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Pen Craft - A Writing Enhancement Platform

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Abstract: ***The Pencraft Python project aims to develop a sophisticated writing enhancement platform utilizing the Django web framework and integrating machine learning algorithms. The platform caters to three user roles: admin, master writer, and writer, each with distinct functionalities tailored to their needs. Through the integration of HTML, CSS, Python- Django, and machine learning technologies, the project seeks to provide users with a comprehensive toolkit for improving their writing skills, receiving feedback, and fostering a collaborative writing community***.

Keywords: plagiarism detecting, grammar checking, content evaluation

1. Introduction

The Pen Craft platform is an innovative content management and review system designed to facilitate seamless collaboration between Writers and Master Writers, with administrative oversight. It provides a structured approach to content submission, evaluation, and feedback, ensuring quality writing and constructive critique [1]. Traditionally, Writers faced challenges in verifying the authenticity, grammatical accuracy, and originality of their work. They relied on multiple tools for plagiarism detection, grammar checking, and spelling correction, often leading to inconsistent results. The Pen Craft platform integrates these essential features into a single system, providing Writers with a streamlined way to submit their work, receive feedback, and improve their writing skills [7]. Master Writers play a crucial role in the system by reviewing submissions, performing plagiarism and grammatical checks, assigning marks, and offering valuable feedback. The admin oversees the overall operations, manages users, reviews complaints, and ensures the system runs efficiently [2]. The key objectives of this project are: To provide a centralized platform for Writers and Master Writers to collaborate. To enable automated plagiarism detection, grammar checking, and content review. To create a structured evaluation process with marks assigned for different aspects of writing. To facilitate direct communication between Writers and Master Writers for constructive feedback. To ensure admin supervision for user management, submission tracking, and complaint resolution. With features like real-time tracking, submission history, messaging, and complaint management, Pen Craft serves as a complete solution for Writers aiming to refine their craft and for Master Writers looking to guide them toward excellence [4].

2. Related Works

Quratulain et al. (2025) evaluated AI-powered writing assistants in improving essay skills at the undergraduate level. While their findings indicated clear benefits in grammar and structure, the tools lacked depth in contextual feedback. Pen Craft builds on this by incorporating qualitative assessments through Master Writers, bridging the gap between mechanical correction and human-like mentorship [2].

Lira et al. (2025) argued that AI assistance enhances rather than hinders learning, particularly when the focus is on augmentation rather than substitution. Pen Craft aligns with this philosophy by encouraging iterative drafting, and offering suggestions without finalizing user content—preserving authorship while supporting skill development [1].

Escalante et al. (2023) examined student engagement with AI-generated feedback and found preferences varied among English-as-a-New-Language (ENL) learners. Pen Craft addresses these diverse needs through multilingual language model support and adjustable feedback intensity, allowing users to tailor the AI's guidance to their proficiency [3].

Zheldibayeva et al. (2025), in their study on the CGScholar AI Helper Project, emphasized the positive long-term impact of AI-driven feedback on student writing development. However, they noted limitations in personalization. Pen Craft extends this concept by integrating submission history and user feedback logs to adapt suggestions over time, providing a more tailored and evolving learning experience [4].

Alharbi (2023) presented a pedagogical overview of AI tools in foreign language classrooms, highlighting the importance of usability and teacher integration. Pen Craft supports this dual role by enabling both autonomous learning and collaborative review with educators via role-based access and feedback channels [5].

Koltovskaia (2023) explored learners' interaction with automated feedback in EFL writing, noting a gap between system suggestions and user perception. Pen Craft mitigates this disconnect with a transparent scoring system, explanations for corrections, and options for human moderation—enhancing trust and comprehension [6].

Moon (2021) analyzed the effectiveness of AI-generated corrective feedback, revealing inconsistent accuracy with

complex structures. To counter this, Pen Craft uses a hybrid approach—merging BERT-based deep learning models with rule-based grammar checks—to enhance reliability across sentence types and complexities [7].

Park (2020) investigated AI grammar checkers in Korean EFL contexts, finding mixed effects on learning outcomes. Pen Craft addresses these limitations by combining grammar correction with writing prompts, style evaluation, and feedback customization, turning the platform into a full-fledged learning assistant rather than a mere proofreader [8].

Park (2019) compared AI grammar tools to human raters, noting discrepancies in nuance and content understanding. Pen Craft narrows this gap by enabling hybrid review workflows, where AI handles technical checks and human reviewers contribute to qualitative evaluations, especially in creative writing contexts [9].

Li et al. (2019) studied Chinese EFL learners' attitudes toward automated writing evaluation (AWE) tools, highlighting adoption barriers related to trust and perceived usefulness. Pen Craft enhances perceived utility through real-time, actionable feedback, and demystifies AI suggestions with justifications rooted in linguistic theory [10].

Ghufron & Rosyida (2018) evaluated Grammarly's effectiveness in EFL contexts, pointing out that it excels in grammar but overlooks content and coherence. Pen Craft incorporates deeper discourse-level analysis using contextual embeddings (e.g., Word2Vec, BERT), allowing it to evaluate thematic relevance and logical flow in addition to grammar [11].

Liao (2016) demonstrated that automated writing evaluation could reduce grammar errors significantly. However, motivation and engagement remained concerns. Pen Craft sustains user motivation with gamified feedback, submission streaks, and progress visualization, turning writing improvement into an engaging process [12].

Lee (2011) revisited the importance of teacher feedback in L2 writing, suggesting that automation alone cannot replace nuanced human input. Pen Craft integrates this insight by maintaining human-in-the-loop options and encouraging reflective revision, rather than passive acceptance of AI suggestions [13].

Lai (2010) found students had mixed preferences between peer and automated evaluations. Pen Craft resolves this dichotomy by offering a blended model— users can receive peer feedback alongside AI-generated suggestions, promoting collaborative and self-regulated learning [14].

Li (2009) reported that while students appreciated computerized feedback for convenience, they often missed deeper clarification. Pen Craft bridges this through its feedback rationale feature, which explains suggestions in plain language, reinforcing understanding while maintaining efficiency [15].

3. Outlined method

- **Content Submission and Acquisition**
  Users (Writers) submit their written content through the Pen Craft web interface. This system supports various formats including plain text and rich-text documents. Each submission is timestamped and stored with a unique identifier for easy tracking and version control.
- **Preprocessing and Text Cleaning**
  Submitted content undergoes preprocessing which includes removal of unwanted characters, normalization of text (e.g., lowercasing, lemmatization), and segmentation into sentences and paragraphs. This step ensures consistency and prepares the data for accurate analysis by downstream modules.
- **Plagiarism Detection and Semantic Analysis**
  Using a combination of TF-IDF, Word2Vec, and BERT-based embedding, the platform performs both surface-level and deep semantic comparisons. It detects copied content as well as paraphrased plagiarism. Cosine similarity and Jaccard similarity are used to quantify overlap with external sources or internal databases.
- **Grammar and Syntax Evaluation**
  Pen Craft employs a hybrid grammar checking system that combines traditional rule-based techniques (subject- verb agreement, punctuation errors) with modern machine learning models like Transformer-based Seq2Seq models and BERT. This allows the system to catch both basic grammatical issues and nuanced syntactic flaws.
- **Creative Content and Readability Scoring**
  Advanced NLP models assess the overall quality of writing by analyzing vocabulary richness, sentence variety, clarity, and tone. Readability scores such as Flesch-Kincaid and Gunning Fog Index are used in conjunction with LSTM-based models to evaluate creative value and audience suitability.
- **Review by Master Writers**
  After automated analysis, Master Writers review the submission. They provide qualitative feedback, highlight areas for improvement, and assign scores based on clarity, originality, grammar, and creativity. This human-in-the-loop process adds depth and mentor- ship to the Writer's learning experience.
- **Administrative Oversight and Workflow Management**
  An Admin dashboard monitors all user activity, submission timelines, complaints, and Master Writer assignments. The Admin ensures operational efficiency, resolves disputes, and maintains data integrity across the platform.
- **Real-Time Feedback and Messaging System**
  The platform features a messaging interface that enables real-time communication between Writers and Master Writers. Feedback is delivered through inline comments, scorecards, and tracked revisions, helping Writers to iteratively refine their work.
- **Performance Tracking and Analytics**
  Each user's progress is monitored through visual dashboards showing submission history, improvement trends, and performance analytics. This helps Writers identify strengths and weaknesses over time and allows

Admins to evaluate system effectiveness.

- **Continuous Learning and Model Enhancement**
  All interactions and feedback loops contribute to the improvement of Pen Craft's AI models. Training data is incrementally updated with anonymized user input to improve grammar detection, plagiarism recognition, and content scoring over time.

3.1 Machine Learning Approach

Machine learning plays a central role in the Pen Craft platform by enabling intelligent evaluation, personalized feedback, and adaptive learning tailored to each writer's development. The core of this system relies on Natural Language Processing (NLP) and deep learning architectures to analyze text and offer meaningful insights. The workflow begins with the collection of textual data, i.e., written content submitted by users. This input undergoes preprocessing steps such as tokenization, stop-word removal, stemming/lemmatization, and vectorization using techniques like TF-IDF and Word2Vec. These processes convert raw text into structured formats suitable for machine learning models. Once transformed, the content is passed through various ML models, each serving a distinct purpose:

- **Grammar and Syntax Correction using Transformer Models**
  Transformer-based models like BERT and Seq2Seq (Sequence-to-Sequence) architectures are used for advanced grammar correction. These models are trained on large corpora of grammatically annotated text and can identify complex syntax errors, sentence structure issues, and awkward phrasing. The system suggests context-aware corrections in real-time, helping users refine their writing.
- **Plagiarism Detection using Semantic Similarity Models**
  The platform employs BERT embeddings combined with cosine similarity and Jaccard similarity metrics to detect both exact and paraphrased plagiarism. By comparing the semantic meaning of sentences rather than just surface-level matching, the model identifies subtle forms of content duplication with high accuracy.
- **Creative Evaluation using Recurrent Neural Networks (RNNs) and LSTM**
  To assess creativity and coherence in writing, LSTM (Long Short-Term Memory) networks are utilized. These models analyze sentence flow, vocabulary richness, and narrative structure. They are trained on a variety of writing samples labeled by quality to predict scores for fluency, engagement, and originality.
- **Readability Prediction through Supervised Learning**
  Supervised regression models are used to compute readability scores such as the Flesch Reading Ease or Gunning Fog Index. These scores guide Writers in adapting their tone and complexity according to target audiences, such as academic, casual, or business readers.
- **Adaptive Feedback and Personalization**
  By continuously analyzing each Writer's submissions over time, the platform builds user-specific learning profiles. Using clustering and classification techniques, the system recognizes patterns in writing habits and tailors recommendations. For instance, frequent misuse of passive voice or repeated grammar errors trigger focused tutorials or practice suggestions.
- **Model Training and Continuous Learning**
  All models are trained on large-scale writing datasets, including academic texts, essays, creative fiction, and blog posts. As new submissions flow in, the system uses incremental learning to retrain anonymized user data, constantly improving performance and relevance. Feedback provided by Master Writers is also incorporated to reinforce supervised learning pipelines.
- **Real-Time Feedback Engine**
  The final system integrates all ML modules into a unified pipeline, offering real-time feedback as users write. The platform highlights issues inline, suggests rephrases, flags potential plagiarism, and assigns preliminary scores before a Master Writer's final evaluation. Through this comprehensive, ML-enhanced architecture, Pen Craft delivers a personalized, efficient, and educational writing experience. It not only corrects errors but actively nurtures skill development, turning every writing task into a learning opportunity.

3.2 Datasets for Pencraft

To effectively develop and evaluate the intelligent writing assistance features of the Pen Craft platform, diverse and well-structured datasets are essential. These datasets support the system's capabilities in user management, writing evaluation, communication, feedback handling, and administrative control, enabling robust model training and performance tracking.

3.2.1 Users Dataset

This dataset stores essential information about all platform participants, including Writers, Master Writers, and Admins. It is foundational for user authentication, role-based access control, and usage analytics. Key Features: User ID, Username, Email, Role, Password Hash, Join Date, Last Login, Status. Applications: Personalized feedback tracking, access control, role- specific features, engagement analysis

3.2.2 Submissions Dataset

Records every writing piece submitted by Writers for review. It forms the core of content evaluation workflows, feeding into grammar analysis, plagiarism checking, and quality scoring algorithms. Key Features: Submission ID, User ID, Title, Content, Submission Date, Status, Plagiarism Score, Grammar Score, Final Score, Master Writer ID, Feedback. Applications: Machine learning model training for grammar and creativity scoring, tracking submission trends, feedback- driven learning loops

3.2.3 Submission History Dataset

Captures revision histories and iterative improvements on submitted work, supporting longitudinal analysis of writing improvement and editing patterns. Key Features: History ID, Submission ID, Revision Date, Revised Content, Revised By, Revision Comments. Applications: Monitoring writer progress, training ML models on iterative

refinement, version comparison, and feedback efficiency

3.2.4 Messaging Dataset

Enables traceable communication between platform users. It supports structured feedback exchange and clarification processes between Writers, Master Writers, and Admins. Key Features: Message ID, Sender ID, Receiver ID, Message Content, Timestamp, Subject, Status. Applications: Training NLP models for sentiment and intent detection, assessing support responsiveness, automating message classification

3.2.5 Complaints Dataset

Documents complaints related to content evaluation, plagiarism, or platform functionality. It plays a vital role in quality assurance and administrative review processes. Key Features: Complaint ID, User ID, Submission ID (optional), Complaint Type, Complaint Description, Date Filed, Status, Admin ID, Resolution. Applications: Analyzing complaint patterns, automating complaint triage, improving system transparency and user satisfaction.

3.2.6 Administrative Logs Dataset

Maintains an audit trail of actions performed by Admins on the platform, such as account moderation and complaint resolution. Key Features: Log ID, Admin ID, Action, Details, Timestamp. Applications: Monitoring platform governance, ensuring transparency, training anomaly detection models for platform misuse

3.2.7 System Configuration Dataset

Holds customizable system parameters that influence automated tools like plagiarism detection thresholds and grammar rule activation. Key Features: Config ID, Config Name, Config Value, Last Updated Applications: Dynamic model tuning, A/B testing configurations, supporting user-specific or context- sensitive tool adaptation

4. Results and Discussion

The implementation of machine learning models for plagiarism detection, grammar checking, and creative content evaluation has shown promising results in improving text analysis and content quality.

a) Plagiarism Detection Results

The plagiarism detection model, utilizing TF-IDF and Cosine Similarity, effectively identified textual similarities between documents. Traditional methods such as Jaccard Similarity performed well for exact matches, while BERT-based semantic similarity models provided a deeper contextual understanding, detecting paraphrased or reworded content with higher accuracy. The deep learning models outperformed classical methods in cases of synonym replacement and sentence restructuring.

b) Grammar Checking Results

The grammar correction model demonstrated improved accuracy when fine-tuned transformer models (BERT and GPT-based) were employed. While rule-based approaches such as SpaCy and Language Tool efficiently handled basic grammatical errors, they struggled with complex sentence structures. Sequence- to-sequence models using Transformers provided superior results by accurately predicting grammatical corrections within contextual sentences. The model's accuracy increased significantly when trained on large- scale grammatical datasets.

c) Creative Content Evaluation Results

For content evaluation, readability metrics like the Flesh-Kincaid Index provided basic readability scores, but lacked deeper assessments of fluency and coherence. Transformer-based models such as GPT and BERT successfully analyzed creativity and writing style, offering insights into engagement and logical flow. LSTM models were useful for evaluating coherence but required extensive training data. The results showed that a combination of readability metrics and AI-based writing assessment provided the most comprehensive evaluation.

d) Discussion on Model Optimization

Hyperparameter tuning played a crucial role in enhancing model efficiency. Techniques such as Grid Search and Random Search helped in selecting optimal parameters for text vectorization and neural network configurations. Learning rate scheduling and dropout mechanisms prevented over-fitting in deep learning models, ensuring generalized performance. Fine-tuning transformer models on domain-specific datasets further improved accuracy in-grammar checking and content evaluation. The study confirms that integrating traditional and deep learning-based NLP techniques can significantly enhance plagiarism detection, grammar correction, and content evaluation. However, challenges such as computational complexity and dataset dependency must be addressed for real-world applications. Future enhancements include training on more diverse datasets and implementing real-time feedback mechanisms for improved usability.

5. Conclusion

The Pen Craft Python project represents a groundbreaking development in the field of writing enhancement and mentorship. By seamlessly integrating Django and machine learning technologies, the platform offers a dynamic and user-centric environment that caters to the diverse needs of writers, master writers, and administrators. Writers benefit from a streamlined process to manage their submissions, receive actionable feedback, and connect with experienced master writers who can provide valuable guidance. The platform's features, such as tracking submission status and viewing detailed feedback, empower writers to refine their craft and achieve their creative goals. Master writers are equipped with robust tools to evaluate submissions, perform plagiarism and grammar checks, and offer constructive feedback. Their role is crucial in nurturing and developing emerging talent, and the platform's features facilitate this by 77 enabling efficient management of submissions and communication with writers. Administrators gain comprehensive oversight with access to analytics, user management capabilities, and submission tracking. This empowers them to ensure the smooth operation of the platform, maintain high standards, and address any issues promptly. The integration of machine learning enhances the platform's ability to provide accurate and insightful feedback, further

supporting the continuous improvement of writing skills. The Pen Craft Python project not only fosters a collaborative and supportive writing community but also sets a new standard for writing enhancement platforms by combining technology with creativity. In conclusion, The Pen Craft Python project is poised to make a significant impact on the writing industry, offering valuable resources for writers and mentors alike. Its innovative approach to writing enhancement and mentorship highlights its potential to elevate the writing experience and contribute to the success of its users.

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