minutes, GCS will activate the irrigation system. Once the soil moisture levels have crossed the environmental threshold for 5-minutes, GCS will activate the irrigation system.

CHAPTER 4

Test Identifications

This section defines the test to be conducted for testing the system.

4.1 General Information

This section provides general and/or common information for all tests.

4.1.1 Test Levels

The tests performed will be system level tests.

4.1.2 Test Classes

The tests conducted will be connection tests.

4.1.3 Test Conditions

The test conditions will validate an internet connection. Each test will generate artificial data and simulate a data transfer.

4.1.4 Test Progression

Test progression does not apply.

4.1.5 Data recording, reduction, and analysis

No data will be recorded for these tests.

4.2 Planned Tests

A list of tests and brief description are:

Test One WiFi Connection Test (§ 4.2.1)

Test Two Waterproofing Test (§ 4.2.2)

Test One Environmental Threshold Test (§ 4.2.3)

4.2.1 WiFi Connection Test

This section defines the plans for the WiFi Test test.

4.2.1.1 Test Objective

The test objective for WiFi Test is to validate that the Raspberry Pi Pico W is connected to the internet.

4.2.1.2 Test Level

The test level for WiFi Test is a system level test.

4.2.1.3 Test Type or Class

The test type or class for WiFi Test is a connection test.

4.2.1.4 Qualification Method

The test qualification method for WiFi Test is the successful reading of packets. The test will compare the number of packets sent with the number of packets received.

4.2.1.5 Traceability

There is no test traceability for WiFi Test.

4.2.1.6 Special Requirements

There are no special requirements for WiFi Test.

4.2.1.7 Data Recoding

The test data recoding for WiFi Test will be the packets sent and packets received.

4.2.1.8 Assumptions or Constraints

The test assumptions or constraints for WiFi Test are that the tester has access to a WiFi network.

4.2.1.9 Safety, Security, and Privacy

There are no test safety, security, or privacy concerns for WiFi Test.

4.2.2 Waterproofing Test

This section defines the plans for the Waterproofing Test test.

4.2.2.1 Test Objective

The test objective for Waterproofing Test is to validate that the Garden Control System meets the IP65 waterproof rating.

4.2.2.2 Test Level

The test level for Waterproofing Test is a hardware test.

4.2.2.3 Test Type or Class

The test type or class for Waterproofing Test is a waterproof test.

4.2.2.4 Qualification Method

The test qualification method for Waterproofing Test is that the Garden Control System meets the IP65 waterproof rating standards.

4.2.2.5 Traceability

There is no test traceability for Waterproofing Test.

4.2.2.6 Special Requirements

There are no special requirements for Waterproofing Test.

4.2.2.7 Data Recoding

There will be no data recording for Waterproofing Test.

4.2.2.8 Assumptions or Constraints

The test assumptions or constraints for Waterproofing Test are that the tester has a facility that can successfully rate GCS for the IP65 waterproof rating.

4.2.2.9 Safety, Security, and Privacy

There are no test safety, security, or privacy concerns for Waterproofing Test.

4.2.3 Environmental Threshold Test

This section defines the plans for the Environmental Threshold Test test.

4.2.3.1 Test Objective

The test objective for Environmental Threshold Test is to validate that the irrigation operates properly when environmental thresholds are met.

4.2.3.2 Test Level

The test level for Environmental Threshold Test is a system level test.

4.2.3.3 Test Type or Class

The test type or class for Environmental Threshold Test is a functionality test.

4.2.3.4 Qualification Method

The test qualification method for Environmental Threshold Test is the successful when the system activates the GCS irrigation system when temperature and environmental thresholds are met and the GCS irrigation system deactivates when environmental thresholds are met.

4.2.3.5 Traceability

There is no test traceability for Environmental Threshold Test.

4.2.3.6 Special Requirements

There are no special requirements for Environmental Threshold Test.

4.2.3.7 Data Recoding

The test data recoding for Environmental Threshold Test will be the the values recorded by the temperature and soil moisture level sensors.

4.2.3.8 Assumptions or Constraints

The test assumptions or constraints for Environmental Threshold Test are that the tester has access to a water supply.

4.2.3.9 Safety, Security, and Privacy

There are no test safety, security, or privacy concerns for Environmental Threshold Test.

CHAPTER 5

Schedule

This section provides an overview of the testing schedule.

When the STP is developed, a general time line should be established so general dates should be understood, but exact dates may not be known. Thus, this schedule sets expectations for need-by dates for resources such as laboratories, test ranges, etc.

The WiFi Packet test should be conducted as soon as possible to test if the Raspberry Pi Pico W is functioning properly.

CHAPTER 6

Traceability

This section provides traceability of the system components and interfaces to the design requirements. There is currently no traceability for the Garden Control System project.

CHAPTER 7

Notes

This chapter is ...TBD....

7.1 Note Area 1

This section is ...TBD....

7.2 Note Area 2

This section is ...TBD....

APPENDIX

Additional Information

This section provides additional information, as necessary, to augment the STP.