Integrated Project 2 (IP2) ALC: Project Specification May 2020

1 Introduction

Students will work in groups and will undertake the following tasks over one trimester: Analysis, design, implementation, test and evaluation of a web application that accesses a range of online data sources; specific extracts of these data sources are to be represented within the web application, including the use of Google Maps and other visualisations that represent the transformation of data into useful human-readable information.

It is suggested that students undertake the following tasks in the order presented:

- Read this document.
- Run the code examples and examine them in detail.
- Re-read this document.

1.1 Technologies

Technologies to be used include HTML, CCS, JavaScript (including JQuery and Google Maps libraries). Some aspects of coding are supported by detailed example code with explanatory comments, as well as online tutorial/documentation sources. The web application is to be implemented with client-side code (JavaScript) and makes API calls to access data from external sources; no server-side code is required.

1.2 Deliverables for This module

The following deliverables are required.

- A deployed application on a web host, that is accessible by academic staff. See Section 2.1 below.
- A group Report and the web application (70% of total assessment)
    - 30 (this is minimum page count) to 40 pages, including appendices. Font size 11. No penalty for exceeding page count. Delivered Friday of Week 12
    - The report structure will be specified soon.
- Individual student reflective report (20% of total assessment)
    - 2100 words +/- 10%. Work that is greater than 10% over the word limit specified will have 10% deducted from the mark.
    - Delivered Friday of Week 12
    - The report structure will be specified soon.
- Presentation (10% of total assessment)
    - 10 minutes PowerPoint presentation (overview of design and implementation) and 10 minutes demonstration of the web-application. Up to 10 minutes of questions on analysis, design and implementation, including aspects of HCI and technology. Delivered in Week 13 by Collaborate Ultra on GCU Learn; no setup required to use this.

1.3 Structure of the specification document

The remainder of this specification document has the following sections:

- A specification of the required content of the web application
- A brief introduction to the GeoJSON format used by the earthquake data sources
- An introduction to the data sources (earthquake data and weather data); this is map-based. Students will also select another two data sources of their own choice, to use with other types of visualisations (**not** map-based).

- A set of code examples to introduce the following:
    - Loading data sources
    - Processing the data sources to extract specific data content
    - Using Google Maps
        - Loading a map
        - Placing and labelling markers on the map
        - Creating marker pop-up infoWindow content
        - Executing code when a marker is clicked
        - Creating clusters (groups) of markers when they are close to each other on a map.
    - Dynamic creation of buttons on web pages. The buttons are configured to load specific data sources. Your application can use these or dropdown lists as an alternative.

2 Specification

The specification includes an overview and details of the features required.

2.1 Overview

The web application will comprise a set of web pages and a menu to allow the user to access these pages. The styling and layout of the web application is to be defined by the student groups. The web application can be deployed on a web server (including GitHub Pages) or can be run locally (since it does not require any back-end code).

The application must have the following pages:

- An overview page that explains the purpose of the application
- An author page that provides a brief introduction to each of the group members
- A page that introduces GeoJSON
  - This should include (a) a narrative overview and (b) links to useful external web pages that explain the GeoJSON format in detail
- An Earthquake mapping page with a set of buttons (or dropdowns) and a map. The buttons or dropdowns allow the user to select different feeds that are to be displayed on the map.
- A Weather page that allows a user to enter a place name and to view a five-day weather forecast for that location.
- Two additional (non-map-based) pages that are based upon data selected by the student group (by undertaking some web search for appropriate data sources). These pages should show interesting visualisations of two data-sets that each represent some current activity within the world.

2.2 Detailed Specification

2.2.1 Sample Code

Sample code is discussed in Section 6 for Google Maps, earthquake and weather data sources.

2.2.2 API Keys

In order to run the example code and also run your own code, you will need to register for the following API keys :

- Google Maps: https://developers.google.com/maps/documentation/javascript/get-api-key
  - Note that we will organise vouchers from Google to allow you to use this for no cost.
- Weather data from weatherstack.com [1]. Register for the free service. See Section 4.2 below

You will need to use your own API keys in the sample code provided. Once you have your keys, just do a search in the supplied HTML example source code files for the following keywords:

- YOUR-GOOGLE-MAPS-API-KEY (search for this)
  - In files: IP2_Map1.html, IP2_Map2.html, IP2_Map3.html, IP2_Map4.html, IP2_Map5.html
  - Replace ‘YOUR-GOOGLE-MAPS-API-KEY’ with your own Google Maps API key
- YOUR-WEATHERSTACK-KEY (search for this)
  - In files: IP2_Map5.html

  - Replace 'YOUR-WEATHERSTACK-KEY with your own weatherstack.com key

2.2.3 Web Page General

Try to make the layout responsive if you have implemented responsive layouts previously.
Try to fit content so as to not have the pages scrolling.
The menu should be in a regular format/position for each web page.

2.2.4 Overview Page

This should include a narrative that explains the purpose and content of the IP2 Project. It can include a link to a version of the project specification document in a suitable web-readable format (such as PDF).

2.2.5 Author Page

A brief bio (including technical interests) for each student in the group. Include photos if you like (not obligatory).

2.2.6 GeoJSON Overview

Create a narrative introduction to GeoJSON so that a reader who does not already know about this can gain a basic understanding.
In addition, provide a set of links to a range of external tutorial pages that provide more detailed information about GeoJSON.

2.2.7 Earthquake Mapping Page

To gain the fundamental understanding of the programming methods to be used on this page, students should refer to the example code discussed in section 6 of this report. You will find examples of all aspects that are required for your web application. You need to integrate these to implement the pages as specified below.

The Earthquake Mapping page should comprise the following:

- **Possibility-1**: A set of dynamically created buttons to select all feeds that are available from the following page:
  https://earthquake.usgs.gov/earthquakes/feed/v1.0/geojson.php
  - See the code example: IP2_Map6.html . You will have to extend the number of buttons to cover all the groups ('Past Hour', 'Past Day', etc) and the individual items for each group ('Significant Earthquakes', 'M4.5+ Earthquakes', etc).
- **Possibility-2:** Use dropdown lists to select the feeds listed above, instead of buttons.
- A Google Map that is freshly populated by clicking any button (or selecting from dropdown list)
  - Must include clustered markers
    - See examples: IP2_Map4.html
  - Must include an infoWindow for each marker.
    - The infoWindow has the content that is included in example: IP2_Map3.html.
    - In addition, the infoWindow should contain a link to any other data source that can be indexed by lat/lon.

2.2.8 Weather Page

This page should allow the user to enter the name of a location. The page then displays a five-day weather feed.
For each day this should include:
(a) a graphic image (supplied by the weatherstack.com feed),
(b) as much useful information that you can find from the data returned within the weather feed. See a typical layout by exploring a commercial weather provide such as Yahoo Weather.
Note: You need to explore what data is returned from the appropriate weatherstack.com API call.

2.2.9 Additional Visualisation Pages

- These **two pages** should use any visualisation techniques that are **not** map-based. You should use a different visualisation method for each page.
  You should do some research and find the data-sources first and then find appropriate visualisations.
  Note: Do not copy a complete set of data with visualisation from an external web page. We wish you to find the data and then decide upon appropriate visualisations and explain how this is implemented.

3 General Advice

- Go through all the code examples, running them and examining each line of code.
- Run through the examples in order (from IP2_Map1.html onwards).
- When starting to build your own code, add one new feature at a time. When a new feature is working, then save that code as a working version (and don't touch it again!). Use this version as the starter code for the next version. If something goes wrong, you can simply start with the previous working version.
- Save all of your versions on ALL of the following:
  - Online repositories (Cloud providers/GitHub/Bitbucket)
  - Local storage on your laptop
  - USB storage
    - Yes, I said ALL of these. Don't be lazy about this. Something is bound to go wrong, somewhere, at some time. When you tell us that you have lost all your stuff, we will just say: "well, it's good that everything is backed up". If you tell us that you didn't back-up, then we will tell you that you don't get any marks for lost stuff.
    - Back-up frequently. How often? Well, how much work do you want to have to redo if you lose something? Your time is valuable, so save frequently and back up often.
- Split up tasks with your team members ASAP. Manage tasks online with Trello (or equivalent).

3.1 Tools

Use development tools that you are familiar and confident with. Test your code using an appropriate browser that includes good Developer Tools. You can easily add breakpoints to your code so that you can stop and examine variables. You can easily breakpoint within the response of an ajax call so that you can see the data returned from an API call.
You must test your web application with a wide range of popular browsers.

Use a good quality editing environment for your code. I'm using the free Visual Studio Code environment. Its code highlighting is very useful. You can right-click on a source file in the editor to open the code in your browser. Use GitHub or BitBucket code repositories if you are familiar with these.

The Group should use the following tools (or equivalent)

1. A project management/tracking tool such as Trello [2] to allocate and track individual tasks.
2. Any sketching tool to create initial sketches of the site, for initial discussions.
3. A wireframing tool, such as Balsamiq (a licence will be provided for this) [3]
4. A free-to-use high-fidelity prototyping tool such as Adobe-XD [4] to prototype a few pages in colour at high-resolution.
5. Web implementation methods (including available framework, if you wish) and web implementation tools of your own selection. You are free to use any technologies that you like. You will be asked to justify your selection of methods/tools within your final reporting. You cannot use a Content Management System.

4 Data Feeds to be used for Earthquakes and Weather

4.1 GeoJSON

GeoJSON is a geospatial data interchange format based on JavaScript Object Notation (JSON). It defines several types of JSON objects and the manner in which they are combined to represent data about geographic features, their properties, and their spatial extents. GeoJSON uses a geographic coordinate reference system, World Geodetic System 1984, and units of decimal degrees [5]. The examples that you will use are based on *points* (latitude, longitude). The page at [6] explains GeoJSON at an introductory and comprehensive level.

You can see many examples at: http://geojson.xyz/

You will be accessing GeoJSON data for earthquakes:

U.S Geological Survey. The page at [7] explains the GeoJSON format and also has links to predefined data feeds that you can access. The supplied HTML code examples show exactly how to access this data.

4.2 Weather Data from weatherstack.com

We will source weather data from weatherstack.com [1]. Register for the free service.

Documents and help are at: https://weatherstack.com/documentation

5 Google Maps Help

Documentation and examples are available for Google Maps at:

https://cloud.google.com/maps-platform/

The following documentation is especially useful:

https://developers.google.com/maps/documentation/javascript/get-api-key
https://developers.google.com/maps/documentation/javascript/adding-a-google-map
https://developers.google.com/maps/documentation/javascript/marker-clustering
https://developers.google.com/maps/documentation/javascript/maptypes

6 Sample Code

Please note: the provided code is not delivered as an example of good web-layout practise! It is put together as a quick example of coding some of the key aspects. Also, please zoom-out the web pages until you can see a button above the top-left of the map. Click the button to see the visualisation.
You are expected to create your own layouts that obey best HCI practices.

Sample code is made available at:
https://drive.google.com/drive/folders/1htM426P26Hobuzg7hmyGPceeCOaszfPj?usp=sharing

Please note the advice about editing the files below and adding your own API keys as described above in Section 2.2.2.

File	Overview
IP2_Map1.html	Web page with Google map. Click button to populate map with earthquake markers from a specific USGS data feed. Markers are not labelled. Note that these examples use data sources that end with **.geojson**. Do NOT use sources that end with **.geojsonp**
IP2_Map2.html	Web page with Google map. Click button to populate map with earthquake markers from a specific USGS data feed. Markers are labelled to show the magnitude of the earthquake.
IP2_Map3.html	Web page with Google map. Click button to populate map with earthquake markers from a specific USGS data feed. Markers are labelled to show the magnitude of the earthquake. Each marker has an infoWindow that includes a URL that is part of the GeoJSON data. The infoWindow URL opens in the same browser tab.
IP2_Map4.html	Web page with Google map, earthquake markers and clustering. Click on a cluster to zoom in to see markers (and maybe other clusters).
IP2_Map5.html	Web page with Google map and markers labelled with earthquake magnitude. Accesses weather data when clicking on a Google Maps marker. The weather data is used to populate a weather image and a weather summary. **Remember – your web application will have a separate weather page!**
IP2_Map6.html	Constructing a set of buttons where each one make a different ajax request, each button associated with a specific URL.

7 Examples of Data

7.1 Earthquake Data

The data is shown as an illustration. The data will obviously change over time.
Feed: https://earthquake.usgs.gov/earthquakes/feed/v1.0/summary/2.5_hour.geojson

```
{
    "type": "FeatureCollection",
    "metadata": {
        "generated": 1533742458000,
        "url": "https://earthquake.usgs.gov/earthquakes/feed/v1.0/summary/2.5_hour.geojson",
        "title": "USGS Magnitude 2.5+ Earthquakes, Past Hour",
        "status": 200,
        "api": "1.5.8",
        "count": 1
    },
    "features": [
        {
            "type": "Feature",
            "properties": {
                "mag": 2.6,
                "place": "6km ENE of Mammoth Lakes, CA",
                "time": 1533741217560,
                "updated": 1533742270324,
                "tz": -480,
                "url": "https://earthquake.usgs.gov/earthquakes/eventpage/nc73066416",
                "detail": "https://earthquake.usgs.gov/earthquakes/feed/v1.0/detail/nc73066416.geojson",
                "felt": 2,
                "cdi": 2.2,
                "mmi": null,
                "alert": null,
                "status": "automatic",
                "tsunami": 0,
                "sig": 104,
                "net": "nc",
                "code": "73066416",
                "ids": ",nc73066416,",
                "sources": ",nc,",
                "types": ",dyfi,focal-mechanism,geoserve,nearby-cities,origin,phase-data,scitech-link,",
                "nst": 30,
                "dmin": 0.003796,
                "rms": 0.05,
                "gap": 53,
                "magType": "md",
                "type": "earthquake",
                "title": "M 2.6 - 6km ENE of Mammoth Lakes, CA"
```

```
      },
      "geometry": {
        "type": "Point",
        "coordinates": [
          -118.9095001,
          37.6525002,
          2.43
        ]
      },
      "id": "nc73066416"
    }
  ]
}
```

Weather Data: OVER/

7.2 Weather Data

The data is shown as an illustration. The data will obviously change over time.
Here is a request that uses latitude and longitude as parameters:
http://api.weatherstack.com/current?access_key=PUT_YOUR_KEY_HERE&query=nairobi

```
{
   "request": {
      "type": "City",
      "query": "Nairobi, Kenya",
      "language": "en",
      "unit": "m"
   },
   "location": {
      "name": "Nairobi",
      "country": "Kenya",
      "region": "Nairobi Area",
      "lat": "-1.283",
      "lon": "36.817",
      "timezone_id": "Africa\/Nairobi",
      "localtime": "2020-05-17 17:21",
      "localtime_epoch": 1589736060,
      "utc_offset": "3.0"
   },
   "current": {
      "observation_time": "02:21 PM",
      "temperature": 23,
      "weather_code": 116,
      "weather_icons": [
         "https:\/\/assets.weatherstack.com\/images\/wsymbols01_png_64\/wsymbol_0002_sunny_intervals.png"
      ],
      "weather_descriptions": [
         "Partly cloudy"
      ],
      "wind_speed": 24,
      "wind_degree": 70,
      "wind_dir": "ENE",
      "pressure": 1022,
      "precip": 0,
      "humidity": 61,
      "cloudcover": 75,
      "feelslike": 25,
      "uv_index": 11,
      "visibility": 10,
      "is_day": "yes"
   }
}
```

8 References

[1] "weatherstack," [Online]. Available: https://weatherstack.com/.

[2] "Trello," [Online]. Available: https://trello.com/.

[3] "Balsamiq wireframing tool," [Online]. Available: https://balsamiq.com/.

[4] "Adobe XD prototyping tool," [Online]. Available: https://www.adobe.com/uk/products/xd.html.

[5] http://geojson.org/, "GeoJSON," [Online]. Available: http://geojson.org/.

[6] "More than you ever wanted to know about GeoJSON," [Online]. Available: https://macwright.org/2015/03/23/geojson-second-bite.html.

[7] "GeoJSON Summary Format," [Online]. Available: https://earthquake.usgs.gov/earthquakes/feed/v1.0/geojson.php.

[8] http://geojson.org/. [Online]. Available: https://tools.ietf.org/html/rfc7946.