

System Development Plan

for the

Garden Control 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 Project artifact repository.

Change Record

Date	Version	Author(s)	Change Reference
25 Dec 2023	P1	Lewis Collier	1st draft 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.

TABLE OF CONTENTS

DOCUMENT CHANGE HISTORY	i
TABLE OF CONTENTS	ii
LIST OF TABLES	iv
LIST OF FIGURES	v
CHAPTER	
1 Scope	1
1.1 Identification	1
1.2 System Overview	1
1.3 Document Overview	2
1.3.1 Document Version Information	2
2 References	3
2.1 Acronyms and Abbreviations	3
2.2 Glossary and Definitions	3
2.3 Referenced Documents	4
2.3.1 External Documents	4
2.3.2 Project Specific Documents	4
3 Required Work Overview	5
3.1 Program Status	5
3.2 SDLC Situation	5
3.3 Requirement Plans	5
3.4 Documentation Plans	5
3.5 Schedule and Resource Constraints	7
3.6 Other Constraints	7
4 System Development Plans	8
4.1 Hardware Development Plans	8
4.2 Firmware Development Plans	8
4.3 Software Development Plans	8
4.3.1 Raspberry Pi SDK Installation	8
4.4 Integration Plans	9
4.5 Testing Plans	9
4.6 Other Development Activities	9
5 System Transition Plans	10
5.1 Configuration Management Plans	10
5.2 Release Plans	10
5.3 User Support Plans	10
5.4 Other Transition Plans	10

The KNEAD Project	UNCLASSIFIED DISTRIBUTION RESTRICTIONS ON TITLE PAGE	System Development Plan
6 Management and Control Activities		11
6.1 Technical Review Events		11
6.2 Skills and Resources Needed		11
6.3 Scheduled Development and Monitoring		11
6.4 Other Management and Control Activities		11
7 Notes		12
7.1 Note Area 1		12
7.2 Note Area 2		12
APPENDIX		
Other Info		13

LIST OF TABLES

Table	Page
1 Acronym Definitions	3
2 Glossary Terms and Definitions	3

LIST OF FIGURES

Figure	Page
1 Raspberry Pi Pico W microcontroller board	1

CHAPTER 1

Scope

This document provides the System Development Plan (SDP) for the Garden Control System. The system will be referred to as the GCS.

1.1 Identification

The Garden Control System described in this document shall be known as GCS version 1.0. Garden Control System is the unofficial name for GCS. An official name will be determined at a later time. GCS is currently in development. No versions or releases are available at this time.

1.2 System Overview

The Garden Control System will be able to measure moisture levels and control irrigation in raised garden beds. GCS 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 high-level architecture for the GCS system. This is an image of the

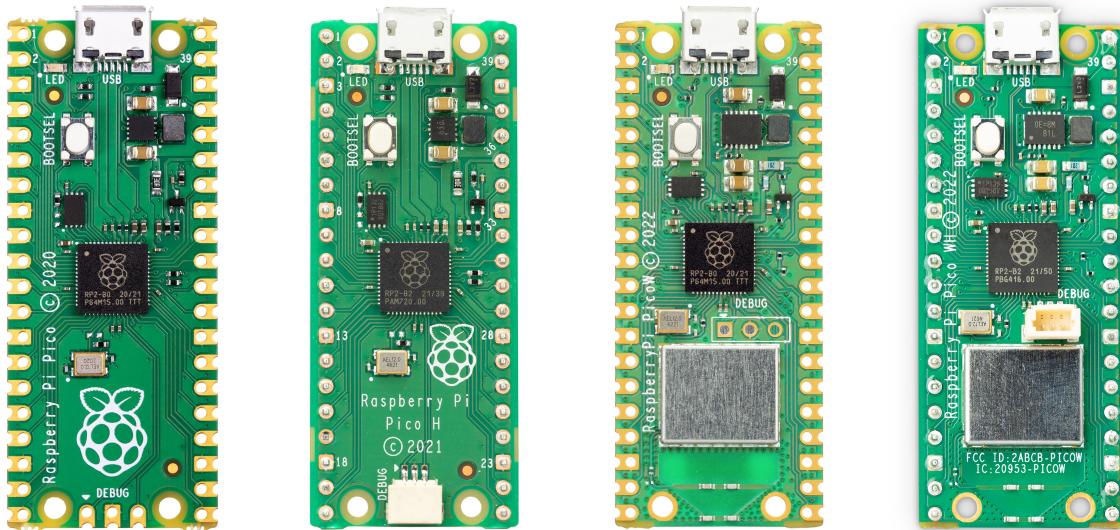


Figure 1: Raspberry Pi Pico W microcontroller board

Raspberry Pi Pico W microcontroller board.

The general concept of operations (CONOP) for this system is ...TBD....

1.3 Document Overview

This section provides information about this document's contents, structure, and version information.

1.3.1 Document Version Information

This document was produced in \LaTeX and *BibLaTeX/Biber*. The editing and document preparation were performed using MiK \TeX version 2.9 with the build option [$\text{\LaTeX} \Rightarrow \text{PS} \Rightarrow \text{PDF}$]. The $\text{\LaTeX}svn-multi$ 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.

This revision of this document has the following properties:

Tracking Item	Data
Repository	https://svn.riouxsvn.com/kneadlatxinputs/ ExampleArtifactFolders/1%20-%20SDP/KNEAD_SDP.tex
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KNEADdocument Date	2021/12/05

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.
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

2.3.2 Project Specific Documents

CHAPTER 3

Required Work Overview

This chapter will provide an overview of the required work, project constraints, project status, and project dependencies for the Garden Control System.

3.1 Program Status

The Garden Control System program exists within the UMD MAGE class ENPM818I: Variable Topics in Engineering: Embedded Software Design and Optimization under the supervision of Dr. W. Lewis Collier.

3.2 SDLC Situation

This is an original project. All materials for this project are generated for the purpose of designing the Garden Control System. Design materials will be completed by the end of ENPM818I.

3.3 Requirement Plans

The requirement plan for the Garden Control System project is to design and document the design plan for the Garden Control System.

3.4 Documentation Plans

The documents listed

The following documents are listed here just to test reference generation. A “real” SDP would reference these as applicable for the project.

- ref·KNEAD·OCD·ExProj, ref·KNEAD·OCD·ExProj [ref·KNEAD·OCD·ExProj]
is the OCD, which outlines the project overall so, generally, it is created first.
- ref·KNEAD·SDP·ExProj, ref·KNEAD·SDP·ExProj [ref·KNEAD·SDP·ExProj]
is this document.
- ref·KNEAD·SPS·ExProj, ref·KNEAD·SPS·ExProj [ref·KNEAD·SPS·ExProj]
is the SPS, which should come from the customer or end user, but often is generated by the developer with customer approval.
- ref·KNEAD·SSS·ExProj, ref·KNEAD·SSS·ExProj [ref·KNEAD·SSS·ExProj]
is the SSS that is the developer’s design specification to meet the SPS requirements.
- ref·KNEAD·SUM·ExProj, ref·KNEAD·SUM·ExProj [ref·KNEAD·SUM·ExProj]
is the SUM that acts somewhat like part of the SSS since it illustrates the UI design

part of the SSS, but in a separate artifact that also can be used as a standalone users' manual.

- **ref·KNEAD·HRS·ExProj, ref·KNEAD·HRS·ExProj [ref·KNEAD·HRS·ExProj]**
is a HRS, which often is not used for smaller projects but can have multiple instances for large projects to more fully detail hardware design.
- **ref·KNEAD·SRS·ExProj, ref·KNEAD·SRS·ExProj [ref·KNEAD·SRS·ExProj]**
is a SRS, which often is not used for smaller projects but can have multiple instances for large projects to more fully detail software or firmware design.
- **ref·KNEAD·IRS·ExProj, ref·KNEAD·IRS·ExProj [ref·KNEAD·IRS·ExProj]**
is the IRS, which often is not use but may be needed, even if HRS or SRS artifacts are not, to fully document detailed interfaces such as Application Programming Interfaces (API) or other detailed mechanical or electrical interfaces.
- **ref·KNEAD·SSDD·ExProj, ref·KNEAD·SSDD·ExProj [ref·KNEAD·SSDD·ExProj]**
is the SSDD that provides a road map to the design and other design details needed to understand the hardware and software design.
- **ref·KNEAD·STP·ExProj, ref·KNEAD·STP·ExProj [ref·KNEAD·STP·ExProj]**
is the STP that highlights the planning for system testing.
- **ref·KNEAD·STS·ExProj, ref·KNEAD·STS·ExProj [ref·KNEAD·STS·ExProj]**
is the STS, which is sometimes called a test procedure. There could be multiple of these based on the overall project size.
- **ref·KNEAD·STR·ExProj, ref·KNEAD·STR·ExProj [ref·KNEAD·STR·ExProj]**
is an STR that documents the results of a given test. Multiple instances are expected based on the test plan. And, there could be multiple versions of a given test plan to document repeated occurrences of a given test specification/procedure.
- **ref·KNEAD·SVD·ExProj, ref·KNEAD·SVD·ExProj [ref·KNEAD·SVD·ExProj]**
is an SVD that documents a given release of a system. Multiple versions of these "release notes" are expected, with one SVD issued for each system release cycle.

3.5 Schedule and Resource Constraints

The ENPM course and Garden Control System project involves five development milestones and five design milestones. The development assignments must demonstrate understanding of the stated embedded development objectives. The design assignments require draft completions of the listed artifacts and that will be the basis of the design artifacts for the final project. The following is the order in which assignments must be completed for this course and project.

- Development Assignment 1: Dev Kit and Tools
- Design Artifact 1: SDP and SVD
- Development Assignment 2: Debugger and Emulator
- Design Artifact 2: OCD and SPS
- Development Assignment 3: IO Streams and Interrupts
- Design Artifact 3: SSS
- Development Assignment 4: Security Measures
- Design Artifact 4: SSDD
- Development Assignment 5: Networking
- Design Artifact 5: STP and STS

There are currently no known resource constraints. This project is only designed by one person. Design work is the culmination of my work throughout the class.

3.6 Other Constraints

Current constraints for the Garden Control System project are unknown. As design and development of the Garden Control System project progresses, this section will be updated.

CHAPTER 4

System Development Plans

This chapter will provide a brief overview of the required hardware and firmware for Garden Control System.

4.1 Hardware Development Plans

There will be no hardware development for this project. All development will take place on a Raspberry Pi Pico W development kit.

4.2 Firmware Development Plans

The firmware development plan will follow the development assignment outline for the course ENPM818I. The development assignments are as follows:

- Dev Assignment 1
 - Development kit and tools are operational
- Dev Assignment 2
 - Debugger and Emulator tools for the development kit are operational
- Dev Assignment 3
 - Demonstrate necessary IO Stream and Interrupt Handler for the project.
- Dev Assignment 4
 - Demonstrate security measures necessary for the project.
- Dev Assignment 5
 - Implement networking capabilities for the project.

4.3 Software Development Plans

4.3.1 Raspberry Pi SDK Installation

The required steps to locally setup the Raspberry Pi SDK for the Raspberry Pi Pico W are as follows:

- SDK Documents with references

The software development plan for this project is still ...TBD.... This section will be updated in the future.

4.4 Integration Plans

The integration plans for this project are still ...TBD.... This section will be updated in the future.

4.5 Testing Plans

All firmware and software for Garden Control System will be accompanied with unit tests. An open source tool will be selected to audit the code base and there will be a set threshold for code coverage. Otherwise, the formal testing plan for Garden Control System is still ...TBD... and will be updated in the future.

4.6 Other Development Activities

Other development activities will be added to this document in the future. As of now, this section is ...TBD....

CHAPTER 5

System Transition Plans

The following chapter details the system transition plans for Garden Control System.

5.1 Configuration Management Plans

All code repositories for Garden Control System will be housed in Github. All code repositories will be controlled by Git.

New code will be added and integrated into the Garden Control System code base on a feature by feature basis. Pull Requests will be subject to a specified template, minimum code test coverage threshold met, and passing of other specified tests referenced in section 4.5. Any PRs that fail to meet the template specifications and testing requirements will be rejected until the requirements are met. A PR template, code coverage threshold, and required tests will be detailed in section 4.5.

5.2 Release Plans

Release plans for Garden Control System are still ...TBD.... This section will be updated in the future.

5.3 User Support Plans

User Support Plans for Garden Control System are still ...TBD.... This section will be updated in the future.

5.4 Other Transition Plans

Other transition plans for Garden Control System are still ...TBD.... This section will be updated in the future.

CHAPTER 6

Management and Control Activities

SDP-6.0.0 :: THIS CHAPTER PROVIDES AN OVERVIEW OF THE REQUIRED WORK FOR DEVELOPMENT OF GARDEN CONTROL SYSTEM. SEE REFERENCE [ref·SDP·DID] FOR MORE INFORMATION.

This chapter will feature the output of ENPM818I Development Assignment 1. The output will demonstrate the proper installation of all required SDKs and software packages for the Raspberry Pi Pico W.

6.1 Technical Review Events

SDP-6.1.0 :: THIS CHAPTER PROVIDES AN OVERVIEW OF THE REQUIRED WORK FOR DEVELOPMENT OF GARDEN CONTROL SYSTEM. SEE REFERENCE [ref·SDP·DID] FOR MORE INFORMATION.

This section is ...TBD....

6.2 Skills and Resources Needed

SDP-6.2.0 :: THIS CHAPTER PROVIDES AN OVERVIEW OF THE REQUIRED WORK FOR DEVELOPMENT OF GARDEN CONTROL SYSTEM. SEE REFERENCE [ref·SDP·DID] FOR MORE INFORMATION.

This section is ...TBD....

6.3 Scheduled Development and Monitoring

SDP-6.3.0 :: THIS CHAPTER PROVIDES AN OVERVIEW OF THE REQUIRED WORK FOR DEVELOPMENT OF GARDEN CONTROL SYSTEM. SEE REFERENCE [ref·SDP·DID] FOR MORE INFORMATION.

This section is ...TBD....

6.4 Other Management and Control Activities

SDP-6.4.0 :: THIS CHAPTER PROVIDES AN OVERVIEW OF THE REQUIRED WORK FOR DEVELOPMENT OF GARDEN CONTROL SYSTEM. SEE REFERENCE [ref·SDP·DID] FOR MORE INFORMATION.

This section is ...TBD....

CHAPTER 7

Notes

ALL-NOTES :: THIS SECTION SHALL CONTAIN ANY GENERAL INFORMATION THAT AIDS IN UNDERSTANDING THIS DOCUMENT (E.G., BACKGROUND INFORMATION, RATIONALE, ETC.)

This chapter is ...TBD....

7.1 Note Area 1

ALL-NOTES :: THIS SECTION SHALL CONTAIN ANY GENERAL INFORMATION THAT AIDS IN UNDERSTANDING THIS DOCUMENT (E.G., BACKGROUND INFORMATION, RATIONALE, ETC.)

This section is ...TBD....

7.2 Note Area 2

ALL-NOTES :: THIS SECTION SHALL CONTAIN ANY GENERAL INFORMATION THAT AIDS IN UNDERSTANDING THIS DOCUMENT (E.G., BACKGROUND INFORMATION, RATIONALE, ETC.)

This section is ...TBD....

APPENDIX

Other Info

ALL-APPENDIX :: THIS SECTION SHALL CONTAIN ANY GENERAL INFORMATION THAT AIDS IN UNDERSTANDING THIS DOCUMENT (E.G., BACKGROUND INFORMATION, RATIONALE, ETC.)

This section provides other information, as necessary, to document the system development plan.