Understanding Web Development

Designed by Open Government Products

Objectives

- Become familiar with the building blocks of websites
- Be unafraid of code and engineers

What to expect

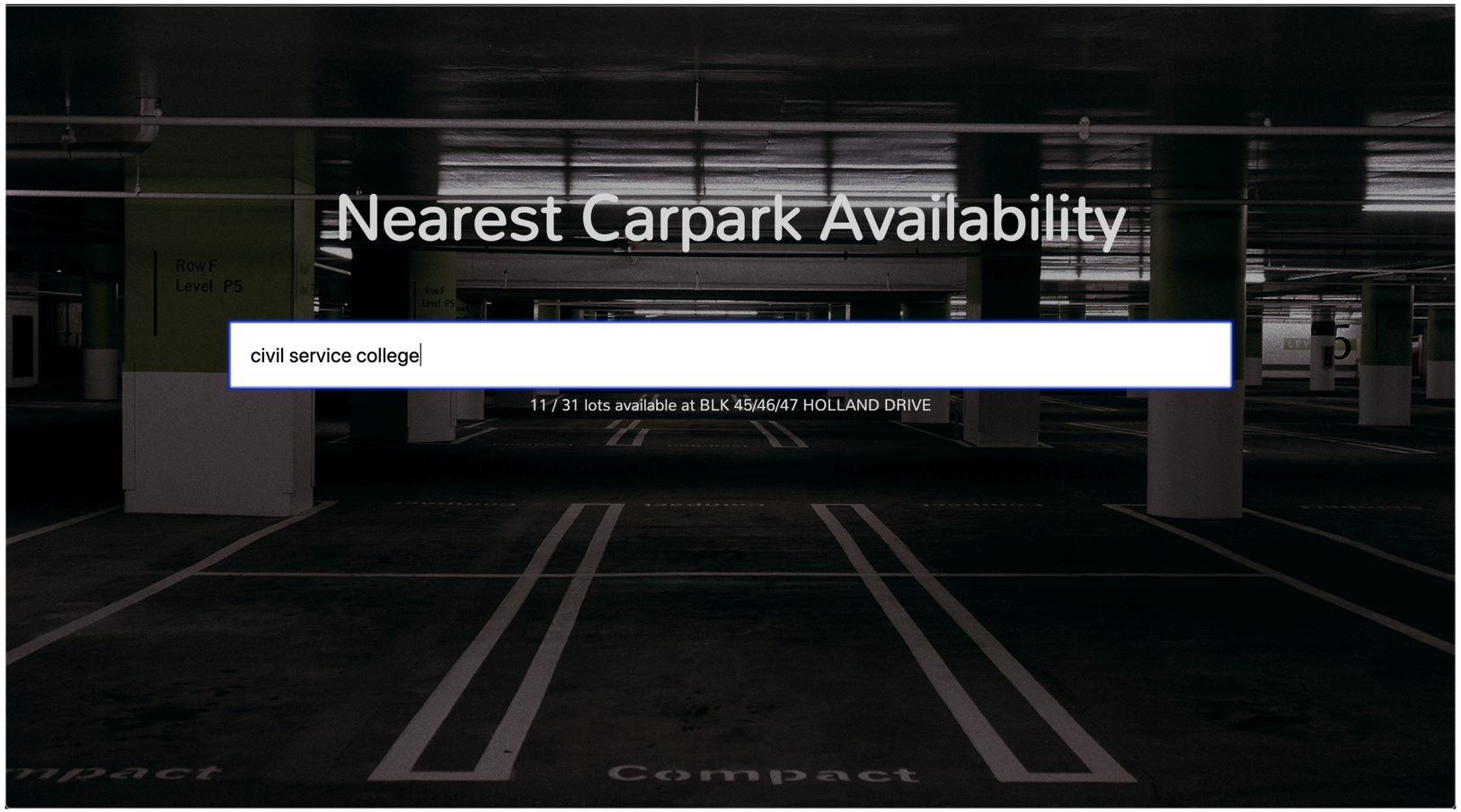
This is a **hands on introduction** to web technologies that covers a lot of ground in a short time.

- We don't expect you to walk out as proficient coders, only with an appreciation of how websites work
- We encourage you to experiment and to ask questions

Don't need to take photos!

All material is available online at github.com/opengovsg/live-parking-info

What you're going to build



Outline

1. Introduction to HTML - building the skeleton of our site
2. Introduction to Javascript - adding interactivity to our site
3. Introduction to APIs - fetching and displaying data on the site
4. Introduction to CSS - styling the site
5. Deploying the site on the cloud

Install the following to get started

- Visual Studio Code code.visualstudio.com/download
- Google Chrome chrome.com
- The starter code github.com/opengovsg/live-parking-info

Setup

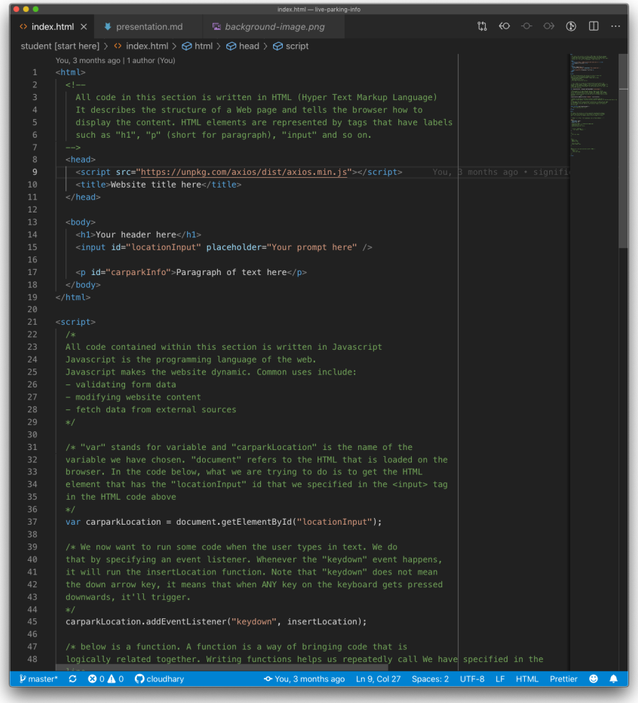
- Open the slides in `presentation/presentation.pdf`

Setup

- Also open `index.html` in **Google Chrome**

Setup

- Open `student [start here]/index.html` in **Visual Studio Code**



What is Visual Studio Code?

Visual Studio Code is a text editor program (similar to Notepad or Microsoft Word) specifically designed for editing source code of computer programs. Some helpful features that you'll experience as you code today include:

- Suggested autocompletion
- Code highlighting

How does the web work?

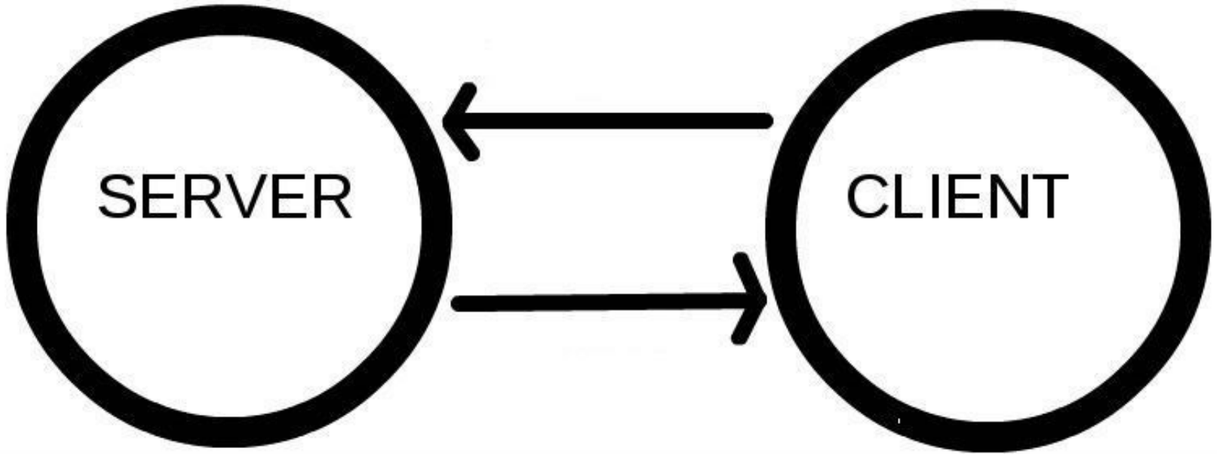
Before writing code, let's provide a simplified view of what happens when you view a webpage in a web browser on your computer or phone.

Clients and servers

- Clients are typically computing devices such as your computer, phone, or tablet that run browsers such as Firefox, Chrome, Safari, Edge, etc.
- Servers are computers that store webpages, sites, or apps.

What happens when I go to a website?

Your client device will download the webpage from the server and display it in the user's web browser.



For more information, go to How the Web Works

Websites are simply files

- Your website exists only on your client (your computer), so that change is only visible to you.
- The fact that you were able to make changes shows that these are simply text files on your computer

Follow along

- Go to tech.gov.sg or any website of your choice
- Right click on the webpage and select "Inspect"
- Type CMD + SHIFT + C or click on "Select element" icon
- Select any text
- Modify the content within it

What does a webpage consist of?

Term	Metaphor	Function
HTML	Skeleton	Structure
CSS	Skin / Clothes	Styling, formatting
Javascript	Brain	Behaviour/actions

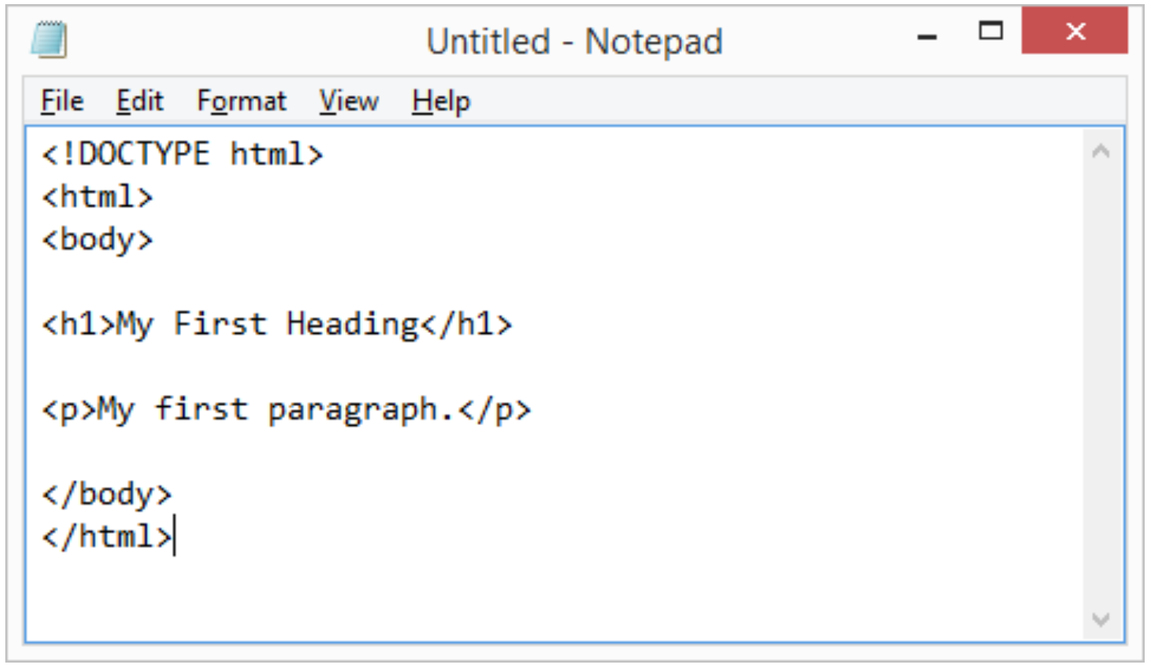
HTML

What is HTML?

- Hyper Text Markup Language
- It describes the structure of a Web page and tells the browser how to display the content.
- HTML elements are represented by tags
  - `<h1>` for header
  - `<p>` for paragraphs
  - `<input>` for user input

<h1> What is Markup Language? </h1>

 A system for annotating a document in a way that is syntactically distinguishable from the text.



```
<head>
  <script src="https://unpkg.com/axios/dist/axios.min.js"></script>
  <title>Website title here</title>
</head>
```

- `<title>` is the opening tag for the page's content and `</title>` is the closing tag
- Modify the website title

```
<body>
  <h1>Your header here</h1>
  <input id="locationInput" placeholder="Your prompt here" />

  <p id="carparkInfo">Paragraph of text here</p>
</body>
```

- The `h1` tag makes the content inside become a **header**

```
<body>
  <h1>Your header here</h1>
  <input id="locationInput" placeholder="Your prompt here" />

  <p id="carparkInfo">Paragraph of text here</p>
</body>
```

- `input` creates an input box
- `input` tags aren't designed to contain text or other elements, so there is *no* corresponding closing tag

```
<body>
  <h1>Your header here</h1>
  <input id="locationInput" placeholder="Your prompt here" />

  <p id="carparkInfo">Paragraph of text here</p>
</body>
```

- HTML tags can have extra **attributes** given to them
- The `placeholder` **attribute** will specify the grey shadow text that prompts the user

```
<body>
  <h1>Your header here</h1>
  <input id="locationInput" placeholder="Your prompt here" />

  <p id="carparkInfo">Paragraph of text here</p>
</body>
```

- <p> tags stand for paragraph

```
<body>
  <h1>Your header here</h1>
  <input id="locationInput" placeholder="Your prompt here" />

  <p id="carparkInfo">Paragraph of text here</p>
</body>
```

Change your header, placeholder, and paragraph text

A short detour

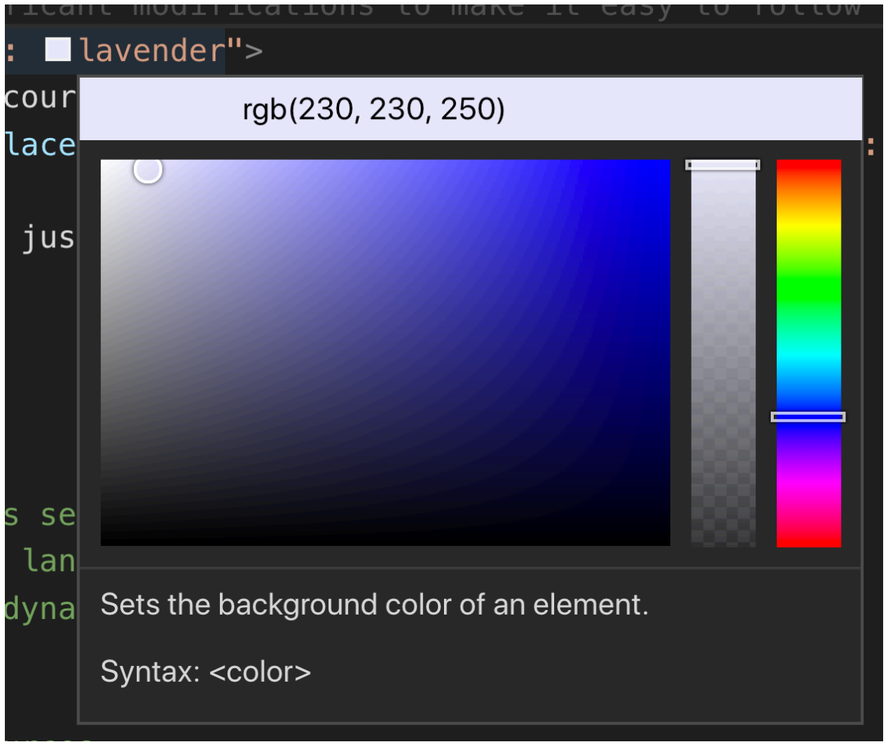
Adding styles to your page!

```
body {
  color: lightgrey;
  background-color: blue;
}
```

What colors can I use? Find out here

Choose from millions of colors!

Hover over the color and wait for this to pop out



Recap

- Webpages all require HTML files in your browser
- HTML tells the browser what to display
- Using HTML tags and attributes

What's next:

Adding interaction to our page!

Javascript

What is Javascript?

- Programming language for the Web
- Update and change both HTML and CSS
- Calculate, manipulate and validate data

Move on to the section that starts with the `script` tag

```
async function insertLocation(event) {
    alert("You typed something!");
}
```

`alert` creates a pop up on your screen. Refresh the page and try to make it run

When does it run?

The pop up runs when the user types in something to the text box. Lets review the existing code to understand why

Current code

```
var carparkLocation = document.getElementById("locationInput");

carparkLocation.addEventListener("keydown", insertLocation);
```

```
var carparkLocation = document.getElementById("locationInput");
```

- `var` stands for variable
- a variable is a way to store information, like saving a word document
- We chose to name the variable `carparkLocation`
- `document` refers to the HTML that is loaded on the browser.

We're trying to connect to the HTML `<input>` tag by using `getElementById`

```
carparkLocation.addEventListener("keydown", insertLocation);
```

- Whenever a `"keydown"` happens, go and `insertLocation`
- `"keydown"` does not mean the down arrow key, it means that when ANY key on the keyboard goes down

```
async function insertLocation(event) {
    alert(1 + 2);
}
```

Javascript can do computation, unlike HTML

Introducing functions

- Functions are like recipes - they're a way to group some instructions together

```
async function insertLocation(event) {
    alert(1 + 2);
}
```

- `insertLocation` is the function name
- `event` is the function input
- `{` is used to denote the start of function and `}` to denote end

```
async function insertLocation(event) {
  if (event.key === "Enter") {
      alert("You hit enter!");
  }
}
```

- we are using a conditional here, the `if` statement
- we use === to indicate that we're checking if they are equal because = was used to assign variables

```
async function insertLocation(event) {
  if (event.key === "Enter") {
      alert(carparkLocation.value);
  }
}
```

`carparkLocation.value` gets the text that the user has typed into the input box

Do you find the pop ups annoying?

- We want to display the user typed information back to them
- We can do that by using Javascript to:

  1. Find the <p> tag in the document

  2. Change the text inside

- We already gave the <p> tag the `carparkInfo` id in our HTML code

```
async function insertLocation(event) {
  if (event.key === "Enter") {
    document.getElementById("carparkInfo").innerText = carparkLocation.value;
  }
}
```

`innerText` will change the text in that element to the value of carparkLocation.value

Recap

- We have extracted information that the user has typed
- We can display that information back to the user

How do we fetch the information?

What is an API call?

- Way for apps to communicate (over the internet)
- An API call is like a phone call to a wise person who has the answers to your questions
  - **"What time is it now?"**
  - **"Where are all the carparks in Singapore?"**
  - **"What is the current price of Bitcoin?"**

Instructor Demo

- See how to make a credit card charge with Stripe
- See the latest weather on data.gov.sg

Why do we use APIs and libraries?

Less work for you. Why reinvent the wheel if there already is a good solution out there?

Why do we use APIs and libraries?

Open source libraries are generally more secure and perform better than their proprietary equivalents

- Many people would have scrutinized the code to identify bugs, loopholes and vulnerabilities and fix them
- Over time, these libraries will be "battle-tested" and prove that they can withstand load and usage

Why do we use APIs and libraries?

Organizations and communities that build and maintain APIs and libraries have many resources to do them well

Why do we use APIs and libraries?

Some information or actions can only be provided by certain people/organisations

- NEA collects weather data in Singapore and they host the data on data.gov.sg
- MAS provides authoritative exchange rates of SGD against other currencies

By using APIs and libraries, you can keep your app simple and focus on adding value

Instructor Demo

- run `python demo.py` to see the facial recognition software

How do we make an API call?

- We need the help of a request library
- A library is a set of functions that someone else has written
- It's just like using tools that a wise man created

Axios library

```
<head>
  <script src="https://unpkg.com/axios/dist/axios.min.js"></script>
</head>
```

- We'll be using the `axios` library to retrieve information
- Click on the link to see the code that we're using

Why do you trust this library?

See how many people are using this library at npmjs.com/package/axios

Explore the API

Go to https://opengovsg.github.io/carparks-near-me

- Click on "Try it out" and type a location of your choice
- Copy the Request URL and paste it into the browser

```
async function insertLocation(event) {
  if (event.key === "Enter") {
    var carparkResponse = await axios.get("https://carparks-near-me.herokuapp.com?location=jurong")
  }
}
```

- Let's make the API call that will provide the data
- We `await` for the response from the API, cause that takes time
- It's like waiting for an order in a restaurant to be fulfilled

```
async function insertLocation(event) {
  if (event.key === "Enter") {
    var carparkResponse = await axios.get("https://carparks-near-me.herokuapp.com?location=jurong")
    console.log(carparkResponse)
  }
}
```

- In order to see all the info, we need to use the "Console"
- Right click, select "Inspect", and click on the `Console` tab

```
async function insertLocation(event) {
  if (event.key === "Enter") {
    var carparkResponse = await axios.get("https://carparks-near-me.herokuapp.com?location=" + carparkLocation.value)
    console.log(carparkResponse.data)
  }
}
```

Let's fetch data based on what the user types in

```
async function insertLocation(event) {
  if (event.key === "Enter") {
    var carparkResponse = await axios.get("https://carparks-near-me.herokuapp.com?location=" + carparkLocation.value)
    var carpark = carparkResponse.data
    document.getElementById("carparkInfo").innerText = carpark.address
  }
}
```

- We change the text inside the <p> tag that has the `carparkInfo` id
- `getElementById` is case sensitive, so be precise with your casing and spelling
- Be precise with your spelling and casing - computers are quite unforgiving!

```
async function insertLocation(event) {
  if (event.key === "Enter") {
    var carparkResponse = await axios.get("https://carparks-near-me.herokuapp.com?location=" + carparkLocation.value)
    var carpark = carparkResponse.data
    document.getElementById("carparkInfo").innerText = carpark.lots_available + " lots available at " + carpark.address
  }
}
```

Structure the text that you want the user to see by choosing between the different fields within

Recap

- Javascript connects to HTML using `getElementById`
- A function is a bunch of code that's grouped together
- Calling a function runs the code in it
- Made API call to get nearest capark

What's next?

- Content and logic is all done!
- Next - styling your site!

```
body {
  background-image: url("background-image.png");
  background-size: cover;
  background-position: center;

  text-align: center;
  color: #F2F2F2;
  margin-top: 10%;
}
```

- Style the body
- Add each line one at a time and see the change

carpark-style.css

```
h1 {
  font-size: 64px;
}
```

Style the `h1`

```
input {
  font-size: 20px;

  width: 70%;
  padding: 12px 20px;
  margin-bottom: 30px;
  border-radius: 4px;
}
```

Style the `input` search box

```
@import url('https://fonts.googleapis.com/css?family=Mandali');

body {
  background-image: url("background-image.png");
  background-size: cover;
  background-position: center;

  text-align: center;
  color: #F2F2F2;
  margin-top: 10%;
  font-family: "Mandali";
}
```

Import a font package from fonts.google.com

```
@media only screen
  and (max-device-width: 480px) {

  input {
    font-size: 32px;
    width: 95%;
  }
}
```

`@media` query: checking for screen size and then defining a specific style for the element

Recap

- Use CSS Selectors to style the `body`, `h1`, and `input`
- Use `@media` queries to set style for mobile devices

Term	Metaphor	Function
HTML	Skeleton	Structure
CSS	Skin / Clothes	Styling, formatting
Javascript	Brain	Behaviour/actions

Next Step!

- Deploying your app to the internet
- Up till now, your website has only been accessible on your computer
- We will now deploy it to the cloud so everyone can see and use it!

Deployment

1. Go to netlify.com/drop
2. Drag and drop the app folder on to the site.
3. Wait for it to process your data
4. Voila! Your site has been hosted!

Cloud deployments do not need to be hard or expensive

Recap

1. What a website consists of
2. HTML + Javascript + CSS
3. API calls - communication over the internet
4. Deploying websites to the cloud

That's all folks!

Any questions?

Challenge Mode

For more of a challenge, try these:

- Change the background to another image
- Can we give the user some visual indication that information is loading?
- Can we show additional information for the nearest carpark?
- Can we display an icon based on carpark type?
- Can we show the two nearest carparks instead of only one?