**Appendices**

**Appendix 1: Project Management**



**Project Gantt Chart**

**Appendix 2:**

**Different database engines available in AWS RDS**

A screenshot of a computer

Description automatically generated

**Appendix 3**

**Connection of the AWS Database instance to MySQL Workbench**

A diagram of a computer

Description automatically generated

**Appendix 4**

**User Manual**

To use the App, Users need to do the following:

* Open the Anaconda prompt from the start menu of a computer.
* Type the command:

Streamlit run streamlit\_app.py

The web-based Streamlit application will start running. The Internet must be on for the application to come up.

**Appendix 5**

**Technical Manual**

* Install Visual Studio code on your Computer.
* **Upload the test.json and the Streamlit app code in Appendix 6 and Appendix 7, respectively.**
* Install the required Python libraries through the Visual Studio code terminal using the command:

**pip install streamlit pandas folium streamlit\_folium numpy**

* Open the Anaconda prompt and run the command line:

**streamlit run streamlit\_app.py**

when this is executed, the Streamlit application will display the map of preloaded historical event(s) in a simulated format.

**Appendix 6**

**Python code for Streamlit application**

import streamlit as st

import pandas as pd

import folium

from streamlit\_folium import folium\_static

import numpy as np

# 'test.json' is initially loaded into 'df'

# Data Loading process

df = pd.read\_json('test.json')

# This code portion converts 'Month' from name to number to ensure consistency

df['Month'] = pd.to\_datetime(df['Month'], format='%B').dt.month

# This ensures that 'Day' and 'Year' are zero-padded and for correct handling

df['Day'] = df['Day'].apply(lambda x: f"{x:02d}")

df['Year'] = df['Year'].apply(lambda x: f"{x}" if len(str(x)) == 4 else f"20{x}")

# This code portion below attempts to combine and parse the DateTime column

try:

    df['DateTime'] = pd.to\_datetime(df[['Year', 'Month', 'Day']].astype(str).agg('-'.join, axis=1) + ' ' + df['Time'])

except ValueError as e:

    st.error(f"Error parsing DateTime: {e}")

# This creates the sidebar used for selecting events

option = st.sidebar.radio('Choose an event:', df['BattleName'].unique())

# This helps to filter data depending on the selected event

filtered\_data = df[df['BattleName'] == option]

# The function below helps to display map markers and lines for different RouteID

def display\_map(data):

    m = folium.Map(location=[20, -100], zoom\_start=4)

    # This gives various colors for the different RouteIDs

    colors = ['red', 'blue', 'green', 'purple', 'orange', 'darkred',

              'lightred', 'beige', 'darkblue', 'darkgreen', 'cadetblue',

              'darkpurple', 'white', 'pink', 'lightblue', 'lightgreen',

              'gray', 'black', 'lightgray']

    # The code line below groups by RouteID and also draw lines

    for route\_id, group in data.groupby('RouteID'):

        color = colors[route\_id % len(colors)]  # This Cycles through colors if more RouteIDs than colors

        locations = group[['Latitude', 'Longitude']].values

        folium.PolyLine(locations, color=color, weight=2.5, opacity=1).add\_to(m)

        # The code line below helps to add markers

        for \_, row in group.iterrows():

            folium.Marker([row['Latitude'], row['Longitude']],

                          popup=f"{row['KeyEventNotes']}",

                          tooltip=f"Time: {row['DateTime']}").add\_to(m)

    if not data.empty:

        locations = data[['Latitude', 'Longitude']]

        m.fit\_bounds([[locations['Latitude'].min(), locations['Longitude'].min()],

                      [locations['Latitude'].max(), locations['Longitude'].max()]])

    folium\_static(m)

# The code section below helps to handle various functionalities based on users preferred selection

view\_option = st.sidebar.radio("View Options:", ["Select KeyEventNote", "Show All KeyEventNotes", "Select Time"], key='view\_option')

if view\_option == "Select KeyEventNote":

    key\_event\_note\_select = st.sidebar.selectbox("Select KeyEventNote:", filtered\_data['KeyEventNotes'].unique(), key='key\_event\_select')

    selected\_data = filtered\_data[filtered\_data['KeyEventNotes'] == key\_event\_note\_select]

    display\_map(selected\_data)

elif view\_option == "Show All KeyEventNotes":

    display\_map(filtered\_data)

elif view\_option == "Select Time":

    time\_options = filtered\_data['DateTime'].dt.strftime('%Y-%m-%d %H:%M:%S').sort\_values().unique()

    selected\_time = st.sidebar.select\_slider('Select Time:', options=time\_options, key='time\_select')

    selected\_data = filtered\_data[filtered\_data['DateTime'].dt.strftime('%Y-%m-%d %H:%M:%S') == selected\_time]

    display\_map(selected\_data)

**Appendix 7**

**test.json**

[

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 1,

        "LocationName": "Pertland Firth",

        "Latitude": 58.37,

        "Longitude": -2.475,

        "KeyEventNotes": "One German Submarine Around Pertland Firth which was not yet sighted by british forces",

        "Time": "23:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 30,

        "CountryEnRoute": "Germany"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.756,

        "Longitude": -2.698,

        "KeyEventNotes": "Grand Fleet leaves Scapa Flow and sails forward towards Jutland AREA",

        "Time": "10:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.853,

        "Longitude": -1.754,

        "KeyEventNotes": "Grand Fleet advances forward",

        "Time": "02:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.822,

        "Longitude": -1,

        "KeyEventNotes": "Grand Fleet advances forward",

        "Time": "03:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.702,

        "Longitude": -0.63,

        "KeyEventNotes": "Grand Fleet advances forward",

        "Time": "04:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.651,

        "Longitude": 0,

        "KeyEventNotes": "Grand Fleet advances forward",

        "Time": "05:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.633,

        "Longitude": 0.42,

        "KeyEventNotes": "Grand Fleet advances forward",

        "Time": "06:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.59,

        "Longitude": 0.71,

        "KeyEventNotes": "Grand Fleet advances forward",

        "Time": "07:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.51,

        "Longitude": 1,

        "KeyEventNotes": "Grand Fleet advances forward",

        "Time": "08:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.39,

        "Longitude": 1.64,

        "KeyEventNotes": "Grand Fleet advances forward",

        "Time": "09:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.27,

        "Longitude": 2,

        "KeyEventNotes": "Grand Fleet advances forward",

        "Time": "10:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.16,

        "Longitude": 2.63,

        "KeyEventNotes": "Grand Fleet advances forward",

        "Time": "11:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.09,

        "Longitude": 2.87,

        "KeyEventNotes": "Grand Fleet advances forward",

        "Time": "11:45:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 3,

        "LocationName": "On Sea",

        "Latitude": 57.45,

        "Longitude": -1.47,

        "KeyEventNotes": "German Submarines around Cromarty area whose location is not yet known to british forces",

        "Time": "11:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 30,

        "CountryEnRoute": "Germany"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.09,

        "Longitude": 2.87,

        "KeyEventNotes": "British Second Battle Squadron Joins THE Grand fleet to increase the fleet size",

        "Time": "11:45:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58.02,

        "Longitude": 3,

        "KeyEventNotes": "British Second Squadron and Grand fleet sail together",

        "Time": "12:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 58,

        "Longitude": 3.65,

        "KeyEventNotes": "British Second Squadron and Grand fleet advances",

        "Time": "13:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 57.91,

        "Longitude": 4,

        "KeyEventNotes": "British Second Squadron and Grand fleet advances",

        "Time": "14:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 57.81,

        "Longitude": 4.31,

        "KeyEventNotes": "British Second Squadron and Grand fleet advances",

        "Time": "15:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 57.5,

        "Longitude": 5,

        "KeyEventNotes": "British Second Squadron and Grand fleet advances while responding to fire from lutzow german fleet",

        "Time": "16:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 57.41,

        "Longitude": 5.2,

        "KeyEventNotes": "British Second Squadron and Grand fleet advances",

        "Time": "17:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 56.699997,

        "Longitude": 5.866663,

        "KeyEventNotes": "British Second Squadron and Grand fleet arrives at battle area",

        "Time": "18:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 57.85,

        "Longitude": -4,

        "KeyEventNotes": "British Second battle squadron leaves Croamarty Moray Firth",

        "Time": "09:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 57.81,

        "Longitude": -2.45,

        "KeyEventNotes": "British Second battle squadron advances",

        "Time": "10:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 57.79,

        "Longitude": -1.85,

        "KeyEventNotes": "British Second battle squadron advances",

        "Time": "02:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 57.75,

        "Longitude": -1.33,

        "KeyEventNotes": "British Second battle squadron advances",

        "Time": "03:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 57.87,

        "Longitude": -0.88,

        "KeyEventNotes": "British Second battle squadron advances",

        "Time": "04:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 58,

        "Longitude": 0,

        "KeyEventNotes": "British Second battle squadron advances",

        "Time": "05:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 58.01,

        "Longitude": 0.345,

        "KeyEventNotes": "British Second battle squadron advances",

        "Time": "06:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 58.05,

        "Longitude": 0.893,

        "KeyEventNotes": "British Second battle squadron advances",

        "Time": "07:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 58.22,

        "Longitude": 1.33,

        "KeyEventNotes": "British Second battle squadron advances",

        "Time": "08:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 58.06,

        "Longitude": 1.85,

        "KeyEventNotes": "British Second battle squadron advances",

        "Time": "09:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 58.09,

        "Longitude": 2.32,

        "KeyEventNotes": "British Second battle squadron advances",

        "Time": "10:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 4,

        "LocationName": "On Sea",

        "Latitude": 58.16,

        "Longitude": 2.63,

        "KeyEventNotes": "British Second battle squadron advances and Joins the Grand fleet",

        "Time": "11:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 5,

        "LocationName": "On Sea",

        "Latitude": 56,

        "Longitude": -2.25,

        "KeyEventNotes": "One German Submarine Around Pertland Firth which was not yet sighted by british forces",

        "Time": "11:30:00",

        "Year": 1916,

        "Month": "May",

        "Day": 30,

        "CountryEnRoute": "Germany"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 6,

        "LocationName": "On Sea",

        "Latitude": 56.19,

        "Longitude": -2.73,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron advances",

        "Time": "10:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 6,

        "LocationName": "On Sea",

        "Latitude": 56.34,

        "Longitude": -2,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron advances",

        "Time": "01:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 6,

        "LocationName": "On Sea",

        "Latitude": 56.39,

        "Longitude": -1.42,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron advances",

        "Time": "02:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 6,

        "LocationName": "On Sea",

        "Latitude": 56.45,

        "Longitude": -1,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron advances",

        "Time": "03:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 6,

        "LocationName": "On Sea",

        "Latitude": 56.47,

        "Longitude": -0.35,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron advances",

        "Time": "04:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "RouteID": 6,

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        "Latitude": 56.49,

        "Longitude": 0.869,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron advances",

        "Time": "05:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "BattleName": "Battle Of Jutland",

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        "LocationName": "On Sea",

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        "Longitude": 0.972,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron advances",

        "Time": "06:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "Longitude": 1.315,

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        "Time": "07:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "BattleName": "Battle Of Jutland",

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        "Longitude": 1.69,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron advances",

        "Time": "08:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "Longitude": 2.212,

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        "Time": "09:00:00",

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        "Day": 31,

        "CountryEnRoute": "Britain"

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        "Longitude": 2.83,

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        "Time": "10:00:00",

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        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "RouteID": 6,

        "LocationName": "On Sea",

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        "Longitude": 3.24,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron advances",

        "Time": "11:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "Longitude": 3.71,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron advances",

        "Time": "12:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "Longitude": 4.46,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron advances",

        "Time": "13:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "Longitude": 5,

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        "Time": "14:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "RouteID": 6,

        "LocationName": "On Sea",

        "Latitude": 56.699997,

        "Longitude": 5.866663,

        "KeyEventNotes": "Battle Cruiser Fleet and 5th Battle Squadron at Battle Area",

        "Time": "14:30:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "RouteID": 7,

        "LocationName": "On Sea",

        "Latitude": 58.735,

        "Longitude": 4.36,

        "KeyEventNotes": "German Battle Cruiser fleet Lützow not yet sighted and sailing",

        "Time": "23:30:00",

        "Year": 1916,

        "Month": "May",

        "Day": 30,

        "CountryEnRoute": "Germany"

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        "BattleName": "Battle Of Jutland",

        "RouteID": 7,

        "LocationName": "On Sea",

        "Latitude": 57.43,

        "Longitude": 4.44,

        "KeyEventNotes": "German Battle Cruiser fleet Lützow  sighted by the Grand Fleet Crew",

        "Time": "15:41:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Germany&Britain"

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        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 57.39,

        "Longitude": 4.61,

        "KeyEventNotes": "British Ship Lion Opens Fire on Enemy Battle Ship Lutzow",

        "Time": "15:48:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 7,

        "LocationName": "On Sea",

        "Latitude": 57.22,

        "Longitude": 4.63,

        "KeyEventNotes": "German Battle Cruiser fleet Lützow  opens fire",

        "Time": "16:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Germany"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 57.2,

        "Longitude": 4.69,

        "KeyEventNotes": "British Ship, Indefatigable hit by salvo from German ship, Von der Tann in the fleet lutzow as it is firing and advancing, magazine exploded; ship sunk by another salvo.",

        "Time": "16:06:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "BattleName": "Battle Of Jutland",

        "RouteID": 7,

        "LocationName": "On Sea",

        "Latitude": 57.14,

        "Longitude": 4.72,

        "KeyEventNotes": "Destroyer action; two German T.B.D.s sunk;",

        "Time": "16:15:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Germany"

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        "BattleName": "Battle Of Jutland",

        "RouteID": 7,

        "LocationName": "On Sea",

        "Latitude": 57.09,

        "Longitude": 4.75,

        "KeyEventNotes": "Nesor and Nomad disabled; sunk later by German Battle Fleet",

        "Time": "16:20:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 57.02,

        "Longitude": 4.81,

        "KeyEventNotes": "Queen Mary hit by salvo from Derfflinger; magazine exploded; ship sunk.",

        "Time": "16:26:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 56.92,

        "Longitude": 5.79,

        "KeyEventNotes": "British battle cruisers again in touch with German ships. Lion fired 15 salvoes during next 10 minutes.",

        "Time": "17:42:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "",

        "Latitude": 56.82,

        "Longitude": 5.79,

        "KeyEventNotes": "German battle cruisers sank British Defence Ship and damaged Warrior.",

        "Time": "18:16:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 56.79,

        "Longitude": 5.65,

        "KeyEventNotes": "British 3rd Battle Cruiser Squadron – Invincible , Inflexible, Indomitable, Canterbury and Chester jointly attacked German T.B.D. Shark and sank it.",

        "Time": "18:20:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 56.74,

        "Longitude": 5.51,

        "KeyEventNotes": "Invincible, under repeated salvoes, notably from Derfflinger, blew up and sank.",

        "Time": "18:30:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 7,

        "LocationName": "On Sea",

        "Latitude": 56.72,

        "Longitude": 5.61,

        "KeyEventNotes": "German Battle Cruiser line Lützow hauled away badly damaged; Derfflinger ceased fire.",

        "Time": "18:33:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Germany"

    },

    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 56.7,

        "Longitude": 5.63,

        "KeyEventNotes": "British Ship Marlborough torpedoed, but continued in action",

        "Time": "18:54:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": ""

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        "RouteID": 2,

        "LocationName": "On Sea",

        "Latitude": 56.69,

        "Longitude": 5.79,

        "KeyEventNotes": "British ships held their targets under intermittent but effective fire. German Fleet turning westward.",

        "Time": "19:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain"

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        "BattleName": "Battle Of Jutland",

        "RouteID": 8,

        "LocationName": "On Sea",

        "Latitude": 56.69,

        "Longitude": 5.83,

        "KeyEventNotes": "German T.B.D. V48 sunk by British gunfire.",

        "Time": "19:05:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": ""

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    {

        "BattleName": "Battle Of Jutland",

        "RouteID": 8,

        "LocationName": "On Sea",

        "Latitude": 56.69,

        "Longitude": 5.84,

        "KeyEventNotes": "German torpedo attack successfully dealt with by British light forces.",

        "Time": "19:25:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": ""

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        "BattleName": "Battle Of Jutland",

        "RouteID": 9,

        "LocationName": "On Sea",

        "Latitude": 56.69,

        "Longitude": 5.85,

        "KeyEventNotes": "German battle cruisers broke off action; Derfflinger on fire.",

        "Time": "19:37:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Germany"

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        "RouteID": 9,

        "LocationName": "On Sea",

        "Latitude": 56.69,

        "Longitude": 5.87,

        "KeyEventNotes": "German T.B.D. S35 sunk by British 12th Flotilla.",

        "Time": "19:50:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Britain &Germany"

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        "Latitude": 56.699997,

        "Longitude": 5.866663,

        "KeyEventNotes": "German ships gradually turns away.",

        "Time": "19:59:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": ""

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        "Latitude": 54.25,

        "Longitude": 7.95,

        "KeyEventNotes": "German fleet leaves helligoland and advances towards Jutland war location",

        "Time": "05:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Germany"

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        "LocationName": "On Sea",

        "Latitude": 55,

        "Longitude": 7.23,

        "KeyEventNotes": "German fleet advances",

        "Time": "10:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Germany"

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        "KeyEventNotes": "German fleet  advances",

        "Time": "11:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

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        "KeyEventNotes": "German fleet  advances",

        "Time": "14:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Germany"

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        "Time": "15:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Germany"

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        "Longitude": 6.17,

        "KeyEventNotes": "German fleet  advances",

        "Time": "16:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Germany"

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        "Longitude": 6,

        "KeyEventNotes": "German fleet  advances",

        "Time": "17:00:00",

        "Year": 1916,

        "Month": "May",

        "Day": 31,

        "CountryEnRoute": "Germany"

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        "RouteID": 9,

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        "Latitude": 56.699997,

        "Longitude": 5.866663,

        "KeyEventNotes": "German fleet  advances",

        "Time": "18:00:00",

        "Year": 1916,

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        "Day": 31,

        "CountryEnRoute": "Germany"

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    {

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        "RouteID": 1,

        "LocationName": "On Sea",

        "Latitude": 19.39,

        "Longitude": -99.28,

        "KeyEventNotes": "beautiful translucent white cloud that showed a carmine red background spreading throughout the northwest, which was divided into various groups with growing intensities",

        "Time": "07:00:00",

        "Year": 1859,

        "Month": "September",

        "Day": 2,

        "CountryEnRoute": "Mexico"

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        "BattleName": "Aurora Sighting",

        "RouteID": 1,

        "LocationName": "On Sea",

        "Latitude": 20.61,

        "Longitude": -100.48,

        "KeyEventNotes": "Beautiful aurora moving",

        "Time": "05:40:00",

        "Year": 1859,

        "Month": "September",

        "Day": 2,

        "CountryEnRoute": "Mexico"

    },

    {

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        "RouteID": 1,

        "LocationName": "On Sea",

        "Latitude": 20.67,

        "Longitude": -103.4,

        "KeyEventNotes": "Beautiful aurora moving",

        "Time": "05:00:00",

        "Year": 1859,

        "Month": "September",

        "Day": 2,

        "CountryEnRoute": "Mexico"

    },

    {

        "BattleName": "Aurora Sighting",

        "RouteID": 1,

        "LocationName": "On Sea",

        "Latitude": 20.5,

        "Longitude": -100.05,

        "KeyEventNotes": "Beautiful aurora moving",

        "Time": "05:00:00",

        "Year": 1859,

        "Month": "September",

        "Day": 2,

        "CountryEnRoute": "Mexico"

    },

    {

        "BattleName": "Aurora Sighting",

        "RouteID": 1,

        "LocationName": "On Sea",

        "Latitude": 20.87,

        "Longitude": -102.01,

        "KeyEventNotes": "observations of oscillations of magnetic needles suggesting a strong magnetic disturbance, no failures in the telegraph network",

        "Time": "05:30:00",

        "Year": 1859,

        "Month": "September",

        "Day": 2,

        "CountryEnRoute": "Mexico"

    },

    {

        "BattleName": "Aurora Sighting",

        "RouteID": 1,

        "LocationName": "On Sea",

        "Latitude": 19.99,

        "Longitude": -101.04,

        "KeyEventNotes": "Beautiful aurora moving",

        "Time": "05:50:00",

        "Year": 18,

        "Month": "September",

        "Day": 2,

        "CountryEnRoute": "Mexico"

    },

    {

        "BattleName": "Aurora Sighting",

        "RouteID": 1,

        "LocationName": "On Sea",

        "Latitude": 22.11,

        "Longitude": -101.03,

        "KeyEventNotes": "Beautiful aurora moving",

        "Time": "06:05:00",

        "Year": 1859,

        "Month": "September",

        "Day": 2,

        "CountryEnRoute": "Mexico"

    }

]

**Appendix 7**

**Python Code for Streamlit application**