Software Requirements Specification

for

Muridae Visualization Utility

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1.0 Introduction

1.1 Purpose

The purpose of this Software Requirements Specification (SRS) is to describe in detail systems requirements for the Muridae Visualization Utility (M-VU). This document will outline user interactions with the system and data import and data management functions. The intended audience for this document is project developers, testers and the client, Parrish Waters, Ph.D., Visiting Assistant Professor, University of Mary Washington.
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1.2 Scope

The M-VU software will be a standalone, web-based application which will parse gathered data to create user-defined vector and heat maps. The primary purpose of M-VU will be to create these visual representations of the gathered data for further analysis and study. Datasets can be saved and managed, allowing comparison over a broad range of time periods. Both vector and heat maps are customizable, presenting several viewing options to suit the user's particular needs.

1.3 Definitions, Acronyms, and Abbreviations

1.3.1 Admin User

A user level which is permitted to import and manage datasets.

1.3.2 Heat Map

A map in the M-VU system which shows frequency and duration of a subject's visit to a particular location.

1.3.3 M-VU

Muridae Visualization Utility is the software which this SRS describes (pronounced EM-VIEW).

1.3.4 SRS

This Software Requirements Specification.

1.3.5 User

A base-level user which is permitted to view data.

1.3.6 Vector Map

A map in the M-VU system which shows a directed graph of a subject's travel over the grid of study.

1.4 Overview

This SRS is structured in five parts. This first part provides a general system overview, and a guide to the remaining parts of the SRS. The second part outlines functional requirements for M-VU and broad design particulars for the software. The third part enumerates interfaces with the user, hardware and software. The fourth and section contains detailed descriptions of functional requirements, and provides a guide for user interactions with M-VU through use cases. The fifth part describes non-functional requirements.

2.0 Overall Description

2.1 General Description

M-VU is a web-based system which will aid researchers visualize the movements of RFID-equipped mice or rats over a grid of locations. The RFID data is collected and reported in a Microsoft Excel spreadsheet, providing time and location stamps for each individual subject.

M-VU will parse this spreadsheet and display both vector and heat maps, with user-selected customization to show various numbers of subjects, over any valid time frame, and with multiple display options for color and style.

M-VU will also collect imported datasets, allowing for broader study over multiple data entries. An administrator will have privileges to manage these datasets, adding a new spreadsheet or deleting previous entries. Datasets will be stored in a web-hosted database.

2.2 Product Functions

M-VU will permit an admin to upload a dataset into the M-VU database. The system will ensure an uploaded file is the proper format with valid data (See Appendix A for a sample of the data format). M-VU will include functionality for the admin to view raw data from all imported datasets. The admin will also be able to delete uploaded datasets from the M-VU database. The admin will also have control over user account access, with the ability to add, delete and manage passwords for user accounts.

The heart of M-VU is the parsing of datasets into vector and heat maps. With valid data uploaded, either an admin or user can view these maps. The views are customizable over multiple custom queries. Viewers should be able to select from one, some or all subjects over a particular dataset.

Subjects should carry information fields for user edit, allowing a subject to be labeled or colored in a particular way when displayed.

The selection of datasets to visualize is also a key search parameter. A viewer can select a timeframe which spans multiple datasets to display in vector or heat map. The timeframes are abstract and don't correspond necessarily to a direct measure of seconds or minutes; but they are relative to each other, and can be weighted as such.

2.3 User Characteristics

System privileges will be divided into two classes: Admin and User. An Admin account will have account management functionality, including adding and deleting other users, setting privileges for other users, and password maintenance for other users. Admin accounts will have the ability to add and delete items from the available datasets. Admins will be able to edit and save characteristics for a subject over a particular dataset. Admin accounts will also have access to all User account functions.

User accounts will be able view vector and heat maps, creating custom queries to filter the data to suit their particular needs.

2.4 Design and Implementation Constraints

The M-VU system must handle Excel datasets as they are offered. That includes considerations for missing or incomplete data. While online hosting is required for the M-VU system, consideration should be strongly given to hosting options with minimum cost. Performance and load considerations will be minimal for M-VU, so expense is a primary concern.

2.5 Assumptions and Dependencies

The system will properly function on Safari and Chrome web browsers. Other web browsers will be unsupported and accessing M-VU with an alternative browser may result in undesirable effects.

The system will count on external hosting, and thus be at the mercy of this external host for up-time and performance issues.

3.0 External Interface Requirements

3.1 User Interfaces

3.1.1 User Login Page

Upon navigating to the system home page, a user will be greeted with the user login page, prompting the user for a username and password. Executing the login button on the page will validate the user, check for privileges, and redirect to the main M-VU page.

3.1.2 User Management Page

The user management page will be available only to an admin-level user. From here, an admin can manipulate user accounts (create new account, reset passwords, change privilege levels, delete user accounts).

3.1.3 Data Administration Page

The data administration page will permit an admin-level user to manipulate which datasets are maintained in the M-VU database. Datasets will be listed with various attributes (upload timestamp, lines of data, user-defined descriptions), and the admin can choose to delete a set.

3.1.4 Upload Data Page

The upload page will include an interface for adding new datasets to the M-VU database. An admin-level user will be able to navigate through their local file tree, select a file, and upload it into the M-VU database.

3.1.5 View Map Page

The view map page will contain the interface for viewing a particular dataset as a map. Options will include the various queries used to sort the data, choice of dataset to view, and options to switch between a vector and heat map.

3.2 Hardware Interfaces

The M-VU system will act as a standard web page, requiring users interaction with the mouse and keyboard. Site will display correctly on both Safari and Chrome Internet browsers.

3.3 Software Interfaces

The M-VU system will properly parse and store information from .XLS and .CSV files, which will follow a standard format used for data collection.

4.0 System Features

4.1 Use Case Diagram

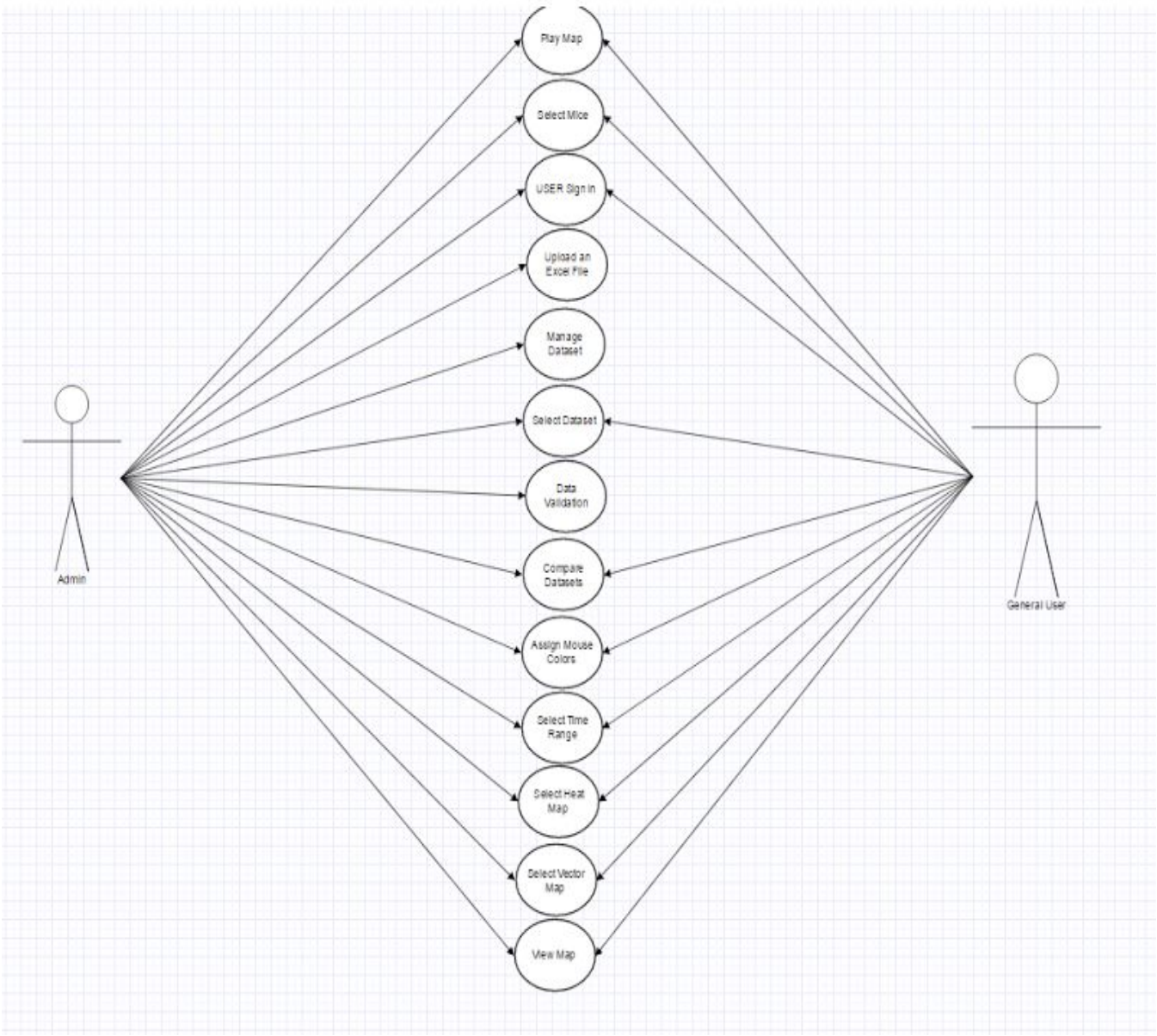


Figure 1: Use Case Diagram

Description: Figure 1 is the use case diagram which shows the use cases for the system these describe a sequence of actions that provide something of value to an actor within the system
Key: Circles = Use cases Figures = Actors

4.2 View Map

4.1.1 Description and Priority

By selecting a valid dataset, the user is able to view a map. Priority 10.

4.1.2 Pre-conditions

At least one valid dataset has been uploaded to the M-VU database.

4.1.2 Stimulus/Response Sequences

Basic Path:

1. From the list of available uploaded datasets, the user selects one to display.
2. The map is displayed, showing all contained subjects with all contained plot points.
3. From the list of custom display options, the user selects which subjects from the dataset to display.
4. The display is updated, including only those subjects selected in Step 3.
5. From the list of custom display options, the user selects some new color for a particular subject.
6. The display is updated, with color options as chosen in Step 5.

4.3 Select Vector Map

4.2.1 Description and Priority

With a valid dataset and query options selected, the user is able to view a vector map of the data. Priority 20.

4.2.2 Pre-conditions

At least one valid dataset has been uploaded to the M-VU database. The user has loaded this dataset, and set some combination of valid view options.

4.2.2 Stimulus/Response Sequences

Basic Path:

1. The user selects the Vector Map options.
2. The system displays the vector map, conforming to all user-selected view options (subjects to include, colors, time period).

Alternate Path:

1. The user clicks the Clear Search Options button.
2. Search fields are reset to their default values, and no map is displayed.

4.4 Select Heat Map

4.3.1 Description and Priority

With a valid dataset and query options selected, the user is able to view a heat map of the data. Priority 20.

4.3.2 Pre-conditions

At least one valid dataset has been uploaded to the M-VU database. The user has loaded this dataset, and set some combination of valid view options.

4.3.2 Stimulus/Response Sequences

Basic Path:

1. The user selects the Heat Map options.
2. The system displays the heat map, conforming to all user-selected view options (subjects to include, colors, time period).

Alternate Path:

1. The user clicks the Clear Search Options button.
2. Search fields are reset to their default values, and no map is displayed.

4.5 Play Map

4.4.1 Description and Priority

While viewing a vector or heat map, the user presses the play button and the map is drawn over time. Priority 40.

4.4.2 Pre-conditions

The user has selected a valid dataset, has set view options, and the system is properly displaying either a vector or heat map.

4.4.2 Stimulus/Response Sequences

Basic Path:

1. The user selects one of several time compression options (1x, 2x, 8x) to control speed of playback.
2. The user presses the play button.
3. The display then resets the displayed map to the initial time stamp.
4. The display then draws over time the dataset's plot points, at a speed factor relative to the user's time compression choice.

4.6 Select Mice

4.5.1 Description and Priority

User selects mice whose data is to be included on the heat or line map. Priority 40.

4.5.2 Pre-conditions

User has a dataset open, either by loading an old one or uploading a spreadsheet in order to create a new one.

4.5.2 Stimulus/Response Sequences

Basic Path:

1. Application will generate a list of mice present in the dataset and a method by which the user can highlight or select them.
2. User selects which mice they would like to be included on the next generated map.

Alternate Path:

1. The dataset is empty, therefore there are no mice to generate a list from. The application does not generate a list of mice.
2. The user cannot select any mice.
3. The user must fill the dataset or select a new one and then can proceed to the **Basic Path**.

4.7 Select Time Range

4.6.1 Description and Priority

User selects the time frame for which they want to be represented in their map. Priority 30.

4.6.2 Pre-conditions

User has a dataset open, either by loading an old one or uploading a spreadsheet in order to create a new one.

4.6.2 Stimulus/Response Sequences

Basic Path:

1. Application will generate an upper and lower bound using the highest and lowest time value present in the dataset. Note the unit of measure for time is abstract, and relative to a particular dataset and its entries.
2. User will select a value between the upper and lower bound to be the start time.
3. User will select a value between the upper and lower bound to be the end time.

Alternate Path:

1. The dataset is empty, therefore there are no mice to generate a list from. The application does not generate an upper or lower time bound.
2. The user cannot select any time frame.
3. The user must fill the dataset or select a new one and then can proceed to the **Basic Path**.

4.8 Assign Mouse Colours

4.7.1 Description and Priority

User selects the colour by which they want each mouse to be identified by in the line map. Priority 50.

4.7.2 Pre-conditions

User has a dataset open, either by loading an old one or uploading a spreadsheet in order to create a new one. User has selected to view the line map mode.

4.7.2 Stimulus/Response Sequences

Basic Path:

1. Application generates a list of mice from dataset.
2. Application automatically assigns initial colours to mice randomly, in such a way that no two mice share a colour.
3. For each mouse user selects from a list of colours what colour they want to represent each mouse. There is no limitation here on how many mice can use the same colour here.

4.9 Compare Datasets

4.8.1 Description and Priority

User selects two datasets to compare. Priority 40.

4.8.2 Pre-conditions

There is more than one dataset present in storage.

4.8.2 Stimulus/Response Sequences

Basic Path:

1. User selects first dataset that they want to compare.
2. User selects options for viewing the first map, including time range, map mode, which mice to display and mouse colours (if line map is selected).
3. User selects to generate new map.
4. User indicates that they would like to compare this map with another from another dataset.
5. User selects second dataset.

6. Application generates some options for the second map to match the first, including map mode.
7. User selects the rest of the options for the second map, including time range, which mice to display and line colours (if line map was selected).
8. User selects to generate the second map and compare.
9. The first and second maps are displayed side by side.

4.10 Upload an Excel File

4.9.1 Description and Priority

User selects an Excel file with a file extension of .csv and uploads the data to the system. Priority 10.

4.9.2 Pre-conditions

User has a dataset to upload with mice data in the proper template

4.9.2 Stimulus/Response Sequences

Basic Path:

1. Application will take in the user submitted csv file
2. The application will then parse the data
3. The data will then be added to the database that will be set up

Alternate Path:

1. The excel does not have .csv extension
2. The application will issue an error to the user
3. The user will need to convert excel spreadsheet into a csv and retry uploading after the user will proceed on the Basic Path.

4.11 Data Validation

4.10.1 Description and Priority

Application will be able to detect errors in potential mice data and will handle them accordingly. Priority 20.

4.10.2 Pre-conditions

User has tried to upload a dataset to the application

4.10.2 Stimulus/Response Sequences

Basic Path:

1. Application will generate an error message that communicates to the user the problem the application had encountered when trying to upload a dataset
2. User will fix the problem encountered and retry data validation.

Alternate Path:

1. There will be no problems within the proposed dataset
2. No errors will be presented to the user
3. Program will upload the dataset to the application

4.12 Select Dataset

4.11.1 Description and Priority

User selects the dataset by which they want the heat and line map to represent. Priority 30.

4.11.2 Pre-conditions

User has uploaded datasets to the application prior to data selection.

4.11.2 Stimulus/Response Sequences

Basic Path:

1. Database is accessed in the background of the application.
2. Application generates a list of datasets represented by date ranges to the user.
3. The user selects a dataset for the application to use
4. The dataset is loaded into the application
5. The heat and line map represents the data

Alternate Path:

1. User Selects Home
2. User is sent back to homepage

4.13 Manage Dataset

4.12.1 Description and Priority

User selects a dataset to either save or delete. Priority 30.

4.12.2 Pre-conditions

There is at least one dataset present in storage.

4.12.2 Stimulus/Response Sequences

Basic Path:

1. User selects a dataset to manage
2. User is given an option pane to select what he wants to do with the dataset
3. User selects to delete the dataset
4. Application generates a message to whether or not the user wants to continue
5. User selects to continue
6. Application deletes the data within storage
7. User is sent back to the home window

Alternate Path:

1. User selects to save the dataset
2. Application generates a message to whether or not the user wants to continue
3. Application will save the data to storage
4. User is sent back to the home window

4.14 User Sign In

4.13.1 Description and Priority

User will be able to login to the system. Priority 30.

4.13.2 Pre-conditions

User knows the password and username to enter the application.

4.13.2 Stimulus/Response Sequences

Basic Path:

1. User is brought to a login screen requesting a password and username
2. User will type in the username and password
3. Application will validate the credentials
4. User will proceed to the home window

Alternate Path:

1. Application will issue an error message if the credentials do not match the application's
2. The user will re-submit the credentials
3. If the user is denied up to 5 times in a row the user will be locked out

5.0 Other Nonfunctional Requirements

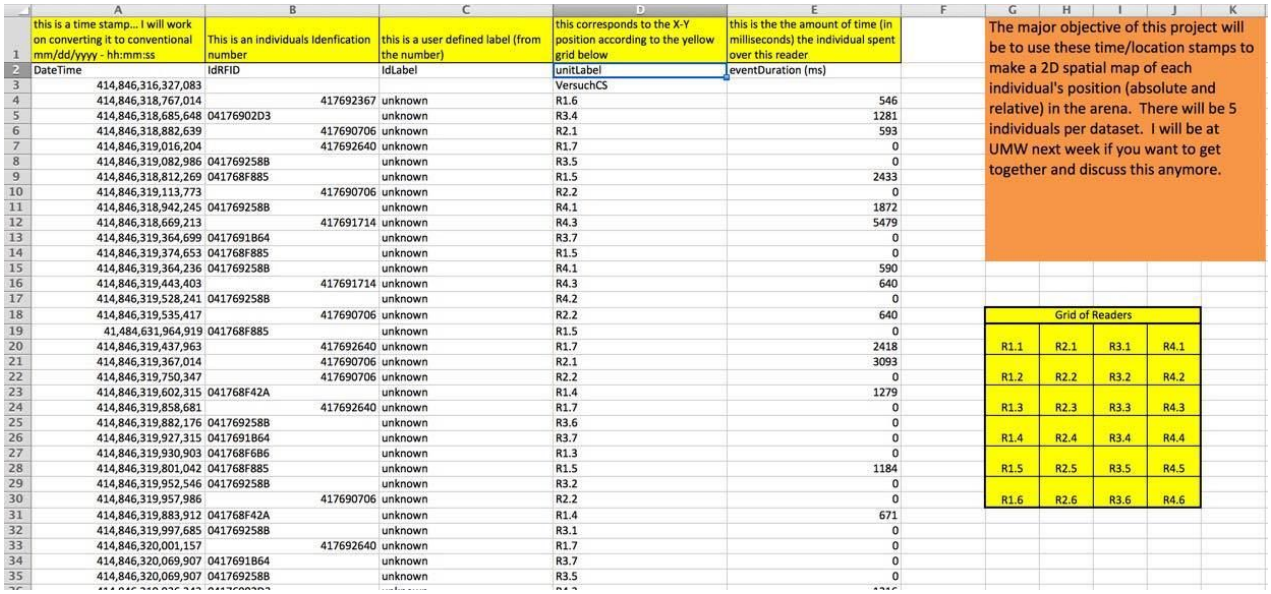
5.1 Performance Requirements

Though vector and heat maps should be recalled and drawn in a reasonable timeframe, system performance is not an overwhelming concern beyond reasonable page load and display times for any given web-based application.

5.2 Security Requirements

The M-VU system and database does not store any sensitive user data, but efforts should still be made to secure the subject data stored, to prevent malicious actors from damaging the integrity and validity of the stored information.

Appendix A: Data sample



	A	B	C	D	E
1	this is a time stamp... I will work on converting it to conventional mm/dd/yyyy - hh:mm:ss	This is an individuals Idenfication number	this is a user defined label (from the number)	this corresponds to the X-Y position according to the yellow grid below	this is the the amount of time (in milliseconds) the individual spent over this reader
2	DateTime	IdRFID	IdLabel	unitLabel	eventDuration (ms)
3	414,846,316,327,083			VersuchCS	
4	414,846,318,767,014	417692367	unknown	R1.6	546
5	414,846,318,685,648	04176902D3	unknown	R3.4	1281
6	414,846,318,882,639	417690706	unknown	R2.1	593
7	414,846,319,016,204	417692640	unknown	R1.7	0
8	414,846,319,082,986	041769258B	unknown	R3.5	0
9	414,846,318,812,269	041768F885	unknown	R1.5	2433
10	414,846,319,113,773	417690706	unknown	R2.2	0
11	414,846,318,942,245	041769258B	unknown	R4.1	1872
12	414,846,318,669,213	417691714	unknown	R4.3	5479
13	414,846,319,364,699	0417691B64	unknown	R3.7	0
14	414,846,319,374,653	041768F885	unknown	R1.5	0
15	414,846,319,364,236	041769258B	unknown	R4.1	590
16	414,846,319,443,403	417691714	unknown	R4.3	640
17	414,846,319,528,241	041769258B	unknown	R4.2	0
18	414,846,319,535,417	417690706	unknown	R2.2	640
19	41,484,631,964,919	041768F885	unknown	R1.5	0
20	414,846,319,437,963	417692640	unknown	R1.7	2418
21	414,846,319,367,014	417690706	unknown	R2.1	3093
22	414,846,319,750,347	417690706	unknown	R2.2	0
23	414,846,319,602,315	041768F42A	unknown	R1.4	1279
24	414,846,319,858,681	417692640	unknown	R1.7	0
25	414,846,319,882,176	0417692588	unknown	R3.6	0
26	414,846,319,927,315	0417691B64	unknown	R3.7	0
27	414,846,319,930,903	041768F6B6	unknown	R1.3	0
28	414,846,319,801,042	041768F885	unknown	R1.5	1184
29	414,846,319,952,546	041769258B	unknown	R3.2	0
30	414,846,319,957,986	417690706	unknown	R2.2	0
31	414,846,319,883,912	041768F42A	unknown	R1.4	671
32	414,846,319,997,685	041769258B	unknown	R3.1	0
33	414,846,320,001,157	417692640	unknown	R1.7	0
34	414,846,320,069,907	0417691B64	unknown	R3.7	0
35	414,846,320,069,907	041769258B	unknown	R3.5	0

Figure 2: Example Data Format

Description: Figure 2 is an example page from the dataset, showing the columns included in the .XLS file.

The dataset is uploaded from a Microsoft Excel file with a standard format for the column layouts and their contents. The included columns are:

DateTime: The DateTime column is a timestamp for when a particular sensor reading was taken. Note the data is not in a standard month/day/year/hour/minute/second format. Instead, it is a relative measurement, and can be compared to other timestamps in the dataset.

idRFID: The RFID of the subject recorded in a given dataline of the dataset.

idLabel: A user-defined label for a given subject. Note in a dataset, these are frequently "unknown." M-VU will give the user the chance to define this label, and the information will be stored in the M-VU database.

unitLabel: The grid location where this particular subject was located during this dataline.

eventDuration: The time (in milliseconds) the subject remained in this grid location.