✅ Feasibility of Each Step

Step	Function	Can it be implemented without ML?	Tools/Tech
1. Heuristic Authenticator	Parse magic numbers, detect spoofing	✅ Yes	C/C++, Rust, or Go + magic number DB
2. Steganography Detector	Entropy & LSB analysis	✅ Yes	Manual entropy calc, stego signature DB
3. Behavior Logger	Run in sandbox, monitor activity	✅ Yes	Use **Cuckoo Sandbox**, `strace`, `procmon`, WinAPI hooks
4. Byte Pattern Analyzer	Compare byte distribution to known formats	✅ Yes	Cosine similarity, n-gram match
5. Structure Fingerprinter	Check for a valid archive format	✅ Yes	Manual format decoders for ZIP, EXE, RAR

🧩 Integration Design: All in One Tool

🖼️ Frontend (Drag & Drop GUI)

- **Frameworks**:
    - Electron.js or Tauri (Rust) for a desktop app
    - HTML5 + JavaScript for web GUI
- **UI Features**:
    - Drag & drop/upload file
    - Display: File metadata, type confidence, spoof detection, entropy graphs, sandbox behavior summary

- One-click export of full report

⚙️ Backend (Core Analysis Engine)

- **Languages**: Rust (safe), Go (fast), or C++ (powerful), depending on your preference
- Modular engine with:
  - `module_magic()`: magic number & extension consistency
  - `module_entropy()`: calculate entropy and LSB analysis
  - `module_behavior()`: interface with Cuckoo or custom sandbox
  - `module_pattern_matcher()`: manual byte pattern similarity
  - `module_structure()`: check headers, footers, section alignment

🧪 Sandbox/Behavior Module

- You can:
  - Integrate **Cuckoo Sandbox** via API (for Windows behavior)
  - Or build a lightweight runner for `.exe` or `.py` in an isolated VM or Docker container
- Capture:
  - Network calls
  - File system changes
  - Process tree

🧾 Output: Unified Report

- **Type Guess**: e.g., “Disguised Executable (EXE)”
- **Spoof Detection**: e.g., “Fake PNG header; structure mismatch”
- **Stego Warning**: “Unusual entropy: possible embedded data”
- **Behavior Summary**: “Initiated network connection to 45.11.X.X”
- **Byte Similarity**: “Matches EXE with 89.3% confidence”
- **Archive Test**: “Invalid ZIP structure”

📌 Is This Already Made?

No, not in **one unified, drag-and-drop tool**, especially not open source. Some components exist in isolation:

- Cuckoo Sandbox (behavior)
- TrID (file type via magic number)
- binwalk (embedded file detection)
- stegdetect (basic stego)
  But nothing combines **all 5 forensic techniques into a single UX-friendly, modular tool**.

🚀 What to Call This?

Ideas:

- **FileScope** – "See beyond the extension"
- **FIRE** – File Inspection & Reverse Engineering
- **DeepInspect** – Hybrid static + dynamic inspection

🧱 Tool Name Suggestion

FileScope – *"See Beyond the Extension"*

🧩 Tool Overview

Feature	Description
Input	Drag-and-drop or upload any file
Output	Real-time display of detection results + exportable PDF report
Detection Modules	Magic number check, header spoof detection, entropy & LSB scan, sandbox behavior check, byte pattern analyzer, structure validation
Report	Generates a clean PDF log with timestamp, summary, risk rating, and technical details

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⚙️ Architecture Overview

mathematica
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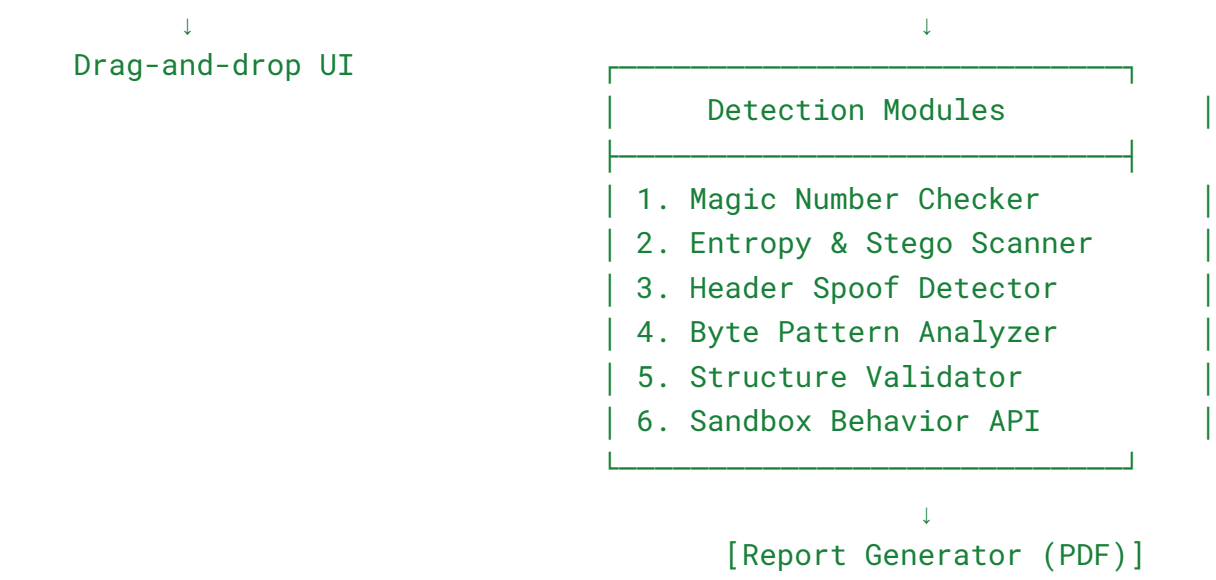

📁 Module Design Details

1. 🔍 Magic Number + Extension Checker

- Match the magic number against the known database
- Compared to extension (if any)
- Flag mismatch

> Example: Header says PNG but content = MZ (Windows EXE)

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2. 📊 Entropy + Steganography Detector

- Calculate the **Shannon entropy** of the file and chunks
- Highlight high-entropy zones
- Check for common **LSB** steganography signatures

> Alert if entropy > 7.8 in image files

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3. 🎭 Spoofed Header Validator

- Look for:
    - Mismatched file structure (e.g., wrong offsets in PE)
    - Invalid or impossible values
    - Conflicts between the header & real content
- Optionally use `binwalk` logic (reimplemented)

---

4. 📈 Byte Pattern Analyzer

- Compare n-gram frequency to known file types
- Use cosine similarity (manual math, no ML lib)
- Detects the true nature of obfuscated files

---

5. 🧱 Archive/File Structure Validator

- ZIP, RAR, 7Z, DOCX, EXE:
    - Parse internal structure
    - Validate magic numbers + internal table of contents

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6. 🛡️ Behavior Sandbox (Optional, Extensible)

- External interface to:
    - **Cuckoo Sandbox** (via REST API)
    - **Custom Virtual Machine script** that logs process, file, and network activity
- Detects mismatched behavior:
    - `.jpg` making system calls = suspicious

🖥️ GUI Design (Tauri or Electron)

Component	Description
Drag-and-Drop Zone	Accept file upload
Live Output Panel	Show type, structure, entropy, and spoof alerts
Entropy Graph	Display byte-wise entropy

File Behavior	(Optional) Show sandbox behavior log
PDF Export Button	Generate and save a detailed PDF report

🧾 PDF Report Contents

text
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```
==============================
   FileScope Forensic Report
==============================

File: suspicious.bin
Time: 2025-06-18 13:24 IST
----------------------------------
[SUMMARY]
Detected Type: Executable (EXE)
Declared Type: PNG
Status: SPOOFED
Risk Level: HIGH

[DETAILS]
- Magic Number: MZ (Executable)
- Extension: None
- Structure Validity: Invalid PNG format
- Entropy Analysis: 8.12 (Possible Encryption/Stego)
- LSB Check: Hidden bits found in offset 4000–5000
- Behavior: Attempted network access on port 443
- Byte Pattern Similarity: 91% match to known EXE

[RECOMMENDATION]
Quarantine the file immediately. DO NOT run on production systems.

------------------------------
Generated by FileScope v1.0
```

Use a **PDF generation library** like:

- **Rust**: `printpdf`, `genpdf`
- **C++**: `libharu`, `wkhtmltopdf` wrapper
- **Go**: `gofpdf`

💻 Technologies to Use

Part	Tech
Frontend GUI	Tauri (Rust-based) or Electron.js
Core Engine	Rust or C++
PDF Report	`printpdf` (Rust), `libharu` (C++)
Entropy/Pattern	Custom algorithms
Behavior	Optional: API to Cuckoo Sandbox or Docker VM
File Structure	Manual format parsers or signatures (open-source format specs)

🚀 Roadmap

🔹 Phase 1: MVP (Core Static Analysis)

- Magic number + extension check
- Entropy + LSB scanner
- Header validator
- Byte pattern analyzer
- PDF report

🔹 Phase 2: Full Prototype

- GUI frontend
- File structure validator
- Drag-and-drop + output display
- PDF export button

🔹 Phase 3: Sandbox Extension

- Cuckoo/VM behavior logger
- Network/process/file change hooks