CTIS411 Senior Project I

Initial Plan

Web-AR Smart Indoor Gardening System

Team 5

Mert Köroğlu, 22003433

Eren Tarak, 21903229

Talha Rehman Abid, 22001505

Eray Altay, 21803051

Bilkent University

Department of Information Systems and Technologies

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Change History

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Change List:

- The Executive Summary was rewritten and extended.
- New abbreviations added.
- Project Purpose is extended.
- Some parts have been moved from Project Communication to Project Organization and Stakeholders.
- Product Requirements extended. Also, some non-functional requirements are edited and replaced with functional requirements.
- Figure 1 and Figure 2's captions are changed. Also, Figure 1 is edited.
- Document change control added to Change Control.
- Project Communication extended.
- Added a new paragraph for Milestones and Deliverables.
- Table 2 edited.
- The discussion part is rewritten.
- Rewritten Risks part and added Figure 3 and Figure 4
- Page numbers corrected.

Project Team

Team 5		
Name, Surname	**Student Id Number**	**e-mail**
Mert Köroğlu	22003433	mert.koroglu@ug.bilkent.edu.tr
Eray Altay	21803051	eray.altay@ug.bilkent.edu.tr
Talha Rehman Abid	22001505	rehman.abid@ug.bilkent.edu.tr
Eren Tarak	21903229	eren.tarak@ug.bilkent.edu.tr

Project Details

Project Name	**Web-AR Smart Indoor Gardening System**
Software Name	**FloraVision**
Academic Advisor	**Dr. Duygu Albayrak**
Github URL	**https://github.com/Smart-Indoor-Gardening-System**
WEB page	

Executive Summary

The Web-AR Smart Indoor Gardening System project improves individual indoor gardening by providing an accessible, affordable hardware kit. With this project, an IoT device and sensors turn the camera of the person's device into an augmented reality portal. It conveys this to the user for follow-up with visual data-based statistics. The system helps the user automate tasks by detecting and predicting anomalies by monitoring soil moisture, light intensity, and air quality. Users can receive this information remotely, easily and in detail, with regular updates, and take the experience of creating a personal garden to the next level.

This document covers our initial analysis of the project. Some of the major topics covered in this document are the following. Our major constraint for this project includes developing an IoT product using Arduino Nano, using data analysis tools to calculate valuable predictions, and displaying our findings using our web application and AR feature. We determined that we would use the Agile methodology using the Scrum framework for our software development lifecycle. The reason for using Agile is to see tangible progress in a short time by dividing our work into small tasks. We expect that the project will take 10 months and the project will end in June. Our major milestones for this project consist of SRS, SDD and SPMP documents, their resubmissions after feedback as well as product deliverables that will take place after January. Our major goals for this project include providing plant owners with real-time plant status and valuable health graphs, analytics, and growth predictions. Our assumption for this project is that every team member will contribute to this project as well as each team member will work at least 15 hours per week, also, the cost for developing this project will not exceed 1500TL. Risks for this project include technological challenges when developing our hardware kit and failure to accurately monitor and respond to environmental variables that come from our sensors.

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Abbreviations

AR	Augmented Reality
AWS	Amazon Web Services
CTIS	Information Systems and Technologies
FV	FloraVision
FVF	FloraVision Functional Requirement
FVN	FloraVision Non-Functional Requirement
IoT	Internet of Things
Q&A	Question and Answer
SDD	Software Design Description Document
SPMP	Software Design Description Document
SRS	Software Requirements Specification
TL	Turkish Lira
XP	Extreme Programming

1. Project and Product Purpose

1.1 Project Purpose

The purpose of the project is to develop an IoT-based plant development and maintenance system that allows people to grow healthier plants by providing accurate data at regular intervals. This project aims to empower IoT technology and sensors to solve the challenges users deal with when they take care of their plants. The purpose is to simplify and enhance the plant care experience for a casual audience, making it more accessible and less work oriented. Another purpose of the project is to learn IoT development using Arduino Nano and learn how to process data received from our IoT device. Learning augmented reality development is another key aspect of this project. It is important for us to learn and have an idea about technologies we have not experienced before. Finally, learning software project documentation is another important skill that we want to gain from this project.

1.2 Product Purpose

Our product aims to help people to grow their plants with accurate data collected from our IoT device. With this data, we aim to provide people with growth rate prediction, optimum conditions needed and a bunch more information to make people grow their plant with less stress and better results.

1.3 Business Need

Due to lack of knowledge and time to practice plant care, many people do not have the knowledge they need to care for their plants, leading to problems such as overwatering, inadequate lighting or incorrect humidity levels. Additionally, many beginners may not have enough time and follow a systematic order to control their plants.

1.4 Project Objectives

Our project objectives need to be measurable, specific for the problem and achievable. To accomplish these goals, we set ourselves to develop a service that can monitor and

collect real- time data on plants via sensors and process this to improve the plants' care with AR integration.

Our objective for this product is:

- To provide customers with real-time environmental data information for their plant through the IOT device sensors.
- To provide customers with detailed health analysis for their plants using data analysis models.
- To provide daily, weekly, and monthly insight about the user's plant.
- To provide a device independent web application for customers.
- To provide AR technology for easy data monitoring from device cameras.

1.5 Product Deliverables

Our product deliverables contain an IoT gardening device with sensors to view moisture levels, light intensity, and air quality. A web app for AR data visualization and monitoring plants for users. And an anomaly detection and recommendations analytics platform.

1.6 Competitive Advantages

Our system differs from competition with the feasibility of the service. The system only focuses on core dynamics of the plant for the general audience. Easy to access with AR integration, and easy to follow with data visualization and easy to adapt with insights.

Competitor:

- Xiaomi Mi Plant Sensor:
  - Xiaomi Mi plant sensor provides sunlight, humidity, and soil moisture data about your plant by their app. System uses Bluetooth to connect to your device and provide real time data. The system allows you to select the type of plant that you want to monitor, and then it gives insight about how much light, moisture, etc. Your plant needs.

- The system lacks Augmented reality for data visualization.
- The system lacks the feature of intelligent assistance for proactive care for the monitored plant.
- Our product will be accessed by customers through our web application while Xiaomi Mi uses a mobile application.
- The product's major shortcoming is its analytics and graphs are not portable as the users cannot get them as an email nor download them to their devices.

2. Project Scope

In project scope, we emphasized our goals, constraints, limitations, and scope on our project. The scope of our project is to use cloud, web, IoT and AR development to create our product FloraVision. While creating our project any monetization, post release maintenance, customer support will be omitted from our project scope. In project goals, we mentioned the overall achievements and goals that we want to gain until the end of the project. In constraints and limitations, we emphasized the major constraints we are going to obey until the end of our project. At last, we talked about our general scope of the project regarding the project's development and provided materials that are excluded from our project scope. To better summarize our project's scope, we provided our work breakdown structure in Table 1 Below we divided our project scope into four parts.

2.1 Project Goals:

1. Provide plant owners with real-time plant status.
2. Provide valuable healthy graphs, analytics, and growth predictions.
3. Making consistent team communication and advisor discussions on a daily-weekly-monthly basis.
4. Create a strategic work distribution between all team members.
5. Deliver satisfying reports during the project planning stage (SRS document, etc.).
6. Create a compact and functional hardware product.
7. Meet project deadlines for all requirements.
8. Develop user-friendly and high-performance software.
9. Gather feedback from potential users to optimize the user experience.

2.2 Constraints and Limitations:

1. The project should ensure stable and reliable performance for global usage.
2. Since the development part of the project will start after the first semester, development will be estimated to last 4 to 5 months.
3. The product should be compatible with the Chrome browser on all devices.
4. The project must adhere to legal regulations regarding user information storage.

5. Arduino Nano will be a microcontroller for our hardware product.
6. Humidity, temperature, soil moisture and light intensity sensors will be used for the IoT product.
7. React.js will be used for front-end development.
8. Node.js will be used for the backend development.
9. Project will depend on machine learning models for predictions.
10. Users of the product will have an internet connection.
11. Project will use AWS for cloud storage.

2.3 Project in Scope:

1. Use the cloud for data storage accessible from anywhere.
2. Utilize web development for the user interface.
3. Implement libraries or game engines for AR features.
4. Incorporate hardware and embedded development.
5. Utilize IoT libraries for the hardware device.

2.4 Project Excluded from Scope:

1. Monetization and marketing activities.
2. Post-deployment maintenance and support.
3. Ongoing customer support.
4. Mobile application development.

Table 1 Work Breakdown Structure

Breakdown	**Description**	**WBS**	**Code**
The Web-AR Smart Indoor Gardening System Project			**1.0**
Deliverable 1	**Preparing the Initial Plan**		**1.1**
WP1	Making a first draft for the initial plan	1.1.1	
WP2	Get feedback for the plan from the advisor	1.1.2	
WP3	Update the plan based on the feedback	1.1.3	

Breakdown	**Description**	**WBS**	**Code**
WP4	Implement the final touches	1.1.4	
WP5	Finishing the plan	1.1.5	
Deliverable 2	**Preparing a Business Model Canvas**		**1.2**
WP1	Preparing a first draft	1.2.1	
WP2	Get feedback from advisor and from the teacher	1.2.2	
WP3	Update the plan based on the feedback	1.2.3	
WP4	Implement the final touches	1.2.4	
WP5	Finishing the Business Model Canvas	1.2.5	
Deliverable 3	**Preparing Software Requirements Specification Document**		**1.3**
WP1	Making a first draft for the Software Requirements Specification Document	1.3.1	
WP2	Get feedback for the plan from the advisor	1.3.2	
WP3	Update the plan based on the feedback	1.3.3	
WP4	Implement the final touches	1.3.4	
WP5	Finishing the document	1.3.5	
Deliverable 4	**Preparing Requirements Prototype**		**1.4**
WP1	Making a first draft for the requirements prototype	1.4.1	
WP2	Get feedback for the prototype from the advisor	1.4.2	
WP3	Update the plan based on the feedback	1.4.3	
WP4	Implement the final touches	1.4.4	
WP5	Finishing the requirements prototype	1.4.5	
Deliverable 5	**Preparing the Software Project Management Plan Document**		**1.5**
WP1	Making a first draft for the Software Project Management Plan	1.5.1	
WP2	Get feedback for the plan from the advisor	1.5.2	

Breakdown	**Description**	**WBS**	**Code**
WP3	Update the plan based on the feedback	1.5.3	
WP4	Implement the final touches	1.5.4	
WP5	Finishing the Software Project Management Plan	1.5.5	
Deliverable 6	**Preparing the Software Design Description Document**		**1.6**
WP1	Making a first draft for the Software Design Description Document	1.6.1	
WP2	Get feedback for the document from the advisor	1.6.2	
WP3	Update the plan based on the feedback	1.6.3	
WP4	Implement the final touches	1.6.4	
WP5	Finishing the Software Design Description Document	1.6.5	
Deliverable 7	**Making a Demo**		**1.7**
WP1	Analyze the needs for the demo	1.7.1	
WP2	Implement first features to the demo	1.7.2	
WP3	Test the demo for performance	1.7.3	
WP4	Gather feedback from the advisor	1.7.4	
WP5	Finalize the demo	1.7.5	
Deliverable 8	**Development on Hardware**		**1.8**
WP 1	Research hardware components.	1.8.1	
WP 2	Assemble the IoT device.	1.8.2	
WP 3	Conduct hardware testing and optimization.	1.8.3	
Deliverable 9	**Software Development**		**1.9**
WP 1	Design the user interface for the web application.	1.9.1	
WP 2	Implement AR features.	1.9.2	
WP 3	Design data visualization components.	1.9.	

Breakdown	**Description**	**WBS**	**Code**
		3	
WP 4	Make predictive analysis components.	1.9.4	
Deliverable 10	**Data Management**		**2.0**
WP 1	Setting up cloud data storage options.	2.0.1	
WP 2	Reviewing data security.	2.0.2	
Deliverable 11	**Testing**		**2.1**
WP 1	Testing the quality and assurance of the hardware and software for performance and its reliability.	2.1.1	
WP 2	Identify the issues.	2.1.2	
WP 3	Conduct a testing group to gather feedback and make improvements.	2.1.3	
Deliverable 12	**Polishing the User Experience**		**2.2**
WP 1	Gather and analyze the feedback from the testing group.	2.2.1	
WP 2	Iterate the user interface based on the feedback	2.2.2	
WP 3	Polish and optimize the experience.	2.2.3	
Deliverable 13	**Submitting First Increment**		**2.3**
WP1	Finalize the increment	2.3.1	
WP2	Deliver to the advisor.	2.3.2	
Deliverable 14	**Submitting Second Increment**		**2.4**
WP1	Finalize the increment	2.4.1	
WP2	Deliver to the advisor.	2.4.2	
Deliverable 13	**Preparing Project Poster**		**2.5**
WP1	Making a first draft for the poster	2.5.1	
WP2	Get feedback for the poster	2.5.2	

Breakdown	**Description**	**WBS**	**Code**
WP3	Polish the design and optimize the poster for the feedback	2.5.3	
WP4	Evaluate the updated design with a test group	2.5.4	
WP5	Making final touches	2.5.5	
WP6	Implementing the last design for the poster	2.5.6	
Deliverable 14	**Making final touches to project**		**2.6**
WP 1	Verify the performance criteria	2.6.1	
WP 2	Finalizing the product	2.6.2	
WP3	Preparing a demo presentation to the department	2.6.3	
WP4	Get feedback for the presentation	2.6.4	
WP5	Evaluate the feedback	2.6.5	
WP6	Finalizing the demo presentation	2.6.6	

3. Product Requirements

In project requirements, we provided our major functional and non-functional requirements that will be followed during the project's development. These requirements are gathered mostly by thinking about what the users of the software would want from this project. Our project aims to attract people that want to grow plants in an indoor setting in an easier and more fun way. Also, we want to help potential indoor farmers to grow their crops with less stress and more control. Therefore, we gathered these requirements using our potential users in mind, and what would they want from this software. Context diagram is provided in Figure 1 to better specify the software product to be developed.

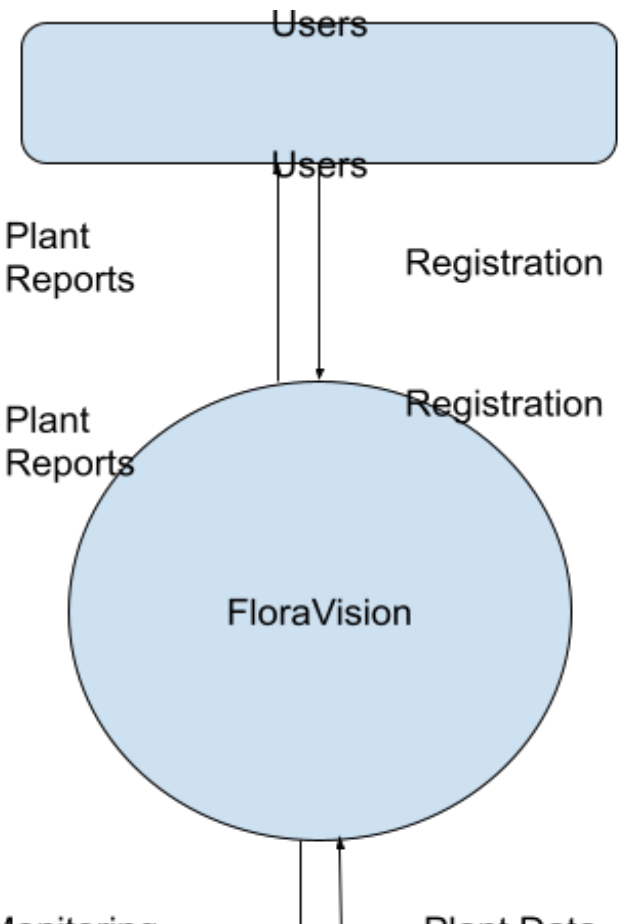
Functional Requirements:

1. (FVF-1-1) The system shall analyze environmental factors that are important for plant growth.
2. (FVF-1-2) The system shall provide recommendations for optimizing environmental conditions.
3. (FVF-1-3) The system shall implement a health prediction model that provides short-term and medium-term health predictions for plants based on scientific threshold values and environmental data collected.
4. (FVF-1-4) The system shall monitor plants' status.
5. (FVF-1-5) The system shall send environmental sensor data from hardware to the cloud.
6. (FVF-1-6) The system shall connect to the internet for wireless data transmission.
7. (FVF-1-7) The system shall provide real time visual data and data history through AR and the web.
8. (FVF-1-8) The system shall authenticate users before login.
9. (FVF-1-9) The system shall enable user's remote access through web application.
10. (FVF-1-10) The system shall enable the user to add multiple IoT devices.

11. (FVF-1-11) The system shall enable the user to see daily, weekly, and monthly charts about their plant's conditions.
12. (FVF -1-12) The system shall send push notifications to the user's device when there are any anomalies in the sensor data.
13. (FVF-1-13) The system shall enable the user to select the plant they want to monitor.
14. (FVF-1-16) The system shall send suggestions through notifications.
15. (FVF-1-15) The system shall have a data backup and recovery feature.

Non-Functional Requirements:

1. (FVN-2-2) The system shall backup every month.
2. (FVN-2-3) The system shall provide fast response time (less than 10 seconds) for data analysis and optimization recommendations for environmental conditions.
3. (FVN-2-4) The system shall render AR graphical charts in less than 5 seconds.
4. (FVN-2-5) The system shall ensure that the web-based interface is responsive and adapts differently to different screen sizes and devices.
5. (FVN-2-6) The system shall ensure that it is available 24/7 to the user.



4. Software Development Process Model

Our team decided to use Agile methodology for this project while using a customized version of Scrum framework.

1. Reasons for using Agile Methodology:
    a. One reason for using Agile is to see our constant process. By dividing work into small tasks, we can come up with tangible progress in a short time. Because meetings with our advisor will be held weekly, using Agile methodology might help us develop progress faster that can be evaluated by our advisor. With this, any feedback or required change from our advisor would not cost us to make big and difficult changes, instead these changes will be easy and fast.
2. Reasons for using Scrum Framework:
    a. Members of the team are more familiar with the Scrum framework than other frameworks (Kanban, XP, etc.). Some members also have experience with the Scrum framework.

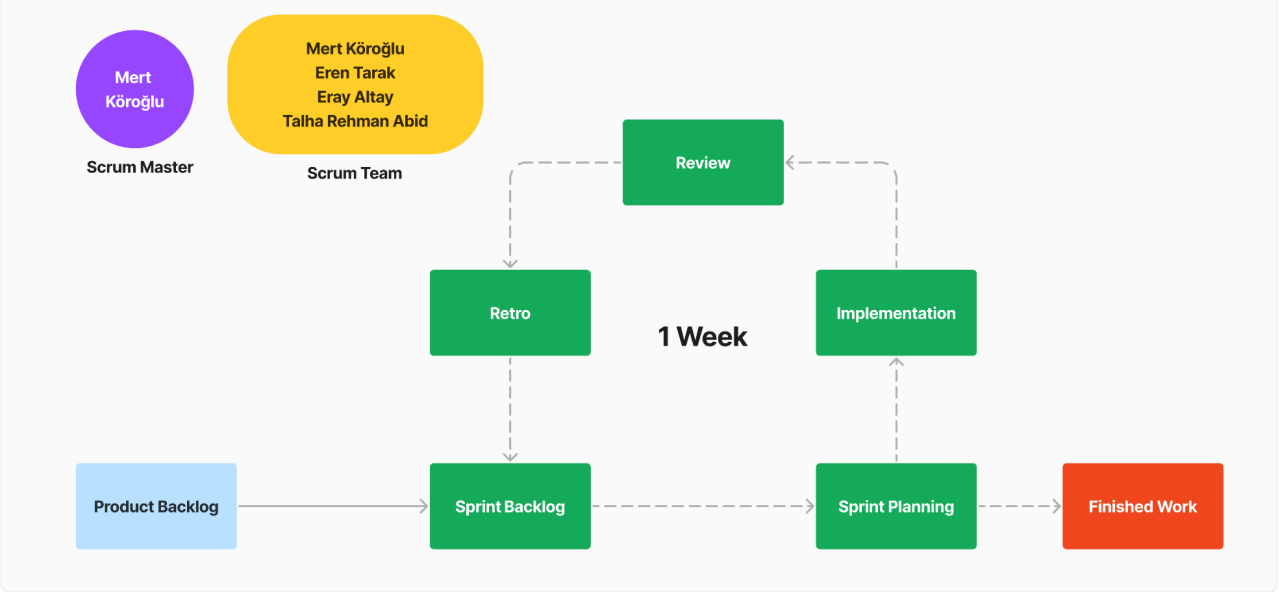
Changes in Scrum Framework:

1. Daily meetings during the morning will not be held because of availability reasons. Instead, communication tools like WhatsApp will be used for sharing daily progress done by each member.
2. For sharing knowledge across the different modules of the system, pair programming sessions will be conducted when it is needed. Team members will work closely on integration-related tasks.
3. Our sprints will be 1 weeklong.

4. The customized Scrum that will be used on this project is given in Figure 2

Experience in Scrum and Agile:

- Mert Köroğlu used Scrum framework during semester internship and found it convenient to use it during the Senior Project.
- Eray Altay used Agile methodology in Google Game and Application Academy for Unity game development project. To use Agile for the project all its applicants took Coursera courses of Project Management by Google.



5. Project Stakeholders and Organization

In Project Stakeholder and Organization, we came up with a list of stakeholders that will affect our project either positively or negatively during the runtime of the project. These list provides how each stakeholder will affect the project's development and we also included our team organization to emphasize the roles of each member of the project.

Team Organization:

- Each team member will primarily focus on a specific module of the system while they support the team across the other modules as their secondary responsibilities.
- Mert Köroğlu will be mainly responsible for hardware development for the IoT kit.
- Talha Abid will be mainly responsible for the data science module.
- Eren Tarak will be mainly responsible for front-end and back-end development.
- Eray Altay will be mainly responsible for web development and data science modules.
- Secondary responsibilities of team members can be changed periodically based on the project needs and team members interests by Mert Köroğlu, the scrum master.

CTIS Department (Dept. of Information Systems and Technologies):

- The department allows us to use their building during the development process.

Dr. Duygu Albayrak:

- Our advisor will help and guide us while developing our project.
- She will give feedback on our codes and requirements.
- She will answer our questions about the project throughout the year.
- She will grade us throughout the project.

Dr. Oumout Chousein Oglou:

- Our instructor will help us learn how to document the requirements during the project lifecycle.
- He will answer our questions about the project throughout the year.

- He will grade our project requirements.

Competitor:

- Xiaomi Mi Plant Sensor:
  - Xiaomi's product will influence us in how we can approach building our product. We may be influenced by the device itself or the user interface of their app. We think that Xiaomi's product will benefit us positively and will help us to take inspiration from its features.

6. Project Communication

In this part, we mentioned how various communication channels will be held with every stakeholder and team member of the project. With this, we aim to provide some plans and schedules about how the collaboration and information exchange will be held during the project's development.

- Inner-team Meetings and Communications:
    - WhatsApp will be used for accessing team members quickly when necessary.
    - Trello will be used during project planning meetings and active development.
    - Miro will be used for brainstorming ideas for the project.
    - Zoom will be used during Scrum Sprint planning, review, and retro meetings. Also, it will be used when unplanned necessary meetings.
    - Face-to-face meetings will be held in Bilkent University C building, these meetings can be Sprint meetings or general Q&A sessions between members.
    - Eren Tarak will schedule zoom meetings for project discussion.
    - Mert Köroğlu will submit the deliverables to Moodle.
- Advisor Meetings with Dr. Duygu Albayrak:
    - Advisor communication will be held over our WhatsApp group.
    - Advisor meetings will be held on Bilkent University C building, top floor in Duygu Albayrak's room or using Zoom every week on Thursdays between 16.30 and 17.20.
    - Eray Altay and Talha Abid will be responsible for taking notes about discussion during the meeting.
- Meetings with Dr. Oumout Chousein Oglou:
    - Will be held during Mondays between 8.45 to 10.05 and on Wednesdays between 13.45 to 15.05.
    - Questions regarding the project will be asked to Dr. Oumout Chousein Oglou using the CTIS411 Moodle page in related forums.

- Submissions for our documents will be sent through CTIS411 Moodle page.
- Feedback meetings about our documents will be held through Zoom.

7. Project Change Control

Codebase change control will be implemented by using the git version control system. We have a dedicated GitHub organization named Smart-Indoor-Gardening-System for the project. All the team members have permission to read and write for this organization. We plan to have dedicated repositories for each module of the system such as Arduino repository for the IoT device, frontend repository, backend repository and data science related repository. This approach will facilitate the deployment of the codebase and implementation of separation of concerns as well.

Project Change Control Process

Document Change Control:

Document change control will be held by first laying out the problems that we received from the feedback meeting. After all problems are gathered using the team's communication channels, each problem will be distributed among the team members. This will ensure that all team members will have a part in the projects change control. After all work is divided among the members, a new Google Docs document will be opened containing the document that we will work on. In this document every team member will make changes to the Doc file according to the distributed work. After all the feedback is handled, all team members will check the document for formatting and spelling. After every team member agrees that document is finished, Mert Köroğlu will upload the new version of the file to Moodle system.

Codebase Change Control

1. Change Identification
    a. Changes can be proposed by any team member based on project needs or external feedback. Proposals should be submitted through the project's GitHub repository under the "Issues" section, clearly labeled as change requests.
2. Change Documentation
    a. Each change request should include:
        i. Description of the proposed change.
        ii. Rationale for the change.

iii. Impact assessment on other modules or components.
iv. Proposed solution or implementation approach.
v. The documentation will be stored within the corresponding GitHub repository for traceability.

3. Change Review
    a. The Scrum Master, Mert Köroğlu will review the change requests regularly. The team will discuss the proposed changes during sprint planning or dedicated review meetings.
4. Change Approval:
    a. Changes will be approved through a collaborative decision-making process involving team members. Approval will be documented within the GitHub repository, indicating the approval status and any conditions attached.
5. 5. Implementation:
    a. Once approved, changes will be implemented on a dedicated branch of the respective repository. The implementation process will follow Git branching strategies, ensuring codebase stability.
6. Testing:
    a. Each change will undergo rigorous testing to ensure it does not adversely affect the existing functionality. Automated tests and manual verification will be conducted based on the nature of the change.
7. Documentation Update
    a. Documentation within the project's GitHub repository, including the README file, will be updated to reflect the implemented changes.
8. Deployment
    a. Changes will be merged into the main branch only after successful testing and documentation updates.
9. GitHub Repository for Change Control:
    a. The change control process will be primarily managed through the "Issues" section of the project's GitHub repository.
    b. The GitHub organization URL is: https://github.com/Smart-Indoor-Gardening-System

Each team member with GitHub usernames:

- Eren Tarak: erentrk01
- Mert Köroğlu: mertkoroglu
- Eray Altay: Dreameray
- Talha Abid: talharehmanabid1999

10. Adaptation of Scrum Framework:
    a. Daily meetings will be asynchronous due to availability constraints, ensuring team members can contribute updates at their convenience. The GitHub repositories will serve as a central hub for communication and documentation of changes.

Design Tools:

Figma: The team will use Figma as the primary design tool for creating user interfaces and posters.

Managing Design Changes in Figma:

1. Create Design Files: Begin by creating organized design files in Figma for different components, screens, or posters within the project. Consider using separate pages or frames for distinct sections.

2. Version Control in Figma: Figma maintains version history automatically. Use this feature to track changes over time. Each new change creates a version that can be referenced or rolled back if needed.

3. Components and Styles: Utilize Figma's component and style libraries for consistency. If a design change affects multiple instances, update the master component or style, ensuring uniformity.

4. Design Notes and Descriptions: Add descriptive notes or comments to your designs. Explain the rationale behind specific design decisions and changes. This documentation can be crucial for understanding the context of modifications.

5. Feedback and Comments: Collaborate with team members by using Figma's commenting feature. Leave feedback directly on design elements or frames. This provides a centralized space for discussions about design changes.

6. Design Review Meetings: Schedule design review meetings within Figma or Zoom to discuss proposed design changes. Figma allows real-time collaboration, making it easy for team members to provide input.

7. Approvals and Decisions: Document design approvals and decisions within Figma. Figma's "Design History" or add comments indicating the approval status and any conditions attached to the design change can be used.

8. Iterative Design Process: Figma supports an iterative design process. Implement changes incrementally, gather feedback, and make revisions as needed. Save versions at significant milestones in the design process.

9. File Organization: Keep the Figma files well-organized. Consider creating a dedicated space for design documentation or use frames/pages to group related designs together.

Data Change Control:

Description: As the project involves scientific data collection and analysis, changes in data formats, sources, or processing methods should be controlled.

1. Process: Clearly document any changes in data formats or sources in the README file of related repository.
2. Assess the impact of data changes on analytics and predictions and share it in the README file.
3. Ensure data quality and consistency.

The section above was generated by ChatGPT. CTIS Web Page Project Description, Project Purpose in this document, functional and non-functional requirements, the first paragraph of this section and the question of this section were provided as an input prompt. The generated text effortlessly blends into the overall text flow, requiring few edits to add the GitHub usernames, thanks to the clarity provided by the prompt. We have used ChatGPT in this section, due to our limited experience regarding the best practices of codebase change management process of a 4-person team, design change control in Figma and data change control guidelines. Thanks to ChatGPT, easy to read commands of the change control management process provided to the team.

8. Milestones & Deliverables

In this section, we came up with major milestones and deliverables that will be achieved during the entire development of our project. In the Table 2, we provided a table about our projected milestones. In this table we provide the start and due dates of each milestone for our project. We provided each task title that we considered a milestone.

Table 2 Milestones

WBS NUMBER	TASK TITLE	TASK OWNER	START DATE	DUE DATE	DURATION	PCT OF TASK COMPLETE
1	Initial Plan					
1.1	First Draft	All members	1/10/23	7/10/23	6	100%
1.1.1	Second Draft	All members	8/10/23	12/10/23	4	100%
1.2	Final	All members	13/10/23	16/10/23	3	100%
2	Business Model Canvas					
2.1	Final	All members	13/10/23	16/10/23	3	100%
3	Software Requirements Specification Document					
3.1	Final	All members	13/10/23	13/11/23	30	100%
4	Requirements Prototype					
4.1	Final	All members	13/10/23	13/11/23	30	100%
5	Software Project Managemen					

	t Plan Document:					
5.1	Final	All members	14/11/23	11/12/23	27	0%
6	Software Design Description Document					
6.1	Final	All members	12/12/23	5/1/24	23	0%
7	First Increment					
7.1	Final	All members	8/1/24	17/3/24	69	0%
8	Second Increment					
8.1	Final	All members	18/3/24	21/4/24	33	0%
9	Demo Presentation					
9.1	Poster Preparation	All members	22/4/24	15/5/24	23	0%
9.2	Video Preparation	All members	22/4/24	15/5/24	23	0%
9.3	Final	All members	22/4/24	15/5/24	23	0%

9. Assumptions

In this part, we came up with assumptions which we held for our project's development. These assumptions are listed after our team's initial planning of the project. While these are our initial considerations, all assumptions of our project can be modified over time.

- Each team member will contribute to the project.
- Each team member will work at least 15 hours a week.
- Costs will not exceed 1500TL during the project's development.

External Dependencies:

- An External Scientific Database or dataset for indoor plants optimum environmental variable values. If we cannot find any scientific datasets or databases, we can collect scientific data from journals and papers to create our own database or dataset based on these.
- Internet Connectivity
- AWS for cloud storage.
- Humidity, temperature, soil moisture and light intensity sensors will be used for the IOT product.
- A battery for power supply.

10. Risks

The Web-AR Smart Indoor Gardening System project could face challenges down the road of the project development. We identified eight risks in this project development lifecycle. Each risk has been analyzed based on its Probability of Failure (Pf) and Consequence of Failure (CoF), resulting in a Risk Factor (RF) that reflects the potential impact on the project's success. And we ranked them according to their probability of occurrence, meaning likelihood of these scenarios. On Figure *3* we provided a Risk Table to visualize the potential risks regarding the project and the product. Also, on the Figure 4 we provided a Risk Impact Matrix to show each risk's potential impact to our project.

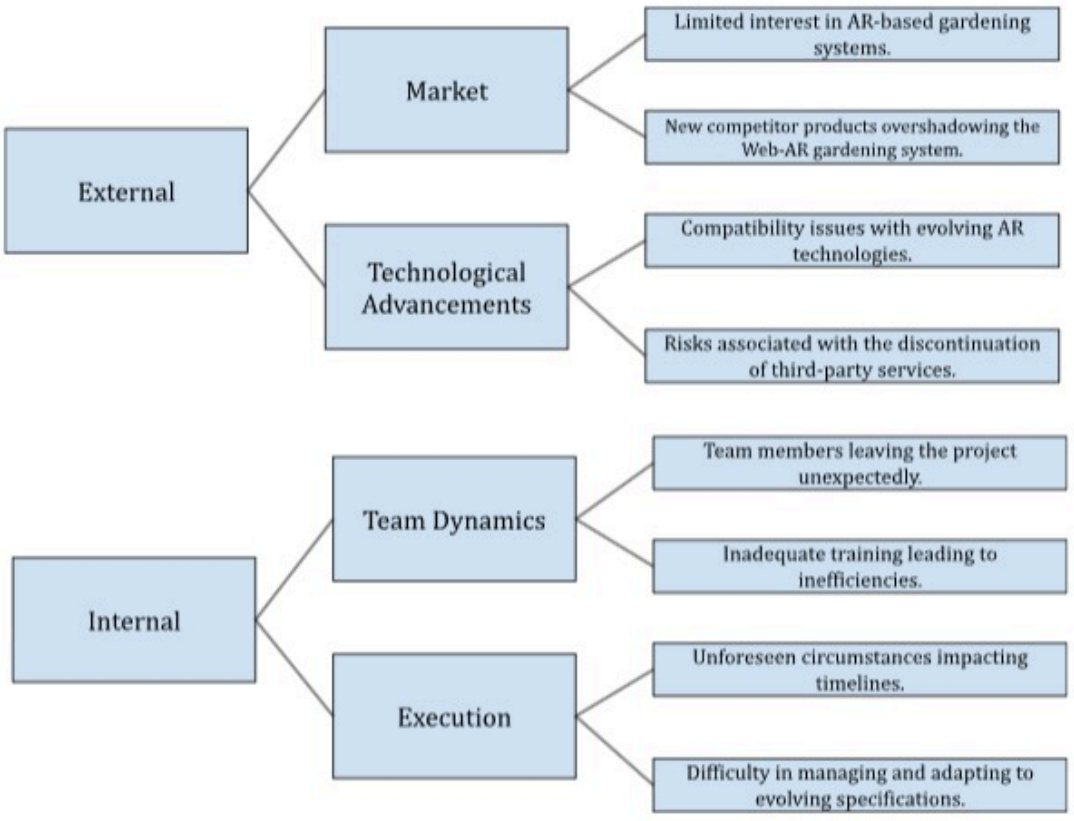


Figure 3 Risks Table for FloraVision

Limited Interest in AR-based Gardening System (Risk A):

Probability of Failure (Pf):

Pm (Maturity) = 0.9

Pc (Complexity) = 0.5

Pd (Dependency) = 0.3

Pf = 0.56

Consequence of Failure (CoF) :

Cc (Cost) = 0.5

Cs (Schedule) = 0.5

Cr (Reliability) = 0.5

Cp (Performance) = 0.5

Cf = 0.5

RF = 0.78

With an RF of 0.78, this risk highlights the potential challenges of gaining interest in the product. Strategies such as creating more aesthetically appealing products and deciding effective marketing campaigns to reduce probability or impact could have been suggested. Anticipated results include decreased popularity and adoption, which can be reduced by actively addressing user engagement and marketing strategy.

New Competitor Products Overshadowing (Risk B):

Probability of Failure (Pf):

Pm (Maturity) = 0.9

Pc (Complexity) = 0.7

Pd (Dependency) = 0.1

Pf = 0.56

Consequence of Failure (CoF) :

Cc (Cost) = 0.1

Cs (Schedule) = 0.1

Cr (Reliability) = 0.1

Cp (Performance) = 0.1

Cf = 0.1

RF = 0.61

To overcome this risk with an RF of 0.61, we could make the product more attractive for the audience and market it at a lower price or make it totally free to use. Expected consequences include a possible decline in product quality, which active market-going strategies aim to prevent.

Compatibility Issues with Evolving AR Technologies (Risk C):

Probability of Failure (Pf):

Pm (Maturity) = 0.9

Pc (Complexity) = 0.9

Pd (Dependency) = 0.7

Pf = 0.83

Consequence of Failure (CoF) :

Cc (Cost) = 0.1

Cs (Schedule) = 0.7

Cr (Reliability) = 0.7

Cp (Performance) = 0.9

Cf = 0.6

RF = 0.93

This high-risk scenario with an RF = 0.93 score emphasizes the potential challenges of ensuring compatibility with evolving AR technologies. Accurate testing and monitoring can be suggested to reduce the chance of this occurrence. Anticipated results may include potential inefficiencies in system application due to differences in equipment and environments.

Risks Associated with Discontinuation of Third-party Services (Risk D):

Probability of Failure (Pf):

Pm (Maturity) = 0.9

Pc (Complexity) = 0.5

Pd (Dependency) = 0.5

Pf = 0.63

Consequence of Failure (CoF) :

Cc (Cost) = 0.1

Cs (Schedule) = 0.7

Cr (Reliability) = 0.7

Cp (Performance) = 0.7

Cf = 0.55

RF = 0.83

With an RF of 0.83, this risk highlights the potential impact of relying on third-party services. Consideration of widely adopted systems can be recommended to reduce probability. Anticipated outcomes may require systems to adapt to changes and possible disruptions in service.

Team Members Leaving the Project Unexpectedly (Risk E):

Probability of Failure (Pf):

Pm (Maturity) = 0.5

Pc (Complexity) = 0.5

Pd (Dependency) = 0.5

Pf = 0.5

Consequence of Failure (CoF) :

Cc (Cost) = 0.1

Cs (Schedule) = 0.5

Cr (Reliability) = 0.5

Cp (Performance) = 0.3

Cf = 0.35

RF = 0.67

This risk, with an RF of 0.67, highlights the potential impact of unexpected team members leaving. Regular communication and addressing team member concerns could be recommended to minimize chances or impact. Expected outcomes might include increased workload for the remaining team members and possible termination plans for the project's some parts.

Inadequate Training Leading to Inefficiencies (Risk F):

Probability of Failure (Pf):

Pm (Maturity) = 0.9

Pc (Complexity) = 0.9

Pd (Dependency) = 0.7

Pf = 0.83

Consequence of Failure (CoF):

Cc (Cost) = 0.1

Cs (Schedule) = 0.7

Cr (Reliability) = 0.7

Cp (Performance) = 0.5

Cf = 0.5

RF = 0.91

This high-risk scenario with an RF = 0.91 score emphasizes potential incompetence due to inadequate training. Simplification of the use of the system and selection of less complex technologies can be recommended to minimize the probability or impact. There are potential differences in system application from anticipated outcomes and desired outcomes when this risk could occur.

Unforeseen Circumstances Leading to Time Overruns (Risk G):

Probability of Failure (Pf):

Pm (Maturity) = 0.3

Pc (Complexity) = 0.1

Pd (Dependency) = 0.7

Pf = 0.36

Consequence of Failure (CoF) :

Cc (Cost) = 0.1

Cs (Schedule) = 0.9

Cr (Reliability) = 0.3

Cp (Performance) = 0.7

Cf = 0.5

RF = 0.68

With an RF of 0.68, this risk highlights possible time exceedances due to unforeseen circumstances. One way to tackle this risk is to create schedules with buffer times to minimize chance or impact. Anticipated consequences may include delayed timelines and potential problems with system functions.

Difficulty in Managing and Adapting to Evolving Specifications (Risk H):

Probability of Failure (Pf):

Pm (Maturity) = 0.3

Pc (Complexity) = 0.3

Pd (Dependency) = 0.7

Pf = 0.43

Consequence of Failure (CoF) :

Cc (Cost) = 0.1

Cs (Schedule) = 0.7

Cr (Reliability) = 0.3

Cp (Performance) = 0.3

Cf = 0.35

RF = 0.63

This risk, with an RF of 0.63, highlights the challenges of managing ongoing explanations. Pre-planning and selective planning can be recommended to minimize probability or impact. Expected side effects might include potential delays and poor system performance.

Figure 4 Risk Impact Matrix

In these environments where risks could become reality, the project team must remain vigilant, proactive, and adaptive to the circumstances. This analysis provides a roadmap for minimizing the probability and impact of each risk, allowing us for a more successful project execution.

11. Discussions

1. Limitations and Constraints

- We sometimes had other assignments during the creation of the document, therefore this led to some tasks taking longer than expected.

2. Health and Safety Issues

- We did not encounter any health and safety issues while creating this document.

3. Legal Issues

- We did not encounter any legal issues while creating this document.

4. Economic Issues and Constraints

- We did not encounter any economic issues and constraints while creating this document.

5. Sustainability

- While creating this document no paper is used. Only a digital copy of the Initial Plan was used for creating the document.

6. Ethical Issues

- We did not encounter any ethical issues while creating this document.

7. Multidisciplinary Collaboration

- While creating the initial plan, we did not receive any multidisciplinary collaboration from someone.

12. Curriculum Vitae

ERAY ALTAY

0553 690 1757 · eray.altay@ug.bilkent.edu.tr

Summary

Aim to leverage my skills in software engineering, video game design, project management, and UI/UX design. My goal is to drive innovation and enhance the software industry experience for customers.

Experience

Turk Telekom Innova Ankara, Türkiye

Innova is the R&D department of Türkiye's biggest communication company Turk Telekom.

Intern 02-2023 – 05-2023

Responsible for Data Engineering

- Learned and applied data technologies such as Docker, Kafka, and Kibana to process and analyze large-scale datasets.
- Explored basic AI concepts and applications such as machine learning, natural language processing.

OTTO GAMES Ankara, Türkiye

Otto Games is a mobile gaming start-up company within ODTU Teknokent.

Intern 07-2022 – 08-2022

Responsible for Software Development

- Gained hands-on experience in hyper casual game development and game design using Unity and C.

Education

Bachelor of Science, Information Systems and Technologies, Bilkent University, 2024

Skills

- Programming Languages: Java, C#, C, Python, Swift, HTML, CSS, JavaScript, SQL, PHP, R
- Software: Microsoft Word, Microsoft PowerPoint, Linux, Windows
- Languages: Turkish (native), English (professional working proficiency), Korean (beginner)

EREN TARAK

0543 925 3704 · eren.tarak@ug.bilkent.edu.tr

Summary

A 4th-year Information Systems and Technologies student at Bilkent University, part-time Software Engineer at Orion Innovation.

Experience

Orion Innovation Istanbul, Türkiye

Orion Innovation offers digital transformations for businesses.

Intern for 2 months, Part-time Software Engineer for 1 month 06-2023 – Current

Responsible for React & Node.js Development

- Contributing to the research and development of the 'Discovery of Interactions and Anomalies for Microservices' Tool for SmartDelta International project.

Jotform Ankara, Türkiye

Jotform is an online form builder platform for businesses.

Intern 01-2023 – 05-2023

Responsible for React.js Development

- Developed an user-friendly document management tool from scratch for internal document management tasks of the company.

Netcad Yazılım A.Ş. Ankara, Türkiye

Netcad offers smart city planning and GIS solutions. 08-2022 – 09-2022

Responsible for web development

- Developed a web-based 3d scientific visualization application from scratch.

Education

Bachelor of Science, Information Systems and Technologies, Bilkent University, 2024

Skills

- Programming Languages: JavaScript, TypeScript, Python
- Languages: Turkish (native), English (professional working proficiency), German (beginner)
- Soft Skills: Time management, listening skills, problem-solving.

MERT KÖROĞLU

0538 044 9696 · mert.koroglu@ug.bilkent.edu.tr

Summary

Hi, I'm Mert, a 4th year Information Systems and Technologies student at Bilkent University. I'm interested in Embedded programming and game development.

Experience

ESEN Sistem Entegrasyon Ankara, Türkiye

ESEN offers space, avionic and defense solutions.

Software Development Intern 01-2023 – 06-2023

Responsible for Software Development

- Worked as a front-end developer in a Tübitak Teydeb project.
- Created a front-end for a real time IOT signal processing application.
- Take place in service development using python.
- Used MATLAB for data processing.

Netcad Yazılım A.Ş. Ankara, Türkiye

Netcad offers smart city planning solutions.

Software Development Intern 06-2022 – 07-2022

Responsible for Software Development

- Created a python application for smart city mapping solutions.
- Created a web application to run the python script for better user interface.

Education

Bachelor of Science, Information Systems and Technologies, Bilkent University, 2024

Skills

- Programming Languages: C++, JavaScript, Python, HTML, CSS
- Software: Unreal Engine, Linux, Blender
- Languages: Turkish (native), English (professional working proficiency)
- Soft Skills: Strong collaboration and teamwork, problem solving.

TALHA REHMAN ABID

0552 880 4697 · rehman.abid@ug.bilkent.edu.tr

Summary

Hi, I'm Talha, a 4th year Information Systems and Technologies student at Bilkent University.

Experience

Dakik Yazılım Ankara, Türkiye

HPC and Blockchain Solutions.

Software Development Intern 03-2023 –

Responsible for Data Science

- specialized in 3D modeling tasks within machine learning.

Bilişim A.Ş. Ankara, Türkiye

Creates software solutions.

Software Development Intern 07-2022 – 08-2022

Responsible for Software Development

- Pharmacy Web Application Development

Education

Bachelor of Science, Information Systems and Technologies, Bilkent University, 2024

Information Systems, Metropolia University of Applied Sciences, 2022

Skills

- Programming Languages: HTML, CSS, PHP, React.js, Python
- Software: Scikit-learn, open3d
- Languages: English (native)