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Metadata and Location-Based Digital Document Authenticity Identification

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Abstract

The growth of digital documents has simplified the creation, storage, and distribution of information, but it has also increased the possibility of document forgery and manipulation. This study implements a digital forensic approach to support the identification of digital document authenticity through metadata and location analysis. The research method follows the National Institute of Standards and Technology (NIST) framework, consisting of collection, examination, analysis, and reporting. The system was developed as a web-based application using HTML, CSS, and JavaScript, with support for JPG, PNG, PDF, and DOCX files. The analyzed metadata includes file type, file size, creation time, modification time, software or device information, author identity, and GPS coordinates when available. The system was tested using black box testing on key features, including file upload, fetch URL, export JSON, clear, and GPS location display. The results show that the system is able to extract and present metadata in a structured manner and support the initial verification of digital document authenticity. Metadata can be used as an early indicator to detect inconsistencies in document history, although the reliability of the analysis depends on the completeness of metadata stored in the examined file.

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1. Introduction

The use of digital documents is becoming increasingly widespread in administration, education, journalism, government, business, and legal proceedings. Digital documents are preferred because they are easy to create, store, send, and retrieve using computing devices. This development accelerates the exchange of information, but at the same time raises issues regarding the authenticity and integrity of documents. Digital files can be copied, altered, or moved without always leaving visual changes that are easily recognizable by the average user (Putra & Lestari, 2021; Nugroho et al., 2022).

Advances in document and image processing software have made the manipulation of digital documents increasingly easy. Changes can include text editing, image cropping, object merging, element removal, or alterations to specific information within the file. If a manipulated

document is used as evidence, a source of public information, or the basis for decision-making, the consequences can range from the spread of false information and defamation to legal issues (Sari & Hidayat, 2021; Hadi & Prakoso, 2022).

In the context of Indonesian law, electronic documents are recognized as valid evidence provided they comply with statutory regulations. Therefore, examination methods are needed to help assess the authenticity of documents objectively and in a verifiable manner. One relevant approach is digital forensics, which is the process of identifying, collecting, examining, analyzing, and reporting digital evidence while ensuring data integrity (Kent et al., 2006; Casey, 2011).

Metadata is a key component in the examination of digital documents. Metadata is information embedded within a file and may include details regarding the creation date, modification date, authoring application, device used, creator's identity, and the document's creation location, if available. In digital image files, location information is generally stored in Exchangeable Image File Format (EXIF) metadata when the GPS feature on the device is active (Camera & Imaging Products Association, 2012; Rahman & Yusuf, 2020).

This study focuses on the implementation of a web-based metadata analysis system to assist in the initial identification of the authenticity of digital documents. The research questions addressed include how metadata is used in the document authenticity identification process, what metadata information can serve as indicators of manipulation, and how location metadata supports the verification of digital documents. This article presents the system development methodology, implementation results, functional testing, and a discussion of the benefits and limitations of metadata in digital forensic examination.

2. Research Methodolgy

This study employs a system development approach using the NIST digital forensics framework. This framework was selected because it provides a systematic workflow for handling digital evidence, from the data collection stage through to report preparation. The stages involved consist of collection, examination, analysis, and reporting (Kent et al., 2006).

The objects of examination in this study are digital documents that have the potential to store metadata, specifically JPG and PNG image files, PDF documents, and DOCX Office documents. Each file type has different metadata characteristics. Therefore, the system is designed to identify the file type first before determining the appropriate metadata extraction process.

Stages of Digital Forensics

The application of the NIST framework in this study was adapted to the requirements of digital document metadata examination. The details of the stages used are presented in Table 1.

Table 1. Application of the NIST phases to metadata analysis

NIST Phases	System Implementation	Expected Output
Collection	Users upload digital documents via file upload or URL without altering the original file content.	The digital document was successfully received by the system in its original state.
Examination	The system identifies the file type and extracts available metadata based on the document format.	Technical and descriptive metadata were extracted from the file.
Analysis	The metadata is analyzed to determine the creation date, modification date, application, device, author, and GPS location.	Preliminary indications of the document's authenticity or discrepancies can be identified.
Reporting	The metadata results are displayed in the interface and can be exported to JSON format.	The inspection results can be read, saved, and used for documentation.

System Design

The system was developed as a web-based application using HTML, CSS, and JavaScript. The system interface consists of a document input area, control buttons, a metadata navigation menu, a document summary panel, and a GPS location panel. The input area is used to receive files from the user's device or retrieve files via a URL link. The control buttons include Fetch URL, Export JSON, and Clear.

Once a document is uploaded, the system reads the file name, extension, and MIME type to determine the file category. Image files are processed to read EXIF metadata; PDF files are processed to display document information such as title, author, authoring application, creation date, and modification date; while DOCX files are processed to read Office document properties such as author, last modified by, application, created, modified, pages, words, and characters.

The extracted metadata results are then grouped into several categories, including Summary, File Info, Camera/Origin, Date/Time, Software History, Author/Copyright, GPS Location, and All Metadata. This grouping ensures that the obtained information is not displayed in raw form but is organized according to analysis needs. The system is designed on a read-only principle, so the examined documents are not modified during the analysis process.

Analyzed Metadata Indicators

The metadata indicators used in this study include information that can help trace the history of a document's creation and changes. The main indicators consist of file type, file size, creation time, modification time, the application or device used, the creator's identity, the identity of the last modifier, and GPS coordinates if available. Discrepancies between metadata and the document's claims can serve as an initial indication of alterations or manipulation, but do not directly prove forgery without additional supporting examinations.

Testing Technique

System testing was conducted using the black-box testing method. This testing focuses on the system's output matching the provided input without evaluating the internal structure of the program code. The features tested include image file upload, PDF file upload, DOCX file upload, Fetch URL, Export JSON, Clear, GPS Location display, and the system's response to files with limited metadata.

3. Results and Discussion

System Implementation Results

The developed system successfully provides the core functions for receiving digital documents, recognizing file types, extracting metadata, and displaying inspection results in a web interface. For image files, the system can display EXIF information such as the device, capture time, software, and GPS location, if available. For PDF files, the system displays document metadata such as the PDF version, title, author, authoring application, creation date, and modification date. For DOCX files, the system displays document property information, such as the creator, the last user to modify the file, the application, creation time, modification time, and document statistics.

The GPS Location feature works on image files that store geolocation data. If GPS coordinates are found, the system converts the coordinates to a format that can be visualized on a digital map. If location metadata is unavailable, the system still displays other information readable from the file and provides a note stating that GPS data was not found. This behavior is important because not all image files store location data, especially if the device's GPS feature is inactive or if metadata has been deleted during file editing or transfer.

The Export JSON feature supports documentation of inspection results because the extracted metadata can be saved in a structured format. The JSON format also facilitates further analysis using other tools. Meanwhile, the Clear feature is used to delete analysis results from the display so the system is ready for the next document.

Functional Testing Results

Testing was conducted on the system's main functions using various types of input, including image files, PDFs, DOCX files, document URLs, metadata results, currently displayed analysis data, files with GPS metadata, and files with limited metadata. A summary of the test results is presented in Table 2.

Table 2. System functional test results

No.	Fitur yang Diuji	Input	Expected Results	Result
1	Upload image file	JPG/PNG	The system reads files and displays image metadata.	Success
2	Upload PDF file	PDF	The system reads and displays PDF metadata.	Success
3	Upload DOCX file	DOCX	The system reads Office document metadata.	Success
4	Fetch URL	Document URL	The system retrieves files from a URL and processes the metadata.	Success
5	Export JSON	Analysis metadata	The system exports metadata to JSON format.	Success
6	Clear	Analysis data	The system clears the analysis results display.	Success
7	GPS Location	Files with GPS data	The system displays location coordinates on a map.	Success
8	Limited file metadata	Files with incomplete metadata	The system continues to display available information.	Success

Discussion

Test results show that the system has fulfilled its primary intended functions. The system's ability to read multiple file formats demonstrates that metadata can be utilized as an initial source of information in the examination of digital documents. Creation and modification timestamps can be used to verify the consistency of a document's history. For example, discrepancies between the modification timestamp and the claimed date of document use can serve as a basis for further investigation.

Information regarding the creating application, device, author, and "last modified by" also plays a crucial role in tracing a file's origin. In Office documents, metadata on the creator and last modifier can help identify specific users' involvement in the document's creation or revision process. In PDFs, the creating application and modification date can provide insight into the conversion or editing process. In image files, EXIF metadata may contain information about the camera device, capture time, and GPS coordinates when location features are active.

Location metadata provides strong verification value when available. GPS coordinates can be compared to claims about the scene of an incident, the document's creation location, or the context of events related to the file. However, the absence of GPS metadata does not necessarily mean the document has been manipulated. The location may not be recorded because the GPS feature was inactive, the device does not support geotagging, the metadata was deleted by a specific application, or the file was compressed when sent via a digital platform.

Thus, metadata analysis is best positioned as an initial identification tool, not as the sole basis for definitively declaring a document authentic or forged. For stronger evidentiary purposes, metadata should be combined with other techniques, such as hash value verification, document content analysis, file structure analysis, application trace examination, and image forensics. Combining multiple methods will yield a more comprehensive assessment and reduce the risk of erroneous conclusions.

4. Conclusion

This study successfully implemented a web-based digital document metadata analysis system to assist in the preliminary identification of document authenticity. The system is capable of accepting

JPG, PNG, PDF, and DOCX files, extracting available metadata, and displaying the results of the examination in a structured format without altering the original content of the document. Metadata can serve as an initial indicator in assessing the history of digital documents. Information regarding creation time, modification time, the application or device used, the document creator, the last modifier, and GPS location can help identify inconsistencies that may indicate alterations or manipulation. Testing results show that the file upload, Fetch URL, Export JSON, Clear, and GPS Location features function as required by the system. The main limitation of this approach lies in the completeness of the metadata. Not all files store complete metadata information, and certain metadata may be lost due to editing, compression, or file transfers. Therefore, metadata analysis should be used as an initial step in digital forensic investigations and combined with other methods to strengthen the results of document verification.

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