IT313 Software Engineering
Non-Functional Testing

Software Engineering Project

Group 25

December 1, 2024

Non-functional testing focuses on assessing the quality attributes of a software system that do not relate to its functionality, such as

- Performance
- Reliability
- Scalability
- Usability
- Maintainability
- Security

The main goals of non-functional testing are to improve the usability, efficiency, maintainability, and portability of the product, minimize production risk and cost, optimize installation, setup, execution, management, and monitoring of the product, and collect measurements and metrics for internal research and development. It also aims to enhance the knowledge of the product behaviour and technologies in use.

Non-functional Testing types:

- Load and Stress testing
- Performance testing
- Security testing
- Compatibility testing
- Reliability and Availability testing

1. Load and Stress Testing

Here we have performed the load testing **in Jmeter**.

A **Jmeter** Test Plan must have listener to showcase the result of performance test execution.

- Listeners capture the response coming back from Server while **Jmeter** runs and showcase in the form of – tree, tables, graphs and log files.
- It also allows you to save the result in a file for future reference. There are many types of listeners **Jmeter** provides. Some of them are: Summary Report, Aggregate Report, Aggregate Graph, View Results Tree, View Results in Table etc.

Here is the detailed understanding of each parameter in Summary report.

- **Label:** It is the name/URL for the specific HTTP(s) Request. If you have selected "Include group name in label?" option then the name of the Thread Group is applied as the prefix to each label.
- **Samples:** This indicates the number of virtual users per request.
- **Average:** It is the average time taken by all the samples to execute specific label.
- **Min:** The shortest time taken by a sample for specific label.
- **Max:** The longest time taken by a sample for specific label.
- **Std. Dev.:** This shows the set of exceptional cases which were deviating from the average value of sample response time. The lesser this value more consistent the data. Standard deviation should be less than or equal to half of the average time for a label.
- **Error%:** Percentage of Failed requests per Label.

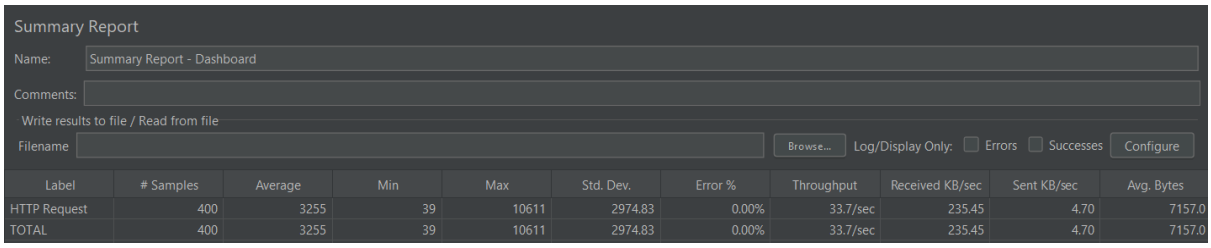
- **Throughput:** Throughput is the number of requests that are processed per time unit (seconds, minutes, hours) by the server. This time is calculated from the start of first sample to the end of the last sample. Larger throughput is better.
- **KB/Sec:** This indicates the amount of data downloaded from server during the performance test execution. In short, it is the Throughput measured in Kilobytes per second.

Test – HTTP GET Request of all the pages

Web-Pages:

1. Dashboard
2. Profile
3. Stock Info
4. Login
5. Landing

1. Dashboard Page



Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
HTTP Request	400	3255	39	10611	2974.83	0.00%	33.7/sec	235.45	4.70	7157.0
TOTAL	400	3255	39	10611	2974.83	0.00%	33.7/sec	235.45	4.70	7157.0

Number of Users	Ramp-up Period	Loop Count	Total Samples (Users*Loops)	Average Error(In %)	Throughput (Response/s)
200	2	2	400	0	33.7
400	2	2	800	7.12	11.1
600	2	2	1200	44.8	14

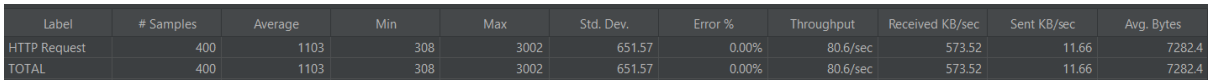
2. Profile Page

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
HTTP Request	400	1383	52	7010	1179.70	0.00%	36.5/sec	235.76	5.03	6615.0
TOTAL	400	1383	52	7010	1179.70	0.00%	36.5/sec	235.76	5.03	6615.0

Number of Users	Ramp-up Period	Loop Count	Total Samples (Users*Loops)	Average Error(In %)	Throughput (Response/s)
200	2	2	400	0	36.5

400	2	2	800	8.25	11.6
600	2	2	1200	56.08	14

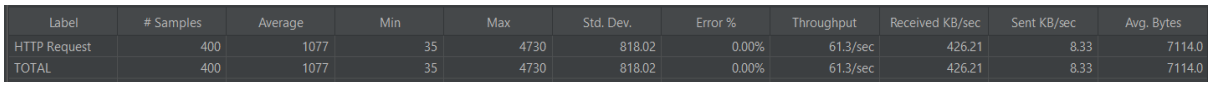
3. StockInfo Page



Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
HTTP Request	400	1103	308	3002	651.57	0.00%	80.6/sec	573.52	11.66	7282.4
TOTAL	400	1103	308	3002	651.57	0.00%	80.6/sec	573.52	11.66	7282.4

Number of Users	Ramp-up Period	Loop Count	Total Samples (Users*Loops)	Average Error(In %)	Throughput (Response/s)
200	2	2	400	0	80.6
400	2	2	800	13	9.3
600	2	2	1200	65.08	13.9

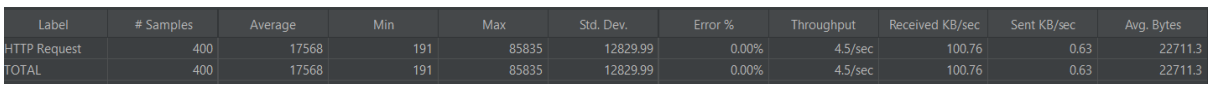
4. Login Page



Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
HTTP Request	400	1077	35	4730	818.02	0.00%	61.3/sec	426.21	8.33	7114.0
TOTAL	400	1077	35	4730	818.02	0.00%	61.3/sec	426.21	8.33	7114.0

Number of Users	Ramp-up Period	Loop Count	Total Samples (Users*Loops)	Average Error(In %)	Throughput (Response/s)
200	2	2	400	0	61.3
400	2	2	800	9.62	11.7
600	2	2	1200	48.5	12.7

5. Landing Page



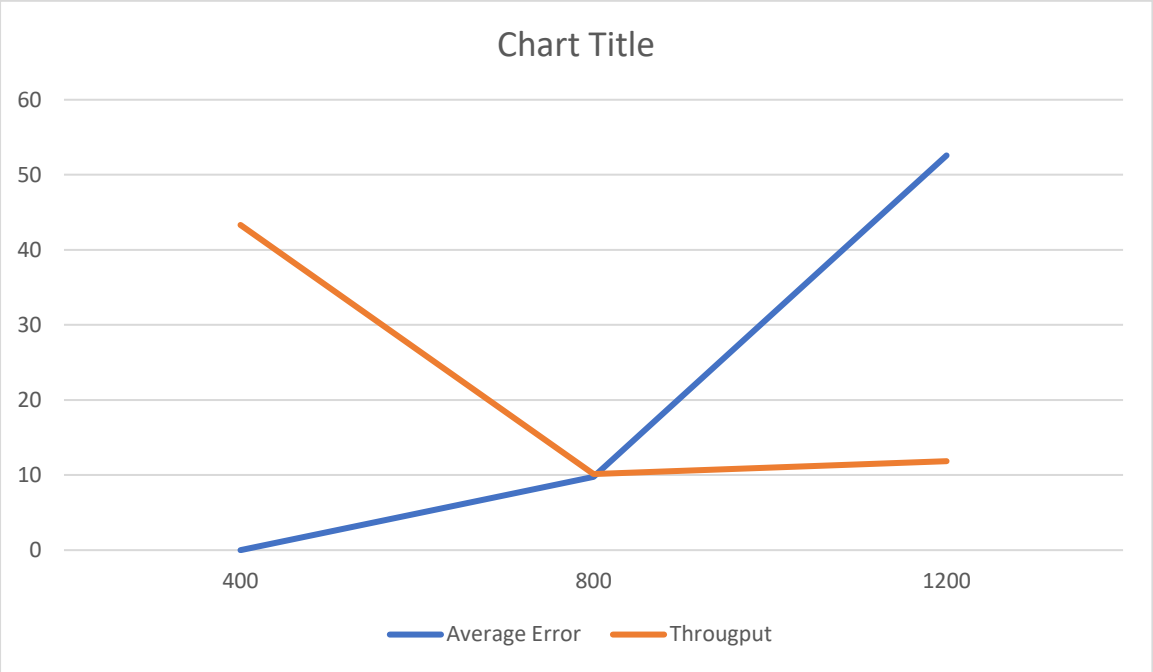
Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
HTTP Request	400	17568	191	85835	12829.99	0.00%	4.5/sec	100.76	0.63	22711.3
TOTAL	400	17568	191	85835	12829.99	0.00%	4.5/sec	100.76	0.63	22711.3

Number of Users	Ramp-up Period	Loop Count	Total Samples (Users*Loops)	Average Error(In %)	Throughput (Response/s)
200	2	2	400	0	4.5

400	2	2	800	10.9	7
600	2	2	1200	48.45	4.6

Average Analysis:

Number of Users	Ramp-up Period	Loop Count	Total Samples (Users*Loops)	Average Error(In %)	Throughput (Response/s)
200	2	2	400	0	43.32
400	2	2	800	9.78	10.14
600	2	2	1200	52.58	11.84



2. PERFORMANCE TESTING

Objective: To assess and test system's responsiveness, scalability and performance under various conditions

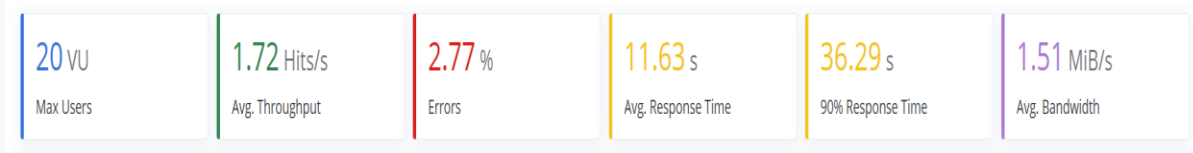
Tools used: **Blaze-Meter**

The test is conducted under the following conditions:

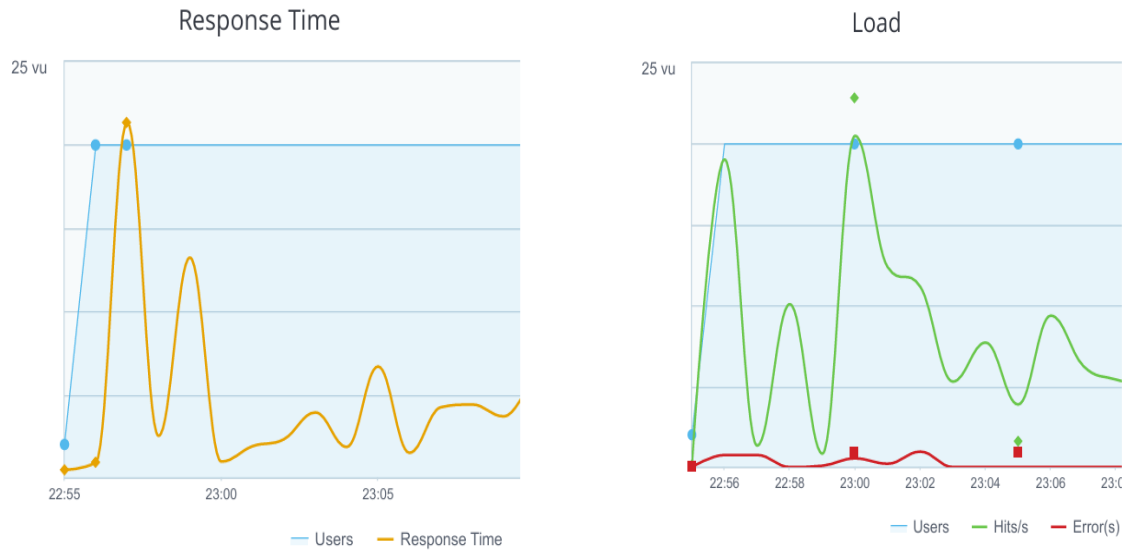
- Duration: 20 minutes
- Test Type: JMeter
- No. of CPUs: 2
- Fixed Location

Duration	20 minutes	Test Type	JMeter
Started	Nov 30, 2024, 10:55:56 PM	Response Codes	2xx Non-Http
Ended	Nov 30, 2024, 11:18:03 PM	Locations	Functional Testing Default Location

The output is as follows:

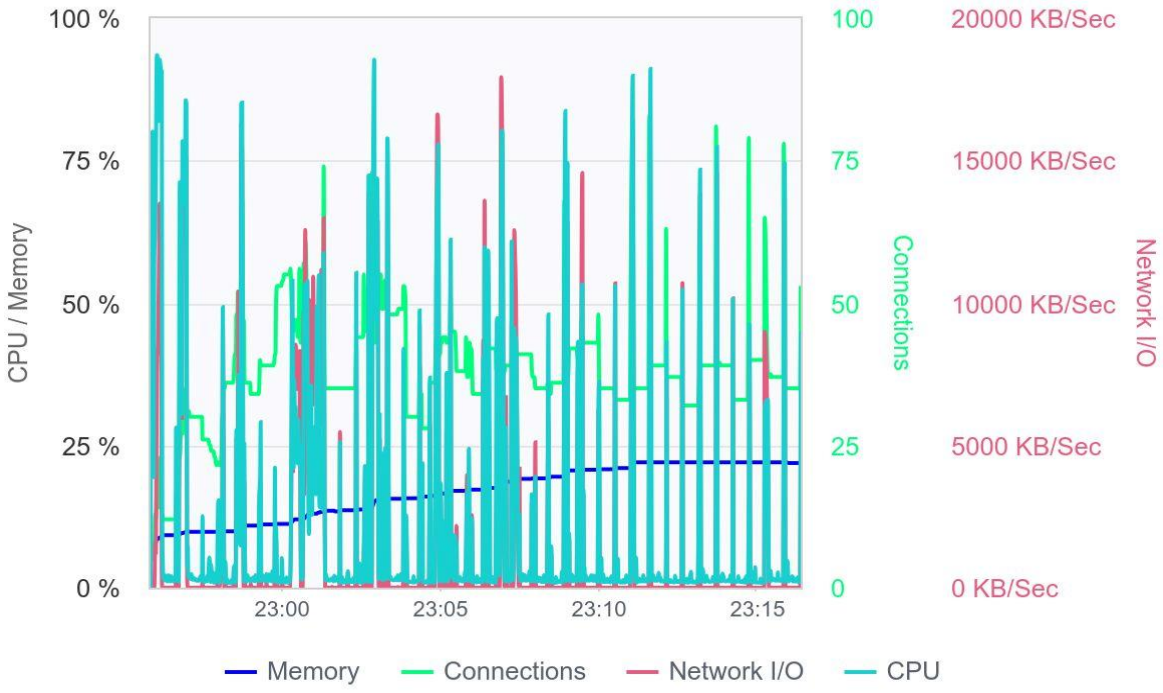


- The website can handle up to 6192 hits in an hour.
- The error rate according to the no. of users is quite low, giving an average bandwidth of 1.51 MB/s.
- Average response time of all users is 11.63 seconds.



From the left graph, it is noticed that, as the no. of users increase, the response time decreases, becoming constant after a certain time.

From the right graph, it is noticed that, as the no. of users increases the error probability increases. As the error increases, average throughput decreases.



The above graph shows the system metrics during the test.

3. Security

Objective: To ensure the system is protected from possible intruders and finding all possible loopholes.

- The system works on session-based login and authentication. If URL is not correct then 404 Error page gets opened.
- If user is not logged in then, page directly redirects to login page.
- The password in MongoDB is stored in hash format using bcrypt , so password is not visible to anyone and hence it is secured.

Tool Used: Immuni Web

The security testing was done on the following parameters:

- Tested on: Dec 1st, 2024 04:58:38 GMT +5:30
- Server IP: 76.76.21.61
- Reverse DNS: Absent
- Location: Walnut, USA
- Client: Desktop version

Server Security Test

Web Server Security Test

HTTP RESPONSE	HTTP VERSIONS	NPN
200	HTTP/1.0 HTTP/1.1 HTTP/2	N/A
ALPN	**CONTENT ENCODING**	**SERVER SIGNATURE**
H2	None	Vercel
WAF	**LOCATION**	**HTTP METHODS ENABLED**
No WAF detected	Carolina Internet, Ltd.	✔ GET ✔ HEAD ✔ OPTIONS

Software Security Test

Web Software Found	Web Software Outdated	Web Software Vulnerabilities
1	1	0

Fingerprinted CMS & Vulnerabilities

No CMS were fingerprinted on the website.	Information

Fingerprinted CMS Components & Vulnerabilities

React 19.0.0-rc-66855b96-20241106

The component is outdated. No known security vulnerabilities found. Update to the most recent version **18.3.1**.

GDPR Compliance Test

PRIVACY POLICY

Privacy Policy was not found on the website or is not easily accessible.	Misconfiguration or weakness

WEBSITE SECURITY

No publicly known vulnerabilities were found in the website CMS or its components.	Good configuration

TLS ENCRYPTION

HTTPS encryption is present on the web server.	Good configuration

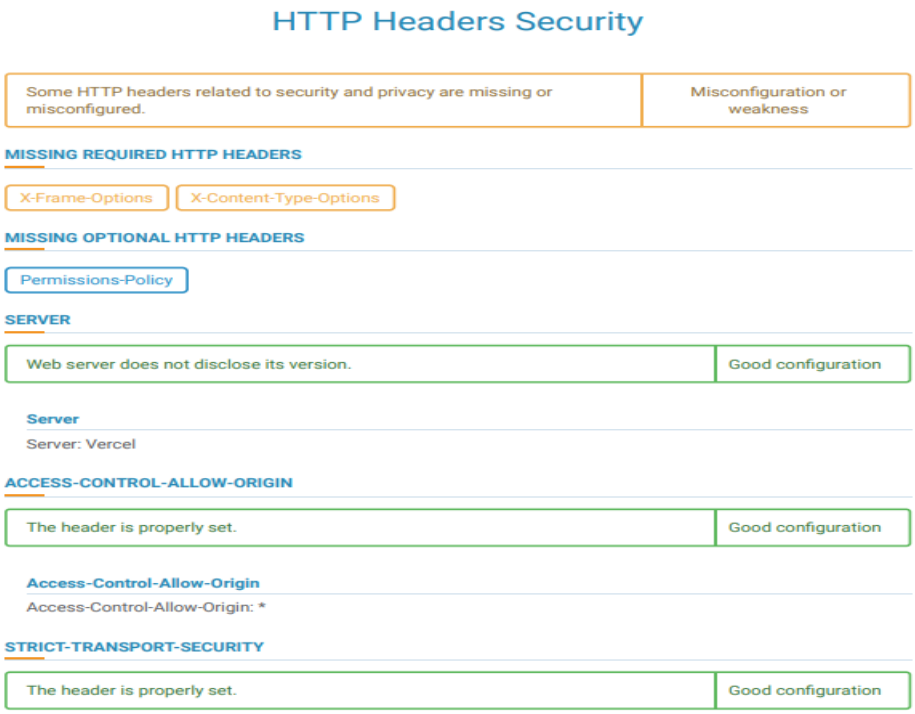
COOKIE PROTECTION

No cookies with personal or tracking information seem to be sent.	Information

COOKIE DISCLAIMER

No third-party cookies or cookies with tracking information seem to be sent.	Information

HTTPS Headers Security



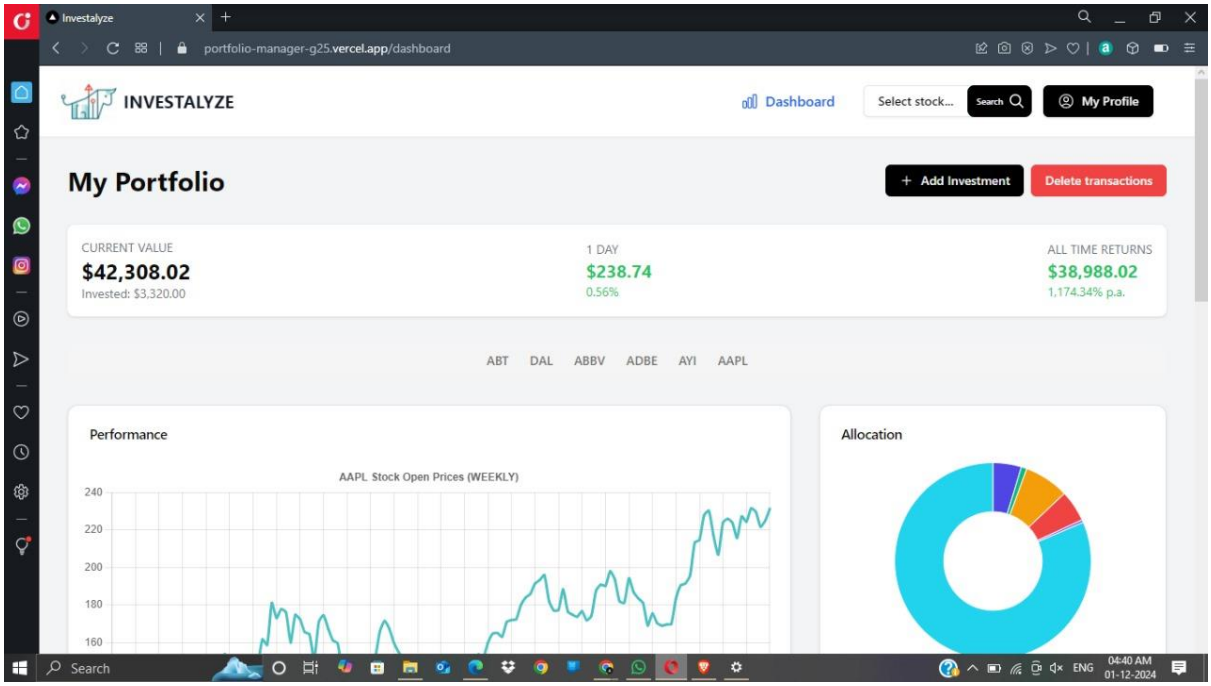
Cookie Privacy

Summary:

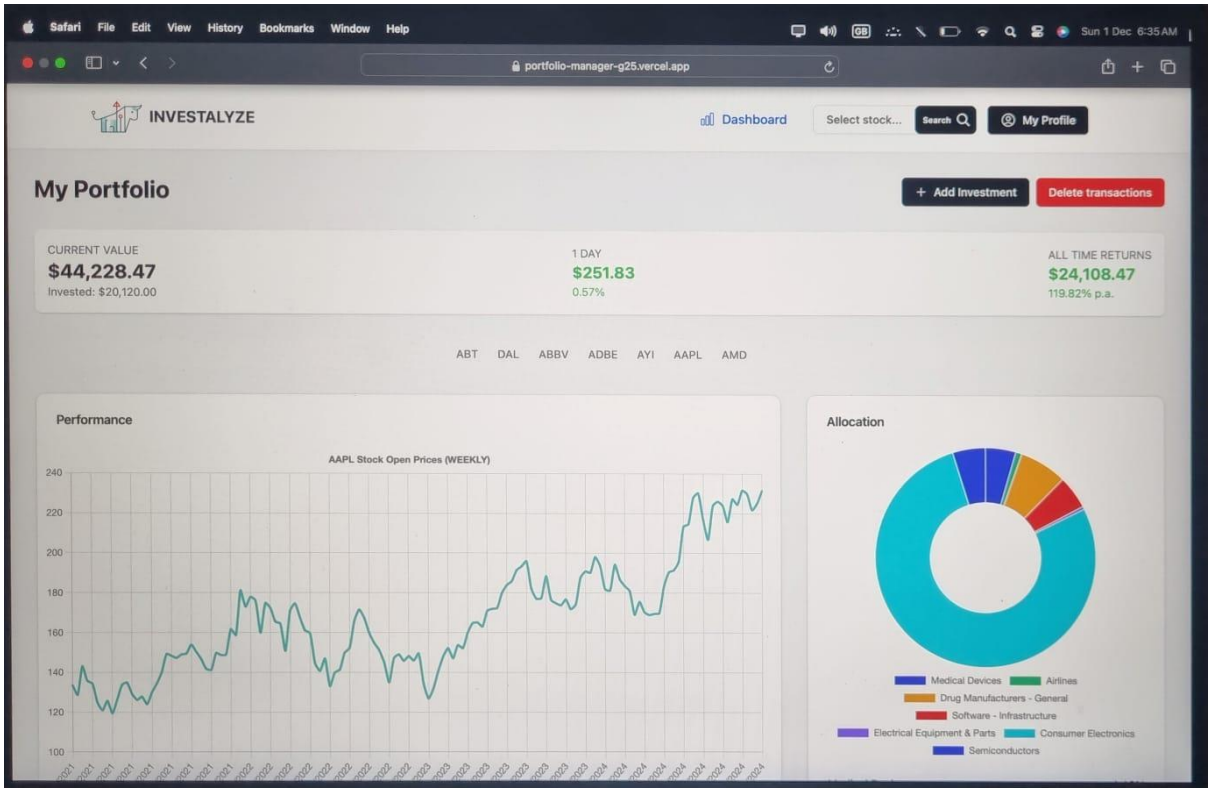
- GET HTTP method is enabled
- No CMS is present
- Software Component is outdated in website
- No privacy policy found
- No publicly found vulnerabilities
- HTTPs encryption present
- No cookies
- No third-party cookies
- Header properly set
- Web server does not disclose the its version

4. Compatibility Testing

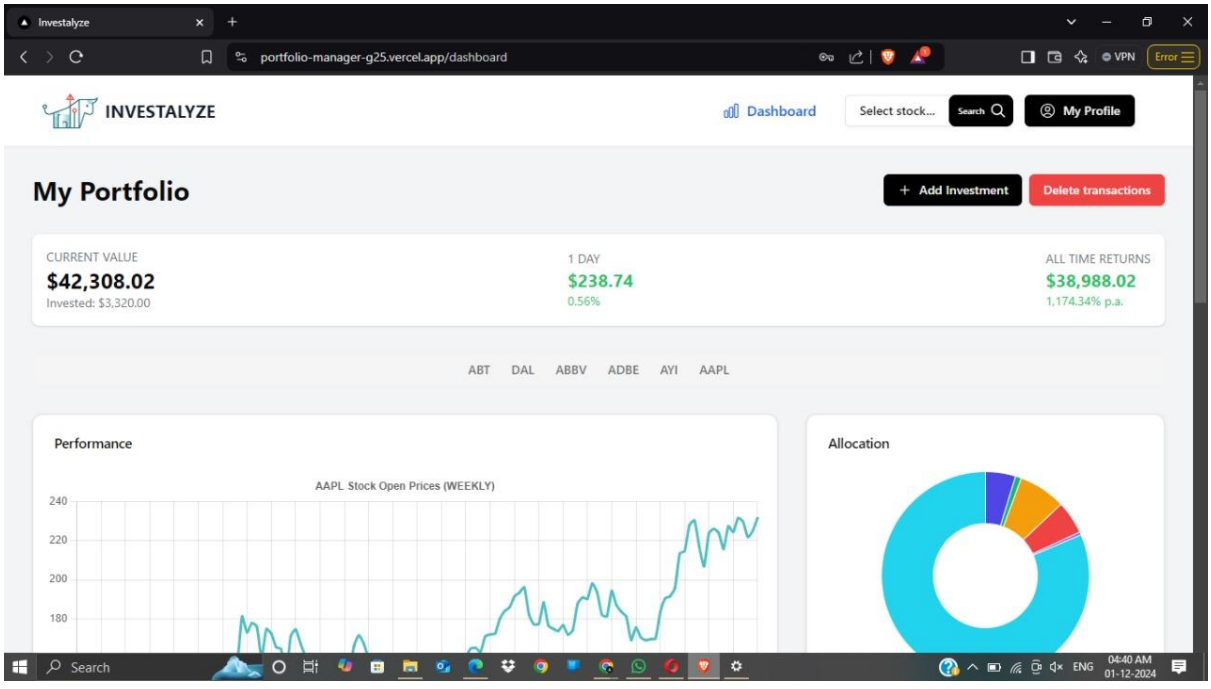
Compatibility Testing is a type of software testing performed to ensure that an application or system works as intended across different environments, including various hardware, operating systems, browsers, networks, and devices. The goal is to verify that the software is compatible with external factors it may encounter in real-world use. This testing identifies potential issues such as rendering errors, performance inconsistencies, or feature malfunctions caused by variations in configurations or platforms. It helps improve user experience and ensures broader accessibility for the application.



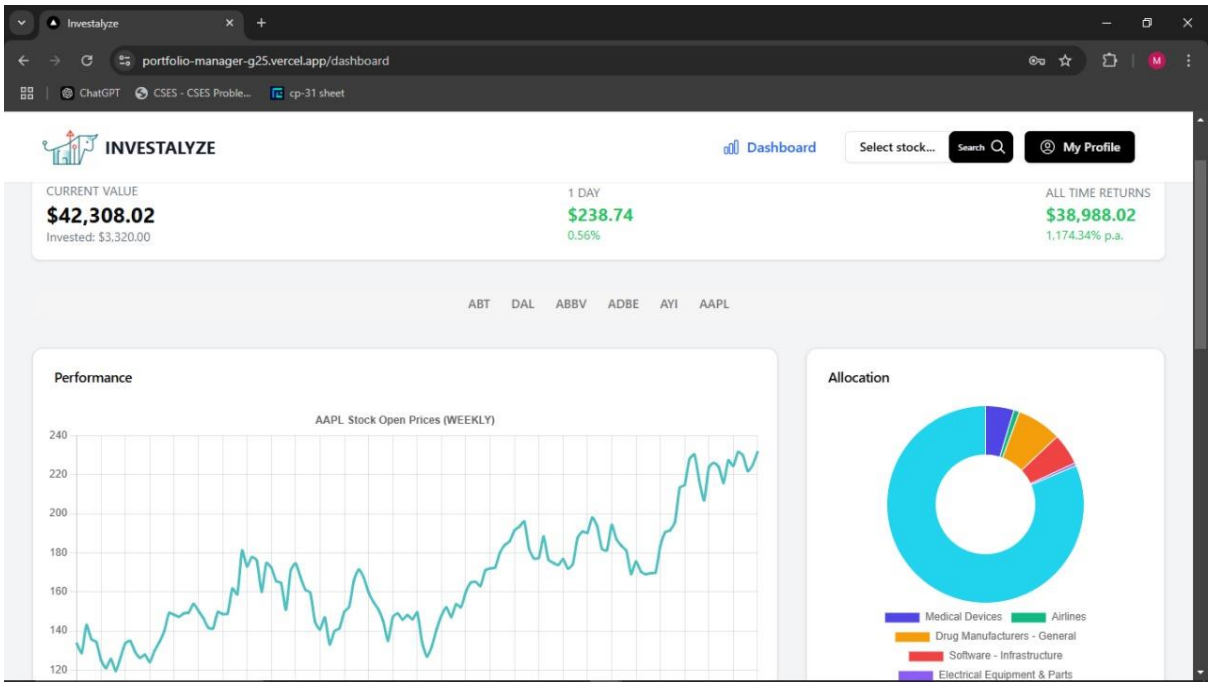
Resolution- 1366*768 Version:- 78.0.4093.147 Opera Stable System:Windows 10 64-bit



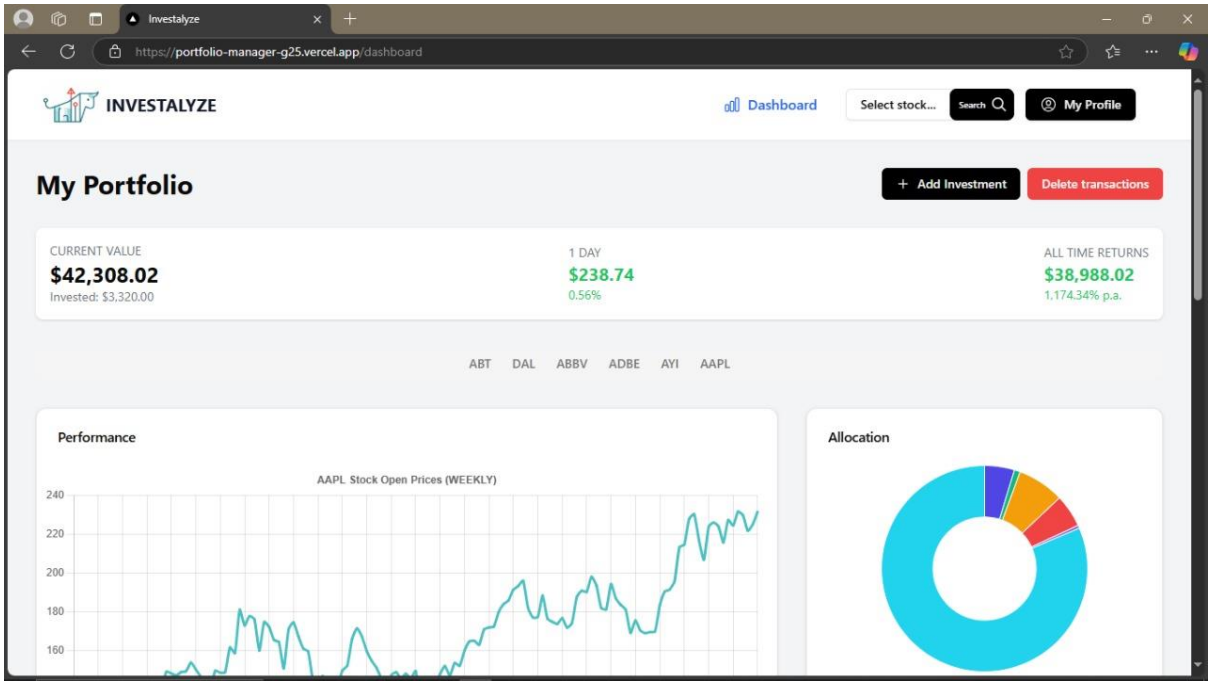
Resolution- 2560*1664 Version:- safari 17.3 (19617.2.4.11.8)



Resolution- 1366*768 Version:- 1.73.91 Chromium: 131.0.6778.85 (Official Build) (64-bit)



Resolution- 1366*768 **Version:- 131.0.6778.86 (Official Build) (64-bit)**



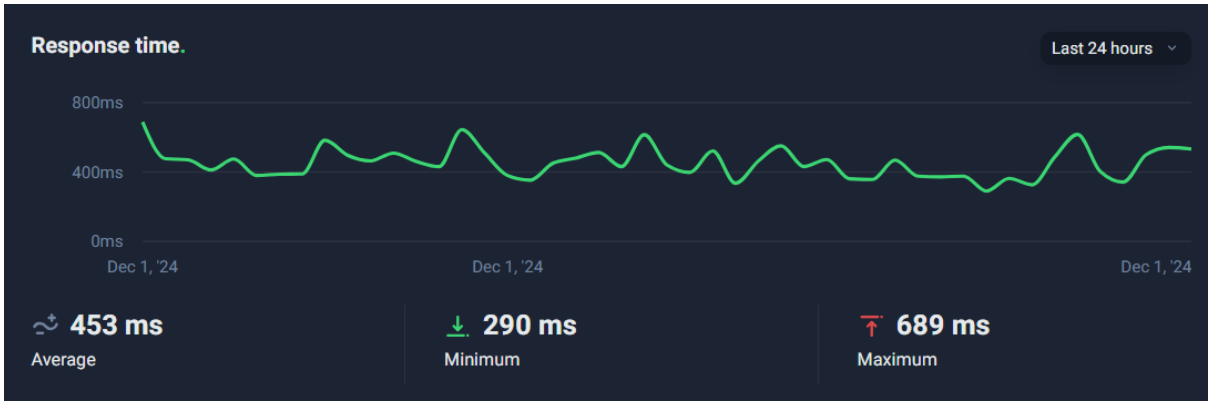
Resolution- 1366*768 **Version:- 131.0.2903.70 (Official build) (64-bit)**

5. Availability and Reliability Testing

Objective: To ensure the system' s reliability and availability under different conditions.

Tool used: UpTime Robot

The monitor tracking is implemented and the website was live 24 hours. No issue was noticed despite using the website continuously by multiple users and all over the time.



HTTP Request v/s Time

- No major drops of response time throughout 24 hours.
- Multiple user activity shows drop-in response time, but not major.
- Users: 9-10, working parallel