

S2_Joint_Assign_License_Plate_ AB_FINAL

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05/05/2023

Assignment

Joint Assignment: License Plate Management

By Agnes Beviz

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1. Video link

Project video: [S2 License Plate Assignment Video AB.mov](https://uowtsd-my.sharepoint.com/:v:/g/personal/2222151_student_uwtsd_ac_uk/EZ2yXqurM21NjN1eV0mfjcBgJhqs86x8vVJQB5U07G53Q?e=XGtI5N) (https://uowtsd-my.sharepoint.com/:v:/g/personal/2222151_student_uwtsd_ac_uk/EZ2yXqurM21NjN1eV0mfjcBgJhqs86x8vVJQB5U07G53Q?e=XGtI5N)

Timestamps:

- 0:00 – Intro
- 0:50 – Overview and demo of ‘Happy Path’ license search, purchase and assign steps
- 9:25 – Web Client
- 14:55 – Web Service
- 18:43 – Future Improvements

2. Client

2.1 Design and Implementation

Please see the readme of the UI project for running instructions, dependencies used, and overview of the file structure.

To research how to present the interface to the customer, I looked at the [dvlaregistration](#) website which lets users search and purchase license plates [1], and the [gov.uk](#) service to assign a license plate to a vehicle [2].

Based on these I decided to use the [gov.uk](#) frontend design library [3], using an open source react implementation of the library [4]. The advantage of the library is that it made it possible to create a user interface with a similar look and feel to [dvla](#) and government services. It was however a learning process and came with many challenges, in particular how to integrate the library with the implementation logic and axios calls to the service.

Please see Fig. 1 and Fig. 2 for screenshots of the search screen displaying results for a license plate in both full screen and mobile view. In the appendices I have included a full user flow of screenshots which also show both views.



License Plate Management System



License plate results:

IB38 JUY	£10.23	Buy Now
UI48 JUP	£205.77	Buy Now
YU94 VJU	£241.34	Buy Now
KA43 JUO	£113.21	Buy Now

Fig. 1 Screenshot of license plate partial search with full screen view

Dimensions: Responsive
523 x 754
100%
No throttling



License Plate Management System



License plate results:

IB38 JUY

£10.23

Buy Now

UI48 JUP

£205.77

Buy Now

YU94 VJU

Fig. 2 Screenshot of license place partial search, mobile view.

As discussed in the video and readme, conditional rendering [5] and the `useState` hook to dynamically render the page. Additional research on using `useState` hooks to handle form submission with React [6], and on how to apply `useState()` to objects [7] helped me implement the frontend.

2.2 Discussion of Implementation and improvements to be made

A clear area where the Client could be improved is validation, which could be done by setting required fields, controlling the user input, and setting type limits on the inputs. It would also be better to render the error messages from the web service more accurately in the frontend, so that the user is aware of why if the axios request fails.

Authentication would also be necessary for license plate management service, with the client restricted to only the necessary endpoints to fulfil the service. Adding a server layer between the user interface and the web service would improve security, as there would be an additional processing layer between the database and the client.

The user interface would also need to meet the international WCAG 2.1 AA accessibility standard [8]. As the frontend library is designed for government services, the integration exists to meet the WCAG 2.1 standard, but work would need to be done on the application to implement it.

Other areas for improvement include:

- Testing with unit tests and functional tests.
- Rendering the inputs which can be accepted by the web service in full
- Adding functionality to display for example the license plates owned by a customer, or the purchases they have completed (the web service already has this implemented)
- Refactor the codebase into smaller components to make it more maintainable and readable.
- Implementing type checking by using for example TypeScript, or `prop-types` [9] with react would improve the integrity of the project. It would also help with validating user inputs.

3. Web Service

3.1 Overview

Please see the README for instructions to run the application and an overview of the file structure, implementation logic, and future improvements.

The web service focused on license plates that meet the current UK requirements of two numbers, two letters, space, and then three letters introduced in 2001 [10]. The license plate records in the insert file meet these requirements, and were generated using Mockaroo [11].

The dvlaregistration website [1], and government service to assign a license plate number to a vehicle [2] were used to understand the system requirements and inform design decisions.

3.1 Preventing inappropriate license plates

The system does not have logic implemented to prevent rude license plates. I got as far as researching this topic and how I would implement it, so I will share that here.

The DVLA holds a list of banned license plates which it updates every annually [12]. The terms banned are contextual for the current political situation, and it would not be as simple as using a reference list of generic inappropriate terms. For example, license plate numbers related to covid such as 'CO71 VD' and 'CO71 ONA' were added to the ban list in 2021, and terms like 'WA23 RUS' were added in 2023 [13].

To prevent banned license plate numbers being added, two systems would need to be in place:

- Check license plate numbers inserts through the web service. This could be done in the *setLicensePlateNumber()* method throwing an exception and preventing the record being created if the license plate number matches a number in the ban list
- If records are being migrated to the web service, any insert statements would need to be filtered for banned license plate numbers.

The list of banned license plate numbers could be generated using a method that checks for viable replacements of numbers that look like letters and visa versa. Ultimately this list would need to be added to and checked manually, with contextual terms as listed above added.

4. Big Data and NoSQL

4.1 Principles of Big Data and No SQL

NoSQL databases have been developed to meet the needs web oriented systems which deal with vast amounts of data [14]. In order to store the amount of data for large global web services, the single node systems used by relational databases were no longer sufficient [15]. The solution to scale single node servers hosting databases to computing resources with additional storage capacity and RAM has a limit, and when these limits are reached the data is distributed across different devices [16].

Traditional relational data management systems (RBDMSs) have sub optimal performance when distributed across different storage devices, as they were designed to run on single nodes. With distributed data storage, RBDMS become complex to manage and joins and transactions cannot be performed as efficiently [16] .

NoSQL databases provide a data storage solution for the vast amounts of data which needs to be stored for Big Data and the Internet of Things [14]. The term broadly refers to all databases that do not use SQL, which there are a variety of different types of database systems which fall under the NoSQL label.

A core principle of NoSQL databases is that they do not adhere to a fixed schema and are unstructured [14]. This has the advantage of working well with in Big Data web services, which are often developed in an agile way. The flexibility of not having to design a fixed database schema from the outset means that the web applications can be developed iteratively with feedback loops from users via product owners.

As discussed above, NoSQL databases can be run on distributed storage and scale well horizontally [14]. In order to achieve improved availability and horizontal scaling, NoSQL databases have typically have a lower level of consistency than RBDMSs [15].

There are also disadvantages of using NoSQL databases over RBDMSs, notably that data needs to be denormalised to an extent as a compromise for a more flexible schema and horizontal scalability. In NoSQL databases, joins are not typically implemented in the database management system, and as a result the data processing demands on the application layer are higher [16] [14].

4.2 Evaluation of MongoDB and use cases

Mongo DB is a document oriented NoSQL database, and also uses a key-value system to store data [14]. MongoDB can easily be scaled horizontally, making it ideal for cloud based development and web services handling Big Data.

As MongoDB uses a JSON file type, it is suited to integration with JavaScript based client side applications [17]. MongoDB also has the advantage of a flexible schema, which means that the database design can be adapted as the service evolves. However, a distinct advantage of MongoDB over other NoSQL databases is that an explicit schema can be optionally applied using schema validation [18]. MongoDB also supports queries across multiple fields [16]. MongoDB is also able to cache data to improve performance, reducing the data retrieval time from distributed data storage.

In order to improve performance and horizontal scalability, MongoDB has sacrificed consistency and isolation to an extent. This means that is not suited to contexts where transaction integrity is paramount (such as financial databases), as the transactions are not ACID [16].

MongoDB is used by companies such as Meta, Twitter, and Google [19], and is a core part of the MEAN stack which includes MongoDB, ExpressJS, Angular, and NodeJS.

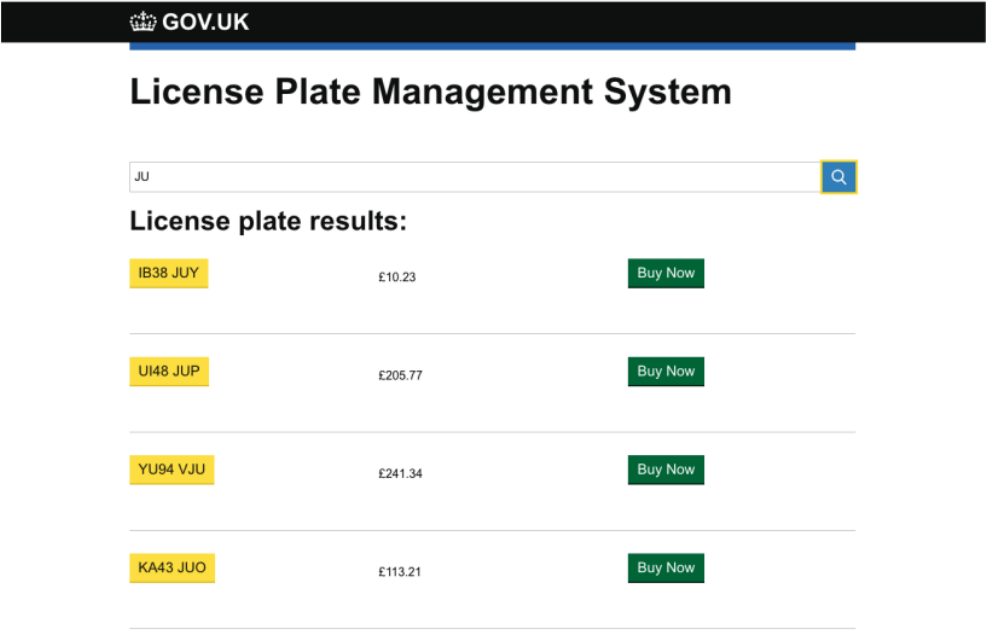
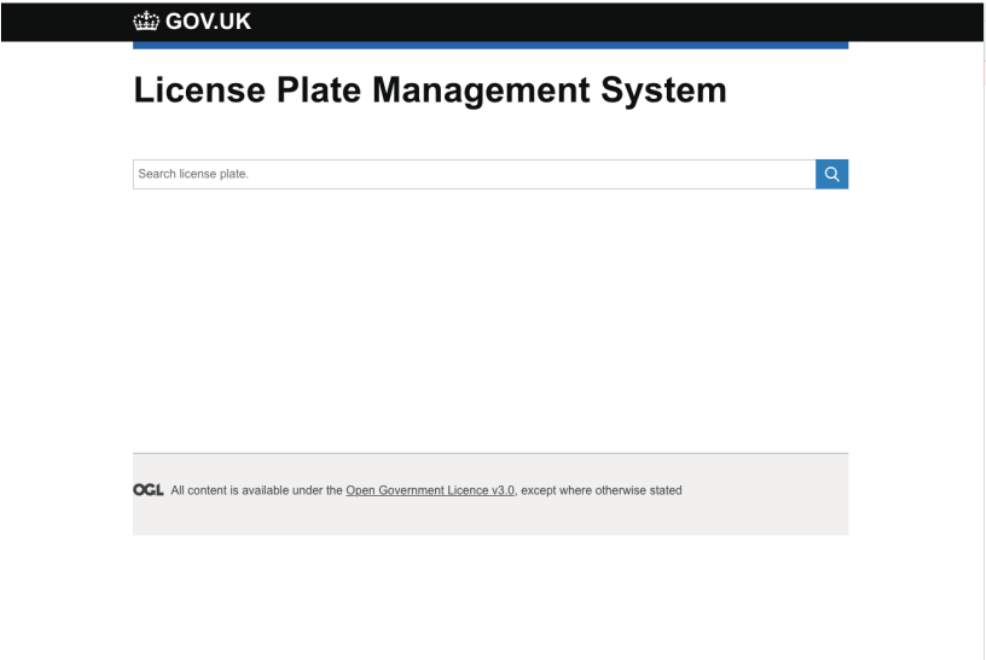
The flexible and scalable structure of MongodDB make it ideal for social media with evolving user comments, and situations which require a large volume of data storage.

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Appendix: Screenshots in desktop view



Driving license number:

Driving license number should be 16 digits long.

You have submitted your customer details.

Payment Details

Payment type input options

Card holder name:

Card number:

Card number should be 16 digits long.

Expiration date:

You have submitted your payment details.



License Plate Management System

Purchase and Assign your license plate

Customer Details

Title:

Firstname:

Surname:

Address:

Postcode:

Phone number:

Email:

You have submitted your payment details.

License Purchase Summary:

License plate number:	OK90 HJF
Price:	£128.64
Driving license number:	1234567890527893
Payment card expiry date:	2024-10-23

Confirm Purchase

Purchase Complete

Set Vehicle

Vehicle identification number:

01234567890234156

The Vehicle Identification Number must be 17 characters long.

Submit

Your vehicle with vehicle number has been successfully submitted

Purchase Complete

Set Vehicle

Vehicle identification number:

01234567890234156

The Vehicle Identification Number must be 17 characters long.

Submit

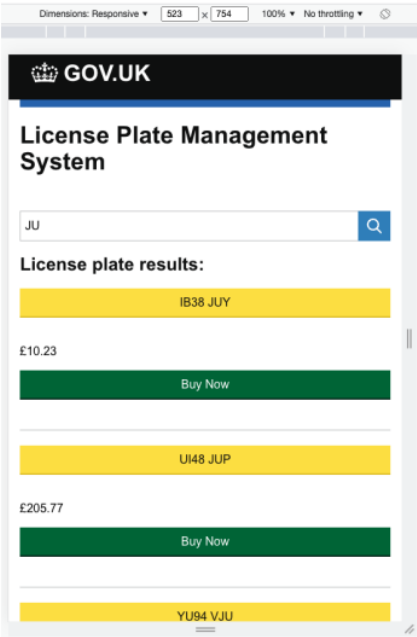
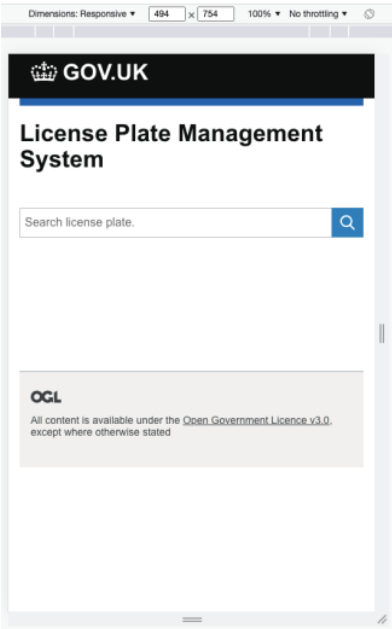
Your vehicle with vehicle number has been successfully submitted

Assign License Plate To Vehicle

Assign License Plate

Your License Plate Has Been Assigned

Appendix: Screenshots in mobile view



Dimensions: Responsive 494 x 754 100% No throttling

GOV.UK

License Plate Management System

Purchase and Assign your license plate

Customer Details

Title:

Firstname:

Surname:

Address:

Postcode:

Phone number:

Dimensions: Responsive 494 x 754 100% No throttling

Email:

Driving license number:

Driving license number should be 16 digits long.

Submit

Payment Details

Payment type input options
Debit Card

Card holder name:

Card number:

Card number should be 16 digits long.

Expiration date:

Submit

Dimensions: Responsive ▾ 452 x 702 100% ▾ No throttling ▾

Card number:
1234567890123456
Card number should be 16 digits long.

Expiration date:
2023-10-23

Submit

You have submitted your payment details.

License Purchase Summary:

License plate number:	bc51 tva
Price:	£323.47
Driving license number:	1234567892123456
Payment card expiry date:	2023-10-23

Confirm Purchase

Purchase Complete

FINAL GRADE

65/100

GENERAL COMMENTS

Instructor

Implementation

REST (30): 19

AJAX (20): 12

Code/Doc (10): 7

Features (20): 13

Report (20): 14

Feedback:

=====

I would have liked a little more discussion of scenarios where the documented oriented approach of MongoDB is best used. Also you could have provided more analysis of BigData.

All the fundamental UI functionality has been demonstrated and you used govuk-react and there is evidence of some testing. There are obviously some limitations, especially around data entry validation and some missing features.

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