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# **A Forensics Activity Logger to Extract user Activity from Devices**

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**ABSTRACT:** Nowadays, mobile devices have become one of the most popular instruments used by a person on its regular life, mainly due to the importance of their applications. In that context, mobile devices store user's personal information and even more data, becoming a personal tracker for daily activities that provides important information about the user. Derived from this gathering of information, many tools are available to use on mobile devices, with the restrain that each tool only provides isolated information about a specific application or activity. Therefore, the present work proposes a tool that allows investigators to obtain a complete report and timeline of the activities that were performed on the device. This report incorporates the information provided by many sources into a unique set of data. Also, by means of an example, it is presented the operation of the solution, which shows the feasibility in the use of this tool and shows the way in which investigators have to apply the tool.

**KEYWORDS:** Forensics, Activity Logger, User Activity, Mobile Devices, Personal Information, Data Extraction, Investigation Tool, Complete Report, Timeline, Digital Evidence, Android OS, Applications, Information Sources, Feasibility, User Behavior, Evidence Analysis.

## **I. INTRODUCTION**

Mobile phones are integral to daily life, storing vast amounts of user data that serve as valuable digital evidence in forensic investigations. Mobile forensics involves retrieving data without altering its original state, allowing analysts to recover deleted files, browsing history, and messaging records. Forensic analysts must adhere to principles of preventing evidence contamination, systematic documentation, and maintaining a proper chain of custody.

Various forensic tools, both commercial (e.g., Cellebrite UFED, Oxygen Forensic Suite) and open-source, assist in mobile device analysis. While no single tool captures all user activities, analysts often use multiple tools to ensure comprehensive data recovery and analysis.

### **1.1 Problem Statement:**

The challenge is to extract data while maintaining integrity and compliance with legal standards. This project aims to develop a forensic activity logger that systematically extracts and organizes user activity data, focusing on security, accuracy, and adherence to forensic best practices, particularly for Android devices.

### **1.2 Evolution of Forensic Activity Logging:**

Digital forensics has evolved from basic mobile data extraction techniques to more advanced methods. This project integrates machine learning for pattern recognition and anomaly detection to enhance forensic analysis.

### **1.3 Significance of Forensic Activity Logging:**

Forensic activity logging is crucial in cybersecurity, criminal investigations, and corporate security. It enables the detection of suspicious behavior and analysis of digital interactions, enhancing investigative capabilities.

**1.4 Methodological Framework:**

The forensic activity logger follows a structured framework comprising three components:

1. Data Retrieval: Extracting relevant user activity data securely.
2. Data Processing: Organizing and analyzing data to identify patterns and anomalies.
3. Report Generation: Compiling data into structured forensic reports that meet legal requirements.

**1.5 Objectives and Scope:**

The project aims to develop a forensic activity logger for secure extraction of user activity data, supporting law enforcement and cybersecurity professionals. It includes real-time and historical data analysis, advancing digital forensic methodologies and strengthening investigative capabilities.

**II. DESIGN METHODOLOGY**

The forensic activity logger design methodology is a systematic approach to guarantee efficiency, precision, and adherence to forensic standards. The methodology is in line with industry best practices and incorporates machine learning algorithms such as Random Forest to improve classification accuracy. The process is segmented into major steps: data acquisition, preprocessing, model selection, Random Forest model initialization and training, aggregation of prediction, evaluation, hyperparameter optimization, and deployment.

**2.1 Existing System**

The current forensic data extraction systems rely on traditional digital forensic techniques, including physical device access, manual log retrieval, and generic mobile forensic tools. These systems focus on retrieving data without deep analysis or intelligent filtering. While forensic tools like Oxygen Forensic Suite and Cellebrite are available, they often require specialized hardware, making them inaccessible to independent investigators and law enforcement agencies with limited resources.

**2.2 Proposed System**

The proposed Forensic Activity Logger aims to overcome the limitations of existing forensic tools by providing an automated, real-time, and intelligent forensic data analysis system.

This system integrates advanced machine learning algorithms for smart classification and filtering of user activities. It is designed with a secure backend using Python and supports data retrieval via APIs that extract logs, messages, app usage, and browsing history without compromising user privacy.

**2.3 Algorithm**

The forensic activity logger employs a **multi-step algorithm** to ensure accurate and efficient forensic data extraction and analysis.

**Forensic Activity Logger Workflow****Step 1: Start**

- Initialize the system and prepare necessary libraries.

**Step 2: Data Collection**

- Retrieve the list of installed applications and extract system logs of user interactions.

**Step 3: Data Integration and Processing**

- Merge and preprocess collected data, ensuring integrity and removing redundancies.

**Step 4: Activity Logging**

- Log user activities (call logs, messages, app usage, browsing history) with timestamps and store securely.

**Step 5: Generate Unified Report**

- Aggregate logged data into a structured format and perform statistical analysis, creating visual representations.

**Step 6: Output User Behavior Report**

- Generate a final report detailing application usage, browsing patterns, and communication logs, exportable in PDF, CSV, or JSON.



#### Step 7: End

- Finalize the logging process, securely store or delete sensitive data as required.

#### System Architecture

The forensic activity logger focuses on extracting and analyzing user activity from mobile devices, ensuring data integrity for law enforcement investigations.

#### System Components:

- **Data Collection Module:** Extracts call logs, SMS, browsing history, and app usage using APIs while minimizing intrusion.
- **Data Processing & Storage Module:** Parses logs, encrypts data, and stores it securely.
- **System Log Analysis Module:** Detects suspicious patterns and unauthorized access using AI-based anomaly detection.
- **Report Generation Module:** Aggregates data into forensic reports formatted for law enforcement.
- **Security & Integrity Module:** Implements cryptographic hashing, access controls, and logs activities for audit trails.

#### Workflow

1. User grants permissions for data extraction.
2. System extracts data from logs and apps.
3. Data is encrypted and stored securely.
4. Anomaly detection scans for suspicious activities.
5. Report generation summarizes findings for investigators.
6. Audit logs maintain a history of activities for compliance.

#### Security Measures

- **Encryption:** AES-256 for all extracted data.
- **Access Control:** Multi-factor authentication for authorized users.
- **Tamper Detection:** Hash-based validation for data integrity.
- **Logging & Monitoring:** Continuous monitoring for unauthorized access.

#### System Architecture Diagram

A visual representation of the forensic activity logger system is shown below:

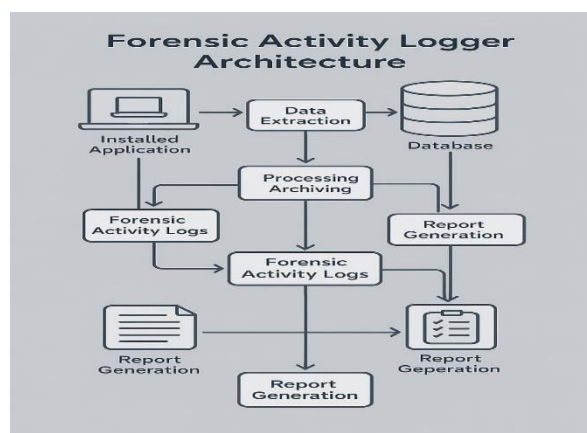


Figure-1: Forensic activity logger architecture

This architecture ensures forensic accuracy, secure storage, and efficient reporting. The system is scalable and can be integrated with AI-based analytics for deeper insights.

## 2.4 Entity-Relationship (ER) Diagram

The Entity-Relationship (ER) Diagram is a crucial part of database design for the Forensic Activity Logger system. This helps in structuring the forensic database efficiently to ensure seamless data retrieval and integrity. The ER diagram for the forensic activity logger consists of multiple entities, including Users, Devices, Logs, Investigators, and Cases. These entities interact with each other through well-defined relationships, ensuring a secure and structured data flow.

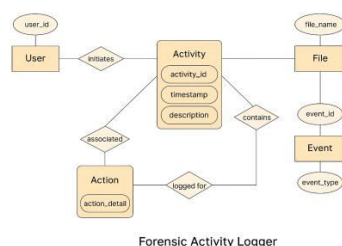


Figure-2 Entity-Relationship (ER) Diagram

## 2.5 Data Flow Diagram (DFD)

The Data Flow Diagram (DFD) for the Forensic Activity Logger represents how data moves through the system, from user activity collection to forensic analysis. The system captures call logs, messages, browsing history, and app usage from user devices.

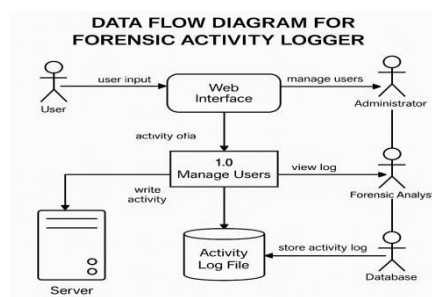


Figure-3 Data Flow Diagram For forensic Activity logger

## 2.14 System Requirements

The forensic activity logger requires a combination of hardware and software components to ensure seamless performance, data integrity, and efficient forensic analysis. The system is designed to be lightweight yet powerful enough to handle real-time data extraction and processing. Below are the detailed system requirements categorized into hardware and software specifications.

### Hardware Requirements

The hardware specifications ensure that the forensic activity logger operates efficiently without performance bottlenecks. The minimum hardware requirements are:

Component	Specification
Processor	Intel i3 or above
Hard Disk	Minimum 40 GB storage
RAM	Minimum 4 GB

Table-1 : Components and specifications

A higher configuration, such as an Intel i5 or i7 processor with SSD storage and 8GB+ RAM, is recommended for optimal performance, especially when handling large volumes of forensic data.

**SOFTWARE REQUIREMENTS:**

The software requirements define the operating environment and development tools necessary for running and maintaining the forensic activity logger efficiently. The system is built using Python and runs on a Windows-based operating system.

**Table -2 Software requirements**

Software components	Operating systems
Operating system	Windows 8 or above
Programming language	Python 3.7 or later
Database	MySQL/PostgreSQL
APIs & Libraries	Flask, Django, Pandas, NUMpy
Security mechanisms	SHA-256 Encryption, Access control

**III.IMPLEMENTATION**

The implementation of our mobile forensics activity logger focuses on creating a user-friendly and efficient tool for extracting, analyzing, and reporting user activity from mobile device data. We leverage Python's versatility and its rich library ecosystem to streamline the forensic investigation process. The core functionalities include data loading, extraction, filtering, analysis, and reporting, all accessible through a graphical user interface. This implementation prioritizes accuracy, robustness, and ease of use, ensuring that investigators can effectively utilize the tool to gather critical insights.

The mobile forensics activity logger is a user-friendly tool designed for efficiently extracting, analyzing, and reporting user activity from mobile device data using Python. Key functionalities include data loading, extraction, filtering, analysis, and reporting, all accessible via a graphical user interface.

**3.1 Import Necessary Libraries:**

The tool utilizes Python libraries like tkinter for the GUI and tkinter.filedialog for easy file selection.

**3.2 Load and Extract Data:**

Data is loaded from various file formats in binary mode to maintain integrity. The chardet library detects file encoding to prevent corruption.

**3.3 Filter and Organize Data:**

Extracted data is filtered based on criteria like timestamps and application names, organized into structured formats (e.g., lists or Pandas DataFrames), and displayed clearly. Customizable filtering options and export capabilities (CSV, JSON) enhance analysis.

**3.4 Analyze Forensic Activity:**

The tool analyzes organized data to uncover insights and reconstruct user actions, utilizing timestamp analysis, keyword searching, and data visualization (charts, graphs). Reports can be exported for easy sharing, empowering investigators to interpret data effectively.

Bookmark message

**3.5 Display and Report Forensic Findings**

The final step involves presenting the forensic findings in a clear and understandable manner. Comprehensive reports, summarizing the analysis and conclusions, are generated. Investigators can customize reports with notes and annotations, ensuring accuracy and relevance.

### 3.6 Deployment code:

```

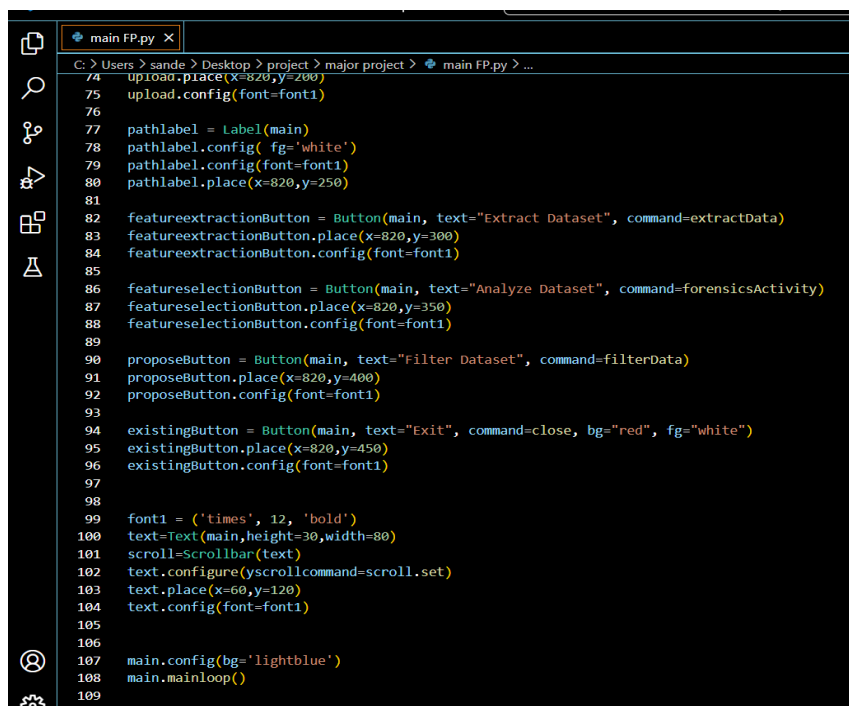
1  from tkinter import messagebox
2  from tkinter import *
3  from tkinter.filedialog import askopenfilename
4  from tkinter import simpledialog
5  import tkinter
6  import numpy as np
7  from tkinter import filedialog
8  from bs4 import BeautifulSoup
9  import datetime
10 import pathlib
11
12 main = tkinter.Tk()
13 main.title("Forensics Activity Logger ")
14 main.geometry("1300x1200")
15
16 global filename
17 global testData
18 global content
19
20 def upload():
21     global filename
22     filename = filedialog.askopenfilename(initialdir = "MobileData")
23     pathlabel.config(text=filename)
24     text.delete('1.0', END)
25     text.insert(END,'Selected file loaded\n')
26
27 def extractData():
28     global content
29     global testData
30     text.delete('1.0', END)
31     with open(filename, 'rb') as f:
32         content = f.read().decode("utf-16")
33     f.close()
34     soup = BeautifulSoup(str(content), "html.parser")
35     testData = soup.text
36     text.insert(END,content)
37

```

```

39 def forensicsActivity():
40     global testData
41     text.delete('1.0', END)
42     arr = testData.split("\n")
43     text.insert(END,"Total lines found in file : "+str(len(arr))+"\n")
44     fname = pathlib.Path(filename)
45     modify_time = datetime.datetime.fromtimestamp(fname.stat().st_mtime)
46     create_time = datetime.datetime.fromtimestamp(fname.stat().st_ctime)
47     size = fname.stat().st_size / 1000
48     text.insert(END,"File Created Date : "+str(create_time)+"\n")
49     text.insert(END,"File Last Modified Date : "+str(modify_time)+"\n")
50     text.insert(END,"File size in KB : "+str(size))
51
52 def filterData():
53     global testData
54     text.delete('1.0', END)
55     arr = testData.split("\n")
56     values = ''
57     for i in range(len(arr)):
58         if 'PM' in arr[i] or 'AM' in arr[i]:
59             values+=arr[i]+"\n"
60     text.insert(END,values)
61
62 def close():
63     main.destroy()
64
65 font = ('times', 16, 'bold')
66 title = Label(main, text='Forensics Activity Logger ')
67 title.config(bg="lightblue", fg='black')
68 title.config(font=font)
69 title.config(height=3, width=120)
70 title.place(x=0,y=5)
71
72 font1 = ('times', 13, 'bold')
73 upload = Button(main, text="Upload Dataset", command=upload)
74 upload.place(x=820,y=200)

```



```

74 upload.place(x=820,y=200)
75 upload.config(font=font1)
76
77 pathlabel = Label(main)
78 pathlabel.config( fg='white')
79 pathlabel.config(font=font1)
80 pathlabel.place(x=820,y=250)
81
82 featureextractionButton = Button(main, text="Extract Dataset", command=extractData)
83 featureextractionButton.place(x=820,y=300)
84 featureextractionButton.config(font=font1)
85
86 featureselectionButton = Button(main, text="Analyze Dataset", command=forensicsActivity)
87 featureselectionButton.place(x=820,y=350)
88 featureselectionButton.config(font=font1)
89
90 proposeButton = Button(main, text="Filter Dataset", command=filterData)
91 proposeButton.place(x=820,y=400)
92 proposeButton.config(font=font1)
93
94 existingButton = Button(main, text="Exit", command=close, bg="red", fg="white")
95 existingButton.place(x=820,y=450)
96 existingButton.config(font=font1)
97
98
99 font1 = ('times', 12, 'bold')
100 text=Text(main,height=30,width=80)
101 scroll=Scrollbar(text)
102 text.configure(yscrollcommand=scroll.set)
103 text.place(x=60,y=120)
104 text.config(font=font1)
105
106
107 main.config(bg='lightblue')
108 main.mainloop()
109

```

## IV. RESULTS AND DISCUSSION

The mobile forensics activity logger significantly streamlined the analysis of digital evidence from Android devices by automating the extraction and organization of user activity data from various sources. It generated a consolidated timeline of user actions, reducing the time and effort needed for investigators to analyze device usage. Testing across multiple Android brands confirmed the tool's stability and reliability, with features that accurately handle different file encodings and highlight key events.

Built with Python, the tool's open-source nature ensures transparency and preserves the integrity of digital evidence, crucial for legal proceedings. By consolidating data from diverse sources, it minimized manual effort and allowed investigators to focus on critical findings, leading to resource savings.

Future developments could include expanding compatibility to iOS and Windows Phone and improving efficiency and usability. Overall, the tool has shown great potential to enhance the efficiency and accuracy of digital forensic investigations.

## OUTPUT

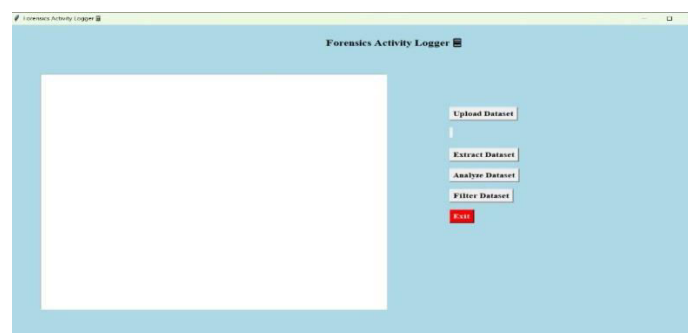


Figure-4: Result-1



In above screen click on 'Upload Dataset' button to upload chat log file

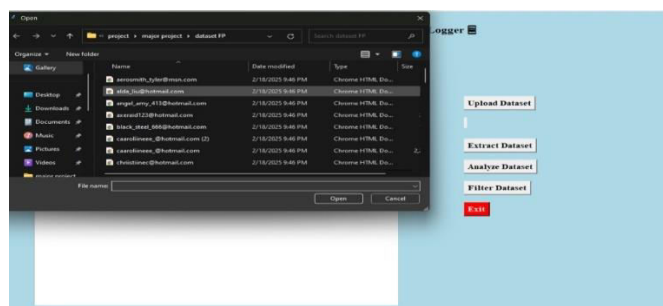


Figure-5: Result-2

In above screen I am selecting and uploading first chat log file and then click on 'Open' button to get below screen

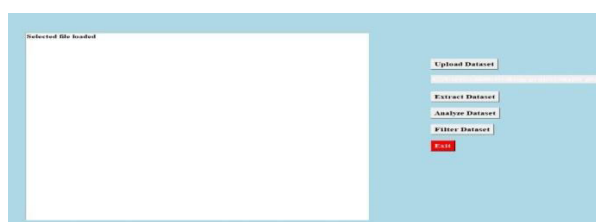


Figure-6: Result-3

In above screen chat log file is uploaded and now click on 'Extract Dataset' button to extract content from file

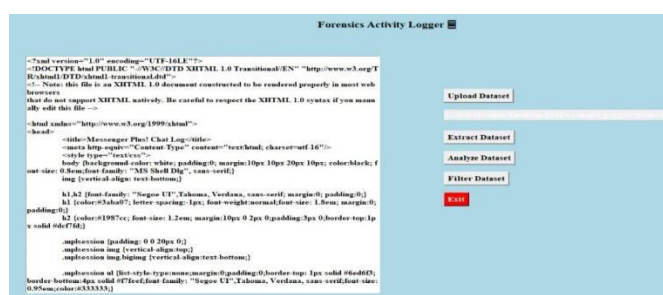


Figure-7: Result-4

In above screen we can see entire file content is in HTML format and user cannot understand anything from that so click on 'Apply Forensics Activity' to extract details from file



Figure-8: Result-5

In above screen for new file the size 464 KB with 445 chat messages lines. In above screen in first line we can see file contains total 113 lines and we can see file created and modified date and file size is 39.272 KB and now we extracted all details and now click on 'Filter Data' button to removed out all HTML tags to clean chat message like below screen

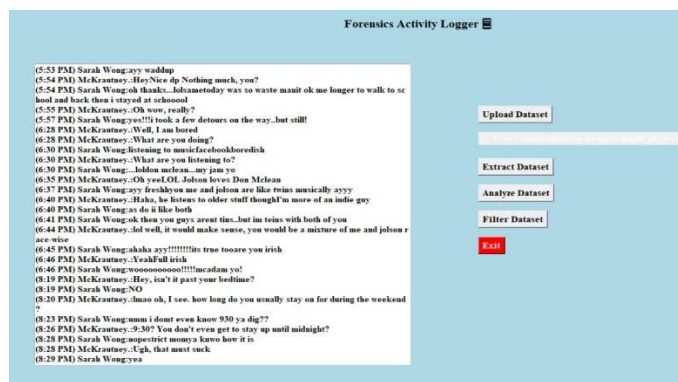


Figure-9: Result-6

In above screen from HTML content we extracted chat messages and user can read above messages clearly. So by applying forensic activity logger we have clean chat messages from HTML tags. Similarly you can upload other file and extract messages. Now see other files

## V. CONCLUSION & FUTURE WORK

**Conclusion:** The mobile forensics activity logger represents a significant advancement in analyzing digital evidence from Android devices. Rigorous testing confirmed its stability and reliability, effectively automating evidence analysis and reducing investigation time. By consolidating data from various sources, it addresses the limitations of existing tools, streamlining the analytical process. Built with Python, the tool ensures data integrity and transparency, crucial for legal admissibility. Its efficiency allows investigators to focus on interpreting findings rather than data collection, leading to substantial cost savings.

**Future Work:** Future development should expand compatibility to iOS and Windows Phone, enhancing cross-platform applicability. Improving interoperability with third-party forensic tools will create a more cohesive workflow, reducing manual data transfer risks. Additionally, focusing on non-functional characteristics like efficiency and usability through performance testing and user feedback will ensure the tool remains effective and user-friendly in the evolving mobile forensics landscape.

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