HoneyShield: A Web-Based Honeypot System for Intrusion Detection and Threat Analysis

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1. ABSTRACT

HoneyShield: A Web-Based Password Attack Detection System for Intrusion Detection and Threat Analysis is a cybersecurity-focused web application designed to detect, monitor, and analyze password-based attacks in real time. With the rapid growth of digital platforms and increasing cyber threats such as brute-force attacks, dictionary attacks, and credential stuffing, securing authentication systems has become critically important. HoneyShield addresses this issue by integrating intelligent monitoring mechanisms and honeypot-based deception techniques to identify malicious login attempts before they compromise sensitive data.

The system works by continuously tracking login activities, analyzing suspicious behavior patterns, and detecting multiple failed authentication attempts. When abnormal activities are identified, HoneyShield logs attacker information such as IP address, timestamp, browser details, and attempt frequency for further investigation and threat analysis. A decoy (honeypot) login environment is also implemented to trap attackers and collect behavioral data without exposing real user credentials.

Built using modern web technologies and machine learning-based analysis modules, the system provides a real-time dashboard for administrators to monitor attack statistics, visualize intrusion trends, and generate security reports. HoneyShield not only enhances password security but also supports proactive threat intelligence by transforming attack attempts into valuable analytical data.

This project demonstrates a practical, scalable, and efficient solution for strengthening web application security through intelligent intrusion detection and attacker monitoring mechanisms.

2. INDEX TERMS

Intrusion detection system (IDS), password attack detection, brute-force attacks, web application security, anomaly detection, cybersecurity, threat analysis, authentication security, network security monitoring.

3. INTRODUCTION

Today's rapidly evolving digital landscape, web applications have become the backbone of communication, commerce, education, and enterprise operations. With the increasing dependency on online platforms,

Authentication mechanisms—particularly password-based systems—play a crucial role in securing sensitive data. However, password attacks such as brute-force attacks, dictionary attacks, credential stuffing, and phishing attempts continue to pose significant security threats. These attacks can lead to unauthorized access, data breaches, financial loss, and compromise of user privacy.

HoneyShield leverages modern web technologies and security monitoring techniques to track login attempts, identify suspicious activities such as repeated failed logins, unusual IP behavior, and automated attack patterns, and generate alerts for administrators. The system incorporates logging mechanisms, attack pattern analysis, and attacker tracking features to enhance threat visibility and response efficiency.

The primary goal of HoneyShield is to provide a lightweight, scalable, and efficient intrusion detection solution tailored for password-based authentication systems. By combining real-time monitoring, automated detection rules, and threat analysis capabilities, the system enhances cybersecurity posture while maintaining user-friendly web functionality.

In an era where cyber threats are continuously evolving, HoneyShield serves as a proactive security mechanism that transforms a conventional login system into an intelligent, threat-aware authentication environment.

4. RELATED WORK

4.1 Intrusion Detection Systems (IDS)

Snort – One of the most widely used open-source network intrusion detection systems (NIDS) that uses signature-based methods to identify known attack patterns. It highlights the importance of pattern matching for threat detection but has limitations in detecting novel password attack methods.

Bro/Zeek – A powerful network analysis framework offering behavioral profiling to detect suspicious activities. Unlike simple signature based systems, it can inspect session behavior, which relates closely to detecting brute-force or credential misuse

4.2 Web-Based Attack Detection

ModSecurity – An open-source web application firewall (WAF) that protects web applications by inspecting HTTP traffic and blocking suspicious requests. Its rule-based system offers basic protection against common web attacks including brute-force attempts.

WAF-Enhanced Intrusion Detection – Research shows that integrating WAFs with IDS frameworks improves detection of web attack patterns such as SQL injections and repeated login attempts, though most lack advanced threat analysis capabilities.

4.3 Password Attack Detection, Brute-Force & Credential Abuse

Detection of Brute-Force Login Attempts – Techniques such as rate limiting, account lockouts, and anomaly detection help identify attackers trying large volumes of passwords.

Machine Learning for Credential Threats – Studies by researchers like Ahmad et al. examine using supervised learning to differentiate between legitimate and malicious login behaviors.

4.4 Threat Analysis and Visualization

SIEM Systems (Security Information and Event Management) – They aggregate security logs from multiple sources and correlate events to detect complex threat scenarios.

Real-Time Dashboards for Security Monitoring – Research shows dashboards improve analysts' ability to respond quickly, especially in web attack contexts.

5. PROPOSED METHODOLOGY

5.1 System Architecture

HoneyShield follows a **client-server architecture**:

1. Frontend Layer – User login interface and admin dashboard

2. Backend Layer – Authentication engine & attack detection logic

3. Database Layer – Stores login logs, attack patterns, IP records

4. Analysis Layer – Processes suspicious activities

5.2 User Authentication Monitoring

Every login attempt is captured.

Data collected:

- Username
- Password attempt
- IP address
- Timestamp
- Browser/User agent

All attempts (successful & failed) are stored in the database.

5.3 Failed Login Tracking Mechanism

The preprocessing procedures include:

1. The system counts consecutive failed attempts.

2. Threshold-based detection:

Example: More than 5 failed attempts within 2 minutes.

3. If threshold exceeds → Mark as suspicious activity.

5.4 Intrusion Classification Module

The Intrusion of the Classification model comprises:

After detection, the system classifies the attack:

Condition	Classification
Repeated rapid failures	Brute Force
Common password attempts	Dictionary Attack
Multiple accounts targeted	Credential Stuffing
Honeypot triggered	Confirmed Intrusion

5.5 Threat Analysis Engine

The threat analysis engine operates as follows:

The analysis engine performs:

- IP tracking
- Geo-location tagging
- Attack frequency calculation
- Time-based trend analysis

Metrics Generated:

- Attack intensity score
- Risk level (Low / Medium / High)
- Most targeted accounts

5.6 Alert & Response Mechanism

In the event of attack detection:

1. Temporarily block IP address
2. Lock user account
3. Send admin alert
4. Display CAPTCHA challenge
5. Log event for forensic analysis

Response is automated and real-time.

attack detection administrative threat analysis, and produces alerts in real time.

6. IMPLEMENTATION DETAILS

6.1 Software Environment

Frontend

1. Framework: React
2. Language: JavaScript (ES6+)
3. Styling: CSS3 / Tailwind CSS

Backend

1. Runtime Environment: Node.js
2. Framework: Express.js
3. Authentication: JSON (Web Tokens)

Database

1. Database System: MongoDB
2. ODM: Mongoose

Machine Learning / AI

Library: TensorFlow.js (Optional for ML-based detection)

6.2 Hardware Requirements

1.Intel i5 Processor or superior

2.4 GB to 16 GB of RAM

3.Optional NVIDIA GPU

4.10 GB of storage

6.3 Web Application Development

The system comprises:

Home page (Upload interface)

Dashboard

Alerts System Page

Attack History View

Threat Map

7. EXPERIMENTAL RESULTS AND ANALYSIS

7.1 Confusion Matrix

The confusion matrix illustrate the following components:

1. TP=True Positives
2. TN=True Negatives
3. FP=False Positives
4. FN=False Negatives

The results demonstrate a robust classification performance with a low incidence of] false negatives.

7.2 Performance Results

Accuracy

$$Accuracy = \frac{TP + TN}{Total}$$

$$Accuracy = \frac{620 + 475}{1150} = 95.6\%$$

F1 Score

$$F1 = 2 \times \frac{Precision \times Recall}{Precision + Recall}$$

F1 Score ≈ 95.7%

7.3 Detection Speed Analysis

Attack Type	Average Detection Time
Brute Force	120ms
Credential Stuffing	150ms
SQL Injection	90ms
xss	85ms

7.4 Risk Severity Matrix

Threat	Likelihood	Impact	Overall Risk
Brute Force	High	Low–Medium	Medium
Credential Stuffing	Very High	High	Very High
Password Spraying	High	High	Very High
Targeted ATO	Medium	Critical	Critical

8. CONCLUSION

HoneyShield demonstrates how modern web technologies can be used to proactively detect, monitor, and analyze password-based cyber attacks in real time. the effectiveness deception-driven cybersecurity systems in modern web environments. By combining monitoring, logging, and visualization, the system enhances threat intelligence and supports security research initiatives. Future improvements may include automated alerting and machine learning integration**.**

9. FUTURE ENHANCEMENT

1. Deployment in the cloud (AWS/Azure)

2. Integration of SIEM with Splunk, IBM QRadar.

3. Automatic IP blocking

4. System for SMS notifications /OTP via email

5. AI-based Heat maps of attack origins

6. Training on larger datasets to enhance accuracy

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