Project Plan

Abstract

The aim of this project is to create a simulated live train tracker for the London Underground service. I am doing this project as most train travel apps only show the predicted time the train is arriving but not where the train is on a map. This would be useful for a user using the website as normally at a train station the arrival time of trains scrolls on a tiny screen. The train the user may want to catch is not shown all the time. With this website the user can easily keep track of the train they wish to catch by tracking the train's movement or clicking on the train icon and viewing its timetable.

The completed project should be a website that uses the predicted train arrival times from the TFL API to calculate how far away a train is from a station. The estimated location of the train is then rendered as an image on a map. The map will show each tube line, each station and all the trains currently running rendered at their estimated location. Clicking on a station will show a timetable of predicted arrival times and highlight the rendered trains that are going to the station. Clicking on a train will bring up information detailing what station it is going to, tube line it is running on and predicted arrival time.

Reports

Basic web page development in HTML5: html, javascript, css

What html, css and javascript do separately. Explains how html css and javascript work together to create an interactive website. Why css and javascript are external files to html.

Advanced technologies: Django, Mapbox, Leaflet

Explain what a backend is. Why Django is being used and how it works. How Django uses server side scripting to create interactive websites. What Mapbox and Leaflet do and how they render a map differently. The pros and cons of each library and why I chose one over the other.

How I gathered the railway and station coordinates

The final program should show the actual locations of the tube lines. So I will have to search and filter the OpenStreetMap data to get this. I will explain the process I used to acquire this data.

Using TFL API data to calculate train location

Describe and explain the algorithm I will use that calculates where a train is based off the TFL arrival prediction times for each station.

Proof of concept programs

An interactive map Django application using Mapbox or Leaflet.

A Django application that will return the user a html page showing an interactive map when visiting a specific URL.

Render a map with tube lines and stations drawn over using Mapbox or Leaflet

Either using Mapbox or Leaflet, a map will be shown with coloured lines representing each tube line and station icons using data from the report *'How I gathered the railway and station coordinates'*.

Animate a train icon moving from the beginning of a tube line to the end

Using the coordinate data from OpenStreetMap a train icon will be placed at the beginning of a tube line and move towards the end following the exact railway data.

Use TFL API data to calculate a train location and place it on the map

Using the algorithm described in the report *'Using TFL API data to calculate train location'.* I will place a train icon at the location calculated. Then animate the train moving by assuming a certain train speed. Then every 30 seconds I will update the location based on calculating the TFL arrival predictions.

Timeline

Term 1

Week 3 (04/09/21)

04/09/21:
Start the report *Basic web page development in HTML5: html, javascript, css*.
Start the proof of concept program *An interactive map Django application using Mapbox or Leaflet.*

Week 4 (11/10/21)

11/10/21
Deliver the report *Basic web page development in HTML5: html, javascript, css*.
Deliver the proof of concept program *An interactive map Django application using Mapbox or Leaflet.*
Start the report *Advanced technologies: Django, Mapbox, Leaflet.*

Week 5 (18/10/21)

23/10/21
Deliver the report *Advanced technologies: Django, Mapbox, Leaflet.*
Start the report *How I gathered the railway and station coordinates.*

Week 6 (25/10/21)

25/10/21
Start the proof of concept program *Render a map with tube lines and stations drawn over using Mapbox or Leaflet*

Week 7 (1/11/21)

6/11/21
Deliver the report *How I gathered the railway and station coordinates.*
Deliver the proof of concept program *Render a map with tube lines and stations drawn over using Mapbox or Leaflet.*
Start the proof of concept program *Animate a train icon moving from the beginning of a tube line to the end.*

Week 8 (8/11/21)

13/11/21
Deliver the proof of concept program *Animate a train icon moving from the beginning of a tube line to the end.*
Start the report *Using TFL API data to calculate train location.*

Week 9 (15/11/21)

18/11/21
Start the proof of concept program *Use TFL API data to calculate a train location and place it on the map.*

Week 10 (22/11/21)

24/11/21
Deliver the report *Using TFL API data to calculate train location.*

Week 11 (28/11/21)

30/11/21

Deliver the proof of concept program *Use TFL API data to calculate a train location and place it on the map.*

Term 2

21/01/22

Website shows a map with all tube lines, stations and estimated train locations rendered in. The train icons don't move.

04/02/22

All train icons move along their specific tube line. No update from server, assumed train speed.

11/02/22

Website gets the most recent predicted arrival times from the server to update estimated train locations to be more accurate. This is done every 30 seconds.

25/02/22

Clicking on a train icon will show information about that train. This can include the next station, predicted time and current location.

3/03/22

Clicking on a station shows additional information such as entrance points and platforms

07/03/22

Clicking on a station will highlight all trains going towards it. If a disruption has occurred it will be shown as well.

15/03/22

The train icons are now a 3d model representing a train.

17/03/22

Train model is coloured based on what line it serves.

18/03/22

If a train is late the model will be highlighted to reflect that additionally hovering over it will show how late it is

19/03/22

Map changes colour based on time of day.

20/03/22

Fix bugs and optimise performance.

Material / References

https://traintimes.org.uk/map/tube/
https://github.com/dracos/underground-live-map
A website that is similar to the project I am making. It shows the live train positions of all tube lines however the tube railway tracks displayed just connect stations in a straight line. I looked through the source code on github, helped me find out about Leaflet.

https://minitokyo3d.com/
https://github.com/nagix/mini-tokyo-3d
A similar website to what I am making however shows the live train positions in tokyo. Looking through the source code of this let me find out that Mapbox has their own API that is more powerful than Leaflet. Also assured me that showing the actual railway lines is possible.

https://overpass-turbo.eu/
https://www.openstreetmap.org/
Overpass turbo is a website that uses the overpass api which allows me to query OpenStreetMap data for specific queries. This let me research how I will get the railway line data and plan for future problems using this data.

https://www.goodreads.com/book/show/6988746-html5
Html5: Up and Running: Dive Into the Future of Web Development. Main book used to help me understand how Html5 works. Will help me in developing the website.

Risks

TFL API rate limit

I have signed up for an account with TFL API and have yet to receive my API key and API ID. If I can't get these then I will be rate limited to 50 requests per minute. This will not be enough to query all stations in the underground service every minute. Therefore I will change the layout of the website such that there's a menu to choose which tube line to show. This decreases the amount of requests needed keeping in line with the limit.

Mapbox tile limit

In the unlikely case I go over 50,000 page loads for vector tiles or 200,000 raster tile images per month, I will run out of free tile requests and have to pay. If this is the case I will change the server I use to retrieve these tiles and use the completely free service from OpenStreetMap.

Poor performance

If the javascript I write for this website is very badly optimised. The browser may be unable to render all trains on a map. If this happens then I will change from displaying all trains to only trains for a chosen line. Same solution as the TFL API rate limit risk.