Instal : Jurnal Komputer

E-ISSN: 2808-683X
Edisi : Volume 18 Nomor 02 | Tahun 2026

Available online at https://journalinstal.cattleyadf.org/index.php/Instal/index

Implementation of NLP-Based AI in German Wordle Game for the Provision of Automated Sentence Examples

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ARTICLE INFO

Keywords:

Artificial Intelligence,
Natural Language Processing, Game-Based Learning,
Wordle,
German Language

ABSTRACT

This study implements an artificial intelligence system based on Natural Language Processing (NLP) in a German-language Wordle game with the aim of providing automatically generated example sentences for each appearing word. The system is designed not only to display the correct answer, but also to present contextual usage of the word through simple and easily understandable sentences. The development process involves German text analysis, including verb tense forms (Zeitformen), verb conjugation, word structure, and basic sentence patterns, supported by Natural Language Processing techniques to generate example sentences and German– Indonesian translations automatically. Therefore, this system is expected to assist users in learning the German language through word- based game activities.

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INTRODUCTION

The development of artificial intelligence technology (Artificial Intelligence) has had a significant impact in various fields, including in the world of education and foreign language learning. One of the most widely used branches of AI is Natural Language Processing (NLP), which is a technology that allows computers to understand, process, and generate human natural language. The application of NLP in language learning is considered to be able to help users understand vocabulary, sentence structure, and the context of language use more effectively and interactively.

German is one of the foreign languages that is widely studied and used in various countries, especially in the European region. However, learning German is often considered difficult, especially in terms of verb conjugation, the use of tense forms, the use of articles, and sentence structures that differ from Indonesian.

Along with the development of digital learning media, game-based learning approaches are increasingly used as an interesting learning alternative. One of the popular word games is

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Wordle, which is a word guessing game developed by Josh Wardle in 2021. Wordle is a text-based word guessing game that challenges players to guess one target word in a limited number of attempts. While Wordle is effective in practicing vocabulary recognition, the game generally focuses solely on finding the correct word without providing examples of the use of words in sentences.

Based on these problems, this study implemented artificial intelligence based on Natural Language Processing (NLP) in the German Wordle game to provide examples of automatic sentences. It is hoped that this system can help users learn German through word games more effectively.

The study leveraged OpenAI's API to generate automatic German sentences through structured prompts. The system is designed to be able to create a short sentence using the target word of the game by paying attention to the form of time, subject, and conjugation of verbs. This approach allows for contextual, easy-to-understand sentence output, and accompanied by Indonesian translations, thus supporting the vocabulary learning process more effectively and interactively. This method also increases the relevance of the context in which words are used in real terms.

METHODS

Needs Analysis

At this stage, a needs analysis is carried out to identify and formulate the needs of the system to be developed, with the aim that the system built is in accordance with the research objectives and user needs. Based on the results of the analysis, the main features of the system were determined, including the mechanics of the Wordle game in German, the process of validating German vocabulary so that only valid words can be used in the game, and the provision of automatic examples of German sentences along with Indonesian translations.

System Planning

The system design was carried out to describe the workflow of the German Wordle game developed in this study. This stage aims to provide a clear picture of the processes that occur in the system, from the time the user starts the game to the system providing feedback on the answers entered. At this stage, the structure of the game logic, the word-checking mechanism, and the flow of interaction between the user and the system are also determined so that the game process runs in a directional and easy to understand manner. With the system design, application development can be carried out more systematically and in accordance with the learning objectives to be achieved. To make it easier to understand the flow of the process, the workflow of the German Wordle game is visualized in the form of a flowchart as follows.

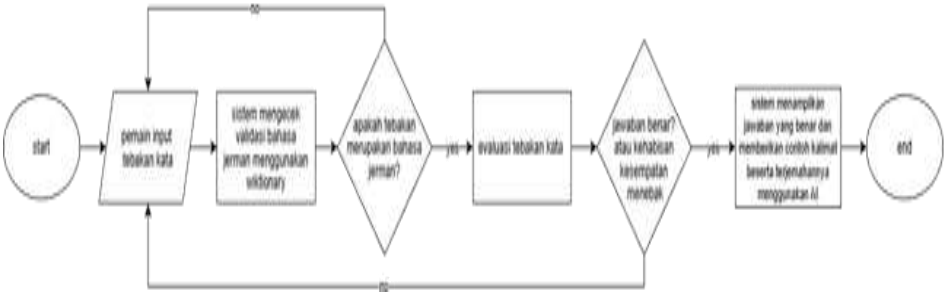

Figure 1. Flowchart game mechanics

Implementation

The system implementation stage is carried out as a realization of the system design that has been prepared previously. At this stage, all components of the German Wordle game system are embodied into an application that can be run by the user. Implementation is carried out by

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integrating the Wordle game mechanics, validation of German vocabulary, and the provision of example sentences automatically. In addition, this stage also includes the process of customizing the appearance of the interface, setting up the gameplay, and initial testing to ensure that each feature can run as designed before being used by the user.

System Testing

System testing is carried out to ensure that all system functions have run well and produce outputs as expected. The test was carried out by trying all the main features of the system to ensure that the system can be used functionally and is able to support the German learning process through the Wordle game. This process also aims to detect errors or bugs that may arise, so that they can be fixed immediately so that the system's performance remains stable and comfortable to use.

Evaluation

The evaluation of the system aims to assess the effectiveness of the German Wordle game system as a medium to support vocabulary learning based on the results of using the system after the testing stage is carried out. This evaluation process is important to find out the extent to which the developed system is able to meet the research objectives, which are to help users in improving their understanding and mastery of German vocabulary in an interactive and fun way.

In addition, the evaluation also looked at the learning aspect, namely how far the game helped the user in learning German vocabulary. This is seen from the increase in the number of vocabulary remembered, the ability to recognize word patterns, and the accuracy of users when guessing words based on the instructions provided. Feedback from users is also used to know the advantages and disadvantages of the system directly.

The results of the evaluation are then analyzed to assess the overall success rate of the system. If there are still shortcomings, these results will be the basis for further improvement and development of the system to be more optimal as a game-based learning medium.

RESULTS AND DISCUSSION

In the early stages of the game, players are asked to enter a guess word into the system. For example, players enter the word "KATZE" and then press the Enter key. Next, the system will carry out the word validation process by utilizing Wiktionary to ensure that the words entered are valid vocabulary in German. The validation results showed that the word "KATZE" is a German word that means cat, so the word is declared valid and can be further processed by the system. After that, the system evaluates each letter in the word spell by comparing it with the target word. In this example, the letter "A" in the second box and the letter "E" in the fifth box turn green, which indicates that the letter is correct and in the right position. Meanwhile, the gray box indicates that the letter is not in the target word. This color visualization helps players in understanding the level of match of the word guesses with the target word.

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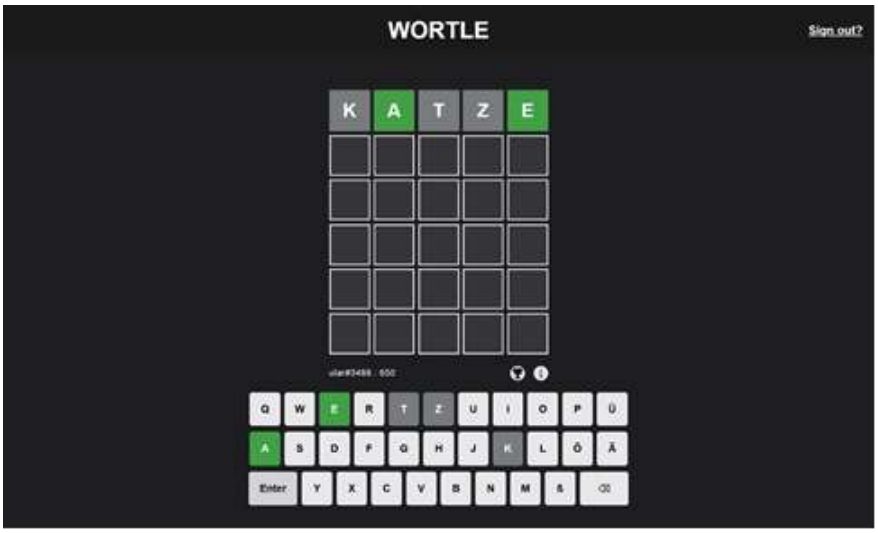

Figure 2. Gameplay view when the user guesses the word

On the next try, the player enters the guess word "MILCH" which means milk, then presses the Enter key. Next, the system conducts an evaluation process for the word by comparing it with the target word. The results of the evaluation showed that the fifth square on the guessing line turned yellow. This color change indicates that the letter "H" is in the target word, but is in the wrong position.

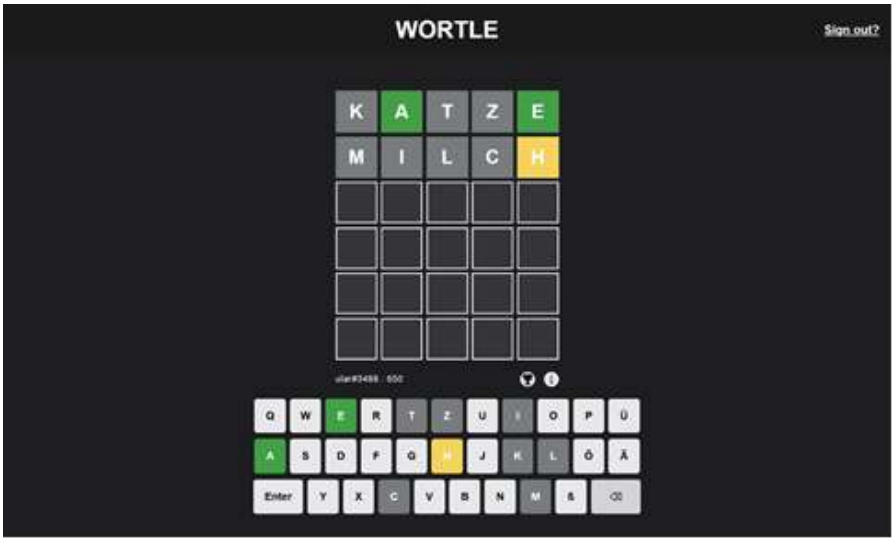

Figure 3. The process of guessing words in the second stage

On the next try, players enter the guess "GRUND" which means base or foundation. After the enter key is pressed, the system evaluates the words entered. The results of the evaluation showed that the letter "N" in the fourth box turned green. This color change indicates that the letter "N" is the correct letter and is in the right position in the target word.

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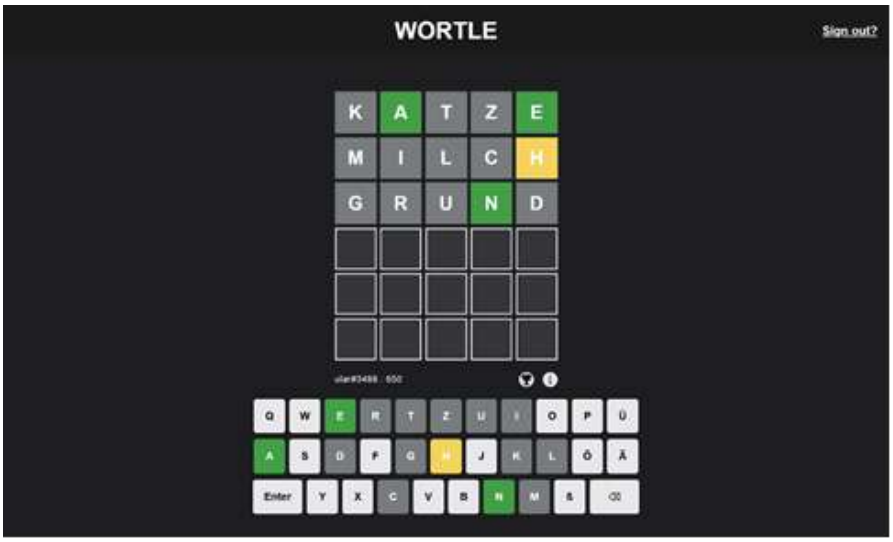

Figure 4. The process of guessing words in the third stage

Based on the results of the evaluation in several previous experiments, it can be seen that the second letter of the target word is "A", the fourth letter is "N", and the fifth letter is "E". Thus, the temporary pattern of the target word can be written as "_A _ N E". In addition, the system also shows that the letter "H" is part of the target word, but is not in the right position, as indicated by yellow in the previous experiment. Since the first and third boxes still have not identified the correct letters, it can be concluded that the letter "H" is likely in one of these positions.

On the next guessing opportunity, players enter the word "FAHNE". The system then carries out the validation and evaluation process as previously described. The results of the evaluation show that the player's guess was successful, where the correct target word is "FAHNE" which means flag.

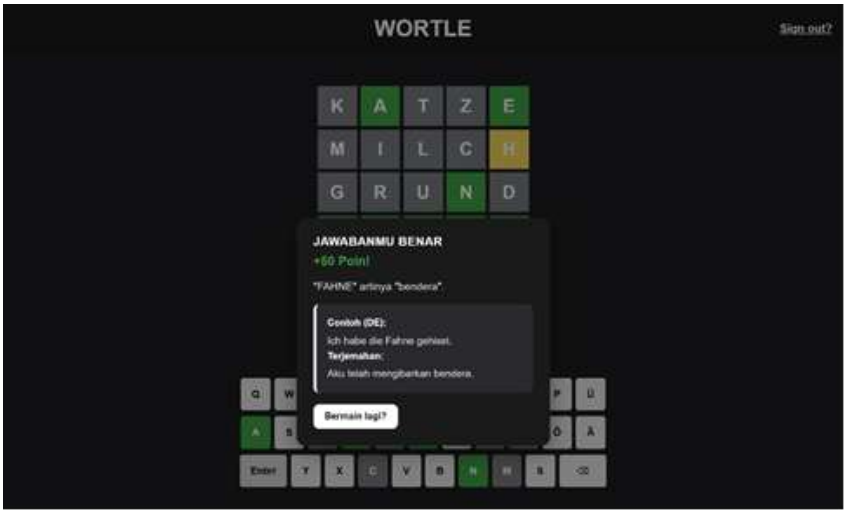

Figure 5. Display of guesses along with examples of German sentences

Once the player has successfully guessed the target word, the system automatically displays a sample sentence that uses the word as part of the learning feature. An example of the sentence produced is "Ich habe die Fahne gehisst", which means "I have raised the flag" in Indonesian. In addition to obtaining sample sentences and their translations, players also get 50 points as a form of appreciation. To be able to earn points, players are required to log in using a Google account. The amount of points earned is determined based on the number of attempts when

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the player successfully guesses the target word. If the guess is correct on the first try, the player will get 100 points. Furthermore, success in the second to sixth attempts will earn 80 points, 70 points, 50 points, 30 points, and 10 points, respectively. The game is also equipped with a leaderboard feature that functions to display player ratings based on the accumulated scores obtained. The more points you collect, the higher the player's ranking on the leaderboard. So that players can compete with other players to get the highest ranking in this German wordle game.

Figure 6. Game leaderboard view

The result of the example sentence of the word "FAHNE", namely "Ich habe die Fahne gehisst", is arranged using the time form (Zeitform) of Perfekt. The Perfekt tense form is used in German to denote an action that has been completed and has a connection to the current condition. In general, the sentence structure in the form of Perfekt follows the pattern of Subject + haben/sein (according to conjugation) + object + Partizip II. In the example sentence, the system uses "ich" as the subject, followed by "habe" as a conjugation form of the auxiliary verb haben for the subject of ich. The word "die Fahne" acts as an object with a feminine gender, while "gehisst" is the Partizip II form of the verb hissen which means to wave.
Based on this explanation, it can be concluded that the example sentences generated by the system have followed the correct German sentence structure in accordance with the rules of Zeitform Perfekt. This sentence formation process is supported by the application of artificial intelligence based on Natural Language Processing (NLP) which allows the system to understand the structure of the language and generate sentences automatically. This shows that the use of AI in the system is able to support the provision of relevant and grammatically appropriate sentence examples for German language learning.

CONCLUSION

In this study, the author developed an educational game called Wortle. The name Wortle comes from the word wort which means "word" in German and is an adaptation of the game Wordle adapted to learning German vocabulary.
Based on the results of the design, implementation, and testing of the system that has been carried out, it can be concluded that the application of artificial intelligence based on Natural Language Processing (NLP) in the German Wordle game has been successfully implemented in accordance with the research objectives. The system developed is able to integrate the mechanics of the Wordle game with language learning features, especially in the provision of automatic examples of German sentences along with their translations.

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The use of Wiktionary's API allows the system to validate German vocabulary so that players can only enter valid and appropriate words. Meanwhile, the use of OpenAI's API with the GPT-3.5-Turbo model supports the system in generating examples of sentences that are relevant and easy for users to understand. The test results show that all the main features of the system, such as word validation, game evaluation, scoring, leaderboard, and the provision of sentence examples, can run well.

REFERENCES

[1] N. Nurmansyah, R. R. Suhana, N. Nasrudin, and S. M. Hamid, "Wordle: Gamification in Enhancing Students' Vocabulary," *Anglo-Saxon: Jurnal Ilmiah Program Studi Pendidikan Bahasa Inggris*, vol. 15, no. 2, pp. 11–22, 2024, doi: 10.33373/as.v15i2.6042.

[2] A. Manzano-Leon et al., "Between Level Up and Game Over: A Systematic Literature Review of Gamification in Education," *Sustainability*, vol. 13, no. 4, 2021, doi: 10.3390/su13042247.

[3] T. I. Slamet and C. Meng, "Gamification in collaborative learning: Synthesizing evidence through meta-analysis,"*Journal of Computers in Education*, vol. 12, pp. 1367–1403, 2025, doi: 10.1007/s40692-024-00349-4.

[4] A. G. C. S. Sibuea, S. Pujiastuti, and A. B. Harahap, "The Development of an Interactive Learning Game for German Vocabulary Level A1.1," 2024, doi: 10.4108/eai.6-11-2024.2356608.

[5] A. Usman, A. P. Utomo, F. Amilia, Dzarna, and C. K. Galatea, "Research on Educational Games in Learning in Indonesia: A Systematic Review of the Literatures," *Jurnal Penelitian Pendidikan IPA*, vol. 10, no. 3, pp. 105–115, 2024, doi: 10.29303/jppipa.v10i3.5321.

[6] D. N. Aini and A. P. K. Kirana, "Interaktivitas Game Animasi Penunjang Keterampilan Berbahasa Asing," *Edukatif: Jurnal Ilmu Pendidikan*, vol. 5, no. 3, 2023. doi:10.31004/edukatif.v5i3.5011.

[7] C. L. Cofino, R. B. Escorial, D. L. Enquilino, and B. Enquilino, "A Literature Review on Natural Language Processing (NLP) in Aiding Industry to Progress," *International Journal of Engineering Trends and Technology*, vol. 72, no. 2,pp. 41–46, Feb. 2024. doi:10.14445/22315381/IJETT-V72I2P105.

[8] K. Ritchey, S. Patterson, B. Patterson, dan N. Ritchey, "Wordle as a Teaching Tool," *PRIMUS*, vol. 33, no. 8, pp. 901–915, 2023, doi: 10.1080/10511970.2023.2193951.

[9] N. A. R. Pamungkas, "The Effects of Wordle Media on Students' Vocabulary Mastery," *JETAL: Journal of English Teaching & Applied Linguistics*, vol. 2, no. 2, pp. 56–61, Apr. 2021, doi: 10.36655/jetal.v2i2.533.

[10] H. Holz, Design, Development, and Evaluation of Research Tools for Evidence-Based Learning: A Digital Game- Based Spelling Training for German Primary School Children, *Dissertation, Universität Tübingen*, 2020. DOI: 10.15496/publikation-51623.

[11] M. Daniels, "AI-Powered Game-Based Learning for Project Management Education," in *Proceedings of the European Conference on Games Based Learning*, vol. 19, no. 1, pp. 209–216, 2025, doi:10.34190/ecgbl.19.1.4203.

[12] A. A. Puspita and I. Sobara, "Implementation of the Website-Based Game Blooket.com asa Medium to Enhance Vocabulary Mastery in German Language Learning at SMA Laboratorium UM," *Journal DaFIna: Journal Deutsch als Fremdsprache in Indonesien*, vol. 8, no. 2, pp. 1–7, 2024, doi:10.17977/um079v8i22024p1-7.

[13] Z. Wu, "Machine Learning based Data Analysis for Wordle Game," *Frontiers in Computing and Intelligent Systems*, vol. 4, no. 3, pp. 117–120, 2023, doi: 10.54097/fcis.v4i3.11237.

Page : 135-142
https://doi.org/10.54209/jurnalinstall.v18i02.496

[14] S. U. N. Fajria and D. F. Heriyawati, "Students' Speaking Development Through Word Adventure Game-Based Learning," *Academia Open*, vol. 11, no. 1, pp. 1–10, 2026, doi:10.21070/acopen.11.2026.13135.

[15] F. S. Abe, J. A. Tapayan, and G. R. Baluyos, "Using Word Treasure Game (WTG) in Enhancing Students' Vocabulary in Filipino Literature," *International Journal of Research and Innovation in Social Science*, vol. 9, no. 9, pp. 5–16, Sep. 2025, doi: 10.47772/IJRISS.2025.90900002.

[16] H. Harsinda, W. Wahyu, S. N. Ilmi Hl., and S. U. Khasanah, "Stimulating Motivational Engagement in Vocabulary Learning: Evidence From the Word Tail Game in an EFL Classroom," *Studies in Language, Education, and Culture (SeLEC),* vol. 1, no. 2, pp. 96–111, Nov. 2025, doi:10.56303/selec.v1i2.977.