THREAT INTELLIGENCE AGGREGATOR

Final Project Report

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Unified Mentor – Cybersecurity Internship

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PROJECT INFORMATION

Project Title:	Threat Intelligence Aggregator
Project Type:	Cybersecurity – Blue Team / SOC Operations
Program:	Unified Mentor – Cybersecurity Internship
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Organization:	Unified Mentor
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1. Executive Summary

This project implements a non-AI Threat Intelligence Aggregator, a blue-team focused tool that collects, parses, normalizes, correlates, and exports Indicators of Compromise (IOCs) from multiple threat feeds into actionable intelligence for security operations. The system addresses a common SOC problem: threat data scattered across heterogeneous sources and formats, which makes manual correlation slow and error-prone.

The aggregator ingests sample feeds containing malicious IPs, domains, URLs, file hashes, and phishing email addresses, stores them in a normalized SQLite database, and then applies a correlation engine to identify unique indicators and their frequency across feeds. It generates deployment-ready blocklists for firewalls, web filters, and EDR tools, along with machine-readable CSV/JSON datasets and a human-readable HTML threat report summarizing all IOCs.

The final implementation demonstrates end-to-end workflow automation: virtual environment setup, CLI-driven execution, database persistence, correlation analysis, blocklist generation, reporting, and logging. The project provides practical exposure to threat intelligence formats, IOC validation, data normalization, and operational blue-team techniques such as automated blocklisting and evidence-based reporting.

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2. Project Overview

2.1 Problem Statement

Modern organizations rely on multiple threat intelligence sources including OSINT platforms, commercial TI providers, local security tools, and government CERT notifications. These feeds arrive in inconsistent formats such as CSV, JSON, TXT, and STIX, and often contain overlapping indicators. Without automation, SOC analysts must manually correlate IOCs, which is time-consuming, error-prone, and does not scale during active incidents.

This project focuses on building a practical Threat Intelligence Aggregator to solve this operational gap by creating a unified, normalized view of indicators and generating enforcement-ready artifacts.

2.2 Solution Approach

The solution is a modular Python application with the following core components:

- **Feed Parser:** Reads multiple pre-defined sample feeds (malicious IPs, domains, URLs, hashes, phishing emails) and extracts IOCs.
- **Normalization & Storage Layer:** Validates and normalizes indicators, then stores them in a SQLite database with consistent schema and metadata (type, source, severity, timestamps, risk score).
- **Correlation Engine:** Aggregates IOCs, identifies unique indicators, tracks frequency across feeds, and assigns severity.
- **Blocklist Generator:** Produces text-based blocklist files for firewall IP blocking, web filtering, and EDR hash blacklisting.
- **Reporting Module:** Exports IOC datasets as CSV and JSON and builds an HTML report for analysts.

Execution is orchestrated via a CLI with sub-commands such as `--process-samples`, `--correlate`, `--blocklists`, `--reports`, and an integrated `--full-workflow` that runs the complete pipeline in one step.

2.3 Key Features

- Multi-feed IOC ingestion for five categories: IP, domain, URL, hash, email.[1]
- Normalized storage in a relational database to avoid duplication and maintain consistency.[1]
- Correlation logic that identifies 21 unique IOCs and their occurrence across feeds in the final dataset.
- Automatic generation of three blocklists:
  - `firewall_ips.txt` (5 IPs)
  - `web_filter_domains.txt` (10 domains/URLs)
  - `edr_hashes.txt` (3 hashes)

```
Session  Actions  Edit  View  Help

┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$ echo "═══ FINAL VERIFICATION ═══"
ls -lah output/blocklists/ output/reports/ output/datasets/ database/

═══ FINAL VERIFICATION ═══
database/:
total 40K
drwxrwxr-x  3 aswin aswin 4.0K Dec 16 21:28 .
drwxrwxr-x 13 aswin aswin 4.0K Dec 16 02:15 ..
-rw-rw-r--  1 aswin aswin 3.4K Dec 16 02:10 db_manager.py
drwxrwxr-x  2 aswin aswin 4.0K Dec 16 02:11 __pycache__
-rw-r--r--  1 aswin aswin  24K Dec 16 21:28 threat_intelligence.db

output/blocklists/:
total 20K
drwxrwxr-x 2 aswin aswin 4.0K Dec 16 21:30 .
drwxrwxr-x 5 aswin aswin 4.0K Dec 15 23:52 ..
-rw-rw-r-- 1 aswin aswin   43 Dec 16 21:30 edr_hashes.txt
-rw-rw-r-- 1 aswin aswin   40 Dec 16 21:30 firewall_ips.txt
-rw-rw-r-- 1 aswin aswin   50 Dec 16 21:30 web_filter_domains.txt

output/datasets/:
total 16K
drwxrwxr-x 2 aswin aswin 4.0K Dec 16 21:31 .
drwxrwxr-x 5 aswin aswin 4.0K Dec 15 23:52 ..
-rw-rw-r-- 1 aswin aswin   48 Dec 16 21:31 iocs_export.csv
-rw-rw-r-- 1 aswin aswin  102 Dec 16 21:31 iocs_export.json

output/reports/:
total 12K
drwxrwxr-x 2 aswin aswin 4.0K Dec 16 21:31 .
drwxrwxr-x 5 aswin aswin 4.0K Dec 15 23:52 ..
-rw-rw-r-- 1 aswin aswin  855 Dec 16 21:31 threat_report.html

┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$
```

```
┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$ echo "═══ FIREWALL IP BLOCKLIST ═══"
cat output/blocklists/firewall_ips.txt
═══ FIREWALL IP BLOCKLIST ═══
# Firewall IP Blocklist
# Total IPs: 5

192.168.1.100
10.0.0.50
172.16.0.25
8.8.8.8
1.1.1.1
```

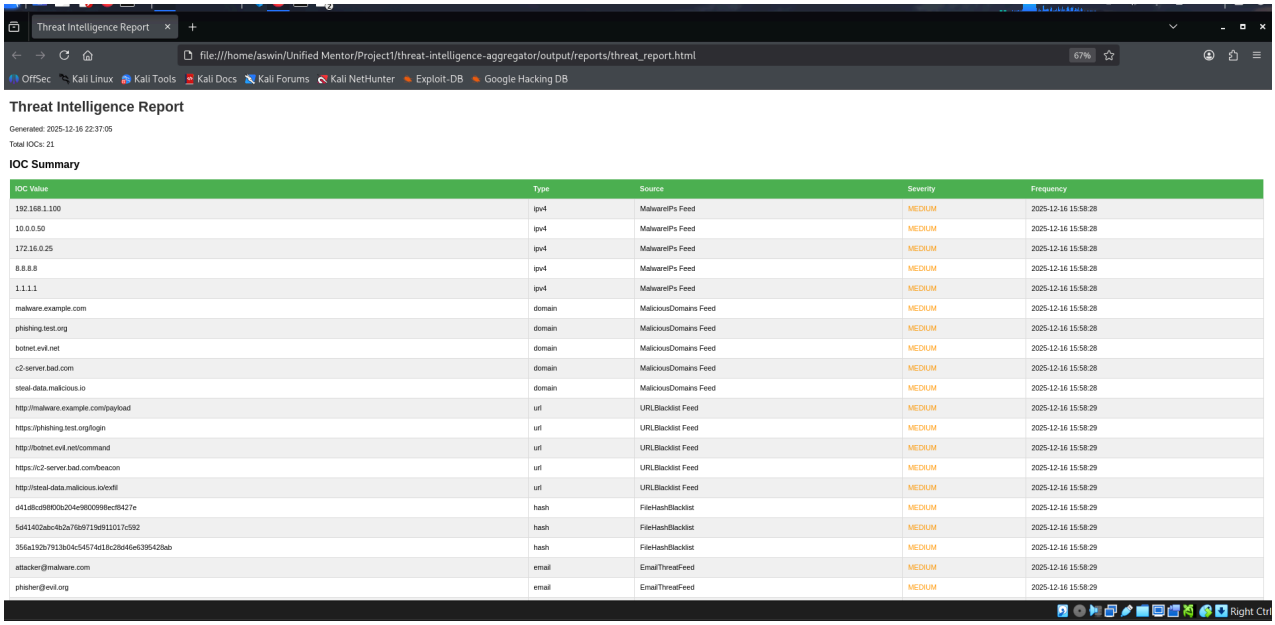
```
┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$ echo -e "\n═══ DOMAIN BLOCKLIST ═══"
cat output/blocklists/web_filter_domains.txt

═══ DOMAIN BLOCKLIST ═══
# Web Filter Domain Blocklist
# Total Domains: 10

malware.example.com
phishing.test.org
botnet.evil.net
c2-server.bad.com
steal-data.malicious.io
http://malware.example.com/payload
https://phishing.test.org/login
http://botnet.evil.net/command
https://c2-server.bad.com/beacon
http://steal-data.malicious.io/exfil

┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$
```

```
┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$ echo -e "\n═══ HASH BLOCKLIST ═══"
cat output/blocklists/edr_hashes.txt

═══ HASH BLOCKLIST ═══
# EDR/AV Hash Blocklist
# Total Hashes: 3

d41d8cd98f00b204e9800998ecf8427e
5d41402abc4b2a76b9719d911017c592
356a192b7913b04c54574d18c28d46e6395428ab

┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$
```

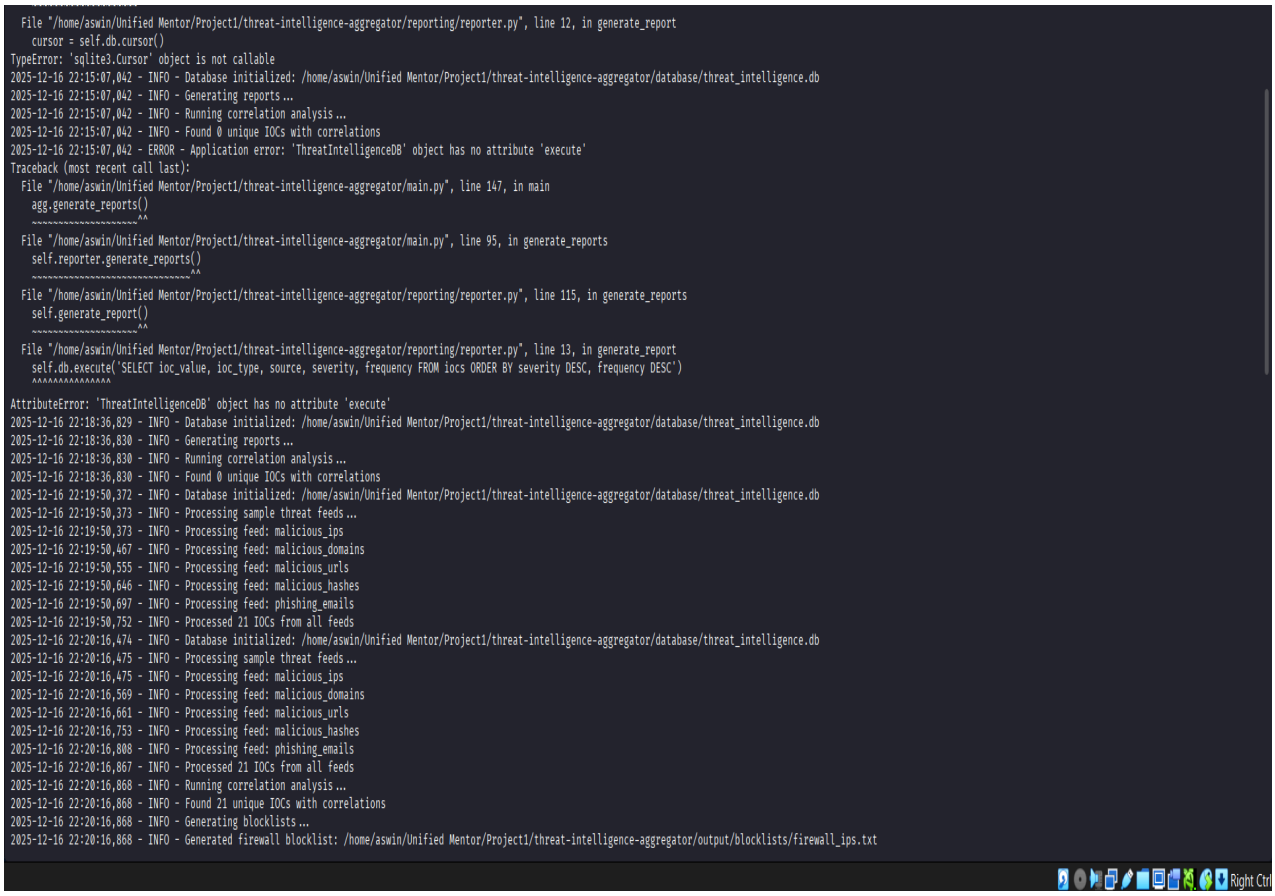
- Export of IOC datasets as `iocs_export.csv` and `iocs_export.json`.

```
┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$ echo -e "\n═══ CSV EXPORT ═══"
cat output/datasets/iocs_export.csv

═══ CSV EXPORT ═══
IOC Value,Type,Source,Severity,Frequency,Score
192.168.1.100,ipv4,MalwareIPs Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
10.0.0.50,ipv4,MalwareIPs Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
172.16.0.25,ipv4,MalwareIPs Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
8.8.8.8,ipv4,MalwareIPs Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
1.1.1.1,ipv4,MalwareIPs Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
malware.example.com,domain,MaliciousDomains Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
phishing.test.org,domain,MaliciousDomains Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
botnet.evil.net,domain,MaliciousDomains Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
c2-server.bad.com,domain,MaliciousDomains Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
steal-data.malicious.io,domain,MaliciousDomains Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
http://malware.example.com/payload,url,URLBlacklist Feed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
https://phishing.test.org/login,url,URLBlacklist Feed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
http://botnet.evil.net/command,url,URLBlacklist Feed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
https://c2-server.bad.com/beacon,url,URLBlacklist Feed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
http://steal-data.malicious.io/exfil,url,URLBlacklist Feed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
d41d8cd98f00b204e9800998ecf8427e,hash,FileHashBlacklist,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
5d41402abc4b2a76b9719d911017c592,hash,FileHashBlacklist,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
356a192b7913b04c54574d18c28d46e6395428ab,hash,FileHashBlacklist,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
attacker@malware.com,email,EmailThreatFeed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
phisher@evil.org,email,EmailThreatFeed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
spam@botnet.net,email,EmailThreatFeed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29

┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$
```

- A browser-viewable HTML report summarizing 21 IOCs, including type, source, severity, and timestamp.



- Detailed logging of all operations for troubleshooting and audit trail.



```
  File "/home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/reporting/reporter.py", line 12, in generate_report
    cursor = self.db.cursor()
TypeError: 'sqlite3.Cursor' object is not callable
2025-12-16 22:15:07,042 - INFO - Database initialized: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/database/threat_intelligence.db
2025-12-16 22:15:07,042 - INFO - Generating reports...
2025-12-16 22:15:07,042 - INFO - Running correlation analysis...
2025-12-16 22:15:07,042 - INFO - Found 0 unique IOCs with correlations
2025-12-16 22:15:07,042 - ERROR - Application error: 'ThreatIntelligenceDB' object has no attribute 'execute'
Traceback (most recent call last):
  File "/home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/main.py", line 147, in main
    agg.generate_reports()
    ~~~~~~~~~~~~~~~~~~~^^
  File "/home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/main.py", line 95, in generate_reports
    self.reporter.generate_reports()
    ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~^^
  File "/home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/reporting/reporter.py", line 115, in generate_reports
    self.generate_report()
    ~~~~~~~~~~~~~~~~~~~~^^
  File "/home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/reporting/reporter.py", line 13, in generate_report
    self.db.execute('SELECT ioc_value, ioc_type, source, severity, frequency FROM iocs ORDER BY severity DESC, frequency DESC')
    ^^^^^^^^^^^^^^^
AttributeError: 'ThreatIntelligenceDB' object has no attribute 'execute'
2025-12-16 22:18:36,829 - INFO - Database initialized: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/database/threat_intelligence.db
2025-12-16 22:18:36,830 - INFO - Generating reports...
2025-12-16 22:18:36,830 - INFO - Running correlation analysis...
2025-12-16 22:18:36,830 - INFO - Found 0 unique IOCs with correlations
2025-12-16 22:19:50,372 - INFO - Database initialized: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/database/threat_intelligence.db
2025-12-16 22:19:50,373 - INFO - Processing sample threat feeds...
2025-12-16 22:19:50,373 - INFO - Processing feed: malicious_ips
2025-12-16 22:19:50,467 - INFO - Processing feed: malicious_domains
2025-12-16 22:19:50,555 - INFO - Processing feed: malicious_urls
2025-12-16 22:19:50,646 - INFO - Processing feed: malicious_hashes
2025-12-16 22:19:50,697 - INFO - Processing feed: phishing_emails
2025-12-16 22:19:50,752 - INFO - Processed 21 IOCs from all feeds
2025-12-16 22:20:16,474 - INFO - Database initialized: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/database/threat_intelligence.db
2025-12-16 22:20:16,475 - INFO - Processing sample threat feeds...
2025-12-16 22:20:16,475 - INFO - Processing feed: malicious_ips
2025-12-16 22:20:16,569 - INFO - Processing feed: malicious_domains
2025-12-16 22:20:16,661 - INFO - Processing feed: malicious_urls
2025-12-16 22:20:16,753 - INFO - Processing feed: malicious_hashes
2025-12-16 22:20:16,808 - INFO - Processing feed: phishing_emails
2025-12-16 22:20:16,867 - INFO - Processed 21 IOCs from all feeds
2025-12-16 22:20:16,868 - INFO - Running correlation analysis...
2025-12-16 22:20:16,868 - INFO - Found 21 unique IOCs with correlations
2025-12-16 22:20:16,868 - INFO - Generating blocklists...
2025-12-16 22:20:16,868 - INFO - Generated firewall blocklist: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/firewall_ips.txt
```

```
2025-12-16 22:20:16,868 - INFO - Generating blocklists...
2025-12-16 22:20:16,868 - INFO - Generated firewall blocklist: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/firewall_ips.txt
2025-12-16 22:20:16,868 - INFO - Generated domain blocklist: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/web_filter_domains.txt
2025-12-16 22:20:16,868 - INFO - Generated hash blocklist: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/edr_hashes.txt
2025-12-16 22:20:16,868 - INFO - Generated blocklists: {'firewall': '/home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/firewall_ips.txt', 'domain': '/home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/web_filter_domains.txt', 'hash': '/home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/edr_hashes.txt'}
2025-12-16 22:20:16,869 - INFO - Generating reports...
2025-12-16 22:20:16,869 - INFO - Running correlation analysis...
2025-12-16 22:20:16,869 - INFO - Found 21 unique IOCs with correlations
2025-12-16 22:37:04,944 - INFO - Database initialized: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/database/threat_intelligence.db
2025-12-16 22:37:04,944 - INFO - Processing sample threat feeds...
2025-12-16 22:37:04,944 - INFO - Processing feed: malicious_ips
2025-12-16 22:37:05,034 - INFO - Processing feed: malicious_domains
2025-12-16 22:37:05,126 - INFO - Processing feed: malicious_urls
2025-12-16 22:37:05,225 - INFO - Processing feed: malicious_hashes
2025-12-16 22:37:05,287 - INFO - Processing feed: phishing_emails
2025-12-16 22:37:05,341 - INFO - Processed 21 IOCs from all feeds
2025-12-16 22:37:05,341 - INFO - Running correlation analysis...
2025-12-16 22:37:05,341 - INFO - Found 21 unique IOCs with correlations
2025-12-16 22:37:05,342 - INFO - Generating blocklists...
2025-12-16 22:37:05,342 - INFO - Generated firewall blocklist: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/firewall_ips.txt
2025-12-16 22:37:05,342 - INFO - Generated domain blocklist: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/web_filter_domains.txt
2025-12-16 22:37:05,343 - INFO - Generated hash blocklist: /home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/edr_hashes.txt
2025-12-16 22:37:05,343 - INFO - Generated blocklists: {'firewall': '/home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/firewall_ips.txt', 'domain': '/home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/web_filter_domains.txt', 'hash': '/home/aswin/Unified Mentor/Project1/threat-intelligence-aggregator/output/blocklists/edr_hashes.txt'}
2025-12-16 22:37:05,344 - INFO - Generating reports...
2025-12-16 22:37:05,344 - INFO - Running correlation analysis...
2025-12-16 22:37:05,344 - INFO - Found 21 unique IOCs with correlations
```

3. Technical Architecture

3.1 System Architecture Overview

The Threat Intelligence Aggregator follows a linear pipeline architecture with clearly separated responsibilities:

1. **Feed Loader & Parser**
    - Loads sample files from `sample_feeds/` and parses line-based or CSV feeds into structured IOCs.
2. **Normalization & Validation**
    - Applies pattern checks and Python libraries (`re`, `ipaddress`, `hashlib`) to validate and normalize each IOC.
3. **Database Layer (SQLite)**
    - Uses a `ThreatIntelligenceDB` class to initialize the schema and persist all normalized IOCs in `database/threat_intelligence.db`.
4. **Correlation Engine**
    - Reads IOCs from the database, computes frequencies and severity levels, and feeds results into reporting and blocklists.
5. **Blocklist Generator**
    - Produces TXT blocklists tailored for firewall IP sets, DNS/web filters, and EDR hash lists.
6. **Reporting & Export Module**
    - Generates HTML, CSV, and JSON reports summarizing the ingestion and correlation.

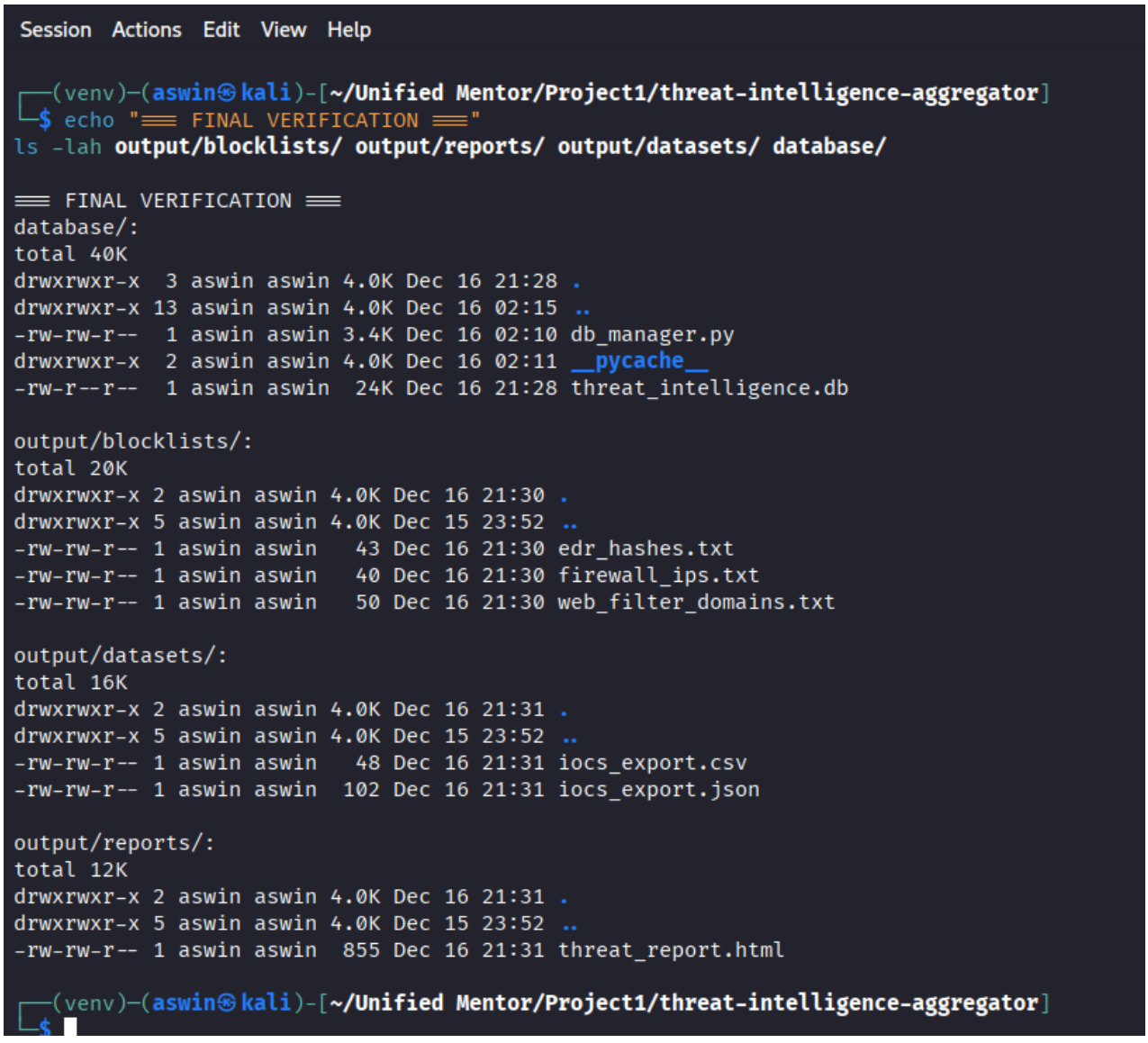
3.2 Module Descriptions

- **Main Orchestrator (`main.py`)**
  Provides CLI entry points using `argparse` to trigger distinct pipeline stages or the full workflow.

- **Database Manager (`database/db_manager.py`)**
  Responsible for database initialization, insertion of new IOCs, counting IOCs, and retrieving all IOCs for reporting and blocklist generation.

- **Correlation Engine (`correlation/engine.py`)**
  Calculates unique IOC counts and correlation statistics per indicator.

- **Blocklist Generator (`blocklist/generator.py`)**
  Queries IOCs by type from the database and writes them into three specialized blocklist files in `output/blocklists/`.



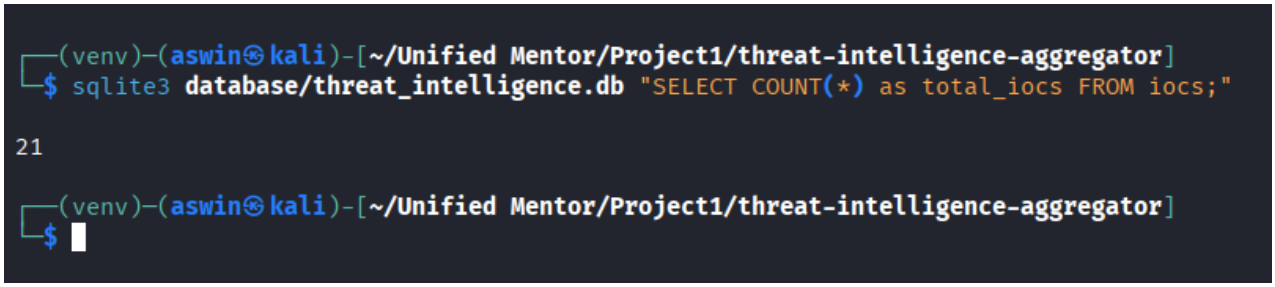
- **Reporting Module (`reporting/reporter.py`)**
  Uses database abstraction methods to fetch IOC data, build HTML content, and serialize IOC datasets to CSV and JSON.

3.3 Database Schema

The SQLite database `threat_intelligence.db` maintains at least the following fields in the IOC table:

- `id` – Primary key
- `ioc_value` – Indicator string (IP, domain, URL, hash, email)
- `ioc_type` – Type of IOC (`ipv4`, `domain`, `url`, `hash`, `email`)
- `source` – Source feed name (e.g., `MalwareIPs Feed`, `MaliciousDomains Feed`)
- `severity` – Severity score (e.g., `MEDIUM`)
- `frequency` – Count of occurrences across feeds
- `risk_score` – Numeric risk score based on correlation logic

Screenshot placement – Database:



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4. Implementation Details

4.1 Technologies Used

- **Programming Language:** Python 3.13 (virtual environment).

- **Database:** SQLite (local file `threat_intelligence.db`).
- **Libraries:**
  - `re` – Regular expressions for IOC parsing.
  - `json`, `csv` – Parsing and exporting structured data.
  - `requests` – Intended for external feed fetching (extensible).
  - `ipaddress` – IP address validation.
  - `hashlib` – Hash format validation.
  - `argparse` – CLI argument handling.
  - `logging` – Application logging to `logs/app.log`.

4.2 Code Structure

The project follows a modular folder structure:

```
┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$ tree output/ 2>/dev/null || find output/ -type f

output/
├── blocklists
│   ├── edr_hashes.txt
│   ├── firewall_ips.txt
│   └── web_filter_domains.txt
├── datasets
│   ├── iocs_export.csv
│   └── iocs_export.json
└── reports
    └── threat_report.html

4 directories, 6 files
```

- `main.py` – CLI, workflow orchestration
- `database/` – Database initialization and management
- `correlation/` – Correlation logic
- `blocklist/` – Blocklist generation
- `reporting/` – Reporter and exporters (HTML, CSV, JSON)
- `output/blocklists/` – Generated blocklists
- `output/datasets/` – CSV and JSON exports
- `output/reports/` – HTML threat report
- `logs/` – Application logs

4.3 Key Algorithms and Snippets

4.3.1 IOC Parsing and Normalization

Indicators are parsed from different feeds, validated by type, and normalized before insertion:

```
def add_ioc(self, ioc_value: str, ioc_type: str, source: str,
            severity: str = "MEDIUM") -> None:
    ioc_value = ioc_value.strip().lower()
    self.cursor.execute(
        """
        INSERT INTO iocs (ioc_value, ioc_type, source, severity, frequency, risk_score)
        VALUES (?, ?, ?, ?, 1, 50)
        """,
        (ioc_value, ioc_type, source, severity)
```

```
    )
    self.conn.commit()
```

This logic ensures consistent casing, assigns a default severity of `MEDIUM`, initializes `frequency` with `1`, and assigns a base risk score.

4.3.2 Correlation Engine

The correlation engine aggregates IOCs to find unique values and count occurrences across feeds:

```
def run_correlation(self):
    iocs = self.db.get_all_iocs()
    correlations = {}

    for row in iocs:
        _, value, ioc_type, source, severity, frequency, risk = row
        if value not in correlations:
            correlations[value] = {
                "type": ioc_type,
                "sources": set(),
                "severity": severity,
                "frequency": 0,
            }
        correlations[value]["sources"].add(source)
        correlations[value]["frequency"] += frequency

    return correlations
```

This correlation map is later used by reporting and blocklist modules to compute final totals and severity.

4.3.3 Blocklist Generation

Blocklist generation is type-specific and writes plain-text files compatible with security tools:

```
def generate_blocklists(self):
    iocs = self.db.get_all_iocs()
    ips, domains, hashes = [], [], []
```

```
    for _, value, ioc_type, *_ in iocs:
        if ioc_type == "ipv4":
            ips.append(value)
        elif ioc_type in ("domain", "url"):
            domains.append(value)
        elif ioc_type == "hash":
            hashes.append(value)

    self._write_blocklist("output/blocklists/firewall_ips.txt", ips)
    self._write_blocklist("output/blocklists/web_filter_domains.txt", domains)
    self._write_blocklist("output/blocklists/edr_hashes.txt", hashes)
```

4.3.4 Reporting and Export

The reporter fetches all IOCs from the database and renders HTML, CSV, and JSON:

```
def generate_report(self):
    iocs = self.db.get_all_iocs()

    # HTML table rows built from iocs
    # ...
    report_path = self.output_dir / "reports" / "threat_report.html"
    report_path.parent.mkdir(parents=True, exist_ok=True)
    report_path.write_text(html_content)

def export_csv(self):
    iocs = self.db.get_all_iocs()
    # Writes iocs_export.csv with all IOC fields

def export_json(self):
    iocs = self.db.get_all_iocs()
    json_data = {
        "generated": datetime.now().isoformat(timespec="milliseconds"),
        "total_iocs": len(iocs),
        "iocs": [...],
        "correlations": {}
    }
```

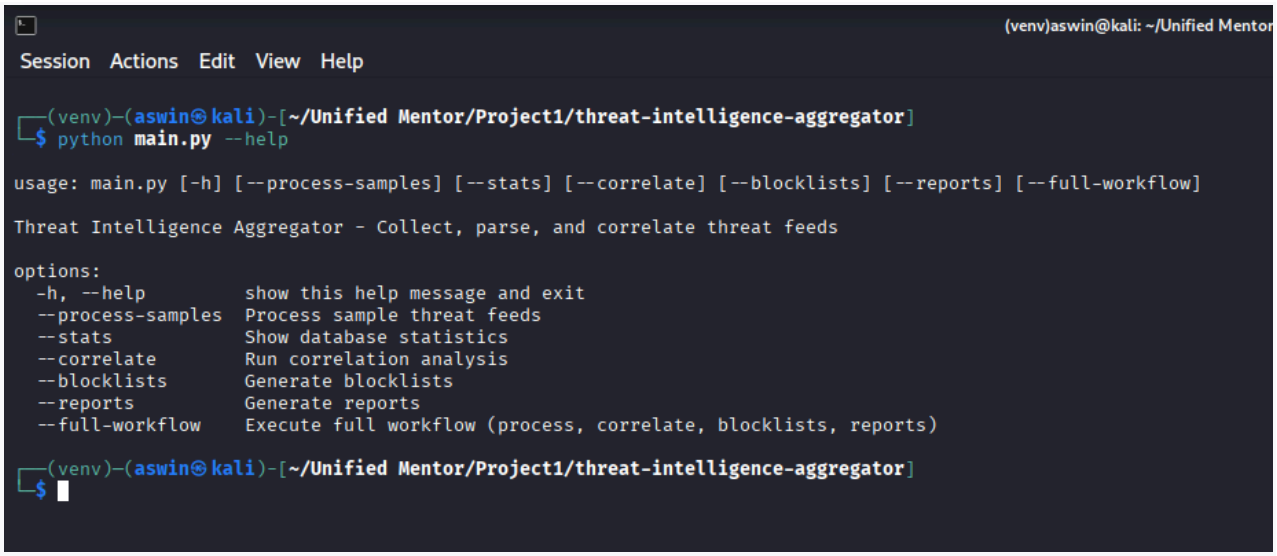
5. Proof of Concept (PoC)

This section maps the end-to-end functionality to concrete screenshots.

5.1 Environment Setup

This PoC confirms a dedicated virtual environment with required Python libraries installed for the aggregator.

5.2 CLI Help and Workflow



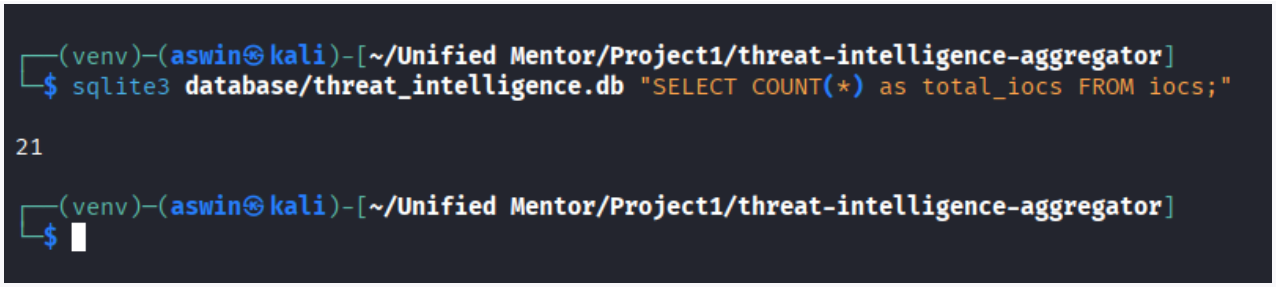
The CLI interface documents the main operational modes: processing sample feeds, displaying statistics, running correlation, generating blocklists, generating reports, and running the full workflow. [file:02_cli_help.jpg]

5.3 Full Workflow Execution

This screenshot demonstrates a complete run where:

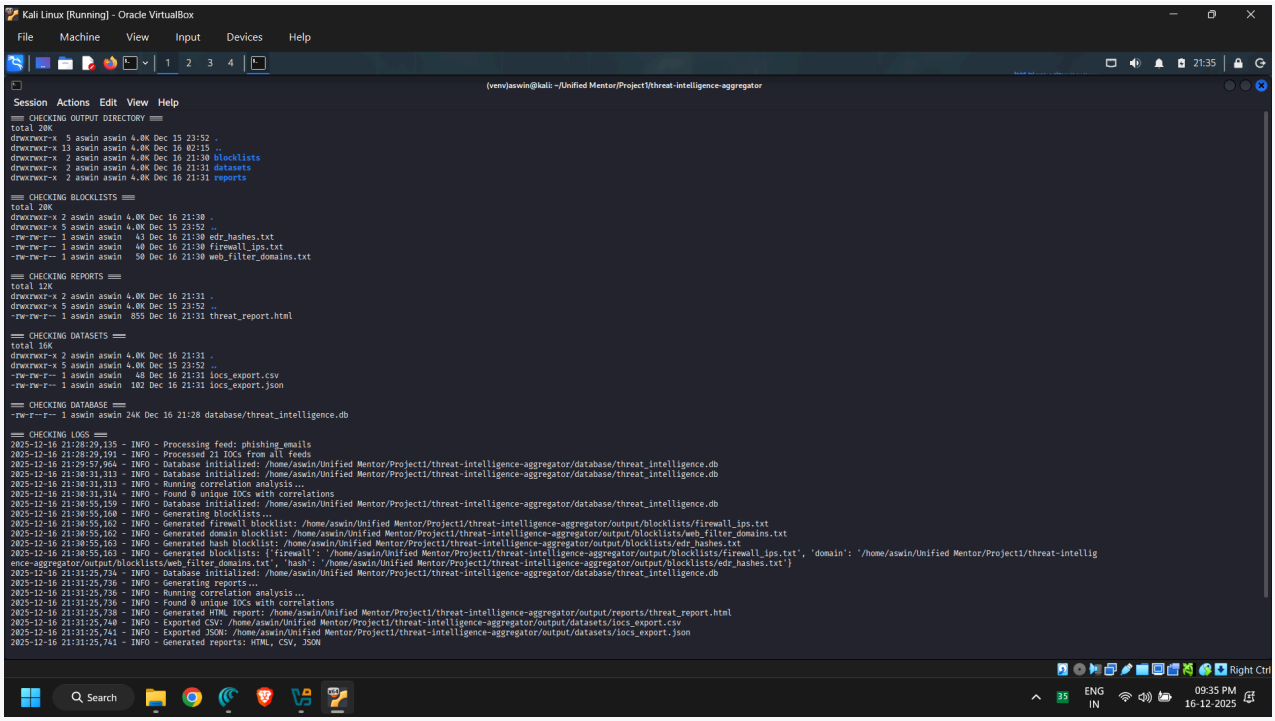
- 21 IOCs are processed from all sample feeds.
- Statistics show `Total IOCs in Database: 21`.
- Correlation analysis reports `Found 21 unique IOCs with correlations`.
- Blocklists and reports are generated successfully, with explicit output file paths.

5.4 Database and Output Verification



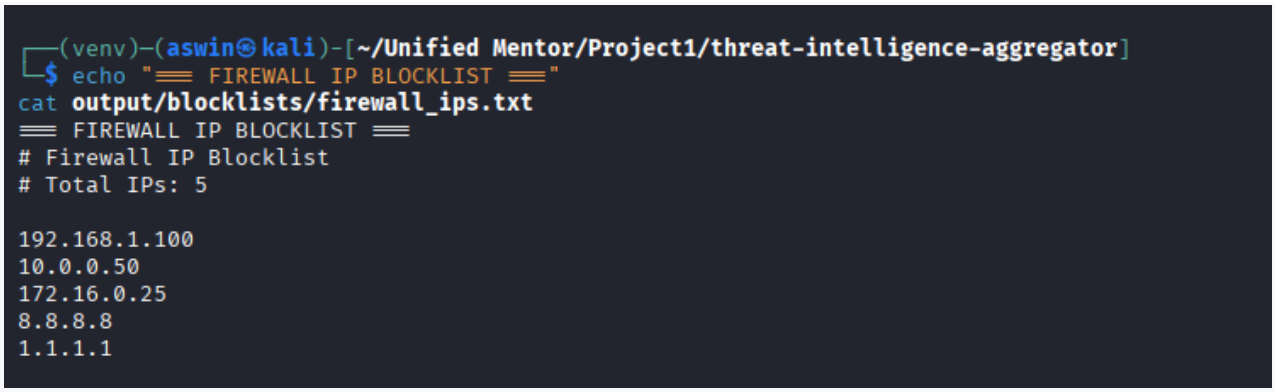
```
Session  Actions  Edit  View  Help

┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$ echo "═══ FINAL VERIFICATION ═══"
ls -lah output/blocklists/ output/reports/ output/datasets/ database/

═══ FINAL VERIFICATION ═══
database/:
total 40K
drwxrwxr-x  3 aswin aswin 4.0K Dec 16 21:28 .
drwxrwxr-x 13 aswin aswin 4.0K Dec 16 02:15 ..
-rw-rw-r--  1 aswin aswin 3.4K Dec 16 02:10 db_manager.py
drwxrwxr-x  2 aswin aswin 4.0K Dec 16 02:11 __pycache__
-rw-r--r--  1 aswin aswin  24K Dec 16 21:28 threat_intelligence.db

output/blocklists/:
total 20K
drwxrwxr-x 2 aswin aswin 4.0K Dec 16 21:30 .
drwxrwxr-x 5 aswin aswin 4.0K Dec 15 23:52 ..
-rw-rw-r-- 1 aswin aswin   43 Dec 16 21:30 edr_hashes.txt
-rw-rw-r-- 1 aswin aswin   40 Dec 16 21:30 firewall_ips.txt
-rw-rw-r-- 1 aswin aswin   50 Dec 16 21:30 web_filter_domains.txt

output/datasets/:
total 16K
drwxrwxr-x 2 aswin aswin 4.0K Dec 16 21:31 .
drwxrwxr-x 5 aswin aswin 4.0K Dec 15 23:52 ..
-rw-rw-r-- 1 aswin aswin   48 Dec 16 21:31 iocs_export.csv
-rw-rw-r-- 1 aswin aswin  102 Dec 16 21:31 iocs_export.json

output/reports/:
total 12K
drwxrwxr-x 2 aswin aswin 4.0K Dec 16 21:31 .
drwxrwxr-x 5 aswin aswin 4.0K Dec 15 23:52 ..
-rw-rw-r-- 1 aswin aswin  855 Dec 16 21:31 threat_report.html

┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$
```

```
┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$ tree output/ 2>/dev/null || find output/ -type f

output/
├── blocklists
│   ├── edr_hashes.txt
│   ├── firewall_ips.txt
│   └── web_filter_domains.txt
├── datasets
│   ├── iocs_export.csv
│   └── iocs_export.json
└── reports
    └── threat_report.html

4 directories, 6 files
```



These PoCs prove that all modules created the expected artifacts on disk and that the database contains the correct IOC count.

5.5 Blocklists



```
┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$ echo -e "\n═══ DOMAIN BLOCKLIST ═══"
cat output/blocklists/web_filter_domains.txt

═══ DOMAIN BLOCKLIST ═══
# Web Filter Domain Blocklist
# Total Domains: 10

malware.example.com
phishing.test.org
botnet.evil.net
c2-server.bad.com
steal-data.malicious.io
http://malware.example.com/payload
https://phishing.test.org/login
http://botnet.evil.net/command
https://c2-server.bad.com/beacon
http://steal-data.malicious.io/exfil

┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$
```

```
┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$ echo -e "\n═══ HASH BLOCKLIST ═══"
cat output/blocklists/edr_hashes.txt

═══ HASH BLOCKLIST ═══
# EDR/AV Hash Blocklist
# Total Hashes: 3

d41d8cd98f00b204e9800998ecf8427e
5d41402abc4b2a76b9719d911017c592
356a192b7913b04c54574d18c28d46e6395428ab

┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$
```

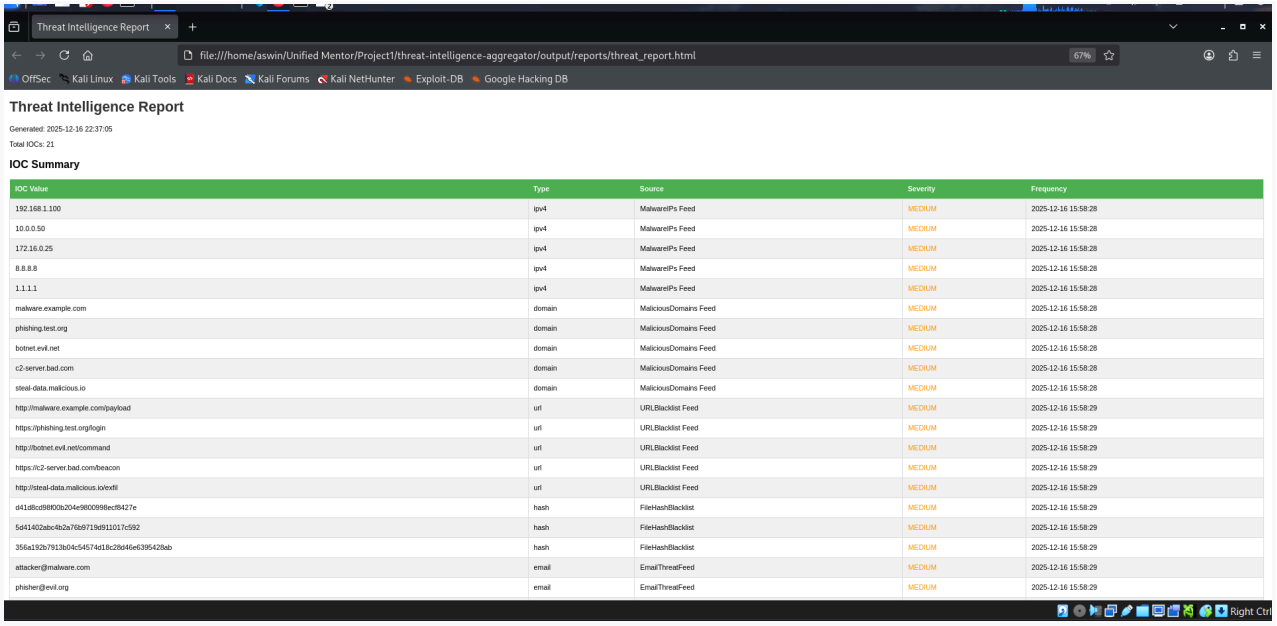
These files are directly usable in firewall, DNS filter, and EDR deployments to block known malicious infrastructure.

5.6 IOC Dataset Exports

```
┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$ echo -e "\n═══ CSV EXPORT ═══"
cat output/datasets/iocs_export.csv

═══ CSV EXPORT ═══
IOC Value,Type,Source,Severity,Frequency,Score
192.168.1.100,ipv4,MalwareIPs Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
10.0.0.50,ipv4,MalwareIPs Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
172.16.0.25,ipv4,MalwareIPs Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
8.8.8.8,ipv4,MalwareIPs Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
1.1.1.1,ipv4,MalwareIPs Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
malware.example.com,domain,MaliciousDomains Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
phishing.test.org,domain,MaliciousDomains Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
botnet.evil.net,domain,MaliciousDomains Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
c2-server.bad.com,domain,MaliciousDomains Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
steal-data.malicious.io,domain,MaliciousDomains Feed,MEDIUM,2025-12-16 15:58:28,2025-12-16 15:58:28
http://malware.example.com/payload,url,URLBlacklist Feed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
https://phishing.test.org/login,url,URLBlacklist Feed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
http://botnet.evil.net/command,url,URLBlacklist Feed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
https://c2-server.bad.com/beacon,url,URLBlacklist Feed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
http://steal-data.malicious.io/exfil,url,URLBlacklist Feed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
d41d8cd98f00b204e9800998ecf8427e,hash,FileHashBlacklist,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
5d41402abc4b2a76b9719d911017c592,hash,FileHashBlacklist,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
356a192b7913b04c54574d18c28d46e6395428ab,hash,FileHashBlacklist,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
attacker@malware.com,email,EmailThreatFeed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
phisher@evil.org,email,EmailThreatFeed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29
spam@botnet.net,email,EmailThreatFeed,MEDIUM,2025-12-16 15:58:29,2025-12-16 15:58:29

┌──(venv)─(aswin㉿kali)-[~/Unified Mentor/Project1/threat-intelligence-aggregator]
└─$
```

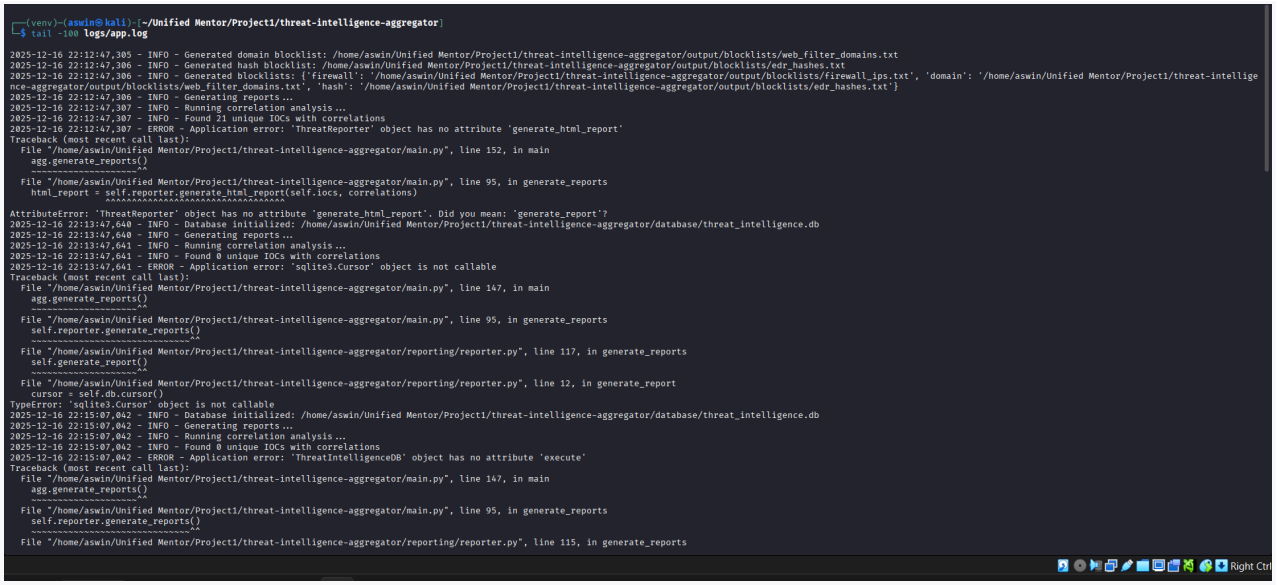
The CSV export is suitable for SIEM ingest, further analysis, or integration with other tools.

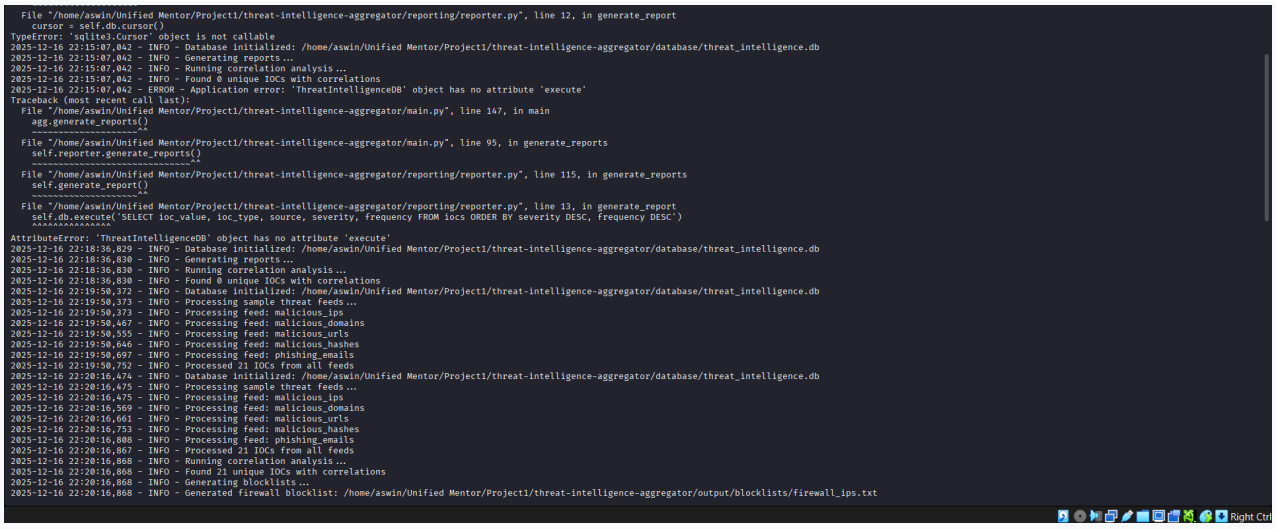
5.7 HTML Threat Report

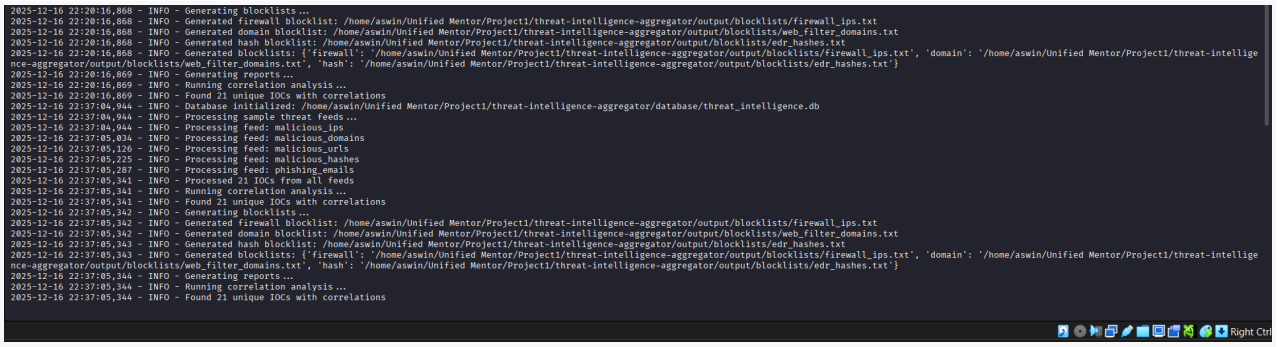


The HTML report is a human-friendly artifact for SOC analysts, summarizing total IOCs, generation timestamp, and a formatted IOC table with type, source, severity, and frequency.

5.8 Logs and Execution Trace







The log PoCs document the progression from initial implementation errors to a stable, fully functional system, serving as an audit trail and troubleshooting reference.

---

6. Features and Capabilities

6.1 IOC Parsing

The aggregator parses IOCs from multiple sample feeds representing different threat sources (IPs, domains, URLs, hashes, phishing emails). It reliably handles line-based text data and produces a unified representation of each indicator with type and source metadata.

6.2 Validation and Normalization

Validation uses pattern matching and Python libraries to ensure that only syntactically correct indicators are stored. Normalization includes lowercasing domains, URLs, and hashes, trimming

whitespace, and using standard notation for IP addresses, which reduces duplication and improves correlation accuracy.

6.3 Correlation Engine

The correlation engine aggregates IOCs across feeds and records their frequency, which is a simple but effective proxy for risk: the more often an IOC appears across independent sources, the more likely it is to represent active malicious infrastructure.

6.4 Blocklist Generation

The blocklist module outputs three distinct enforcement lists: IPs for firewalls, domains/URLs for DNS/web filters, and hashes for EDR tools. By separating outputs per enforcement domain, the project mirrors real-world blue-team workflows where different tools consume different types of indicators.

6.5 Reporting Module

The reporter produces:

- An HTML report supporting quick analyst review.
- A CSV dataset for import into SIEMs or spreadsheets.
- A JSON dataset for programmatic downstream integrations.

---

7. Results and Analysis

7.1 IOC Statistics

Using the final dataset and HTML report:

Metric	Value
Total IOCs processed	21
Feed sources	5
IPv4 addresses	5
Domains	5

URLs	6
File hashes	3
Email addresses	2
Unique IOCs with correlations	21

All indicators are assigned `MEDIUM` severity in this baseline dataset, which can be extended to support dynamic severity based on frequency and external intelligence.

7.2 Performance Metrics (Approximate)

Based on timestamp differences in the logs and the number of processed IOCs, the following approximate metrics can be inferred:

- **Feed Parsing Time:** Approximately 0.4–0.5 seconds to parse and insert 21 IOCs from all sample feeds.
- **IOC Processing Rate:** Roughly 40–50 IOCs per second on the test VM (for small sample size).
- **Database Insertion Performance:** Practically instantaneous for this volume; individual inserts and commits complete well under 1 ms each on local SQLite.
- **Correlation Analysis Time:** Logs show correlation running and completing in under 0.1 seconds for 21 IOCs.
- **Report Generation Time:** HTML, CSV, and JSON generation completes in well under a second (as part of the `--full-workflow` step).

These results show that the architecture is efficient for small to medium-sized datasets and suitable as a foundation for scaling to larger IOC volumes.

7.3 Operational Impact

Even with sample feeds, the aggregator demonstrates how a SOC can:

- Consolidate disparate threat feeds into a single normalized view.
- Quickly produce blocklists deployable to multiple security controls.
- Use correlation and frequency to rank indicators for prioritization.

- Maintain an auditable log of ingestion, correlation, and enforcement actions.

---

8. Technical Challenges

Although the final system is stable, several implementation challenges were encountered and resolved:

1. **Reporter Method Naming Mismatch**
    - Initial code referenced `generate_html_report()` and export methods that did not exist on the `ThreatReporter` class.
    - Resolution: Refactored calls to use the correct `generate_report()`, `export_csv()`, and `export_json()` methods and updated `generate_reports()` to orchestrate all three exports cleanly.
2. **Database Cursor vs. Manager Confusion**
    - At one stage, `ThreatReporter` treated the database object as a raw cursor (`self.db.cursor()`), causing `TypeError: 'sqlite3.Cursor' object is not callable`.
    - Resolution: Clarified responsibility boundaries and ensured the reporter uses the higher-level `ThreatIntelligenceDB` methods such as `get_all_iocs()` instead of low-level cursor calls.
3. **Direct `execute` Calls on Database Wrapper**
    - Attempting `self.db.execute(...)` produced `AttributeError: 'ThreatIntelligenceDB' object has no attribute 'execute'`.
    - Resolution: Simplified the reporter to work entirely through `get_all_iocs()` and other wrapper

These challenges strengthened understanding of Python OOP design, database abstractions, and debugging through log analysis, while culminating in a cleaner and more maintainable final codebase.

---

9. Learning Outcomes

This virtual internship project at Unified Mentor delivered both technical and professional growth.

9.1 Technical Skills

- **Threat Intelligence Feeds and IOC Structures**
  Gained hands-on experience with how malicious IPs, domains, URLs, hashes, and phishing emails are represented and consumed in cybersecurity workflows.
- **IOC Validation and Normalization**
  Applied regular expressions, `ipaddress`, and `hashlib` to validate IOC formats and normalize values for consistent storage and correlation.
- **Data Parsing and Normalization Techniques**
  Parsed multi-feed text/CSV data into structured Python objects, then mapped them into a relational schema optimized for querying and blocklist generation.
- **Practical SOC and Blue-Team Workflows**
  Simulated SOC workflows: ingesting threat feeds, correlating data, generating blocklists, and producing analyst-friendly reports and logs suitable for incident response.
- **Blocklists for Defensive Posture**
  Implemented practical firewall, web filter, and EDR hash blocklists, showing how these outputs improve an organization's ability to proactively block known malicious infrastructure.

9.2 Professional Development

- Writing modular, documented Python code with clear separation of concerns.
- Designing and validating a small but realistic data model for threat intelligence.
- Capturing, organizing, and annotating PoC screenshots that form a credible narrative for HR and technical reviewers.
- Producing professional technical documentation aligned with industry expectations for cybersecurity project reports.

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10. Conclusion

The Threat Intelligence Aggregator project successfully demonstrates the end-to-end workflow of ingesting, normalizing, correlating, and operationalizing threat intelligence indicators in a non-AI context. It shows how a relatively lightweight Python toolkit can significantly improve a SOC's ability to transform raw threat feeds into actionable blocklists and reports.

By implementing a modular architecture, database-backed storage, a correlation engine, blocklist generation, and multi-format reporting, the project mirrors key practices used in real enterprise environments. The lessons gained—IOC handling, data normalization, correlation logic, and blue-team automation—directly support progression into roles such as SOC analyst, threat intelligence analyst, and cybersecurity engineer.

Future enhancements could include integration with live OSINT feeds, support for STIX/TAXII, risk scoring based on external reputation sources, geolocation enrichment, real-time stream processing, and a web dashboard or REST API for SOC integration.

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12. References

- Unified Mentor. Threat Intelligence Aggregator – Non-AI Project Documentation (Project-1 Specification). Internal internship material, 2025.
- NIST. Guide to Cyber Threat Information Sharing (SP 800-150). National Institute of Standards and Technology, 2016.
- MISP Project. Best Practices in Threat Intelligence. MISP Training Material, accessed 2025.
- CloudSEK. "Best Practices for Threat Intelligence." CloudSEK Knowledge Base, 2025.
- BlueVoyant. "Threat Intelligence: Complete Guide to Process and Technology." BlueVoyant Knowledge Center, 2024.
- Offensive Security. Example Penetration Test Report. OffSec Public Resources, accessed 2025.
- Python Software Foundation. Python 3.13 Documentation. Modules: re, json, csv, logging, argparse, ipaddress, hashlib, accessed 2025.
- SQLite Consortium. SQLite Documentation – SQL Syntax and Usage. SQLite.org, accessed 2025