

Integrating Generative AI into Tactical Military Decision-Making

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Abstract

Decision-making in military organizations is particularly challenging at all levels, from tactical to strategic. Therefore, support for decision-making is crucial, which, in modern systems, includes traditional and more advanced command and control (C2) models. Due to the complexity of contemporary military operations, tactical decision-making should involve rapid, precise, and informed consideration of courses of action (COA). This research focuses on determining the application of generative artificial intelligence (AI) systems, such as ChatGPT, within tactical military decision-making as a potential component of the C2 model. As an advanced language model, ChatGPT can provide potential support to commanders in analyzing and selecting the optimal course of action by generating relevant situational solutions based on large data sets utilized by artificial intelligence. The research shows that using ChatGPT in this context enables the automatic generation of relevant scenarios based on realistic and hypothetical input data. Furthermore, by analyzing possible solutions through interaction with the generative AI system, it is possible to optimize decisions as well as the decision-making process at the tactical command level. This reduces human error and improves response time in dynamic and complex military situations. Although increasingly advanced AI models can significantly enhance military decision-making, this process must not be fully automated. Human oversight must be maintained in the final decision-making phase, thereby preserving accountability in critical military decisions.

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Keywords:

military decision-making, C2 system, generative artificial intelligence, course of action

1. Introduction

Decision-making in a military organization is generally considered at the three levels of war, including strategic, operational and tactical. Strategic decision-making occurs at the highest level, within the context of national policy and long-term objectives, and involves planning policy, strategies, resources and alliances. Operational decision-making focuses on implementing strategy through specific military operations (U.S. Joint Chiefs of Staff, 2020). Commanders at the operational level consider various potential courses of action (COA) to coordinate multiple tactical units and different operations, aiming to achieve strategic objectives on the ground (U.S. Army, 2023). Tactical decision-making refers to specific decisions regarding battlefield situations, where commanders assess courses of action (COAs) at the level of individual battles.

The military decision-making process (MDMP) at the operational and tactical levels involves evaluating courses of action through three steps: developing options, analyzing, and selecting. The development of options involves a situational analysis, which results in identifying acceptable courses of action. The analysis includes evaluating each option based on its potential advantages, risks, timeframes, resources, and expected actions of the adversary. Finally, the process concludes with selecting the most acceptable course of action.

Modern battlefields, where extremely fast and accurate contemporary computer-based weapon systems prevail, exceed the organizational capabilities of military decision-makers to manage and plan their use and respond to similarly equipped adversaries (Kott, 2004). As a result, traditional command and control systems face the challenge of processing vast amounts of real-time data while ensuring speed, accuracy, and relevance in decision-making. Modern commanders must also contend with the rapid pace of

adversarial tactics, including cyber threats and disinformation, as well as the complexity of integrating advanced technologies like AI, autonomous systems, and multidomain operations, which demand faster and more adaptive responses. To address this issue, command and control systems are being enhanced with computer technology—computers and software—so that information can be sorted, filtered, and displayed to assist the commander in focusing on the “right” information, at the speed of relevance. Naturally, this approach assumes that the commander’s responsibilities, the circumstances they find themselves in (situational awareness), and the decisions to be made are sufficiently understood in advance to predict their informational needs (Brannon et al., 2009).

The approach to solving the problem, which relates to the limitations of cognitive abilities in decision-making by commanders (or any human being), is implemented as previously mentioned—using computer technology. Artificial intelligence (AI), and especially generative AI, has seen a rising trend in development and application. The advent of deep learning in the first decade of this century enabled the use of convolutional neural networks (CNN), whose models brought significant advances in image and pattern recognition tasks (He et al., 2016). CNNs are applied, for example, for autonomous driving purposes, including object recognition and real-time traffic sign identification. Chronologically, after CNN networks, the focus shifted to generating high-quality synthetic images, enabled by the introduction of Generative Adversarial Networks (GANs), with a significant contribution from Goodfellow et al. (2014). Focusing on the architecture of AI models, a major advancement was made with the transformer architecture, which enabled the development of large language models (such as ChatGPT).

These AI algorithms, particularly large language models, have opened a new path for the development of automated C2 systems—decision-making systems that can process large volumes of information, learn from complex patterns, and make decisions based on context, in a manner that was previously reserved for human decision-makers. Generative artificial intelligence represents a significant breakthrough in AI, offering numerous capabilities beyond the reach of traditional models. Specifically, it involves the ability to create entirely new content, which was not within the scope of

traditional AI models. Models such as Generative Pre-trained Transformers (GPT), leveraging large datasets, have shown the ability to understand and generate human-like text, leading to their widespread application across various fields. ChatGPT, as an example of a generative AI system, falls within the broader category of multimodal systems capable of processing and generating various types of data, including text, images, and code.

Although generative AI models possess advanced data processing capabilities, they face particular challenges that need to be addressed. For instance, Generative Adversarial Network (GAN) models face primary challenges such as instability during training and the generation of adversarial examples that can deceive the models or compromise system security. In response to these challenges, newer approaches based on the concept of diffusion have been developed, ensuring greater stability and reliability of models (Ho et al., 2020).

Thanks to the exceptional development of large language models, particularly GPT models, their application has become feasible across various domains of human activity, including education, healthcare, agriculture, lifestyle, marketing, video games, entertainment, finance, industry, travel, transport, and e-commerce (Yenduri et al., 2024), as well as in specialized fields such as military decision-making (Goecks & Waytowich, 2024). Therefore, it can be said that today's AI algorithms have the potential to revolutionize military decision-making as well as command and control.

Command and control (C2) in modern militaries focuses on supporting commanders in accomplishing their missions by ensuring proper coordination and the timely positioning of resources (Brehmer, 2007). C2 systems are often part of more complex C4ISR systems (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance). The development of C2 military systems and solutions has led to the integration of technologies such as satellite communication systems (SATCOM), control interfaces for unmanned aerial systems (UAS), mobile command posts, real-time intelligence-sharing platforms, cloud computing, cyber defense systems, sensor integration solutions, and other advanced technologies (Army Technology, 2024).

This paper aims to explore the possibilities, methods, and effectiveness of using large language models in C2 systems, with a particular focus on the components of command and control systems related to situational analysis and proposing courses of action. The main research question is as follows:

Is it realistic to apply publicly available generative artificial intelligence (GenAI) models to support the military decision-making process in developing and selecting courses of action at the tactical decision-making level?

The paper is structured as follows: it begins with an introductory section, then a review of previous research, then an experiment applying the ChatGPT-4 model to analyse a tactical military situation. Based on the results obtained, an analysis of the effectiveness is conducted, and finally, a conclusion is drawn.

2. Previous Research

A literature review on the application of artificial intelligence and generative pre-trained transformers (GPT) in command and control (C2) systems is essential for understanding this technology's current development and potential in military operations. This chapter will examine existing research and works that propose and describe the application of artificial intelligence and GPT in areas such as situation awareness, decision-making, and the suggestion of courses of action (COA).

For the search of scientific papers, indexed databases such as Web of Science (WoS) and Scopus, the scientific literature search tool Google Scholar, the specialized database for technical and engineering disciplines IEEE Xplore, and ChatGPT 4.0 were used. The keywords employed in the search included: "course of actions", military, "command and control", and "artificial intelligence". Using these keywords, papers discussing the application of generative pre-trained transformers (GPT) in command and control systems were discovered. Furthermore, considering the observed application of GPT in C2 systems, to improve the search, ChatGPT was used with a query asking it to suggest relevant keywords for the paper on the application of

generative pre-trained transformers in command and control systems. The suggested terms that can be used as keywords include:

1. Generative Pre-trained Transformers in Command and Control
2. AI in Military Decision Making
3. Large Language Model in Military Planning
4. Artificial Intelligence in Command and Control
5. COA-GPT Military Applications
6. Network-Centric Warfare AI Integration
7. AI-Driven Course of Action Development
8. Decision Support Systems in Military Operations
9. Human-AI Collaborations in Command and Control
10. Application of LLMs in Defense Systems
11. AI in Emergency Command and Control
12. Military Planning AI Tools

In addition, a query was made in ChatGPT 4.0: "Find articles related to the term AI in Military Decision Making" in an attempt to find additional papers linking C2 systems with GPTs. Although GPTs were not explicitly mentioned in the query, the three articles on the application of artificial intelligence in military decision-making that were suggested are interesting because they highlight how AI can assist in military operations through decision support (Horyń et al., 2021; Morgan et al., 2023; Zhou & Rosalie, 2024). Additionally, they emphasize the problems, primarily of an ethical nature, that arise when humans overly rely on automated systems in military decision-making (Morgan et al., 2023; Zhou & Rosalie, 2024).

The report (Morgan et al., 2023), which addresses the ethical issues of using artificial intelligence for military purposes, also highlights technological advancements in several key areas of AI that could be utilized to improve military operations. Business organizations largely drive this progress in AI development for various reasons. Business organizations have the ability to leverage capital investments and academic resources that military services find difficult to secure or may not have access to. Therefore, technologies

developed by these organizations for commercial purposes are expected to be adapted for use in military contexts.

The most important areas of technological advancement in AI with potential applications in military operations include computer vision, specifically image recognition, text analysis, autonomous vehicles, simulations, and computer gaming. The same report (Morgan et al., 2023) also lists the potential benefits of applying artificial intelligence for military purposes, obtained through structured interviews. According to the respondents, the most mentioned advantages are the increased speed of decision-making and big data.

The advantages and disadvantages of using artificial intelligence to support decision-making and process big data are discussed in a NATO report (Reynolds & Atalan, 2024). This report is significant for understanding how AI can be integrated into military structures such as command and control, as it provides insight into the complex processes that enable effective application of the technology in military operations. The seriousness and importance of AI for military purposes can be seen in NATO's promotional video "Using Artificial Intelligence to Enhance Military Decision Making," released in the spring of 2024, which presents a vision of artificial intelligence supporting decision-making (NATO Science & Technology Organization, 2024).

Morgan and Waller explore the advantages and potential of artificial intelligence in supporting and taking over decision-making processes in complex situations requiring speed and processing large amounts of information (Waller & Morgan, 2019). They argue that AI will play a key role in future military operations in the air, including tactical control of aircraft and rapid decision-making on the battlefield.

McDowell et al. (2024) propose the use of generative pre-trained transformers (GPT) in military operations to accelerate decision-making and the development of courses of action. The authors believe that advanced technologies like GPTs can transform C2 systems, significantly contributing to military decision-making and operations, making them faster and more efficient.

Furthermore, Goecks and Waytowich present COA-GPT, a model that uses generative pre-trained transformers to accelerate the development of courses of action (COA) in military operations. This model enables the rapid generation of tactical courses of action, taking into account military doctrines and mission-specific data. The authors highlight that COA-GPT significantly reduces the time needed for decision-making and allows commanders to review and adjust proposed courses of action in real-time, making the decision-making process more flexible and adaptable in the dynamic conditions of the battlefield (Goecks & Waytowich, 2024).

The introduction of GPT into decision-making processes in the military is not limited to military operations alone. Due to its exceptional content interpretation capabilities, the author of the article, Hong (2024), suggests that the U.S. Department of Defense (DoD) develop its own generative artificial intelligence model, like GPT models such as ChatGPT. The author discusses the potential and needs of the DoD for its own system of generative large language models (LLM), which could support legal professionals and broader military personnel in daily tasks and decision-making.

Yenduri et al. (2024) argue that generative pre-trained transformers undoubtedly have the potential to transform various areas of human activity, making it logical to conclude that transformers can also be applied for military purposes, specifically in military operations where C2 systems are a key element for success on the battlefield.

In addition to GPTs, which, according to the suggestions of the authors of the previously mentioned articles, can enhance command and control in C2 systems, there are also other approaches worth mentioning, which are considered to have the potential to contribute to improving decision-making in military operations. Goecks et al. (2021) explore how games and simulators can be used as platforms for developing artificial intelligence that supports command and control (C2). These systems allow for the development of AI models through the simulation of real military scenarios. The use of simulators and games enables AI systems to learn through interaction with the environment, accelerating the process of optimizing strategies and courses of action. The authors emphasize that deep learning algorithms, such

as those developed in simulations, are particularly effective in improving situational awareness and suggesting optimal decisions on the battlefield.

Given the vast capabilities of artificial intelligence and generative pre-trained transformers, which, as Yuval Harari put it, have 'hacked the operating system of human civilization,' referring to the underlying structure of human language as the key tool for communication and understanding, their application holds immense potential for military purposes, especially in enhancing military command and control (C2) systems. Although further research is needed to better understand the ethical, security, and technical challenges, existing works clearly indicate that the application of GPTs and other AI systems will play a crucial role in the modernization of military structures. This literature review provides a solid foundation for further research into the potential of artificial intelligence in military operations, with a particular focus on enhancing command and control systems in the Croatian Armed Forces.

3. Research

In this chapter, the GPT model ChatGPT 4o will be utilized in the field of military decision-making to propose courses of action (COAs). To demonstrate the capabilities of the ChatGPT 4o model, a textual template and a COA sketch will be provided, after which the model will be tasked with generating its own version of the COA. An expert or a commander can further evaluate this version within the context of a C2 system.

3.1 The version of operations generated by the commander and staff

The version of operations and its sketch shown here were taken from the work (Tuličić, 1996). The text of the operation version is as follows:

"TASK OF THE BATTALION: 2-66 INFANTRY ATTACK 250100Z MAY 96, with the objective of destroying the enemy's security in the area of NB 135871 (TARGET WOLF) in order to enable the NOP (task-organized unit - TF) 1-12 MECH to continue the attack eastward along Osborne Road."

Operation Formulation COA: "The battalion crosses the starting line at 0100, advancing in the direction of the attack with one company (three infantry platoons, one engineering platoon, and a Stinger section) at the front; followed by the command group; the second company (three infantry platoons and a Stinger section); and the third infantry company (minus) the last (two infantry platoons and the anti-armor platoon). At checkpoint 2, the second company (minus) and the anti-armor platoon occupy Hill 652 to provide fire support for the forces on the main axis of attack. One infantry platoon sets up an ambush in the area of NV 140857 to destroy enemy armored vehicles and prevent the enemy from reinforcing TARGET WOLF. The leading company occupies TARGET 1 to allow the assigned company (attack force) to pass through and secure the key area. The last company passes TARGET 1, occupies TARGET 2, and prevents the enemy security from engaging NOP 1-12 with fire support, while the latter attacks south along Wheeler Road and east along Osborne Road." Figure 1 depicts the sketch of the offensive version of operations described in the previous text.

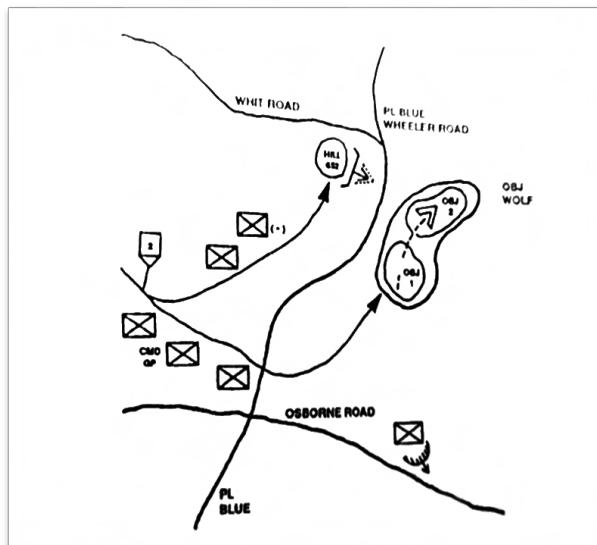


Figure 1. Sketch of the offensive version of operations
(Tuličić, 1996, according to MPRI training materials)

3.2 The version of operations generated by ChatGPT 4.0

A new version of operations was generated using the ChatGPT 4.0 artificial intelligence by first loading the existing version into the model. Then, through prompts², the model was familiarized with the context and asked to analyze the provided operation sketch and generate a new version of the course of action based on this input, considering tactical objectives and key elements. This would guide the model in understanding the request and generating an appropriate response based on the context.

3.2.1 Creating Context and Understanding the Situation in GPT Models

To familiarize the model with the existing version of the operation, the following prompts were used:

Prompt: "You are now the chief of the military staff. I am the commander, and I need your assistance. Do you understand?"

ChatGPT's response: "Understood, Commander! The Chief of Staff is ready to provide assistance. How can I help with your mission?"

Prompt: "Explain the image I have attached."

ChatGPT's response: "The image provided is a tactical military map that illustrates the operation plan or the battlefield situation. Here is a detailed analysis:

Key Elements in the Image

1. Roads and Lines:

- Whit Road and Wheeler Road to the north.
- Osborne Road runs horizontally through the middle of the image.

² A prompt in the context of artificial intelligence and model like ChatGPT refers to the input text or set of instructions given by the user to prompt the model to generate a specific response. A well-constructed prompt is crucial for obtaining a relevant and useful answer from the model. The prompt is a question or instruction that the model uses to understand the context and generate a response.

- PL BLUE: The presumed line of blue forces (PL - Phase Line), located in the southern part of the map and further north along Wheeler Road.

2. Topographical Features:
 - Hill 652: A hill with an elevation of 652 meters, marked as a tactically significant point.
 - OBJ WOLF: The objective of the operation with two subzones marked as OBJ 1 and OBJ 2.
3. Representation of Forces:
 - Rectangles with an "X" inside represent units (likely infantry or mechanized units).
 - Movement Directions: Black arrows show the direction of the attack or the movement of forces towards Hill 652 and OBJ WOLF.
 - On the western side of the map:
 - A group of units located on the western side of Osborne Road.
 - CWO OP: Label for the Command Observation Point.
 - The unit marked with the number "2" on the left side likely represents a command element or support unit.
4. Dynamics of the Operation:
 - Two main axes of attack:
 - The first axis targets Hill 652 (to the north).
 - The second axis targets OBJ 1 and OBJ 2, indicating the key objective within OBJ WOLF.
 - Units are deployed for a converging attack, meaning the forces are moving towards the objectives to converge at critical points.
 - The symbol on the right side of Osborne Road represents a unit ready for maneuver.

Interpretation of the Operation:

1. Focus on Hill 652:
 - Hill 652 is a key elevation point providing an advantage for observation and terrain control.
 - Likely, the first objective is to secure this point in order to gain a terrain advantage.
2. Objectives OBJ WOLF (OBJ 1 and OBJ 2):
 - Securing OBJ WOLF appears to be the main objective of the operation.
 - Forces are advancing from multiple directions to neutralize resistance within these objectives.
3. PL BLUE:
 - The PL BLUE line marks the phase line or the initial line of strength for the operation.

Conclusion:

The image depicts an attack tactic involving coordinated force movements towards the elevated position of Hill 652 and the final objectives of OBJ WOLF (with sub-objectives OBJ 1 and OBJ 2). These elements suggest an operation focused on securing key positions and controlling the terrain.

If you need a more detailed analysis or an assessment of potential scenarios, I am at your service, Commander!"

3.3 Alternative attack course of action (COA) generated by ChatGPT

One of the objectives is to explore whether the GenAI tool can offer alternative actions for the situation described and presented in Figure 1. After ChatGPT demonstrated an understanding of the context and situation – as the analysis of the situation, dynamics of events, and interpretation of the operation align with the COA example from the paper (Tuličić, 1996) – the following prompt was given:

Prompt: "Can you create another version of the attack presented on the same map?"

ChatGPT's response:



Figure 2. Visual response of the ChatGPT tool to the request for alternative courses of action

"The alternative course of action is shown on the map. The main changes include:

1. A flanking maneuver from the south via Osborne Road.
2. Convergence of forces on OBJ WOLF, with a focus on OBJ 1 and OBJ 2.
3. Maintaining observation on the key elevation point Hill 652.

This approach allows for the avoidance of direct conflict on the hill and the concentration of forces on the objectives within OBJ WOLF. If further assessment or elaboration is needed, I am at your disposal!"

The image generated by ChatGPT in response to the given request did not meet expectations, even after several iterations and additional instructions for creation. Therefore, the following prompt was given:

Prompt: "Write the second course of action in words. An image is not required."

ChatGPT's response:

"The second course of action represents an alternative attack plan with an emphasis on bypassing key points and concentrating forces on the primary objectives. Here is a detailed description:

Situation

Main topographical point: Hill 652 remains marked as the dominant elevation, but a frontal assault on it is avoided.

Main objectives: OBJ WOLF, divided into two subzones – OBJ 1 and OBJ 2.

Alternative Course of Action.

Flanking maneuver from the south:

- Instead of a direct assault on Hill 652, forces regroup south of Osborne Road.
- The movement proceeds eastward along Osborne Road towards OBJ 1 and OBJ 2.

Two axes of attack:

- The first group advances directly towards OBJ 1, using support from behind.
- The second group maneuvers slightly to the east and concentrates the attack on OBJ 2.

Maintaining observation:

- A smaller unit remains on Hill 652 in an observation role to ensure battlefield surveillance and report on enemy movements.

Converging attack:

- Both groups advancing towards OBJ WOLF coordinate the final attack from the west and southeast, ensuring simultaneous pressure on OBJ 1 and OBJ 2.

Advantages of the plan:

- By avoiding a frontal assault on Hill 652, the loss of resources and units is reduced.
- The flanking maneuver allows for faster progress and concentration of forces on key objectives.
- The observation unit on Hill 652 ensures battlefield surveillance and information coverage.”

After ChatGPT provided a detailed description of the new course of action, it was sketched, as shown in Figure 3

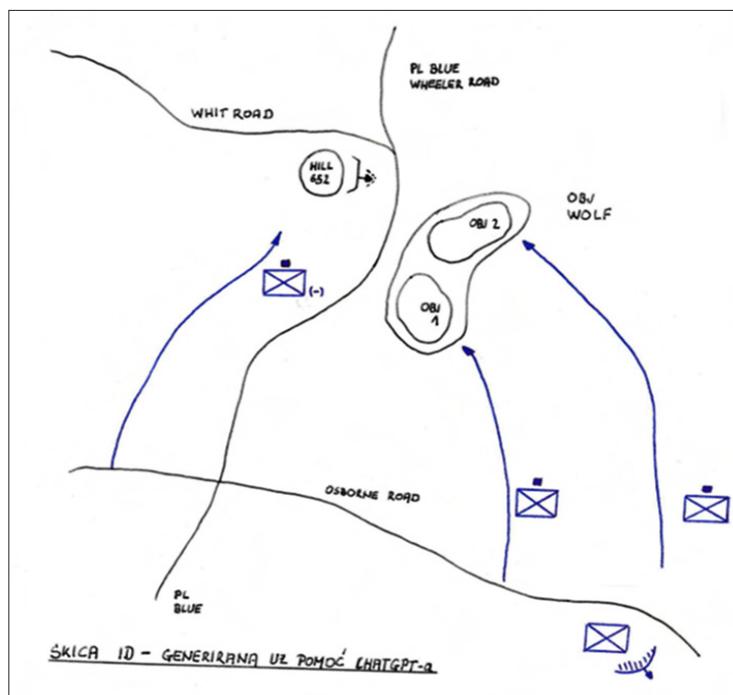


Figure 3. COA sketch created based on the course of action developed by ChatGPT.

3.4 Evaluation of the results generated by ChatGPT

To assess the result of the attack course of action generated by ChatGPT, the text and the subsequently created sketch were evaluated by a human expert. The expert's opinion is that, given the input information used by the model, the generated attack course of action demonstrates a satisfactory level of logical coherence and strategic grounding. However, certain deficiencies in the detail of specific elements were noted, which could be improved with additional specific information or human intervention. The identified deficiencies primarily relate to ChatGPT's tendency to provide overgeneralized responses that lack domain-specific precision, particularly in interpreting military terminology and adapting to real-time operational scenarios. These limitations suggest that, at present, ChatGPT's responses should be supplemented with human oversight to ensure operational accuracy. The AI tool is limited by the knowledge it derives from specific records contained in the databases it learns from. Furthermore, ChatGPT should be enhanced with data from a local database relevant to the context of the military decision-making situation. The expert particularly emphasized that the model demonstrates an understanding of the basic principles of planning and scenario generation, but further study is required to achieve full operational usability.

It should be noted that ChatGPT could enable the generation of recommendations for effective courses of action based on specific military objectives, considering additional external factors such as terrain conditions, enemy tactics, and logistical and strategic considerations.

4. Conclusion

This paper analyzed the application of generative pre-trained transformers (GPT) in command and control (C2) systems, with a particular focus on the generation and optimization of courses of action. Generative models, such as GPT, represent a significant advancement in military systems, enabling faster situational analysis, development of courses of action, and decision-making in dynamic and complex operational environments.

The paper demonstrated the following:

1. Cognitive support for commanders – The integration of GPT can significantly enhance key cognitive functions of commanders, such as intent, situational analysis, and planning.
2. Acceleration of decision-making processes – GPT models enable faster generation of courses of action, reducing the time required for decision-making in crisis situations.
3. Flexibility and adaptability – Models like ChatGPT can process large volumes of data and generate strategic options based on military doctrines, situational analysis, and available resources.

However, the paper also identified certain challenges:

1. Reliability and accuracy – GPT models occasionally generate inaccurate or biased information, which can be critical in a military context.
2. Ethical and security concerns – Additional regulation is required to ensure the responsible application of AI technologies in command systems.

In response to the research question (Is it realistic to apply publicly available generative artificial intelligence (GenAI) models to support the military decision-making process in the development and selection of courses of action at the tactical level?), a conditional positive evaluation can be given. Greater reliability in conclusion about GenAI potential would be possible if we had conducted simulations of different scenarios, that is, applied ChatGPT in various tactical situations. Further development of these systems and their integration with local databases and context promises even better results.

Future research should focus on the development of more reliable and specialized GPT models tailored to military needs, as well as the integration of GPT with simulation tools and real-time sensors. Additionally, future research should explore the integration of generative AI with existing C2 systems and the potential risks associated with adversarial use of these technologies. Furthermore, ethical concerns regarding the deployment of generative AI in military decision-making should be carefully examined, particularly in relation to accountability, bias, and the human oversight required to ensure responsible application.

In conclusion, the application of generative pre-trained transformers in C2 systems has the potential to revolutionize decision-making, enhancing efficiency and situational awareness in modern military operations. The integration of AI technologies is a crucial step toward developing advanced, autonomous, and adaptable command and control systems on the future battlefield.

References

Army Technology. (2024). *Military C2 Systems*. <https://www.army-technology.com/buyers-guide/military-c2-systems/>

Brannon, N. G., Seiffert, J. E., Draelos, T. J., & Wunsch, D. C. (2009). Coordinated machine learning and decision support for situation awareness. *Neural Networks*. <https://doi.org/10.1016/j.neunet.2009.03.013>

Brehmer, B. (2007). Understanding the functions of C2 is the key to progress. *The International C2 Journal*, 1(1), 212–232.

Goecks, V. G., & Waytowich, N. (2024). *COA-GPT : Generative Pre-trained Transformers for Accelerated Course of Action Development in Military Operations*.

Goecks, V. G., Waytowich, N., Asher, D. E., Park, S. J., Mittrick, M., Richardson, J., Vindiola, M., Logie, A., Dennison, M., Trout, T., Narayanna, P., & Kott, A. (2021). On games and simulators as a platform for development of artificial intelligence for command and control. *The Journal of Defense Modeling and Simulation*, ...(...), 11. <https://doi.org/10.1177/ToBeAssigned>

Goodfellow, I., Pouget-Abadie, J., Mirza, M., Xu, B., Warde-Farley, D., Ozair, S., Courville, A., & Bengio, Y. (2014). Generative Adversarial Nets. In Z. Ghahramani, M. Welling, C. Cortes, N. Lawrence, & K. Q. Weinberger (Eds.), *Advances in Neural Information Processing Systems* (Vol. 27). Curran Associates, Inc. https://proceedings.neurips.cc/paper_files/paper/2014/file/5ca3e9b122f61f8f06494c97b1afccf3-Paper.pdf

He, K., Zhang, X., Ren, S., & Sun, J. (2016). Deep Residual Learning for Image Recognition. *2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 770–778. <https://doi.org/10.1109/CVPR.2016.90>

Ho, J., Jain, A., & Abbeel, P. (2020). Denoising Diffusion Probabilistic Models. *CoRR, abs/2006.1*. <https://arxiv.org/abs/2006.11239>

Hong, T. S. (2024). *Practice Notes Generative Pre-Trained Transformers and the Department of Defense's Own Generative Artificial Intelligence Large Language Model*.

Horyń, W., Bielewicz, M., & Joks, A. (2021). *AI-Supported Decision-making Process in Multidomain Military Operations BT - Artificial Intelligence and Its Contexts: Security, Business and Governance* (A. Visvizi & M. Bodziany (eds.); pp. 93–107). Springer International Publishing. https://doi.org/10.1007/978-3-030-88972-2_7

Kott, A. (2004). *Advanced technology concepts for command and control*. Xlibris Corporation.

Mcdowell, K., Novoseller, E., Madison, A., Goecks, V. G., & Kelshaw, C. (2024). Re-Envisioning Command and Control. *2024 International Conference on Military Communication and Information Systems (ICMCIS)*, 1–7. <https://doi.org/10.1109/ICMCIS61231.2024.10540901>

Morgan, F. E., Boudreux, B., Lohn, A. J., Ashby, M., Curriden, C., Klima, K., & Grossman, D. (2023). Military Applications of Artificial Intelligence - Ethical Concerns in an Uncertain World. In *Artificial Intelligence Techniques in Power Systems Operations and Analysis*. <https://doi.org/10.1201/9781003301820-7>

NATO Science & Technology Organization. (2024). *Using artificial intelligence to enhance military decision-making*. <https://www.youtube.com/watch?v=A2ZAHrT3UwM>

Reynolds, I., & Atalan, Y. (2024). *Calibrating NATOs Vision of AI-Enabled Decision Support*. <https://www.csis.org/analysis/calibrating-natos-vision-ai-enabled-decision-support>

Tuličić, J. (1996). *Proces donošenja odluke u američkoj vojsci*.

U.S. Army. (2023). *Military Decision-making Process*. <https://apps.dtic.mil/sti/tr/pdf/AD1018227.pdf>

U.S. Joint Chiefs of Staff. (2020). *JP 5-0 - Joint Planning*. *Joint Publications, December*, 1–360.

Waller, J., & Morgan, P. (2019). Putting AI into Air: What is Artificial Intelligence and What it Might Mean for the Air Environment. *Air and Space Power Review*, 22(2), 58-75. <https://www.raf.mod.uk/what-we-do/centre-for-air-and-space-power-studies/documents1/air-and-space-power-review-vol-22-no-2/>

Yenduri, G., Ramalingam, M., Selvi, G. C., & Supriya, Y. (2024). GPT (Generative Pre-Trained Transformer)— A Comprehensive Review on Enabling Technologies , Potential Applications , Emerging Challenges , and Future Directions. *IEEE Access*, 12(March), 54608–54649. <https://doi.org/10.1109/ACCESS.2024.3389497>

Zhou, W., & Rosalie, A. (2024). *Artificial intelligence in military decision-making : supporting humans, not replacing them*. Humanitarian Law & Policy. <https://blogs.icrc.org/law-and-policy/2024/08/29/artificial-intelligence-in-military-decision-making-supporting-humans-not-replacing-them/>

Primjena generativne umjetne inteligencije u vojnom odlučivanju

Sažetak

Odlučivanje u vojnoj organizaciji osobito je zahtjevno na svim razinama, od taktičke do strateške. Stoga je važna potpora odlučivanju koja u suvremenim sustavima uključuje C2 i još naprednije modele zapovijedanja i kontrole. Usljed složenosti suvremenih vojnih operacija, donošenje odluka na taktičkoj razini treba uključivati brzo, precizno i informirano razmatranje inačica djelovanja (Courses of Action, COA). Ovo istraživanje usmjereno je na utvrđivanje primjene sustava generativne umjetne inteligencije poput ChatGPT-a, u okviru taktičkog vojnog odlučivanja, kao moguće sastavnice modela C2. ChatGPT, kao napredni jezični model, može osigurati potencijalnu podršku zapovjednicima u procesu analize i odabira optimalne inačice djelovanja putem generiranja relevantnih situacijskih rješenja, zasnovanih na velikim količinama podataka koje umjetna inteligencija koristi. Istraživanje pokazuje da primjena ChatGPT-a u ovom kontekstu omogućuje automatsko generiranje relevantnih scenarija na temelju stvarnih i hipotetskih ulaznih podataka. Nadalje,

analizom mogućih rješenja ChatGPT-a, putem interakcije sa sustavom generativne umjetne inteligencije, moguća je optimizacija odluka, kao i samog procesa donošenja odluka na razini taktičkih zapovjednika. Time se smanjuje ljudska pogreška i poboljšava brzina reakcije u dinamičnim i kompleksnim vojnim situacijama. Premda modeli umjetne inteligencije, koji su sve napredniji, mogu bitno poboljšati vojno odlučivanje, taj proces ne smije biti potpuno automatiziran. Mora se zadržati ljudski nadzor u finalnoj fazi odlučivanja, čime se među ostalim čuva i odgovornost u ključnim vojnim odlukama.

Ključne riječi:

vojno odlučivanje, C2 sustav, generativna umjetna inteligencija, inačica djelovanja