Development Team Project: Design Document

Team Name: GAZHA

Team Members: George Koridze, Andrius Busilas, Zukiswa Tuso, Helen Oi Lam Siu, Anda Ziemele, Seyun Hur

Contents

1 Introduction

This design document outlines the development of a secure management application for an online retailer. The application provides a Command-Line Interface (CLI) for authorised users to perform Create, Read, Update, and Delete (CRUD) operations. Security and compliance with the General Data Protection Regulation (GDPR) (GDPR, N.D.) and the Payment Card Industry Data Security Standard (PCI DSS) (PCI Security Standards Council, 2024) are key priorities.

The business model chosen is a B2B eShop for beauty products, targeting individual hair stylists working at salons. Customers must specify their associated companies during registration for platform access. The system uses role-based access control (RBAC) for admins, clerks, and customers.

2 Retail Domain

Consumer trust is critical for retail websites, (D’Adamo et al., 2021), and this application prioritises cybersecurity, privacy, and compliance to meet industry expectations (Appendix 1).

3 System Requirements and Assumptions

3.1 System Requirements

The application meets the following functional and non-functional requirements, supported by user stories (Appendix 2).

- Enabling user authentication and authorisation with RBAC.
- REST Application Programming Interface (API) integration.
- CRUD operations.
- Security capability toggle via CLI.
- Logging and monitoring of interactions.
- Input validation to prevent vulnerabilities.
- Inventory stored in JSON file format.
- Protect Personal data using encryption.
- CLI-based access.

3.2 Assumptions

- Third-party libraries will be used for development.
- Compatible with on-premise infrastructure.
- Not hosted on a live web server.
- Focus on security features, not complete eShop functionality.

4 Design Decisions and Approaches

4.1 Methodology

The Scrum Solo methodology (Pagotto et al., 2016; Brito et al., 2020) is used, dividing the project into iterative sprints for incremental development. SOLID design principles (Singh & Hassan, 2015) and PEP-8 style guide for Python ensure high code quality.

4.2 Software Design

The Model-View-Controller (MVC) pattern separates concerns, enabling rapid prototyping and customisability (Pop & Altar, 2014). The Strategy pattern is used for user validation, ensuring appropriate strategies for authentication and authorisation based on the user (Hays et al. (2000), as cited in Uzunov, 2012; Blancarte, 2021). The two design patterns go hand-in-hand as the controller decides what to send to the view, depending on the strategy applied (Sellares, n.d.).

4.3 Data Structures

Key data structures include:

Data structure	Field	Justification
Array	orderItems	Efficient retrieval using unique IDs.
	inventoryItems	
	orderHistory	

Tree	categoryTree	Efficient searching by brand, category and subCategory fields (Lin, 2023).
Dictionary	Address	Address fields will be stored as key-value pairs for easy storage and retrieval (Ada, n.d.).

Table 1: Data Structures

4.4 API

The application incorporates a REST API to validate user input during registration. It integrates with an internal repository of company IDs for legitimate user verification (Moore. et al, 2023).

`Flask` is used for the REST API to create a microservice without requiring additional decisions, such as data storage (Martinez & Krebs, 2022).

5 Security Concerns and Mitigations

Key security challenges and mitigations are summarised below:

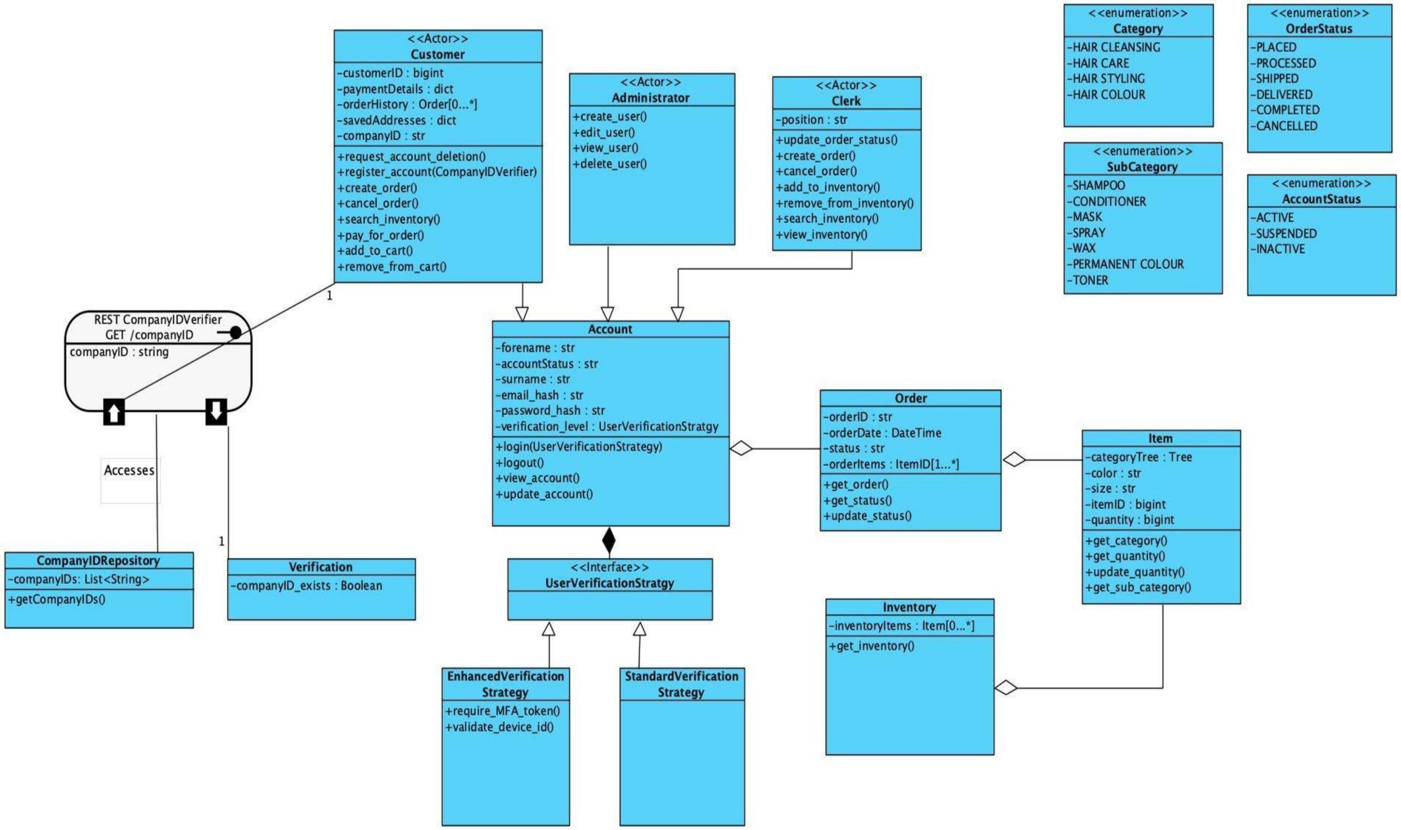
Attack Vector	**OWASP Top 10 2021** (Appendix 3)	**Challenge and Threat**	**Mitigation**	**OWASP Proactive Controls 2024** (Appendix 4)	**STRIDE Threat** (Appendix 5)
Brute Force Attacks	● A04 ● A07 ● A09	Credential stuffing and password spraying to gain unauthorised access.	● Multi-Factor Authentication (MFA) ● Account lockout after 3 attempts ● Monitoring ● Logging	● C4 ● C7 ● C9	● Spoofing (S) ● Repudiation (R) ● Elevation of Privilege (E)

Denial of Service (DoS) Attacks	● A04 ● A09 ● A10	Flooding attacks cause downtime or resource exhaustion.	● Monitoring ● Logging ● Rate-limiting	● C4 ● C9 ● C10	● Denial of Service (D)
Insecure APIs and Injection Attacks	● A03 ● A04	Weak APIs expose systems to unauthorised access and malicious payloads.	● API securing with OAuth ● Token-based API authentication ● Input validation ● Permission limiting	● C3 ● C4	● S ● Tampering (T) ● Information Disclosure (I)
Weak Authentication Mechanisms	● A07	Poor authentication enables unauthorised access.	● Strong password requirement ● MFA ● Secure session management ● Sensitive data encryption ● RBAC	● C7	● S ● R ● E

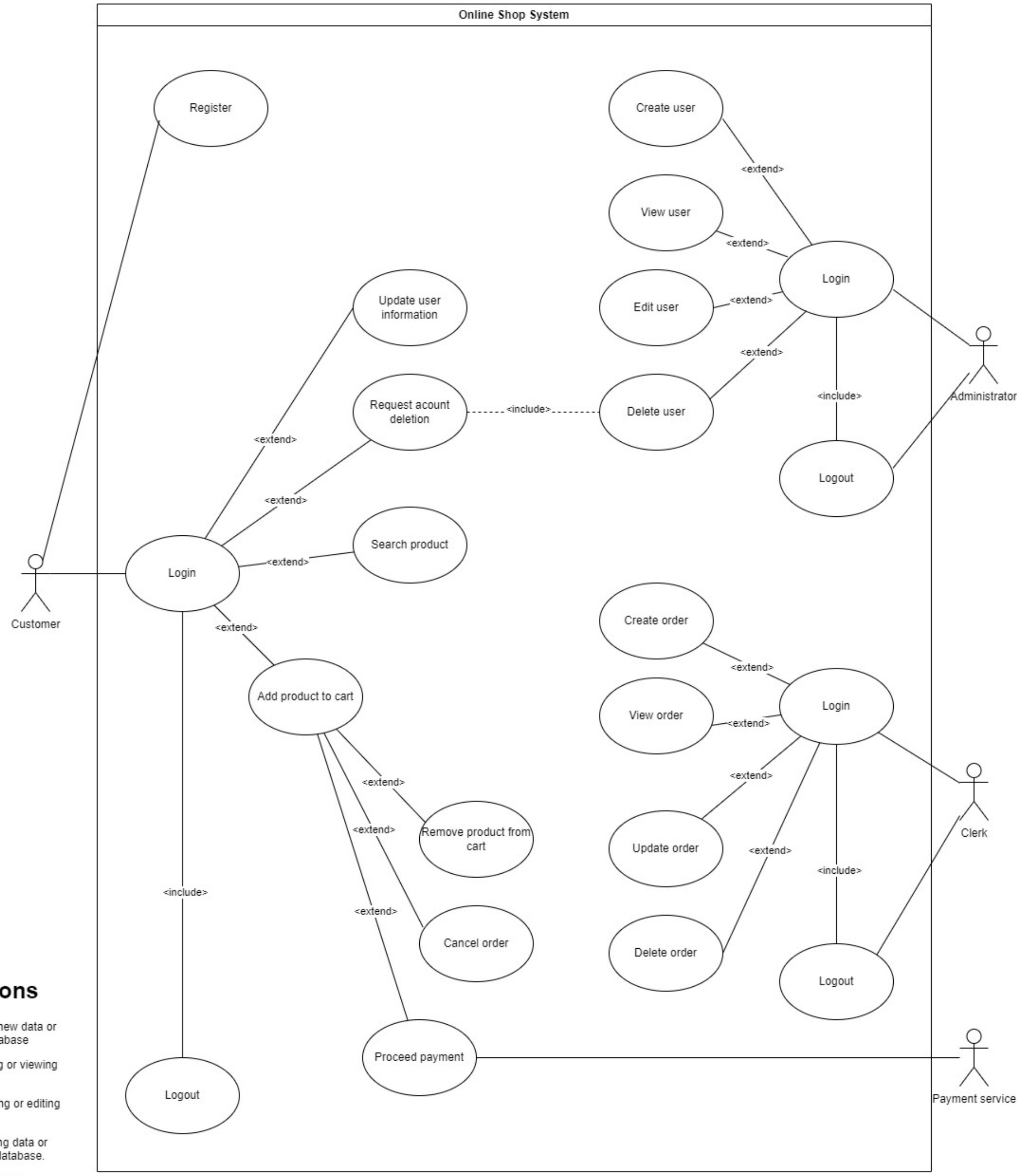
Table 2: Key attack vectors and proposed mitigations, in alignment with OWASP Top Ten and STRIDE.

6 UML Designs

6.1 Class Diagram



6.2 Use Case Diagram



CRUD Operations

Create: Adding new data or records to a database

Read: Retrieving or viewing existing data.

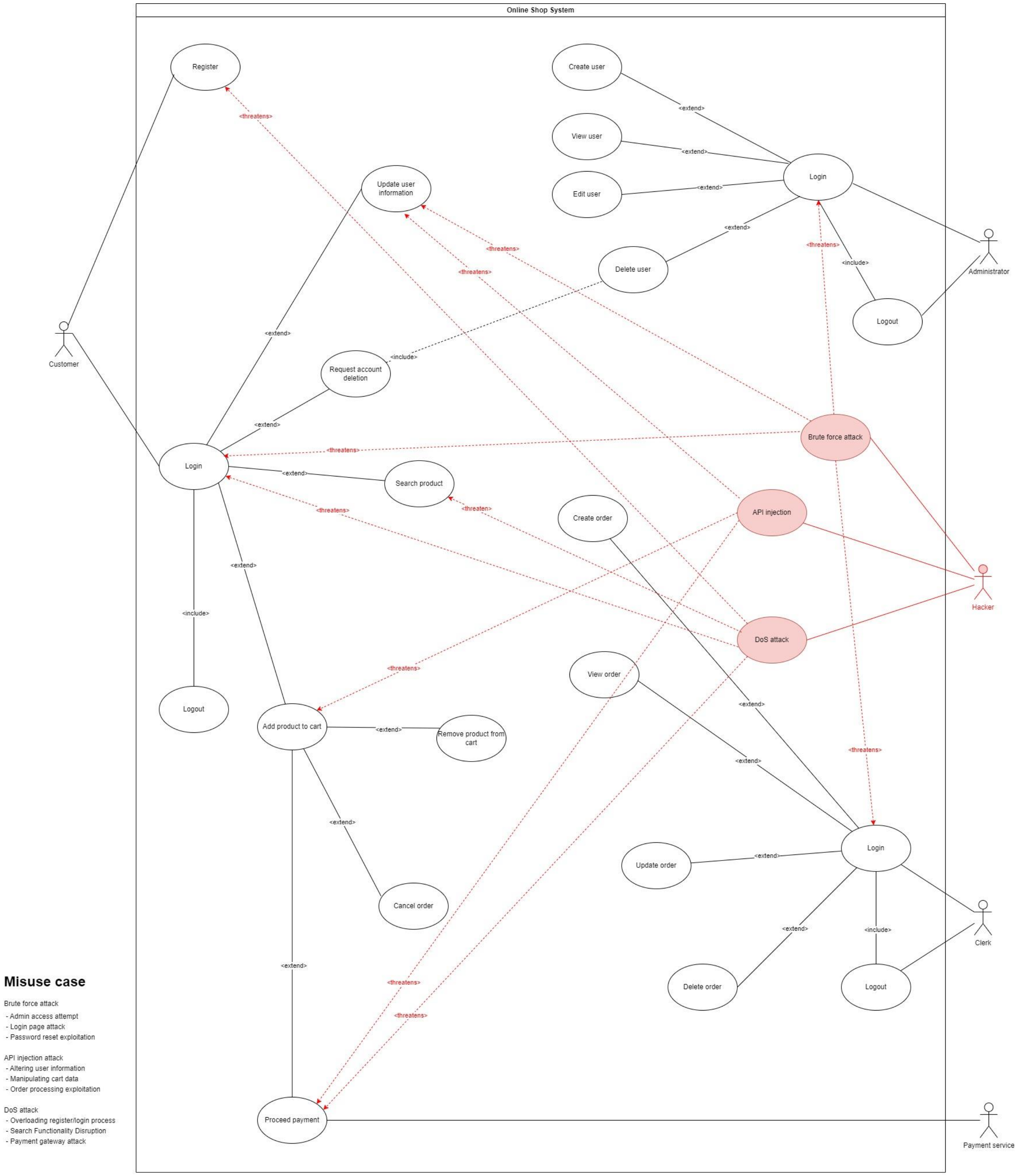
Update: Modifying or editing existing data.

Delete: Removing data or records from a database.

(Codecademy, n.d.)

6.3 Misuse Case Diagram

6.3.1 Misuse Case (Pauli & Xu, 2005)



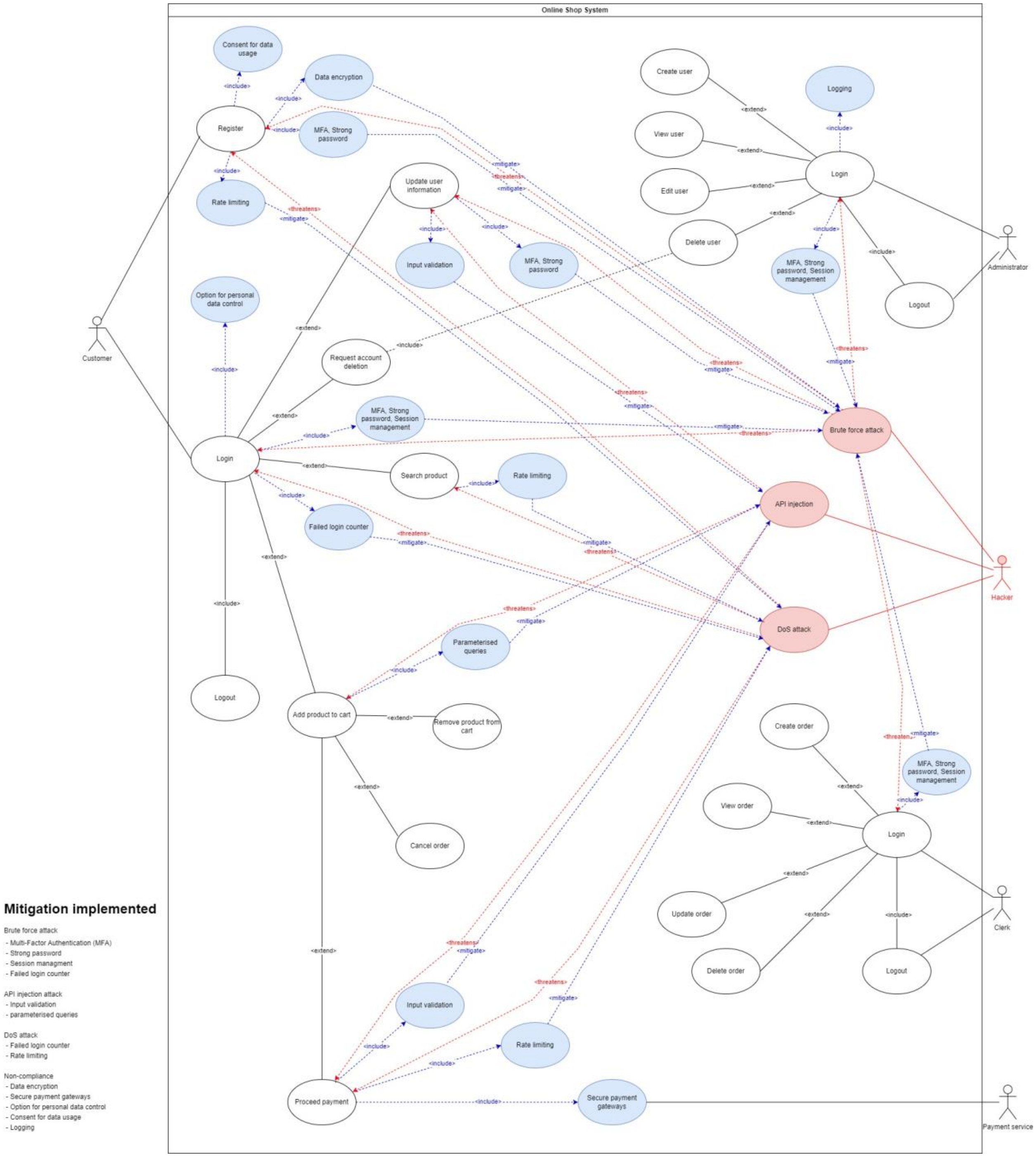
Misuse case

Brute force attack
- Admin access attempt
- Login page attack
- Password reset exploitation

API injection attack
- Altering user information
- Manipulating cart data
- Order processing exploitation

DoS attack
- Overloading register/login process
- Search Functionality Disruption
- Payment gateway attack

6.3.2 Misuse Case with Mitigation



Mitigation implemented

Brute force attack
- Multi-Factor Authentication (MFA)
- Strong password
- Session managment
- Failed login counter

API injection attack
- Input validation
- parameterised queries

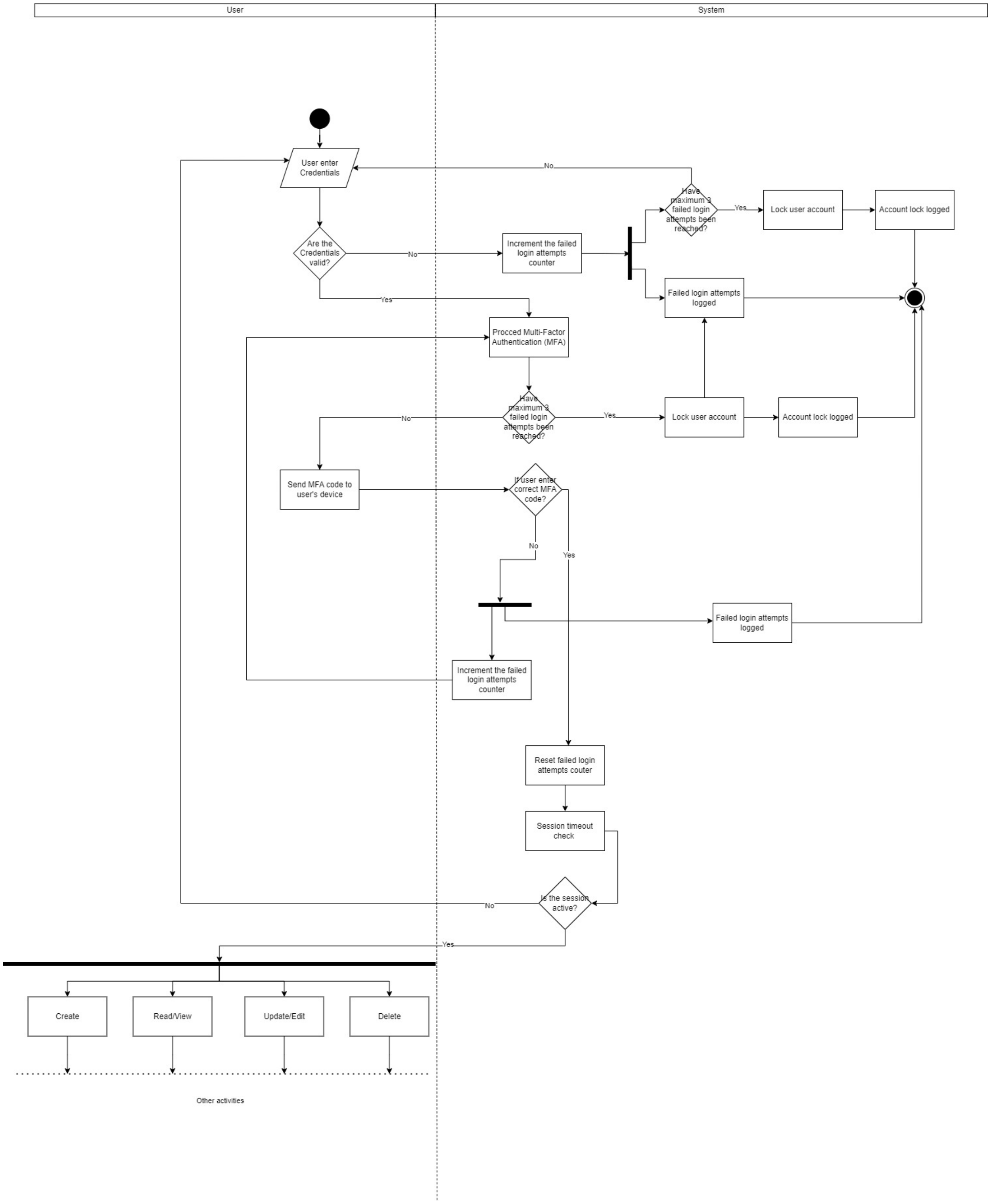
DoS attack
- Failed login counter
- Rate limiting

Non-compliance
- Data encryption
- Secure payment gateways
- Option for personal data control
- Consent for data usage
- Logging

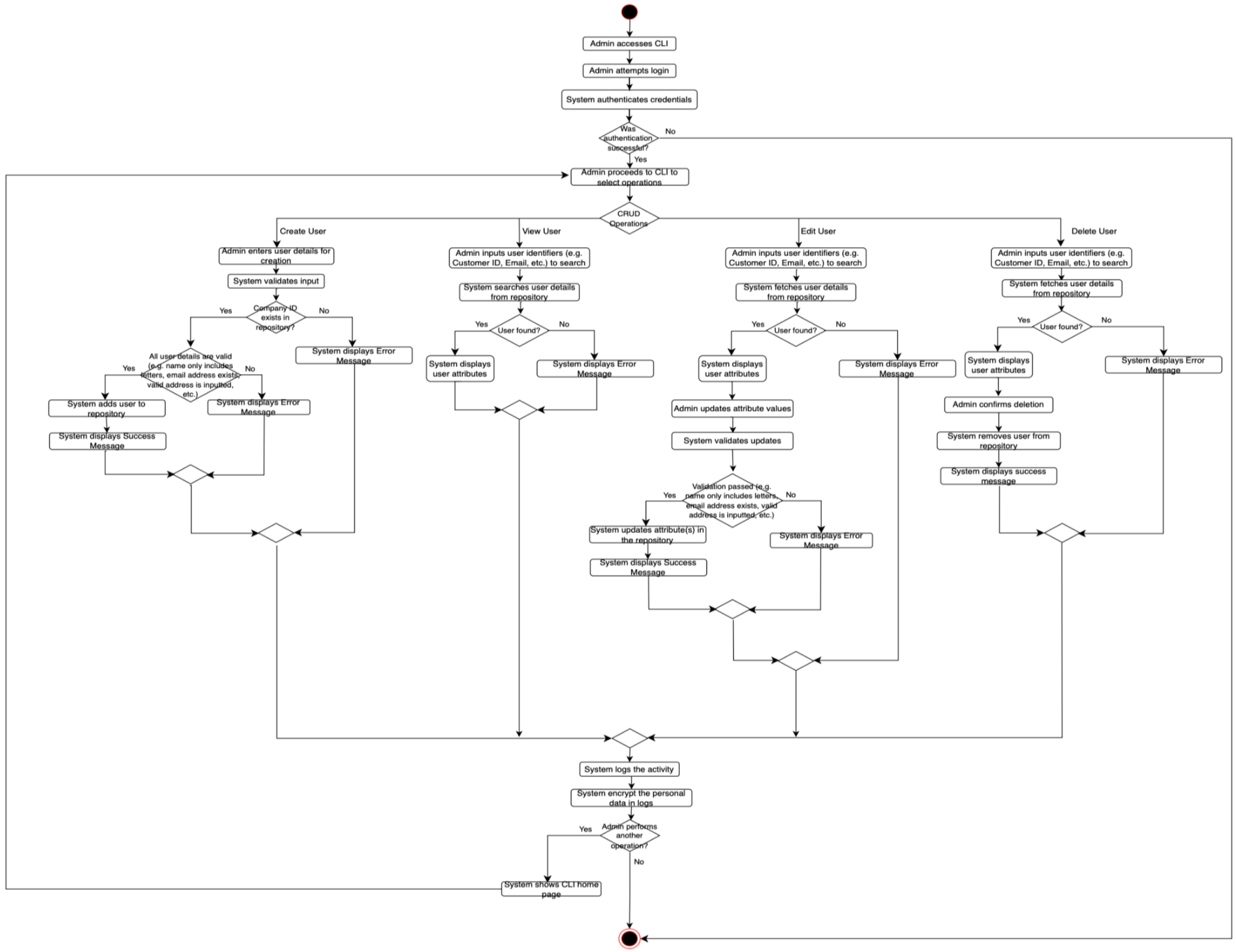
6.4 Activity Diagram

Separate diagrams for login and CRUD operations.

6.4.1 User login activities

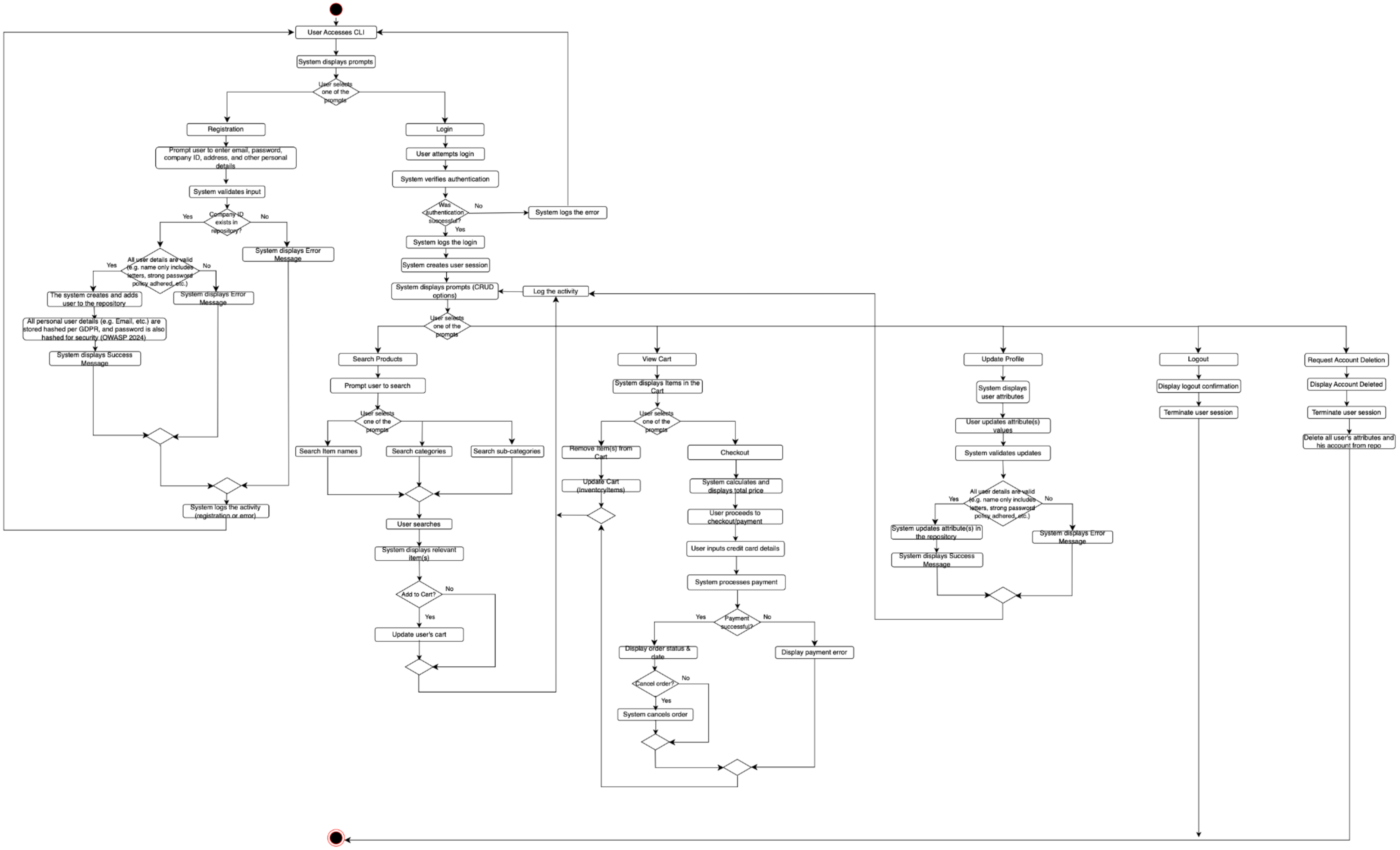

User
System
User enter Credentials
No
Have maximum 3 failed login attempts been reached?
Yes
Lock user account
Account lock logged
Are the Credentials valid?
No
Increment the failed login attempts counter
Failed login attempts logged
Yes
Procced Multi-Factor Authentication (MFA)
Have maximum 3 failed login attempts been reached?
No
Yes
Lock user account
Account lock logged
Send MFA code to user's device
If user enter correct MFA code?
No
Yes
Failed login attempts logged
Increment the failed login attempts counter
Reset failed login attempts couter
Session timeout check
Is the session active?
No
Yes
Create
Read/View
Update/Edit
Delete
Other activities

6.4.2 Administration user CRUD activities



Admin accesses CLI
Admin attempts login
System authenticates credentials
Was authentication successful?
No
Yes
Admin proceeds to CLI to select operations
CRUD Operations
Create User
View User
Edit User
Delete User
Admin enters user details for creation
System validates input
Yes
Company ID exists in repository?
No
All user details are valid (e.g. name only includes letters, email address exists, valid address is inputted, etc.)
Yes
No
System displays Error Message
System adds user to repository
System displays Error Message
System displays Success Message
Admin inputs user identifiers (e.g. Customer ID, Email, etc.) to search
System searches user details from repository
Yes
User found?
No
System displays user attributes
System displays Error Message
Admin inputs user identifiers (e.g. Customer ID, Email, etc.) to search
System fetches user details from repository
Yes
User found?
No
System displays user attributes
System displays Error Message
Admin updates attribute values
System validates updates
Validation passed (e.g. name only includes letters, email address exists, valid address is inputted, etc.)
Yes
No
System updates attribute(s) in the repository
System displays Error Message
System displays Success Message
Admin inputs user identifiers (e.g. Customer ID, Email, etc.) to search
System fetches user details from repository
Yes
User found?
No
System displays user attributes
System displays Error Message
Admin confirms deletion
System removes user from repository
System displays success message
System logs the activity
System encrypt the personal data in logs
Yes
Admin performs another operation?
No
System shows CLI home page

6.4.3 Customer user activities


User Accesses CLI
System displays prompts
User selects one of the prompts
Registration
Prompt user to enter email, password, company ID, address, and other personal details
System validates input
Company ID exists in repository?
Yes
No
System displays Error Message
All user details are valid (e.g. name only includes letters, strong password policy adhered, etc.)
Yes
No
The system creates and adds user to the repository
System displays Error Message
All personal user details (e.g. Email, etc.) are stored hashed per GDPR, and password is also hashed for security (OWASP 2024)
System displays Success Message
System logs the activity (registration or error)
Login
User attempts login
System verifies authentication
Was authentication successful?
No
System logs the error
Yes
System logs the login
System creates user session
System displays prompts (CRUD options)
Log the activity
User selects one of the prompts
Search Products
Prompt user to search
User selects one of the prompts
Search Item names
Search categories
Search sub-categories
User searches
System displays relevant item(s)
Add to Cart?
No
Yes
Update user's cart
View Cart
System displays Items in the Cart
User selects one of the prompts
Remove Item(s) from Cart
Update Cart (InventoryItems)
Checkout
System calculates and displays total price
User proceeds to checkout/payment
User inputs credit card details
System processes payment
Payment successful?
Yes
No
Display order status & date
Display payment error
Cancel order?
No
Yes
System cancels order
Update Profile
System displays user attributes
User updates attribute(s) values
System validates updates
All user details are valid (e.g. name only includes letters, strong password policy adhered, etc.)
Yes
No
System updates attribute(s) in the repository
System displays Success Message
System displays Error Message
Logout
Display logout confirmation
Terminate user session
Request Account Deletion
Display Account Deleted
Terminate user session
Delete all user's attributes and his account from repo

7 Tools and Libraries

Category	Tools and Libraries
Development and Version Control	Python 3; Git and GitHub
Security	`bcrypt` (password hashing to prevent brute-force attacks) (OWASP, 2024a). `cryptography` (encryption key management for sensitive data with secure key storage and retrieval) (PCI Security Standards Council, 2024; Reitz & Schlusser, 2016). `hashlib` (data integrity through secure hashing) (OWASP, 2024a). `pyJWT` (API protection) (OWASP, 2024a).
API Handling and Validation	`requests` (simplifies HTTP requests for integration with APIs) (Madden, 2020). `oauthlib` (framework for authorising API requests). `Flask` (library for creating microframework REST API) (Pallets, 2010).
Input Validation	`regex` (build tailored input validation rules for multiple use cases)
Logging and Monitoring	logging (tracking events and detecting issues with system actions) (Madden, 2020).

Table 3: Tools and Libraries

8 Testing Strategy

The following will be used to test the software application:

Test Category	**Test**	**Methods & Libraries**	**Justification**
White-Box / Functional Testing	Unit Testing	`Pytest` library	Fixtures enhance customisability and user-friendly syntax (Barbosa & Hora, 2022).
	Integration Testing		
Black-Box Testing	Non-Destructive Penetration Testing	Brute Force Attacks (Password Spraying (Ranjan, n.d.), Credential Stuffing)	Identifies weaknesses in authentication; password spraying is increasingly successful (Vugdelija et al., 2021)
	Destructive Penetration Testing	DoS attack; Buffer Overflow Attack	DoS attacks test system resilience by breaking availability, violating GDPR requirements (Bienkowski, 2018).

Table 4: Testing strategy

The following source code analysis tools for static application security testing (SAST) will aid secure code development:

Linter	**Tool**	**Justification**
Security Linter	`Bandit`	Identifies hard-coded passwords and vulnerabilities (Sonar, n.d.).
Type Checking	`Pyre`	Enhances linter performance and code maintainability (Bailey, 2019).
General Linter	`Ruff`	Integrates capabilities of `Flake8`, `mccabe`, `isort` and `pydocstyle`.

Table 5: SAST

9 Compliance and Privacy

This application limits personal data collection to essential information under Article 6(1)(f) (GDPR, 2024a), ensures GDPR compliance for user rights and data handling (Appendix 6), and adheres to PCI DSS standards for secure payment data handling and transmission (Appendix 7).

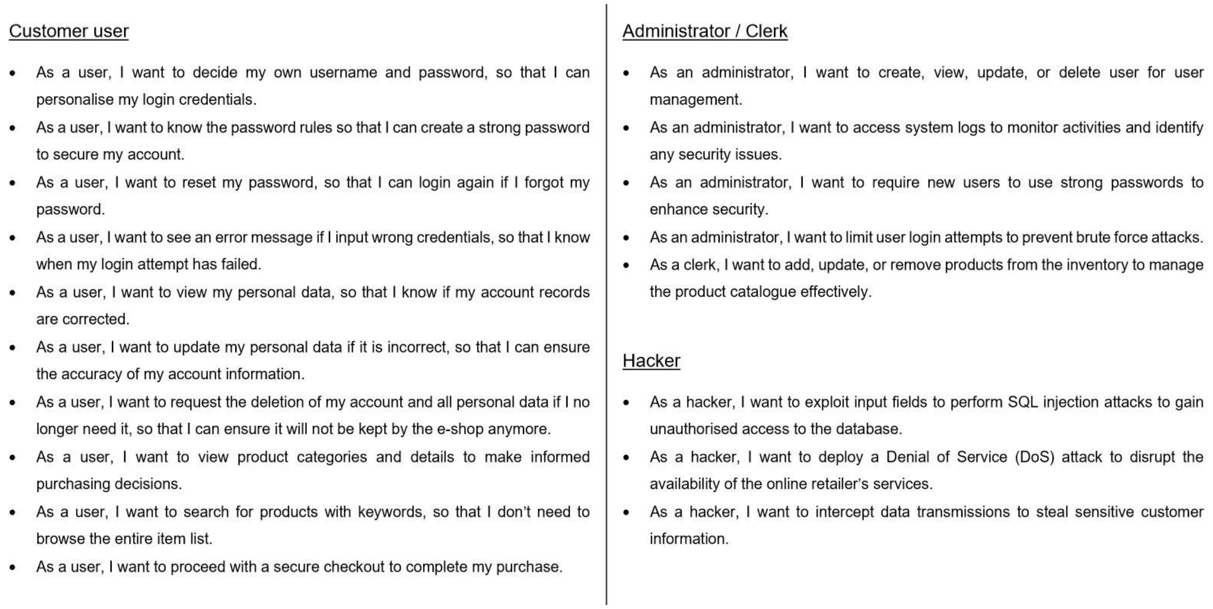
10 Appendices

- ○ **Appendix 1: Domain requirements table**

Requirement Area	**Requirement**	**Justification**
Cybersecurity and Privacy	Data Protection	Safeguards consumer information from unauthorised entry ensures GDPR adherence and builds customer confidence (D'Adamo et al., 2021).
	Secure Payment Systems	Safe transaction processing enhances buyer trust and minimises fraudulent activities, which are key concerns in e-commerce (D'Adamo et al., 2021).
	User Authentication	Two-factor verification provides a crucial security barrier that decreases the likelihood of unauthorised account access (D'Adamo et al., 2021).
	Regular Security Audits	Consistent security checks actively detect weaknesses, uphold protection, and reduce data breach risk (D'Adamo et al., 2021).
	Incident Response Plan	A breach response strategy enables swift action during security incidents, minimising potential

		harm to reputation and consumer faith (D'Adamo et al., 2021).
User Experience and Trust	Accessible and Reliable Customer Support	Precise item details help to avoid misinformation, enhance consumer trust, and lower return frequencies (D'Adamo et al., 2021).
	Secure and Convenient Checkout	An intuitive protected checkout process decreases cart abandonment and boosts conversion rates (D'Adamo et al. 2021).
Operational and Technical	Scalability	Facilitates expansion by ensuring that the system can manage traffic surges during high-volume periods (D'Adamo et al., 2021).
	Cross-Device Compatibility	A uniform user experience is delivered across platforms, which is crucial to the increasing prevalence of mobile shopping (D'Adamo et al., 2021).
	Inventory and Order Management	Live-stock monitoring ensures order precision, minimises errors, and enhances customer satisfaction (D'Adamo et al., 2021).
	Analytics and Personalization	Data analysis enables personalised experiences, boosting engagement and the probability of repeat purchases (D'Adamo et al., 2021).
Compliance and Legal	Adherence to Consumer Rights	Adherence to consumer protection regulations builds trust and shields companies from legal consequences (D'Adamo et al., 2021).
	Cross-Border Sales Compliance	Guarantees comply with international tax and customs regulations that are crucial for global expansion and scaling (D'Adamo et al. 2021).
	Transparency in Data Usage	Open communication about data usage strengthens consumer trust, aligns with privacy laws, and addresses consumer data concerns (D'Adamo et al., 2021).

○ Appendix 2: User stories



Customer user

- As a user, I want to decide my own username and password, so that I can personalise my login credentials.
- As a user, I want to know the password rules so that I can create a strong password to secure my account.
- As a user, I want to reset my password, so that I can login again if I forgot my password.
- As a user, I want to see an error message if I input wrong credentials, so that I know when my login attempt has failed.
- As a user, I want to view my personal data, so that I know if my account records are corrected.
- As a user, I want to update my personal data if it is incorrect, so that I can ensure the accuracy of my account information.
- As a user, I want to request the deletion of my account and all personal data if I no longer need it, so that I can ensure it will not be kept by the e-shop anymore.
- As a user, I want to view product categories and details to make informed purchasing decisions.
- As a user, I want to search for products with keywords, so that I don't need to browse the entire item list.
- As a user, I want to proceed with a secure checkout to complete my purchase.

Administrator / Clerk

- As an administrator, I want to create, view, update, or delete user for user management.
- As an administrator, I want to access system logs to monitor activities and identify any security issues.
- As an administrator, I want to require new users to use strong passwords to enhance security.
- As an administrator, I want to limit user login attempts to prevent brute force attacks.
- As a clerk, I want to add, update, or remove products from the inventory to manage the product catalogue effectively.

Hacker

- As a hacker, I want to exploit input fields to perform SQL injection attacks to gain unauthorised access to the database.
- As a hacker, I want to deploy a Denial of Service (DoS) attack to disrupt the availability of the online retailer's services.
- As a hacker, I want to intercept data transmissions to steal sensitive customer information.

○ Appendix 3: OWASP Top 10 2021

OWASP Top 10 Web Application Security Risks (OWASP, 2021)	
A01:2021 – Broken Access Control	Limit unauthorised access by enforcing role-based controls, least privilege, and deny-by-default policies on all endpoints.
A02:2021 – Cryptographic Failures	Secure sensitive data with strong encryption (e.g., AES-256), key management, and enforce HTTPS to prevent exposure.
A03:2021 – Injection	Prevent SQL, NoSQL, and command injections with parameterized queries, input validation, and avoiding concatenated queries.
A04:2021 – Insecure Design	Use secure design principles, threat modelling, and architectural reviews to prevent vulnerabilities in initial development.
A05:2021 – Security Misconfiguration	Review configurations, disable unused features, secure cloud storage, and update software to prevent exposure from misconfigurations.

A06:2021 – Vulnerable and Outdated Components	Update components, avoid deprecated libraries, and use dependency management tools to protect against known vulnerabilities.
A07:2021 – Identification and Authentication Failures	Strengthen authentication with MFA, strong password policies, and secure session management to prevent unauthorised access.
A08:2021 – Software and Data Integrity Failures	Use code signing, secure CI/CD pipelines, and validate dependencies to ensure software and data integrity.
A09:2021 – Security Logging and Monitoring Failures	Implement logging, real-time monitoring, and alerting to detect and respond to security incidents effectively.
A10:2021 – Server-Side Request Forgery (SSRF)	Prevent SSRF by validating URLs, restricting HTTP requests, and applying strict network access controls.

- **Appendix 4: OWASP Top 10 2024 Proactive Controls**

OWASP Top 10 2024 proactive controls (OWASP, 2024b)	
C1: Implement Access Control	Inadequate access controls allow unauthorised access. Use **RBAC** or attribute-based access control (**ABAC)**, enforce least privilege, and review permissions to restrict access.
C2: Use Cryptography to Protect Data	Weak cryptography exposes data. Secure sensitive data using **AES** encryption, proper key management, and enforce HTTPS for data in transit.
C3: Validate all Input & Handle Exceptions	Unvalidated inputs allow injection attacks. Apply **OWASP Input Validation** guidelines, sanitise data, and handle exceptions for secure data processing.
C4: Address Security from the Start	Early-stage security prevents vulnerabilities. Use **Secure Software Development Lifecycle (S-SDLC)** principles, perform threat modelling, and apply secure design.
C5: Secure By Default Configurations	Default settings increase risk. Change defaults, disable unnecessary features, and follow **OWASP Security Configuration** guidelines to strengthen defences.

C6: Keep your Components Secure	Outdated components introduce vulnerabilities. Regularly update dependencies, use **OWASP Dependency-Check**, and monitor for known security issues.
C7: Secure Digital Identities	Weak authentication risks account security. Implement **MFA**, enforce strong passwords, and secure sessions using **OAuth 2.0** or **OpenID Connect**.
C8: Leverage Browser Security Features	Prevent browser-based attacks using **CSP** and **HSTS** headers, secure cookies, and enable client-side security policies.
C9: Implement Security Logging and Monitoring	Lack of logging impedes response. Log security events, monitor in real-time, and establish alerts to detect suspicious activity early.
C10: Stop Server-Side Request Forgery	SSRF allows unauthorised server requests. Validate URLs, enforce network access controls, and limit outbound requests per **OWASP SSRF Prevention** guidelines.

- **Appendix 5: STRIDE Model**

STRIDE Model	Threats	Mitigations
Spoofing	Impersonation of customers, admins, APIs, or payment systems.	Use multi-factor authentication (MFA), strong password policies, and token-based API authentication
Tampering	Modifying product data, payments, or client-side scripts.	Enforce input validation, use cryptographic hashes, and apply Content Security Policies (CSP)
Repudiation	Denial of actions like orders or changes by users or employees.	Secure, tamper-proof logging with timestamps and digital signatures.
Information Disclosure	Leaking customer data, API keys, or sensitive backend info.	Enforce HTTPS, encrypt sensitive data, and implement least-privilege access.

Denial of Service (DoS)	DDoS attacks, API abuse, resource exhaustion.	Deploy WAFs, rate-limiting, and scalable architectures.
Elevation of Privilege	Gaining admin-level access or exploiting weak role configurations.	Apply RBAC, enforce least-privilege principles, and regularly patch systems.

- **Appendix 6: Correspond GDPR Compliance**

GDPR Standards (GDPR, N.D.)	
Art. 5: Principles relating to processing of personal data	Only collect personal data that is necessary for legitimate business interest for e-commerce (e.g. name, address, payment information) and ensure the data is processed lawfully and transparently.
Art. 7: Conditions for consent	Allow customers to give, withdraw or refuse consent for data collection.
Chapter 3 - Rights of the data subject (Art. 12-14)	Ensure information disclosure on privacy policy, data collection, storage and processing purposes.
Chapter 3 - Rights of the data subject (Art. 15-22)	Provide mechanisms for users to access, update, and request deletion on their personal data. Customers retain the right to request account deletion under the “Right to erasure” (also known as "right to be forgotten") provision (GDPR, 2024b).

- **Appendix 7: Correspond PCI DSS Compliance**

PCI DSS Requirements (PCI Security Standards Council, 2024)	
Requirement 3 (v4.0.1): Protect Stored Account Data	Ensure cardholder data is securely stored by minimising data storage, encrypting the stored Primary Account Number (PAN), and implementing access controls.
Requirement 4 (v4.0.1): Protect Cardholder Data with Strong Cryptography During	Ensure the safeguarding of cardholder data by encrypting data in transit, avoiding the sending of cardholder data via email or other end-user messaging, and enhancing payment page security.

Transmission Over Open, Public Networks	

11 References

Ada (n.d.) *Dictionaries*. Ada Computer Science. Available from: https://adacomputerscience.org/concepts/struct_dictionary [Accessed 21 November 2024].

Alsharnouby, M., Abuadbba, M.A., Ahmed, M., Nepal, S. & Camtepe, S., 2021. Phishing attacks and defences. *Frontiers in Computer Science*. [online] Available at: https://www.frontiersin.org/articles/10.3389/fcomp.2021.563060/full [Accessed 21 November 2024].

Bailey, C. (2019) *Pros and Cons of Type Hints*. Real Python. Available from: https://realpython.com/lessons/pros-and-cons-type-hints/ [Accessed 21 November 2024].

Barbosa, L. & Hora, A. (2022) How and why developers migrate Python tests. In 2022 IEEE International Conference on Software Analysis, Evolution and Reengineering (SANER) (538-548). IEEE.

Bienkowski, T. (2018) GDPR is Explicit About Protecting Availability. Netscout. Available from: https://www.netscout.com/blog/gdpr-availability-protection [Accessed 25 November 2024]

Blancarte, O. (2021) *Strategy - Behavioural Pattern*. Oscar Blancarte. Available from: https://reactiveprogramming.io/blog/en/design-patterns/strategy [Accessed 21 November 2024].

Brito, J.N., Rebelo, C. & Brito, M.A. (2020) *Scrum solo application in a project with a strong integration component*. Available from: https://repositorium.sdum.uminho.pt/handle/1822/71816 [Accessed 9 November 2024].

Codecademy. (n.d.) *What is CRUD?* Available from: https://www.codecademy.com/article/what-is-crud [Accessed 7 November 2024].

D'Adamo, I., González-Sánchez, R., Medina-Salgado, M. S. & Settembre-Blundo, D. (2021) 'E-Commerce Calls for Cyber-Security and Sustainability: How European Citizens

Look for a Trusted Online Environment', *Sustainability*, 13(12), p. 6752. doi:10.3390/su13126752.

GDPR. (n.d.) *General Data Protection Regulation*. Available from: https://gdpr.eu/tag/gdpr/ [Accessed 20 November 2024].

GDPR. (2024a) General Data Protection Regulation (GDPR). Available at: https://gdpr.eu/article-6-how-to-process-personal-data-legally/ [Accessed on 24th November 2024].

GDPR. (2024b) General Data Protection Regulation (GDPR). Available at: https://gdpr.eu/article-17-right-to-be-forgotten/ [Accessed on 24th November 2024].

Hays, V., Loutrel, M. & Fernandez, E.B. (2000) 'The object filter and access control framework', *Proceedings of the Pattern Languages of Programs (PLoP2000) Conference*.

Krebs, B. & Martinez, J. (2022) Developing RESTful APIs with Python and Flask. Available from: https://auth0.com/blog/developing-restful-apis-with-python-and-flask/ [Accessed 1 December 2024].

Lin, K. (2023) *Search Trees*. University of Washington. Available from: https://courses.cs.washington.edu/courses/cse373/23au/lessons/search-trees/ [Accessed 19 November 2024].

Madden, N. (2020) *API Security in Action*. Manning Publications.

Moore, B., McDougall, A., Rolshausen, E., Smith, S. & Stehle, B. (2003) B2B e-commerce with WebSphere Commerce Business Edition V5.4. 1st ed. Research Triangle Park, NC: IBM, International Technical Support Organization.

OWASP. (2021) *OWASP Top Ten 2021: The Ten Most Critical Security Risks to Web Applications*. Available from: https://owasp.org/www-project-top-ten/.

OWASP. (2024a) *OWASP Cheat Sheet Series, Introduction - OWASP Cheat Sheet Series*. Available from: https://cheatsheetseries.owasp.org/index.html [Accessed 6 November 2024].

OWASP. (2024b) *OWASP Top Ten Proactive Controls 2024: The Ten Most Critical Security Practices for Developers*. Available from: https://top10proactive.owasp.org/archive/2024/the-top-10/ [Accessed 5 November 2024].

Pagotto, T., Fabri, J., Lerario, A. & Gonçalves, J. (2016) ‘Scrum solo: Software process for individual development’, *2016 11th Iberian Conference on Information Systems and Technologies*. doi:10.1109/CISTI.2016.7521555.

Pallets (2010) Flask. Available from: https://flask.palletsprojects.com/en/stable/ [Accessed 1 December 2024].

Pauli, J.J. & Xu, D. (2005) ‘Misuse case-based design and analysis of secure software architecture’, *Proceedings of the International Conference on Information Technology: Coding and Computing*. doi:10.1109/ITCC.2005.199.

PCI Security Standards Council. (2024) *Payment Card Industry (PCI) Data Security Standard – Requirements and Testing Procedures Version 4.0.1*. Available from: https://www.pcisecuritystandards.org/standards/pci-dss/ [Accessed 20 November 2024].

Ranjan, R. (n.d.) *Password Spraying*. OWASP. Available from: https://owasp.org/www-community/attacks/Password_Spraying_Attack [Accessed 21 November 2024].

Reitz, K. & Schlusser, T. (2016). The Hitchhiker’s Guide to Python: Best Practices for Development. 1st ed.. O’Reilly Media.

Sellares, T. (n.d.) The Model View Controller: a Composed Pattern. Universitat de Girona. Available from: https://imae.udg.edu/~sellares/EINF-ES1/MVC-Toni.pdf [Accessed 27 November].

Singh, H. & Hassan, S.I. (2015) Effect of solid design principles on quality of software: An empirical assessment. *International Journal of Scientific & Engineering Research*, *6*(4): 1321-1324.

Sonar (n.d.) Why you should use a linting tool. SonarSource. Available from: https://www.sonarsource.com/learn/why-linter/ [Accessed 25 November].

Uzunov, A.V., Fernandez, E.B. & Falkner, K. (2012) ‘Securing distributed systems using patterns: A survey’, *Computers & Security*, 31(5), pp. 681–703.

Vugdelija, N., Nedeljković, N., Kojić, N., Lukić, L. & Vesić, M. (2021) Review of brute-force attack and protection techniques. In 13th International Conference, ICT Innovations 2021 (220-230).

12 Bibliography

Albuquerque, C. & Correia, F.F. (2023) ‘Deployment Tracking and exception tracking: Monitoring Design Patterns for cloud-native applications’, *Proceedings of the 28th European Conference on Pattern Languages of Programs* [Preprint]. doi:10.1145/3628034.3628038.

Almashor, M., Pranggono, B. & Khan, I. (2021) ‘Phishing Attacks: A Recent Comprehensive Study and a New Anatomy Model’, *IEEE Access*, 9, pp. 114402–114422.

Bishop, M. (2002) *Computer Security: Art and Science*. Boston: Addison-Wesley.

Bonneau, J., Herley, C., Van Oorschot, P.C. & Stajano, F. (2012) ‘The Quest to Replace Passwords: A Framework for Comparative Evaluation of Web Authentication Schemes’, *IEEE Symposium on Security and Privacy (S&P)*, IEEE, pp. 553–567.

Dougherty, C., Sayre, K., Seacord, R.C., Svoboda, D. & Togashi, K. (2009) *Secure design patterns*. Software Engineering Institute. Available from: https://insights.sei.cmu.edu/documents/813/2009_005_001_15110.pdf [Accessed 13 November 2024].

Eskandari, M., Khorsandroo, S. & Clark, J. (2020) ‘Botnet Command and Control Architecture Analysis’, *Journal of Cyber Security and Mobility*, 9(3), pp. 335–354.

GDPR. (2022) Complete guide to GDPR compliance. Available from: https://gdpr.eu/ [Accessed on 24th November 2024].

GDPR. (2024c) What is considered personal data under the EU GDPR? Available at: https://gdpr.eu/eu-gdpr-personal-data/ [Accessed on 24th November 2024].

Google Developers. (2024) *Cloud Vision API Documentation*. Available at: https://cloud.google.com/vision [Accessed 23 November 2024].

Gunawan, J. & Kosala, R.R. (2020) ‘Genie Enterprise Resource Planning for Small Medium Enterprises Implementing Single Page Web Application’, *The 3rd International Conference on Eco Engineering Development*. Solo, Indonesia, 13–14 November 2019. IOP Publishing Ltd.

Haddaraa, M., Salazar, A. & Langsetha, M. (2023) Exploring the Impact of GDPR on Big Data Analytics Operations in the E-Commerce Industry. Procedia Computer Science 219(2023):767-777. DOI: https://doi.org/10.1016/j.procs.2023.01.350.

Jakimoski, K., Stefanovska, Z. & Stefanovski, V. (2022) 'Optimization of Secure Coding Practices in SDLC as part of Cybersecurity Framework', *Journal of Computer Science Research*, 4(2), pp. 31–41. doi:10.30564/jcsr.v4i2.4048.

Khan, S. (2019) 'Cyber Security Issues and Challenges in E-Commerce', *Proceedings of the 10th International Conference on Digital Strategies for Organizational Success*. doi:10.2139/ssrn.3323741.

Kollát, S. (2023) 'Beyond Basics: Building Scalable TypeScript Applications with Chain of Responsibility Design Pattern', *DevOpsCookie*. Available from: https://samuelkollat.hashnode.dev/beyond-basics-building-scalable-typescript-applications-with-chain-of-responsibility-design-pattern [Accessed 13 November 2024].

Kumaraguru, P., Rhee, Y., Sheng, S., Hong, J., Downs, J. & Cranor, L.F. (2007) 'Getting Users to Pay Attention to Anti-Phishing Education: Evaluation of Retention and Transfer', *Proceedings of the Anti-Phishing Working Groups eCrime Researchers Summit*. New York: ACM, pp. 70–81.

Lucassen, G., Dalpiaz, F., Werf, J.M.E.V.D. & Brinkkemper, S. (2016) 'The use and effectiveness of user stories in practice', *Requirements Engineering: Foundation for Software Quality: 22nd International Working Conference, REFSQ 2016*, Gothenburg, Sweden, March 14–17, 2016. *Proceedings*, 22, pp. 205–222. Springer International Publishing.

Lucidchart (2024) *UML Activity Diagram Tutorial*. Available from: https://www.lucidchart.com/pages/uml-activity-diagram [Accessed 20 November 2024].

Mai, P.X., Goknil, A., Shar, L.K., Pastore, F., Briand, L.C. & Shaame, S. (2018) 'Modeling Security and Privacy Requirements: A Use Case-Driven Approach', *Information and Software Technology*, 100, pp. 165–182. doi:10.1016/j.infsof.2018.04.007.

MarshMcLennan (2020) *Cyberattacks: The increasing risk for retail*. Available at: https://www.marshmclennan.com/assets/insights/publications/2020/may/Cyberattacks_The_Increasing_Risk_For_Retail_Oliver_Wyman.pdf [Accessed 21 November 2024].

McDermott, J. & Fox, C. (1999) 'Using abuse case models for security requirements analysis', *15th Annual Computer Security Applications Conference*. Phoenix, AZ, USA, 6–10 December 1999. IEEE, pp. 55–64.

Moyo, S. & Mnkandla, E. (2019) 'A metasynthesis of solo software development methodologies', *2019 International Multidisciplinary Information Technology and Engineering Conference (IMITEC)*. IEEE, pp. 1–8.

Moyo, S. & Mnkandla, E. (2020) ‘A Novel Lightweight Solo Software Development Methodology With Optimum Security Practices’, IEEE Access. doi:10.1109/ACCESS.2020.2971000.

Parabol (n.d.) *45 User Story Examples to Inspire Your Agile Team*. Available from: https://www.parabol.co/blog/user-story-examples/ [Accessed 15 November 2024].

PayPal Developers. (2024) *PayPal REST API Documentation*. Available at: https://developer.paypal.com/docs/api/overview/ [Accessed 23 November 2024].

Pillai, R. (2023) *API Rate Limiting*. Available from: https://medium.com/@rajeshpillai/api-rate-limiting-2542c2a90b38 [Accessed 14 November 2024].

Ponemon Institute (2021) *Cost of a Data Breach Report*. IBM Security. Available from: https://www.ibm.com/security/data-breach [Accessed 12 November 2024].

Priyawati, D., Rokhmah, S. & Utomo, I. (2022) ‘Website Vulnerability Testing and Analysis of Internet Management Information System Using OWASP’, *International Journal of Computer and Information System*, 3(3), pp. 143–147. doi:10.29040/ijcis.v3i3.90.

Refactoring Guru. (n.d.) *Chain of Responsibility in Java*. Refactoring.Guru. Available from: https://refactoring.guru/design-patterns/chain-of-responsibility/java/example [Accessed 13 November 2024].

ResearchGate. (2024) *The impact of data breaches on consumer trust in e-commerce*. Available at: https://www.researchgate.net/publication/383398469 [Accessed 21 November 2024].

RFC 4732 (2006) *Internet Denial-of-Service Considerations*. Available from: https://www.ietf.org [Accessed 13 November 2024].

Sandhu, R.S., Coyne, E.J., Feinstein, H.L. & Youman, C.E. (1996) ‘Role-Based Access Control Models’, *IEEE Computer*, 29(2), pp. 38–47.

Shostack, A. (2014) *Threat Modeling: Designing for Security*. Indianapolis: Wiley.

Sindre, G. & Opdahl, A.L. (2005) ‘Eliciting security requirements with misuse cases’, *Requirements Engineering*, 10, pp. 34–44. doi:10.1007/s00766-004-0194-4.

Sparx Systems (2024) *UML 2 Tutorial - Activity Diagram*. Available from: https://sparxsystems.com/resources/tutorials/uml2/activity-diagram.html [Accessed 20 November 2024].

Sravani, D., Reddy, J.R., Viswas, P.S., Jyothi, N.M. & Chandukiran, P. (2023) ‘Python security in devops: Best practices for secure coding, configuration management, and continuous testing and monitoring’, *2023 4th International Conference on Electronics and Sustainable Communication Systems (ICESC)*, pp. 514–520. doi:10.1109/icesc57686.2023.10193128.

Stallings, W. (2016) *Cryptography and Network Security: Principles and Practice*. 7th ed. Boston: Pearson Education.

Twilio Developers. (2024) *Twilio API Documentation*. Available at: https://www.twilio.com/docs/usage/api [Accessed 23 November 2024].

Vihovde, E.H. & Meng, Q. (2024) ‘Test-driven development: Ensuring code quality in integration with CI/CD’, *2024 8th International Conference on Management Engineering, Software Engineering and Service Sciences (ICMSS)*, pp. 8–11. doi:10.1109/icmss61211.2024.00009.

Whittle, J., Wijesekera, D. & Hartong, M. (2008) ‘Executable misuse cases for modeling security concerns’, *2008 ACM/IEEE 30th International Conference on Software Engineering*. Leipzig, Germany, 10–18 May 2008. IEEE, pp. 121–130.

Yadav, A. & Sehgal, J. (2023) ‘Concurrent data processing in Microsoft Dynamics CRM using python’, *International Journal of Innovative Research in Computer Science and Technology*, 11(5), pp. 18–22. doi:10.55524/ijircst.2023.11.5.3.

Zacharias, A. (2023) *Learn How to Fill Out a Software Design Document Template*. Available from: https://www.notion.so/blog/design-document-template [Accessed 4 November 2024].