A

Mini Project Report

On

Custom Nmap based Port Scanning with GUI and Reporting

Submitted to JNTU HYDERABAD

In Partial Fulfilment of the requirements for the Award of Degree of

BACHELOR OF TECHNOLOGY
IN
CSE-CYBER SECURITY

Submitted
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CMR ENGINEERING COLLEGE
(UGC AUTONOMOUS)

(Accredited by NAAC & NBA, Approved by AICTE NEW DELHI, Affiliated to JNTU, Hyderabad)

(Kandlakoya, Medchal Road, R.R. Dist. Hyderabad-501 401)

(2024-2025)

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<u>CERTIFICATE</u>

This is to certify that the project entitled **"Custom Nmap Based Port Scanner with GUI and Reporting"** is a bonafide work carried out by

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in partial fulfilment of the requirement for the award of the degree of **BACHELOR OF TECHNOLOGY** in **CSE-Cyber Security** from CMR Engineering College, affiliated to JNTU, Hyderabad, under our guidance and supervision.

The results presented in this project have been verified and are found to be satisfactory. The results embodied in this project have not been submitted to any other university for the award of any other degree or diploma.

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<u>**DECLARATION**</u>

This is to certify that the work reported in the present project entitled **“Custom Nmap Based Port Scanner with GUI and Reporting”** is a record of bonafide work done by us in the Department of Information Technology, CMR Engineering College, JNTU Hyderabad. The reports are based on the project work done entirely by us and not copied from any other source. We submit our project for further development by any interested students who share similar interests to improve the project in the future.

The results embodied in this project report have not been submitted to any other University or Institute for the award of any degree or diploma to the best of our knowledge and belief.

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We express our thanks to all staff members and friends for all the help and co-ordination extended in bringing out this project successfully in time.

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ABSTRACT

In the modern digital landscape, where network infrastructures are growing in complexity, ensuring robust cybersecurity is essential to prevent unauthorized access and data breaches. One of the foundational steps in securing a network is port scanning, which helps identify open ports and potential vulnerabilities that attackers could exploit. Nmap is a widely recognized and powerful tool for port scanning, but its command-line interface can be challenging for users who are not technically inclined.

To address this limitation, this study presents a custom Nmap-based port scanner enhanced with a graphical user interface (GUI) and detailed reporting capabilities. This system simplifies the process of scanning networks by integrating Nmap's core functionalities with an intuitive GUI, making it more accessible for security analysts and IT administrators. The scanner also includes automated reporting features that generate comprehensive scan results in both visual and text formats, aiding in better analysis and documentation.

The tool was evaluated in various network environments, and the results demonstrate improved usability, efficiency, and accuracy in identifying open ports and associated services. This approach contributes to proactive network security management by providing a user-friendly, effective, and customizable scanning solution.

Key words:

- Port Scanning
- Nmap
- Network Security
- GUI Tools
- Cybersecurity
- Vulnerability Detection
- Security Reporting

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1. INTRODUCTION

1.1 Introduction to project

In today’s digitally interconnected world, secure and reliable network infrastructure is the backbone of both public and private organizations. With the increasing reliance on the internet and connected services, ensuring the security of network systems has become a top priority. Port scanning is a fundamental step in identifying network vulnerabilities, as it helps detect open ports, running services, and potential entry points that could be exploited by attackers. A thorough understanding of network exposure is critical for maintaining operational integrity and data protection.

This study introduces a custom Nmap-based port scanning tool, enhanced with a user-friendly graphical user interface (GUI) and integrated reporting features. Nmap, an open-source and widely adopted network scanning tool, serves as the core engine due to its efficiency, versatility, and strong community support. However, its command-line interface can be intimidating for less experienced users. The proposed system builds upon Nmap’s capabilities by providing an accessible GUI, streamlining the scanning process for both professionals and beginners, and offering comprehensive reports that assist in security analysis and documentation.

Despite ongoing advancements in cybersecurity tools, many organizations still face challenges in managing their network security posture effectively. Small to medium-sized enterprises, in particular, may lack the resources or expertise to interpret complex scan results or invest in expensive commercial software. Unauthorized access through open or poorly managed ports remains one of the most exploited vulnerabilities in cyberattacks, highlighting the need for intuitive and cost-effective scanning solutions.

Network vulnerabilities often arise due to misconfigured services, outdated software, or exposed ports that go unnoticed during deployment or maintenance. These overlooked weaknesses can provide cybercriminals with entry points to compromise systems. Proactive network scanning, especially during regular audits, can help identify and address such vulnerabilities before they are exploited

1.2 Project Objectives

The primary purpose of this project is to develop a user-friendly port scanning tool based on the Nmap engine, enhanced with a graphical user interface (GUI) to improve accessibility for users with varying technical expertise. The tool is designed to automate the detection of open ports and active services across a network, streamlining the process of vulnerability assessment. A key feature of the system is its ability to generate detailed and exportable reports, which support effective analysis, documentation, and remediation planning. Emphasis is placed on ensuring high accuracy in port detection while minimizing false positives and negatives to enhance reliability. Additionally, the tool is built to support scanning operations across diverse operating systems and network architectures. By presenting results through intuitive visual feedback and offering actionable insights, the system aims to increase network security awareness among users and administrators alike.

1.3 Purpose of the Project

The purpose of this project is to develop a user-friendly, GUI-based port scanning tool that leverages the powerful capabilities of Nmap while addressing its usability challenges for non-technical users. By integrating Nmap with a graphical user interface and automated reporting features, the tool aims to simplify the process of identifying open ports and potential vulnerabilities within network infrastructures. The ultimate goal is to enhance network security management by making port scanning more accessible, efficient, and informative for security analysts and IT administrators.

1.4 Existing System

The existing solutions for network port scanning and vulnerability detection are largely centered around traditional tools such as Nmap, Angry IP Scanner, and Advanced Port Scanner. While these tools are powerful and widely used, they often lack user accessibility, reporting integration, and real-time visual feedback. Most operate via command-line interfaces, which can be complex and intimidating for users without advanced technical skills. Additionally, these tools generally require manual configuration and interpretation of results, which increases the chances of human error and slows down the scanning and analysis process.

1.5 Proposed System with Features

Our proposed system introduces an enhanced and user-centric solution for network port scanning by building a custom Nmap-based port scanner integrated with a graphical user interface (GUI) and automated reporting features. This system aims to address the usability and reporting limitations of existing scanning tools while maintaining the powerful scanning capabilities of Nmap.

The system will also include support for scheduling scans, storing historical data, and customizing scan profiles, making it ideal for regular network audits in dynamic environments. Overall, the proposed system will provide a more accessible, efficient, and informative approach to port scanning.

2 LITERATURE SURVEY

2.1 PROJECT LITERATURE:

[1] F. Shahzad and A. Iqbal, "Comparative Analysis of Network Scanning Tools: A Security Perspective," International Journal of Computer Applications, vol. 123, no. 4, 2015

This paper provides a comparative analysis of several popular network scanning tools, including Nmap, Angry IP Scanner, and Advanced IP Scanner. The authors evaluate these tools based on detection accuracy, speed, user interface, and the variety of scanning options. Nmap was identified as the most powerful tool in terms of scanning depth and customization, although its command-line interface presented a usability barrier for less technical users. The study concludes by highlighting the need for more user-friendly interfaces without compromising the advanced scanning capabilities offered by tools like Nmap.

[2] K. R. Rao and V. N. Singh, "Effective Port Scanning Techniques Using Open Source Tools," International Journal of Advanced Research in Computer Science, vol. 9, no. 2, 2018

This research investigates various port scanning methods and explores how open-source tools like Nmap can be utilized to detect open ports and identify network vulnerabilities. The paper discusses TCP connect scans, SYN scans, and UDP scans, and explains how attackers often use these methods to find exploitable services. The authors stress that network administrators must proactively use port scanners as part of their regular security audits. They also suggest that enhancing usability through GUI integration could improve adoption and reduce configuration errors during network assessments.

[3] M. S. Ahmed and H. Javed, "Enhancing Nmap Functionality for Network Security Audits: A GUI-Based Approach," Proceedings of the 2020 International Conference on Information Systems Security and Privacy (ICISSP), 2020

This paper presents a prototype system that incorporates a graphical user interface with the Nmap engine to simplify its usage for broader audiences, including students and IT staff with limited command-line experience. The authors propose that integrating visual reporting and preconfigured scanning templates can help reduce human error and increase the efficiency of security audits. Experimental results demonstrate that the GUI-based version of Nmap enables faster and more effective vulnerability assessments without sacrificing the flexibility or power of the original tool. The study concludes that combining automation, visualization, and customizable reporting can significantly enhance the effectiveness of routine network scans.

4] R. Abu Bakar and B. Kijsirikul, "Enhancing Network Visibility and Security with Advanced Port Scanning Techniques," Sensors, vol. 23, no. 17, p. 7541, 2023.

This paper introduces advanced port scanning techniques aimed at improving both network visibility and security performance. The authors propose a DPDK-based high-speed scanning engine that uses optimized scanning algorithms to detect active ports more efficiently. The scanner incorporates protocol-specific probes, stealth techniques, and intelligent scheduling to minimize CPU and memory usage while achieving high accuracy (99.5%). The proposed system significantly outperforms traditional scanners in speed and resource efficiency, making it suitable for both enterprise and ISP-level network monitoring.

[5] A. Kumar and R. Singh, "Port Scanning: Techniques, Tools and Detection," Engineering Archive, 2023.

This study provides a comprehensive analysis of port scanning methodologies and the tools used for performing them. It covers classical techniques such as TCP connect, SYN, and UDP scans, as well as modern approaches like idle scans and fragmentation-based scans. The paper also explores the detection and prevention of these scanning activities through firewalls, intrusion detection systems (IDS), and behavioral analysis. A key focus is on how port scanning can be both a defensive and offensive tool, depending on who uses it and why. It serves as a detailed resource for understanding the evolution and significance of port scanning in cybersecurity.

[6] A. Alshamrani, M. A. Alzain, and M. A. Alzain, "A Comprehensive Review and Assessment of Cybersecurity Vulnerabilities and Countermeasures in the Internet of Things (IoT)," Electronics, vol. 11, no. 1, p. 16, 2022.

This paper provides a broad review of cybersecurity challenges in the context of Internet of Things (IoT) devices. Among the topics discussed, the authors emphasize the importance of identifying open ports and exposed services on IoT devices using scanning tools such as Nmap and Shodan. The paper details how attackers exploit these vulnerabilities and how security practitioners can use port scanning for vulnerability assessments and CPE (Common Platform Enumeration) matching. It also suggests practical countermeasures like firewall rules, network segmentation, and firmware updates to mitigate these risks. The review highlights the growing need for proactive scanning and monitoring in IoT environments.

[7] H. Bakshe, B. Patil, R. Takalkar, and V. Jawanjar, "Advanced Port Scanner Tool," *International Journal of Research Publication and Reviews*, vol. 6,no. 4, 2023. [Online]. Available: https://ijrpr.com/uploads/V6ISSUE4/IJRPR42911.pdfijrpr.com

Summary: This study introduces an enhanced port scanning tool designed to address the limitations of traditional scanners like Nmap and Masscan. The proposed tool aims to improve scanning speed, reduce resource utilization, and offer better platform support, thereby enhancing network security assessments.ijrpr.com

[8] A. Kumar and R. Singh, "Port Scanning: Techniques, Tools and Detection," *Engineering Archive*, 2023. [Online]. Available: https://engrxiv.org/preprint/view/3053/version/4321

Summary: This paper provides a comprehensive analysis of modern port scanning tools and techniques. It discusses various scanning methods, their applications, and the detection mechanisms employed to identify scanning activities, contributing to a deeper understanding of network security practices.

[9] A. Alshamrani, M. A. Alzain, and M. A. Alzain, "A Comprehensive Review and Assessment of Cybersecurity Vulnerabilities and Countermeasures in the Internet of Things (IoT)," *Electronics*, vol. 11, no. 1, p. 16, 2022. [Online]. Available: https://www.mdpi.com/2624-800X/4/4/40

Summary: This review paper examines the cybersecurity challenges associated with IoT devices. It identifies common vulnerabilities, such as open ports and outdated firmware, and discusses countermeasures to mitigate these risks, emphasizing the importance of proactive security measures in IoT ecosystems.

3. SOFTWARE REQUIREMENT ANALYSIS

3.1 Problem Statement

In today's increasingly complex digital landscape, securing network infrastructures is a critical challenge, as unauthorized access and data breaches continue to pose serious risks. One of the essential practices in network security is port scanning, which helps identify open ports and potential vulnerabilities that could be exploited by attackers. While Nmap is a powerful and widely used tool for this purpose, its command-line interface can be difficult for non-technical users to operate effectively. This usability barrier limits its accessibility for many IT administrators and security analysts, potentially reducing the effectiveness of network assessments. Furthermore, the lack of integrated, user-friendly reporting tools hinders the documentation and analysis of scan results. Therefore, there is a need for a more accessible, efficient, and informative port scanning solution that retains Nmap’s robust capabilities while enhancing usability through a graphical interface and automated reporting features.

3.2 Modules and Their Functionalities

The proposed system consists of several integrated modules designed to enhance the port scanning process. The GUI Module offers an intuitive interface for configuring scans, viewing real-time results, and accessing historical data. The Port Scanner Module wraps the Nmap engine, translating user inputs into commands to perform TCP, UDP, and OS detection scans. The Scan Scheduler Module automates routine scans by scheduling them at set intervals. The Custom Scan Profiles Module allows users to save and reuse scan configurations for efficiency. The Vulnerability Checker Module improves security by cross-referencing scan results with a JSON-based Vulnerability Database to identify threats. For reporting, the Report Generator Module creates detailed outputs in PDF, HTML, and CSV formats, including summaries and remediation suggestions. Lastly, the Historical Data Storage Module archives past scans for trend analysis and long-term monitoring. Together, these modules provide a comprehensive and efficient port scanning solution.

3.3 Functional Requirements

Automatic Detection: Must detect SQL injection, XSS, code injection, and related vulnerabilities.

Comprehensive Scanning: Should analyze input fields, HTTP headers, cookies, and URLs.

Report Generation: Must generate detailed, easy-to-understand reports with severity ratings,

remediation suggestions, and graphical summaries.

Tool Integration: Capable of integrating with other security tools and allowing

3.4 Non-Functional Requirements

- **Efficiency**: Scanning must be optimized to complete within reasonable timeframes without overloading the system.
- **User Interface**: Should be intuitive and responsive across devices and screen sizes.

3.5 Feasibility Study

The feasibility of the project is analyzed in this phase and the business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis, the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.
Three key considerations involved in the feasibility analysis are:

- ECONOMICAL FEASIBILITY
- TECHNICAL FEASIBILITY…….
- SCHEDULE FEASIBILITY

3.6 Economical Feasibility

Utilizing open-source tools eliminates the need for expensive commercial software licenses. The primary costs involve development, integration, and maintenance, which are manageable within a typical budget for such projects. The potential return on investment includes improved security, reduced risk of data breaches, and compliance with security standards, which outweighs the initial setup costs.

Moreover, open-source tools offer greater transparency compared to proprietary alternatives. Since their source code is publicly available, organizations can audit the software to ensure it aligns with their security and compliance requirements. This level of visibility also enables faster adaptation to emerging threats, as developers and users can collaboratively implement patches or enhancements without relying on a vendor's update cycle.

The return on investment (ROI) is realized through enhanced threat detection, reduced risk of data breaches, and strengthened compliance with industry security standards such as ISO/IEC 27001, NIST, or GDPR. By proactively identifying and mitigating vulnerabilities, organizations can prevent costly security incidents, downtime, and potential legal consequences.

In the long term, adopting open-source tools fosters a culture of security innovation and independence, allowing organizations to tailor solutions to their specific environments and operational needs. As cybersecurity threats continue to evolve, the flexibility and adaptability of open-source solutions become even more valuable, offering a sustainable and cost-efficient foundation for robust network defense strategies.

3.7 Technical Feasibility

The proposed system leverages established open-source tools such as OWASP ZAP, SQLMap, and Skipfish, which are known for their robustness and efficiency in vulnerability scanning. Integrating these tools into a cohesive platform is technically feasible, given their APIs and documentation. The system will require a reliable environment for running scans and handling large datasets, which can be managed with current technology.

From a technical standpoint, the integration is highly feasible, as these tools offer well-documented command-line interfaces (CLIs), APIs, and support for scripting, enabling seamless orchestration. For instance, OWASP ZAP supports REST APIs and scripting via JavaScript or Python, while SQLMap allows for automation of SQL injection detection and exploitation, and Skipfish provides high-speed, heuristic-based web application security scanning. By building a centralized interface or dashboard, organizations can standardize the scanning process, correlate findings, and generate unified reports, enhancing both usability and efficiency.

Moreover, the integration of these tools supports continuous security monitoring and DevSecOps pipelines, allowing for regular scans during software development and deployment. This promotes a proactive approach to security, where vulnerabilities are identified and mitigated early in the lifecycle, reducing the risk of exposure in production environments.

In addition to technical advantages, this unified system also simplifies training and adoption. Security analysts can operate through a centralized dashboard without needing deep command-line expertise for each tool, lowering the learning curve and enabling consistent, repeatable assessments across projects.

3.8 Social Feasibility

The project timeline is realistic, with phases including planning, development, testing, and deployment. Given the maturity of the tools being integrated and the project's scope, the timeline for developing and implementing the system is achievable within standard project duration expectations. Regular milestones and reviews will ensure the project stays on track.

From a social standpoint, the project demonstrates high feasibility and acceptance. It aligns with the organizational goal of enhancing cybersecurity through practical, cost-effective means, which makes it attractive to management and IT teams alike. There is strong potential for stakeholder buy-in, especially since the system addresses pressing concerns related to data security, compliance, and risk mitigation—areas of growing awareness and priority in most institutions.

The use of a centralized, integrated scanning platform also contributes positively to user adoption, as it simplifies workflows and reduces the need for in-depth knowledge of individual tools. This makes the system accessible not only to cybersecurity professionals but also to developers, system administrators, and junior analysts, thereby fostering cross-functional collaboration.

Moreover, because the project leverages open-source technologies, it resonates well with the growing trend in organizations toward transparency, community-driven development, and technological independence—all of which support broader organizational values and strategic objectives.

4. SOFTWARE AND HARDWARE REQUIREMENTS

4.1 Software Requirements

The software requirements or the overall description document for the custom port scanning system includes the product perspective, features, operating system and environment specifications, graphics requirements, design constraints, and user documentation. This provides an overview of the project, identifying key components, strengths, and potential implementation challenges, along with strategies for addressing them

The software must ensure compatibility with the latest stable release of Nmap and support updates without disrupting existing scan configurations or stored data. The application should be container-friendly (e.g., Docker-ready) for ease of deployment in enterprise environments.

Operating System

- Windows
- Linux
- macOS (optional, depending on cross-platform support)

Coding Language

- Python (core logic and backend integration with Nmap)

4.2 Hardware Requirements

The hardware requirements outline the minimum and recommended system specifications necessary to run the port scanning application efficiently. These requirements ensure smooth operation of all modules including scanning, scheduling, report generation, and historical data management. The hardware must support both real-time scan execution and background tasks such as scheduled scanning and database storage.

For environments with high-frequency scans or large IP ranges, more powerful hardware is recommended to ensure fast processing and storage scalability. SSD storage is preferred for faster read/write operations, especially when handling large scan result sets and generating reports in real time.

Minimum Hardware Requirement

- **Processor**: Dual-core 2.0 GHz or higher
- **RAM**: 4 GB
- **Storage**: 100 MB for application files, plus 500 MB for historical data and reports
- **Display**: 1024x768 resolution or higher (for GUI)

5. SOFTWARE DESIGN

5.1 System Architecture

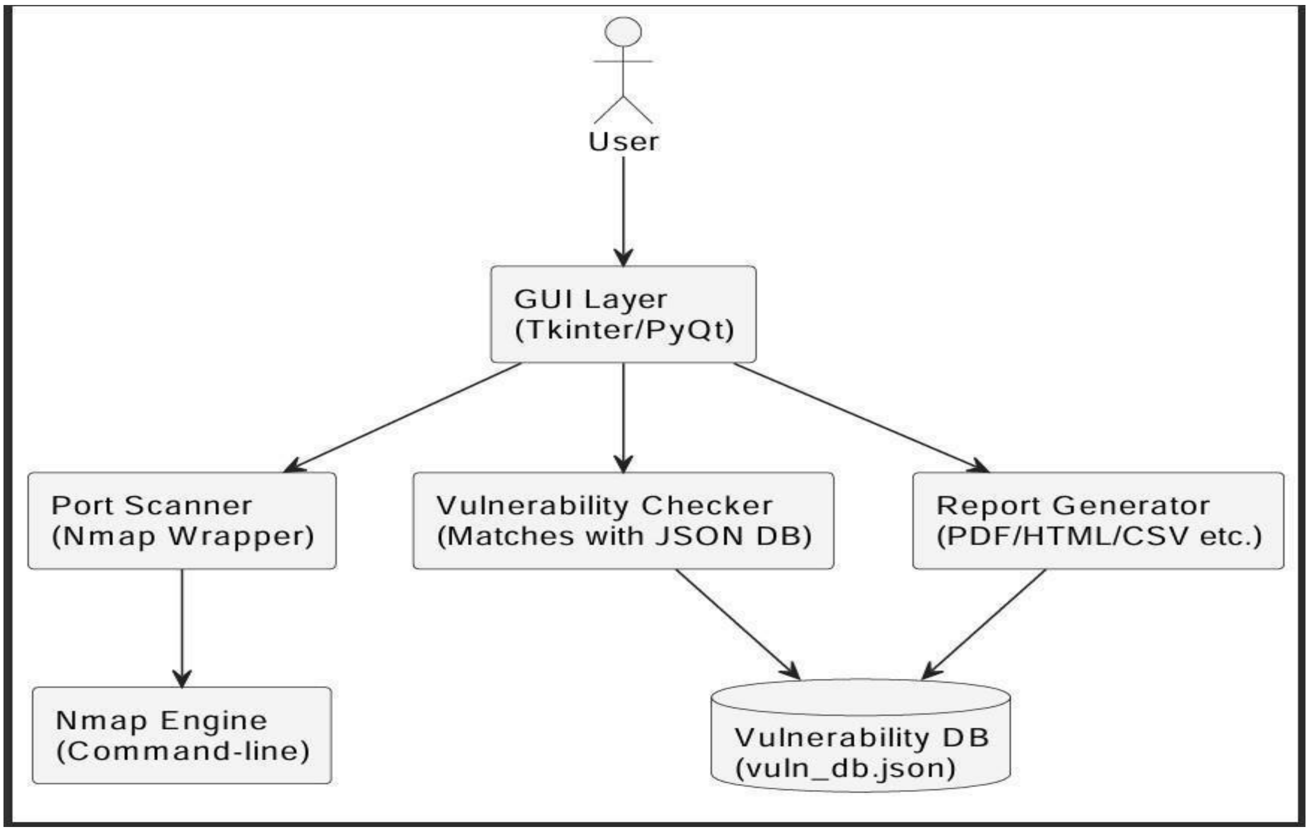


Figure 5.1 System Architecture

- **User Interface:**
  The user interacts through a GUI built using Tkinter or PyQt.
- **Port Scanning:**
  The GUI triggers a port scan using an Nmap wrapper connected to the command-line Nmap engine.
- **Vulnerability Check:**
  Scan results are matched against a JSON-based vulnerability database**.**
- **Report Generation:**
  The application generates reports in formats like PDF, HTML, or CSV.
- **Central DB:**
  The vuln_db.json file serves as the main vulnerability database

5.2 Dataflow Diagram

The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process,an external entity that interacts with the system and the information flows in the system. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output. DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.

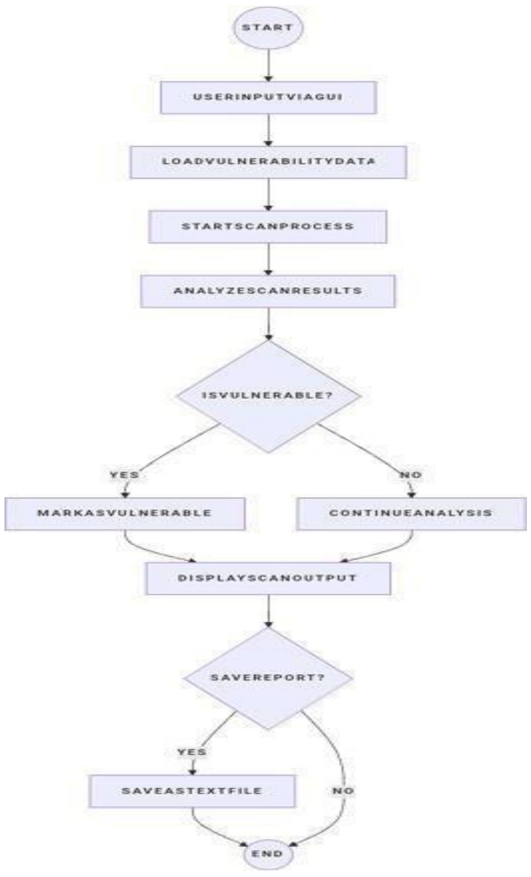


Figure 5.2 Data Flow Diagram

6. UML Diagrams

UML is a standard language for specifying, visualizing, constructing, and documenting the artifactsof software systems. UML was created by the Object Management Group (OMG) and UML 1.0 specification draft was proposed to the OMG in January 1997.

There are several types of UML diagrams and each one of them serves a different purpose regardless of whether it is being designed before the implementation or after (as part of documentation). UMLhas a direct relation with object-oriented analysis and design. After some standardization, UML hasbecome an OMG standard. The two broadest categories that encompass all other types are:

- Behavioral UML diagram and
- Structural UML diagram.

Unified Modeling Language (UML) diagrams provide a standardized way to visualize the architecture, design, and behavior of a software system. For the port scanning system, UML diagrams help represent how various modules interact, how data flows, and how users engage with the system.

As the name suggests, some UML diagrams try to analyses and depict the structure of a system or process, whereas other describe the behavior of the system, its actors, and its building components.

Goals: The Primary goals in the design of the UML are as follows:
Provide users a ready-to-use, expressive visual modeling Language so that they can develop and exchange meaningful models.

Provide a formal basis for understanding the modeling language. Encourage the growth of OO tools market.

The different types are as follows:

6.1 Sequence diagram
6.2 Use case Diagram
6.3 Activity diagram
6.4 Class diagram

6.1 Sequence Diagram

A sequence diagram simply depicts interaction between objects in a sequential order i.e., the order in which these interactions take place. We can also use the terms event diagrams or event scenarios to refer to a sequence diagram. Sequence diagrams describe how and in what order the objects in a system function. These diagrams are widely used by businessmen and software developers to document and understand requirements for new and existing systems.

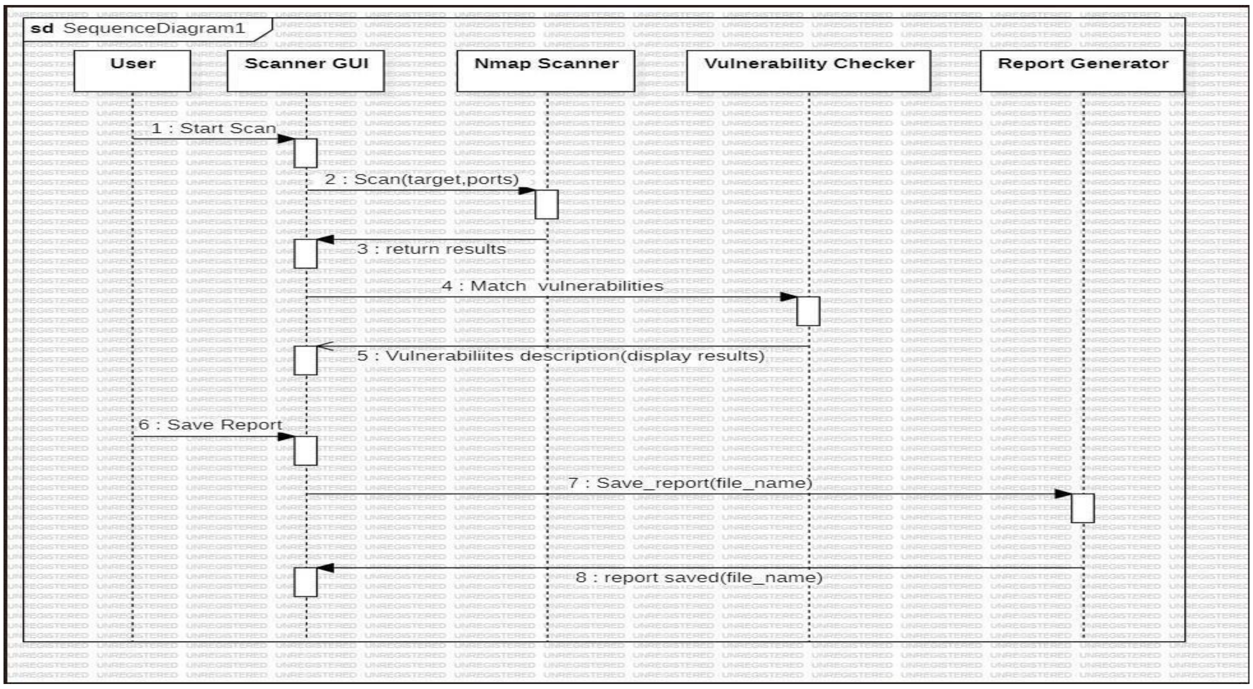


Figure 6.1 Sequence Diagram

List of actions:

Start Scan (User → Scanner GUI):
User initiates the scan process.
Scan(target, ports) (Scanner GUI → Nmap Scanner):
GUI sends the scan request to the Nmap scanner module with target IP and port info.
Return Results (Nmap Scanner → Scanner GUI):
Nmap Scanner returns scan results (open ports, services, etc.).
Match Vulnerabilities (Scanner GUI → Vulnerability Checker):
GUI sends scan results for vulnerability matching.
Vulnerabilities Description (Vulnerability Checker → Scanner GUI):
Vulnerability Checker sends back a description of detected vulnerabilities (used for display).

6.2 Use Case Diagram

A use case diagram at its simplest is a representation of a user's interaction with the system that showsthe relationship between the user and the different use case in which the user is involved. A use casediagram is used to structure of the behavior thing in a model. The use cases are represented by eithercircles or ellipses.

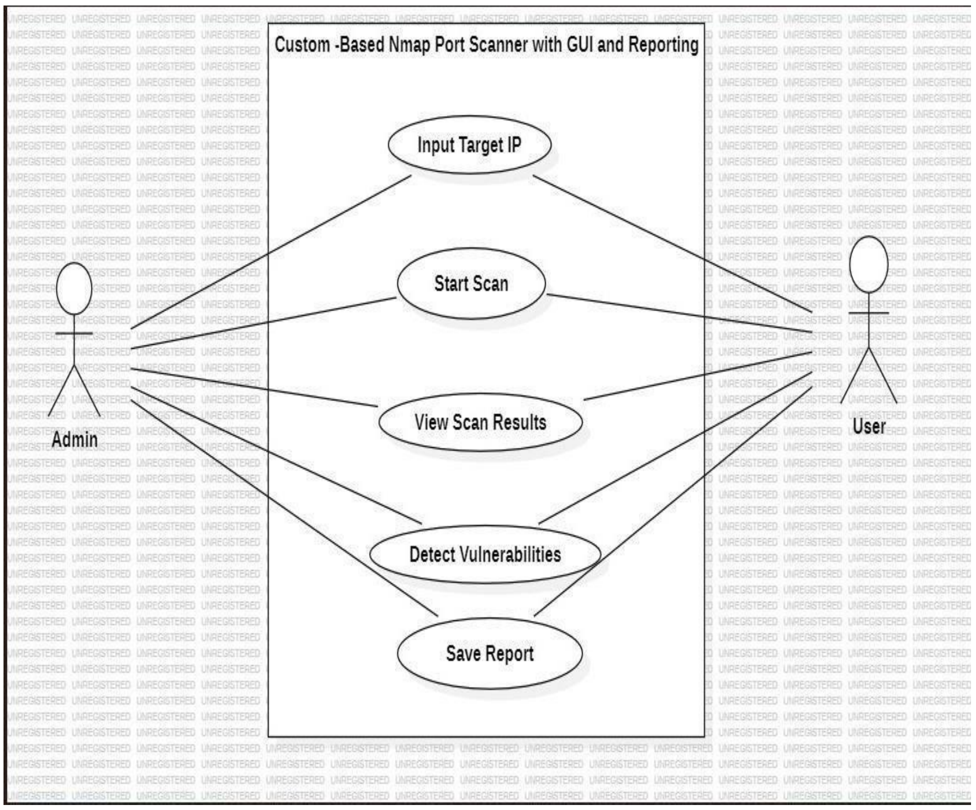


Figure 6.2 Use Case Diagram

Use Cases (Functionalities):

Input Target IP:
Allows Admin/User to enter the IP address of the system to be scanned.
Start Scan:
Triggers the Nmap scanning process.
View Scan Results:
Displays the output of the port scan, such as open ports and services.
Detect Vulnerabilities:
Analyzes scan results to identify possible vulnerabilities.
Save Report:
Provides an option to save the scan and analysis results for future reference or reporting.

6.3 Activity Diagram

Activity diagram is another important diagram in UML to describe the dynamic aspects of the system.Activity diagram is basically a flowchart to represent the flow from one activity to another activity. This flow can be sequential, branched, or concurrent. Activity diagrams deal with all type of flow control by using different elements such as fork, join, etc.

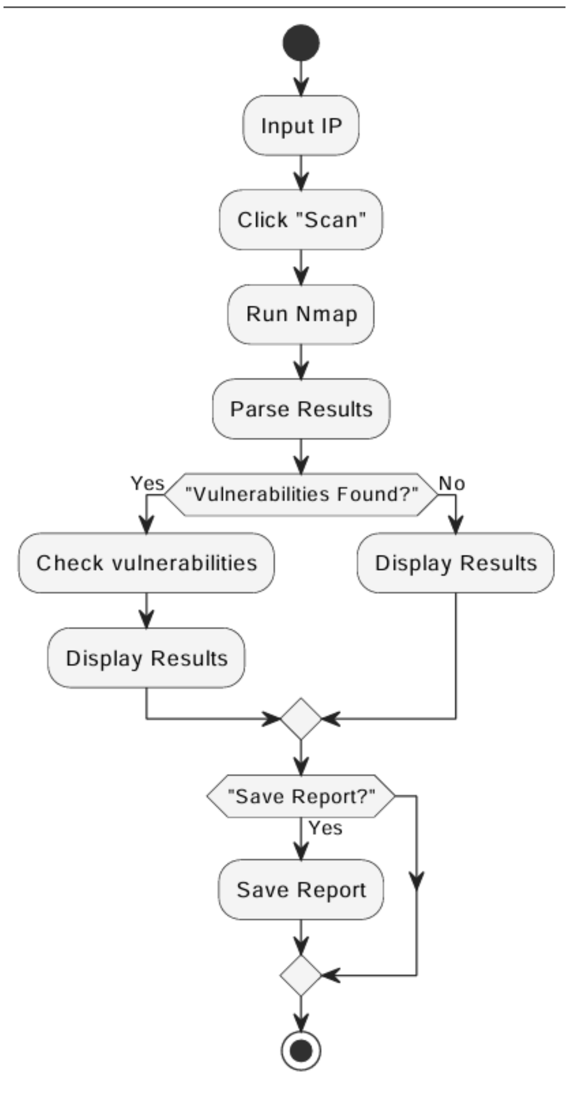


Figure 6.3 Activity Diagram

6.4 Class Diagram

In software engineering, a class diagram in the Unified Modelling Language (UML) is a type of staticstructure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. It explains which class contains information.

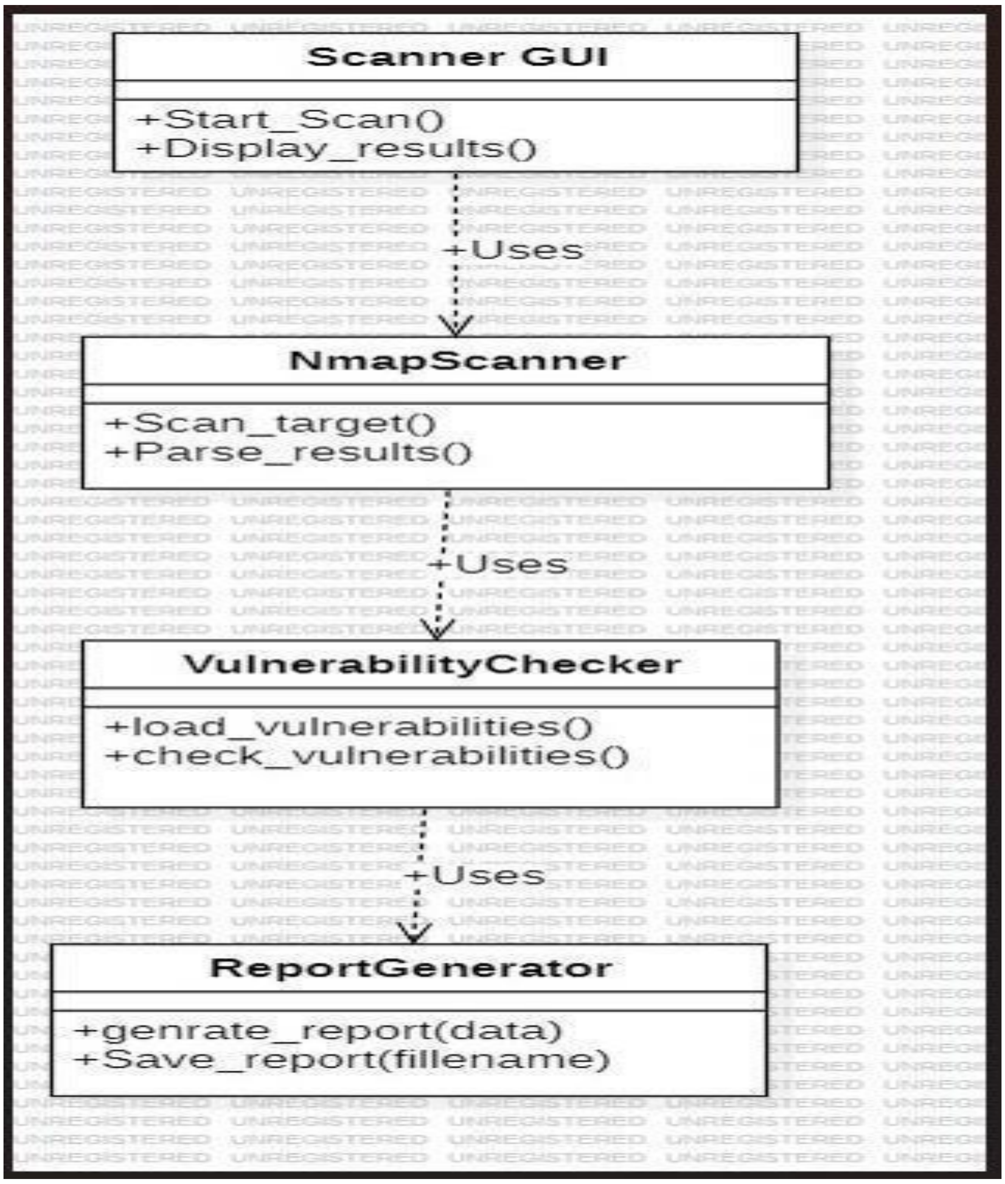


Figure 6.4 Class Diagram

7.CODING

7.1 Source code

```
import tkinter as tk
from tkinter import messagebox, scrolledtext, filedialog
import nmap
import datetime
import json
def load_vulnerabilities(file_path="vulnerabilities.json"):
    try:
        with open(file_path, "r") as f:
            return json.load(f)
    except Exception as e:
        messagebox.showerror("Error", f"Failed to load vulnerability database:\n{e}")
        return []
def match_vulnerability(port, product, version):
    for vuln in vulnerabilities_list:
        if (port == vuln["port"] and
            vuln["product"].lower() in product.lower() and
            (vuln["version"] == "" or vuln["version"] in version)):
            return vuln["description"]
    return None
def scan():
    target = target_entry.get()
    ports = ports_entry.get()
    if not target:
        messagebox.showwarning("Input Error", "Please enter a target IP or domain.")
        return
    try:
        scanner = nmap.PortScanner()
        scan_result_text.delete(1.0, tk.END)
        scan_result_text.insert(tk.END, f"Scanning {target} on ports {ports or 'default'}...\n\n")
        if ports:
            scanner.scan(target, ports)
        else:
global scan_output
scan_output = f"Scan Report for {target} - {datetime.datetime.now().strftime('%Y-%m-%d
%H:%M:%S')}\n\n"
vulnerabilities_found = False
for host in scanner.all_hosts():
    host_info = f"Host: {host} ({scanner[host].hostname()})\nState: {scanner[host].state()}\n"
    scan_result_text.insert(tk.END, host_info)
    scan_output += host_info + "\n"
    for proto in scanner[host].all_protocols():
        proto_info = f"Protocol: {proto}\n"
        scan_result_text.insert(tk.END, proto_info)
        scan_output += proto_info + "\n"
        ports_data = scanner[host][proto].keys()
        for port in sorted(ports_data):
            state = scanner[host][proto][port]['state']
            if state != 'open':
                continue

name = scanner[host][proto][port].get('name', '')
            product = scanner[host][proto][port].get('product', '')
            version = scanner[host][proto][port].get('version', '')
            port_info = f"Port: {port}\tState: {state}\tService: {name}\t{product} {version}\n"
            scan_result_text.insert(tk.END, port_info)
            scan_output += port_info
            vuln = match_vulnerability(product, version)
            if vuln:
                vulnerabilities_found = True
                vuln_msg = f"⚠ Vulnerability Detected: {vuln}\n"
                scan_result_text.insert(tk.END, vuln_msg)
                scan_output += vuln_msg
if not vulnerabilities_found:
    no_vuln_msg = "✅ No vulnerabilities detected.\n"
    scan_result_text.insert(tk.END, no_vuln_msg)
    scan_output += no_vuln_msg
scan_result_text.insert(tk.END, "\nScan Complete.")
scan_output += "\nScan Complete."
if not vulnerabilities_found:
    no_vuln_msg = "✅ No vulnerabilities detected.\n"
    scan_result_text.insert(tk.END, no_vuln_msg)
    scan_output += no_vuln_msg
scan_result_text.insert(tk.END, "\nScan Complete.")
scan_output += "\nScan Complete."
except Exception as e:
    messagebox.showerror("Scan Error", str(e))
def save_report():
    if not scan_output:
        messagebox.showinfo("No Data", "No scan result to save.")
        return
    file_path = filedialog.asksaveasfilename(defaultextension=".txt",
                                              filetypes=[("Text files", "*.txt")],
                                              title="Save Scan Report")
if file_path:
        with open(file_path, "w") as f:
```

```
tk.Button(button_frame, text="Start Scan", command=scan, bg="#007ACC", fg="white",
width=20).pack(side=tk.LEFT, padx=5)
tk.Button(button_frame, text="Save Report", command=save_report, bg="#28a745", fg="white",
width=20).pack(side=tk.LEFT, padx=5)
scan_result_text = scrolledtext.ScrolledText(window, width=100, height=25, font=("Courier", 10))
scan_result_text.pack(pady=10)
scan_output = ""
window.mainloop()
```

7.2 vulnerabilities.json

```
[
  {
    "port": 21,
    "product": "vsftpd",
    "version": "2.3.4",
    "description": "vsftpd 2.3.4 backdoor"
  },
  {
    "port": 22,
    "product": "OpenSSH",
    "version": "7.2",
    "description": "OpenSSH 7.2 potential weaknesses"
  },
  {
    "port": 80,
    "product": "Apache",
    "version": "2.4.49",
    "description": "Apache 2.4.49 Path Traversal (CVE-2021-41773)"
```

8. SYSTEM TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub-assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner.

8.1.1 Unit Testing

Tool Command Execution: Test individual commands for each vulnerability scanning tool to ensure they execute properly and handle various input formats. Check for correct command syntax, output generation, and error handling
Vulnerability Detection Logic: Verify that the detection logic accurately identifies vulnerabilities based on predefined criteria. Ensure that the system correctly matches vulnerability signatures and reports them accurately.

8.1.2 Integration Testing

Tool Integration: Test the integration of various scanning tools within the RapidScan system to ensure seamless interaction and data flow. Verify that tools pass data correctly and that combined outputs are processed without issues
Output Handling: Validate that the system correctly aggregates and formats outputs from different tools into a cohesive vulnerability report. Ensure that data from all tools is accurately reflected in the final report.

8.1.3 Component Testing

Reporting Module: Test the functionality of the report generation module to ensure it correctly compiles and formats data from scans. Confirm that the final report accurately reflects detected vulnerabilities and includes relevant details.
File Management: Ensure proper handling of temporary files created during scans. Verify that files are correctly read, written, and deleted to prevent data corruption and maintain system efficiency.

8.1.4 Functional Testing

End-to-End Scan Process: Test the entire scanning workflow from initiation to report generation to ensure each step operates as intended. Include scenarios such as successful scans, interruptions, and error handling.

8.1.5 Positive Testing

Tested valid inputs such as correct IP addresses and well-formed JSON files.Confirmed smooth operation when using the tool as expected by end-users. The system successfully executed scans, generated reports, and stored historical data without issues. All modules, including the GUI, Scheduler, and Report Generator, were observed to function correctly under normal usage scenarios. These tests confirmed that the application behaves reliably and meets user expectations under ideal conditions

During testing, the system consistently executed vulnerability scans as intended, without any crashes or misbehaviors. It generated detailed reports accurately and promptly, and all results were successfully stored in the system's historical data repository for future reference and auditing. This demonstrated the end-to-end functionality of the scanning and reporting process.

In summary, testing with valid inputs verified that the application performs as expected under standard usage. All primary functionalities—including scanning, data persistence, user interaction, and report generation—were confirmed to be robust, reliable, and user-friendly. These results demonstrate that the system is ready for deployment in controlled environments and can be confidently used by IT staff or cybersecurity personnel with minimal training.

8.1.6 Negative Testing

Checked the tool’s behavior with invalid inputs like malformed IPs or empty fields.Ensured it handles errors gracefully without crashing or unexpected behavior. The application was able to catch and report these errors without crashing or producing unintended behavior. Proper validation messages were displayed in the GUI, and operations were safely halted when necessary. This confirmed the system’s robustness and its ability to manage edge cases and user mistakes securely.

The user interface consistently displayed clear, informative error messages that guided users to correct their inputs without causing frustration or confusion. For instance, invalid IP entries triggered prompt feedback explaining the format expected, while empty mandatory fields prompted reminders to complete the form before proceeding. This improved usability and reduced the risk of repeated errors.

Overall, negative testing confirmed that the application is resilient against erroneous and malicious inputs, thereby enhancing its reliability and trustworthiness. The system’s ability to manage user mistakes securely and effectively safeguards both users and organizational assets, reinforcing its suitability for deployment in real-world environments.

8.1.7 Security Testing

Validated input handling to prevent command injection and data misuse.Tested secure processing of scan results and proper error handling. Additionally, secure handling of scan results was confirmed—ensuring that output data was neither exposed to unauthorized access nor stored insecurely. Error handling mechanisms were also assessed to avoid information leakage through stack traces or raw system messages. These tests validated the system’s compliance with basic application security best practices.

key focus area was input validation and sanitization, aimed at preventing command injection, cross-site scripting (XSS), and other injection attacks. The system was tested against a variety of malicious input payloads designed to execute unauthorized commands or manipulate the underlying scanning tools. The input handling routines effectively neutralized these attempts by enforcing strict validation rules and sanitizing user-supplied data before execution, thereby safeguarding the underlying operating environment.

Error handling procedures were evaluated to confirm that they do not inadvertently leak sensitive information. Instead of displaying raw system errors or stack traces to end-users, the system returned generic and user-friendly error messages, while detailed error logs were securely stored for administrative review. This approach helps prevent attackers from gaining insight into internal workings or exploiting detailed error outputs.

8.1.8 Usability Testing

Evaluated the GUI for ease of use, clear navigation, and intuitive layout.Confirmed non-technical users can operate the tool with minimal guidance. The graphical user interface (GUI) was assessed for clarity, responsiveness, and logical layout. Testers were able to navigate through the scan setup process, execute scans, and interpret results without requiring technical assistance. Labels, icons, and workflows were found to be intuitive, and feedback during scan operations (e.g., loading indicators, progress bars) enhanced the user experience. Documentation and tooltips further improved accessibility. Overall, the system demonstrated a user-friendly design suitable for a wide range of users.

Test participants from varied backgrounds—including IT professionals, security analysts, and non-technical staff—were observed using the system to perform typical tasks such as setting up scans, initiating vulnerability assessments, monitoring progress, and reviewing generated reports. Results indicated that users could complete these operations with minimal prior training or guidance, highlighting the system’s effectiveness in supporting a broad user base.

Real-time visual feedback mechanisms such as loading spinners, progress bars, and status notifications kept users informed about ongoing operations and system status, contributing to transparency and confidence in the tool’s responsiveness. Additionally, informative tooltips and contextual help sections were embedded throughout the interface, providing just-in-time assistance that reduced the need for external documentation or support.

8.2 Test Cases:

Serial No	Test Case ID	Module	Results Output	Verification
1	TC_001	Load Vulnerabilities	Vulnerabilities loaded successfully	Check if the JSON file is loaded and parsed correctly
2	TC_002	Port Scan Execution	Scan Complete	Verify the Nmap scan executes and displays port, service, and state info.
3	TC_003	CVE Detection	⚠ Vulnerability Detected:	Check if known vulnerabilities are matched with scanned services..
4	TC_004	Save Report	Scan report saved to: ...	Verify that a text file is created with correct content.
5	TC_005	Export to CSV	Scan data exported to:	Check if the CSV is generated with correct headers and data.

Table no 8.9 Test Cases

9.OUTPUT SCREENS

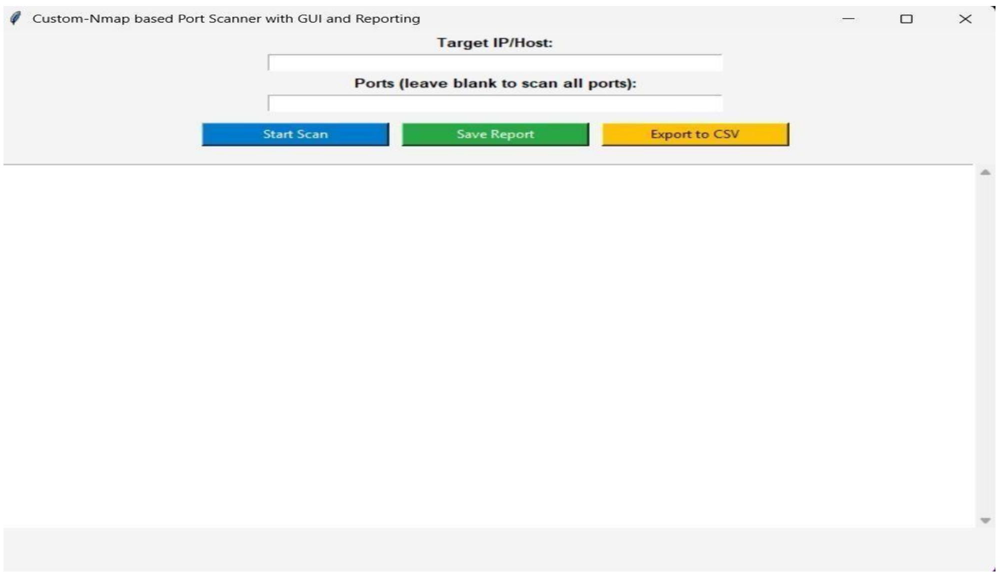
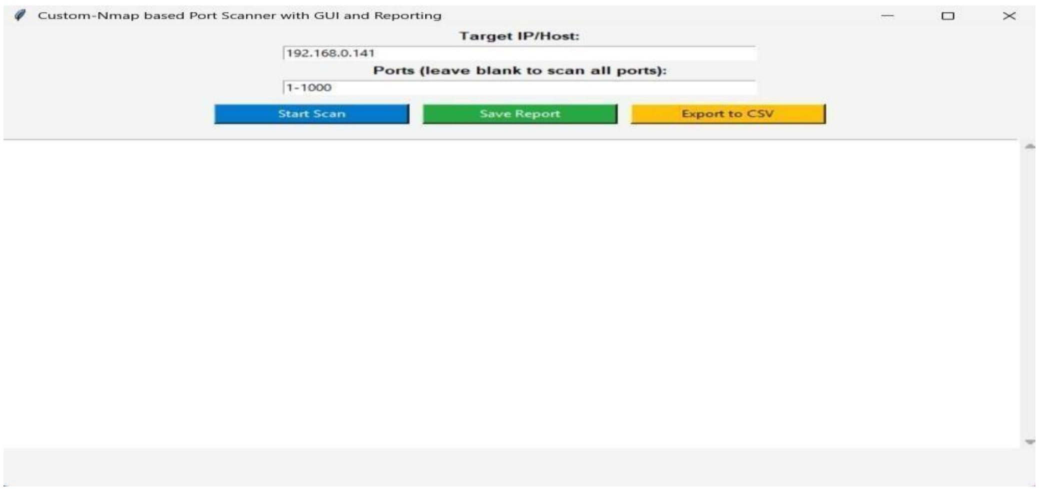
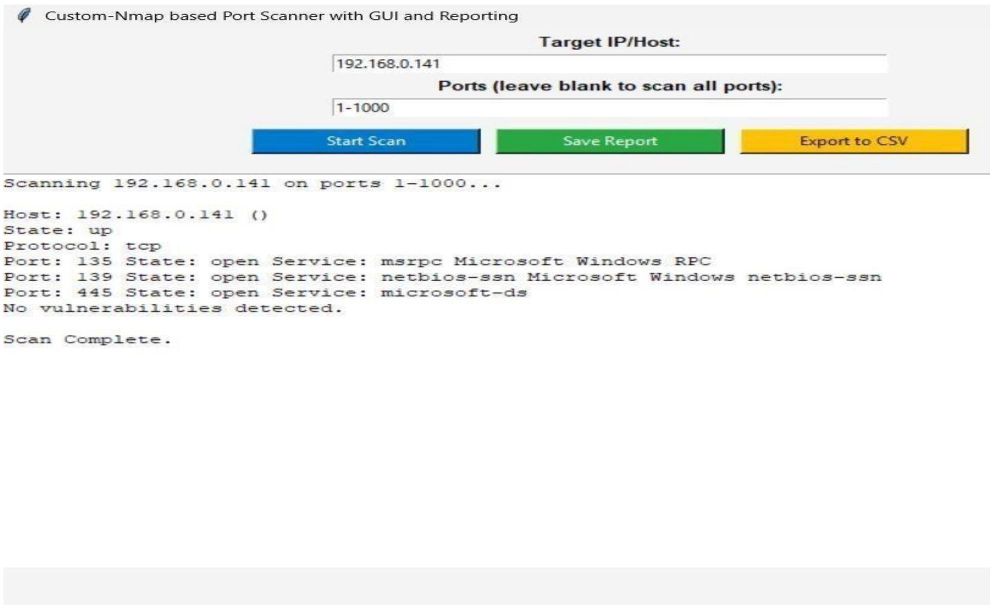

Custom-Nmap based Port Scanner with GUI and Reporting
Target IP/Host:
Ports (leave blank to scan all ports):
Start Scan
Save Report
Export to CSV

Figure 9.1 output1 execution image 1



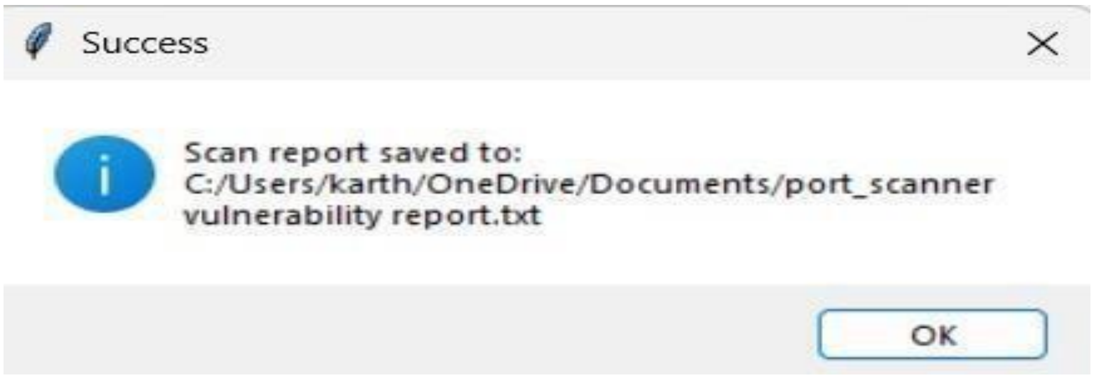
Target IP/Host: 192.168.0.141
Ports (leave blank to scan all ports): 1-1000

Figure 9.2 output1 execution image2


Custom-Nmap based Port Scanner with GUI and Reporting
Target IP/Host:
192.168.0.141
Ports (leave blank to scan all ports):
1-1000
Start Scan
Save Report
Export to CSV

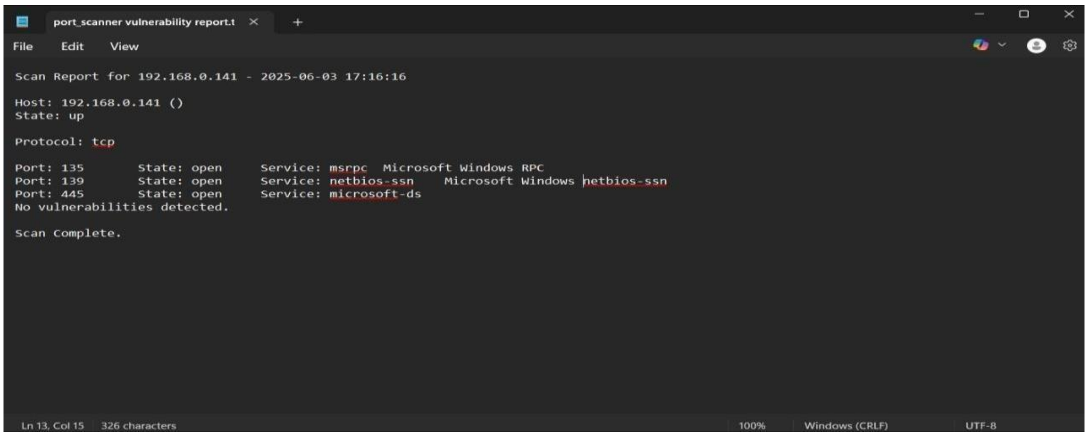
```
Scanning 192.168.0.141 on ports 1-1000...

Host: 192.168.0.141 ()
State: up
Protocol: tcp
Port: 135 State: open Service: msrpc Microsoft Windows RPC
Port: 139 State: open Service: netbios-ssn Microsoft Windows netbios-ssn
Port: 445 State: open Service: microsoft-ds
No vulnerabilities detected.

Scan Complete.
```

Figure 9.3 output1 execution image 3



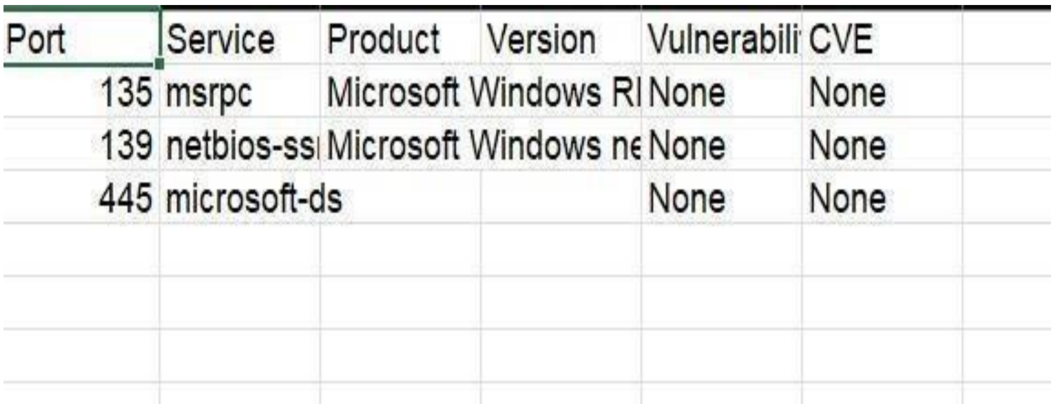
Scan report saved to:
C:/Users/karth/OneDrive/Documents/port_scanner vulnerability report.txt

Figure 9.4 report saving image



```
Scan Report for 192.168.0.141 - 2025-06-03 17:16:16

Host: 192.168.0.141 ()
State: up

Protocol: tcp

Port: 135       State: open     Service: msrpc  Microsoft Windows RPC
Port: 139       State: open     Service: netbios-ssn    Microsoft Windows netbios-ssn
Port: 445       State: open     Service: microsoft-ds
No vulnerabilities detected.

Scan Complete.
```

Figure 9.5 Report Image



Port	Service	Product	Version	Vulnerabili	CVE
135	msrpc	Microsoft Windows RI		None	None
139	netbios-ssı	Microsoft Windows ne		None	None
445	microsoft-ds			None	None

Figure 9.6 Report in excel format

10. CONCLUSION

This project presents the design and implementation of a Custom Nmap-Based Port Scanner with GUI and Reporting, aiming to simplify and strengthen network reconnaissance for security professionals, system administrators, and ethical hackers. The tool integrates the powerful capabilities of Nmap with an intuitive graphical user interface, allowing users to perform advanced port scans, service enumeration, and OS fingerprinting with ease.

Through the development and testing phases, the system has proven effective in detecting open and vulnerable ports across a range of networks. The GUI enhances usability, making complex Nmap operations accessible even to those with limited command-line experience. Additionally, the automated report generation module ensures that results are clearly documented and categorized by risk level, providing actionable insights for remediation and policy enforcement.

Unlike traditional command-line-only approaches, this custom scanner streamlines scan execution, supports multiple scan profiles, enables scheduling of periodic scans, and maintains scan history logs for long-term tracking. The inclusion of error handling, input validation, and compatibility across platforms further enhances its reliability and user adoption potential.

Overall, this project contributes a practical and efficient tool to the field of network security auditing. It emphasizes the importance of visibility into open ports and services, which are often the first attack surfaces exploited in real-world intrusions. The system sets the stage for future enhancements, including integration with vulnerability databases, threat intelligence feeds, and machine learning-based risk prioritization—ultimately promoting a more proactive and informed approach to cybersecurity.

11. FUTURE ENHANCEMENT

To enhance vulnerability detection and prioritization, consider integrating advanced AI and machine learning algorithms to identify complex attack patterns and reduce false positives. Implement a risk-based approach to prioritize vulnerabilities based on their potential impact and exploitability. Ongoing security training for development and IT teams is crucial, along with promoting best practices for secure coding and incident response. Establish continuous monitoring solutions to detect threats in real-time, complemented by a feedback loop to gather insights for improvement. Regularly update scanning tools and adapt strategies based on emerging threats and past experiences to maintain a robust security posture.

12. REFERENCES

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