Mice Visualization Software Requirements Specification

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1 Introduction

1.1 Purpose

The intention of this document is to define the requirements of the Mice Visualization application. It outlines the functional requirements as well as some general constraints on the system. The document represents the entirety of the software requested by the client during the requirements phase. The software development team shall be implementing the requirements to the furthest extent in the given time frame. By reading this document, stakeholders and developers shall understand the system and its functions.

1.2 Scope

This project is designed for scientists to be able to analyze behavioral data that they have collected. The cross-platform application shall allow any scientist to manage their datasets, visually track and analyze mice movement patterns, and better understand the behavior of mice. This application is specifically designed for interdisciplinary collaboration of University of Mary Washington (UMW) departments, including but not limited to, biology and psychology.

1.3 References

Requirements stated in this document represent the information that the client, Dr. Polack, has provided.

1.4 Document Overview

This document provides an overview of the system, clients and users, and constraints and requirements of the software. Following the requirements section, the appendices contain a glossary and team member contributions.

2 Project Description

2.1 System Overview

The fundamental goal of the software is to assess the influence of voluntary wheel running (VWR) on behavioral patterns and social rank of mice. With this goal in mind, users shall be able to upload external datasets in order to visually analyze various paths of mice. The user shall be able to view a congregated heat map as well as a vector map containing the paths of the mice.

2.2 Client Characteristics

The client for this project is Dr. Jennifer Polack, who is representing junior biology and psychology professors at UMW and their research on mouse interaction and behavior. The goal of their team is to assess the influence of voluntary wheel running on behavioral patterns and social rank of mice. Dr. Polack can be reached by email at jenniferpolack@gmail.com, or in person in room B21 of Trinkle Hall at UMW.

2.3 User Characteristics

The initial users of this system shall be Dr. Stahlmen and Dr. Waters, biology and psychology professors respectively. This software could be used by other researchers in the future. All users shall have the same access and privileges on their desktop application – there shall be no user accounts or sharing of files through the application. A user may add new datasets in addition to loading and deleting previously used datasets. Users shall be able to use different maps and overlays to view the datasets and shall have the ability download this information onto their computers.

2.4 General Constraints

The application shall allow for the user to load in a dataset covering any amount of time and any amount of data. Depending on the size of these datasets and software and hardware specifications, the amount of time it takes to both load in the data as well as run the analytical functions may vary.

3 Requirements

3.1 General Requirements

Requirements supporting fundamental user abilities and system components are listed here.

REQ 1: The system shall be a cross-platform desktop application developed in Java.
REQ 2: The user shall be able to load a previously used dataset.
REQ 3: The user shall be able to load a new dataset.
REQ 4: Upon loading a new dataset, the system shall store it in a data structure.
    REQ 4.1: The system shall retain indicated dimensions.
    REQ 4.2: The system shall retain animation settings: speed, timespan, repeat option state.
    REQ 4.3: The system shall retain the selected mice.
REQ 5: The user shall be able to delete previously loaded datasets.
REQ 6: Upon initial load of a dataset, an empty grid shall be displayed.
    REQ 6.1: User shall have a choice between a vector map, heat map or overlay.
REQ 7: The grid shall be visible with all maps.
REQ 8: The system shall support up to 6 mice.
REQ 9: The user shall be able to change the combination of mice displayed at any time.

3.2 Animation Requirements

This section states requirements concerning animation features. By using these features, the user shall be able to view the path of the mice or see areas that the mice congregated to the most over a specified timespan.

REQ 10: The user shall be able to change the speed of the animation.
REQ 11: The user shall be able to select start and stop times for the animation.
REQ 12: The user shall be able to play, pause and repeat the animation.

3.3 Heat Map Requirements

The heat map is a feature of the system that shall allow the user to see which areas of the cage the mice had congregated around the most.

REQ 13: The system shall support a static average heat map of all the data over the selected time period for the selected mice.
REQ 14: Unless an overlay is selected, heat maps shall adhere to animation requirements.

3.4 Vector Map Requirements

Vector Map specific requirements are listed below.

REQ 15: Vector maps shall adhere to animation requirements.

REQ 16: The system shall have a uniquely colored line for each of the selected mice.

3.5 Overlay Requirements

Specific requirements for displaying multi-layer maps are covered here.

REQ 17: The system shall support an overlay of maps.

REQ 18: The system shall support animated or static vector maps in an overlay.

REQ 19: In an overlay, the system shall support the display of a heat map barring that that heat map is rendered statically (no animation).

3.6 Input Requirements

Requirements regarding the input file format and type for datasets are listed here, as well as user input regarding dimensions.

REQ 20: The system shall support comma separate value (.csv) files for new datasets.

REQ 21: Input datasets must have one row per entry.

- REQ 21.1: An entry includes the mouse RFID number, grid location and duration of stay.
- REQ 21.2: Entries shall have all of the data in the first column of the csv file.

REQ 22: Upon input of an unsupported file, the system shall display an error to the user to indicate either a problem with file format or file extension (.csv).

REQ 23: User shall be prompted to type row by column dimensions for the dataset before parsing the data.

- REQ 23.1: User shall input the full dimensions of the cage used to produce the dataset.

REQ 24: When inputting a dataset, the user shall be able to indicate where on the map the feeding station shall be displayed.

- REQ 24.1: Feeding stations shall be: top row (center, right or left) or bottom row (center, right or left)
- REQ 24.2: By default, the system shall place the feeding station in the top center square.

3.7 Output Requirements

This section covers the type of output created by the system.

REQ 25: The user shall be able to download images of static heat and vector maps and overlays.

4 Assumptions

- The system shall assume the user has mice identified by a RFID.
- The system shall assume the user has the ability to accurately track these mice in the cage.
- The system shall assume the user has the ability to store the tracking data of the mice in a csv file.

5 Appendices

5.1 Glossary

- .csv File: simple file format to store tabular data using a comma (,) as a delimiter.
- Heat Map: map indicating where the mice spend time; red, orange, yellow, green, light blue, and dark blue show congregation volume ranging from high to low respectively.
- Vector Map: map showing the paths of the mice; each mouse is represented by a different color line.

5.2 Team Contributions

Introduction: Alec Carlyle, Mikaela Goldrich
Product Overview: Michael Prime, Mikaela Goldrich
Requirements: Michael Prime, Alec Carlyle, Mikaela Goldrich
Assumptions: Mikaela Goldrich
Appendices: Michael Prime, Alec Carlyle, Mikaela Goldrich