Software Design Document

<Accident Data User Interface>

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# System Vision

## Problem Background

The Victoria state accident dataset contains crash statistics from 2015-2020. This data holds a wealth of information to be uncovered by various organisations. Therefore, a way to analyse and represent this data in an easy to use and fast manner is needed. The proposed software allows users to manipulate the dataset enabling comparisons within the dataset. The software also supports graph generation making correlations between different factors easily displayed.

Text input and mouse clicks are examples of input that the software will receive. The text input will constitute users searching keywords, the mouse clicks users selecting periods of time. The software will output tabulated accident data and be able to formulate bar graphs for specific data points.

The application allows users to automate certain data processing techniques. Saving the user time by generating results that allow users to check if specific keywords are tied to different types of crash data (e.g., determining how many accidents involved pedestrians). This frees the user from manually cross-checking the dataset which would be immensely time-consuming and cumbersome for a dataset of this size. The software also provides the user with aggregated ready-to-use data representations in the form of bar graphs. These graphs can be taken directly from the interface and pasted into presentations. Supplying users with a way to tailor-make their own graphs to visually display whatever part of the dataset they are interested in.

The target audience for this software is individuals or entities with a vested interest in Victorian accident data. This is not limited to the Victorian Police, private insurance companies, government committees dedicated to road safety (e.g., Victorian Parliamentary Safety Committee), The Department of Transport and Planning, and non-profit organisations (e.g., Road Safety Promotion Australia). These entities will all use the software to review and draw conclusions on vehicular accidents in the state of Victoria. A non-profit may use this data to enact a target road safety plan. An insurance company might use this data to increase or decrease the excess they charge for different age groups.

## System Overview

The proposed system will allow end users to manipulate the Victora state accident dataset. Displaying information in an accessible and easy-to-use manner. The key features of the system are as follows:

* Allow users to display all accidents that happened in a specific time period.
* Produce a bar graph that displays the average number of accidents in each hour of the day for a selected period.
* Search a selected period by a keyword (e.g., collision) and retrieve all accidents caused by this accident type.
* Enable the user to examine, the impact of alcohol on accidents (e.g., most common accident type associated with alcohol).
* Allow users to graph the accident fatalities over the 5-year period to investigate data trends.

The application is a data analysis instrument with a graphical user interface. It will contain a graphic pointer which will be the default windows mouse design to avoid confusion. A search bar area that is clearly marked. An attractive colour scheme that makes buttons and menus easy to find. The system must be able to aggregate data points and output an appropriate graphical visualisation. It must be able to respond to user directions in the form of a keyword search. Time periods within the dataset must be able to easily be selected.

The software is purely a dataset analysis tool. New data cannot be added, existing data cannot be deleted. The application takes input as keystrokes and mouse clicks, it will not respond to any other inputs (e.g., voice activation). The program's output is bar graphs and tables. It is not coded to produce other types of data visualisation (e.g., pie charts).

## Potential Benefits

This software can be used to examine accident trends in Victoria. This type of data analysis is important for the proposed client (a non-profit organisation) to have access to. The examination of the dataset can enable the non-profit to identify driving behaviours that may be detrimental. This allows them to create targeted programs and advertisements to reduce the negative effects.

# Requirements

## User Requirements

The end user is volunteer at a non-profit organisation. The end user needs to be able to easy able to create graphs and search keywords. The data that the user has access to needs to be streamlined and not overwhelming.

What the end user needs:

* Clarity, components of the graphic user interface are minimalistic with limited ways to get lost in the interface.
* Efficiency, easily and quickly generates graphical data.
* Reliability, able to perform lots of iterations without errors.

## Software Requirements

R1. The software shall load the Victoria state accident dataset.

R2. The software shall have a date dropdown menu where time frames can be selected.

R3.1 The software shall accept English words as searchable keywords.

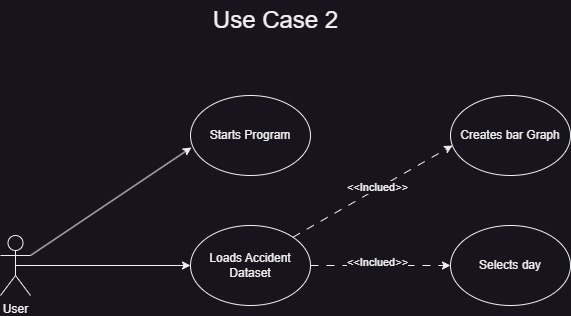
R3.2 Words that are part of the accident description shall be displayed.

R4. Outputs from the program shall be displayed in a 250 x 250 pixel visual.

## Use Cases & Use Case Diagrams

|  |  |
| --- | --- |
| Use Case ID | 1 |
| Use Case Name | Accidents per Timeframe |
| Primary Actor | User |
| Secondary Actor | None |
| Description | Creating a table of all accidents that have happened in a set timeframe. |
| Trigger | The user selects the timeframe that it wants to display. |
| Pre-Condition | The user opens the software and loads up the accident dataset. |
| Post-Condition | Accidents are displayed in table form. |
| Success Scenario | All accidents that occurred at that time are present. |
| Abort Scenario | Some or all the accidents are missing from the table. |

|  |  |
| --- | --- |
| Use Case ID | 2 |
| Use Case Name | Graphing accidents per hour |
| Primary Actor | User |
| Secondary Actor | None |
| Description | Creating a bar graph that shows the average number of accidents per hour on a chosen day. |
| Trigger | User selects the day they want to graph. |
| Pre-Condition | The user opens the software and loads up the accident dataset. |
| Post-Condition | Bar graph displaying the average accidents per hour on a given day |
| Success Scenario | The hours and accidents are correctly displayed, and the bar chart renders properly. |
| Abort Scenario | The chart doesn’t display correctly and/or the averages are incorrect. |



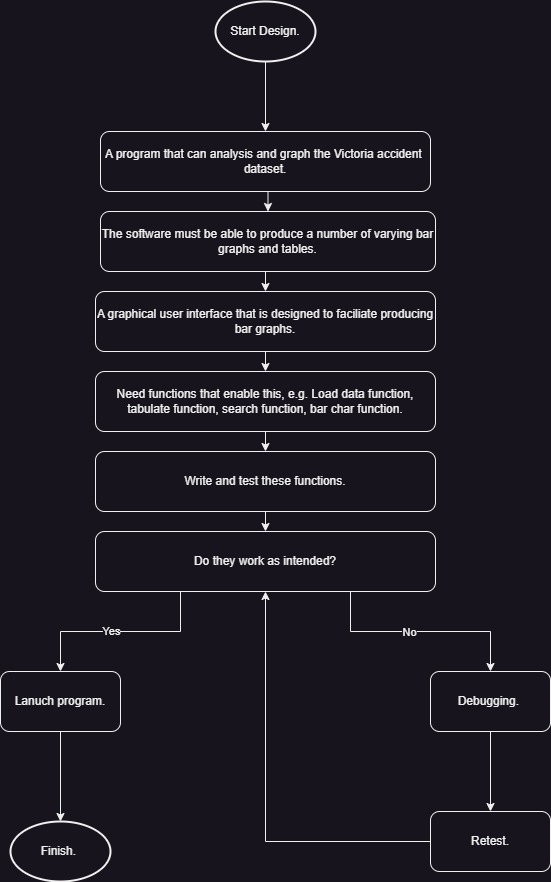
|  |  |
| --- | --- |
| Use Case ID | 3 |
| Use Case Name | Accident keyword search. |
| Primary Actor | User |
| Secondary Actor | None |
| Description | Producing accident results that contain the keyword that the user searches. |
| Trigger | The selects a period and searches a keyword. |
| Pre-Condition | The user opens the software and loads up the accident dataset. |
| Post-Condition | A table of accidents that contain the keyword is produced. |
| Success Scenario | The table correctly displays all the accidents containing the keyword for the selected period. |
| Abort Scenario | Accidents that do contain the keyword are shown and/or the timeframe is incorrect. |

|  |  |
| --- | --- |
| Use Case ID | 4 |
| Use Case Name | Graphing alcohol-related accidents |
| Primary Actor | User |
| Secondary Actor | None |
| Description | Creating a bar graph that correlates accident types and alcohol. |
| Trigger | The user selects a drop-down menu to sort by alcohol-related accidents. |
| Pre-Condition | The user opens the software and loads up the accident dataset. |
| Post-Condition | A bar graph that shows accident types that involved alcohol. |
| Success Scenario | An adequately rendered bar graph that correctly shows the different accident types and how many of each were alcohol related. |
| Abort Scenario | Graphic rendered incorrectly and/or incorrectly displays proportion of alcohol related incidents. |

|  |  |
| --- | --- |
| Use Case ID | 5 |
| Use Case Name | Graphing accident fatalities overtime |
| Primary Actor | User |
| Secondary Actor | None |
| Description | Creating a bar graph that maps accident fatalities over each year. |
| Trigger | The user selects the fatalities keyword to be graphed over each year. |
| Pre-Condition | The user opens the software and loads up the accident dataset. |
| Post-Condition | A bar graph that shows the number of accident fatalities each year. |
| Success Scenario | The bar graph displays the correct numbers, and the graphic is rendered well. |
| Abort Scenario | Incorrect fatality numbers and/or the graphic does not display properly. |

# Software Design and System Components

## Software Design



## System Components

### Functions

Load Data function

* This function loads the Victoria state accident dataset to the program interface.
* The input is the crash statistics Victoria excel file which contains string, integer, and float data types.
* Variable names may be compressed or slightly altered.
* Returns the data from the dataset.

Tabulate function

* This function formats the requested data into table format.
* The input is the data to be tabulated usually a string data type.
* Variable names may be different in the table compared to the dataset file If the user requests it.
* Returns a table of the requested data.

Search function

* This function searches for a specific keyword in the dataset and retrieves entries containing the keyword.
* The input is a keyword which is a string data type.
* This function shouldn’t change any variables or have any side effects.
* Returns data with the selected keyword.

Bar chart Function

* This function formats the requested data into a bar graph.
* The input is the names of the bar graph axes (string) and the data to be graphed (string, integer, or float depending on what data is retrieved).
* This function shouldn’t have any side effects.
* The return value is the completed bar chart.

### Data Structures / Data Sources

The data structures in the software are:

* Lists, arrays, tuples
* These data structures will primarily be used in the tabulate function and the bar chart function.

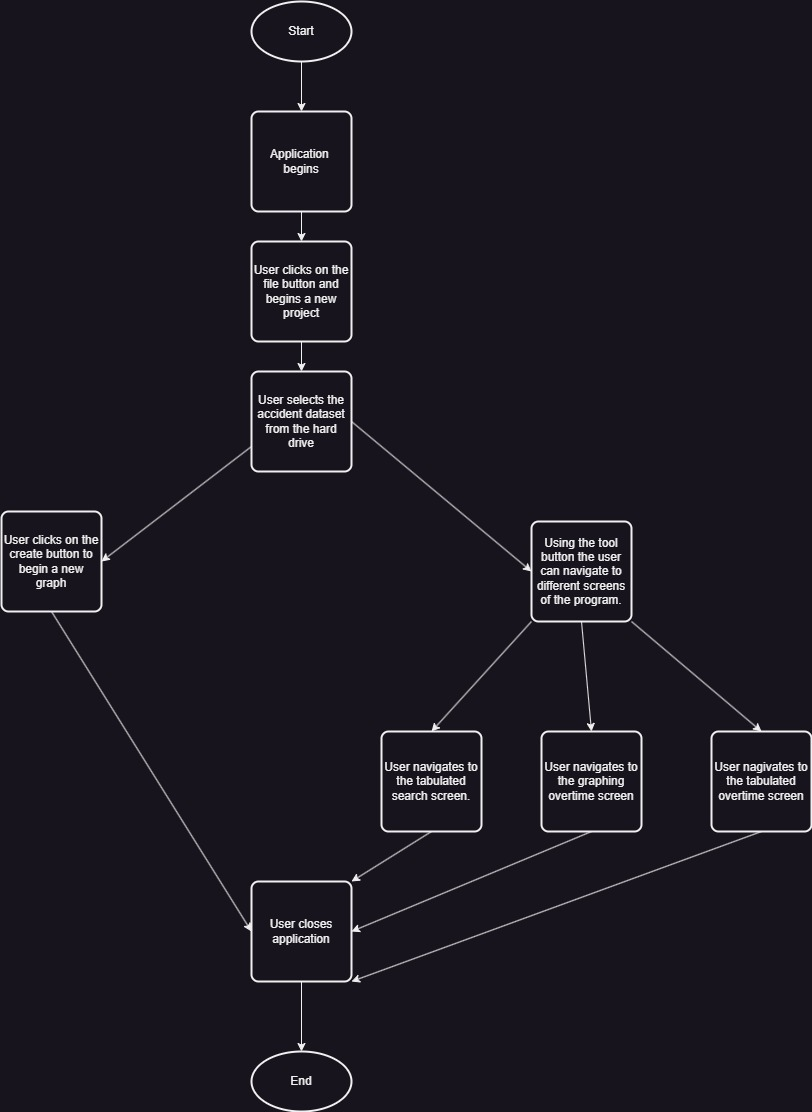
### Detailed Design

No non-standard algorithms that operate on data structures were used.

# User Interface Design

Draw.io was used to create the wireframes and flowcharts. The design goal for the interface was to make producing a graphical output as simple and easy as possible. To that end, the home screen was designed to enable the user to immediately start graphing the data as soon as possible. The two left-hand sections of the home screen enable the creation and editing of a bar graph. The right-hand section contains the bar graph itself and some minor font editing tools. To navigate to the other features of the program such as tabulation, the user needs to select the tools button. Some of these other screens also have graphing capabilities.

## Structural Design



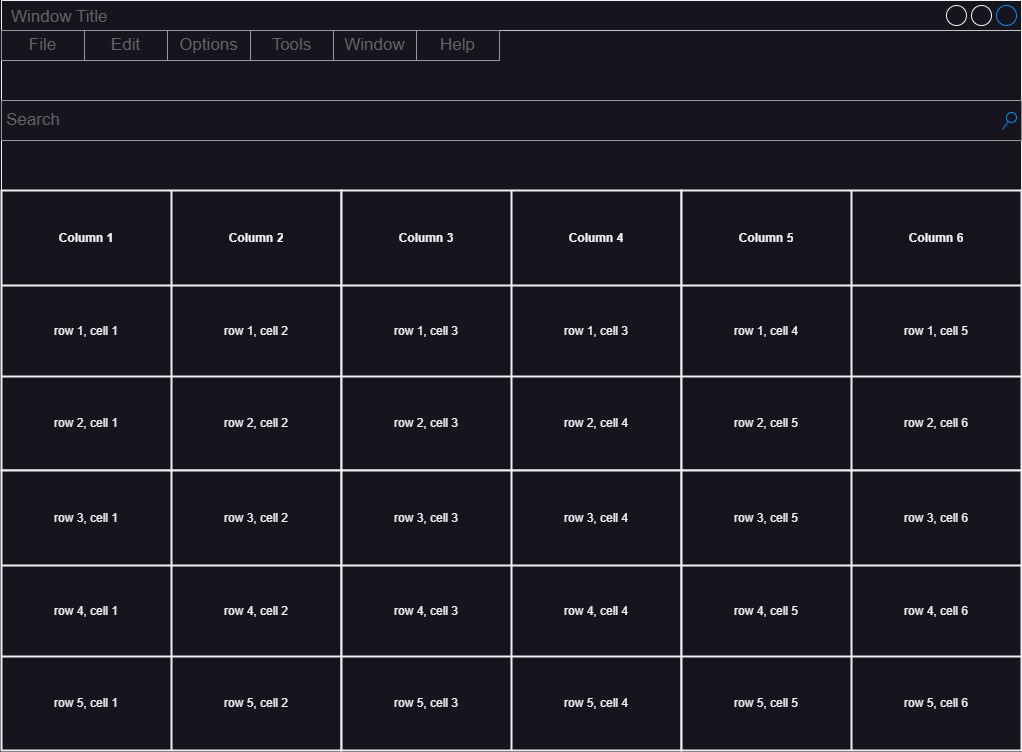
## Visual Design

Home Screen

A screenshot of a computer

Description automatically generated

Tabulated Search Screen.



Tabulated Overtime Screen

A screenshot of a computer

Description automatically generated

Graphing Overtime Screen

