Coding for Policymakers

Objectives

- Understand iterative product development
- Learn about web applications
  - Frontend (HTML, Javascript, CSS)
  - APIs
  - Backend/server

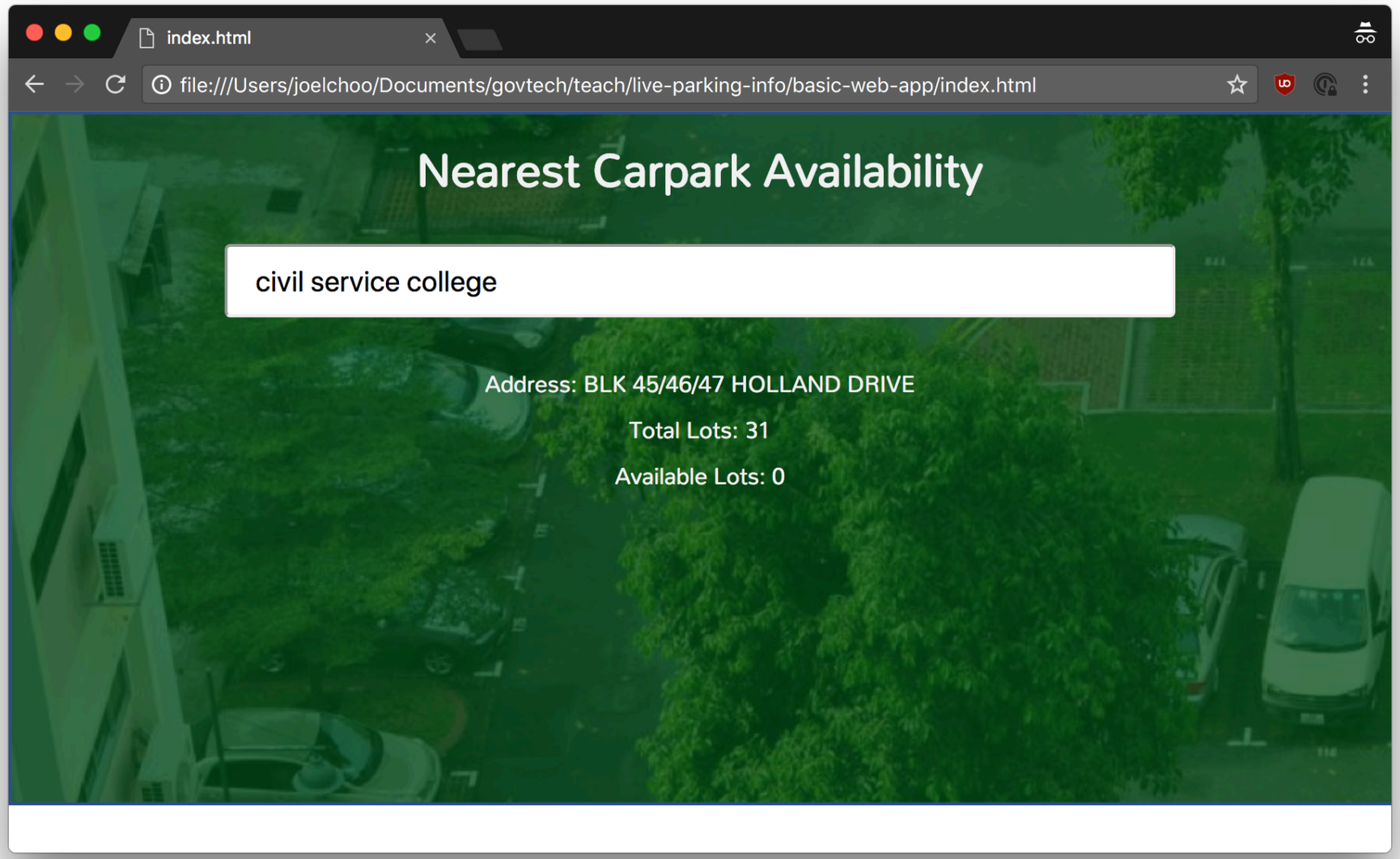
Overview

- Sharing on parking.sg
- Hands on coding workshop

Sharing on parking.sg

Hands on coding workshop

What you're going to build



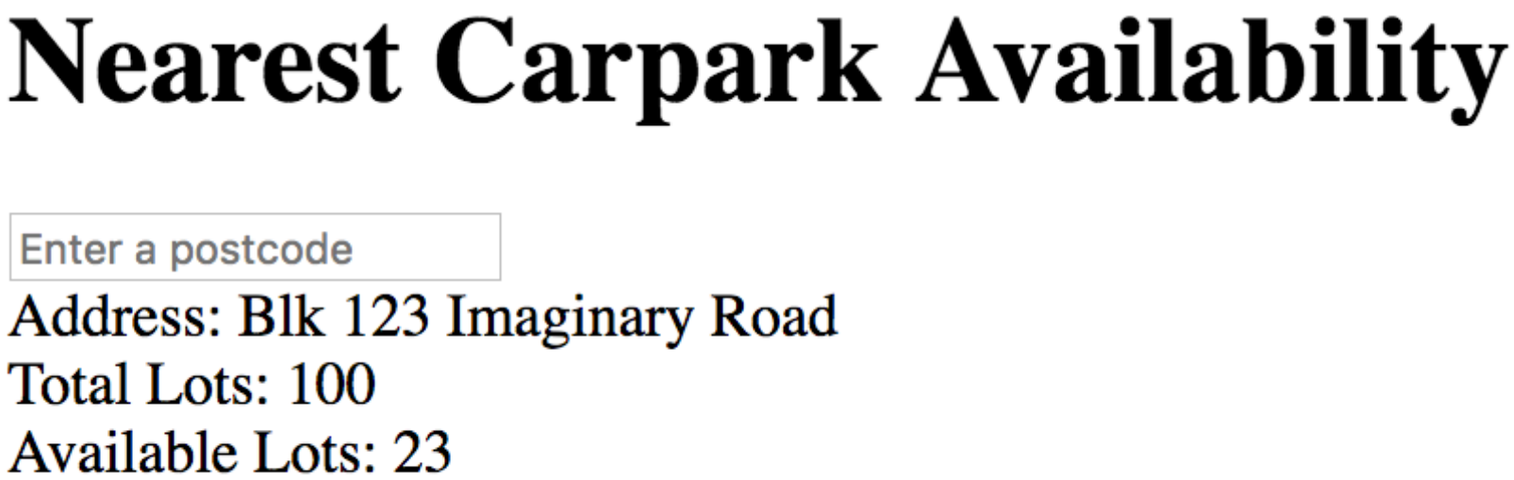
Hands on workshop

1. What is a website?
2. Displaying text
3. Adding interaction
4. Communicating with other apps
5. Adding styles!
6. A simple server

Before we begin

- Slides are provided as handouts
- You can also refer to digital copy of the slides

Step 1 - Displaying some text



Setup

Open the folder using Atom.

Open the `index.html` file using Google Chrome.

```
hello
```

- Save the file and refresh the page in Chrome
- Websites are just text files interpreted by the browser
- HTML files specify the content that the browser should display

```
<body>
  hello
</body>
```

- HTML uses tags to differentiate between different parts of the page
- `<body>` - opening tag for the page's content
- `</body>` - closing tag
- Everything between opening and closing tags is the tag's content

```
<body>
  hello there!
</body>
```

```
<body>
  hello

  there!
</body>
```

- HTML has a specific way of formatting content
- What you see is not necessarily what you get

```
<body>
   <h1>hello</h1>

   there!
</body>
```

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

```
<body>
  <h1>Nearest Carpark Availability</h1>
</body>
```

```
<body>
  <h1>Nearest Carpark Availability</h1>
  <input>
</body>
```

- `input` creates an input box
- `input` is a basic element, does not require a closing tag

```
<body>
  <h1>Nearest Carpark Availability</h1>
  <input placeholder="Enter a location">
</body>
```

- HTML elements/tags can have extra **attributes** given to them
- These **attributes** can change the behaviour and appearance of the element

```
<body>
  <h1>Nearest Carpark Availability</h1>
  <input placeholder="Enter a location">

  <div>Hello!</div>
</body>
```

`divs` are containers for content

```
<body>
  <h1>Nearest Carpark Availability</h1>
  <input placeholder="Enter a location">

  <div>Address: Blk 123 Imaginary Road</div>
  <div>Total Lots: 456</div>
  <div>Available Lots: 78</div>
</body>
```

`div`s can be used to organise and arrange content

A short detour

Adding styles to your page!

```
<body style="background-color: lightskyblue">
    .
    .
    .
</body>
```

https://developer.mozilla.org/en-US/docs/Web/CSS/color_value

Step 1 - A quick recap

- HTML files in browser are webpages
- HTML tells the browser what to display
- HTML tags, attributes

What's next:

Adding interaction to our page!

Metaphor - the human body

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

```
<body>
  <h1>Nearest Carpark Availability</h1>
  <input placeholder="Enter a location">

  <div>Address: Blk 123 Imaginary Road</div>
  <div>Total Lots: 456</div>
  <div>Available Lots: 78</div>
</body>
```

```
<script> alert("Hello!") </script>
```

`script` content is javascript code that the browser will execute

```
<body>
  <h1>Nearest Carpark Availability</h1>
  <input placeholder="Enter a location">

  <div>Address: Blk 123 Imaginary Road</div>
  <div>Total Lots: 456</div>
  <div>Available Lots: 78</div>
</body>

<script src="carpark-logic.js"></script>
```

To make it simpler, we can put the javascript code into another file

carpark-logic.js

```
alert("Hello!")
```

Note: For subsequent slides, the slide title is the file you should be editing

What's next

We want to use javascript to insert text into our HTML document. We can do that by:

1. Finding the right location in our HTML where we want to inject text
2. Inject the text into that location!

What's next

To find the right location to inject the text, we need to give the location a name (or ID)!

index.html

```
<body>
  <h1>Nearest Carpark Availability</h1>
  <input placeholder="Enter a location">

  <div id="carparkAddress"></div>
  <div>Total Lots: 456</div>
  <div>Available Lots: 78</div>
</body>

<script src="carpark-logic.js"></script>
```

Refresh the page - the address should have disappeared

carpark-logic.js

```
document.getElementById("carparkAddress").innerText =
  "Address: Blk 123 Imaginary Road"
```

- `document.getElementById` allows the javascript to find the right element in the HTML
- Setting `innerText` changes the content of the HTML element
- Refresh the page and the address should reappear

index.html

```
<body>
  <h1>Nearest Carpark Availability</h1>
  <input placeholder="Enter a location">

  <div id="carparkAddress"></div>
  <div id="carparkTotalLots"></div>
  <div id="carparkAvailableLots"></div>
</body>

<script src="carpark-logic.js"></script>
```

Refresh the page - total and available lots should have disappeared

carpark-logic.js

```
document.getElementById("carparkAddress").innerText =
  "Address: Blk 123 Imaginary Road"
document.getElementById("carparkTotalLots").innerText =
  "Total Lots: 456"
document.getElementById("carparkAvailableLots").innerText =
  "Available Lots: 78"
```

Refresh the page - total and available lots should reappear

carpark-logic.js

```
function addCarparkToPage([address, totalLots, availableLots]) {
  document.getElementById("carparkAddress").innerText =
    "Address: " + address
  document.getElementById("carparkTotalLots").innerText =
    "Total Lots: " + totalLots
  document.getElementById("carparkAvailableLots").innerText =
    "Available Lots: " + availableLots
}
```

Introducing functions

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

carpark-logic.js

```
function addCarparkToPage([address, totalLots, availableLots]) {
  document.getElementById("carparkAddress").innerText =
    "Address: " + address
  document.getElementById("carparkTotalLots").innerText =
    "Total Lots: " + totalLots
  document.getElementById("carparkAvailableLots").innerText =
    "Available Lots: " + availableLots
}
```

`addCarparkToPage` is the function name

`address, totalLots, availableLots` are function **inputs**

carpark-logic.js

```
function addCarparkToPage([address, totalLots, availableLots]) {
  document.getElementById("carparkAddress").innerText =
    "Address: " + address
  document.getElementById("carparkTotalLots").innerText =
    "Total Lots: " + totalLots
  document.getElementById("carparkAvailableLots").innerText =
    "Available Lots: " + availableLots
}

addCarparkToPage(["Blk 123", "456", "78"]) // run the function
```

Defining VS running the function
Writing VS cooking the recipe

Refresh the page - the text should reappear

Recap

- Javascript adds interaction
- Javascript links to HTML using `getElementById`
- A function is a bunch of code that's grouped together
- Calling a function runs the code in it

What's next?

Handle the input that has been typed in

index.html

```
<body>
  <h1>Nearest Carpark Availability</h1>
  <input id="locationInput" placeholder="Enter a location">

  <div id="carparkAddress"></div>
  <div id="carparkTotalLots"></div>
  <div id="carparkAvailableLots"></div>
</body>

<script src="carpark-logic.js"></script>
```

Give the input element an ID

carpark-logic.js

```
function addCarparkToPage([address, totalLots, availableLots]) {
    .
    .
    .
}

addCarparkToPage(["Blk 123", "456", "78"])
```

```
document.getElementById("locationInput")
```

Retrieve the input element using its ID

carpark-logic.js

```
function addCarparkToPage([address, totalLots, availableLots]) {
    .
    .
    .
}

addCarparkToPage(["Blk 123", "456", "78"])
```

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

`var` is short for variable

Saving the element into the `locationInput` variable

Like saving your word document into `Document.docx`

carpark-logic.js

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

locationInput.addEventListener("keydown", handleKeydown)
```

- React to user typing in the input box by adding an **event listener** (`addEventListener`)
- `handleKeydown` is a function that will be called when the user types something (`keydown`)

carpark-logic.js

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

function handleKeydown(event) {
  addCarparkToPage(["Blk 123", "456", "78"])
}

locationInput.addEventListener("keydown", handleKeydown)
```

Remember to remove `addCarparkToPage` from earlier

Refresh the page - the text should disappear

Type into the input box - the text should reappear

carpark-logic.js

```
function handleKeydown(event) {
  if (event.key === "Enter") {
    addCarparkToPage(["Blk 123", "456", "78"])
  }
}
```

We only want to care about when the `Enter` key is pressed

What's next

Now we need to get the location that we typed in.

We can do that in a similar way to how we injected the text.

Find the input element, and extract it's content.

carpark-logic.js

```
function handleKeydown(event) {
  if (event.key === "Enter") {
    addCarparkToPage([locationInput.value, "456", "78"])
  }
}
```

`locationInput.value` gets the text that has been typed into the input box

Recap

- React to user input by registering **event listeners**
- Only react to Enter key press
- Get the text that the user has typed in

What's next?

Now we need to use the location to find the nearest carpark.

We'll do that in two steps:

1) location -> X and Y (like latitude and longitude)

2) X and Y -> Carpark

carpark-logic.js

```
function searchLocation(location) {
  addCarparkToPage([location, "456", "78"])
}

function handleKeydown(event) {
  if (event.key === "Enter") {
    searchLocation(locationInput.value)
  }
}
```

Create the `searchLocation` function

TODO: make transition less awkward

We need to take the location and find the nearest carpark to it.

First, we will convert the location to X and Y values.

To do that, we need to make an API call.

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?"

Why use API calls?

- Don't reinvent the wheel
- Keeps our app simple!
- Some information can only be provided by some people/ organisations (e.g. price of Bitcoin)

Our API call

"What are the X and Y coordinates of this location?"

https://docs.onemap.sg/#onemap-rest-apis

index.html

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

<body>
  ...
</body>
```

```
<script src="carpark-logic.js"></script>
```

- `head` loads before the `body`
- `axios` is an external library to help make API calls

carpark-logic.js

```
function searchXY(response) {
  addCarparkToPage(["Blk 123", "456", "78"])
}

function searchLocation(location) {
  axios.get("https://developers.onemap.sg/commonapi/search", {
    params: {
      searchVal: location,
      returnGeom: "Y",
      getAddrDetails: "N"
    }
  }).then(searchXY)
}
```

carpark-logic.js

```
function searchXY(response) {
  var searchResult = response.data.results[0]
  addCarparkToPage(["Blk 123", "456", "78"])
}
```

Extract the search result from the `response`

carpark-logic.js

```
function searchXY(response) {
  var searchResult = response.data.results[0]
  addCarparkToPage(["Blk 123", searchResult.X, searchResult.Y])
}
```

Display the search result for us to check that it is correct

What's next

- Now we want to get the nearest carpark to that X and Y value
- Slightly too complicated for now, so we can use a helper API that I created

index.html

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

<body>
  ...
</body>
```

```
<script src="carpark-helpers.js"></script>
<script src="carpark-logic.js"></script>
```

Import my helper API

carpark-logic.js

```
function searchXY(response) {
  var searchResult = response.data.results[0]
  getNearestCarparkTo(searchResult.X, searchResult.Y)
    .then(addCarparkToPage)
}
```

Use my helper API

Recap

- Made API call to convert location to X and Y
- Use helper API to get the nearest carpark

What's next?

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

index.html

```
<head>
  <script src="https://unpkg.com/axios/dist/axios.min.js"></script>
  <link rel="stylesheet" type="text/css" href="carpark-style.css"></link>
</head>

<body>
  <h1>Nearest Carpark Availability</h1>
  <input id="locationInput" placeholder="Enter a location">

  <div id="carparkAddress"></div>
  <div id="carparkTotalLots"></div>
  <div id="carparkAvailableLots"></div>
</body>

<script src="carpark-helpers.js"></script>
<script src="carpark-logic.js"></script>
```

carpark-style.css

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

body {
  font-family: "Mandali";
  text-align: center;
  background-image: url("background-image.png");
  background-repeat: no-repeat;
  color: #F2F2F2;
}

input {
  width: 70%;
  border-radius: 4px;
  font-size: 20px;
  padding: 12px 20px;
  margin-bottom: 30px;
}

@media only screen
  and (max-device-width: 480px) {
  body {
    background-image: unset;
    color: #000;
  }
}
```

Recap

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

Next Step!

- Deploying your app to the internet
- Up to now, your website is just on your computer
- We will now deploy it to the internet so everyone can see and use it!

Deployment

1. Go to https://www.bitballoon.com/
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!

Recap

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

Next Step - Building your own API

- Build a simple backend to serve a simple API
- We'll replace my helper API with a real API

Create a new file called `backend.js`

`backend.js`

```
var express = require("express")

var app = express()

app.listen(3000, function () {
  console.log("Server running...")
})
```

Open the command line (TAs can help!)

Type `node backend.js` and hit enter

You should see `Server running...`

backend.js

```
var express = require("express")

var app = express()

app.listen(3000, function () {
  console.log("Server running...")
})
```

Importing `express`, a lightweight server

backend.js

```
var express = require("express")

var app = express()

app.listen(3000, function () {
  console.log("Server running...")
})
```

Creating our server

backend.js

```
var express = require("express")

var app = express()

app.listen(3000, function () {
  console.log("Server running...")
})
```

Running our server - start listening to requests

Right now your server is just listening but doesn't respond to any requests.

Let's get it respond to incoming requests

You've set up a phone, but you're not answering any calls

backend.js

```
var express = require("express")

var app = express()

app.get('/', function (req, res) {
  res.send("Hello")
})

app.listen(3000, function () {
  console.log("Server running...")
})
```

Listen to `/`
i.e. my phone number is 98765432

When `/` is requested, send `Hello` as the response
i.e. when someone calls me at 98765432, say Hello

backend.js

```
var express = require("express")
var getNearestCarparkTo = require("./carpark-helpers.js")

var app = express()

app.get('/', function (req, res) {
  getNearestCarparkTo(req.query.x, req.query.y).then(function (carpark) {
    res.set("Access-Control-Allow-Origin", "*")
    res.send(carpark)
  })
})
```

Send the `x` and `y` values to the helper API

Send the carpark replied by the helper API back as a response

backend.js

```
var express = require("express")
var getNearestCarparkTo = require("./carpark-helpers.js")

var app = express()

app.get('/', function (req, res) {
  getNearestCarparkTo(req.query.x, req.query.y).then(function (carpark) {
    res.set("Access-Control-Allow-Origin", "*")
    res.send(carpark)
  })
})

app.listen(3000, function () {
  console.log("Server running...")
})
```

index.html

```
<head>
  <script src="https://unpkg.com/axios/dist/axios.min.js"></script>
  <link rel="stylesheet" type="text/css" href="carpark-style.css"></link>
</head>

<body>
  <h1>Nearest Carpark Availability</h1>
  <input id="locationInput" placeholder="Enter a location">
  <div id="carparkAddress"></div>
  <div id="carparkTotalLots"></div>
  <div id="carparkAvailableLots"></div>
</body>

<script src="carpark-helpers.js"></script>
<script src="carpark-logic.js"></script>
```

Delete the highlighted line

index.html

```
<head>
  <script src="https://unpkg.com/axios/dist/axios.min.js"></script>
  <link rel="stylesheet" type="text/css" href="carpark-style.css"></link>
</head>

<body>
  <h1>Nearest Carpark Availability</h1>
  <input id="locationInput" placeholder="Enter a location">
  <div id="carparkAddress"></div>
  <div id="carparkTotalLots"></div>
  <div id="carparkAvailableLots"></div>
</body>

<script src="carpark-logic.js"></script>
```

Refresh the page - the search should no longer be working

carpark-logic.js

```
function searchXY(response) {
  var searchResult = response.data.results[0]
  getNearestCarparkTo(searchResult.X, searchResult.Y)
    .then(addCarparkToPage)
}
```

Delete the highlighted lines

carpark-logic.js

```
function searchXY(response) {
  var searchResult = response.data.results[0]

  var url = "http://localhost:3000"
  axios.get(url, {
    params: {
      x: searchResult.X,
      y: searchResult.Y
    }
  }).then(response => {
    addCarparkToPage(response.data)
  })
}
```

Set up `carpark-logic` to use our backend API

That's all folks!

Any questions?