GreenRoutes, By UWSpin – ECCE App Challenge, 2016

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Mission Statement

GreenRoutes is meant to inspire the public to reduce their carbon footprint by using alternative travel methods. It informs users of the carbon dioxide (CO_2) emissions released by each type of transportation: driving, bus, and cycling.

The app provides a tool to calculate the carbon dioxide emissions between the different transportation methods. Then it allows the user to navigate to their destination using the desired mode.

Background Information

Climate change has been a major issue throughout time, but it have been getting worse as more pollution is released and is affecting the climate all over the world including Canada. According to the (Natural Resource Canada, 2015), the amount of emission produced by vehicles was approximately 2.3 kg of carbon dioxide based on a National Inventory Report for the periods from 1990 – 2006. In comparison to the National Inventory Report from the period 1990 – 2013, the emission has increased in the Transport Sector under the guidelines of Intergovernmental Panel on Climate Change (IPCC) by 38% because of vehicle population increase and the distant travelled associated with the vehicle (Environmental and Climate Change Canada, 2015). The City of Waterloo Sustainability follows their mission statement is "Our environment and how we care for it is the most highly regarded characteristic of our city. This, combined with climate change, is making sustainability - acting today in a way that will not negatively affect tomorrow - a key direction for the City of Waterloo." (The City of Waterloo, 2015). Which is the reason our team have created an app that is able to make a difference and contribution to the sustainability sector in the City of Waterloo and slowly promote awareness of climate change.

Characteristic of the App

The application that our team (UWSpin) has created will be appealing to the many users across the City of Waterloo because it allows the user to simply input or geolocate their desired location and destination, and observe which type of transportation to use based on the emission outcome and the shortest route possible. The main factor that will attract users to this app will be mainly based on the idea of promoting awareness towards climate change and community sustainability in the City of Waterloo.

What makes this app interesting is that it allows any user to put a value to how much carbon they put into the atmosphere based on their favored travel method. The idea is that this will inspire users to use an alternative travel method after they see how much of an impact they can make. The application gives the user flexibility of using the app on any type of smartphone, tablet, or web browser.

The simple user interface allows the user to quickly navigate through the app to see both how they can change their carbon footprint, and how long an alternative method will change their travel time.

To Install This App

- Web users can type ____ into your internet browser.

- Mobile user can scan the QR code of the app on your mobile devices.

Functions

1. **Emission Calculator**

The Emission Calculator widget allows the user to select points on the map, typically their current location and their destination. The app will then process three routes for each type of transportation method; being an owned vehicle, a bus route, or walking/cycling. The user can then click or touch the different routes, and the app will give a pop-up which describes the amount of emissions that each route will emit, as well as the travel time of the route. After the user decides on their desired transportation method, they can then use one of the provided direction widgets to direct them through their route.

All emissions are calculated on a Gram per Kilometer basis and are estimates. They do not include time stopped on the route or driving habits. For vehicles, emissions are identified for cars, midsize vehicles such as SUVs and cross-over vehicles, and trucks. For the bus data, the emission estimate is based on a single person riding the bus.

For the bus route, because of the quality of the available bus network and time constraints, the routing aspect of the bus routes was not completed. However, an estimate of the emissions on the route was created by using the route lines. In future versions, the app would hopefully be able to incorporate the entire bus route and calculate travel times and directions for this network.

2. **Navigation**

There are three directional widgets. Each of them uses a custom network to route the user to their destination. The widgets include a driving widget, a cycling widget and a walking widget. Each has different rules and travel times to account for the differences in possible speeds. The driving widget uses the actual road network speeds, while the cycling and walking widgets use an average walking and cycling speed to calculate directions and travel time.

To use the directional widgets, the user ca either type addresses right into the widget location and destination fields, or click on the map for each of the two fields. For the current location field, the user can click a location icon next to the field, and the app will identify their location.

Assumptions

1. **Travel speed**

- The average walking speed is 4.2 km/h.

- The average cycling speed 15.5 km/h.
- Cars travel at the speed limit on every road.

2. **Fuel consumption**

CO2 emissions vary in different car classes. Thus, we chose the best-selling sedan, SUV and truck from 2015 as representatives.

Year	Make/ Mode	Year	Class	Eng. size/Cyl	Trans	Fuel	CO2 emission (g/km)
2015	Honda Civic	2015	C	1.8/4	AV	X	163
2010	Ford ESCAPE	2015	US	2.5/4	AS6	X	218
2010	Ford F-150 FFV 4X4	2015	PL	3.5/6	A6	X	285

We used the [public transport carbon footprint calculator](#) to estimate the CO2 emissions of buses. It is 98.7 g/km.

3. Network analysis

In road network analysis:

- No traffic jam
- No stop sign
- No waiting time

Cycling and walking are using the same network of roads except for highways. All local roads are assumed to be walkable and bikeable.

Limitations and Known Issues

Limitations

Data limitation

Available GRT bus routes and stops data could not support appropriate road network analysis due to the quality of the data. Therefore, only estimated roads and CO2 emissions are generated. The routing and travel time could not be calculated.

Data sources:

All data sources used in this app are open data.

- [Community Access Bikeshare Stations](#)
- [Transit - GRT Stops](#)
- [Transit - GRT Routes](#)

- City Boundary
- Road network: Ontario Road Network from Land Information Ontario
- Fuel consumption estimation using Fuel Consumption Ratings Search tool for Conventional Vehicles from Natural Resources Canada and Public Transport Carbon Footprint Calculator

References

Environmental and Climate Change Canada. (2015, April 17). National Inventory Report 1990-2013: Greenhouse Gas Sources and Sinks in Canada - Executive Summary. Retrieved from https://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=5B59470C-1&offset=3&toc=show

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