🔐 PROJECT REPORT 🔐

Post-Breach Black Box Logger — Encrypted, Tamper-Evident Keylogger

🔹 Introduction

Today's organizations face sophisticated cyberthreats and insider attacks that often destroy or manipulate logs to conceal their traces.
Effective incident response depends on having a reliable and tamper-evident view into what exactly occurred on a compromised host.

The **Post-Breach Black Box Logger** was designed to aid cybersecurity analysts by:

✅ **Capturing keystrokes alongside process and directory context**
✅ **Encrypting all captured data to maintain confidentiality**
✅ **Applying HMAC-SHA256 to guarantee tamper-evident storage**

This lightweight tool lets incident responders piece together a timeline of attacker activity, without needing elevated privilege or kernel components.

🔹 **Abstract**

This keylogger is a lightweight, forensic-grade tool tailored for incident response and post-breach investigations.
 It performs:

➥ **AES-256-GCM Encryption:** To keep captured keystrokes and context confidential.
 ➥ **HMAC-SHA256:** To assure tamper-evident storage of messages.
 ➥ **Context Capture:** To provide additional information (like process and directory) alongside keystrokes.

The encrypted messages, base64-encoded and serialized in JSON, are convenient for storage, parsing, and eventual decryption by analysts.

🔹 Tools Used

✅ **Python 3.x** — Main scripting and implementation
 ✅ **pynput (Python)** — To capture keystrokes
 ✅ **pywin32, psutil** — To extract process and directory context
 ✅ **Cryptography (AES-GCM, HMAC)** — To encrypt messages and validate integrity
 ✅ **os, json, base64** — To handle file operations and encoding
 ✅ **Environment Variables or Windows Credential Vault** — To safely store the encryption key

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🔹 Key Features

➥ **AES-256-GCM Encryption:**
 Encrypts each keystroke with a unique 96-bit nonce.

➥ ** HMAC-SHA256 Tamper Detection:**
 Ensuring messages have not been altered in storage.

➥ **Process and Window Title Capture:**

Provides context alongside keystrokes — useful for attack reconstruction.

➥ **Environment-Safe:**

Runs under **current-user privilege**, avoiding suspicion and administrative intervention.

➥ **Base64 Encoded Logs:**

For convenient storage, parsing, and eventual decryption by analysts.

➥ **Controlled Duration:**

Easily exits with a predefined key (such as ESC).

🔹 Implementation Summary (Workflow)

➥ **Initiate:**

Logger starts and attaches to the keyboard stream.

➥ **Capture:**

For each keystroke, it:

- Records the key pressed
- Captures the active window title
- Logs the associated process path

➥ **Encrypt:**

Encrypts the data with AES-256-GCM alongside a unique 96-bit nonce.

➥ **HMAC:**

Generates a HMAC-SHA256 to guarantee tamper-evident storage.

➥ Serialize:

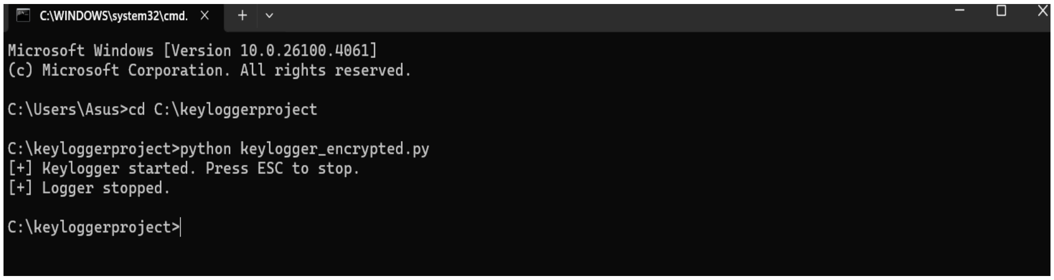
Packages the encrypted blob, HMAC, and context into base64-encoded JSON.

➥ Store:

Writes safely to a local file.

🔹 Photos and Screenshots

✅ **Screenshot 1:** Logger in action (CMD window)



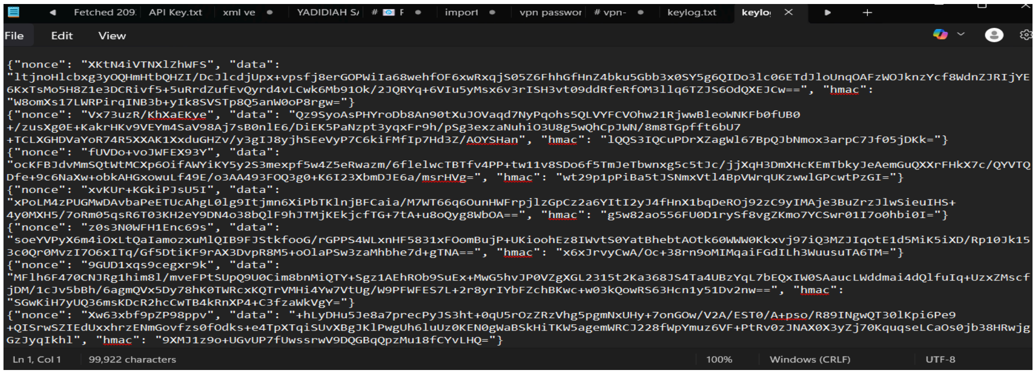
```
Microsoft Windows [Version 10.0.26100.4061]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Asus>cd C:\keyloggerproject

C:\keyloggerproject>python keylogger_encrypted.py
[+] Keylogger started. Press ESC to stop.
[+] Logger stopped.

C:\keyloggerproject>
```

✅ **Screenshot 2:** Encrypted base64-encoded messages in a text file



```
{"nonce": "XKtN4iVTNXlZhWFS", "data":
"ltjnoHlcbxg3yOQHmHtbQHZI/DcJlcdjUpx+vpsfj8erGOPWiIa68wehfOF6xwRxqjS05Z6FhhGfHnZ4bku5Gbb3x0SY5g6QIDo3lc06ETdJloUnqOAFzWOJknzYcf8WdnZJRIjYE
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4y0MXH5/7oRm05qsR6T03KH2eY9DN4o38bQlF9hJTMjKEkjcfTG+7tA+u8oQyg8WbOA==", "hmac": "g5w82ao556FU0D1rySf8vgZKmo7YCSwr01I7o0hbi0I="}
{"nonce": "z0s3N0WFH1Enc69s", "data":
"soeYVPyX6m4iOxLtQaIamozxuMlQIB9FJStkfooG/rGPPS4WLxnHF5831xFOomBujP+UKioohEz8IWvtS0YatBhebtAOtk60WWW0Kkxvj97iQ3MZJIqotE1d5MiK5iXD/Rp10Jk15
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GzJyqIkhl", "hmac": "9XMJ1z9o+UGvUP7fUwssrwV9DQGBqQpzMu18fCYvLHQ="}
```
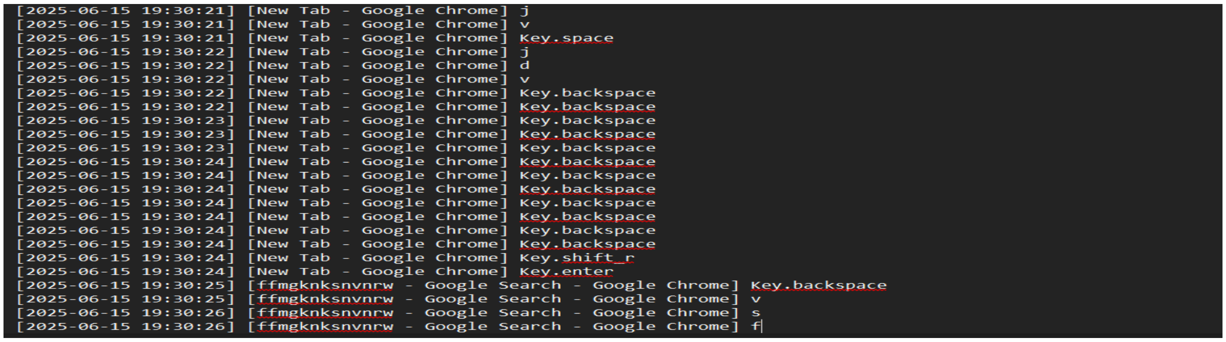
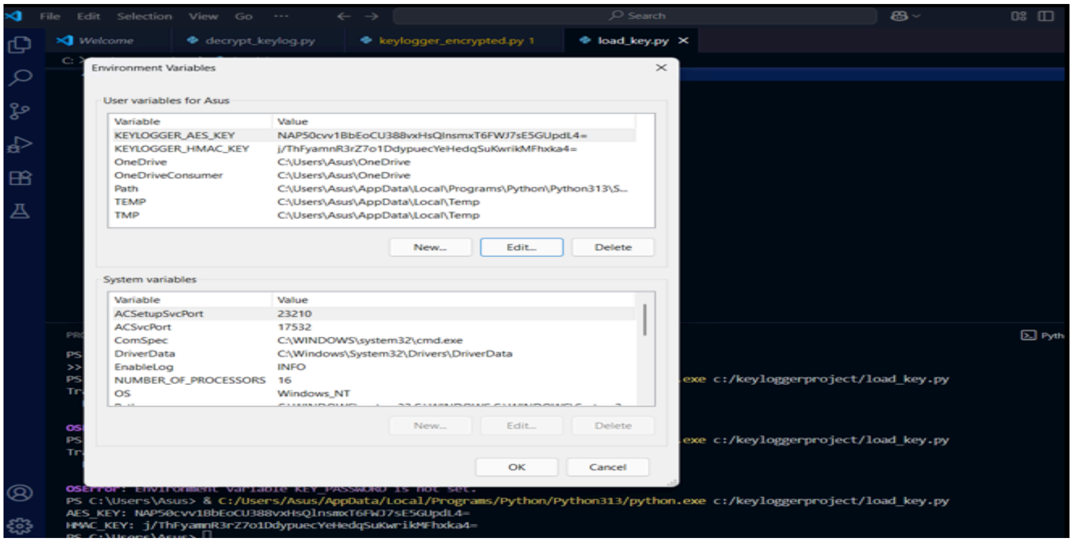

✅ **Screenshot 3:**Decrypted log showing keystrokes and context



```
[2025-06-15 19:30:21] [New Tab - Google Chrome] j
[2025-06-15 19:30:21] [New Tab - Google Chrome] v
[2025-06-15 19:30:21] [New Tab - Google Chrome] Key.space
[2025-06-15 19:30:22] [New Tab - Google Chrome] j
[2025-06-15 19:30:22] [New Tab - Google Chrome] d
[2025-06-15 19:30:22] [New Tab - Google Chrome] v
[2025-06-15 19:30:22] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:22] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:23] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:23] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:23] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:24] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:24] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:24] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:24] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:24] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:24] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:24] [New Tab - Google Chrome] Key.backspace
[2025-06-15 19:30:24] [New Tab - Google Chrome] Key.shift_r
[2025-06-15 19:30:24] [New Tab - Google Chrome] Key.enter
[2025-06-15 19:30:25] [ffmgknksnvnrw - Google Search - Google Chrome] Key.backspace
[2025-06-15 19:30:25] [ffmgknksnvnrw - Google Search - Google Chrome] v
[2025-06-15 19:30:26] [ffmgknksnvnrw - Google Search - Google Chrome] s
[2025-06-15 19:30:26] [ffmgknksnvnrw - Google Search - Google Chrome] f
```

✅ **Screenshot 4:** Secure key storage in environment variables



Environment Variables

User variables for Asus

Variable	Value
KEYLOGGER_AES_KEY	NAP50cvv1BbEoCU388vxHsQlnsmxT6FWJ7sE5GUpdL4=
KEYLOGGER_HMAC_KEY	j/ThFyamnR3rZ7o1DdypuecYeHedqSuKwrikMFhxka4=
OneDrive	C:\Users\Asus\OneDrive
OneDriveConsumer	C:\Users\Asus\OneDrive
Path	C:\Users\Asus\AppData\Local\Programs\Python\Python313\S...
TEMP	C:\Users\Asus\AppData\Local\Temp
TMP	C:\Users\Asus\AppData\Local\Temp

New... Edit... Delete

System variables

Variable	Value
ACSetupSvcPort	23210
ACSvcPort	17532
ComSpec	C:\WINDOWS\system32\cmd.exe
DriverData	C:\Windows\System32\Drivers\DriverData
EnableLog	INFO
NUMBER_OF_PROCESSORS	16
OS	Windows_NT

New... Edit... Delete

OK Cancel

```
PS
>>
PS                                                            .exe c:/keyloggerproject/load_key.py
Tr

OS
PS                                                            .exe c:/keyloggerproject/load_key.py
Tr

OSError: Environment variable KEY_PASSWORD is not set.
PS C:\Users\Asus> & C:/Users/Asus/AppData/Local/Programs/Python/Python313/python.exe c:/keyloggerproject/load_key.py
AES_KEY: NAP50cvv1BbEoCU388vxHsQlnsmxT6FWJ7sE5GUpdL4=
HMAC_KEY: j/ThFyamnR3rZ7o1DdypuecYeHedqSuKwrikMFhxka4=
PS C:\Users\Asus> 
```

🔹 Conclusion

The **Post-Breach Black Box Logger** successfully provides a lightweight, tamper-evident, encrypted logging solution tailored for **post-incident investigations**.

➥ It performs:

✅ **Confidential data collection**

✅ **Context enrichment**

✅ **Integrity validation**

➥ All this while avoiding kernel components or elevated privilege — making it an ideal tool for lightweight incident response.

➥ The implementation highlights proficient use of:
✅ **Cryptography fundamentals (AES-GCM, HMAC)**
✅ **Python scripting and API integration**
✅ **Environment-safe techniques and lightweight persistence**

🔹 Future Improvement Ideas

➥ Integrate GUI for forensics team to view/decrypt messages directly
➥ Provide automatic backup to a remote server
➥ Support additional context (network activity, file accesses)

✅ **Final Notes:**
This project underscores my ability to combine coding skills with cybersecurity principles — designing a lightweight, tamper-evident, post-breach logging tool that is **technically sophisticated yet practical for incident response**.
