The OpenShift Deployment URL: http://c22076452-cmt120-cw2-prod-c22076452-cmt120-cw2.apps.openshift.cs.cf.ac.uk/

Student Number: C22076452

Quality – Storing Information

The blog uses a MySQL database on deployment and an SQLite file on local testing. The data that the website handles include post and comment texts, JSON objects and image files. Not all data is treated equal as some of them require additional steps for proper processing. Passwords, for example, need to be hashed before being stored on the database as a VARCHAR field, rather than be stored in plaintext form. But an even more important example are images. Due to their significantly increased size (orders of magnitudes bigger than VARCHARs, actually), it would not be efficient to store an image in its full form onto the database. (mrswats, 2021) (davidism, 2015) The standard practice is to use a file system of some sort that would store the images of the user under a randomly generated UUID as a filename (or any sort of randomized string padded onto the original filename) to each uploaded image file in the process to avoid filename collision, then store the filename itself, or its directory, into the database as the image reference for future queries.

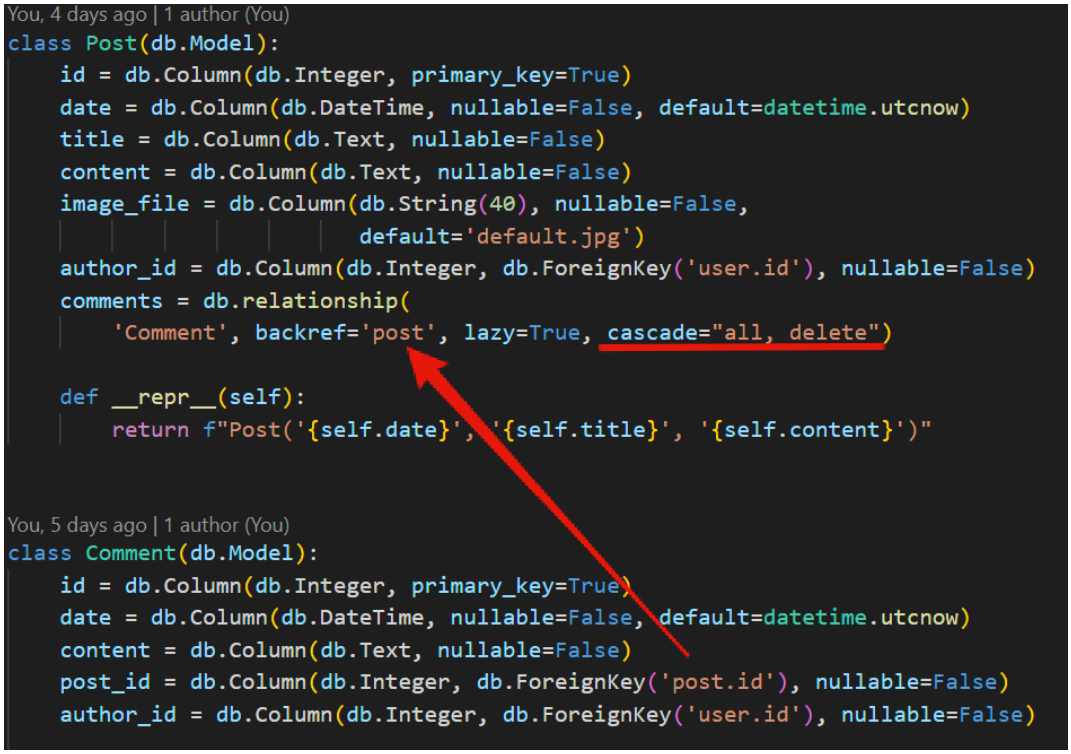


Figure 1: A one-to-many relationship between a post and its comments with cascading deletion.

Another aspect of information handling is the deletion of data upon the request of the user. The user may choose to delete comments from posts, delete a post of their own, or even delete their entire account. Since posts contain comments, it forms a one-to-many relationship between them, meaning that if the post was deleted, the comments should also be deleted. Comments and posts form two separate tables on the database, removing a post without removing their corresponding comments would leave those comments in an orphaned state i.e. from a one-to-many to a none-to-many relationship.

The goal here is to define a relationship that forces deletions of all children entries when their singular parent is deleted. In this case, the parent's relationship is specified to delete all children records in a cascading manner as shown in Figure 1, using the "cascade" parameter. The explicit definition of relationships here demonstrates the R in RDBMS, a Relational Database Management System. This very same behaviour applies to user account deletion, whereby posts and comments associated with the user would be deleted as well.

The current implementation of the file upload system uses the static folder to store and manage files uploaded by the user. A major concern stems from the fact that user data is deleted on every new build. A better implementation would be to use an external file system, such as a Content Delivery Network (CDN) to deliver image files on the fly. An inquiry was made about this on the university's StackOverflow, but no response was given suggesting a method that leverages on-site facilities.

Security – The use of environmental variables to self-configure the app.

The assignment's tutorial handouts provided by the university has suggested that students replace the "SQLALCHEMY_DATABASE_URI" field of the application's configuration when migrating from the local SQLite file to the university's MySQL server. Although that method would be the most straightforward and easy-to-implement method, it would expose the credentials for the MySQL server within the source code. And as such, should the repository ever be compromised, the credentials would be compromised along with it. As a preventative measure for this collateral damage, database parameters, including address and credentials, are loaded as a set of environment variables to be read by a custom configuration script.

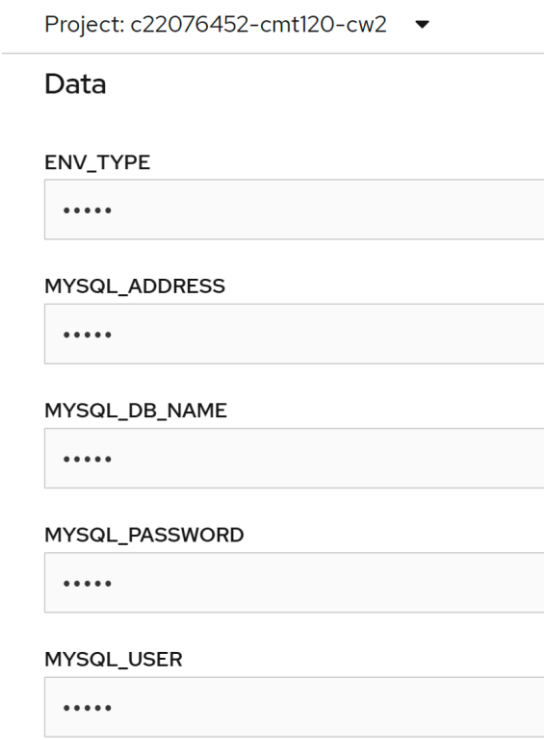


Figure 2: Environmental variables fields inside a Secrets form.

On OpenShift, the university's containerization suite of choice, credentials may be stored in the Secrets tab in the form of a set of keys and values, as shown in Figure 2. Doing so would enable the application of these secrets directly into a deployment's Environment tab, i.e., all containers under the same deployment would have said secrets initialized automatically as environment variables inside each of them. This is shown in Figure 3.

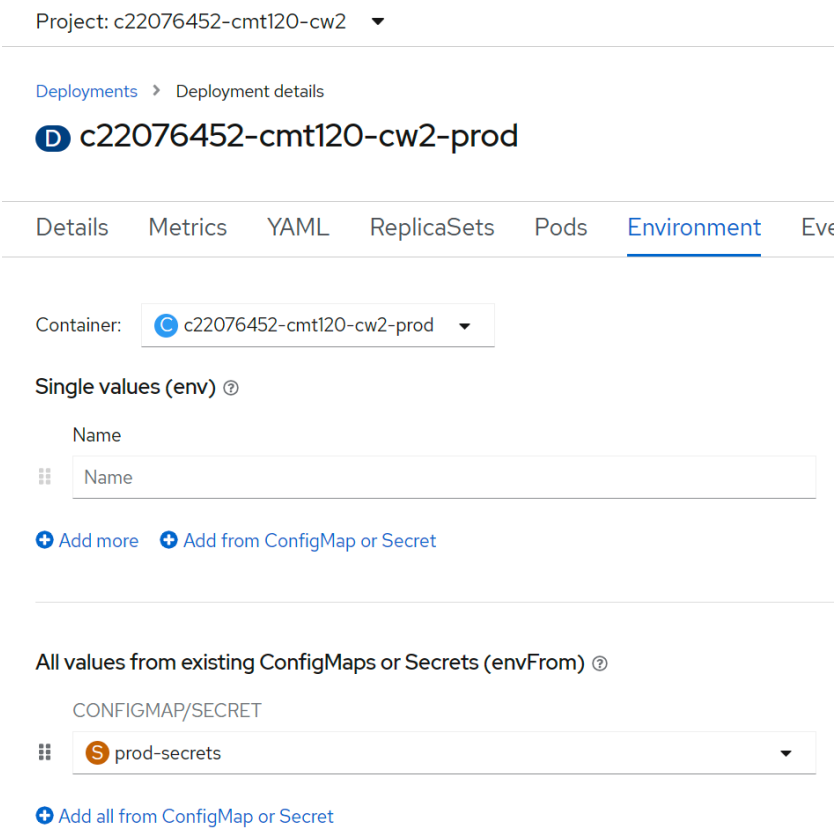


Figure 3: Linking the secret to a deployment to complete the server-side setup.

The configuration script would use the key ENV_TYPE upon start up to check if the current pod is of the Production type, a Staging type, or a Development type. This is because each environment has its own separate set of parameters.

This implementation also allows for the creation and/or usage of the remote databases using a locally run Flask application by using the host machine's own environmental variables, where ENV_TYPE value would be used to target the appropriate remote database, e.g., PROD for Production type environment, which would create the Production database on the university's MySQL server. This would make it much more efficient when redeploying the application with updated database models throughout development, where the database would need to be reset or migrated quickly.

Since credentials must be available to the system in the form of environmental variables, unauthorized users running on privileged access (su/admin) would be able to read the credentials in plaintext. Therefore, using encrypted passwords instead would make it harder for bad actors to gain access to the database. (Carter, 2012)

References

Carter, J., 2012. *Is it secure to store passwords as environment variables (rather than as plain text) in config files?.* [Online]
Available at: https://stackoverflow.com/a/12461944
[Accessed 17 January 2023].

davidism, 2015. *Serve image stored in SQLAlchemy LargeBinary column.* [Online]
Available at: https://stackoverflow.com/a/31858076/11690953
[Accessed 15 January 2023].

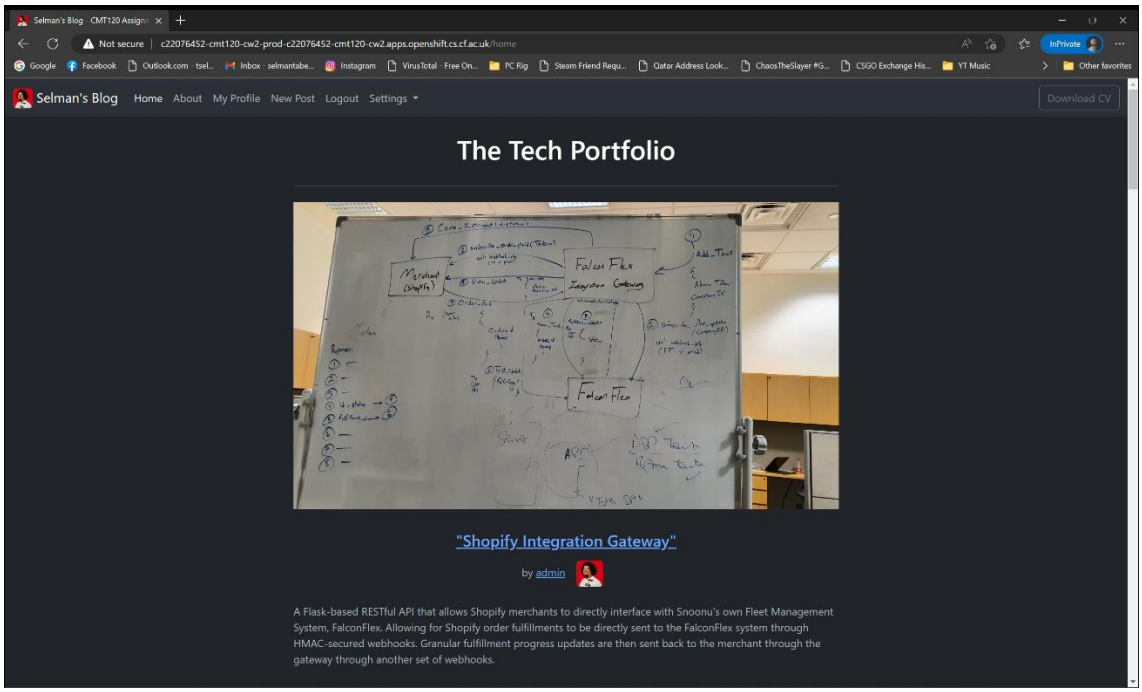
mrswats, 2021. *how to store images in sqlalchemy database and display it on React frontend?.* [Online]
Available at: https://www.reddit.com/r/flask/comments/rdv0m0/comment/ho3kryo/
[Accessed 15 January 2023].

Appendix A – Advanced Functionalities

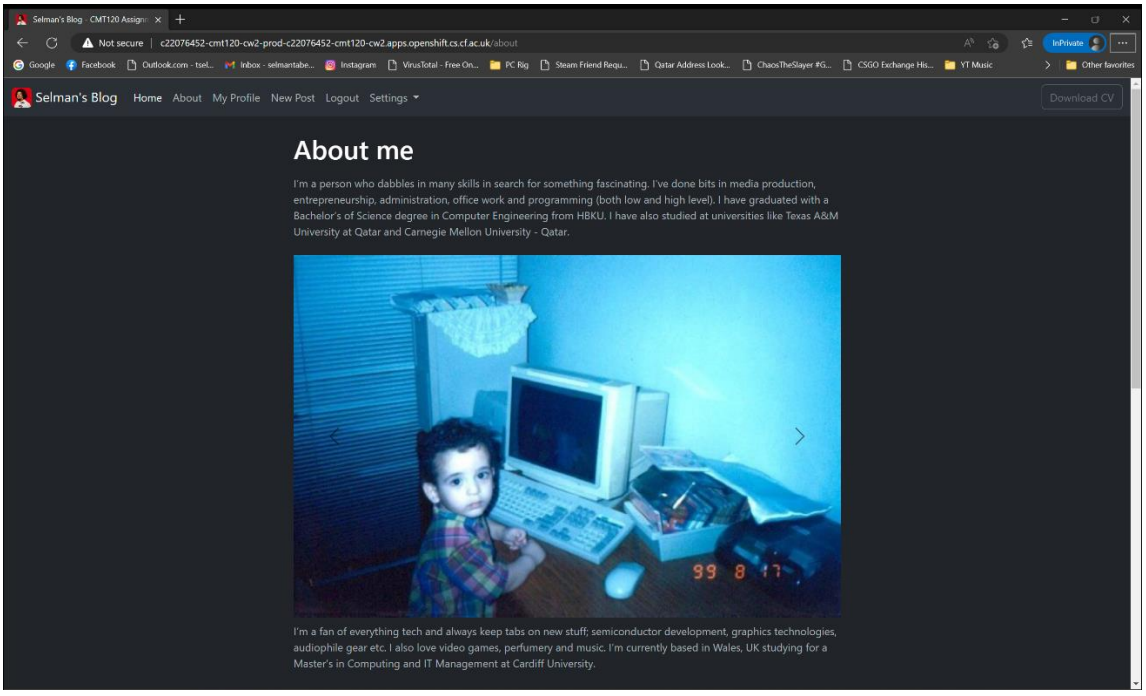
- Cascading deletion relationships (e.g. deleting a post will wipe out all associated comments).
- File upload – for avatars and post images.
- File size check (8MB limit for post images, 2MB for user avatars)
- Uploaded file deletion upon post deletion.
- User-specific directory deletion upon account deactivation
- Authentication (Registration, login, and password changes).
- JSON-based user settings implementation for loading user session parameters (e.g. Dark Mode, and more, does not require changing database models since extra key-value pairs may simply be added on top of existing parameters).
- Self-configuring application through a custom script and loaded environment variables.
- Filename collision avoidance by UUID generation on uploaded files.
- Login viewer to redirect unauthorized users to the login page upon accessing restricted pages.
- Navbar changes depending on whether a user is logged in.
- Custom error handling pages, with some added easter eggs and humor sprinkled throughout.
- Responsive site layout using Bootstrap.
- Database creation script for rapid remote database creation.
- Test data generated through a test script that populates the site with data.
- File download from static directory.
- Dark Mode Vs. Light Mode, with icons to match.
- User profiles contain post counts comment counts, along with the account creation date displayed in a user-friendly format.
- Autoplay photo carousels on the About page.
- Comment and post deletion option available only to the user.
- Login requirement for any content deletion, preventing unintended actions from malicious users.
- Disabling buttons when an action is not possible (No avatar set – can’t delete avatar)
- Flash messages for various errors and feedback.
- Using session data to track the current page for a smoother color mode toggling experience.

Appendix B – All Pages

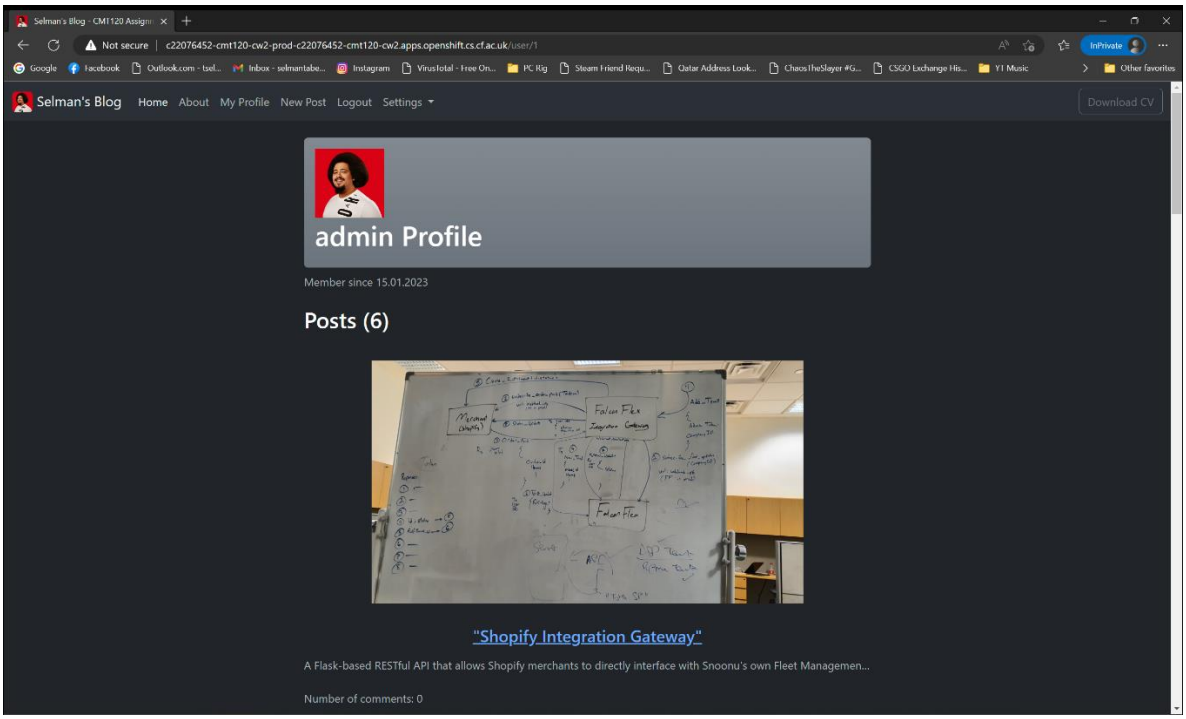
The Portfolio – Main Page



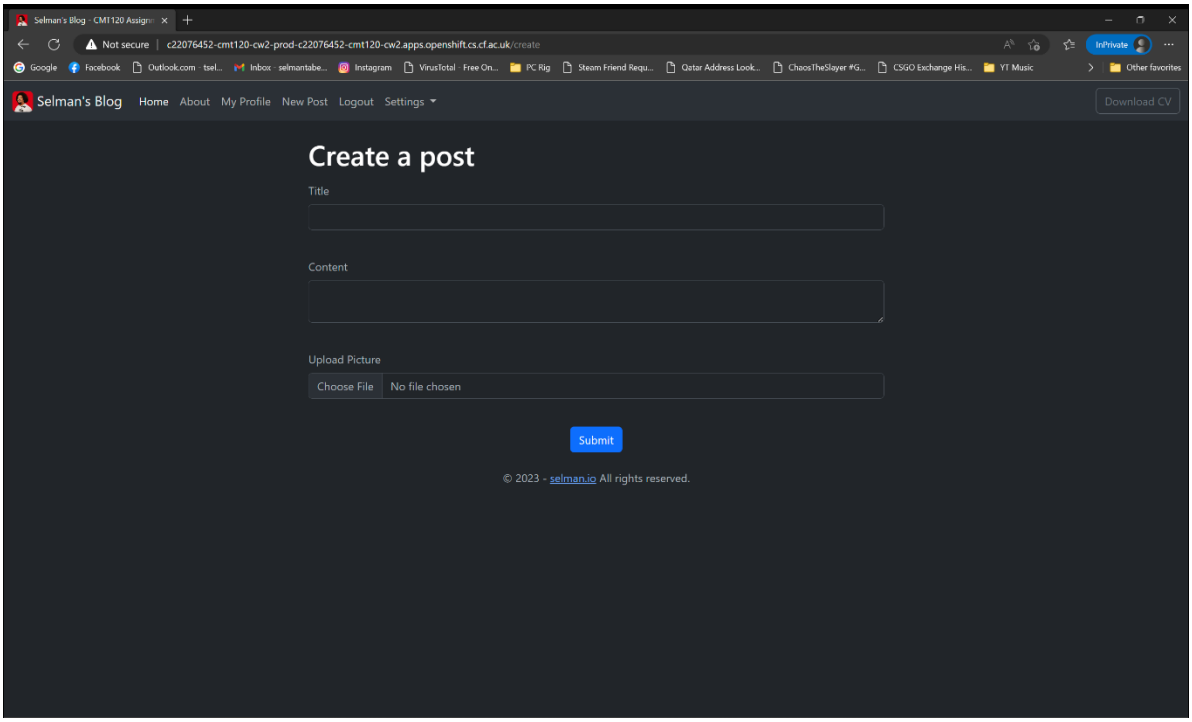
About Me



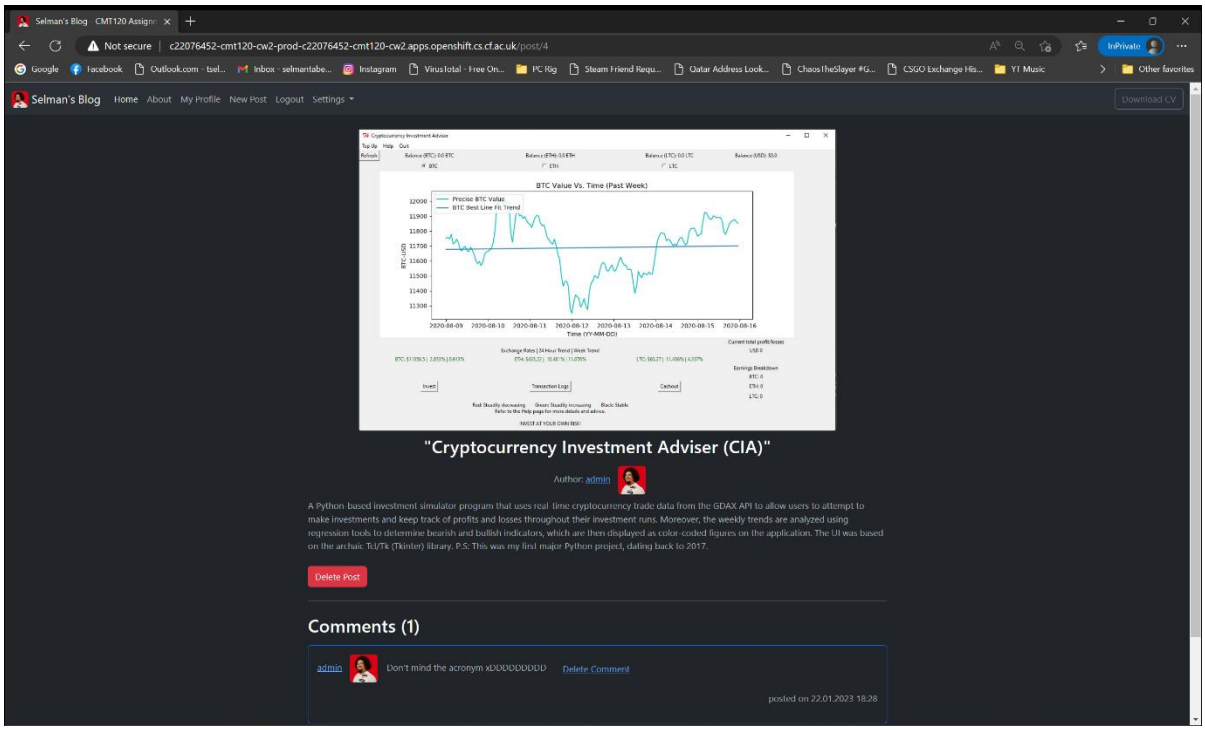
User Profile



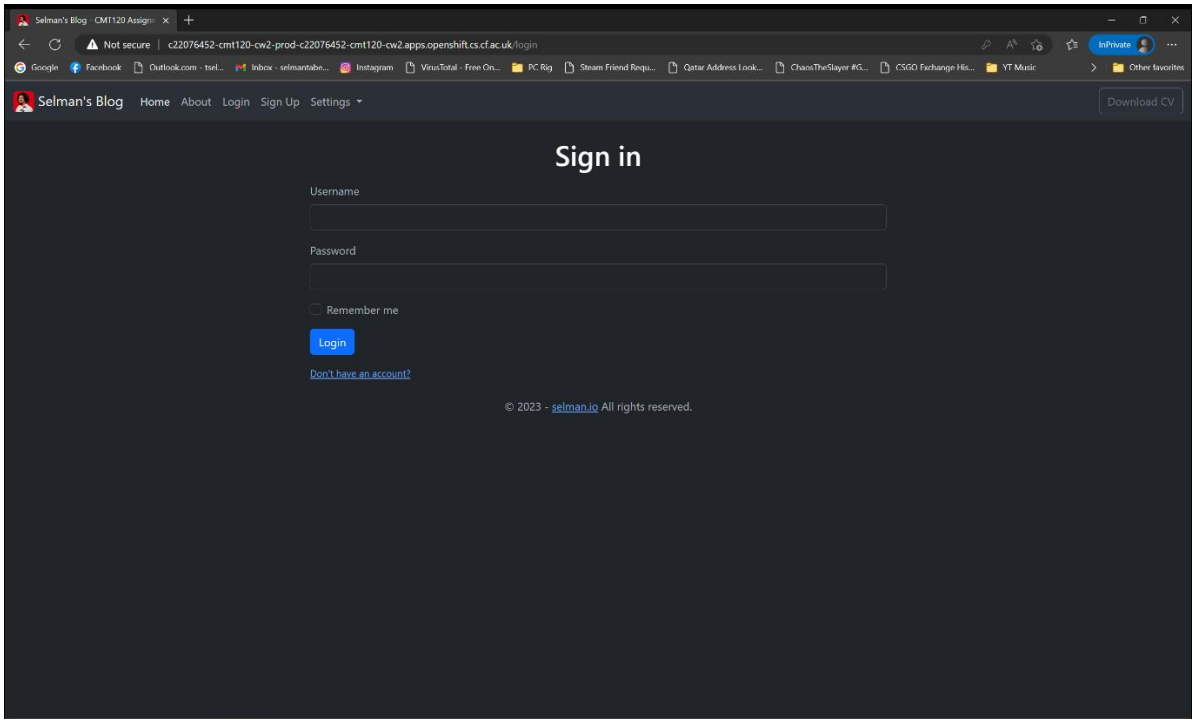
Post Creation Page



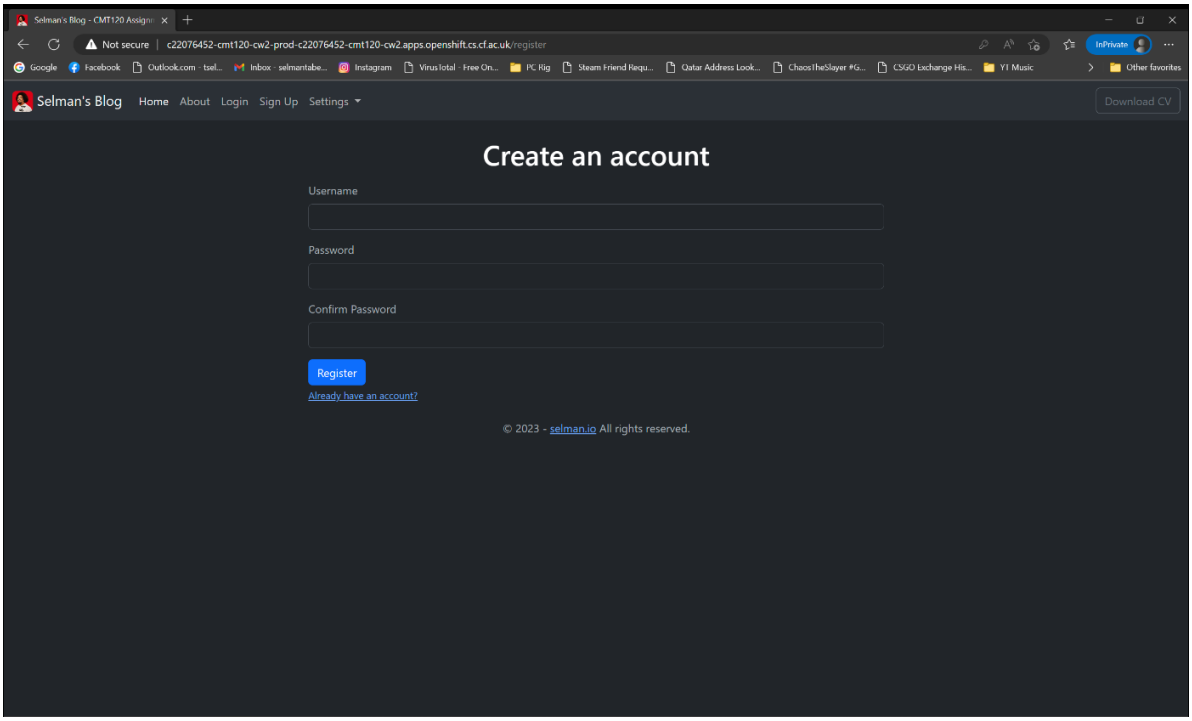
Post Page



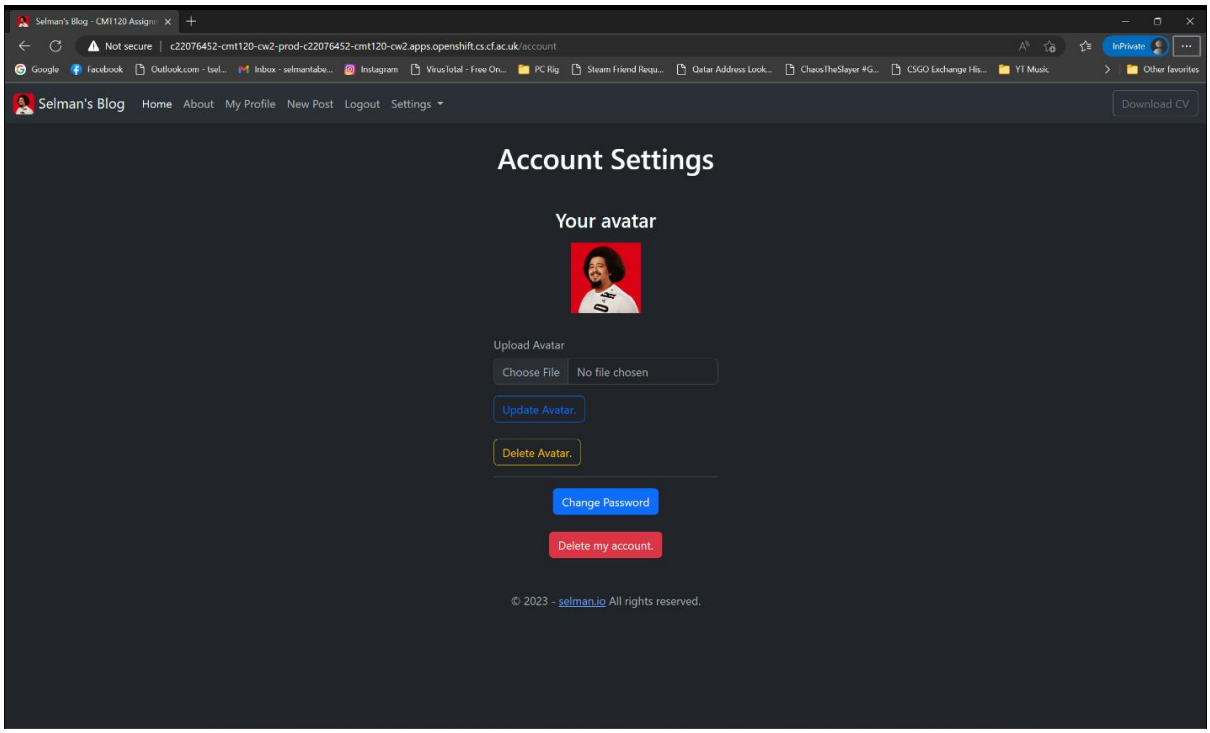
Login Page



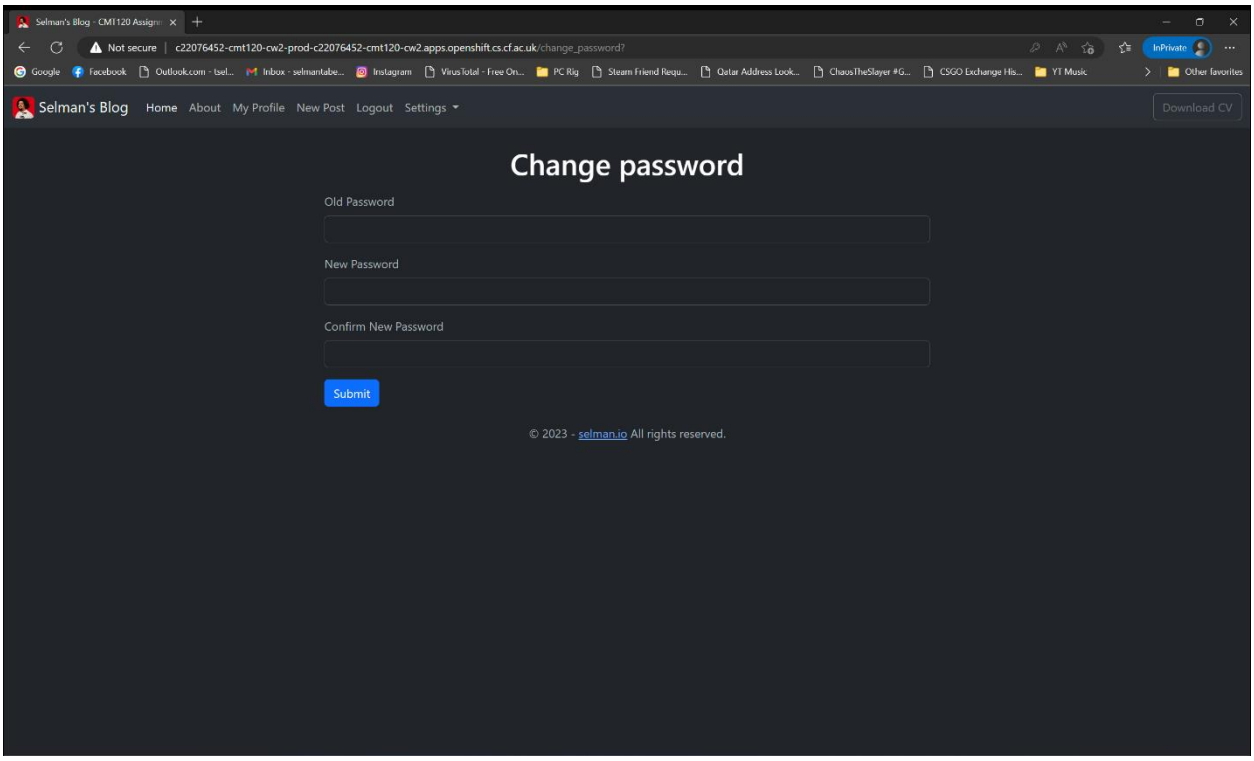
Signup Page



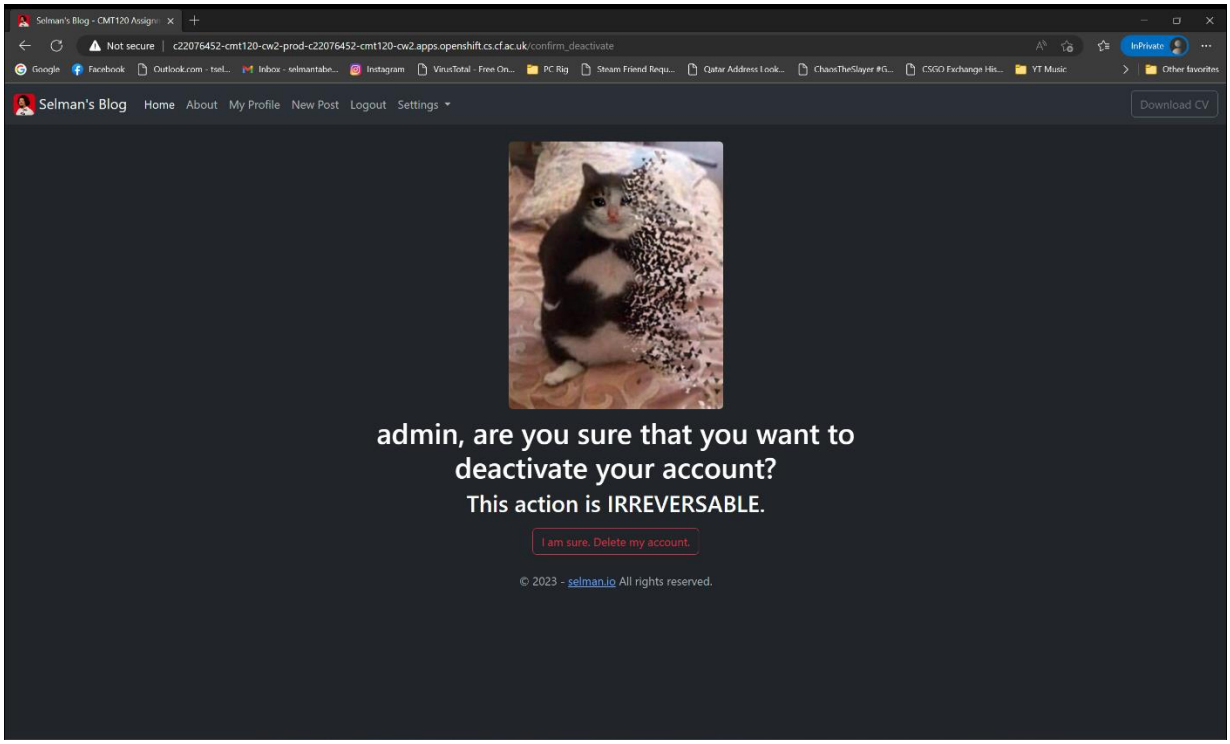
Account Settings



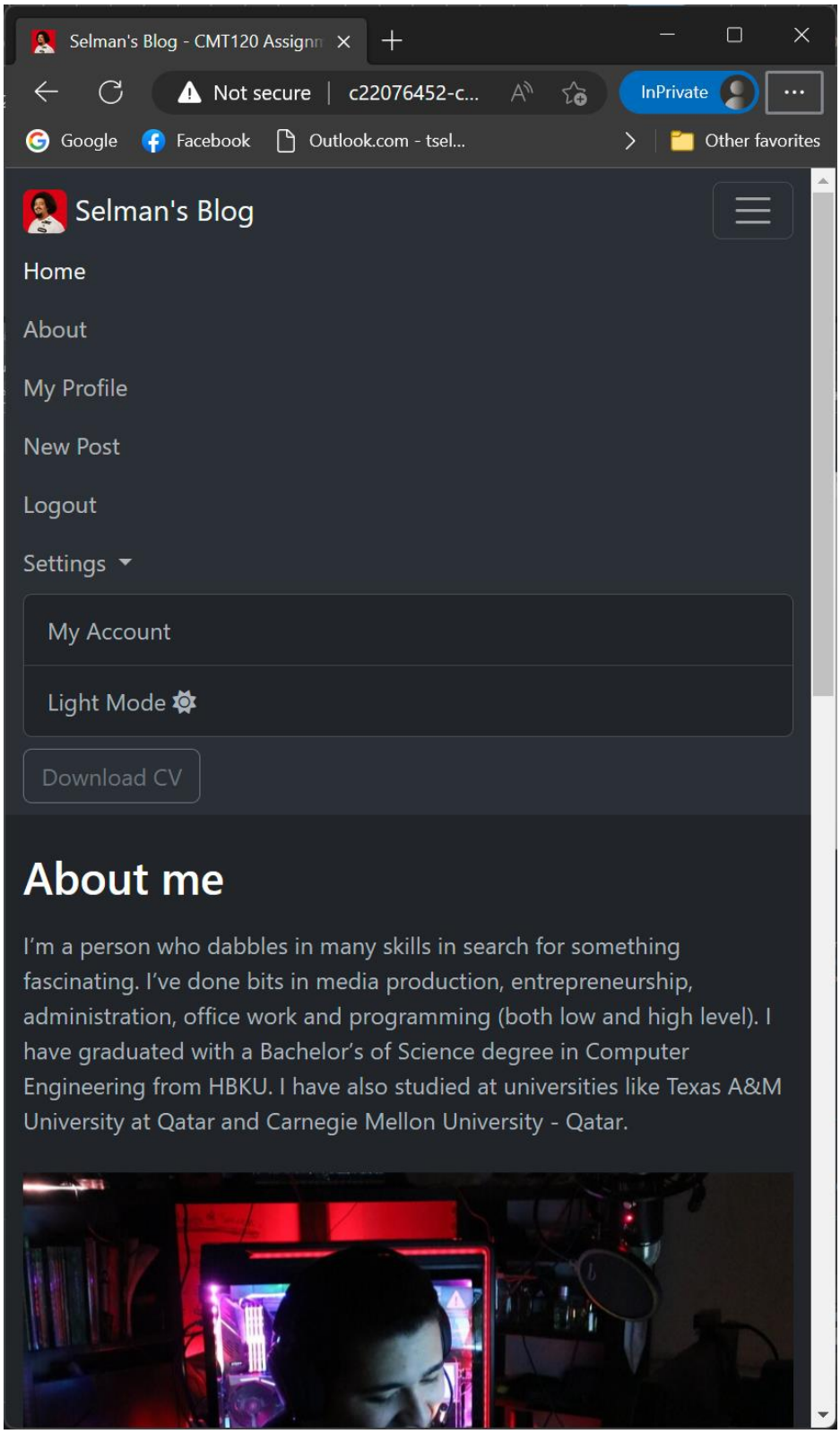
Password Change Page



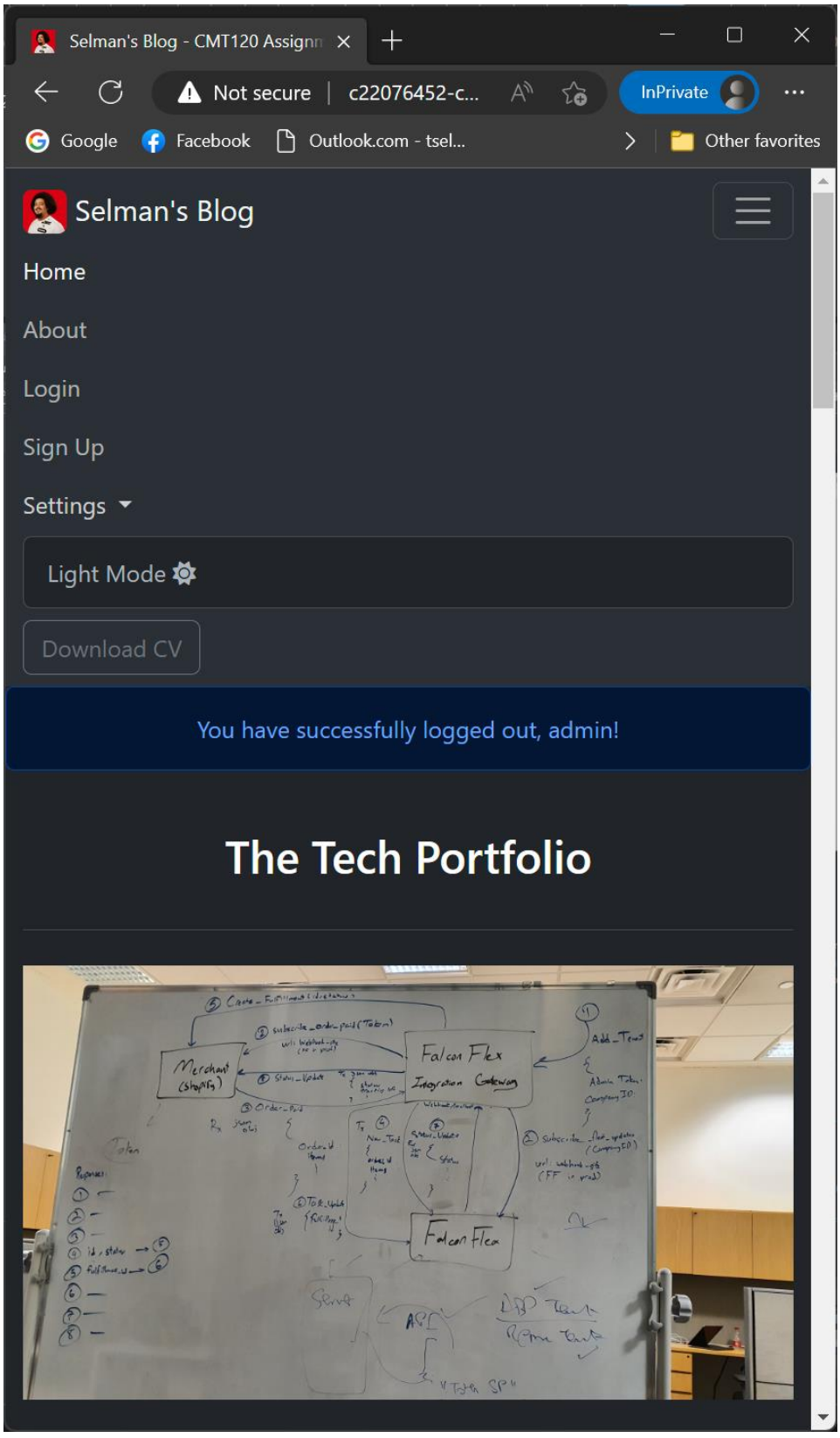
Account Deactivation Page



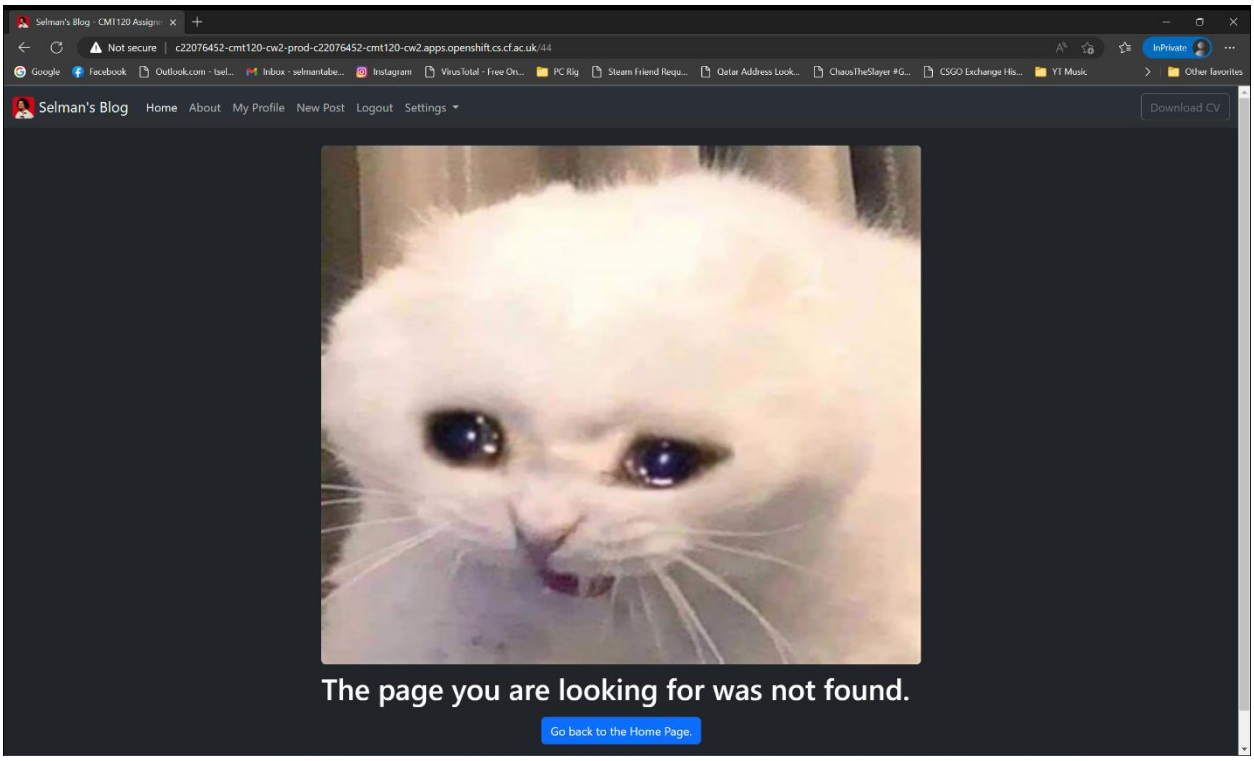
Burger Popup Menu (Logged in)



Burger Popup Menu (Logged out)



Error 404 – Page Not Found



Error 403 – Forbidden