“Cy” Sophus

DESIGN DOCUMENT

SDDEC20-04
Client - Doug Jacobson

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Executive Summary

Development Standards & Practices Used

- Linux Development
- Unit Circle and Radians

Summary of Requirements

- Build a system that allows for user interaction with the table
- Build a system that can send live position drawing data
- Develope a multitude of different ways for interaction

Applicable Courses from Iowa State University Curriculum

- CPRE
    - 308: Operating Systems: Principles and Practices
    - 288: Embedded Systems I: Introduction
    - 281: Digital Logic
    - 488: Embedded Systems Design
- COM S
    - 309: Software Development Practices
- EE
    - 201: Electric Circuits
    - 230: Electronic Circuits and Systems

New Skills/Knowledge acquired that was not taught in courses

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1 Introduction

1.1 Acknowledgement

Our team would like to acknowledge our client Doug Jacobson for supplying us with the information needed to complete this project, as well as a Sisyphus table for testing.

1.2 Problem and Project Statement

Artist and engineer Bruce Shapiro has created the Sisyphus kinetic art table as a medium for artistic expression. Unfortunately, the process for creating tracks for the marble to follow is a fairly complicated process, with difficulty increasing exponentially the more intricate the design. This hurdle also limits the creativity of the artists using it, as much time must be spent planning a route in a polar coordinate file rather than spent creating new designs.
Our team was tasked with developing an interface for users to more easily use the Sisyphus table. The interface allows increased freedom of expression, eliminating much of the difficulty with creating tracks through applications for uploading images directly to the table, or simply for easier route planning.

1.3 Operational Environment

Our product exists in both physical and virtual space. Through physical components, we connect the table to our applications hosted on the internet, allowing ranged control of the device. Our interfaces are purely software so as to be displayed online for ease of access.

1.4 Requirements

The following are the requirements for the project:

- Self-explanatory user interface.
- Draw different kinds of shapes depending on how the user interacts with the table.
- Integration with broadcast media (i.e Twitch).
- Image scanning system.

1.5 Intended Users and Uses

Our intended users are owners of a Sisyphus table, and artists with an interest in the Sisyphus table. In the event that a table owner streams video of their table online and allows input, the interface should also support those that are allowed input to that table.

Our single intended use is to more easily design tracks for the Sisyphus table.

1.6 Assumptions and Limitations

Assumptions:

- Users of the Sisyphus table have access to the internet.
- The Sisyphus table is a working prototype.
- The table operates in an area with heavy foot traffic.

Limitations:

- Web interfaces must be supported on all major browsers and some smartphones.
- The table requires extra hardware in order to connect to the IOT.
- Physical size of the finished table is determined by the implementation of the end product.
- Additional equipment needed is limited by the budget.

1.7 Expected End Product and Deliverables

Physical:
A setup for wireless communications between the table and our web interfaces.

Virtual:
An centralized web interface for easier track design including:

- An automated process for converting from cartesian coordinates to polar coordinates.
- A gui for creating designs.
- A system to connect the web interface to a particular table.
- An application for uploading images for conversion to a track.

2 Specifications and Analysis

2.1 Proposed Approach

- To ensure maximum efficiency in the Sisyphus table's performance, we are employing a well-documented approach to executing a plan to deliver the table on-time and on-budget.
- The initial phase of our project will comprise of conceptual engineering in which the budget and schedule is properly assorted to deliver the desired end-result.
- Documentation begins when the table is acquired.
- Development on the first phase of the project focuses on establishing a complete understanding on manipulating information outputted by the table.
- Communication between user and table will be tested using basic means designed by the team. The communication is declared enough when we can give multiple purposes to our method of user interaction with the table.
- A robustly tested and developed first approach to interacting with the table allows for further development for other means of interactions between table and user.

2.2 Design Analysis

Progress

- Met with client and developed a roadmap for the project
- Created prototype UI elements for Web and App development
- Created documentation and organization for the project to ensure development is on track and deliver a professional product

Successes

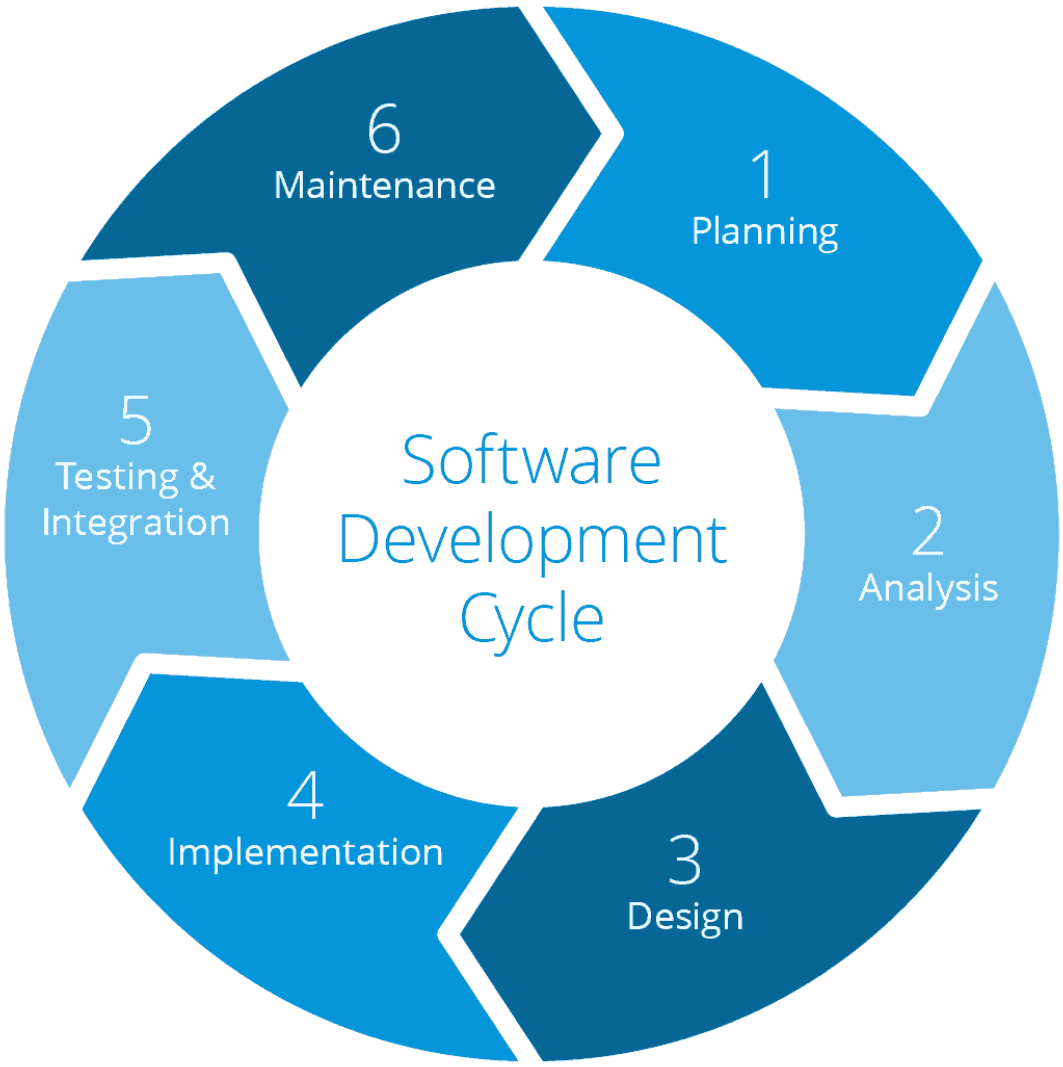
- Team communication is consistent and deadlines are apparent and respected
- Proposal is clear to our client and meets their needs
- Skills of team members cover project needs and development process is clear

Failures

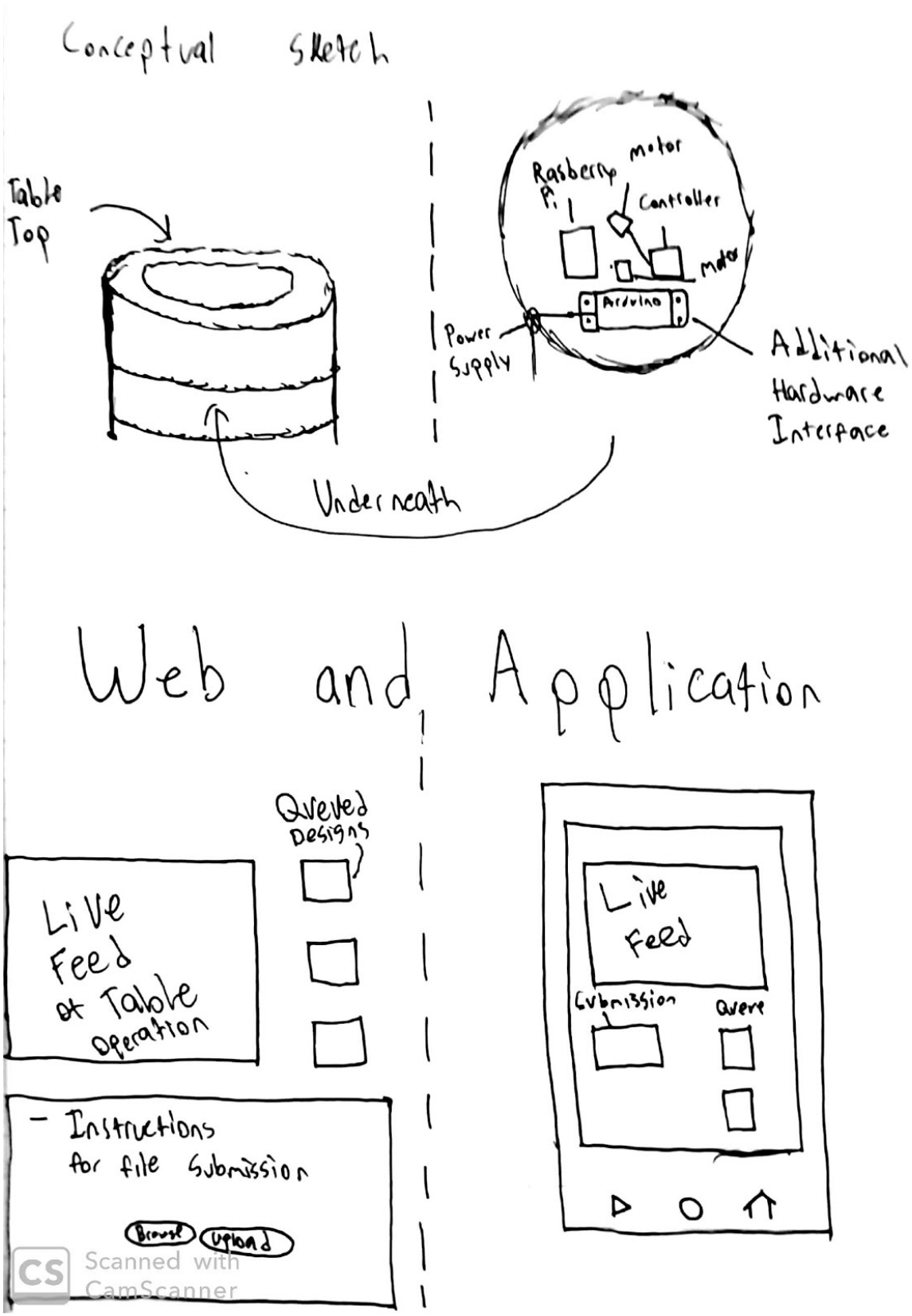
- Instances of meetings in person falling through
- Deliberation of concrete project design still prevalent
- Understanding and undertaking project roles and responsibilities

2.3 Development Process

For this process, the Agile Development Cycle appears as the most prevalent choice as our development focuses on a heavy use of programming and hardware testing in order to adapt a given product. This product is then developed further with developments and testing in order for us to deliver a UI and User interactable version of this product.


Software Development Cycle
1 Planning
2 Analysis
3 Design
4 Implementation
5 Testing & Integration
6 Maintenance

2.4 Conceptual Sketch



---Tentative Plans---

3. Statement of Work

3.1 Previous Work And Literature

Sand Drawing robot
https://www.youtube.com/watch?v=7T1esQgRwrM

3.2 Technology Considerations

- website hosting services
    - https://www.hostinger.com/?utm_medium=affiliate&utm_source=aff2175&utm_campaign=aff24&session=102ac2af44be2304481410e04e8a99
    - https://www.bluehost.com/special/homenewm?utm_source=%28direct%29&utm_medium=affiliate&utm_campaign=affiliate-link_hostfacts_notype

3.3 Task Decomposition

- Research how to create files that the table can read
- Implement a UI for creating these files for a general user base
- Put up a website that can be accessed by the wider world
- Create a server that can create files that receives requests from the website and sends them to the table
- Coordinate a place to display the table on Campus

3.4 Possible Risks And Risk Management

- Website Security
    - Proper login credentials and user verification
    - Only allowing a certain amount of requests per hour

3.5 Project Proposed Milestones and Evaluation Criteria

3.6 Project Tracking Procedures

3.7 Expected Results and Validation

4. Project Timeline, Estimated Resources, and Challenges

4.1 Project Timeline

4.2 Feasibility Assessment

4.3 Personnel Effort Requirements

4.4 Other Resource Requirements

4.5 Financial Requirements

5. Testing and Implementation

5.1 Interface Specifications

5.2 Hardware and software