# Hazard Analysis
# Greenway

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## Revision History

| Date | Version | Notes |
|---|---|---|
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# Contents

# 1 Introduction

## 1.1 Background

### 1.1.1 Scope

The scope of the proposed software, Greenway, is a mapping software that not only gives fuel efficient directions to the intended destination but provides the user with fuel cost calculations. The intention is to calculate fuel costs using gas price data, car mileage information and terrain information to show how much money it will take to get to the intended destination using the most fuel efficient route.

### 1.1.2 Document Purpose

The purpose of this document is to identify potential hazardous components of Greenway and methods to mitigate these risks to an acceptable level. The following sections describe details of potential hazards in depth for each subsystem which also helps to understand how the system works as a whole to avoid these hazards.

## 1.2 Overview

### 1.2.1 Scope of Hazard Analysis

The scope of the this document covers all individual components that build up the entire system. These components include the "Car Selection System", the "Destination Selection System", the "Route Calculation System", the "Terrain Data Collection System", the "Gas Price Collection System", and the "Fuel Cost Calculation System". The components mentioned each have their own safety considerations.

### 1.2.2 Definition of Hazard

Team Roadkill has defined hazard to be, "any aspect, property, or feature of Greenway which communicates incorrect information to the user or negatively impacts the user experience.".

# 2 Component Overview

The following is a description of each of Greenway's subsystems that make up the larger system.

## 2.1 Car Selection System

This component is responsible for allowing the user to input car data and collecting relevant car information, such as mileage.

### 2.2 Destination Selection System

This component lets the user input the desired destination.

### 2.3 Route Calculation System

This component is responsible for calculating the most fuel efficient route to the destionation selected by the user.

### 2.4 Terrain Data Collection System

This component is responsible for collecting terrain data and providing it to the fuel cost calculation component.

### 2.5 Gas Price Collection System

This component is responsible for collecting gas price data from local gas stations.

### 2.6 Fuel Cost Calculation System

This component is responsible for calculating fuel cost taking into consideration fuel mileage data, terrain data, and gas price data.

## 3 Safety Considerations

### 3.1 Car Selection System

**Issue 1:** Incorrect input

**Solution 1:** The system will allow the user to change the selected car. It will also allow the user to verify their selection before confirming it as there selected car.

**Issue 2:** Invalid input

**Solution 2:** The system will check if their car exists in the database, and will let the user enter a new car if their current selection isn't in the database.

**Issue 3:** Invalid data

**Solution 3:** The system will allow the user to verify if our estimate is sensible for their car. If it is not then the user can manually enter required data like mileage.

**Issue 4:** No internet connection

**Solution 4:** The system will prevent user input and indicate to the user that Internet connectivity is required for the functionality of the system.

### 3.2 Destination Selection System

**Issue 1:** Incorrect input

**Solution 1:** The system will allow the user to change the selected destination. It will also allow the user to verify their pick before confirming it as there selected destination.

**Issue 2:** Invalid input

**Solution 2:** The system will check if their destination is valid (reachable by car and exists on the map) before letting them set it as their desired destination.

**Issue 3:** No internet connection

**Solution 3:** The system will prevent user input and indicate to the user that Internet connectivity is required for the functionality of the system.

### 3.3 Route Calculation System

**Issue 1:** Invalid output

**Solution 1:** The system will validate the output with estimation tools built into to it ensure that the route is a acceptable range.

**Issue 2:** No internet connection

**Solution 2:** The system will prevent user input and indicate to the user that Internet connectivity is required for the functionality of the system.

**Issue 3:** Hidden Costs

**Solution 3:** The system will ensure that the user know only fuel efficiency is being used to calculate the given route and it does not necessarily ensure the cheapest route to take.

### 3.4 Terrain Data Collection System

**Issue 1:** Invalid output

**Solution 1:** The system will validate the output against an external database to ensure that the data is in an acceptable range.

**Issue 2:** No internet connection

**Solution 2:** The system will prevent user input and indicate to the user that Internet connectivity is required for the functionality of the system.

**Issue 3:** Extreme Weather

**Solution 3:** The system will ensure that the user knows weather conditions can make certain routes undesirable, and that they should do research before going on specific routes.

### 3.5 Fuel Cost Calculation System

**Issue 1:** Invalid output

**Solution 1:** The system will validate the output against an external database to ensure that the data is in a acceptable range.

**Issue 2:** No internet connection

**Solution 2:** The system will prevent user input and indicate to the user that Internet connectivity is required for the functionality of the system.

**Issue 3:** Fuel Cost changes

**Solution 3:** The system will ensure that the user knows when the application checked the fuel prices and that there might be certain inaccuracies with the estimation due to prices changing constantly.

## 4 FMEA Worksheet

## 5 Conclusion

In summary, it is important to realize the potential hazards of each function to avoid potential risks and negative experiences for the user. The above document contents highlight important safety considerations along with risks/failures for each function. This will ensure the program is developed with expected behaviour.

| Failure Mode and Effects Analysis | | | | | |
|---|---|---|---|---|---|
| **Design Function** | **Failure Modes** | **Causes of Failure** | **Effects of Failure** | **Detection** | **Recommended Actions** |
| Car Selection System | Invalid input | Users attempt to input a car that doesn't exist | No car is selected | The system check will fail. | Error message is provided telling the user that the car does not exist. |
| | Invalid data | Users attempt to put in information that is outside the scope of the vehicle | The car data will have bizarre measurements that will not match other cars' data | The system's sample range will fail. | Provide a message to tell the user to check the estimate and change required data if necessary |
| | No internet connection | Internet connection from the users' end is too weak | Unable to access the database that contains all the car data | The retrieval of data from the database will fail | Display an error message to the user that informs that they must be connected to the internet to use the system. |
| Destination Selection System | Incorrect input | Users inputs a destination which is not there intended destination. | User is shown the undesired destination | The confirmation screen will prompt up if the selected destination is correct, if incorrect the user will be select the option to say no. | The system will prompt and allow the user to change the selected destination. |
| | Invalid input | Users attempt to input a destination that is not reachable by car or does not exist on the map. | No destination is selected | The system will return an error to the user | Error message is provided telling the user that the destination is not reachable or the destination does not exist. |
| | No internet connection | Internet connection from the users' end is too weak | Unable to access destination and map information. | The retrieval of destination and map information will fail | Display an error message to the user that informs that they must be connected to the internet to use the system. |

Table 1: FMEA Table Part 1