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Research article

A study on ChatGPT for Industry 4.0: Background, potentials, challenges, and eventualities

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ABSTRACT

ChatGPT is an Artificial Intelligence (AI)-powered Natural Language Processing (NLP) tool that comprehends and produces text in response to given commands. It can be adopted for various requirements, like answering our inquiries, assisting us with content creation, translating languages, and more. The fourth industrial revolution, called "Industry 4.0," denotes a new production age focused on automation, digitalisation, and real-time connectivity of production systems. ChatGPT can help Industry 4.0 in a variety of ways. ChatGPT and AI-driven process optimisation is poised to revolutionise Industry 4.0 by enhancing productivity, quality assurance, and efficiency. For developing this paper, various articles on ChatGPT/ AI for Industry 4.0 were identified through Scopus, ScienceDirect, Google Scholar and ResearchGate. Industry 4.0 progresses due to the incorporation of cutting-edge technology like AI, Machine Learning (ML), and NLP and Manufacturing operations are changing. The ChatGPT language model is becoming well-known for daily use because of its promising applications. In the framework of Industry 4.0, it promises to revolutionise processes to assist advancement in boosting business productivity and efficiency. This paper studies the major need for ChatGPT for Industry 4.0. Various associated features, traits and versatile competencies of ChatGPT for Industry 4.0 are identified and briefed. Finally, it identifies and discusses the significant applications of ChatGPT for Industry 4.0. ChatGPT is a very flexible and efficient method for creating human-machine interfaces and automatically generating text, which provides proper knowledge and guidance to the employee. Applications for ChatGPT include chatbots, virtual assistants, automated customer care, language translation, and content production. In future, it will become an effective tool for enhancing communication and automating processes in Industry 4.0.

1. Introduction

Artificial Intelligence (AI) and Machine Learning (ML) have seen enormous progress in recent years, propelling the technological world forward. The most recent advancement in this field is ChatGPT, a cutting-edge language model created by OpenAI. Numerous opportunities have been made possible for many industries, including design and manufacturing, by this cutting-edge AI system. ChatGPT, which aims to change how people interact with computers and automate jobs, harnesses the potential of generative AI. The

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capacity of ChatGPT to converse like a real human being is one of its most impressive features (Wang et al., 2023; Haleem et al., 2022; Zhang et al., 2023a). The ChatGPT has revolutionised several sectors and can help create major advancements in Industry 4.0. ChatGPT is anticipated to rule the business world using several AI solutions for the next ten to fifteen years. The possible uses for ChatGPT are limitless, whether for boosting processes, interacting with customers in novel ways, or helping with coding (Alsadi et al., 2023; Badini et al., 2023).

ChatGPT is now being tested in a variety of settings. The world of experimenters and researchers is eager to see its potential and, maybe, its practical industrial applications. ChatGPT has assisted many creative writers in overcoming writer's block, which can aid bloggers who produce content amid today's quick-paced requirements for content generation (Chhillar et al., 2023; Aydın and Karaarslan, 2022). AI has allowed humans to communicate with machines more intuitively and naturally, from voice recognition to NLP. ChatGPT can be used in numerous sectors and is one of the most recent developments in AI. The capacity of ChatGPT to now comprehend both text and graphics as input is the most notable development. In comparison to its predecessor, this feature is a significant improvement. It allows the model to handle multimodal material, creating new use cases like analysing visual input (Atieh et al., 2023; Sobania et al., 2023).

The primary purpose of ChatGPT is to provide human-like replies to natural language inquiries or prompts in various settings and on various themes. This may include responding to queries, offering details, participating in dialogues, producing writing, and more. By responding to inquiries and addressing problems, ChatGPT for chatbots in customer care may provide immediate assistance to clients. Industry 4.0 may provide 24/7 customer support without requiring human contact using an advanced chatbot. This is especially important for the e-commerce, retail, and telecommunications sectors since these sectors often deal with consumer inquiries about goods and services. Industry 4.0 may speed up response times and provide consumers with more individualised care by adopting a customer service chatbot (Tissir et al., 2023; Rathore, 2023a; Rosati et al., 2023).

Many firms consider document creation essential, yet the process may take time and resources. Industry 4.0 may automate document production and simplify its processes using ChatGPT's natural language-generating capabilities. This may save time and money while generating consistent, error-free documents suited to their particular requirements by utilising ChatGPT (Guo et al., 2023; Liu et al., 2023; Chehri et al., 2023). Cybersecurity is a significant responsibility for organisations of all sizes in the modern digital environment. Businesses may strengthen their cybersecurity defences and shield their systems from possible attacks using ChatGPT. The sophisticated NLP capabilities of ChatGPT allow it to automatically identify threats of cyberattacks and avoid phishing schemes (Ryalat et al., 2023; Singh et al., 2023a).

Intelligent chatbots that can have natural language conversations with users may be made using ChatGPT. These chatbots may be used as personal virtual assistants and for customer service, sales, or support to provide human-like replies. Based on the programming language and the type of code being documented, ChatGPT can suggest appropriate documentation templates when a programmer enters their code. For instance, ChatGPT can offer a template for function documentation if the code is a function and includes parameters, return values, and a description of the function's goal (Javaid et al., 2023a; Frederico, 2023; Dohale et al., 2023; Uyan et al., 2023). The main aim of this paper is to identify and study significant applications of ChatGPT for Industry 4.0.

2. ChatGPT

Generative Pre-trained Transformer generates coherent and contextually relevant language; ChatGPT employs a specific architecture to comprehend the context and links between words in a phrase. A substantial quantity of text from sources like websites, books, and articles is used by ChatGPT to learn new things. This aids in its learning about a variety of topics and aids in its comprehension of how language functions, including grammar and context. ChatGPT can now produce text written by a human due to this training, making it useful in various settings and occupations. ChatGPT was created utilising a variety of NLP algorithms and supporting models (Haleem et al., 2022; Sharma and Yadav, 2022). It was designed to simulate human-like text dialogues for people.

There are several possibilities for firms to use ChatGPT in routine processes and software. Despite some current restrictions on how comprehensive the answers offered by this chatbot are, it is already more than capable of assisting businesses in increasing their bottom line and improving customer experiences. ChatGPT understands user input and produces answers that mimic human conversation using NLP and ML. Companies may use ChatGPT to build virtual assistants who can answer consumer questions, freeing up staff for more difficult work. ChatGPT enables automated discussions between people and computers by using NLP and AI. As it offers a quick and affordable way to engage with customers, this technology is quickly gaining popularity across various industries (Rathore, 2023b; Korzynski et al., 2023).

3. Industry 4.0

The Fourth Industrial Revolution, often known as Industry 4.0, is now underway and expected to significantly impact how people live and work. Industry 4.0 transforms how businesses produce, enhance, and distribute their goods. The Internet of things (IoT), cloud computing, analytics, AI, and ML are among the cutting-edge technology manufacturers incorporate into their manufacturing processes. Advanced sensors, embedded software, and robots are all included in this revolution, which gather and analyse data to help with decision-making. AI fosters innovation across sectors and allows us to achieve things we never thought imaginable, which is central to this shift (Calabrese et al., 2023; Kliestik et al., 2023; Febiandini and Sony, 2023).

The manufacturing sector has a fantastic potential to join Industry 4.0 by developing smart factories. Real-time visibility of manufacturing assets is ensured by analysing the massive volumes of big data gathered from sensors on the factory floor. This analysis also gives tools for doing predictive maintenance to reduce equipment downtime. ChatGPT is revolutionising how humans engage

with computers and is one of the most intriguing instances of AI in action. In Industry 4.0, technologies play an ever-more-important role in changing the industry. Industry 4.0 strongly depends on networked technologies, which enable organisations to function more effectively and effectively (Chen et al., 2023a). Fundamentally, Industry 4.0 is about using technology to streamline, accelerate, and improve current business processes (He et al., 2023a; Gupta and Jauhar, 2023).

4. Need of ChatGPT for Industry 4.0

ChatGPT assists in choosing the best test automation technologies, comparing various tools, and giving guidance on properly assessing them in an Industry 4.0 environment. ChatGPT may recommend well-known test automation frameworks and advise which framework to employ for a certain project. Developers may utilise ChatGPT as a useful tool for minimal code testing to ensure their apps are dependable, strong, and satisfy user needs (Prieto et al., 2023; Wankhede and Vinodh, 2023). Customer support teams have used this technology to automate work for decades. Industry 4.0 can adopt this technology to perform sophisticated customer care tasks. ChatGPT may provide clients with a more individualised experience by connecting with customer relationships management systems and loyalty programmes, such as proposing pertinent services and promotions based on their prior reservations and preferences. It can spot problems, provide suggestions on addressing them, and guarantee that the programme satisfies user needs (Javaid et al., 2021a; Patange and Pandya, 2023; Mijwil et al., 2023).

ChatGPT can be used to enhance language comprehension and processing. The model can recognise the subtleties of language and context since it has been trained on a vast quantity of text data. For NLP applications like sentiment analysis, text categorisation, and language translation, this makes it a perfect tool. This may help companies better understand the requirements of their customers as well as academics working to enhance NLP systems. Search and recommendation engines may be enhanced using ChatGPT (de Azambuja et al., 2023; Singh, 2023; Mantravadi et al., 2023). The model may be used to interpret the purpose of a user's inquiry and provide relevant answers. This may enhance search engine outcomes and give people tailored suggestions. Businesses who wish to improve user experience on their website or app and boost engagement and conversions may find this helpful. ChatGPT contains every feature required for widespread commercial success in Industry 4.0. It may become an operational cornerstone in any business that values technological growth and innovation with a capable implementation partner (Korkmaz et al., 2023; Lampropoulos, 2023; Alhayani et al., 2023).

The adaptability and customizability of ChatGPT is an additional advantage. The model may be adjusted to fit certain applications and requirements. This implies that it can be taught to comprehend certain languages and particular data sets. This makes it a useful tool for companies and academics that want to create personalised language models for their unique requirements. Creating test data for our applications using ChatGPT is another service it offers. ChatGPT can make the required data to verify the software's functioning by giving it the input parameters and their anticipated outcome (Miller, 2023; Zhang et al., 2023b). ChatGPT's skills may be used to assist testers in exploring the programme's features and finding any bugs. Specialised solutions for certain requirements may help with the development of unique apps. ChatGPT can optimise efficiency and ensure the dependability of automated processes of Industry 4.0 by analysing current code to find possible problems and make changes. Using ChatGPT, engineers and designers may do coding more quickly and with less manual effort. Professionals may greatly increase their productivity and improve the design

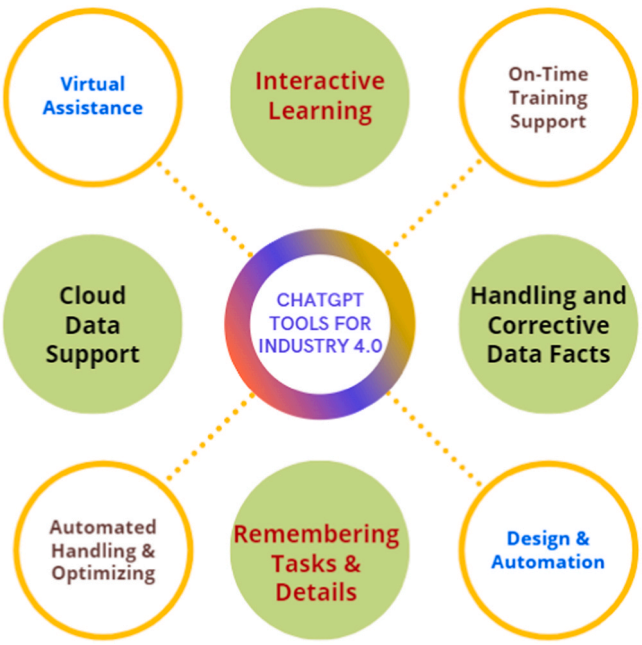

Fig. 1. Interactive Traits of ChatGPT for Industry 4.0.

process using AI's sophisticated comprehension of human language and coding skills (Upadhyay et al., 2023; Haleem and Javaid, 2019).

5. Research objectives

ChatGPT's AI technologies have shown to have strong capabilities. The product features of ChatGPT will continue to develop, and its capacity to handle real work will become more mature with the ongoing accumulation of self-training and integration with other software tools. ChatGPT is expected to make its way into business applications eventually. ChatGPT may be a potent tool for producing and optimising content. It can create keyword-rich content, meta descriptions, titles, headers, and picture alt tags that aid with search engine rankings (Gupta et al., 2023; Alkaissi and McFarlane, 2023; Komkowski et al., 2023). It will provide us with a list of well-liked keywords, their synonyms, and other terms we might use instead of the original ones while writing an article. ChatGPT's principle applies to computers, software, other businesses, and communication. The depth and breadth are sufficiently anticipated. If the money-making impact persists, it will encourage and draw additional off-site monies to flow into the ChatGPT idea, promoting its continued existence (Corsello and Santangelo, 2023; Ocelík et al., 2023; Zarifhonarvar, 2023). The major research objectives of this article are as under:

1. **RO1: -** to discuss the need for ChatGPT for Industry 4.0 and study the associated features and traits of ChatGPT for Industry 4.0;
2. **RO2: -** to discuss the versatile competencies of ChatGPT for Industry 4.0;
3. **RO3:** - to identify the significant applications of ChatGPT for Industry 4.0. environment.

6. Associated features and traits of ChatGPT for Industry 4.0

Fig. 1 explores the various associated traits and tools of ChatGPT towards supporting the Industry 4.0 culture. It fundamentally relates the different features of virtual assistance, training support, cloud data support, corrective features for practical issues, automated care and other aligned perspectives for channelising and practising industry 4.0 in the real culture of the industrial sphere. These features further support and carefully handle the overall upliftment of the industry towards growth and advancements (Bildirici and Ersin, 2023; Javaid et al., 2021b; Prashar, 2023).

Creating intelligent chatbots that understand and naturally respond to users' questions, perform sentiment analysis on text expressions, support marketing applications, or even generate code in particular programming languages from specific user requests has been extremely successful in recent weeks (Rivas and Zhao, 2023; Qureshi et al., 2023). Marketing professionals may benefit from ChatGPT by optimising the level of client personalisation they can provide via the material delivered to them. It is a ground-breaking technological advancement that will affect many sectors and applications. Content development, customer assistance, education, and many other industries now have new opportunities because of their sophisticated natural language interpretation and generating capabilities (Yue et al., 2023; Pinciroli et al., 2023; Kalla and Smith, 2023).

ChatGPT is a lot more than just a search engine for technical data. It can comprehend the subtleties of information and provide meaningful answers to inquiries that are difficult for conventional search engines to find. As a result, developers who want to rapidly and effectively obtain technical knowledge are increasingly turning to it. Software developers are already using ChatGPT's built-in AI capabilities in cutting-edge programmes for Industry 4.0 (Ding et al., 2023; Chen, 2023). With ChatGPT becoming commonplace in practically all daily-used apps, such as office suites, productivity tools and analytics programs, this is expected to threaten and disrupt established software applications (Mhlanga, 2021; Taecharungroj, 2023).

ChatGPT can alter the game for software professionals by boosting their productivity and accelerating the software development process. Now, programmers can ask ChatGPT to write code for a specific issue, review the code for fixes, ask conceptual questions about any technical subject or technology, and look for best practices for any given issue or technology. By lowering expenses, delivering individualised experiences, and speeding up reaction times, ChatGPT can provide Industry 4.0 operations with endless scalability (Salonitis, 2023; Javaid et al., 2022). The intricacy of language is another constraint on ChatGPT. The model can answer various queries and prompts, although it sometimes struggles to grasp subtleties in language use. This may result in misinterpretations or insufficient replies. It could have trouble understanding idiomatic language or sarcasm, which would cause it to respond inappropriately or in irrelevant ways. Generative design's capability to provide designs optimised for a particular manufacturing procedure or set of materials is another advantage. The programme can provide effective, useful, feasible, and affordable designs by considering material qualities, production limitations, and economic concerns (Werbińska-Wojciechowska and Winiarska, 2023; Wu et al., 2023; Rossini et al., 2023).

Among the chatbot programs used often to automate customer service, respond to frequently asked questions, and converse with consumers, ChatGPT has a strong track record. The conversational responses of an AI-powered chatbot are far better than those of the much more simplistic chatbots now being used on websites. ChatGPT performs a fantastic job of analysing data, assessing online behaviour, and generating product suggestions as part of the online sales and upselling process. There are several ways that ChatGPT may benefit organisations (Arana-Landín et al., 2023; Verma, 2023). ChatGPT can create emails, social media posts, essays, code, and other written material. Customer interaction, decision-making, marketing material, staff training, and natural language understanding are all enhanced by ChatGPT, which also offers the ability to understand queries and requests in their context. Businesses are presently using ChatGPT for research purposes, where it may be utilised to conduct market research and compile data from client comments. This can analyse social media postings and customer evaluations to find trends and patterns companies can employ to enhance their goods and services (Fordal et al., 2023; He et al., 2023b; Javaid et al., 2023b).

Based on current trends and the target demographic a firm is trying to attract, ChatGPT may generate descriptions, headlines, call-to-actions, and other material for marketers. ChatGPT may support language learning and enable instructors to construct more sophisticated instructional products. Examining their learning patterns and suggesting lessons and resources that fit their learning preferences may also be utilised to provide students with individualised learning experiences. By making game characters more individualised and engaging, ChatGPT may improve the gaming experience (Balakrishna et al., 2023; Pardos and Bhandari, 2023). It can be used to analyse player data and give game developers insights so they can make more interesting games. Chatbots that can help travellers with their reservations and provide on-demand responses to their inquiries may be made using ChatGPT. Thus to deliver more individualised travel advice and experiences, it may also be utilised to analyse client data. Social media firms may use ChatGPT to create more interesting social media posts and analyse user data to produce content that is more tailored to the individual.

ChatGPT has a wide range of possible applications. It can fundamentally alter how companies connect with clients, provide healthcare services, educate students, generate news, and advertise goods. This potent language model might change how we engage with and use AI daily. It is a useful tool for corporations, academics, and people alike because of its capacity to produce human-like writing and help with various language-processing tasks. It is a text-generating technology that creates text that resembles human speech in response to commands or input. It is an AI tool that works as a simple model for everyone to understand by combining an NLP programme with reinforcement learning with human feedback. It allows data scientists to address challenging analytical issues because of the extensive information it contains. Creating summaries and doing hypothesis tests also aid in exploratory data analysis (Yang et al., 2023a; Burger et al., 2023; Verma et al., 2023).

Industrial organisations use AI-enabled technology to increase productivity, revenue, and profits. A large portion of the larger Industrials sector believes that AI is crucial to the further development of industrial output. ChatGPT can provide training materials and curricula for employees, enhancing training in Industry 4.0 that might need more resources. It can serve as an internal chatbot, provide customer service, and raise client happiness. Making work go quicker is the major tool marketing aficionados should use to improve their tactics and carry out more effective advertising campaigns, content publications, and other pertinent tasks. Managing many social media accounts, business blogs, newsletters, case studies, white papers, and ebooks may sometimes be challenging. Regularly producing and disseminating useful stuff is now much simpler using ChatGPT. Regression, integration, and performance testing are all automated testing procedures using ChatGPT. For instance, ChatGPT evaluates a web application's usability by simulating user interactions and ensuring it reacts appropriately to diverse inputs (Panda and Kaur, 2023; Pandey et al., 2023; Ausat et al., 2023).

7. Versatile competences of ChatGPT for Industry 4.0

Fig. 2 exemplifies the various extraordinary competencies of ChatGPT proposed for responding to the variety of real-time issues and challenges in the current industrial scenario involving Industry 4.0. It includes distinct internet tools and utilities, digital transformation, facts of exchanging ideas and data, innovations and creativities, updated and renewed features for industrial practices, etc (Rana and Rathore, 2023; Aljanabi, 2023; Gabashvili, 2023).

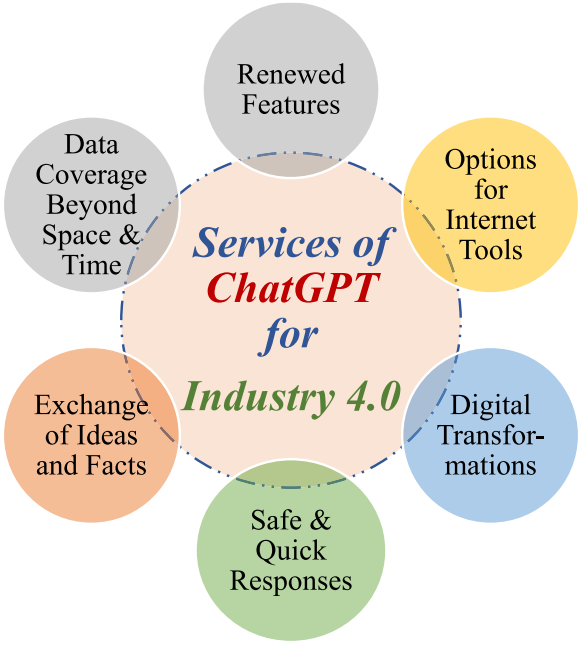

Fig. 2. Impressive Services of ChatGPT for Industry 4.0.

ChatGPT is mostly used in Industry 4.0 to assist training experts as they guide and instruct staff members and company professionals. The tool may respond to inquiries, provide comments on assignments, assist in organising training sessions, and assess each user's progress. This may free up a significant amount of time for trainers, allowing them to concentrate on activities that call for creativity and face-to-face interaction. Businesses nowadays should focus on the demands of their customers and be audience-driven. However, adjusting internal and external operations to achieve these goals is difficult without thorough customer care analytics and a workable strategy. With a wide range of tasks it can automate and speed up, ChatGPT comes to the rescue, assisting businesses to improve their operations and advance within their specialised markets (Masmoudi et al., 2023; Sakirin and Said, 2023). The testing procedure may be automated with the use of ChatGPT. Utilising its ML capabilities, it can create automated test scripts that can be used to test the software continuously while also learning from manual testing activities.

ChatGPT can help identify potential software bugs. It may provide insights into the places likely to contain flaws by analysing the code and the testing data, enabling testers to concentrate their efforts on those areas. ChatGPT can aid in creating test data for low-code applications. It may generate test data based on various situations, including edge cases, positive and negative test cases, and more. The ability of ChatGPT to produce human-like replies is a key feature. It goes far beyond being a chatbot. It will react with the procedure and code for the programme and software application if we ask it to develop a program or even just a basic software application. It suits chatbots, AI system discussions, and artificially intelligent personal assistants (Chen et al., 2023b; Cribben and Zeinali, 2023; Mo et al., 2023). During the conversation, it provides a natural response to queries and inspires the creation of tales and poetry.

The tool's conversational nature and human-like response generation capabilities are very appealing. If the correct instructions are supplied to the device, ChatGPT has the potential to develop into a strong chatbot that can teach a variety of subjects. It may explain anything, including philosophy, storytelling for entertainment, culinary techniques, and recommendations for new techniques (Yang et al., 2023b; Kung et al., 2023). Data scientists compile pertinent information from many sources, assess it, and make helpful inferences. The findings influence numerous business-related activities that are performed. Data scientists perform various computations based on varied patterns, historical data, and current knowledge. Additionally, ChatGPT can offer insightful data on consumer behaviour and preferences. Hospitality companies may enhance their services and products by analysing chatbot interactions to spot trends and patterns in consumer inquiries (Behl et al., 2023; Mattas, 2023).

ChatGPT has the potential to change the logistics industry. By rapidly giving accurate information and simplifying communication, ChatGPT may assist logistics companies in improving productivity, increasing customer satisfaction, and reducing expenses. By analysing data on prior shipments, including delivery times, prices, and weather conditions, ChatGPT can suggest the best routes for forthcoming shipments. This may help businesses lessen their environmental impact while saving them time and money on transportation costs. ChatGPT enables data analysis and provides insights into logistical processes. This may help logistics companies by evaluating data on shipment timings, delivery routes, and other logistics-related characteristics to help them discover areas for improvement and streamline their operations. Because supervised learning and reinforcement learning, both of which have their roots in the ML field, were combined, ChatGPT is what it is today. The capacity to analyse existing data and produce new instances based on the relationship between a feature and a label was provided by the supervised learning component of ChatGPT's algorithm (Raj and Jeyaraj, 2023; Kim et al., 2023a; Paul et al., 2023).

ChatGPT has elevated the technology to entirely new heights. It has a remarkable capacity for understanding and responding to input in natural language. It is now a preferred option for building chatbots that can communicate with people in a human-like way. It can comprehend and produce text that resembles that of a person because of the vast quantity of text data on which it was trained. With these capabilities, ChatGPT becomes a potent tool that can be integrated into various applications, such as chatbots and virtual assistants. Users may find communicating with and performing activities with their virtual assistant simpler. ChatGPT may be integrated into applications other than chatbots and virtual assistants, such as content production, automated writing, and language translation (Cornago et al., 2023; Pandya and Kumar, 2023). ChatGPT may produce text in a certain tone or style, such as a news piece or a commercial description. By doing this, content makers may save time and money while raising their work's quality.

One of ChatGPT's most evident advantages is its capacity to produce text that sounds like human speech. As a result, it may be used to develop chatbots that interact with people conversationally. Businesses looking to enhance client engagement and customer service will find this extremely helpful. Chatbots that ChatGPT drives may assist with sales and marketing and provide answers to consumer questions and product information. The GPT model recognises and comprehends complex language structures during the learning process. Using deep learning algorithms and approaches for NLP, ChatGPT develops the capacity to summarise; comparing two papers is a simple operation. Search engines, video conferencing programs, document editing programs, AI drawing programs, and other programs may all be combined with ChatGPT to yield unexpected outcomes (Gordan et al., 2023; Qadir, 2023).

ChatGPT is capable of more than simply text analysis. The main distinction with this new technology is that it can also function with submitted photos. One incredible use case was when OpenAI showed how a design could swiftly transform into a functioning website. They demonstrated how to use the created code in a preview to see how the website would seem after the picture had been uploaded to ChatGPT. The model's size, the calibre of the training data, and the purpose it is intended for are only a few of the variables that affect how well an AI language model performs. It is conceivable for different models to function well in various contexts and for a new model to sometimes outperform older versions. Thus to keep our site relevant to our audience and search engines, ChatGPT-generated material has to be regularly monitored and updated, just like all of our other content (Singh et al., 2023b; Alshurafat, 2023; Kim et al., 2023b). Additionally, some human touch is required to ensure the information is accurate and interesting.

8. Applications of ChatGPT for Industry 4.0

Industry 4.0 may provide an effective and easy customer care experience by utilising ChatGPT to build a chatbot that can comprehend and answer client questions and requests organically and conversationally. Both the company and the client may benefit by saving time and resources in this way. Chatbots that help clients identify items, make suggestions, and complete transactions may be made using ChatGPT. Customers may have a more individualised shopping experience, and sales for the company may rise. ChatGPT may suggest ways to improve the readability, efficiency, and code structure. This is useful for quality improvements to existing code without changing its behaviour. Renaming variables, eliminating repetitive code, and other improvements that can make the code more efficient and easier for other programmers to understand are all things ChatGPT can suggest. Users can more effectively modify the model's behaviour by using improved customisation options, ensuring that the material produced by AI meets their needs for Industry 4.0 (Giuggioli and Pellegrini, 2023; Uddin et al., 2023; Banitaan et al., 2023; Hassoun et al., 2023). The major applications of ChatGPT for Industry 4.0 are discussed in Table 1.

ChatGPT can change the manufacturing sector in several ways, especially for those using Industry 4.0 to transform advanced manufacturing. Processes and operations across sectors are expected to be revolutionised by the ChatGPT. ChatGPT might be taught to spot item flaws by examining photos or sensor data. This could aid producers in enhancing their quality assurance procedures and lowering the output of faulty goods. Concerning keyword analysis, ChatGPT analysed substantial amounts of textual data produced by users and returned a verbatim analysis that included the most often-used phrases. The straightforward copywriting of chatbots is especially helpful for creating convincing marketing and sales content that supports businesses and products. Automating client feedback gathering and complaint resolution may be accomplished by integrating an intelligent chatbot, such as ChatGPT, into a product-focused website or application. The process of learning to code has been easier by using ChatGPT. This conversational AI can write lines of code for almost any programming language now accessible in response to user input, giving detailed syntactical feedback and suggesting better coding practices based on well-known data structures and algorithms (Giuggioli and Pellegrini, 2023; Cardona et al., 2023).

Businesses of all sizes may automate customer care and assistance with ChatGPT. Customer happiness may be raised through personalising customer care and automating client interactions. Automating client interactions using ChatGPT may help organisations save time and money. It can answer client questions, provide individualised client support, and automate client onboarding procedures. As a result, less manual customer support is required, frees up resources for use in other company areas. Effective marketing communication relies heavily on personalisation. Businesses may utilise ChatGPT to create customised emails and email templates for their clients using customer data. This allows companies to customise their message for specific clients, which may enhance engagement and conversion rates. Personalised emails strengthen the bond between companies and their consumers, whether they are used to welcome new clients, promote products, or advertise sales. Businesses may use ChatGPT to send personalised, more interesting and relevant emails to their consumers, increasing their happiness and loyalty. Businesses may quickly convert written text into spoken words using ChatGPT, expanding the use cases for voice-over work and other applications (Mathew et al., 2023; Roumeliotis and Tselikas, 2023). Businesses may save time and money while enhancing the accessibility and inclusiveness of their content by adopting ChatGPT for text-to-speech conversion. It might improve the user experience and engage users in fresh, creative ways.

9. Discussion

With the help of ChatGPT, the most frequently searched keywords are identified after extensive analyses of human-generated text data. This chatbot's simplicity of copywriting is particularly useful for producing persuading marketing and sales content that promotes companies and items. A product-focused website or application may automate getting customer feedback and handling customer complaints by incorporating an intelligent chatbot like ChatGPT. It enables companies to use AI and ML to automate customer service procedures like prompt customer service and customised customer experiences. It may also automate customer service procedures, such as responding to commonly asked queries and analysing client feedback, allowing organisations to enhance customer care offerings. By using this technology, businesses may benefit from the Internet of Things, digital transformation, and the future of work. Businesses can leverage AI-driven algorithms to simplify operations and save operating costs as robots grow smarter and more self-learning.

In general, this technology is a key factor in Industry 4.0. ChatGPT is ushering in a new age of efficiency, intelligence, and productivity, from assisting companies in streamlining their operations to enhancing team collaboration. Fraud detection and malpractice reduction are other banking and financial services applications for ChatGPT. By streamlining customer service procedures, firms may increase production and efficiency. This may lead to better customer service, more sales, and greater profitability. The use of ChatGPT in a variety of sectors has the potential to change how companies engage with their consumers completely. ChatGPT may provide useful insights into prospective security problems by examining emails, security logs, and network traffic. This enables firms to take preventative action before a security crisis occurs. Additionally, ChatGPT can produce alerts and reports highlighting potential security incidents, assisting companies in staying informed and acting promptly as and when required. Businesses can strengthen their cybersecurity defences and secure their sensitive data from cyberattacks using ChatGPT, giving them peace of mind and preserving their brand.

Developing software may be intricate and time-consuming, requiring great skill and meticulous attention to detail. Businesses may use ChatGPT to expedite their software development procedures and save time and money by not starting from zero when writing simple programs. Businesses may learn important information from customer reviews, social media postings, and news articles using ChatGPT's sophisticated NLP capabilities. Businesses may use the important insights and patterns they discover from this analysis to guide their product development, marketing plans, and customer service initiatives. Businesses can boost employee productivity and happiness by letting employees concentrate on higher-level activities rather than manual procedures using the rising usage of virtual assistants. Additionally, intelligent agents will speed up collaboration between staff members and departments by offering a

Table 1
Significant applications of ChatGPT for Industry 4.0.

S. No	Applications	Description
1	Real-time direction and training to the workers	ChatGPT might provide on-the-ground workers with real-time direction and training based on the insights produced by the industrial AI-based analytics tools inside the premises. We could recommend remedial or preventative measures if any prospective equipment breakdowns occur. It can aid in new hire training and troubleshooting. Processes and operations across sectors are expected to be revolutionised by the ChatGPT. Given its potential application fields, it has gained widespread popularity even though it is still in the testing phase. Businesses could take advantage of one such scenario in an Industry 4.0 environment. This can alter how businesses and industries operate. It can significantly change manufacturing processes and enable collaboration between people and robots in Industry 4.0. Organisations may integrate ChatGPT significantly to alter manufacturing processes and enable various channels to get detailed and customer-focused input on the industrial output. Businesses may make improvements to their goods and production methods with specific input.
2	Provide task lists and schedules	For Industry 4.0, ChatGPT might provide task lists and schedules for employees and industrial managers to guarantee optimum resource utilisation. Data from automated factory dashboards may be further analysed using ChatGPT to provide summaries that might be included in the company's reports. This might be accomplished by converting tabular data into a text format that is simple to read. The decision-makers would benefit from having a clearer grasp of the production levels of the plants across geographical boundaries. The development of Reinforcement Learning from Human Feedback (RLHF) models may make ChatGPT useful for business studies. It might develop novel process-related enhancements, produce many permutations and combinations for product compositions, or develop cutting-edge product features that could be included in future releases. Businesses and industries will widely use ChatGPT and may also stand to gain from it. It has the power to alter how companies run. Because of its ability to automate repetitive tasks, offer real-time data analysis, support several languages, and improve data accuracy, it may change how time and resources are allocated.
3	Analysed industrial data	Large volumes of industrial data might be analysed using ChatGPT to spot inefficiencies in production methods. This may aid producers in streamlining their processes, cutting waste, and enhancing quality assurance. Using sensor data from industrial equipment, ChatGPT might be taught to look for trends and forecast when maintenance would be necessary. Manufacturers could benefit from this by cutting downtime and maintenance expenses. Banking was blessed by the ability to tailor financial advice to the demands of extremely particular consumer profiles. This is because it often needs to be done sufficiently to identify personalities that might ensure excellent returns. Bankers may use ChatGPT to assess internal customer data about buying habits and investment vehicles. Learning to code has been much easier by using ChatGPT. This conversational AI offers exact syntactical feedback and suggests improved coding practices based on well-known data structures and algorithms. It can write lines of code in response to practically every user prompt for any programming language now on the market. ChatGPT may create, edit, and consume system design documentation.
4	Analyse possible danger	Data from suppliers may be analysed using ChatGPT to find possible dangers or opportunities. This may aid firms in choosing suppliers wisely and cutting supply chain expenses. Manufacturing businesses could utilise ChatGPT to provide automated customer care. This can include responding to frequent inquiries, offering technical assistance, and processing orders. To reduce dangers, developers and users must collaborate to implement safety measures and encourage openness. To assist in preserving end-user privacy and maintain faith in AI systems, OpenAI must obtain data that has been anonymised and employs strong security measures. The extensive use of ChatGPT could result in a dependence on AI-generated material that undermines human creativity and critical thinking. Adopting ChatGPT and other AI technologies might greatly impact the economy. It may cause huge firms to centralise their AI resources or cause human labour to be replaced in certain sectors. By enhancing ChatGPT's ability to absorb and recall context from long text sections and back-and-forth conversations, which is being worked on by OpenAI researchers, the coherence and relevance of its responses will be increased.
5	Automate various tasks	Businesses may utilise ChatGPT, for instance, to automate tasks like data collection from various sources, IoT device monitoring, and future-oriented tasks like hiring, onboarding, training, and performance tracking. Businesses may use this to enhance client experiences while saving time and money. ChatGPT is used for various language-related activities, including language learning and customer assistance. It is a useful tool in many industries, including education, business, and entertainment, because of its capacity to comprehend and produce writing that sounds like a human wrote it. ChatGPT enables users to reduce time spent on tasks, enhance communication, and produce original content in various applications. It can produce human-like responses on a variety of subjects. It has outstanding language comprehension and is capable of producing replies that are accurate and relevant. Additionally, fine-tuning, which incorporates human feedback, increases its usefulness and safety, making it a valuable tool with numerous applications.

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Table 1 (*continued*)

S. No	Applications	Description
6	Improve cooperation between people and robots	The use of AI algorithms is not new in Industry 4.0. These technologies have helped digitalise real-time production system connectivity in recent years. Similarly, the ChatGPT model for business may help move things in this direction, especially in improving cooperation between people and robots. ChatGPT allows the creation of interactive chatbots, virtual assistants, and other conversational AI applications. ChatGPT uses an open-source platform to support ML, automated decision-making, and NLP. It also includes technologies like text-to-speech and voice recognition to mimic human dialogue. The language model is a component of OpenAI's wider effort to streamline and automate the digital transformation process, enabling organisations to become more effective and competitive in the future of work. It offers organisations a potent tool for integrating intelligent virtual agents into their operations by utilising the capabilities of automation, the Internet of Things, and ML. In Industry 4.0, this technology can completely transform customer service, business operations, and communication.
7	Create technical documentation on manufacturing.	ChatGPT may be utilised in the Industry 4.0 to automatically produce technical documentation on manufacturing, maintenance, or safety procedures. In reality, it can "translate" tabular data from automated dashboards into a text format that is simple to read. The information might then be included in the company's reports to provide comprehensive production knowledge. ChatGPT may create, edit, and consume system design documentation. We may build our software product's system architecture from the start with conversational AI. The journalism and news media industries are reluctant to include ChatGPT in their creative processes since most news media sectors see it as an impediment to creativity. However, ChatGPT has helped many talented writers get past writer's block, which can help bloggers and journalists who produce content in the fast-paced environment of today's content development requirements. Businesses may produce high-quality written papers that correspond to their criteria by giving precise information and specifications to ChatGPT. This is especially pertinent for creating contracts, invoices, and other business documents where accuracy and compliance are essential.
8	Enhancing the efficiency	Businesses may save time and money while enhancing the efficiency of their marketing and advertising operations by using ChatGPT. It could assist companies in reaching their marketing objectives and expanding their clientele. Businesses may increase productivity and efficiency while producing high-quality software tailored to their specific requirements by employing ChatGPT in software development. Businesses may enhance their awareness of their inventory levels and supply chain management to save costs and increase efficiency by using ChatGPT's sophisticated analytics capabilities. It can produce precise reports on supplier performance and delivery times, giving businesses the information they need to improve their logistics system and guarantee prompt product delivery. ChatGPT may modify and improve its replies as it processes increasing user input, better serving users' requirements. As a result, ChatGPT-built chatbots have the potential to improve user experience over time by becoming effective and efficient. The model may provide quizzes, practice questions, or flashcards to assist students in reviewing and solidifying their comprehension of the course information. It can provide test-taking advice and assist students in developing efficient study schedules to improve their exam performance.
9	Better planning for industrial operations	ChatGPT can provide on-the-ground quality control inconsistency detection and predictive maintenance plans for industrial operations. With its condensed and available technical literature and guides, it can help workers on the trading floor. ChatGPT may output natural language inputs from users, such as voice instructions, as machine and manufacturing robot-actionable steps. ChatGPT may be used to promptly and properly respond to consumer inquiries, cutting down on wait times and raising customer satisfaction. It may also act as a virtual travel companion by giving passengers facts about their trip plans, estimated arrival and departure times, and other crucial information. ChatGPT outperforms any AI-based capability previously available. Therefore, it is important to take anxiety and fear seriously and turn them into opportunities. The potential of ChatGPT for the rail sector has already been shown. The benefits may help businesses and society everywhere. The moment has come to provide the necessary circumstances and terrain for such highly developed AI. This technology is always accessible, unlike a human representative, at any time of day. A chatbot can also respond to numerous queries quickly and easily. This accessibility ensures that activities and procedures go as planned while preventing conflict amongst significant stakeholders, which, in turn, positively impacts the organisation and enhances performance.

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Table 1 (*continued*)

S. No	Applications	Description
10	Enhance human-machine interaction	The ability to enhance human-machine interaction is one of ChatGPT's most promising uses in smart manufacturing. Communication between people and machines must be efficient as industrial processes become automated. ChatGPT may serve as an intelligent interface enabling users to communicate with machines using natural language rather than complicated instructions or codes. This results in an effective and smooth manufacturing process by simplifying the procedure and decreasing the probability of mistakes and miscommunications. Data scientists can use ChatGPT as a conversational interface for interacting with their data. They can communicate with one another in normal language and operate more effectively because they can ask questions, give orders, and get replies. It may provide insights by looking at many data and finding trends, patterns, and anomalies. Data scientists may use these insights to create data-driven choices. ChatGPT creates original material and interacts with people in a natural and human-like manner. It may provide guidance, provide answers, and much more. A large language model, which consists of neural networks that anticipate word sequences and produce phrases that resemble those written or spoken by humans, powers ChatGPT.
11	Problem-solving	ChatGPT can be used in manufacturing settings to improve the problem-solving process. ChatGPT can see patterns and trends in enormous volumes of data from multiple sources, including sensors, devices, and historical records, that human operators would not instantly notice. This makes possible by making better judgements, optimising production schedules, and seeing potential bottlenecks or inefficiencies before they become serious problems. Conversations become increasingly regionalised by using ChatGPT's NLP capabilities. It enables our chatbots to continue conversations akin to those with real operators and provides our consumers with more individualised solutions and suggestions. ChatGPT assists in boosting the effectiveness of customer support teams and gives prompt and correct answers to consumer enquiries. It may relieve them of easy and customary questions so they can concentrate on more complicated ones. ChatGPT may be used for language translation to facilitate multilingual contact with clients and suppliers. Though an impressive AI language model, ChatGPT occasionally exhibits hallucinations in its responses, frequently made worse when denied access to pertinent data.
12	Improve predictive maintenance	AI-driven process optimisation can be used in manufacturing facilities to improve predictive maintenance. AI algorithms can predict equipment failures and maintenance problems before they become serious by analysing data from sensors and machines. This enables manufacturers to take proactive measures to solve issues and save downtime. This lowers the equipment maintenance and replacement price while guaranteeing that production schedules are met and that output quality is constant. ChatGPT is capable of resolving challenging mathematical and scientific puzzles. Compared to its predecessor, it can process complex mathematics problems and effectively simulate chemical processes. It could be used in content development, gaming, healthcare, e-commerce, retail, tourism, hospitality, education, and banking. E-commerce businesses utilise ChatGPT to enhance the product descriptions on their websites. Customers have an almost infinite alternatives because of the industry's intense competitiveness. Companies utilise ChatGPT to develop captivating product descriptions because they recognise that these descriptions are a crucial part of their websites and have the power to make or break their sales.
13	Handling customer support issues	ChatGPT is often used to handle customer service concerns, including tracking purchases, refunds, and frequently asked questions. Since they have greater access and memory than a human, chatbots may provide a more personalised customer experience. Another benefit of deploying chatbots in eCommerce is the ability to assist at any time, regardless of when clients make online purchases. There are several methods to reply to customer queries with ChatGPT. ChatGPT shortens response times without compromising quality and lessens the workload for customer service representatives. Because AI chatbots make it possible to automate standard support inquiries, service tickets, and complaints and make the customer care process much smoother and more proactive, many businesses are implementing them. Since they have many items, manufacturing businesses may use their chatbots to help shortlist options and make purchases. A chatbot may use historical data to identify the client's persona and propose the best product based on their preferences using an algorithm. Intelligent virtual assistants benefit businesses in a variety of ways, one of which is increased productivity and efficiency. The company now has extra human and financial resources using a chatbot prepared to take over routine and redundant work.

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Table 1 (*continued*)

S. No	Applications	Description
14	Helps for the creation of new products	Although ChatGPT is a useful tool that can aid engineers in their work, a human engineer is still necessary. Engineers will continue to be essential in designing and creating new products. Therefore, they will need to learn new techniques and methods of operation that will allow them to use the power of AI technologies while simultaneously retaining their distinctive worth as innovators and problem-solvers. To learn and comprehend programming languages, ChatGPT can offer explanations and examples of programming concepts, a piece of software, syntax, and functions. Beginner programmers who might need to become more familiar with programming concepts or seasoned programmers using a new programming language may find this especially helpful. A key marketing component is providing potential customers with information about a product's features, advantages, and value through product descriptions. In order to create product descriptions that appeal to the interests and preferences of the target audience, ChatGPT can help. Using NLP techniques, ChatGPT can help group search intent by examining search queries and classifying them according to the user's intended goal or purpose. In order to better fulfil the requirements and expectations of their target audience, companies and marketers may use this information to understand the motivation behind certain search phrases and optimise their content and strategy.
15	Potential to reduce the time to market	Because ChatGPT can infer data from numerous parallel treatment plans, it can reduce the time to market. Those enormous amounts of data points can then be quickly analysed for insights and correlations to provide a better understanding of trial results. ChatGPT may be included in a chatbot to provide quick and individualised client service. Among other things, chatbots in marketing may answer client questions, provide technical assistance, and fix problems. ChatGPT may assist in establishing content structure by providing outlines and recommending organising techniques for a specific subject. It may be taught to recognise and react to common customer complaints, such as difficulties with product quality, shipment delays, or billing faults. When a client makes a complaint, ChatGPT may assess the message and deliver a response that recognises the customer's concerns and offers viable options to fix the problem. Manufacturers may automate the inspection process, quickly discovering flaws or discrepancies in real-time by deploying AI-driven quality control solutions. This not only lessens the possibility of defective items being sent into the market, but it also helps producers to resolve problems more swiftly and successfully, thus improving consumer happiness.
16	Examine massive data sets of components.	Enterprise executives may use ChatGPT to examine massive data sets of components and processes. Doing so will make creating and maintaining items like manuals, component catalogues, and operating procedures easier, leading to greater efficiency. For new component suppliers, who sometimes need more documentation advantage than established providers, it might also be leveraged to generate substantial knowledge capital. Customer data may be analysed using ChatGPT to provide reports on customer sentiment and conduct. Businesses may use the information to understand their clients better and make choices that enhance the customer experience. ChatGPT may also examine financial data and provide financial performance reports. This helps businesses to identify patterns, make wiser choices, and maximise their financial performance. ChatGPT may be used to examine written reports and data from quality control inspections to find patterns and trends in product faults. In order to find patterns and trends that suggest when maintenance is required, ChatGPT may be used to examine sensor data and logs from industrial equipment. Employees may more easily access the information they want by using ChatGPT to automatically summarise vast quantities of technical publications, such as manuals and procedures.
17	Analyse and process client enquiries	ChatGPT can swiftly analyse and process client enquiries, provide summary financial reports, and extract information from documents for use in the financial services industry. Financial services professionals may use the platform to provide preliminary summaries of business models for companies and recaps of earnings calls and other significant events. The approach affects advising services by giving oversimplified financial advice to various clients. It can also simplify consumer financial calculations, enhancing customer support and facilitating product marketing. Even inputs in unusual or difficult languages may be understood by ChatGPT. It can comprehend and provide replies to various user inputs since it was trained on a large human language dataset. As a result, it is ideal for developing chatbots that respond to many client enquiries or requests. They are used in various sectors, including customer service, online shopping, and entertainment. Chatbots may comprehend user input more naturally and human-likely by using ChatGPT. For instance, a ChatGPT-powered customer service chatbot may comprehend and address consumer enquiries more quickly and effectively, minimising the need for human interaction.

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Table 1 (*continued*)

S. No	Applications	Description
18	Helps to automate inventory management	ChatGPT helps to automate inventory management. By using a dataset of inventory data to train the model, businesses can utilise ChatGPT to quickly and accurately identify when goods are running low or need to be refilled. Companies may avoid stockouts and ensure that the right items are always available to meet customer demand. Effective supply chain management is essential for organisations aiming to boost customer happiness and their bottom line. By monitoring inventory levels, spotting possible stockouts, and enhancing replenishment cycles via the analysis of purchase orders and invoices, ChatGPT may assist companies in streamlining their supply chain management. The consistent supply of components and materials is one of the most crucial production elements. To prevent waste and ensure that orders are completed, businesses in the manufacturing industry need to maintain track of their supply chain and available inventory. It performs simulations using various data sets and produces precise results. Creating and upkeep self-running software that supports ML projects is the duty of the ML engineer. They are often filled since they are in high demand. To manage huge amounts of data, they need great data management abilities.
19	Better to meet customer demand	Businesses may use ChatGPT in supply chain management to estimate future product demand by training the model on previous sales data. Business owners may use this to plan for the future and ensure they have the right supplies to meet customer demand. Customer support, data input, and content creation are just a few jobs that ChatGPT and other language models can automate using NLP. ChatGPT is not meant to replace or supplement human labour but to enhance and assist it. They help people carry out their tasks effectively and precisely. In addition, human responsibilities like data scientists, engineers, and researchers are necessary for creating and operating AI. By offering round-the-clock assistance, responding to commonly requested queries, and taking care of straightforward requests like booking confirmations and cancellations, ChatGPT may enhance customer service. By doing this, staff members may have more time to work on difficult duties, including answering client concerns. By automating processes that usually need staff time, such as managing customer inquiries and booking confirmations, ChatGPT may help save expenses. For major hospitality companies that respond to many client inquiries, this may result in considerable cost savings.
20	Management of logistics	Another area where ChatGPT is beneficial is the management of logistics and transportation. Data from prior shipments is used to train the model, and businesses may use ChatGPT to forecast potential supply chain delays, interruptions, or disruptions. It may help companies prepare for and deal with these issues, reducing the likelihood of costly delays or stock-outs. Answering client questions and giving feedback on associated work processes are the primary responsibilities of customer service roles. ChatGPT is an expert at providing answers. At the moment, certain banks and online shopping sites have implemented robot customer support. In the future, the intellectual property service sector may depend on AI chatbots like ChatGPT to respond to client inquiries professionally and, over time, via professional knowledge training, progressively develop their features and benefits. It may also be coupled with case management systems to update customers on the status of patent applications and examinations. ChatGPT can be used to create automated test plans and reports to improve the effectiveness of quality control inspections. To ensure that quality management techniques are used consistently. This might include creating standard operating procedures, work instructions, and other documentation.
21	Quality control in manufacturing	There are various ways that ChatGPT may be used for quality control in manufacturing. One method is analysing data from quality control inspections to find trends and possible problems. The model may provide reports and warnings to inform quality control staff, and it can also be used to anticipate when quality problems are likely to arise by training it on past data. ChatGPT can produce text depending on a certain subject or tenor. This implies that it may be used to produce material for various purposes, including creating fiction and news stories. Additionally, it can be used to create poetry, marketing copy, and product descriptions. As a result, ChatGPT is a useful tool for marketers and content producers that want to develop high-quality content fast and effectively. Because of ChatGPT's sophisticated NLP skills, it can build simple programs based on certain specifications and parameters, saving developers important time so they may concentrate on more difficult tasks. By using its underlying large language model, ChatGPT's capacity to comprehend human language is one of its key features. The model can generate high-quality literature that closely mimics information created by humans because of its profound knowledge of grammar, syntax, and semantics.
22	Optimise maintenance schedules	ChatGPT can be used to optimise maintenance schedules to reduce downtime and increase overall equipment efficiency. It can also be used to generate reports and alerts to notify maintenance personnel when maintenance is necessary. If trained on past data, it might conduct and propose preventative maintenance measures to foresee problems and provide suggestions for increased safety. Data analysis of sensors and actuators on equipment and facilities is used in data monitoring to spot abnormalities and sound alerts. There can be building a chatbot that can assist machine operators in the event of issues or inquiries regarding tools or procedures. It creates technical documentation on maintenance, safety, or manufacturing procedures. Natural conversation interfaces for machine management and control are being developed to make it easier for operators to connect with technology. When AI solutions are quick to implement and have a simple user interface, production processes may be improved, machine downtime is decreased, and machine dependability is increased.

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S. No	Applications	Description
23	Helps to perform supply chain management operations	Inventory monitoring, demand forecasting, logistics and transportation management, supplier management, customer service, risk management, and contract management are just a few of the supply chain management operations that can be automated by utilising Chat GPT. Along with the advantages provided by ChatGPT, AI-driven process optimisation is crucial in determining the direction of the future of smart manufacturing. Manufacturers can optimise every process step, from supply chain management to quality control, using ML algorithms and sophisticated analytics. This results in more efficiency and less waste and ensures that items are produced according to the highest standards. A chatbot may also monitor various parameters by connecting with current systems, assuring maximum effectiveness and improved supply chain management. The use of chatbots by organisations to improve customer service has become crucial. Businesses can now build chatbots using ChatGPT that provide more customised and human-like replies, which may greatly increase customer satisfaction. In order to provide more precise and individualised suggestions, ChatGPT may also be utilised to analyse client data. ChatGPT may be used to improve cooperation and communication throughout a supply chain. By using data from prior interactions between suppliers, manufacturers, and retailers to train the model, businesses may utilise ChatGPT to create automatic solutions to frequently asked inquiries and requests. By doing this, coordination, communication time, and resources may be saved, enabling businesses to focus on other important duties.

centralised communication system. This may result in a more effective workflow, better decision-making, and better customer service.

ChatGPT can generate code snippets in various programming languages based on user input and requirements. A code snippet is a brief section written in a programming language that serves as an example of a specific feature, function, or approach. It is a tremendous advance in NLP, allowing AI to create coherent, contextually appropriate, and virtually human speech-like text answers conversationally. Businesses that want to improve their business intelligence skills and make better choices based on data-driven insights might benefit from this. Businesses may provide better insight into their consumers and the market by using ChatGPT's sophisticated analytics capabilities. This will help them remain one step ahead of the competition and make business-growth-oriented choices. ChatGPT is aimed at delivering human-like conversational interactions. It is based on large language models (LLMs), powerful ML models that can interpret and create natural language.

GPT models are constructed on the Transformer architecture, a neural network model developed for NLP applications. The Transformer architecture uses parallel processing and self-attention mechanisms to effectively manage complex linguistic problems and produce correct content in its context. To guarantee that we all have the greatest possible experience, Open AI employed human AI trainers to polish the language models and used human feedback and reinforcement learning approaches. ChatGPT is a sophisticated language model that demonstrates many essential characteristics that distinguish it from its forebears and enhance its usefulness in various applications. ChatGPT's natural language comprehension enables it to easily carry on conversations and read remarks, queries, and commands with frighteningly accurate accuracy. In order to provide more relevant and well-rounded replies, ChatGPT may maintain context from prior chats.

The vast knowledge base of ChatGPT is another noteworthy aspect. The AI chatbot can provide replies on various topics since it was trained on a large dataset that included material from many sources. Due to its scalable design and training approaches, ChatGPT is appropriate for various applications and industries. The model's performance and adaptability to different use cases may be improved by fine-tuning it for certain jobs. Learning experiences may be customised by adjusting to each student's requirements, interests, and ability levels via ChatGPT. It may provide more materials, advise exercises, or suggest learning resources that align with the pupils' goals and learning preferences. The model can use its broad domain knowledge to help students in various areas, including math, physics, history, and language arts. It may give clarifications, responses to inquiries, or advice on certain subjects, assisting students in learning and remembering material more effectively.

In subsequent iterations, better common-sense reasoning capabilities may be added to ChatGPT, allowing the model to handle implicit knowledge and intuitive understanding more successfully. Even when comprehension of human experiences or tacit knowledge is necessary, this will lead to more precise and meaningful answers with fewer follow-up inquiries. By improving the training procedure, data curation, and model evaluation, developers intend to focus on minimising bias and fostering fairness in ChatGPT's outputs. The way telecom firms handle customer care, network administration, fraud detection, sales and marketing, among many other sectors of business, might be completely changed by ChatGPT. Telecom firms may improve customer happiness and loyalty by using the potential of AI and NLP to create more effective, efficient, and personalised interactions with their consumers.

With the ability to provide customers with quicker, more effective, and more individualised help, AI-powered chatbots have the potential to revolutionise the way telecom firms approach customer care. For instance, ChatGPT may be incorporated with the standard customer care channels used by the telecom industry to provide 24/7 immediate, automated help and information on goods and services. Additionally, ChatGPT can be used by telecom companies to design a series of personalised responses to customer inquiries, which can make for an enjoyable and interesting experience. ChatGPT can adjust to the particular requirements and tastes of different clients because of its capacity to learn from previous encounters and its proficiency with NLP. With enterprise-specific data sets, ChatGPT can be used as a conversational agent to message and advise clients. It could significantly increase the bandwidth

of client representatives or do away with the requirement for the position by offering effective, high-level financial education.

The advent of generative AI has the potential to change the business environment significantly. This technology allows for creating new material by learning from existing data, which can disrupt sectors and how enterprises are managed. Generative AI can increase efficiency and productivity, reduce costs, and open up new development opportunities by enabling the automation of many tasks that humans previously did. Therefore, businesses using technology will likely have a significant competitive advantage. ChatGPT may also be used for other writing jobs. It can translate a text into other languages, condense many pages into a paragraph, complete a phrase that is only half finished, create conversation, and more. When the model is trained on data from a particular domain, such as legal papers or medical records, it may also be tailored for certain use cases.

10. Limitations of ChatGPT for Industry 4.0

Although ChatGPT is adept at producing human-like answers, it needs in-depth Industry 4.0 knowledge. This may restrict its capacity to provide precise and pertinent insights in fields that need specialised expertise. As a language model, ChatGPT works with text-based inputs and outputs. It may not be appropriate for applications like robotics or automation that involve interacting with physical systems. Although ChatGPT can produce responses that resemble those of humans, it can be challenging to comprehend how it makes decisions. This may reduce effectiveness in situations requiring interpretability, such as risk assessment or regulatory compliance. Due to data security and intellectual property rights concerns, manufacturing companies might hesitate to share confidential information with ChatGPT. This may reduce the model's capacity to provide insights from a large dataset. ChatGPT's training and deployment processes demand many computer resources for smaller manufacturing organisations with limited resources.

ChatGPT and AI have drawbacks, like with any technology. The loss of jobs is the most apparent drawback; as computers become more adept at conversational AI, virtual assistants, and data processing, they will eventually replace human labour. Employees face hurdles in switching to other professions or competing in the future face a hurdle as a result. The possibility of bias in decision-making due to ChatGPT is another possible problem. As AI-powered systems grow increasingly integrated, their output may include errors or unintentional biases. It has to be closely managed as it might result in distorted findings that disfavour individuals. Nevertheless, some ethical and legal restrictions might make it difficult to implement them. This technology is simple to utilise to damage a company’s reputation. Additionally, it can influence people's opinions of a product. As ChatGPT adoption rises, industry regulatory bodies must implement the necessary laws to reduce legal issues and challenges that could negatively affect businesses.

Concerns regarding ChatGPT's possible use in disseminating misleading information, disinformation, propaganda, or deepfake material arise because it produces plausible-sounding language while having little expertise. Even though ChatGPT is skilled at creating code for narrowly focused, easier problems, it might need to be more proficient at creating code for complex problems. We may need to use the tool to create code blocks that we can combine to solve bigger problems to handle more difficult problems by breaking them down into smaller subproblems. Because it creates replies based on the user's input, it needs more contextual knowledge, which makes it easier to hold casual discussions. It functions like a machine and needs human input to operate and train data. In order to provide reliable replies, many training data is needed. Because people process the information provided to them and because there is much data, bias may result, and unreliable results may be obtained.

Despite having human-like answers, it can only comprehend brief talks since it cannot comprehend the subtleties of human communication, such as body language, humour, sarcasm, and emotions. With its robust and adaptable NPL tool, ChatGPT, a still-evolving AI technology, has the potential to change how humans engage with technology completely. It has yet to reach its full potential. Since there is ongoing research and development in the field of NLP, it is possible to improve it in areas where it could be improved. This will likely lead to further advancements in the capabilities and performance of these models. Google search is reported to be surpassed by ChatGPT. It relies on the individual requirements and tastes of the user; hence it is controversial whether or not it is the best Google substitute as a search engine. For instance, a user may prefer a clear and concise response to website connections in search results.

The calibre of the data used to train ChatGPT is a constraint. Although the model is trained on a sizable amount of text data, this data is only sometimes indicative of how language is used in the real world. The model's capacity to comprehend different situations may be constrained since the training data may be skewed towards certain demographics or subject areas. Flaws or inconsistencies in the data may also impact the model's performance. Although ChatGPT is a tool that can help engineers with their work, it must maintain the knowledge, skill, and creativity that engineers bring to product design and development. The AI tool can answer inquiries regarding general technical knowledge or engineering calculations, but such answers should be treated fairly with scepticism and fact-checking.

For developers wishing to build chatbot apps utilising NLP, ChatGPT is a potent tool. It is the best option for building chatbots that may benefit users because of its capacity to comprehend and react to inputs in various complicated and different languages and learn from and improve over time. Despite having a large database, ChatGPT occasionally fails to capture the diversity of languages, experiences, and cultural backgrounds that exist in real-time. As a result, replies can prove to be unsuitable or out of context. The model can only sometimes manage several properties related to individuals, locations, events, etc. The pre-trained structure may confound variables and provide unpredictable results. Furthermore, the responses might be biased because the data came from the internet. In reality, ChatGPT relies on ML techniques that have been developed using data. We cannot depend on the accuracy of the replies since the training may be biased or flawed.

11. Future scope

Shortly, ChatGPT will be able to assist in creating precise legal contracts. Already, this chatbot is capable of producing legal writing that could compete with some of the best human attorneys. The applications of AI are clear in the end, and we have just begun

to explore their full potential. We may anticipate seeing these technologies play an increasingly significant part in determining the future of employment and our society as we advance towards Industry 4.0 and beyond. We can unleash new levels of creativity, efficacy, and productivity by embracing these technologies and ethically exploiting them, which might help us solve some of the world's most urgent problems and build a better future for all of us. Future developments in AI language models could enable them to access real-time data or perform live research, allowing ChatGPT to provide more accurate and up-to-date responses.

As anticipated improvements and breakthroughs are anticipated to overcome current limitations and enable ChatGPT to become even more adaptive, powerful, and valuable tools for several applications, the future holds immense promise for ChatGPT. The AI community can unleash the full potential of language models and propel the next wave of innovation in NLP and beyond by continuing to invest in research and development. NLP and ML are the foundation of ChatGPT. It predicts developments based on historical data and patterns, including technological and industrial trends. Techniques like time series analysis, text categorisation, and clustering may be used to predict future developments. It will process and produce natural text, as if it were authored by a person, using ML algorithms. It trained on trillions of data points to build a neural network to recognise patterns and correlations, forecast the future, and provide replies.

The future of ChatGPT is promising as new advancements in context comprehension, common sense reasoning, bias reduction, real-time information availability, and flexibility are made possible by continuous research and development. The ChatGPT language model is a potent one with many uses and advantages. It will be a useful tool for companies, content providers, and academics because it can create writing that looks and reads like real beings, can generate text based on certain themes or styles, and may enhance language learning and processing. It will become a useful tool for individuals wishing to create customised language models because of its adaptability, customisation choices, and simplicity of use. In the upcoming days, ChatGPT will help manufacturers by offering real-time information on the condition of processes and equipment in a manufacturing plant. This enables operators to recognise equipment or process problems as they arise and take remedial action before they worsen. The potential of ChatGPT is limitless, and it will undoubtedly be used in manufacturing in the future.

12. Conclusion

ChatGPT uses technology to generate replies for their customer service chatbots, Industry 4.0 may drastically cut response times by automating several tasks that people previously handled. By enhancing productivity and facilitating quicker software development, ChatGPT has the potential to revolutionise the IT sector. With more software products, including ChatGPT, it will become an essential tool for software workers as the technology develops. Chatbots have long been regarded as the finest technique for cultivating and advancing leads through a company's sales funnel. ChatGPT makes it feasible for this engineering to encompass various abilities and tasks beyond giving information or responding to particular queries. Engineers must be able to analyse data, create and test prototypes, assess trade-offs, and make choices based on various criteria, including technical, economic, environmental, and social issues. These issues can be sorted out by using this technological platform. Security is of the utmost importance when programming or developing applications, and ChatGPT now provides a better way to learn about vulnerabilities and perform quality assurance. ChatGPT does jobs and has conversations similar to those of a person. By offering quicker and more effective customer service, this chatbot has the potential to enhance the railway sector in several ways. ChatGPT reduces communication obstacles by formatting textual answers to users' inquiries. In future, ChatGPT will assist engineers with queries and advise on certain subjects for Industry 4.0.

Declaration of Competing Interest

On the behalf of all the authors in paper, I **corresponding author** hereby accept that there is no conflicts of interest.

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