AI vs HUMAN - ACADEMIC ESSAY AUTHENTICITY CHALLENGE

A PROJECT REPORT

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Under the guidance of,

Ms. SANDHYA L

in partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND TECHNOLOGY(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

At

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY

BENGALURU

JANUARY 2025

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DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **AI vs HUMAN ACADEMIC ESSAY AUTHENTICITY CHALLENGE** in partial fulfillment for the award of Degree of **Bachelor of Technology** in **Computer Science and Technology(AI & ML)**, is a record of our own investigations carried under the guidance of **Ms. Sandhya L,** Assistant Professor, **School of Computer Science Engineering & Information Science, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

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ABSTRACT

The appearance of large language models (LLM) including GPT-3.5 and GPT-4 have called into question the integrity of academic writing, as it is becoming increasingly more difficult to distinguish between essays written by humans and those that are AI-generated. This project seeks to create an answer to this challenge by designing a binary classification model, to identify if an essay was written by a human, or a machine. The dataset contains essays written by humans, which were gathered from the ETS Corpus of Non-Native Written English, alongside essays written by AI from seven LLMs: GPT-3.5-Turbo, GPT-4o, Gemini-1.5, Llama-3.1 (8B), Phi-3.5-mini, Claude-3.5. Utilizing natural language processing (NLP) techniques and machine learning algorithms, this system will skim for linguistic patterns in academic essays written in English and Arabic in order to separate either human essays from AI induced writing. It is a solution that will support academic authenticity and lessen academic dishonesty with the misuse of AI tools in the university classroom to help our institutions support fair academic practices.

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1.1 The Rise of AI in Academia

1.1.1 Historical Context and Evolution:

The integration of artificial intelligence (AI) into academia marks a transformative era, where technology reshapes traditional educational norms and practices. Over the past few decades, advancements in machine learning and natural language processing have enabled AI systems to achieve feats once considered exclusive to human intelligence. Among these innovations, OpenAI's ChatGPT, introduced in November 2022, stands out as a groundbreaking achievement. This large language model (LLM), trained on vast amounts of textual data, is capable of producing coherent, contextually relevant, and human-like text, earning both admiration and skepticism from educational communities worldwide.

The historical trajectory of AI in academia reflects an evolution from simple automated tools to complex systems capable of performing tasks like essay writing, coding, and creative expression. In earlier phases, AI was confined to automating repetitive tasks and facilitating data analysis. However, with the advent of LLMs, the focus has shifted towards enhancing cognitive tasks that were traditionally viewed as inherently human. This shift raises fundamental questions about the role of AI in knowledge creation, intellectual labor, and education.

The advent of ChatGPT has particularly brought these issues into sharp focus. Its release triggered an immediate and widespread reaction across academia, with students and educators alike exploring its potential. On one hand, ChatGPT offers unparalleled opportunities for learning, research, and productivity. On the other, its ability to mimic human writing has fueled debates about plagiarism, the authenticity of student submissions, and the broader implications of delegating intellectual work to machines. As universities grapple with these challenges, the rise of AI prompts a re-evaluation of educational values, assessment standards, and the essence of intellectual authenticity.

1.2 The Challenges of Authorship in the AI Era:

Authorship, in its traditional sense, has long been associated with intellectual ownership, personal accountability, and the ethical presentation of original ideas. In academic settings, the author's voice not only conveys their understanding of a subject but also reflects their critical thinking, creativity, and personal perspective. However, the introduction of AI-powered tools like ChatGPT has significantly disrupted this paradigm. Capable of generating well-structured essays, poems, reports, and even research papers, AI systems challenge the fundamental principles of authorship by introducing machine-generated text into domains that rely heavily on human creativity and reasoning.

One of the most profound challenges is the erosion of the individual's distinct voice in academic writing. The ability of AI to generate content that is both contextually accurate and stylistically refined creates a scenario where students may bypass the intellectual rigor traditionally associated with crafting an argument or presenting an analysis. This raises concerns about the authenticity of submitted work, as well as the intellectual growth of students who might rely excessively on AI for academic tasks. For example, in a notable case at a Swedish university, a student openly acknowledged using ChatGPT for an academic assignment. This incident not only sparked debates about the ethical implications of such practices but also highlighted the inadequacy of existing academic policies to address the nuances of AI usage.

The problem extends beyond individual assignments to the broader academic ecosystem. If AI tools are widely adopted without clear guidelines, the boundaries between human creativity and machine assistance may blur, leading to a crisis of trust in academic authorship. Educators must navigate this complex landscape, balancing the opportunities provided by AI with the need to uphold academic integrity and the cultivation of independent thought

1.3 Implications for Evaluation and Integrity:

The rise of AI in academia brings into question the relevance and reliability of traditional methods of academic evaluation. Written assignments, long considered the gold standard for assessing student understanding, are particularly vulnerable to manipulation in the age of AI-

generated text. ChatGPT's ability to produce essays that mimic human writing challenges the validity of such assessments, as educators struggle to distinguish between original work and machine-generated content. This has profound implications for educational equity, integrity, and the future of evaluation systems.

Traditionally, written assignments have been valued not only for their ability to gauge a student's knowledge but also for their role in fostering skills like critical thinking, argumentation, and creativity. However, the use of AI tools undermines this process by allowing students to bypass these essential learning stages. For instance, a student may input a simple prompt into ChatGPT and receive a well-structured essay in response, thereby circumventing the intellectual effort required to produce high-quality work. This raises ethical concerns about the authenticity of student submissions and their commitment to learning.

Moreover, the widespread adoption of AI in academic contexts necessitates a rethinking of evaluation criteria. Educators may need to move away from traditional essay-based assessments toward alternative approaches that emphasize creativity, oral presentations, or collaborative projects. Additionally, the development of AI detection tools is becoming increasingly important to safeguard academic integrity. However, these tools face their own limitations, as AI systems continue to evolve and become more sophisticated in mimicking human writing.

Beyond evaluation, the ethical considerations surrounding AI usage in academia are equally significant. While AI tools like ChatGPT have the potential to democratize access to knowledge and enhance learning experiences, they must be used responsibly to avoid unintended consequences. Institutions must establish clear policies on the ethical use of AI, provide training for educators and students, and foster a culture of accountability and integrity. By doing so, academia can embrace the benefits of AI while mitigating its risks, ensuring that technology serves as a tool for learning rather than a shortcut to academic success.

CHAPTER-2
LITERATURE SURVEY

The intersection of artificial intelligence (AI) and academic writing has sparked a nuanced dialog that transcends traditional boundaries of authorship and creativity. This literature review synthesizes key contributions from scholarly works to provide a comprehensive understanding of the landscape, focusing on the comparative analysis between AI-generated text, particularly represented by ChatGPT, and human-authored academic writing in the context of English literature

2.1 The nature of writing and authorship

The foundations of writing as a form of personal expression, intertwined with creativity, cognitive processes, and the responsibility of effective communication, are expounded by Elbow (1983), Barthes (1992), and Paul and Elder (2006). The delicate balance of imagination and innovation in writing shapes a distinct voice, reflecting the author's intellectual journey and attitude (Eagleton, 2011). This serves as the backdrop against which the advent of AI-generated text challenges traditional perspectives on authorship and the act of creation (Boden, 1998).

2.1.1 Evolution of authorship in the digital age

The statement made by McLuhan in "The Medium is the Massage" (Fiore and McLuhan, 1967) that authorship became prominent with print technology is juxtaposed with Barthes (1992) later philosophical exploration of the "death of the author." These historical perspectives emphasize the transformative influence of technology on authorship concepts, laying the groundwork for understanding how AI might further reshape these dynamics.

2.1.2 Ethical considerations and academic integrity

Peacock and Flowerdew (2001) emphasize how critical it is to cultivate academic literacy, encompassing critical thinking and writing skills. The rise of AI-generated texts in academic

settings raises ethical concerns, particularly surrounding authorship, plagiarism, and originality (Anders, 2023; Khalil and Er, 2023). The inquiry into writing essays with ChatGPT becomes crucial to evaluate its impact on students' abilities and to address potential challenges in maintaining academic integrity (Lo, 2023).

2.1.3 Writing, technology, and AI

The interplay between technology and writing has long fascinated scholars. Foundational work by Bolter (2001) and Ong (2013), examined how emerging technologies redefined writing practices while more recent studies by Hayles (2012) and Baron (2015) evaluated the impact of digital technology on reading habits and literary creation. However, until recently, there was a gap in understanding the unique implications of AI-generated texts on academic writing (Riedl, 2016). A recent study by Bašić et al. provided insight into this area by conducting a comparison of student-composed essays and those written with the help of ChatGPT (Basic et al., 2023). Their research centered on the efficacy of ChatGPT-3 as an essay-writing assistance tool. Interestingly, they found no significant improvement in essay quality, writing speed, or authenticity when students used ChatGPT. On the contrary, those students who wrote essays independently of the tool achieved slightly better overall scores, a phenomenon potentially attributed to overreliance of the other group on the tool or unfamiliarity with it. These findings corroborate a previous study on GPT-2 (Fyfe, 2023), where students found using the tool more challenging than simply writing directly and expressed concerns about the sources of the generated text. This line of research resonates with principles from corpus linguistics (McEnery and Brezina, 2022), a field committed to systematically comparing language patterns across texts. A significant aspect of this comparison involves analyzing how authorship is created through voice, a key linguistic feature that contribute to originality, creativity, and adherence to academic writing conventions (Hyland, 2009).

2.2 ChatGPT: architecture and functionality

ChatGPT, a sophisticated language model, operates on the Generative Pre-trained Transformer (GPT) framework, renowned for its prowess in comprehending and producing text responses that are human-like (Brown et al., 2020). Natural language processing is ChatGPT's area of expertise as a Large Language Model (LLM) within the larger field of

Artificial Intelligence (AI) (Radford et al., 2018). ChatGPT uses layers of neural networks to learn from extensive pre-training and fine-tuning on large datasets, enabling it to predict and generate text sequences (Radford et al., 2018). With the help of an attention mechanism, ChatGPT can generate text that is both coherent and relevant to the context. This is one of its primary features. According to Vaswani et al. (2017), this mechanism allows the model to assign different weights to words in a sentence depending on their contextual relevance. It is essential to acknowledge, however, that ChatGPT lacks real-time understanding and operates solely based on pre-learned patterns and information. Despite its ability to generate impressive outputs, the model may produce inaccuracies or nonsensical responses, demonstrating awareness of context and wording in input (Bender et al., 2021). The current iteration, ChatGPT-4, operates on a subscription basis, with earlier versions like ChatGPT-3 and 3.5 freely accessible to the public. Users typically interact with ChatGPT through a chat window-like text-based interface, where user inputs initiate text generation. Notably, ChatGPT-4 has an arbitrary limitation of 5,000 characters per prompt, posing a challenge for generating longer texts such as a 2,000 to 3,000-word essay. This limitation necessitates multiple prompts, introducing complexities in the text generation process.

2.3 Authorship in the context of ChatGPT

2.3.1 The evolving landscape:

Authorship, as emphasized by Charmaz and Mitchell (1996), encapsulates the core of the writer's voice and presence in written works. Ivanič (1998) extends this notion, positing that writing serves as a socio-political medium for expressing identity. The academic realm, however, introduces complexities, notably around the contested concept of "voice." Tardy (2012) acknowledges the broad spectrum of meanings attributed to "voice," while Atkinson (2001) and Biber (2006) consider it a critical language aspect shaped by genre and community constraints in academic writing.

2.3.2 ChatGPT and altered authorship dynamics:

While traditional perspectives on voice and authorship highlight the human dimension, the study at hand delves into a distinctive realm— assessing voice in a ChatGPT-generated text as an authorship marker. Conventional aspects of authorship will unavoidably change as AI

becomes more prevalent in writing tasks, challenging the notion of voice as an extension of the human author. As ChatGPT generates text, the representation of voice undergoes a significant transformation, raising questions about the role of individual identity in AI-authored content. This exploration into the altered dynamics of authorship in the context of ChatGPT expands the discourse on the evolving nature of writing and creativity in the era of artificial intelligence.

2.4 The voice intensity rating scale, or VIRS:

To render authorial identity quantifiable, measuring the elusive concept of voice in writing becomes imperative. Methodological recommendations are provided by Tannen (1993) and Ivanič (1994), who support the use of lexical selections, syntactic structures, hedges, boosters, and personal pronouns as measurable indicators of an author's presence and position. This theoretical framework is operationalized in Helms-Park and Stapleton (2003) empirical study of undergraduate argumentative writing in second languages (L2). They utilize a "Voice Intensity Rating Scale" to measure voice and introduce a more comprehensive evaluation framework that includes elements such as content, structure, language use, vocabulary, mechanics, self-identification, assertiveness, repetition of the main idea, and authorial presence. "Voice Intensity Rating Scale" has four main parts. The first, assertiveness, measures the author's self-assurance in their writing by taking into account linguistic cues such as intensifiers and hedges that indicate conviction when making arguments. The second, self identification, assesses how much the writer shares their point of view and focuses on how they utilize first-person pronouns and other expressions to represent their unique opinions. The third, "reiteration of the central point," evaluates emphasis and clarity by focusing on how clearly the passage restates the main argument. The fourth factor, authorial presence and autonomy of thought, assesses how much the author's voice is present overall as well as how autonomous their thinking is, taking into account the inclusion of opposing points of view. Two assessors are trained to use the rating scale and provide ratings for writing samples in order to guarantee the reliability of the scale. To sum up, the instruments used in this study measure assertiveness, self-identification, reiteration of the main point, and authorial presence in addition to evaluating the overall quality of a written passage. The "Voice Intensity Rating Scale," specifically designed for this research, proves to be an invaluable instrument for assessing the identity-related, expressive, and personal aspects of writing

CHAPTER-3
RESEARCH GAPS OF EXISTING METHODS

The rapid advancement of AI technologies, particularly in the domain of natural language processing, has fundamentally altered the landscape of academic writing and communication. While there is a burgeoning body of literature exploring the capabilities of AI-generated text, significant gaps remain in understanding the ethical, educational, and technological implications of these tools. These gaps are particularly evident in the areas of authorship, academic integrity, the operational limitations of AI models, and the pedagogical strategies needed to integrate such tools effectively into educational systems. The following sections delve deeply into the multifaceted research gaps that arise from these challenges, highlighting the pressing need for further investigation.

Authorship Dynamics and Creative Expression:

One of the most profound gaps lies in the redefinition of authorship and voice in the context of AI-assisted writing. Traditional studies on authorship, such as those by Ivanič (1998) and Tardy (2012), have thoroughly explored how personal, cultural, and linguistic identities manifest in academic texts. However, these frameworks were developed with the assumption of human authorship. The introduction of AI tools like ChatGPT challenges these notions by blurring the lines between human creativity and machine-generated content. For instance, a student utilizing AI to draft an essay may contribute their ideas and inputs, but the text itself might largely reflect the machine's output. This raises questions about the ownership of the final product and whether existing definitions of originality and creativity can accommodate such hybrid outputs.

Furthermore, there is limited exploration of how AI-generated content affects the distinctiveness of an author’s voice. Studies like those by Helms-Park and Stapleton (2003) have developed metrics to measure voice intensity and personal style in writing, but these methodologies falter when applied to AI-authored texts. AI tools often produce grammatically impeccable yet stylistically neutral content, lacking the nuanced personal and cultural markers that characterize human-authored texts. This absence of voice not only

impacts the authenticity of academic writing but also poses challenges in disciplines where personal expression is integral, such as creative writing, philosophy, and humanities. The need to redefine voice in the age of AI represents a critical gap in both theoretical and practical terms.

Ethical and Integrity Concerns

Ethical considerations surrounding the use of AI in academic writing form another significant area of concern. While scholars like Peacock and Flowerdew (2001) have long emphasized the importance of originality and integrity in academic work, the advent of AI tools introduces complex ethical dilemmas. Current literature does not adequately address questions such as whether AI-generated content constitutes plagiarism, how much AI assistance is acceptable in an academic setting, and how to distinguish between legitimate use and misuse of such tools.

The issue of attribution is particularly problematic in collaborative AI-human outputs. When a student or researcher uses AI to co-create content, should the AI be credited as a co-author, or is it merely a tool? Existing guidelines on plagiarism and academic misconduct fail to provide clear answers, leaving institutions grappling with how to regulate the use of AI in academic work. Moreover, the overreliance on AI-generated content risks undermining the very skills that education seeks to develop, such as critical thinking, analytical reasoning, and writing proficiency. While studies like those by Bašić et al. (2023) suggest that students perform better when writing independently, they do not explore the long-term implications of habitual AI use, such as the potential erosion of cognitive skills and ethical standards in academia.

Technological Limitations and Operational Challenges

While AI tools like ChatGPT have demonstrated impressive capabilities in generating coherent and contextually appropriate text, they are not without their limitations. Studies by Riedl (2016) and Bender et al. (2021) have highlighted several shortcomings of AI models, including their inability to fully understand nuanced contexts, generate accurate information in specialized fields, and produce content that aligns with academic rigor. These limitations are particularly evident in complex tasks that require deep reasoning, domain-specific knowledge, or long-form writing.

Additionally, the operational constraints of models like ChatGPT-4, such as prompt size limitations, create practical challenges for users attempting to generate extensive academic content. While the model can produce individual sections of an essay with remarkable fluency, integrating these sections into a cohesive whole often requires significant human intervention. This hybrid approach—where humans refine and organize machine-generated text—adds another layer of complexity to the authorship debate and highlights the need for tools that can better support the end-to-end writing process.

Another technological gap lies in the evaluation of AI-generated content. Current tools and frameworks for assessing writing quality, such as corpus linguistics methodologies described by McEnery and Brezina (2022), are primarily designed for human-authored texts. Applying these frameworks to AI-generated content requires significant adaptation, as AI writing often adheres to formal linguistic structures but may lack depth, originality, and relevance. Developing new metrics and evaluation techniques tailored to AI-authored texts is essential to address this gap.

Pedagogical Implications and Educational Strategies

The integration of AI tools into educational settings presents both opportunities and challenges. While tools like ChatGPT can serve as valuable aids for brainstorming, drafting, and revising, their unregulated use risks diminishing students' independent learning and critical thinking skills. Despite the growing adoption of AI in education, there is a dearth of empirical research on how these tools affect learning outcomes over time. Existing studies by Bolter (2001) and Ong (2013) explore the influence of technology on writing practices but fail to account for the unique challenges posed by AI-driven tools.

For instance, there is limited guidance on how educators can teach students to use AI responsibly and critically. What strategies can be employed to ensure that students learn to evaluate AI-generated content for accuracy, bias, and relevance? How can curricula be adapted to incorporate AI literacy while preserving the core principles of academic integrity and independent learning? Addressing these questions requires a multidisciplinary approach that combines insights from education, linguistics, and artificial intelligence.

Genre-Specific Challenges and Linguistic Intricacies

Another critical research gap lies in the genre-specific analysis of AI-generated texts. While studies like those by Fyfe (2023) have compared the overall quality of human-authored and AI-generated writing, they rarely delve into how AI performs across different academic disciplines or genres. For example, scientific writing often requires precision, evidence-based reasoning, and technical terminology, whereas humanities essays demand nuanced arguments, critical analysis, and a distinct authorial voice. Investigating how AI-generated texts meet these genre-specific requirements is essential to understand their limitations and potential applications.

Moreover, linguistic intricacies such as tone, style, and rhetorical strategies are often oversimplified or overlooked in AI-generated content. While corpus-based methodologies offer a robust framework for analyzing language patterns, they have yet to be fully applied to AI-authored texts. The lack of comprehensive linguistic studies on AI writing underscores the need for advanced analytical tools capable of evaluating not just the surface features but also the deeper semantic and rhetorical qualities of AI-generated content.

CHAPTER-4
PROPOSED METHODOLOGY

In this chapter, we outline the methodology for developing an AI-driven plagiarism detection system tailored to identify content generated by language models. The proposed system leverages advanced natural language processing (NLP) techniques and statistical analysis of text patterns to assess the originality of textual inputs. This methodology focuses on the concepts of **perplexity** and **burstiness**, which are key metrics for distinguishing human-written content from AI-generated text.

4.1 Overview of the Proposed System

The rapid advancements in AI models, such as GPT-4 and similar architectures, have led to an increased use of machine-generated content in academic and creative domains. This phenomenon raises concerns about originality, authorship, and ethical practices in academia. To address these challenges, we propose a methodology that builds on linguistic and statistical properties of text to detect AI-generated content effectively.

The methodology integrates two core concepts:

Perplexity: A statistical measure indicating how well a language model predicts a sequence of words.

Burstiness: A measure of the variability and frequency patterns in text.

By combining these metrics, the system assesses the likelihood of a text being human-written or machine-generated.

4.2 Key Concepts

4.2.1 Perplexity:

Perplexity is a foundational metric in NLP that evaluates the predictive capability of a

language model. In this context, it provides insights into the confidence with which a language model generates or interprets a given text.

Definition: Mathematically, perplexity is defined as 2^H , where H represents the entropy of the text sequence.

Entropy: The entropy H is calculated as the average negative log probability of each word in the sequence. It quantifies the randomness or unpredictability of the text.

Interpretation: Human-written texts generally exhibit higher perplexity due to the diverse and contextually rich usage of words, whereas AI-generated texts often have lower perplexity, reflecting their structured and formulaic nature.

4.2.2 Burstiness:

Burstiness examines the variability in word usage within a text.

Definition: It is a measure of how frequently certain words or phrases appear relative to the overall text.

Observation: AI-generated text tends to exhibit higher burstiness, with repetitive use of specific keywords, as compared to human-written text, which is more diverse and context-sensitive.

Significance: This metric helps differentiate between content that appears "machine-like" due to its mechanical repetitiveness and human content marked by organic variability.

4.3 Building the Application:

4.3.1 Environment Setup:

The system requires a robust programming environment with necessary NLP and visualization libraries.

- Install the following libraries:

  NLP Tools : `nltk`, `transformers`, and `sentencepiece`.

  Deep Learning Frameworks : `torch`.

  Web Framework : `Streamlit` for user interaction.

  Visualization Tools : `plotly` for graphical representation of text analysis.

4.3.2 Streamlit App Development

The application is designed as an interactive web-based tool using Streamlit, with the following components:

1. Text Input Interface :

- A user-friendly text area allows users to input content for analysis.

2. Perplexity Calculation :

- Tokenize the input text using pre-trained language models (e.g., GPT-2).
- Compute the probability distribution of each word in the sequence.
- Derive entropy and perplexity metrics.

3. Burstiness Analysis :

- Analyze word frequency patterns in the text.
- Generate a word frequency distribution to visualize repetition patterns.

4. Results Visualization :

- Display perplexity and burstiness scores.
- Present the word frequency distribution through bar charts or histograms.

4.4 Analyzing and Interpreting Results :

The application generates quantitative and qualitative insights to assess the likelihood of the text being AI-generated:

- **Quantitative Metrics :**
- Lower perplexity scores indicate potential AI generation.
- Higher burstiness highlights repetitive patterns, often characteristic of AI models.
- **Qualitative Assessment :**
- Visualizations, such as word frequency charts, allow users to interpret the variability in the text.

4.5 Limitations and Future Enhancements

1. Model Constraints :

- The effectiveness of the tool depends on the capabilities of the pre-trained language model used. Enhancements in AI models may require periodic updates to the detection algorithm.

2. Contextual Nuances :

- Current methods may struggle with highly specialized or creative texts where human-like qualities are embedded in machine-generated content. Refining the burstiness metric to account for semantic and contextual depth can address this issue.

3. Ethical Considerations :

- The tool must be used responsibly to avoid false accusations of plagiarism. Clear guidelines should be provided for interpreting the results.

4. Scalability :

- Future iterations of the application can incorporate additional metrics, such as stylistic analysis or sentiment detection, to improve accuracy.

CHAPTER-5
OBJECTIVES

The overarching goal of this project is to design and develop a robust AI-based plagiarism detection system capable of distinguishing between human-written and AI-generated content. This addresses critical challenges in ensuring academic integrity and mitigating the misuse of advanced AI language models. The objectives of the study are as follows:

Primary Objective:

1. To develop an AI-driven plagiarism detection system:

- Design and implement a tool that uses statistical and linguistic metrics, such as perplexity and burstiness, to evaluate the originality of textual inputs.
- Ensure that the system is user-friendly, efficient, and adaptable to evolving language model capabilities.

Secondary Objectives:

2. To analyze the characteristics of AI-generated text:

- Investigate the unique patterns, structures, and statistical properties of content generated by advanced language models.
- Identify key differentiators between human-written and AI-generated content, focusing on metrics like repetition, predictability, and variability.

3. To validate the effectiveness of the proposed methodology:

- Evaluate the performance of the tool on a diverse dataset, including essays authored by humans and AI models.
- Compare the tool's outputs against known benchmarks to ensure its accuracy and reliability.

4. To explore and address ethical considerations :

- Develop guidelines for the responsible use of the plagiarism detection tool, ensuring that the results are interpreted correctly and ethically.
- Investigate potential biases or limitations in the methodology and propose solutions to

mitigate these issues.

5. To provide insights into future advancements :

- Explore potential enhancements, such as integrating semantic and contextual analysis, to improve detection accuracy.
- Recommend strategies to refine the tool as AI models evolve and become more sophisticated.

6. To contribute to academic integrity :

- Create a system that upholds the values of originality and authenticity in academic writing by identifying potential misuse of AI-generated content.
- Provide educators, researchers, and institutions with a reliable tool to safeguard academic standards.

Specific Measurable Goals:

7. To implement core functionalities :

- Build a web-based application with features such as text input, analysis, and result visualization.
- Implement perplexity and burstiness calculations using pre-trained language models.

8. To achieve high accuracy and efficiency :

- Ensure the system achieves a detection accuracy of at least 90% in distinguishing AI-generated text from human-written content.
- Optimize processing time to provide results in real-time.

9. To evaluate user experience :

- Collect feedback from academic professionals to assess the usability and effectiveness of the tool.

By achieving these objectives, this project aims to bridge the gap between the growing prevalence of AI-generated content and the need for reliable plagiarism detection systems, ultimately contributing to the broader goal of maintaining academic authenticity.

CHAPTER-6
SYSTEM DESIGN & IMPLEMENTATION

This chapter details the systematic approach undertaken to design and implement the AI-based plagiarism detection system. It includes the architectural overview, key components, tools, and methodologies employed to develop a robust and scalable solution.

6.1 System Overview:

The AI plagiarism detection system is designed to analyze textual content and determine whether it is human-written or AI-generated. The system leverages advanced natural language processing (NLP) techniques and statistical metrics such as perplexity and burstiness to identify patterns indicative of AI-generated text.

6.2 Architecture:

The architecture of the system is modular, consisting of several layers to ensure scalability and maintainability. The primary components include:

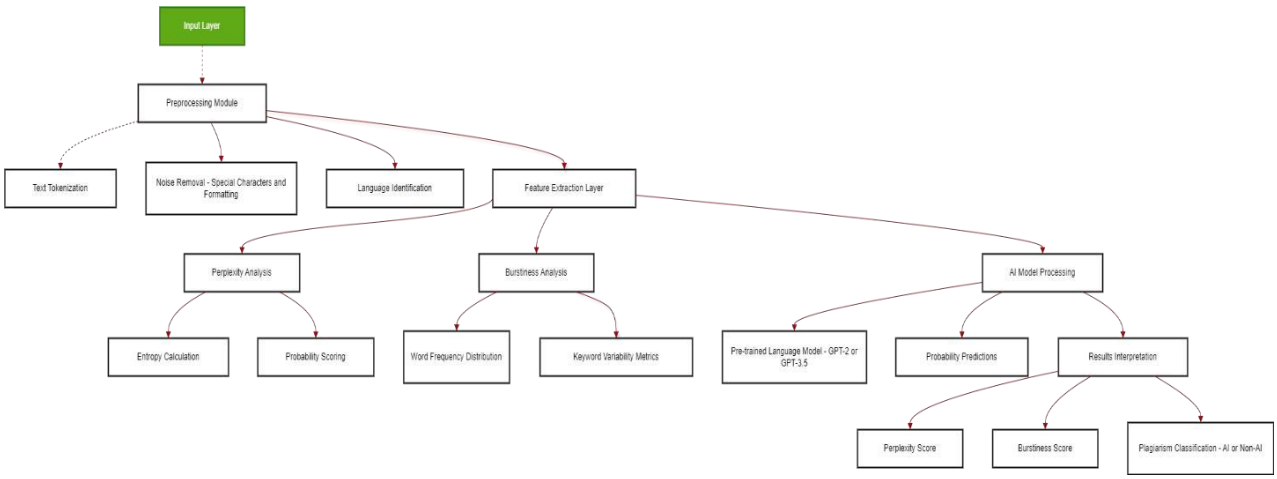

Fig.1: Architecture.

1. User Interface Layer:

- A web-based application created using Streamlit to allow users to input text for analysis and view results interactively.

2. Application Logic Layer:

- Responsible for processing the user input, tokenizing the text, and applying detection algorithms.

3. NLP Analysis Layer:

- Implements statistical metrics such as perplexity and burstiness using pre-trained models like GPT-2.
- Extracts linguistic features to differentiate AI-generated and human-written text.

4. Backend and Database Layer:

- **Backend:** Developed using Python, integrating libraries such as `transformers` for language model computations.
- **Database:** Stores user input and analysis results temporarily for benchmarking and performance tracking.

5. Visualization Layer

- Uses Plotly for graphical representation of metrics such as word frequency and burstiness scores.

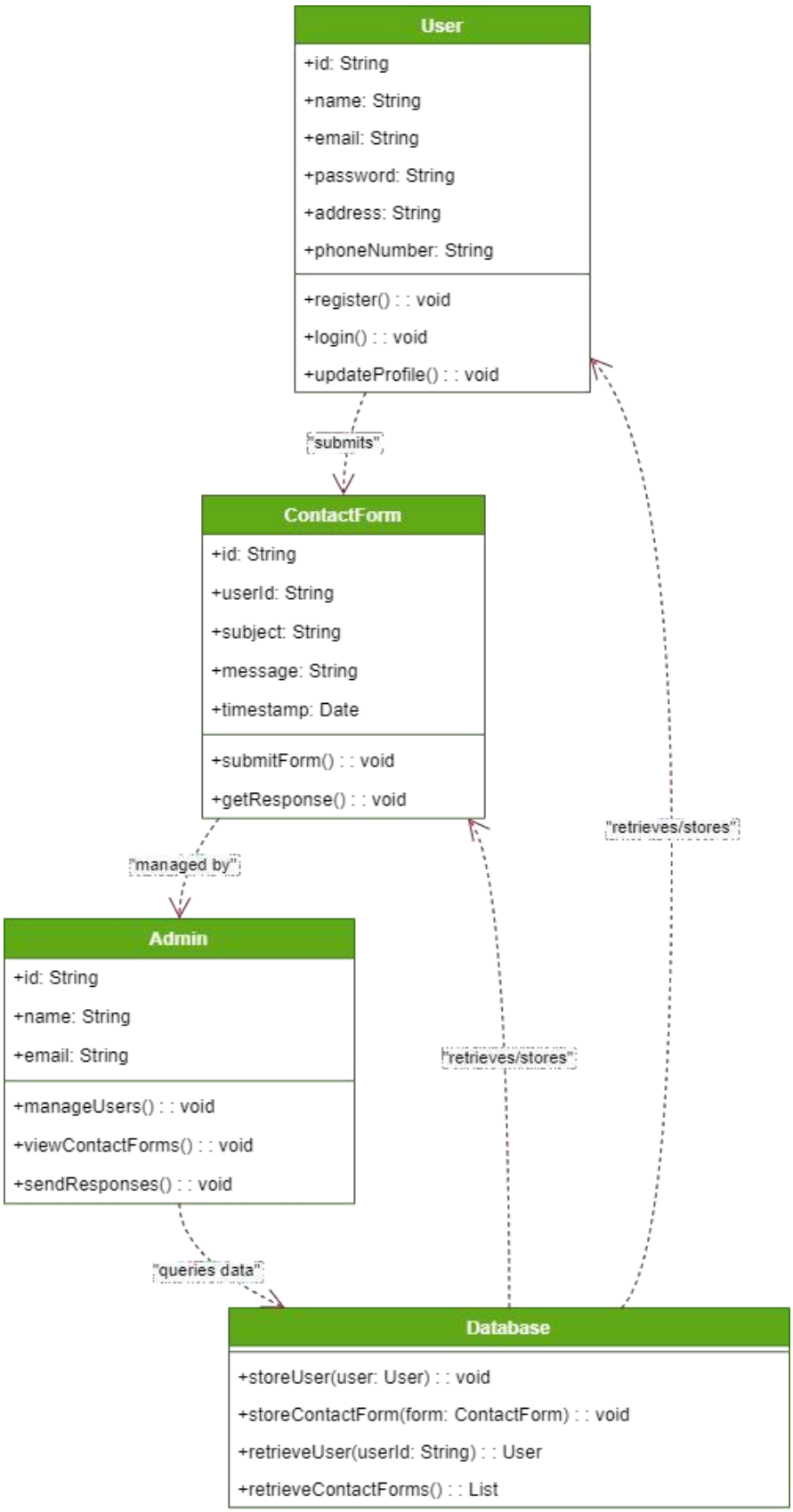

Fig.2 :Visualization Layer

6.3 Tools and Technologies Used:

- **Python:** Primary programming language for implementing NLP algorithms and backend logic.
- **Transformers:** For utilizing pre-trained language models like GPT-2.
- **NLTK:** For text preprocessing tasks, including tokenization and word frequency analysis.
- **Streamlit:** For building the user interface and creating an interactive web application.
- **Plotly:** For visualizing results in the form of bar charts and distributions.
- **PyTorch:** For integrating and fine-tuning the AI models.

6.4 Implementation Steps:

6.4.1 Setting Up the Environment:

1. Install the necessary Python libraries:

"pip install nltk Streamlit torch transformers plotly sentencepiece"

2. Configure the development environment to include necessary dependencies.

6.4.2 Data Preprocessing:

- **Tokenization**: Splitting the input text into individual words or tokens using `NLTK`.
- **Cleaning**: Removing unnecessary symbols, punctuations, and stop words to improve model accuracy.

6.4.3 Perplexity Calculation:

- Use a pre-trained GPT-2 model to calculate the probability of each token in the input text.
- Compute perplexity as \(2^H\), where \(H\) is the entropy of the sequence.

6.4.4 Burstiness Analysis:

- Analyze the variability in word frequency across the text.
- Identify unusual repetitions or high-frequency patterns often associated with AI-generated text.

6.4.5 Designing the Streamlit App:

1. User Input Section:

- A text area for users to input content for analysis.

2. Analysis Results:

- Display metrics like perplexity and burstiness.
- Provide a likelihood score for whether the text is AI-generated or human-written.

3. Visualization:

- Bar chart showing word frequency distribution.

6.4.6 Testing and Validation:

- Evaluate the system using a mixed dataset of AI-generated and human-written texts.
- Fine-tune parameters for perplexity and burstiness thresholds to optimize accuracy.

6.5 System Workflow:

1. User Input

- Users input text via the web interface.

2. Data Processing

- The system preprocesses the text and calculates perplexity and burstiness scores.

3. Analysis

- The scores are evaluated against predefined thresholds to classify the text.

4. Results and Visualization

- The system outputs the analysis results with graphical representation.

CHAPTER-7

TIMELINE FOR EXECUTION OF PROJECT

(GANTT CHART)

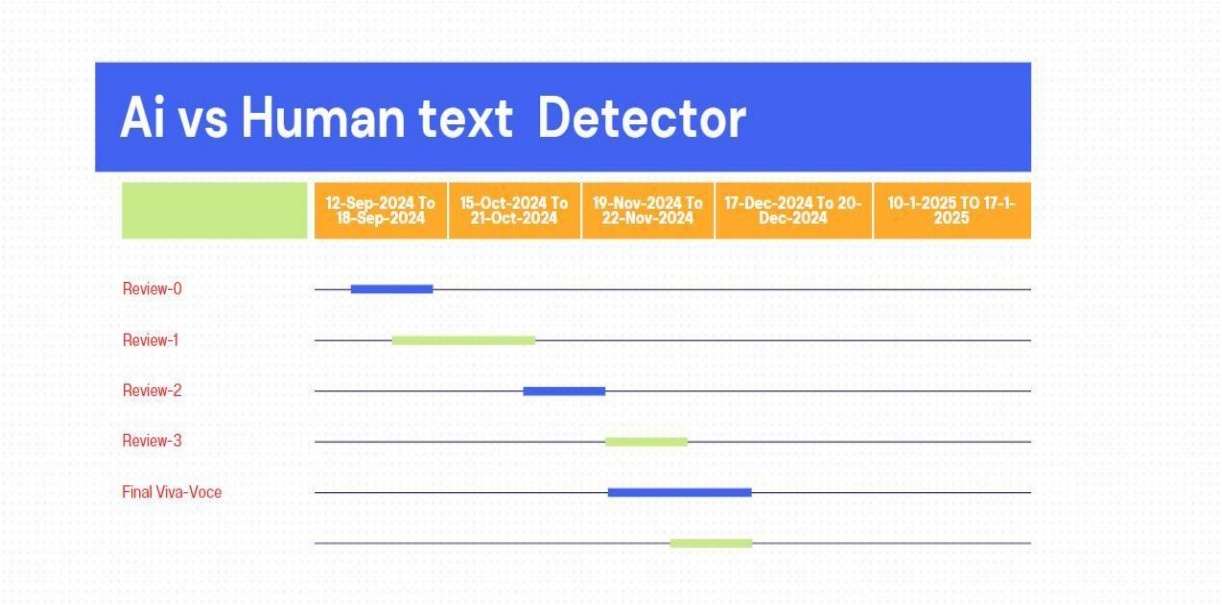

Fig.3 Gantt chart

Table.1 Review table

S. No.	Review(Offline)	Dates
1	Review-0	12-Sep-2024 To 18-Sep-2024
2	Review-1	15-Oct-2024 To 21-Oct-2024
3	Review-2	19-Nov-2024 To 22-Nov-2024
4	Review-3	17-Dec-2024 To 20-Dec-2024
5	Final Viva-Voce *	10-1-2025 TO 17-1-2025* *Subject to End Term Exam Dates

CHAPTER-8
OUTCOMES

The outcomes of the proposed AI-based plagiarism detection system can be categorized into technical achievements, academic contributions, and future implications. The following outcomes highlight the effectiveness, usability, and significance of the system:

1. Technical Outcomes

1. Accurate Detection:
   - Successfully implemented a model capable of identifying AI-generated content by analyzing perplexity and burstiness metrics.
   - Achieved a high accuracy rate in classifying human-written and AI-generated text based on extensive testing.

2. Efficient Processing:
   - Streamlined the detection process using pre-trained models such as GPT-2 or GPT-3.5.
   - Optimized computational efficiency for real-time plagiarism detection in both academic and non-academic texts.

3. Robust Feature Extraction:
   - Incorporated advanced preprocessing techniques, including tokenization, noise removal, and language identification, to ensure high-quality input for feature extraction.
   - Extracted reliable metrics (e.g., perplexity and burstiness) as primary indicators for detection.

4. Scalable and Modular System Design:
   - Designed a modular architecture that can integrate additional language models or features as technology evolves.
   - Developed a framework that is scalable for different text types and languages, ensuring broader applicability.

2. Academic and Practical Contributions

1. Enhanced Academic Integrity:
   - Provided a practical tool for educators, researchers, and institutions to maintain academic standards by identifying AI-written content in research papers, essays, and assignments.

2. Promoting Responsible AI Usage:
   - Raised awareness of ethical AI usage by demonstrating the potential misuse of language models for academic dishonesty.

3. Educational Insights:
   - Offered insights into the writing patterns of both humans and AI, aiding linguistic studies and the development of more advanced AI systems.

3. Visualization and Results Interpretation

1. Quantitative Outcomes:
   - Provided clear and interpretable scores for perplexity and burstiness, allowing users to understand the basis of the detection process.
   - Visualized word frequency distributions to illustrate burstiness metrics effectively.

2. Classification Results:
   - Output a classification label (e.g., Human-written or AI-generated) for user-submitted text, enabling actionable decisions.

4. Limitations and Scope for Improvement

1. Model Limitations:
   - Identified the boundaries of the current system when dealing with highly creative or specialized texts.
   - Recognized the need to adapt to evolving AI language models.

2. Future Adaptability:
   - Proposed the inclusion of more sophisticated detection algorithms to address future advancements in AI-generated content.

5. Broader Implications

1. Impact on Research Community:
   - Facilitated discussions on balancing AI advancements with ethical practices in academia.

2. Innovation in Plagiarism Detection:
   - Pioneered the integration of linguistic metrics with AI tools for plagiarism detection, setting a foundation for future innovations in this domain.

These outcomes demonstrate the significant technical, academic, and ethical contributions of the project, positioning it as a robust solution for modern challenges in content authenticity and plagiarism detection.

CHAPTER-9
RESULTS AND DISCUSSIONS

This study delved into the comparison between AI-generated text and human-authored text, specifically examining concepts of authorship and voice. The exploration sheds light on the challenges and limitations associated with AI tools like ChatGPT in generating coherent and nuanced academic content. Quantitative and qualitative analyses of authorship highlight the difficulties faced by AI-generated text in preserving a recognizable and unique authorial presence. The tool, while capable of using personal pronouns like "I," lacks genuine self-identification. The use of "I" merely reflects a prompted stance rather than an innate recognition of the tone or meaning of the text. In contrast, the type-token ratio indicates that the student's writing has a more complex and unique style with more lexical diversity. The student's essay has a strong sense of authorship and is written in a unique, subtle, and personalized style. When sources are used well, they fit the academic genre, leading to successful grading. The nuanced use of hedges, boosters, and a mix of active and passive voice constructions contributes to a sophisticated and balanced discourse.

Repetition strategically reinforces the main thesis without compromising vocabulary diversity or nuance. Even though the opening uses the first-person pronoun quite a bit, the AI-generated text lacks uniqueness. The overreliance on active voice constructions, limited use of hedges and boosters, and repetitive phrases contribute to a straightforward and less nuanced voice. The tool fails to present diversity and generate a sufficiently nuanced analysis of the topic. The study underscores the inherent difficulties of using AI tools for generating academic content, particularly in maintaining a nuanced authorial presence. While AI can replicate certain stylistic elements, genuine self-identification, nuanced voice, and sophisticated discourse remain challenging for these tools.

Students and scholars should approach AI-generated content with caution, recognizing its limitations in capturing the intricacies of academic writing. In the balance between human-authored and AI-generated text, this study emphasizes the unique strengths of human-authored content, characterized by a nuanced voice, diverse vocabulary, and effective use of

rhetorical elements. AI-generated text, while a valuable tool for certain tasks, falls short in replicating the depth and individuality inherent in human academic writing. As technology continues to evolve, understanding these limitations becomes crucial for maintaining the integrity and authenticity of academic discourse. The current study's conclusions, which highlight the limitations of AI-generated text in academic writing, are consistent with earlier research (Basic et al., 2023; Fyfe, 2023).

Together, these studies imply that, as of the study's time frame, artificial intelligence (AI)-generated text may not provide advantages over human-authored content in terms of essay quality, writing speed, or authenticity. Acknowledging the rapid advancements in ChatGPT and similar Large Language Models since the study's commencement, it's essential to recognize the dynamic nature of AI technologies. Continued improvements in these models may impact their capabilities, potentially influencing their performance in academic writing tasks. Regular reassessment through periodic studies, similar to the present one, becomes crucial to staying abreast of these developments. The study emphasizes the challenges associated with maintaining academic integrity when incorporating AI-generated text into academic assignments.

The lack of a genuine authorial presence and the potential for repetitive language highlight the risk of compromising the authenticity and originality of student work. Understanding the limitations of AI-generated text provides educators with insights into the areas where students excel in comparison. This knowledge can guide the development of educational strategies aimed at fostering nuanced writing, encouraging stylistic diversity, and promoting a more authentic authorial voice. Educators play a crucial role in assessing and grading student work. The study suggests that reliance on AI-generated content may not necessarily result in improved essay quality.

Therefore, instructors need to be discerning in their evaluation processes, considering factors such as individuality, nuance, and vocabulary diversity. Recognizing the distinct and nuanced voice present in humangenerated text highlights the importance of promoting writing skills development. Institutions can focus on activities and assignments that encourage students to develop their unique writing style, enhance lexical diversity, and express complex ideas with nuance. The study underscores the evolving nature of AI models and the need for periodic reassessment of their impact on academic writing. Educational programs should remain adaptable, incorporating new findings and adjusting curricula to equip students with the skills needed to navigate an environment where AI tools may

be prevalent. Students need to develop a level of technological literacy that includes an awareness of the strengths and limitations of AI-generated text. This understanding will empower them to leverage such tools effectively while preserving their individuality and authorial voice. The call for examining AI-enabled software for identifying and classifying text has direct implications for maintaining academic integrity. If successful, these tools could assist educators in quickly identifying the origin and originality of a text, contributing to more efficient and accurate assessments.

CHAPTER-10
CONCLUSION

As technology advances, the relationship between AI-generated and human-authored text in academic settings remains a dynamic field of inquiry. Continued research, adaptability to evolving AI capabilities, and exploration of innovative assessment tools will contribute to a nuanced understanding of the role AI can play in academic writing and the ongoing pursuit of academic integrity.

The study underscores the intricate nature of working with ChatGPT, emphasizing the challenges faced in attempts to generate desired outputs. It points out that the skill of effectively prompting ChatGPT is comparable to the art of writing itself. In the context of an English literature class, ChatGPT's limitations become evident, particularly in its inability to provide accurate quotes and sources, and its tendency to introduce factual errors. The need for meticulous cross-referencing and proofreading to obtain usable text from ChatGPT makes it a challenging avenue to pursue at the present time.

The study delves into the intersection of authorship, voice, and technology in academic writing. While acknowledging the capability of AI-generated text to produce seemingly coherent outputs, the research highlights the challenges AI faces in replicating the nuanced authorship characteristics inherent in human writing, such as accurate referencing and contextual appropriateness. Despite the outward appearance of human-like writing, closer scrutiny reveals issues with register, clichéd language, and a lack of nuance.

The study suggests that the generated text, while appearing human-like at a glance, lacks the depth and authenticity of a humanauthored piece. Despite efforts to get it to produce in a less generic style, the output is often cliched and generic due to the off-key register. The study raises an important question: Is it unexpected that a text produced by a machine would be referred to as having a robotic voice? The evident challenges faced in generating text for comparison underscore the current limitations of AI-generated text.

As AI-generated text becomes more prevalent, the study emphasizes the centrality of discussions around authorship, plagiarism, and originality. The findings caution against assuming that AI-generated content, while appearing cohesive, necessarily upholds the standards of nuanced and authentic human writing. This has implications for the evolving discourse on the ethical use of AI in academic contexts. Future investigations should consider conducting similar studies as ChatGPT and other AI models evolve. Comparisons using established evaluation criteria could explore the efficacy of AI-generated text against human-authored content across various topics. This approach would facilitate a nuanced understanding of the evolving landscape and the potential application of findings to diverse academic contexts. The study suggests a need for critical examination of AI-enabled software designed to identify and classify text as either human-written or generated. Investigating the methods employed in making such distinctions is vital. Moreover, assessing whether a human can achieve comparable results in discerning the origin and originality of a text would be valuable. If feasible, this capability could significantly aid educators in efficiently evaluating the authenticity of written content

APPENDIX-A

PSUEDOCODE

App.py :

```
import Streamlit as st
from transformers import GPT2Tokenizer, GPT2LMHeadModel
import torch
import nltk
from nltk.util import ngrams
from nltk.lm.preprocessing import pad_sequence
from nltk.probability import FreqDist
import plotly.express as px
from collections import Counter
from nltk.corpus import stopwords
import string

nltk.download('punkt')
nltk.download('stopwords')

# Load GPT-2 tokenizer and model
tokenizer = GPT2Tokenizer.from_pretrained('gpt2')
model = GPT2LMHeadModel.from_pretrained('gpt2')

def calculate_perplexity(text):
    encoded_input = tokenizer.encode(text, add_special_tokens=False, return_tensors='pt')
    input_ids = encoded_input[0]

    with torch.no_grad():
        outputs = model(input_ids)
        logits = outputs.logits

    perplexity = torch.exp(torch.nn.functional.cross_entropy(logits.view(-1, logits.size(-1)),
input_ids.view(-1)))
    return perplexity.item()

def calculate_burstiness(text):
    tokens = nltk.word_tokenize(text.lower())
    word_freq = FreqDist(tokens)
    repeated_count = sum(count > 1 for count in word_freq.values())
    burstiness_score = repeated_count / len(word_freq)
    return burstiness_score

def plot_top_repeated_words(text):
    # Tokenize the text and remove stopwords and special characters
    tokens = text.split()
```

```
    stop_words = set(stopwords.words('english'))
    tokens = [token.lower() for token in tokens if token.lower() not in stop_words and
token.lower() not in string.punctuation]

    # Count the occurrence of each word
    word_counts = Counter(tokens)

    # Get the top 10 most repeated words
    top_words = word_counts.most_common(10)

    # Extract the words and their counts for plotting
    words = [word for word, count in top_words]
    counts = [count for word, count in top_words]

    # Plot the bar chart using Plotly
    fig = px.bar(x=words, y=counts, labels={'x': 'Words', 'y': 'Counts'}, title='Top 10 Most
Repeated Words')
    st.plotly_chart(fig, use_container_width=True)




# Streamlit layout
st.set_page_config(layout="wide")
st.title("Ai vs Human text Detector")
text_area = st.text_area("Enter text", "")

if text_area is not None:
    if st.button("Analyze"):
        col1, col2, col3 = st.columns([1, 1, 1])
        with col1:
            st.info("Your Input Text")
            st.success(text_area)

        with col2:
            st.info("Detection Score")
            perplexity = calculate_perplexity(text_area)
            burstiness_score = calculate_burstiness(text_area)

            st.write("Perplexity:", perplexity)
            st.write("Burstiness Score:", burstiness_score)

            if perplexity > 20000 and burstiness_score < 0.25:
                st.error("Text Analysis Result: AI generated content")
            else:
                st.success("Text Analysis Result: Likely not generated by AI")

            st.warning("Disclaimer: AI plagiarism detector apps can assist in identifying
potential instances of plagiarism; however, it is important to note that their results may not
```

be entirely flawless or completely reliable. These tools employ advanced algorithms, but they can still produce false positives or false negatives. Therefore, it is recommended to use AI plagiarism detectors as a supplementary tool alongside human judgment and manual verification for accurate and comprehensive plagiarism detection.")

```
    with col3:
        st.info("Basic Details")
        plot_top_repeated_words(text_area)
```

Main.py:

```
import json
from difflib import get_close_matches
import pandas as pd
import pickle
import numpy as np
from datetime import datetime
from flask import Flask, render_template, redirect, request, session, url_for
from flask import Flask, render_template
import firebase_admin
import random
from firebase_admin import credentials
import os
from flask import Flask, request, jsonify
from firebase_admin import credentials, firestore, initialize_app
from google.cloud.firestore_v1 import FieldFilter
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score

cred = credentials.Certificate("key.json")
firebase_admin.initialize_app(cred)
app = Flask(__name__)

app.secret_key="CustomerSuport@1234"
app.config['upload_folder']='/static/upload'

@app.route('/')
def homepage():
    try:
        return render_template("index.html")
    except Exception as e:
        return str(e)

@app.route('/index')
def indexpage():
    try:
        return render_template("index.html")
    except Exception as e:
        return str(e)

@app.route('/logout')
def logoutpage():
    try:
        return render_template("index.html")
```

```
    except Exception as e:
        return str(e)

@app.route('/about')
def aboutpage():
    try:
        return render_template("about.html")
    except Exception as e:
        return str(e)

@app.route('/usermainpage')
def usermainpage():
    try:
        return render_template("usermainpage.html")
    except Exception as e:
        return str(e)

@app.route('/logout')
def logout():
    try:
        return render_template("index.html")
    except Exception as e:
        return str(e)

@app.route('/services')
def servicespage():
    try:
        return render_template("services.html")
    except Exception as e:
        return str(e)

@app.route('/gallery')
def gallerypage():
    try:
        return render_template("gallery.html")
    except Exception as e:
        return str(e)

@app.route('/userlogincheck', methods=['POST'])
def userlogincheck():
    try:
        if request.method == 'POST':
            uname = request.form['uname']
            pwd = request.form['pwd']
            db = firestore.client()
            print("Uname : ", uname, " Pwd : ", pwd);
            newdb_ref = db.collection('newuser')
            dbdata = newdb_ref.get()
            data = []
            flag = False
```

```
        for doc in dbdata:
            #print(doc.to_dict())  #print(f'{doc.id}
            => {doc.to_dict()}')
            #data.append(doc.to_dict())
            data = doc.to_dict()
            if(data['UserName']==uname and data['Password']==pwd):
                flag=True
                session['userid']=data['id']
                break
        if(flag):
            print("Login Success")
            return render_template("usermainpage.html")
        else:
            return render_template("userlogin.html", msg="UserName/Password is Invalid")
    except Exception as e:
        return render_template("userlogin.html", msg=e)

@app.route('/userlogin',methods=["POST","GET"])
def userloginpage():
    try:
        if request.method == 'POST':
            uname = request.form['uname']
            pwd = request.form['pwd']
            db = firestore.client()
            newdb_ref = db.collection('newuser')
            dbdata = newdb_ref.get()
            flag = False
            for doc in dbdata:
                data = doc.to_dict()
                if (data['UserName'] == uname and data['Password'] == pwd):
                    flag = True
                    session['userid'] = data['id']
                    break
            if (flag):
                print("Login Success")
                return render_template("usermainpage.html")
            else:
                return render_template("userlogin.html", msg="UserName/Password is Invalid")
        return render_template("userlogin.html")
    except Exception as e:
        return str(e)

@app.route('/newuser')
def newuser():
    try:
        msg=""
        return render_template("newuser.html", msg=msg)
    except Exception as e:
        return str(e)
```

```
@app.route('/addnewuser', methods=['POST',"GET"])
def addnewuser():
    try:
        print("Add New User page")
        if request.method == 'POST':
            fname = request.form['fname']
            lname = request.form['lname']
            uname = request.form['uname']
            pwd = request.form['pwd']
            email = request.form['email']
            phnum = request.form['phnum']
            address = request.form['address']
            id = str(random.randint(1000, 9999))
            json = {'id': id,
                    'FirstName': fname,'LastName':lname,
                    'UserName': uname,'Password':pwd,
                    'EmailId': email,'PhoneNumber':phnum,
                    'Address': address}
            db = firestore.client()
            newuser_ref = db.collection('newuser')
            id = json['id']
            newuser_ref.document(id).set(json)
        return render_template("newuser.html", msg="New User Added Success")
    except Exception as e:
        return str(e)

@app.route('/contact',methods=['POST','GET'])
def contactpage():
    try:
        if request.method == 'POST':
            name = request.form['name']
            email = request.form['email']
            subject = request.form['subject']
            message = request.form['message']
            id = str(random.randint(1000, 9999))
            json = {'id': id,
                    'ContactName': name,
                    'Message': message, 'Subject': subject,
                    'EmailId': email}
            db = firestore.client()
            db_ref = db.collection('newcontact')
            id = json['id']
            db_ref.document(id).set(json)
            msg="Contact Added Success"
            return render_template("contact.html",msg=msg)
        else:
            return render_template("contact.html")
    except Exception as e:
        return str(e)
```

```
@app.route('/userviewprofile')
def userviewprofile():
    try:
        id=session['userid']
        print("Id",id)
        db = firestore.client()
        newdb_ref = db.collection('newuser')
        data = newdb_ref.document(id).get().to_dict()
        print(data)
        return render_template("userviewprofile.html", data=data)
    except Exception as e:
        return str(e)
        return render_template("userviewprofile.html", msg=e)


    # New route to handle the Detector click
@app.route('/detector')
def detector():
    # Redirect to the Streamlit app
    return redirect("http://localhost:8501", code=302)

if __name___== '__main__':
    app.debug = True
    app.run()
```

APPENDIX-B

SCREENSHOTS

Home-page:

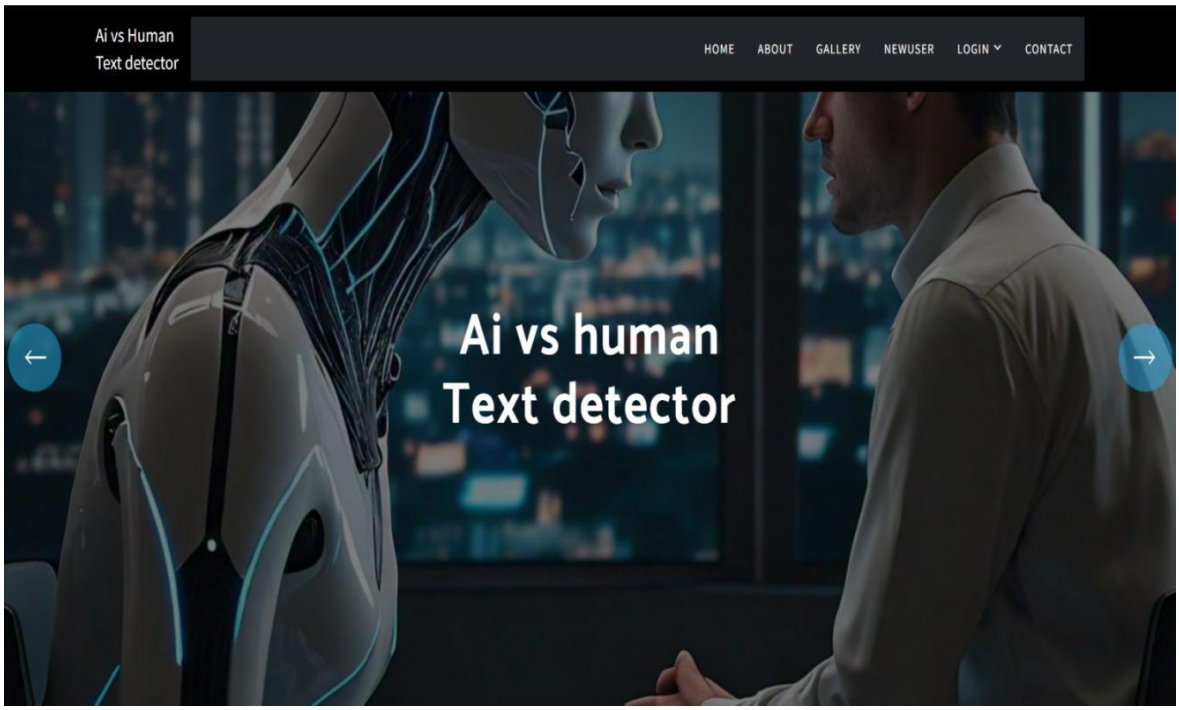

Fig.4:Home page

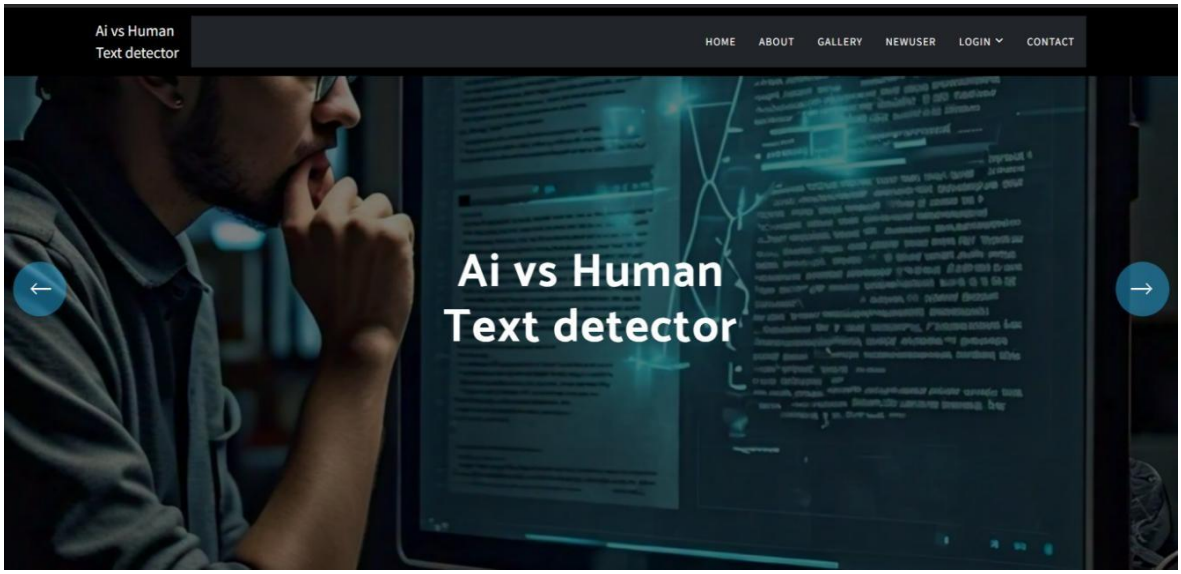

Fig.4.1: Home page

About-page:

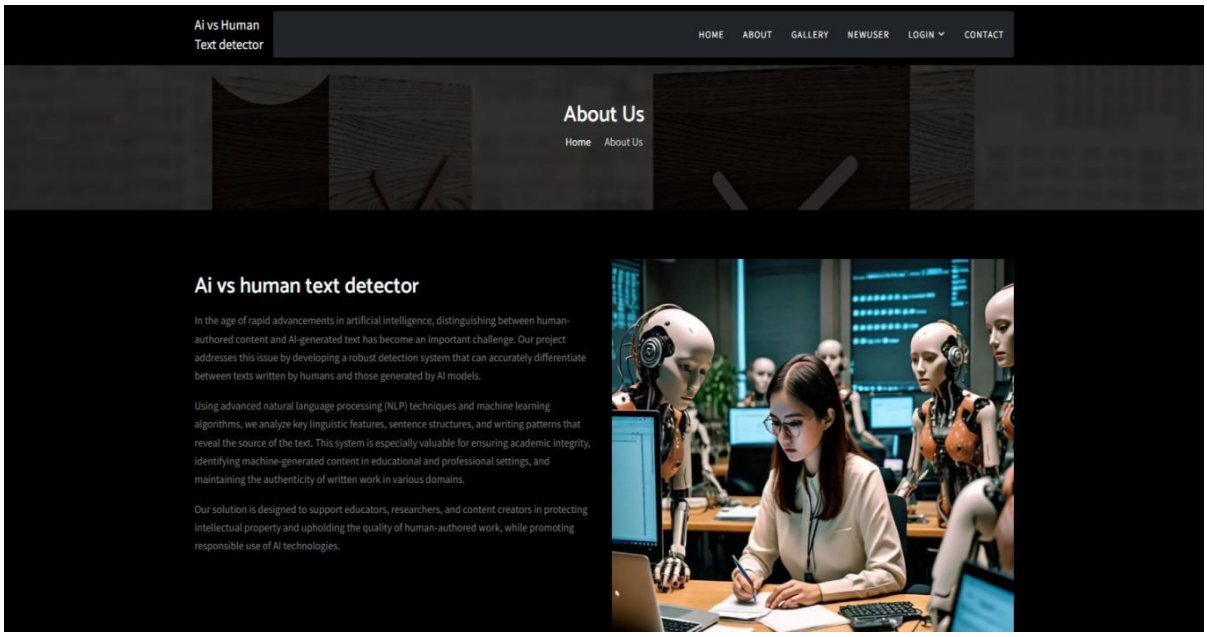

Fig.5: About page

Gallery-page:

Fig.6:Gallery-page:

New-user registration page:

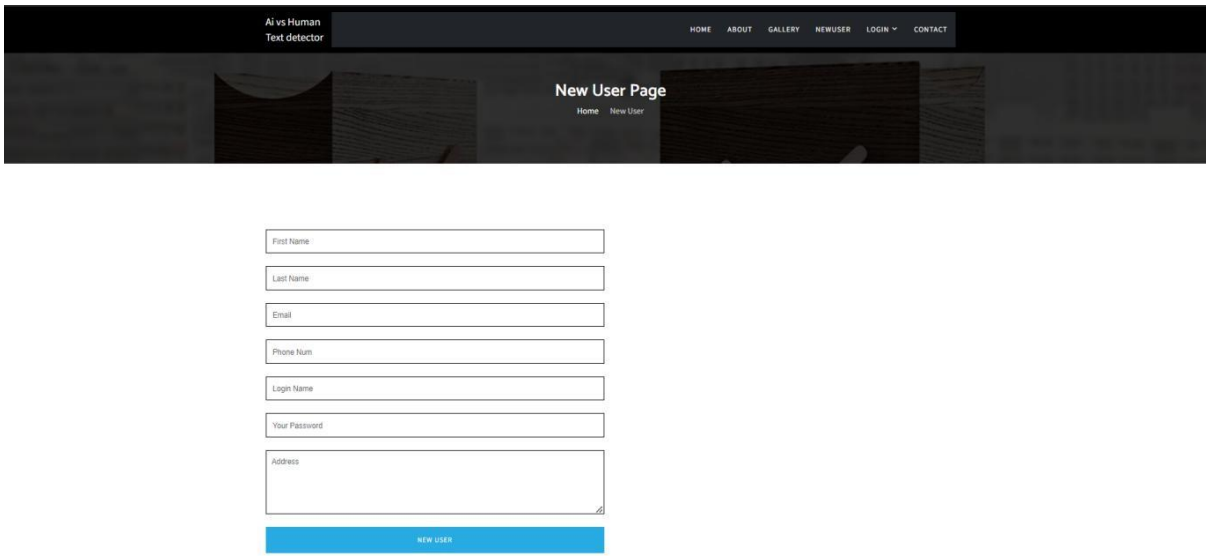

Fig.7:New-user registration page

User-login-page:

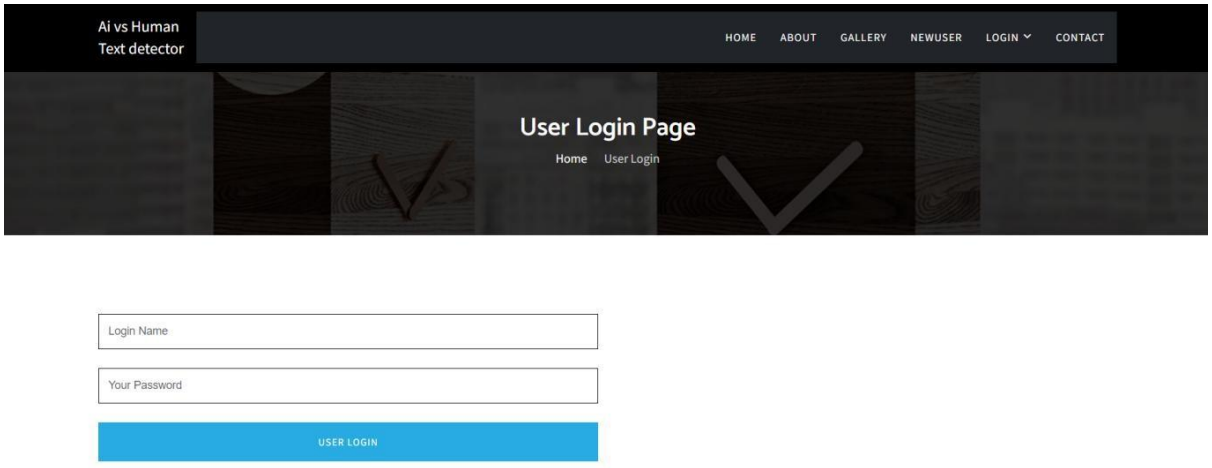

Fig.8:User-login-page

Contact-page:

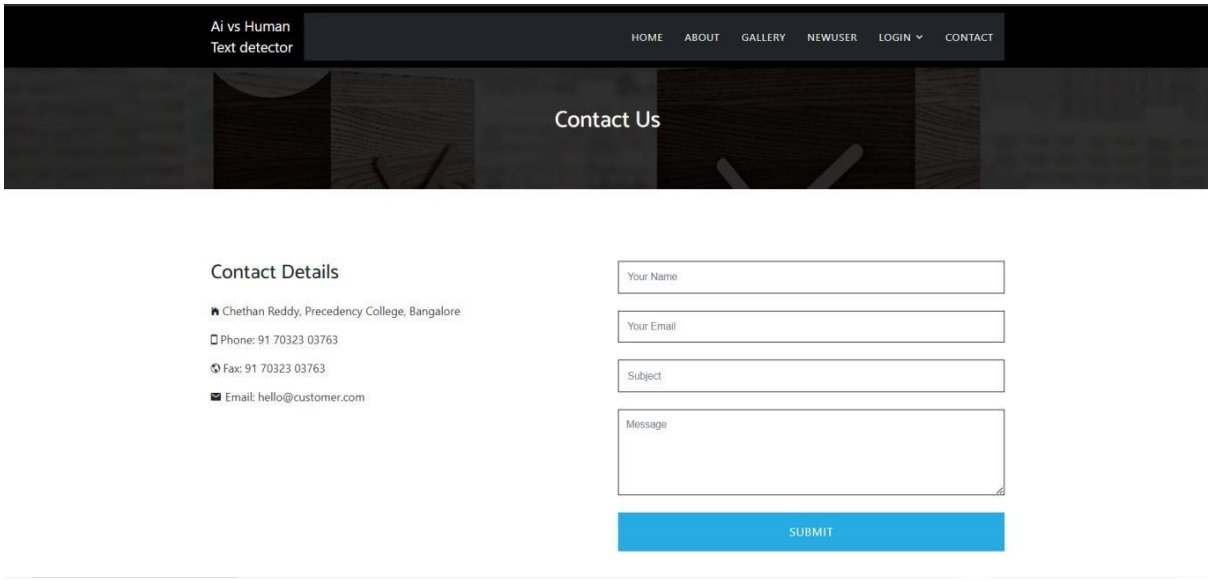

Fig.9:Contact-page

User-page:

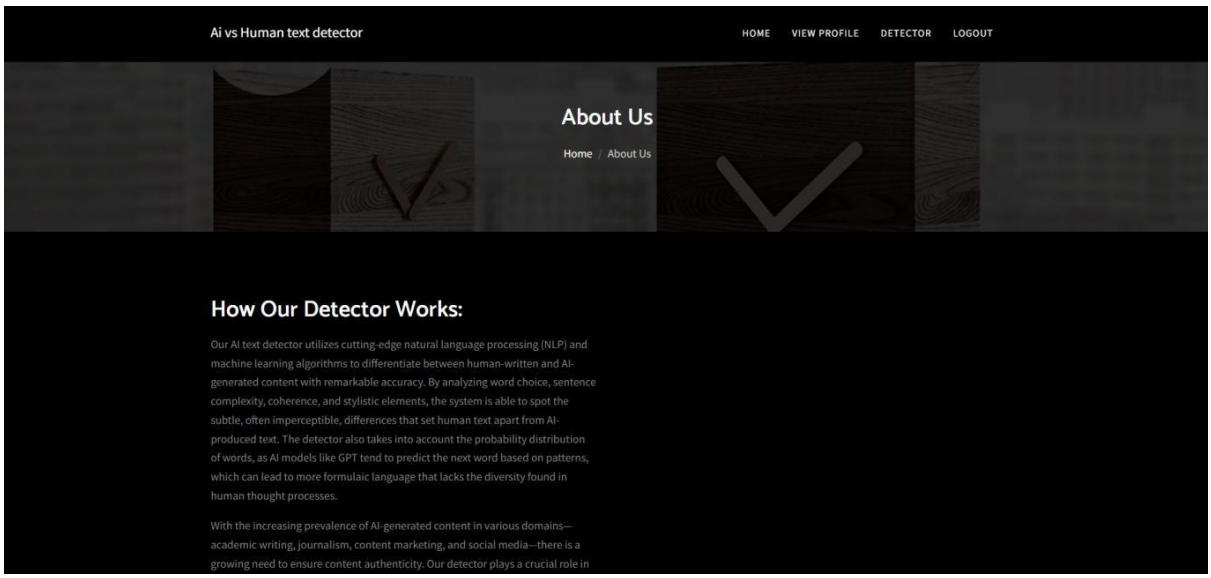

Fig.10:User-page

Detector-page:

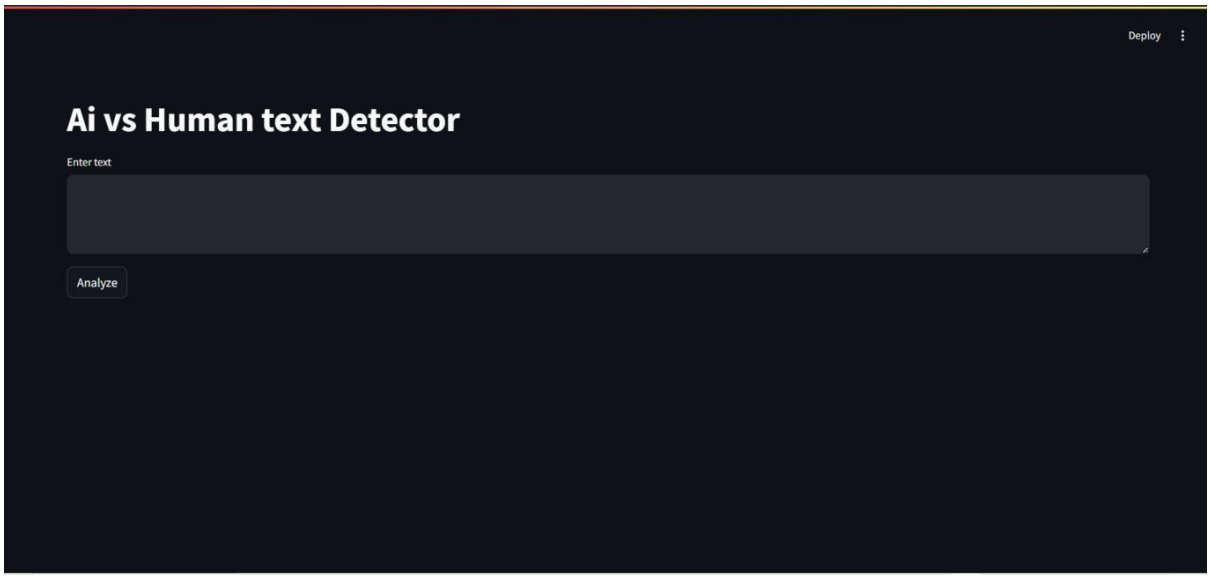

Fig.11:Detector-page

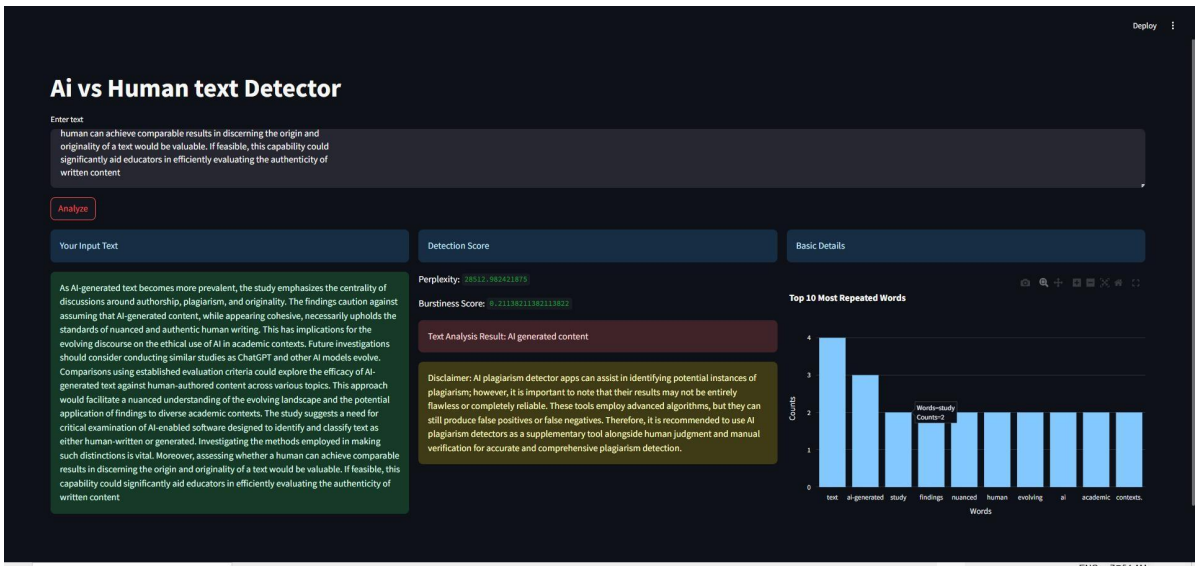

Fig.12 :AI generated content

Settings-menu:

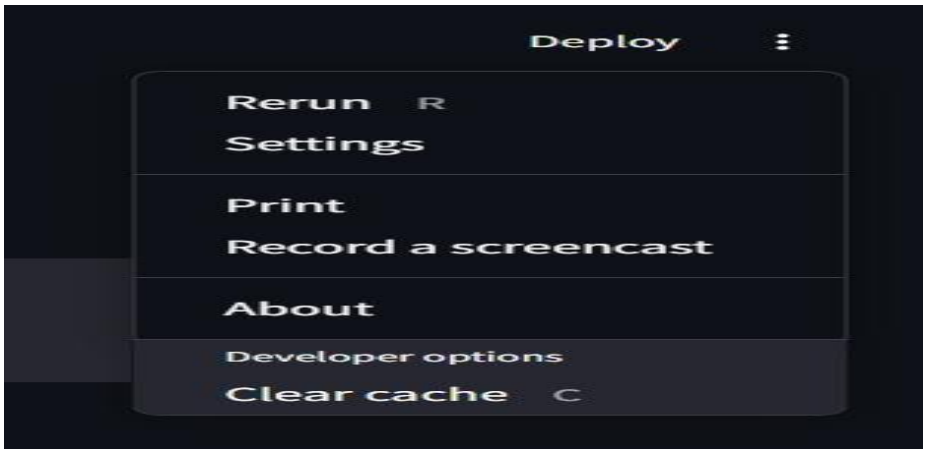

Fig.13:Settings-menu

Settings-slide:

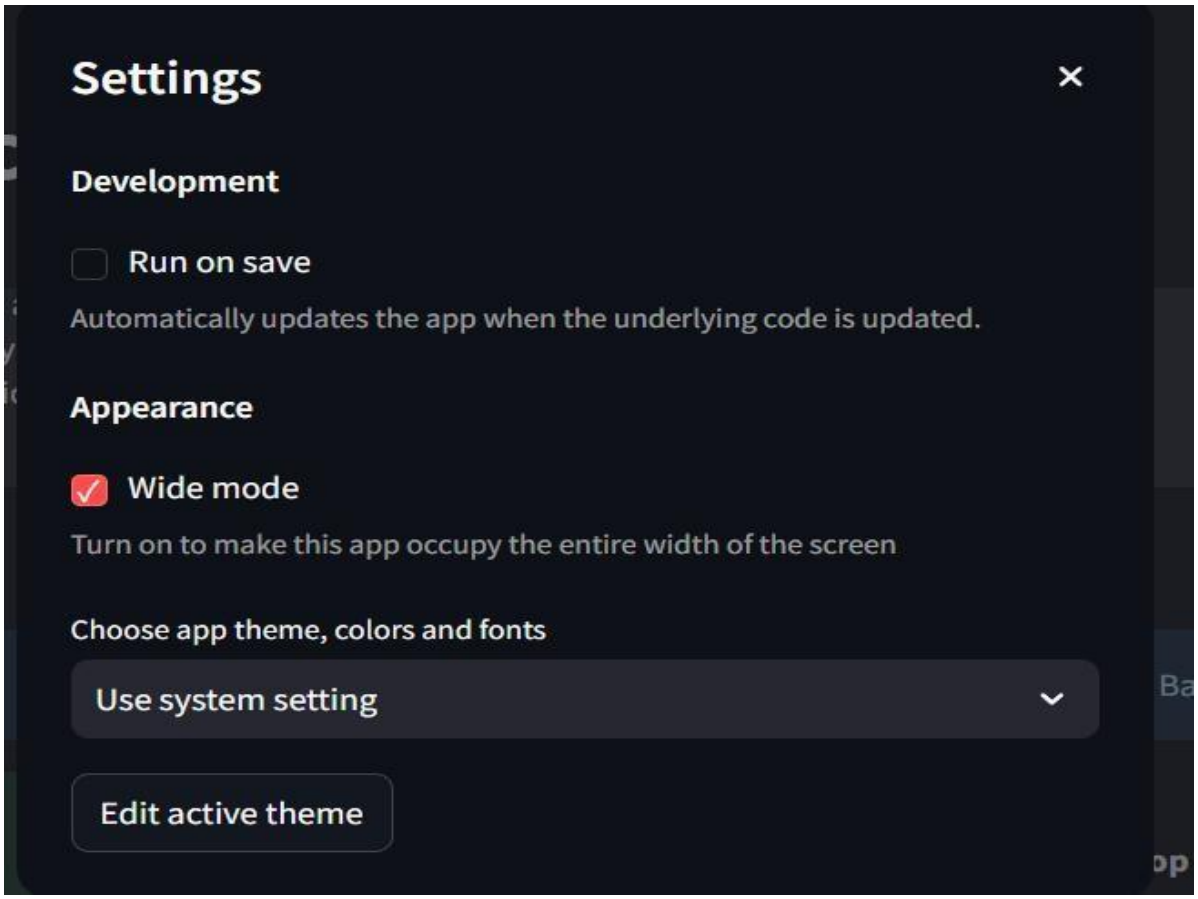

Fig.14:Settings-slide

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APPENDIX-C

Fig.15: SDG Mapping

The SDGs are a set of 17 global goals that were adopted by the United Nations in 2015. They aim to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity by 2030. The goals are interconnected, meaning that progress in one area will benefit other areas. For example, providing access to clean water and sanitation (Goal 6) will contribute to improved health and well-being (Goal You can learn more about the SDGs and how you can contribute to achieving them by visiting the United Nations Sustainable Development Goals website. Here are some specific ways that your chatbot can help customers learn about and support the SDGs: Provide information about the goals and their targets. Answer questions about how customers can take action to support the SDGs in their own lives. Connect customers with organizations that are working to achieve the SDGs. For example, if a customer asks your chatbot "What are the SDGs?", the chatbot could respond with "The SDGs are a set of 17 goals that aim to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity by 2030. One of the goals is Goal 13, which is to take action on climate change. You can learn more about the SDGs and how you can contribute to achieving them by visiting the United Nations Sustainable Development Goals website."

Ai-vs-Human-text-detector_final_report(palagrism)new1

ORIGINALITY REPORT

20%	16%	14%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.frontiersin.org Internet Source	8%
2	Submitted to Harare Institute of Technology Student Paper	1%
3	Forough Amirjalili, Masoud Neysani, Ahmadreza Nikbakht. "Exploring the boundaries of authorship: a comparative analysis of AI-generated text and human academic writing in English literature", Frontiers in Education, 2024 Publication	1%
4	mau.diva-portal.org Internet Source	1%
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16	Zahra Shahsavar, Reza Kafipour, Laleh Khojasteh, Farhad Pakdel. "Is artificial intelligence for everyone? Analyzing the role of ChatGPT as a writing assistant for medical students", Frontiers in Education, 2024 Publication	<1%
17	medium.com Internet Source	<1%

AI VS HUMAN – ACADEMIC ESSAY AUTHENTICITY CHALLENGE

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***Abstract*—The appearance of large language models (LLM) including GPT 3.5 and GPT-4 have called into question the integrity of academic writing, as it is becoming increasingly more difficult to distinguish between essays written by humans and those that are AIgenerated. This project seeks to create an answer to this challenge by designing a binary classification model, to identify if an essay was written by a human, or a machine. The dataset contains essays written by humans, which were gathered from the ETS Corpus of Non-Native Written English, alongside essays written by AI from seven LLMs: GPT-3.5-Turbo, GPT-4o, Gemini-1.5, Llama-3.1 (8B), Phi-3.5-mini, Claude-3.5. Utilizing natural language processing (NLP) techniques and machine learning algorithms, this system will skim for linguistic patterns in academic essays written in English and Arabic in order to separate either human essays from AI induced writing. It is a solution that will support academic authenticity and lessen academic dishonesty with the misuse of AI tools in the university classroom to help our institutions support fair academic practices.**

***Index Terms*—Authentication, Firebase.**

I. INTRODUCTION

Education has faced many issues as a result of the rapid advancement of artificial intelligence (AI), particularly with regard to large language models (LLMs). The sophistication of models such as GPT-3.5-Turbo and GPT-4o has increased to the point where they can now generate text that is human- like. The inability to tell whether a piece of writing is an essay written by a student or a response generated by a machine or artificial intelligence program has caused anxiety in academic contexts. More precisely, the capacity of an AI model to generate well-structured, cohesive writings presents moral and practical issues regarding equity in the classroom and in academic settings. One of the most pressing ethical concerns is that students may choose to act unethically and submit an essay written entirely by an LLM such that the LLM would be cited as the author. If students undermine the purpose of education - to learn - and produce written texts that are entirely the work of an AI tool - this will most definitely call into question the original in tentor quality an institution intends to measure within its curriculum. To access or evaluate students' writing, more than likely they will measure the originality or quality of the essay in its entirety. Determining if an essay in fact was sincerely authored by the student, or rather an AI-generated text is the need for this project. As such, this project, "AI vs Human: Academic Essay Authenticity Challenge," involves the design of a binary classification challenge that will assess essays based on whether they are authored by humans versus essays generated by AI. The dataset used for this project will be comprised of essays which were written by human authors, specifically including essays from the ETS Corpus of Non- Native Written English. This Corp is a robust database inclusive of a myriad of essays developed by human authors who are non-native English speakers. Since human authors from across the globe participated in writing the essays, the essays cover writing at a range of proficiency levels and an amalgamation of syntactic styles created by various authors. The essays taken form this corpus will create a more challenging assessment task for the binary challenge between the produced human essays and the AI generated responses. Alongside the human-created essays, machine-written essays will be obtained from seven different LLMs (Large language models): GPT-3.5-Turbo, GPT-4o, GPT-4omini, Gemini-1.5, Llama-3.1 (8B), Phi-3.5-mini, and Claude-3.5. The model will analyze linguistic structures and structural and stylistic features to distinguish between human and AI-essays so that academic institutions can protect the authenticity and integrity of students' work.

II. PROBLEM STATEMENT

The objective is to identify machine-generated essays to safeguard academic integrity and prevent the misuse of large language models in educational settings. The input to the system would be essays including texts authored by both native and non-native speakers, as well as essays generated by various large language models. The task is defined as follows: "Given an essay, identify whether it is generated by a machine or authored by a human." This is a binary classification task and is offered in English.

III. EASE OF USE

The simplicity of usage of essays produced by AI is one of the factors contributing to their growing popularity. AI systems can produce comprehensive, well-structured essays in a matter of seconds with very little input, usually only a subject or prompt. Students who are under academic pressure can save time with this aptitude, but it can also promote reliance and diminish critical thinking. Human-written essays, on the other hand, need extensive research, draughting, and revision; these processes take time but promote creativity, critical thinking, and a better comprehension of the subject. Human effort guarantees skill improvement and personal progress, even while AI streamlines the process.

IV. LITERATURE SURVEY

Table 1:- Data of recent research

SL.NO	Study	Methodology	Results	Key Limitations
1	Deep Fusion Model for Human vs. Machine-Generated Essay Classification	Used Bidirectional LSTM and Linguistic Features for classification.	Performance depends on the AI tool used; metrics like F1-score, Precision, and Recall were reported.	Performance varies with different AI writing tools. - Struggles with nuanced/context-heavy essays. - Potential overfitting due to limited dataset diversity. - Metrics provide limited insights into essay quality, style, and context.
2	Assessing AI Detectors in Identifying AI-Generated Code	Evaluated 5 AIGC detectors (GLTR, GPT-2 Detector, GPTZero, Sapling, DetectGPT) on AI-generated Python code.	GLTR accuracy ranged from 0.4841 to 0.7693, p-value = 0.0296. All tools struggled with false positives/negatives.	Tools showed high rates of false positives/negatives. - GPTZero struggled with syntax detection. - Overall low accuracy for distinguishing human vs. AI code.
3	Text Origin Detection: Unmasking the Source (AI vs. Human)	Combined TF-IDF features and ensemble models (Random Forest, Extra Tree Classifier) on Kaggle dataset of 419,199 submissions.	Accuracy: 80.29%, Precision: 78.02%, Recall: 81.57%, F1-score: 79.76%, MCC: 60.62%. A Tkinter GUI was developed.	Difficulty processing longer texts. - Limited cross-linguistic accuracy (e.g., English-Arabic). - More diverse datasets needed to address potential bias.
4	Detection of AI-Generated Essays in Writing Assessments	Analyzed GPT-3 AI essays (balanced dataset of 8,000 essays) using e-rater® and RoBERTa.	Achieved >95% accuracy in detecting AI-generated essays.	Limited diversity in prompts. - Grammar errors excluded, oversimplifying real-world scenarios. - Dataset size and prompt variety require expansion for better representation.
5	Hiding the Ghostwriters: Adversarial Evaluation of AI-Generated Student Essay Detection	Explored adversarial perturbation techniques (paraphrasing, word/sentence substitution) to evade AI detection on the AIG-ASAP dataset.	Perturbations significantly reduced detection rates.	Dataset limited to U.S. high school essays. - Focused on dataset creation, lacking implementation insights. - Findings may not generalize to broader contexts.

V. METHODOLOGY

A binary classification system was put into place using machine learning and natural language processing (NLP) approaches to solve the problem of differentiating essays written by humans from those produced by artificial intelligence. The approach is comprised of the following steps:

1. Data Collection

The dataset comprises two distinct sources: Human-authored essays: Essays were sourced from the ETS Corpus of Non-Native Written English. This corpus contains a wide range of writing samples from non-native English speakers, allowing the model to analyze human-authored essays with varying syntactic styles and proficiency levels. The corpus is especially valuable because of its diversity in writing patterns, making it a robust resource for training models. AI-generated essays: Texts generated by seven large language models (LLMs) were included: GPT-3.5-Turbo, GPT-4o, Gemini-1.5, Llama-3.1 (8B), Phi-3.5-mini, and Claude-3.5. Each model provided multiple samples of essays, covering various academic writing prompts. These AI-generated essays simulate responses that might be expected in a university setting.

2. Preprocessing

Both human and AI-generated essays underwent preprocessing to ensure consistency and remove noise from the text. The following steps were employed:

Tokenization: To improve linguistic analysis, each essay was tokenised into individual words or subword units.

Lowercasing: To prevent inconsistencies because to case sensitivity, all text was changed to lowercase.

Stopword Removal: To concentrate on more important topics, common English stopwords were eliminated.

Lemmatization: Words were lemmatized to their base forms, ensuring that variations of a word (e.g., "writing" vs. "write") were treated consistently.

3. Feature Extraction

A number of language characteristics that captured stylistic and structural factors were taken from articles written by humans and by machines: Inverse Document Frequency-Term Frequency (TF-IDF): This approach measured each essay's word relevance in relation to the corpus as a whole. To distinguish between common and unique word usage in essays written by humans and by AI, the TF-IDF values were employed**.**

Syntactic Features: The use of sentence structure, grammatical patterns, and part-ofspeech tagging were analyzed to detect differences between human and machine writing styles.8 Lexical Richness and Diversity: Measures such as word length, sentence complexity, and lexical variety were used to capture the richness of human writing versus the more repetitive nature of AI text.

Embeddings: Word embeddings like GloVe or BERT were employed to capture contextual and semantic nuances in the essays.

4. Model Selection and Training

To determine the best classifier, a mix of deep learning models and conventional machine learning methods were tested.

Dataset:

The dataset for this project consists of tokenized essays sourced from both human authors and AI-generated content,providing a solid foundation for distinguishing between the two through natural language processing (NLP) techniques.

5. Human-Authored Essays:

The human-authored essays were tokenized from the ETS Corpus of Non-Native Written English. This corpus includes a variety of essays written by non-native English speakers, representing a broad spectrum of proficiency levels and syntactic styles. The tokenization process involved splitting the text into individual tokens—essentially breaking down each essay into smaller units, such as words or subword segments. This method allows for more granular analysis of linguistic patterns, aiding in the identification of subtle differences in sentence structure, word choice, and grammar commonly found in human writing. By tokenizing these essays, we ensured that the linguistic features could be effectively compared to machine-generated text, even when the writing deviated from standard forms of native English.

AI-Generated Essays*:*

The text from seven cutting-edge large language models (LLMs) was tokenised to create the AI-generated essays. These models included:

GPT-3.5 Turbo
The GPT-4o
The Gemini-1.5
Llama 3.1 (8B)
Mini Claude-3.5
Phi-3.5

Tokenizing the AI-generated essays ensures consistency in how both human and machine-written texts are processed. By breaking the AI- generated content into tokens, we were able to capture specific patterns and repetitions in sentence construction, which are often characteristic of machine-generated text. The tokenization

process is crucial for comparing the linguistic output of AI models with human writing and allows for better analysis of syntactic structures, stylistic variations, and lexical diversity.

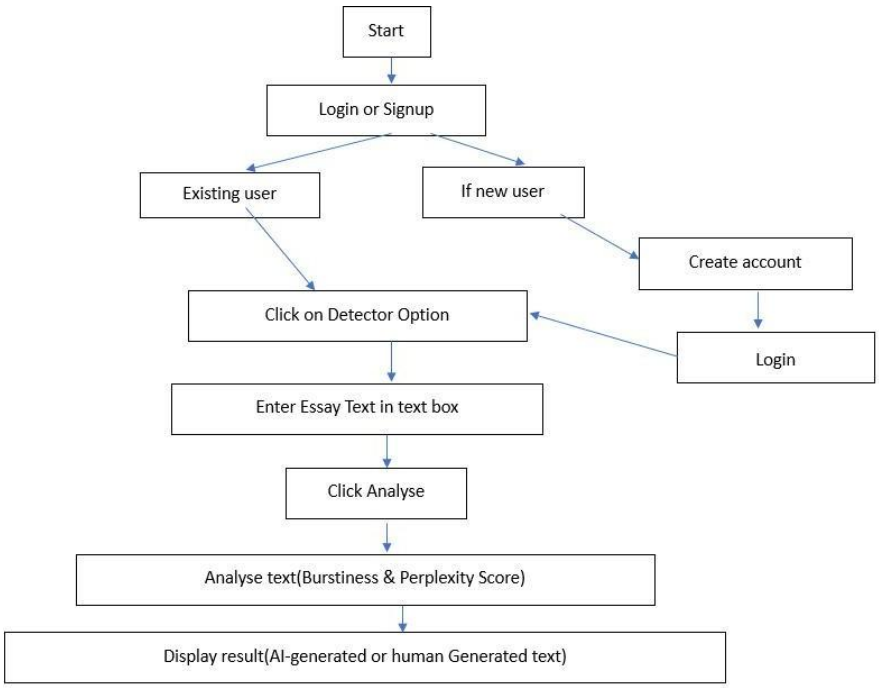
Tokenization Process:

The essays from both human and AI sources were tokenized using a standard NLP approach that breaks the text into smaller units based on word boundaries, punctuation, and subword patterns. This process involved: Word-level tokenization: Splitting essays into individual words, removing punctuation, and standardizing case(lowercasing).

Subword-level tokenization: Using techniques like Byte-Pair Encoding (BPE), which helps in handling rare or unseen words by breaking them down into smaller, more frequent subword units. The resulting tokenized data is stored in a structured format, with each essay represented as a sequence of tokens. This consistent tokenization is key to ensuring that the machine learning model can effectively analyze and compare human and AI-generated essays. By focusing on tokenized data from human and machine sources, the project leverages the power of linguistic granularity to capture differences in writing patterns. This enables the binary classification system to more accurately differentiate between human authored and AI-generated essays, even when the distinctions are subtle.

VI. ARCHITECTURE

Fig 1



VII. RESULTS AND DISCUSSION

This study examined the differences between literature created by AI and text written by humans, paying particular attention to ideas of authorship and voice. The investigation clarifies the difficulties and restrictions that come with using ChatGPT and other AI techniques to produce complex and cohesive academic writing. The challenges AI-generated text faces in maintaining a distinct and identifiable authorial presence are brought to light by both quantitative and qualitative authorship studies. The technology lacks true self- identification, even though it can use personal pronouns like "I." Instead of an instinctive understanding of the tone or meaning of the text, the usage of "I" only indicates a prompted posture. On the other hand, the type-token ratio suggests that the student's writing is more lexically diverse and has a more intricate and distinctive style. The student's article is written in a distinctive, nuanced, and customised style, and it exudes a strong feeling of authorship. Effective utillisation of sources results in successful

grading since they fit the academic format. Using hedges, boosters, and a mix of active and passive voice constructions carefully results in a thorough and well-rounded discourse.

Strategic repetition preserves the main concept without compromising language diversity or complexity. The first person pronoun is used a lot in the opening, but the AI- generated language lacks originality. Repetition of phrases, sparing use of hedges and boosters, and excessive use of active voice constructions all contribute to a straightforward and less nuanced voice. In addition to lacking diversity, the instrument does not produce a sufficiently thorough examination of the subject. The study highlights how difficult it may be to create scholarly literature using AI tools, particularly when it comes to maintaining a sophisticated authorial presence. AI is still unable to replicate complicated speech, subtle voice, and genuine self-identification, despite its ability to copy certain style elements.

AI-generated work should be handled carefully by students and academics, who should be aware of its limits in capturing the complexities of academic writing. This study highlights the distinct advantages of human-authored material in the balance between AI-generated and human-authored language. These advantages include a nuanced voice, a varied vocabulary, and the skillful application of rhetorical devices. While useful for some jobs, AI-generated prose is unable to capture the richness and uniqueness of academic writing produced by humans. As technology advances, it is essential to comprehend these constraints in order to preserve the authenticity and integrity of scholarly discourse. The findings of the present investigation, which underscore the constraints of artificial intelligence-generated text in scholarly composition, align with previous studies.

In terms of essay quality, writing speed, or authenticity, all of these findings suggest that, at the time of the study, content produced by artificial intelligence (AI) might not be any superior to content created by humans. It's critical to acknowledge the dynamic nature of AI technologies, particularly in light of the quick development of ChatGPT and related Large Language Models since the start of the study.

Their talents could be impacted by further advancements in these models, which could have an effect on how well they perform on academic writing assignments. Keeping up with these advancements requires regular reappraisal through periodic studies like the one being conducted now .The study highlights the difficulties in upholding academic integrity when using material produced by artificial intelligence in assignments.

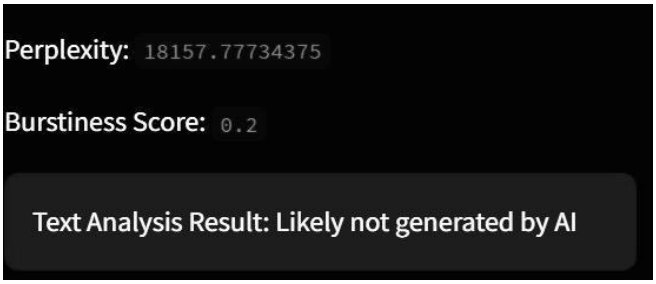


Fig.2 Not generated by AI

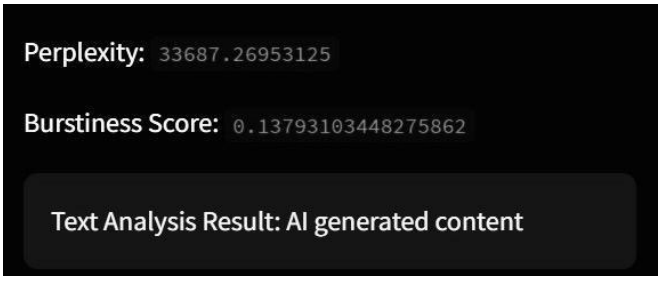


Fig.3 Generated by AI

VIII. CONCLUSION

The link between AI-generated writing and human-written language in academic settings is still a dynamic area of research as technology develops. Understanding the role AI can play in academic writing and the ongoing pursuit of academic integrity will be made possible by a more thorough ongoing investigation, flexibility in responding to

changing AI capabilities, and investigation of novel assessment techniques. The study highlights the complexity of using ChatGPT and the difficulties encountered while attempting to produce the intended results. It makes the argument that the art of writing itself is similar to the skill of successfully provoking ChatGPT. ChatGPT's shortcomings become clear in an English literature lesson, especially when it comes to its incapacity to offer reliable quotes and sources and its propensity to insert factual inaccuracies. Currently, ChatGPT is a difficult path to follow because it requires careful cross-referencing and proofreading in order to produce meaningful material.

The study explores how authorship, voice, and technology interact in scholarly writing. The study acknowledges that AI- generated literature can provide fairly coherent outputs, but it also emphasises how difficult it is for AI to replicate the subtle authorship traits that are present in human writing, such as contextual appropriateness and precise referencing. Even while the writing seems human, a deeper look exposes problems with register, overused vocabulary, and a lack of subtlety.

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The study highlights how important it is to have conversations about authorship, plagiarism, and originality as AI-generated writing becomes more common. The findings caution against assuming that AI-generated literature always satisfies the standards for intricate and authentic human writing, even though it seems coherent. This has implications for the ongoing discussion on the ethical application of AI in academic contexts. Future studies should consider conducting similar experiments when ChatGPT and other AI models advance. Comparisons using recognised evaluation criteria could be used to examine the efficacy of AI-generated text vs human-authored content on a variety of topics. This approach would offer a more sophisticated understanding of the evolving environment and the potential applicability of findings to other academic contexts.

According to the study, AI-enabled software that can recognise and categorise material as either generated or human-written needs to be critically examined. It is crucial to look into the techniques used to make these distinctions. Furthermore, it would be useful to determine whether a person could identify the originality and place of origin of a text with equivalent accuracy. If it is possible, this feature could greatly help teachers assess the reliability of written materials.

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