Maintenance Manual

This maintenance manual serves as a guide to understanding, installing, and modifying StudentGreenTravel. It provides information for both developers using the unpackaged (code) version and users choosing the convenient packaged version of the software.

2.1 Installation and Execution

2.1.1 Packaged Version

1. Unzip the "StudentGreenTravel.zip" file in a directory of your choice.
2. Start the StudentGreenTravel application.

2.1.2 Code Version

1. Install Python.
2. Install Pip.
3. Start Command Line Prompt.
4. Navigate to the directory where you have stored the application folder.
5. Run the "`pip install -r requirements.txt`" command to install the system dependencies.
6. Run the "`calculator.py`" command to execute the application .

2.2 System Description

2.2.1 Hardware and Software Dependencies

The operation of each version of the application is dependent upon meeting the following requirements:

Packaged Version

- Operating System: Windows 10 or Windows 11
- File compression software: 7-Zip or WinRAR

Code Version

- Python 3.10 or newer
- geopy 2.4.1
- numpy 1.26.4
- pandas 2.1.4
- plotly 5.19.0
- PyQt6 6.6.1 and PyQt6_sip 13.6.0
- requests 2.31.0

2.2.2 Organization of System Files and Directories

Packaged Version

- `_internal` directory: Within this directory lie the `data`, `pictures`, and `icons`, housing their respective files that can be edited as needed, alongside all the application's components and packages.
- StudentGreenTravel.exe: the application .exe file

Code Version

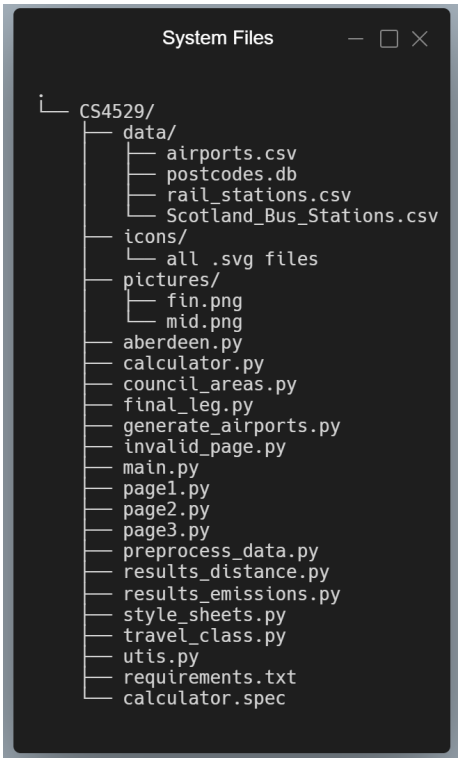

Figure 2.1: System Files in Code Version of StudentGreenTravel

2.2.3 Space and Memory Requirements

- Required Space: 1GB
- Required Memory (RAM): 700MB

2.3 Source Code Files

File	Functionality
aberdeen.py	Contains methods that calculate distances from a home postcode to the university, and divide students according to travel assumptions for transport methods.
calculator.py	Brings together all the features and initiates the program's operation through a class called Calculator.
council_areas.py	Deals with getting the admin district for a list of postcodes and then grouping them by the admin district. Also finds the percentage of postcodes in each admin district with respect to all postcodes for the country.
final_leg.py	Contains the functions to calculate the travel distance for the final leg of the journey of each mode of transport for the students from Scotland and the rest of the UK.
generate_airports.py	Used to generate the airports.csv file which contains only the public UK airports and their longitude and latitude.
main.py	Combines the functionality of the other Back End files and produces the final results.
preprocess_data.py	Contains the functions used to read and prepare the postcodes of students for calculations.
style_sheets.py	Contains the style sheets for the application and its widgets.
test_code.py	Tests the main functions of the project with the unittest framework.
travel_class.py	Holds the Travel class methods used to perform initial and middle leg travel distances calculations.
utils.py	Accommodates functions which are used in multiple other files.
page1.py	Holds the MainPage class which contains the initial menu page components.
page2.py	Holds the Page2 class which contains the middle leg page components.
page3.py	Holds the Page3 class which contains the final leg page components.
results_distance.py	The first final page which contains the webview for the plotly heatmaps and the other widgets for the results.
results_emissions.py	The second final page which contains the webview for the plotly heatmaps and the other widgets for the results.
invalid_page.py	Holds the invalid data page class along with the methods for identifying invalid data points.

Table 2.1: File Functionalities

2.4 Future Improvements

There are areas where the application can be further enhanced and expanded:

- The addition of visualizations of the routes chosen by students for their journeys. This could be implemented as a generalization for students from a certain country, or individual visualizations for each student. However, this may require additional data collection on student travel patterns.
- The software could be made cross-OS compatible. Currently, it does not function on Mac or Linux and the application could benefit from having dedicated versions for these operating systems. This could involve developing dedicated versions for these operating systems using new packaging methods, potentially opening doors for commercial use.
- Despite the tool providing detailed results on both country and council level, it might be a good addition to produce even more results. For instance, displaying council data on flights or offering even more graphical visualizations. This may require creating a new result page designs and developing new Back End methods.
- The software may benefit from larger data sets on transportation hubs and methods to improve the accuracy of distance calculations. For instance, there is a lack of data on Scottish bus stations, which could be addressed by utilizing an API.
- To prepare the product for a broader use beyond the University of Aberdeen, methods for calculating international travel distance could be implemented. However, this may require a major re-design and the utilization of an API for data retrieval.
- To achieve the last two suggestions for future work, the Google Maps API could be implemented to provide the needed data and distance measures. However, this requires additional funding as the API involves a fee for usage.

2.5 Bug Reports

There are three known bugs to the system:

1. Occasionally, during the initial data processing after clicking the ”Prepare Data” button on the initial menu, the system may be labeled as ”Not Responding.” Despite this, the system continues to function properly, and upon completion, it displays a confirmation message.
2. Similarly, when calculating distances and emissions after clicking the ”Calculate” button on the final leg assumptions page, the system may also be marked as ”Not Responding.” However, this issue does not impact any of its core functionalities.
3. Due to time and resource limitations, StudentGreenTravel is currently not signed by a certificate authority (CA). Consequently, Windows Defender may identify it as ”potentially unwanted software” because the publisher is ”Unknown”. This is a security measure and doesn’t indicate any malicious code within StudentGreenTravel. You can safely use the application.