User Invented Applications of AI-Based GPTs in Teaching-Learning and Research-Publications

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Subject Area: Technology Management.
Type of the Paper: Exploratory Research.
Type of Review: Peer Reviewed as per |C|O|P|E| guidance.
Indexed In: OpenAIRE.
DOI: https://doi.org/10.5281/zenodo.10562974
Google Scholar Citation: IJAEML

How to Cite this Paper:
Aithal, P. S. & Aithal, S. (2024). User Invented Applications of AI-Based GPTs in Teaching-Learning and Research-Publications. *International Journal of Applied Engineering and Management Letters (IJAEML)*, *8*(1), 39-55. DOI: https://doi.org/10.5281/zenodo.10562974

International Journal of Applied Engineering and Management Letters (IJAEML)
A Refereed International Journal of Srinivas University, India.

Crossref DOI: https://doi.org/10.47992/IJAEML.2581.7000.0211

Received on: 28/12/2023
Published on: 25/01/2024

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ABSTRACT

Purpose: *AI-Based Generative Pre-trained Transformers (GPT) including ChatGPT of OpenAI and Bard of Google are becoming popular in many industry sectors including Education, Research, and Publications. Innovative users discovered many more uses for such GPTs, even though the main goals of their design and development were to translate publicly available information from many languages to a chosen language of customers or users and to create a highly versatile and adaptable language model capable of understanding and generating text that resembles that of a human. By utilizing extensive pre-training on a variety of datasets, GPT models seek to achieve superior performance in natural language interpretation and generating tasks.*

Methodology: *An exploratory research method is used to analyse the collected information as per the keywords using the Google search engine, Google Scholar search engine, and AI-driven search engines.*

Result and Analysis: *In this paper, a comprehensive analysis of user-found innovative applications of AI-Based GPTs in primary industry sector, secondary industry sector, tertiary industry sector, and quaternary industry sector. Furthermore, some of the Smart-Innovative applications based on users' strategy of identifying opportunities to make effective usage of AI-Based GPTs in Teaching-learning responsibilities and Research & Publications in Higher education industry.*

Originality/Value: *The paper discuses some of these smart-innovative application identified by teachers and researchers for effective use of AI-based GPTs in academics and research & publications other than its primary objectives of language translation, in order to make effective use of them to improve academic and research & publication productivity.*

Type of Research: *Exploratory Research.*

Keywords: AI-based GPTs, ChatGPT, Bard, Innovative applications of GPTs, Solutions to industrial problems, Smart-innovative applications of GPTs, Higher Education – teaching, Academic research & publication.

1. INTRODUCTION TO ICCT UNDERLYING TECHNOLOGIES :

Information generation, processing, communication, storage and manipulation for various applications is possible using information communication and computation technology also called ICCT or simply information technology (IT) [1-5]. As time progress, new technologies under ICCT are emerged and are called ICCT underlying technologies. Such ICCT underlying technologies include twelve emerging technologies which include (1) AI & Robotics Technology, (2) Blockchain Technology, (3) Big Data and Business Intelligence Technology, (4) Cloud Computing, (5) Cyber Security Technology, (6) 3D Printing Technology, (7) IoT Technology, (8) Mobile Business & Digital Marketing technology, (9) Quantum Computing Technology, (10) Ubiquitous Education Technology, (11) Information Storage Technology, and (12) Virtual and Augmented Reality Technology. All these ICCT emerging technologies collectively support to develop Artificial Intelligence powered human like thinking machines. Artificial intelligence is the simulation of human intelligence processes by

machines, especially computer systems [6-10]. Creating Intelligent Machines by mimicking the human brain using artificial neural networks and online analytical techniques is the current research. Accordingly, three types of AI are under development which include (1) Narrow Intelligence, (2) General Intelligence, and (3) Super Intelligence.

2. OBJECTIVES OF THE PAPER :

(1) To overview of the primary purpose of AI-based GPTs as a large language model.
(2) To Review of literature on the use of AI-based GPTs.
(3) To identify and evaluate user-discovered applications of AI-Based GPTs in professional, entertainment, and personal applications.
(4) To identify and evaluate user-discovered applications of AI-Based GPTs in all four industry sectors.
(5) To analyse SMART (Specific, Measurable, Achievable, Realistic, and Time-bound) applications and Out of the Box Thinking Applications to be supported by GPTs in HE teaching-learning and Academic research & publications.
(6) To provide suggestions to use AI-based GPTs in HE teaching-learning and Academic research based on ethical grounds.

3. GPT AS LLM :

3.1 What is GPT? Who invented GPT and When?

Large language models (LLMs) are deep learning algorithms that can recognize, summarize, translate, predict, and generate content using very large datasets. The Generative Pre-trained Transformer (GPT) was developed by OpenAI, an artificial intelligence research laboratory, in 2018. The team that created GPT was led by Alec Radford, a researcher at OpenAI, and included several other AI experts. Since then, OpenAI has continued to improve the GPT models with newer versions, including GPT-2 and GPT-3, which have gained significant attention in the AI research community and have been used in a variety of applications [11-14]. Many companies have licensed GPT from OpenAI and incorporated it into their own products and services, including writing tools like Jasper and Copy AI by paying to OpenAI.

4. PROMINENT ORGANIZATIONS DEVELOPING AND OFFERING AI-BASED GPT :

Microsoft backed OPEN AI as ChatGPT 3.5/4.0, Alphabet's Google as Bard with Gemini AI, Anthropic's Claude, Pi, etc. It is found that currently there are more than 14 Generative AI service providers/competitors.

5. INITIAL OBJECTIVE OF GPT :

While developing the GPTs, developing companies/ teams had the following objectives [15-18]:
(1) Natural Language Processing (NLP): In developing GPTs, companies and teams aimed to advance Natural Language Processing (NLP), enabling machines to comprehend and interpret human language more effectively. This objective involves the development of algorithms and models capable of understanding the nuances, context, and intricacies of natural language, allowing for more sophisticated interactions between machines and users.
(2) Natural Language Understanding: The goal of achieving Natural Language Understanding (NLU) in GPT development focuses on creating models that can not only process language but also comprehend the meaning, context, and intent behind the words. This objective aims to enable GPTs to interpret user inputs more accurately, facilitating more contextually relevant and coherent responses.
(3) Generative Capabilities: Developing generative capabilities was a key objective in GPT development, allowing these models to generate human-like text based on the input they receive. This involves training models to understand language structures and patterns, enabling them to create contextually appropriate and coherent responses, whether for answering questions, completing sentences, or generating creative content.
(4) Enhance Human-Computer Interaction: The objective of enhancing human-computer interaction guided the development of GPTs to create more natural and intuitive interactions between users and machines. By improving language understanding and generative capabilities, GPTs aim to make human-computer interactions feel more seamless, reducing the gap between human communication and machine responses.

(5) Adaptability and Flexibility: GPT development teams sought to create models with adaptability and flexibility, allowing them to perform effectively across a wide range of tasks and domains. This objective involves training GPTs to generalize knowledge and adapt to various input scenarios, making them versatile tools capable of handling diverse applications and providing valuable assistance in different contexts.

(6) Assist in Content Creation: One of the objectives in developing GPTs was to assist in content creation by enabling these models to generate human-like text for various purposes. This involves training GPTs to understand specific content requirements, writing styles, and creative nuances, empowering users to leverage AI assistance in tasks such as writing articles, generating ideas, or even crafting creative narratives.

(7) Continuous Learning and Improvement: To ensure the longevity and effectiveness of GPTs, continuous learning and improvement were key objectives during development. Companies aimed to create models that could adapt to new data, learn from user interactions, and improve their performance over time. This involves implementing mechanisms for ongoing training and fine-tuning, allowing GPTs to stay current and evolve with changing language patterns and user needs.

6. RE-DEFINED OBJECTIVES AFTER THE DEVELOPMENT OF AI-BASED GPT :

(1) Drive Research and Innovation: Their ability to learn and adapt to new data allows them to be applied to a wide range of research areas, leading to advancements in fields like computer vision, robotics, and healthcare.

(2) Democratize AI: GPTs can make AI technology more accessible and user-friendly. Their ability to be fine-tuned for specific tasks and deployed on various platforms allows developers to create AI-powered applications without requiring extensive expertise in machine learning.

(3) Enable Automation and Efficiency: GPTs can automate various tasks currently performed by humans, improving efficiency and saving time and resources. They can be used to automate tasks like data entry, email responses, and customer service interactions, freeing up human resources for more complex and creative endeavours.

Thus, the development of AI-based GPTs is driven by the desire to advance NLP research, improve human-computer interaction, assist in content creation, fuel research and innovation, democratize AI technology, and enable automation for increased efficiency.

- Whether AI-Based Applications are supportive or destructive to the development of Industries and society?
- New local Innovations like Jugaad/ Frugal Innovation.

7. USER-DISCOVERED APPLICATIONS USING AI-BASED GPT :

AI-based GPTs found many applications and usage as per user requirement and identified by users [19-22]. Some of them are listed below:

(1) Automated Content Creation: User-discovered applications using AI-based GPTs have transformed automated content creation, allowing individuals and businesses to generate high-quality written material efficiently. GPTs can assist in drafting blog posts, articles, or social media content by understanding context and generating coherent and contextually relevant text. This application streamlines the content creation process, saving time and resources for content creators while maintaining a consistent and engaging writing style.

(2) Email Drafting and Response Generation: AI-based GPTs have become valuable tools for email drafting and response generation. Users can employ these models to compose professional and contextually appropriate emails by providing prompts or initial content. GPTs analyze the input and generate coherent and personalized responses, significantly reducing the time and effort required for email communication. This application enhances communication efficiency and ensures that users can craft emails with clarity and relevance.

(3) Language Translation and Localization: Users have discovered the effectiveness of AI-based GPTs in language translation and localization. These models excel in providing accurate and context-aware translations across multiple languages. Users can input text in one language and receive coherent translations, contributing to seamless cross-cultural communication and content localization. GPTs in this application are particularly beneficial for businesses and individuals working in global or multilingual contexts.

(4) Customer Support Chatbots: AI-driven GPTs have been widely adopted for creating customer support chatbots that can handle customer inquiries and provide relevant information. These chatbots leverage the language understanding capabilities of GPTs to offer personalized responses to user queries. By automating customer support interactions, businesses can improve response times, enhance customer satisfaction, and streamline their support processes.
(5) Code Autocompletion and Debugging Assistance: In the field of software development, users have harnessed the power of AI-based GPTs for code autocompletion and debugging assistance. GPTs can analyze code snippets, understand programming contexts, and suggest autocompletions, reducing the time developers spend on routine coding tasks. Additionally, these models can provide insights into potential bugs or errors in the code, aiding developers in the debugging process and improving overall code quality.
(6) Personal Task Management: Users have discovered the utility of AI-based GPTs in personal task management. These models can assist in creating to-do lists, setting reminders, and generating task-related content. GPTs understand user inputs regarding tasks and deadlines, helping individuals organize their schedules efficiently. This application contributes to improved productivity and time management for users managing personal and professional tasks.
(7) Creative Writing Support: AI-driven GPTs offer creative writing support, helping users generate ideas, prompts, or even entire storylines. Writers and creatives can use GPTs to overcome creative blocks, explore different narrative directions, or receive inspiration for their projects. GPTs contribute to the creative process by providing diverse and imaginative inputs, fostering creativity in various forms of writing, from storytelling to poetry.
(8) Educational Assistance and Learning Support: Users have leveraged AI-based GPTs for educational assistance and learning support. These models can answer questions, explain concepts, and assist with homework or study materials. GPTs contribute to personalized learning experiences by providing tailored explanations and guidance, enhancing the overall learning process for students and individuals pursuing self-directed education.
(9) Content Summarization and Analysis: GPTs have been applied by users for content summarization and analysis. Users can input lengthy articles, documents, or research papers, and GPTs generate concise and coherent summaries. Additionally, these models can analyze content, providing insights into key themes, sentiments, or trends. This application streamlines information consumption, making it easier for users to grasp the essence of extensive texts quickly.
(10) Voice Assistants and Smart Devices: AI-based GPTs have found extensive application in voice assistants and smart devices. Users can interact with devices using natural language, and GPTs enable these devices to understand, process, and respond to user commands or queries. From setting reminders to answering general knowledge questions, GPTs enhance the functionality and user experience of voice-enabled devices, contributing to the widespread adoption of smart home technologies.
(11) Interactive Storytelling and Gaming: Users have explored the use of AI-based GPTs for interactive storytelling and gaming experiences. GPTs can generate dynamic and context-aware narratives, responding to user inputs and choices in real-time. This application enhances the interactivity and engagement levels in storytelling and gaming scenarios, providing users with unique and personalized experiences based on their decisions and interactions.
(12) Personalized Recommendations: AI-driven GPTs have been employed for generating personalized recommendations across various domains, from entertainment to shopping. These models analyze user preferences, behaviors, and historical data to offer tailored suggestions, such as movie recommendations, product recommendations, or content recommendations. GPTs contribute to enhancing user experiences by providing personalized and relevant suggestions that align with individual preferences.
These innovative applications showcase how AI-based GPT models have revolutionized various professional tasks and entertainment requirements, offering efficiency, automation, and convenience across diverse domains.

8. SMART INNOVATIVE APPLICATIONS OF AI-BASED GPT IN ACADEMIC RESEARCH & PUBLICATION :

Some of innovative potential SMART (Specific, Measurable, Achievable, Relevant, Time-bound) innovative applications of AI-based GPTs in the later stages of usage within higher education teaching-learning activities [23]:

8.1 Professional Applications:

(1) Project Management: Smart innovative applications of AI-based GPTs in project management involve optimizing various aspects of project planning and execution. GPTs can assist in creating project timelines, generating detailed task lists, and even providing insights into potential risks and mitigation strategies. By understanding natural language inputs, these models enhance communication within project teams, streamline collaboration, and contribute to more efficient project completion. Additionally, AI-based GPTs can support decision-making by analyzing project data and proposing recommendations, ultimately improving project management processes.

(2) Customer Service: In customer service, AI-based GPTs play a crucial role in providing intelligent and responsive support. These models can analyze customer inquiries, understand context, and generate personalized responses, contributing to efficient query resolution. GPTs empower customer service teams to handle a high volume of requests, ensuring timely and accurate information dissemination. This application enhances customer satisfaction by delivering a more seamless and responsive support experience, making it an invaluable tool for businesses aiming to provide top-notch customer service.

(3) Marketing and Sales: AI-based GPTs are employed in marketing and sales to enhance various aspects of the customer journey. These models can generate engaging and personalized content for marketing materials, emails, and social media posts, contributing to more effective communication with target audiences. GPTs also aid in lead generation by analyzing customer data and predicting potential leads. In sales, GPTs assist in creating persuasive sales pitches and responding to customer queries. By automating aspects of marketing and sales processes, GPTs contribute to more targeted and efficient campaigns.

(4) Research and Development: Smart applications of AI-based GPTs in research and development involve accelerating innovation and knowledge discovery. These models can assist researchers by generating hypotheses, analyzing literature, and proposing novel ideas. GPTs contribute to the ideation phase of research projects, offering insights and perspectives that can spark innovative solutions. Additionally, they aid in data analysis, providing researchers with a valuable tool for processing and interpreting complex datasets. By leveraging GPTs in research and development, organizations can foster a more agile and creative approach to problem-solving.

(5) Education and Training: In education and training, AI-based GPTs are utilized for personalized learning experiences and content creation. These models can assist educators by generating educational materials, answering student queries, and even creating adaptive learning paths based on individual student needs. GPTs contribute to the development of interactive and engaging e-learning content, enhancing the overall educational experience. In training scenarios, these models assist in creating realistic simulations, providing learners with hands-on experiences and practical knowledge.

(6) Code Generation: AI-driven GPTs find innovative applications in code generation, significantly impacting software development processes. These models can assist developers by generating code snippets, suggesting programming solutions, and even aiding in debugging tasks. GPTs leverage their understanding of coding languages and programming logic to enhance the efficiency of software development. This application streamlines coding processes, reduces development time, and contributes to the creation of high-quality and error-free code.

(7) Legal Research and Writing: Smart applications of AI-based GPTs in legal research and writing involve assisting legal professionals in generating legal documents, conducting legal research, and drafting legal memos. These models can analyze legal databases, understand case law, and provide relevant information to support legal arguments. GPTs contribute to the automation of routine legal tasks, allowing legal professionals to focus on more strategic aspects of their work. By generating accurate and contextually appropriate legal documents, GPTs enhance the productivity and efficiency of legal practices.

8.2 Entertainment Applications:

(1) Creative Writing: In entertainment applications, AI-based GPTs bring innovation to creative writing by assisting authors, scriptwriters, and content creators. These models can generate ideas, suggest plot twists, or even help in crafting dialogue, contributing to the creative process. GPTs excel in understanding context and maintaining a consistent writing style, providing valuable support for writers facing creative blocks. By integrating AI-based GPTs into creative writing workflows, entertainment industries can enhance the efficiency of content creation, leading to more engaging and diverse narratives in literature, film, and other storytelling mediums.
(2) Music Composition: AI-driven GPTs have transformed music composition by providing tools for generating original musical compositions. These models can analyze musical patterns, genres, and even specific artist styles to compose unique pieces of music. GPTs contribute to the creation of diverse and customized musical content, supporting musicians, composers, and music producers in the entertainment industry. This application accelerates the creative process, allowing artists to explore new musical possibilities and experiment with different genres and styles.
(3) Video Editing: In the realm of entertainment, AI-based GPTs enhance video editing processes by automating certain aspects of the editing workflow. These models can analyze video content, understand editing preferences, and generate suggestions for cutting, transitions, and visual effects. GPTs contribute to more efficient video editing, saving time for content creators and allowing them to focus on the creative aspects of storytelling. By automating routine editing tasks, these models streamline the post-production process, contributing to the overall quality and appeal of video content.
(4) Game Design: AI-driven GPTs play a significant role in game design, offering innovative applications in creating interactive and engaging gaming experiences. These models can generate game narratives, design characters, and even suggest level layouts based on user inputs. GPTs contribute to the creative process in game development, providing designers with ideas and insights that can enhance the overall gaming experience. By leveraging AI-based GPTs, the entertainment industry can push the boundaries of game design, fostering creativity and delivering unique gaming content to audiences.
(5) Personalized Content Recommendation: Entertainment applications leverage AI-based GPTs for personalized content recommendations, enhancing user engagement and satisfaction. These models analyze user preferences, viewing history, and behavior patterns to suggest relevant movies, TV shows, music, or books. GPTs contribute to content discovery by offering personalized recommendations that align with individual tastes. This application enhances the overall entertainment experience, keeping users engaged and connected with content that resonates with their preferences.
(6) Social Media Engagement: AI-based GPTs find innovative applications in enhancing social media engagement for entertainment purposes. These models can analyze social media trends, understand user interactions, and generate engaging content for posts or comments. GPTs contribute to the creation of entertaining and shareable content, increasing user engagement on platforms like Instagram, Twitter, and Facebook. By automating aspects of social media content creation, these models help entertainers, influencers, and content creators maintain a consistent and engaging online presence.

8.3 Personal Applications:

(1) Email Management: In personal applications, AI-based GPTs contribute to smart email management by assisting users in organizing, responding to, and prioritizing their emails. These models can analyze the content of emails, understand user preferences, and suggest appropriate responses. GPTs enhance efficiency by categorizing emails, filtering spam, and even drafting replies based on the user's writing style. This application streamlines the email communication process, saving time for users and ensuring that their inbox is well-organized and manageable.
(2) Appointment Scheduling: AI-driven GPTs find innovative applications in personal appointment scheduling by automating the process of setting up meetings, events, or other engagements. These models can analyze calendars, understand scheduling preferences, and propose suitable time slots for appointments. GPTs contribute to time management by coordinating schedules, reducing the back-and-forth communication usually associated with appointment scheduling. This application simplifies personal planning, ensuring that users can efficiently manage their time and commitments.
(3) Personal Finance Management: In personal finance management, AI-based GPTs offer valuable tools for budgeting, expense tracking, and financial planning. These models can analyze financial data,

categorize expenses, and provide insights into spending patterns. GPTs contribute to informed financial decision-making by offering personalized budget recommendations and suggesting ways to optimize savings. This application empowers individuals to take control of their finances, ensuring a more secure and organized approach to personal money management.

(4) Health and Wellness: AI-driven GPTs play a significant role in personal health and wellness applications by providing support for fitness routines, dietary planning, and health monitoring. These models can generate personalized workout plans, offer nutritional advice, and even assist in tracking health metrics. GPTs contribute to a holistic approach to health, helping users set and achieve wellness goals while providing insights into maintaining a healthy lifestyle. This application promotes personalized and data-driven health management for individuals.

(5) Travel Planning: In personal travel planning, AI-based GPTs bring innovation by assisting users in organizing and optimizing their travel experiences. These models can analyze travel preferences, suggest destinations, and even create detailed itineraries based on user inputs. GPTs contribute to seamless travel planning by providing information on flights, accommodations, and local attractions. This application enhances the efficiency of travel arrangements, ensuring that users can plan and enjoy their trips with personalized recommendations and insights.

As GPT technology continues to evolve, we can expect even more creative and impactful applications to emerge, further simplifying and enhancing how we live, work, and play.

9. APPLICATIONS OF AI-BASED GPT IN ALL FOUR INDUSTRY SECTORS :

9.1 Innovative AI-Based GPTs Applications in Primary Industry Sector:

(1) Precision Agriculture and Farming: In the primary industry sector, AI-based GPTs contribute to innovative applications in precision agriculture and farming. These models assist farmers in optimizing crop management by providing insights into planting schedules, irrigation needs, and pest control strategies. GPTs analyze agricultural data, including weather patterns and soil conditions, to offer real-time recommendations for crop health and yield optimization. By incorporating GPTs into precision agriculture, the primary industry sector benefits from increased productivity, resource efficiency, and sustainable farming practices.

(2) Mining Operations Optimization: AI-driven GPTs play a crucial role in optimizing mining operations within the primary industry sector. These models analyze geological data, assess ore quality, and optimize extraction processes. GPTs contribute to improved decision-making in mining operations by identifying efficient extraction methods, predicting equipment maintenance needs, and optimizing resource utilization. By enhancing operational efficiency and reducing environmental impact, GPTs contribute to sustainable and responsible mining practices within the primary industry.

(3) Forest Management and Conservation: In the primary industry sector, AI-based GPTs contribute to forest management and conservation efforts. These models can analyze satellite imagery, assess biodiversity, and monitor deforestation patterns. GPTs aid in the development of sustainable forestry practices by providing insights into optimal logging schedules, reforestation strategies, and habitat conservation. By integrating GPTs into forest management, the primary industry sector can balance economic activities with environmental conservation, promoting long-term ecological sustainability.

(4) Fishing Industry Enhancement: AI-driven GPTs bring innovation to the fishing industry within the primary sector. These models can analyze marine data, including fish migration patterns and environmental conditions, to assist in optimizing fishing strategies. GPTs contribute to sustainable fishing practices by providing insights into optimal harvesting times, avoiding overfishing, and minimizing environmental impact. By incorporating GPTs into the fishing industry, the primary sector benefits from improved resource management and the preservation of marine ecosystems.

(5) Resource Exploration and Extraction: In the primary industry sector, AI-based GPTs contribute to resource exploration and extraction processes. These models analyze geological data, assess potential resource deposits, and optimize extraction methods. GPTs aid in predicting resource availability, guiding exploration efforts, and enhancing decision-making in resource extraction operations. By streamlining exploration processes and minimizing environmental impact, GPTs contribute to responsible resource management within the primary industry.

(6) Environmental Impact Assessment: AI-driven GPTs play a crucial role in environmental impact assessments within the primary industry sector. These models can analyze data related to proposed

projects, assess potential environmental risks, and recommend mitigation measures. GPTs contribute to more accurate and comprehensive environmental impact assessments, ensuring that development projects adhere to regulatory standards and minimize their ecological footprint. By integrating GPTs into environmental assessments, the primary industry sector can balance economic development with environmental conservation.

(7) Supply Chain Management: In the primary industry sector, AI-based GPTs contribute to optimizing supply chain management processes. These models analyze data related to inventory levels, demand forecasting, and transportation logistics. GPTs aid in improving the efficiency of supply chain operations, reducing delays, and minimizing waste. By enhancing resource utilization and ensuring timely delivery of products, GPTs contribute to increased overall efficiency in the primary industry sector.

(8) Workforce Safety and Risk Assessment: AI-driven GPTs enhance workforce safety and risk assessment within the primary industry sector. These models can analyze data related to workplace conditions, equipment performance, and historical safety incidents. GPTs contribute to the development of predictive safety models, identifying potential risks and recommending preventive measures. By prioritizing worker safety and minimizing occupational hazards, GPTs improve overall safety standards in the primary industry.

(9) Regulatory Compliance and Reporting: In the primary industry sector, AI-based GPTs assist in regulatory compliance and reporting processes. These models can analyze complex regulatory frameworks, assess compliance requirements, and generate accurate reports. GPTs contribute to ensuring that businesses in the primary sector adhere to legal and environmental regulations. By automating compliance-related tasks, GPTs streamline reporting processes, reduce errors, and contribute to responsible and transparent business practices.

(10) Market Intelligence and Forecasting: AI-driven GPTs play a crucial role in providing market intelligence and forecasting within the primary industry sector. These models can analyze market trends, assess consumer preferences, and predict demand for agricultural and natural resources. GPTs contribute to informed decision-making by offering insights into market dynamics, pricing trends, and competitive landscapes. By leveraging GPTs for market intelligence, the primary industry sector can optimize production, enhance resource allocation, and stay competitive in the global marketplace.

9.2 Innovative AI-Based GPTs Applications in Secondary Industry Sector :

(1) Automotive Design and Manufacturing: In the secondary industry sector, AI-based GPTs contribute to innovative applications in automotive design and manufacturing. These models streamline the design process by generating concepts, assisting engineers in creating more efficient and aesthetically pleasing vehicle designs. Additionally, GPTs enhance manufacturing processes by optimizing production schedules, predicting maintenance needs, and ensuring quality control. By integrating GPTs into automotive design and manufacturing, the secondary industry sector benefits from increased efficiency, reduced costs, and improved product quality.

(2) Food Processing and Quality Assurance: AI-driven GPTs play a crucial role in the secondary industry sector's food processing and quality assurance. These models contribute to optimizing production processes, ensuring food safety, and maintaining quality standards. GPTs can analyze data related to ingredient proportions, production parameters, and quality metrics to enhance the efficiency of food processing operations. Additionally, they aid in quality assurance by detecting anomalies, identifying potential contamination issues, and offering solutions to maintain high standards in food production within the secondary industry.

(3) Construction and Building Design: In the secondary industry sector, AI-based GPTs revolutionize construction and building design processes. These models can assist architects and engineers in generating innovative design concepts, optimizing structural elements, and even proposing eco-friendly solutions. GPTs contribute to improved project planning and execution by streamlining the design phase, reducing errors, and ensuring cost-effective building solutions. By leveraging GPTs, the construction industry benefits from enhanced creativity, efficiency, and sustainability in building design and planning.

(4) Textile and Apparel Manufacturing: AI-driven GPTs have transformative applications in textile and apparel manufacturing within the secondary industry sector. These models optimize the design and production of textiles and garments by generating creative design ideas, automating pattern

creation, and facilitating efficient manufacturing processes. GPTs contribute to the rapid prototyping of new clothing styles, enabling faster time-to-market for fashion products. Additionally, they aid in quality control by identifying potential issues in manufacturing, ensuring the production of high-quality textiles and apparel.

(5) Consumer Goods Production and Marketing: The secondary industry sector benefits from AI-based GPTs in consumer goods production and marketing. These models contribute to product innovation by generating ideas for new designs, features, and packaging. GPTs also enhance marketing strategies by creating compelling and personalized content for advertisements, social media, and other promotional materials. By automating aspects of consumer goods production and marketing, GPTs streamline processes, improve product visibility, and contribute to the overall success of brands within the secondary industry.

(6) Metallurgy and Heavy Industry: AI-driven GPTs play a significant role in metallurgy and heavy industry within the secondary sector. These models assist in optimizing manufacturing processes for metals, alloys, and heavy machinery by providing insights into material properties, suggesting efficient production methods, and predicting equipment maintenance needs. GPTs contribute to increased productivity, reduced downtime, and enhanced quality control in metallurgical and heavy industrial operations, thereby improving overall efficiency within the secondary industry.

(7) Energy Sector Optimization: In the secondary industry sector, AI-based GPTs contribute to the optimization of processes within the energy sector. These models can analyze vast amounts of data related to energy production, consumption patterns, and equipment performance. By providing predictive insights, GPTs assist in optimizing energy production, improving the efficiency of power plants, and reducing operational costs. Additionally, they contribute to the development of sustainable energy solutions, aligning with the increasing focus on environmental considerations within the secondary industry.

(8) Electrical and Electronics Manufacturing: AI-driven GPTs bring innovation to electrical and electronics manufacturing processes within the secondary industry sector. These models contribute to the design and production of electronic components by offering insights into circuit design, suggesting improvements in manufacturing processes, and aiding in quality control. GPTs streamline product development cycles, reduce time-to-market for electronic devices, and enhance the overall efficiency of electrical and electronics manufacturing within the secondary industry.

(9) Craft and Artisanal Production: In the secondary industry sector, AI-based GPTs contribute to the revitalization of craft and artisanal production. These models can assist artisans and craftspeople by generating design ideas, optimizing production workflows, and offering creative inspiration. GPTs contribute to the preservation of traditional craftsmanship while also supporting innovation and efficiency in craft production processes. By integrating GPTs into artisanal production, the secondary industry sector can harness the benefits of technology while maintaining the unique qualities of handcrafted goods.

(10) Supply Chain Management and Logistics: AI-driven GPTs play a crucial role in optimizing supply chain management and logistics within the secondary industry sector. These models can analyze data related to inventory levels, demand forecasting, and transportation logistics. GPTs contribute to more accurate supply chain planning, reducing delays, minimizing waste, and optimizing distribution networks. By enhancing the efficiency of supply chain operations, GPTs facilitate cost savings and improved customer satisfaction within the secondary industry.

9.3 Innovative AI-Based GPTs Applications in Tertiary Industry Sector :

(1) Customer Service and Support: AI-based GPTs revolutionize customer service and support within the tertiary industry sector by providing intelligent virtual assistants and chatbots. These systems can understand and respond to customer queries in natural language, offering personalized assistance and solutions. GPTs enhance customer interactions, providing instant support, troubleshooting guidance, and information retrieval. This application not only improves customer satisfaction but also allows businesses in the tertiary sector to efficiently manage high volumes of customer inquiries.

(2) Language Translation and Interpretation Services: In the tertiary industry sector, AI-driven GPTs play a pivotal role in language translation and interpretation services. These models excel in understanding and generating accurate translations across multiple languages. Whether in global

business communication or facilitating cross-cultural collaboration, GPTs provide precise language support, breaking down language barriers and fostering effective communication within the tertiary industry.

(3) Financial Analysis and Investment: AI-based GPTs contribute to the tertiary industry's financial landscape by enhancing financial analysis and investment strategies. These models can process vast amounts of financial data, identify trends, and generate insights that inform investment decisions. By leveraging GPTs for data-driven analysis, financial professionals can make more informed and timely decisions, optimizing portfolio management and risk assessment within the tertiary sector.

(4) Healthcare Information and Diagnosis: Within the tertiary industry, AI-driven GPTs find applications in healthcare information and diagnosis. These models can assist medical professionals by analyzing patient data, providing relevant medical information, and supporting diagnostic processes. GPTs contribute to the efficiency of healthcare services, aiding in accurate diagnosis and facilitating the dissemination of medical knowledge within the tertiary sector.

(5) Legal Documentation and Research: AI-based GPTs transform legal documentation and research within the tertiary industry sector. These models can assist legal professionals by generating drafts, summarizing case law, and providing legal insights. GPTs streamline legal research processes, offering efficient document review and analysis. This application enhances the productivity of legal professionals, enabling them to focus on higher-level strategic tasks within the tertiary industry.

(6) Educational Assistance and E-Learning: In the tertiary industry, AI-driven GPTs play a crucial role in educational assistance and e-learning. These models can provide personalized tutoring, generate educational content, and assist students in understanding complex concepts. GPTs contribute to the evolution of e-learning platforms, offering adaptive and interactive learning experiences that cater to individual student needs within the tertiary sector.

(7) Personalized Marketing and Advertising: AI-based GPTs drive personalized marketing and advertising strategies within the tertiary industry. These models can analyze consumer data, generate targeted content, and optimize advertising campaigns. GPTs enhance the effectiveness of marketing efforts by tailoring messages to individual preferences, increasing engagement, and maximizing the impact of promotional activities within the tertiary sector.

(8) Human Resources and Recruitment: Within the tertiary industry, AI-driven GPTs streamline human resources and recruitment processes. These models can assist in resume screening, conduct initial candidate assessments, and even facilitate virtual interviews. GPTs contribute to the efficiency of recruitment efforts, allowing HR professionals to focus on strategic aspects of talent management within the tertiary sector.

(9) Travel and Hospitality Services: AI-based GPTs enhance travel and hospitality services within the tertiary industry. These models can assist in travel planning, provide personalized recommendations, and offer real-time language translation for international travelers. GPTs contribute to a seamless and personalized customer experience, optimizing services within the travel and hospitality sector.

(10) Content Curation and News Generation: In the tertiary industry, AI-driven GPTs play a significant role in content curation and news generation. These models can analyze vast amounts of information, identify relevant trends, and generate coherent news articles or curated content. GPTs contribute to media organizations by automating content creation processes, ensuring timely and engaging information dissemination within the tertiary sector.

9.4 Innovative AI-Based GPTs Applications in Quaternary Industry Sector :

(1) Natural Language Processing (NLP) Research:

In the quaternary industry sector, AI-based GPTs find innovative applications in Natural Language Processing (NLP) research. These models excel in understanding and generating human-like text, contributing to advancements in language-related technologies. From sentiment analysis to language translation, GPTs enhance NLP research capabilities, enabling more nuanced and context-aware language processing applications within the quaternary industry.

(2) Software Development and Code Generation:

AI-driven GPTs play a significant role in the quaternary industry by revolutionizing software development and code generation processes. These models can assist developers by generating code snippets, providing programming suggestions, and even aiding in debugging tasks. This application

accelerates the software development lifecycle, streamlining coding processes and enhancing overall efficiency within the quaternary sector.

(3) Data Analysis and Predictive Modeling:

In the quaternary industry, AI-based GPTs contribute to data analysis and predictive modeling. These models can analyze large datasets, identify patterns, and generate insights that aid in decision-making processes. By leveraging GPTs for predictive modeling, organizations in the quaternary sector can make data-driven forecasts and optimize various aspects of their operations, leading to improved efficiency and strategic decision-making.

(4) Cybersecurity and Threat Detection:

AI-driven GPTs play a crucial role in enhancing cybersecurity measures within the quaternary industry. These models can analyze vast amounts of data to detect anomalies and potential security threats. By continuously learning and adapting to emerging threats, GPTs contribute to robust cybersecurity systems, protecting sensitive information and ensuring the integrity of digital assets in the quaternary sector.

(5) Knowledge Management and Information Retrieval:

Knowledge management and information retrieval are significantly improved in the quaternary industry through the use of AI-based GPTs. These models can efficiently organize, categorize, and retrieve relevant information, facilitating streamlined access to critical knowledge within organizations. This application enhances decision-making processes and promotes efficient knowledge sharing and collaboration within the quaternary sector.

(6) Virtual Collaboration and Remote Work Solutions:

In response to the evolving landscape of work, AI-based GPTs offer innovative solutions for virtual collaboration and remote work within the quaternary industry. These models can facilitate communication, generate meeting summaries, and assist in collaborative document creation, fostering efficient teamwork regardless of geographical locations. GPTs contribute to a seamless virtual work environment, ensuring productivity and connectivity in the quaternary sector.

(7) R&D Support and Innovation:

AI-driven GPTs play a vital role in supporting Research and Development (R&D) activities within the quaternary industry. These models can assist researchers in generating ideas, analyzing relevant literature, and even proposing innovative solutions to complex problems. By enhancing the creative and analytical capacities of R&D teams, GPTs contribute to fostering innovation and driving advancements within the quaternary sector.

(8) AI-driven Decision Support Systems:

The quaternary industry benefits from AI-based GPTs in the development of decision support systems. These models can analyze complex datasets, provide insights, and assist in making informed decisions. By serving as intelligent decision support tools, GPTs empower decision-makers in the quaternary sector to navigate intricate scenarios and optimize outcomes.

(9) Semantic Search Engines and Information Extraction:

In the quaternary industry, AI-driven GPTs contribute to the development of advanced semantic search engines and information extraction systems. These models can understand the context and meaning of queries, enabling more accurate and relevant search results. By improving information retrieval processes, GPTs enhance the efficiency of knowledge workers in the quaternary sector, ensuring quick access to pertinent information.

(10) Automated Documentation and Technical Writing:

AI-based GPTs streamline documentation and technical writing tasks within the quaternary industry. These models can generate coherent and contextually appropriate documentation, saving time for professionals involved in creating manuals, reports, and other technical documents. By automating this aspect of the workflow, GPTs contribute to increased productivity and consistency in documentation practices within the quaternary sector.

10. SMART INNOVATIVE APPLICATIONS OF AI-BASED GPT IN TEACHING-LEARNING OF HIGHER EDUCATION :

Some of innovative potential SMART (Specific, Measurable, Achievable, Relevant, Time-bound) innovative applications of AI-based GPTs in the later stages of usage within higher education teaching-learning activities:

(1) Personalized Learning Paths: AI-based GPTs in higher education have the potential to revolutionize teaching and learning by enabling personalized learning paths. These systems can analyze individual student progress, preferences, and learning styles, tailoring educational content and activities to match each student's specific needs. By leveraging the specificity and adaptability of GPTs, educators can create dynamic and customized learning experiences that cater to diverse skill levels and learning paces. This not only enhances student engagement but also fosters a more efficient and effective learning environment, addressing the unique challenges and strengths of each learner.

(2) Real-time Multilingual Classroom Support: With the aid of AI-driven GPTs, real-time multilingual classroom support becomes a feasible and innovative application in higher education. These systems can break down language barriers by providing instant translation and interpretation services during lectures, discussions, and other educational activities. This ensures that students from diverse linguistic backgrounds can fully participate in the learning process, fostering inclusivity and global collaboration. The capability of GPTs to understand and generate human-like text across multiple languages contributes to a more accessible and enriching educational experience for all learners.

(3) Automated Grading and Feedback Systems: AI-powered GPTs bring efficiency to the assessment process in higher education through automated grading and feedback systems. These tools can analyze written assignments, exams, and other assessments, providing timely and constructive feedback to students. By automating routine grading tasks, educators can allocate more time to personalized interactions with students, addressing specific concerns and providing targeted guidance. This not only streamlines the assessment workflow but also enhances the overall learning experience by offering immediate feedback, allowing students to track their progress and make necessary improvements.

(4) AI-Powered Virtual Labs and Simulations: Incorporating AI-based GPTs into higher education involves the creation of AI-powered virtual labs and simulations. These systems can simulate real-world scenarios, experiments, and complex processes, providing students with immersive and interactive learning experiences. GPTs can generate realistic and contextually relevant scenarios, allowing students to apply theoretical knowledge in practical settings. This innovative approach to education not only facilitates skill development but also accommodates scenarios that may be challenging or impractical to replicate in traditional physical laboratories. AI-powered virtual labs enhance the hands-on learning experience, preparing students for a diverse range of real-world challenges in their respective fields of study.

11. SMART INNOVATIVE APPLICATIONS OF AI-BASED GPT IN ACADEMIC RESEARCH & PUBLICATION :

(1) AI-Powered Literature Review and Synthesis:

One of the SMART applications of AI-based GPTs in academic research involves revolutionizing the literature review and synthesis process. GPTs can analyze vast volumes of academic papers, extracting relevant information, identifying key themes, and summarizing complex content. By automating the literature review stage, researchers can save significant time and resources while ensuring a comprehensive understanding of existing knowledge. The specificity and context-awareness of GPTs contribute to the generation of insightful syntheses, aiding researchers in forming a solid foundation for their work.

(2) Predictive Analytics for Research Trends:

AI-based GPTs offer a SMART solution for staying ahead of emerging research trends through predictive analytics. These systems can analyze large datasets, identifying patterns and correlations that indicate future trends in various academic disciplines. By leveraging machine learning capabilities, GPTs can assist researchers in making data-driven decisions about potential areas of interest and guide the focus of their research efforts. This proactive approach enables academics to contribute to cutting-edge developments and align their research agendas with the evolving landscape of their respective fields.

(3) AI-Assisted Data Collection and Analysis:

In academic research, the integration of AI-based GPTs facilitates efficient data collection and analysis. These systems can streamline the data gathering process by automating tasks such as survey design, text extraction, and content categorization. Moreover, GPTs excel in analyzing complex

datasets, identifying patterns, and drawing meaningful insights. The speed and accuracy of AI-assisted data analysis enhance the rigor and reliability of research findings, allowing researchers to concentrate on interpretation and application rather than spending excessive time on manual data processing.

(4) Collaborative Research Platforms:

SMART collaborative research platforms are empowered by AI-based GPTs, providing researchers with enhanced tools for communication, document collaboration, and knowledge sharing. These platforms leverage GPTs to facilitate seamless collaboration among geographically dispersed researchers. GPTs can assist in drafting, editing, and summarizing research documents, ensuring a unified and coherent output. The collaborative nature of these platforms enhances the efficiency of research teams, enabling them to collectively contribute to projects, exchange ideas, and produce high-quality outputs.

(5) AI-Enhanced Research Ethics and Compliance:

AI-based GPTs play a crucial role in bolstering research ethics and compliance by automating the monitoring and evaluation of ethical considerations in academic research. These systems can assist in identifying potential ethical concerns in research protocols, ensuring that studies adhere to established ethical guidelines and standards. GPTs can analyze research proposals, protocols, and methodologies, providing insights into potential ethical challenges and guiding researchers toward ethically sound practices. By incorporating AI-enhanced tools for research ethics, institutions can strengthen the integrity of academic research and ensure responsible conduct in the pursuit of knowledge.

12. OUT OF THE BOX THINKING INNOVATIVE APPLICATIONS OF AI-BASED GPT :

(1) Converting a draft report into a quality report of a specific size.
(2) Generating a summary of an article – To write abstracts, suggestions, Conclusions, etc.
(3) To create MCQs with answers for a given passage.
(4) To create descriptive questions with answers of different lengths for different marks for a given passage.
(5) Answering Teaching Case Study questions which in principle depends on a given case study passage and well-known theories related to the topic.
(6) To answer assignments based on given study notes.
(7) To remember/recall formulas related to a concept to solve problems on related concepts.
(8) To reframe the passage by removing grammar mistakes.
(9) To reframe the paragraph or passage or CV to make it impressive to the readers.
(10) To reframe a paragraph or passage to remove plagiarism content.
(11) To paraphrase the paragraph or passage
(12) To simplify a given sentence, paragraph or passage.
(13) To modify the title of a paper/document/passage with an impressive title.
(14) To evaluate a paragraph/passage by identifying specific key answers.

13. SUGGESTIONS TO USE AI-BASED GPT ON ETHICAL GROUNDS :

(1) Use many GPTs to get many ideas or multiple possible solutions to a given problem and analyse them to identify an Optimum solution:

Ethical use of AI-based GPTs involves leveraging multiple models to generate diverse ideas or potential solutions to a problem. By employing a variety of GPTs, users can ensure a broad spectrum of perspectives and outputs. This approach promotes inclusivity in decision-making and minimizes the risk of bias associated with a single model. However, it is crucial to critically analyze and evaluate the suggestions to identify the optimum solution, taking into account factors such as feasibility, ethical considerations, and alignment with organizational goals. This practice fosters a balanced and ethical approach to problem-solving, avoiding over-reliance on a singular source of information.

(2) Moral & Ethical Considerations:

When utilizing AI-based GPTs, a primary ethical consideration is the integration of moral and ethical principles throughout the decision-making process. Users must be vigilant in ensuring that the generated content aligns with ethical standards and does not perpetuate biases or engage in harmful practices. It is essential to establish clear ethical guidelines for the use of GPTs, addressing issues such as privacy, fairness, and transparency. Regular ethical reviews and assessments of AI outputs are necessary to uphold moral standards and promote responsible AI use, fostering trust in the technology's applications across various domains.

(3) GPTs are only for simplifying the work not for replacing Humans:
An ethical approach to using AI-based GPTs emphasizes their role as tools to enhance and simplify human tasks rather than replace human involvement entirely. While GPTs can automate certain processes and streamline workflows, their use should be guided by the understanding that human oversight, critical thinking, and ethical judgment are irreplaceable. Users must acknowledge the limitations of GPTs and be cautious of over-reliance, particularly in situations where nuanced decision-making, empathy, or contextual understanding is crucial. Maintaining a balance between the capabilities of GPTs and human expertise ensures a responsible and ethical integration of AI into various domains, preserving the value of human judgment in decision-making processes.

14. CONCLUSION :

In conclusion, this scholarly article provides a thorough examination of alternative applications of AI-based GPTs in the realms of teaching-learning and research-publications within the higher education industry. The paper highlights the extensibility of AI-based GPTs beyond their intended uses by emphasizing user-discovered creative applications in various industry sectors and the strategic usage of these models in academia. An extensive range of applications that researchers and educators have uncovered is illustrated by the analysis that explores the elementary, secondary, tertiary, and quaternary industry sectors. The applications that have been identified as clever and inventive highlight the need of thinking beyond the box. They demonstrate how educators and researchers may use AI-based GPTs to improve efficiency, creativity, and productivity in educational and research settings. Additionally, this helps to expedite tasks and processes.
The highlighted issues related to out-of-the-box thinking showcase the vast potential of AI-based GPTs in addressing various academic and research challenges. These applications show the versatility and adaptability of AI-based GPTs, from turning draft reports into high-quality publications to producing abstracts, making assessment questions, responding to case study inquiries, and even deciphering complicated ideas. The study also emphasizes how these models can be used to improve written content by fixing grammar errors, rephrasing sections, getting rid of plagiarism, paraphrasing, and even simplifying difficult sentences. This article's extensive list of applications not only broadens our awareness of the potential of AI-based GPTs, but also gives researchers and educators important new perspectives on how to best use these instruments to improve student and researcher experiences in general.

REFERENCES :

[1] Aithal, P. S. (2019, October). Industrial Applications of Information Communication & Computation Technology (ICCT)–An Overview. In *Proceedings of National Conference on Recent Advances in Technological Innovations in IT, Management, Education & Social Sciences ISBN* (No. 978-81, pp. 941751-6). Google Scholar↗

[2] Aithal, P. S. (2019). Information communication & computation technology (ICCT) as a strategic tool for industry sectors. *International Journal of Applied Engineering and Management Letters (IJAEML)*, *3*(2), 65-80. Google Scholar↗

[3] Revathi, R., & Aithal, P. S. (2019). A review on impact of information communication & computation technology (ICCT) on selected primary, secondary, and tertiary industrial sectors. *Saudi Journal of Business and Management Studies, 4*(1), 106-127. Google Scholar↗

[4] Aithal, P. S., & Aithal, S. (2020). Information Communication and Computation Technology (ICCT) and its Contribution to Universal Technology for Societal Transformation. *Information, Communications and Computation Technology (ICCT) The Pillar for Transformation" edited by PK Paul et al. published by New Delhi Publishers, New Delhi, India*, 1-28. Google Scholar↗

[5] Aithal, P. S., & Aithal, S. (2019). Management of ICCT underlying technologies used for digital service innovation. *International Journal of Management, Technology, and Social Sciences (IJMTS)*, *4*(2), 110-136. Google Scholar↗

[6] Aithal, P. S. (2023). How to Create Business Value Through Technological Innovations Using ICCT Underlying Technologies. *International Journal of Applied Engineering and Management Letters (IJAEML)*, *7*(2), 232-292. Google Scholar↗

[7] Aithal, P. S. (2023). Advances and new research opportunities in quantum computing technology by integrating it with other ICCT underlying technologies. *International Journal of Case Studies in Business, IT and Education (IJCSBE)*, *7*(3), 314-358. Google Scholar↗

[8] Aithal, P. S., & Aithal, S. (2022). Exploring the Role of ICCT Underlying Technologies in Environmental and Ecological Management. In *Environmental Informatics: Challenges and Solutions* (pp. 15-30). Singapore: Springer Nature Singapore. Google Scholar↗

[9] Aithal, P. S., & Aithal, S. (2019, October). Digital service innovation using ICCT underlying technologies. In *Proceedings of International Conference on Emerging Trends in Management, IT and Education* (Vol. 1, No. 1, pp. 33-63). Google Scholar↗

[10] Aithal, P. S., & Aithal, S. (2018). Study of various general-purpose technologies and their comparison towards developing sustainable society. *International Journal of Management, Technology, and Social Sciences (IJMTS), (2018)*, *3*(2), 16-33. Google Scholar↗

[11] Kasneci, E., Seßler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., ... & Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and individual differences*, *103*, 102274. Google Scholar↗

[12] Aithal, P. S., & Aithal, S. (2023). The Changing Role of Higher Education in the Era of AI-based GPTs. *International Journal of Case Studies in Business, IT and Education (IJCSBE)*, *7*(2), 183-197. Google Scholar↗

[13] Aithal, P. S., & Aithal, S. (2023). Use of AI-Based GPTs in Experimental, Empirical, and Exploratory Research Methods. *International Journal of Case Studies in Business, IT and Education (IJCSBE)*, *7*(4), 33-47. Google Scholar↗

[14] Aithal, S., & Aithal, P. S. (2023). Effects of AI-Based ChatGPT on Higher Education Libraries. *International Journal of Management, Technology, and Social Sciences (IJMTS)*, *8*(2), 95-108. Google Scholar↗

[15] Aithal, P. S., & Aithal, S. (2023). Optimizing the Use of Artificial Intelligence-Powered GPTs as Teaching and Research Assistants by Professors in Higher Education Institutions: A Study on Smart Utilization. *International Journal of Management, Technology and Social Sciences (IJMTS)*, *8*(4), 368-401. Google Scholar↗

[16] Aithal, P. S., & Aithal, S. (2023). Application of ChatGPT in Higher Education and Research–A Futuristic Analysis. *International Journal of Applied Engineering and Management Letters (IJAEML)*, *7*(3), 168-194. Google Scholar↗

[17] Meyer, J. G., Urbanowicz, R. J., Martin, P. C. N., O'Connor, K., Li, R., Peng, P. C., ... & Moore, J. H. (2023). ChatGPT and large language models in academia: opportunities and challenges. *Biodata Mining*, *16*(1), 20-20. Google Scholar↗

[18] MacNeil, S., Tran, A., Mogil, D., Bernstein, S., Ross, E., & Huang, Z. (2022, August). Generating diverse code explanations using the gpt-3 large language model. In *Proceedings of the 2022 ACM Conference on International Computing Education Research-Volume 2* (pp. 37-39). Google Scholar↗

[19] Korkmaz, A., Aktürk, C., & TALAN, T. (2023). Analyzing the user's sentiments of ChatGPT using twitter data. *Iraqi Journal For Computer Science and Mathematics*, *4*(2), 202-214. Google Scholar↗

[20] Fui-Hoon Nah, F., Zheng, R., Cai, J., Siau, K., & Chen, L. (2023). Generative AI and ChatGPT: Applications, challenges, and AI-human collaboration. *Journal of Information Technology Case and Application Research*, *25*(3), 277-304. Google Scholar↗

[21] Skjuve, M., Følstad, A., & Brandtzaeg, P. B. (2023, July). The user experience of ChatGPT: findings from a questionnaire study of early users. In *Proceedings of the 5th International Conference on Conversational User Interfaces* (pp. 1-10). Google Scholar↗

[22] Lan, C., Wang, Y., Wang, C., Song, S., & Gong, Z. (2023). Application of ChatGPT-Based Digital Human in Animation Creation. *Future Internet*, *15*(9), 300-310. Google Scholar↗

[23] Antonius, F., Yuliani, M., & Meilia, S. (2023). The Influence and Impact Of The Ai-Based Application Chat Gpt On The Learning Culture Of Corporations-A Case In An Emerging Market. *International Journal of Humanities Education and Social Sciences*, *3*(3), 1555-1570. Google Scholar↗

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