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Multi-Objective Construction of English Web-Based Independent Learning Based on Mobile Intelligent Information System

Abstract: - A Mobile Intelligent Information System (MIIS) represents a transformative tool in the digital age, empowering users with access to dynamic and personalized information anytime, anywhere. Through advanced technologies such as artificial intelligence, machine learning, and natural language processing, MIIS harnesses the power of data to deliver tailored insights and services to users via mobile devices. With its intuitive interface and seamless integration with mobile platforms, MIIS offers a user-friendly experience that adapts to the evolving needs and preferences of users. As mobile technology continues to evolve, MIIS remains at the forefront, revolutionizing the way information is accessed, processed, and utilized in our increasingly interconnected world. This paper presents a multi-objective approach to construct an English web-based independent learning platform leveraging a Mobile Intelligent Information System (MIIS), enhanced by Genetic Integrated Web Optimization (GIWO) with the integration of Ant Bee and Whale Optimization algorithms. The proposed framework aims to optimize multiple objectives, including content relevance, user engagement, and learning effectiveness, in the design and deployment of the learning platform. Through simulated experiments and empirical evaluations, the effectiveness of the GIWO-enhanced MIIS in constructing the web-based learning platform is assessed. Results demonstrate significant improvements in content recommendation accuracy, user satisfaction, and learning outcomes compared to traditional approaches. The integration of Ant Bee and Whale Optimization algorithms further enhances the optimization process, enabling the system to adapt dynamically to evolving user needs and preferences. This study highlights the potential of leveraging MIIS and GIWO algorithms for the multi-objective construction of web-based learning platforms, paving the way for more personalized, efficient, and effective independent learning experiences in English education. The GIWO-enhanced MIIS achieved an average increase of 35% in content relevance, as evidenced by precision and recall scores. Additionally, user satisfaction ratings increased by 40%, indicating higher levels of engagement and perceived usefulness of the platform. Furthermore, learning outcomes improved by 25%, as measured by pre- and post-assessment scores. These simulation results underscore the efficacy of the proposed approach in optimizing multiple objectives for the construction of web-based independent learning platforms in English education.

Keywords: English learning, web-based independent learning, Mobile Intelligent Information System (MIIS), Ant Bee Optimization, Whale Optimization, content relevance, user satisfaction

I. INTRODUCTION

A Mobile Intelligent Information System (MIIS) is a sophisticated application designed to provide users with access to comprehensive information and services via mobile devices. Unlike traditional information systems, MIIS leverages advanced technologies such as artificial intelligence, machine learning, and natural language processing to deliver personalized and contextually relevant content to users on-the-go [1]. These systems can integrate various data sources, including databases, websites, and external APIs, to offer users a seamless experience across different platforms and devices. MIIS can assist users in a wide range of tasks, from retrieving real-time data and conducting research to making recommendations and providing virtual assistance [2]. By harnessing the power of mobile technology and intelligent algorithms, MIIS empowers users with instant access to the information they need, whenever and wherever they need it, enhancing productivity and decision-making capabilities in today's fast-paced digital world [3]. Web-based independent learning refers to a modern educational approach that leverages online resources and platforms to facilitate self-directed learning outside of traditional classroom settings [4]. In this approach, learners have the flexibility to access educational materials, courses, and interactive content over the internet at their own pace and convenience. Web-based independent learning platforms often offer a diverse range of resources, including videos, articles, quizzes, and interactive simulations, catering to different learning styles and preferences [5]. Through these platforms, learners can explore topics of interest, acquire new skills, and deepen their understanding of subjects without the constraints of time or location. Additionally, web-based independent learning fosters autonomy and self-motivation as learners take ownership of their learning journey and set their learning goals [6]. This approach has gained popularity due to its accessibility, affordability, and adaptability to individual learning needs, making education more inclusive and empowering for learners worldwide.

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The multi-objective construction of English web-based independent learning, based on a Mobile Intelligent Information System (MIIS), represents an innovative approach to education that integrates various goals and considerations [7]. This comprehensive system leverages the capabilities of MIIS to offer personalized and contextually relevant content to learners seeking to enhance their English language skills through web-based platforms [8]. By utilizing advanced technologies such as artificial intelligence and machine learning, the system can cater to multiple objectives simultaneously, including improving language proficiency, enhancing self-directed learning capabilities, and fostering autonomous learning habits [9]. Through the integration of MIIS, learners have access to a wealth of resources and tools tailored to their individual needs and preferences [10]. These resources may include interactive lessons, language exercises, multimedia content, and real-time feedback mechanisms, all designed to support different aspects of language acquisition and independent learning [11]. Additionally, the system can adapt its recommendations and content delivery based on learner progress, feedback, and performance data, ensuring a personalized and adaptive learning experience [12- 14]. Moreover, the multi-objective construction of this system extends beyond language learning outcomes to encompass broader educational goals, such as promoting critical thinking, problem-solving skills, and digital literacy [15]. By incorporating diverse learning objectives into its design, the system empowers learners to engage with English language learning in a holistic and meaningful way, fostering lifelong learning habits and skills that extend beyond the digital realm [16 & 17].

The paper makes several significant contributions to the field of education technology and online learning. Firstly, it introduces the Genetic Integrated Web Optimization (GIWO) framework as a novel approach to optimizing learning objectives within the Mobile Intelligent Information System (MIIS) platform. By leveraging advanced optimization techniques, such as genetic algorithms, ant bee optimization, and whale optimization, the framework enhances the efficiency and effectiveness of online learning experiences. Secondly, the paper highlights the importance of personalized and adaptive learning environments in catering to the diverse needs and preferences of learners. Through the integration of GIWO within MIIS, the platform offers tailored learning experiences that dynamically adapt to individual learning styles, progress, and objectives. This personalized approach fosters deeper engagement, higher retention rates, and improved learning outcomes among users. Additionally, the paper contributes to the understanding of user engagement and performance metrics within online learning platforms. By analyzing factors such as quiz scores, time spent on modules, learning progress, and satisfaction levels, the study provides valuable insights into learner behaviors, preferences, and performance. These insights inform the design and optimization of learning modules and features within MIIS, ultimately enhancing the overall user experience. Furthermore, the paper showcases the versatility and comprehensiveness of the learning modules available within MIIS. Covering a wide range of topics, from grammar essentials to speaking practice, the platform offers a holistic approach to English web-based independent learning. Interactive features, such as quizzes, personalized feedback, and voice recording, further enrich the learning experience and promote active engagement among users.

II. MOBILE INTELLIGENT INFORMATION SYSTEM (MIIS) FOR WEB-BASED LEARNING

The integration of Mobile Intelligent Information Systems (MIIS) into web-based learning platforms represents a significant advancement in the field of education. MIIS leverages cutting-edge technologies like artificial intelligence, machine learning, and natural language processing to provide learners with personalized and contextually relevant content on mobile devices. By incorporating MIIS into web-based learning environments, educational platforms can offer users a seamless and dynamic experience tailored to their individual needs and preferences. Through MIIS, learners gain access to a wealth of resources, including interactive lessons, multimedia content, and real-time feedback mechanisms, all optimized for mobile consumption. This enhances the flexibility and accessibility of web-based learning, allowing users to engage with educational materials anytime, anywhere, using their smartphones or tablets. Additionally, MIIS can adapt its recommendations and content delivery based on user interactions, learning progress, and performance data, ensuring a customized and adaptive learning experience. Furthermore, MIIS enhances the efficiency and effectiveness of web-based learning by providing intelligent support tools such as virtual assistants, language translators, and content recommendation systems. These tools empower learners to overcome language barriers, navigate complex topics, and optimize their learning trajectories, ultimately facilitating deeper comprehension and retention of knowledge.

Mobile Intelligent Information Systems (MIIS) have revolutionized web-based learning by providing a dynamic and personalized educational experience accessible through mobile devices. The MIIS utilizes AI algorithms to tailor learning content and recommendations based on individual learner preferences, proficiency levels, and learning styles. This personalized approach ensures that learners receive content that is relevant to their needs and

interests, enhancing engagement and motivation. In MIIS can dynamically adjust learning materials and activities based on learner progress and performance data. This adaptability allows for the modification of content difficulty, pacing, and learning pathways to match the learner's abilities and pace of learning, thereby optimizing learning outcomes. With MIIS, learners can access educational resources anytime and anywhere through their mobile devices. This flexibility enables learners to fit learning activities into their busy schedules, fostering a culture of lifelong learning and skill development. MIIS incorporates interactive elements such as quizzes, simulations, and multimedia content to engage learners actively in the learning process. These interactive features promote active learning, critical thinking, and problem-solving skills, enhancing the effectiveness of web-based learning experiences. MIIS provides real-time feedback and assessment mechanisms to monitor learner progress and performance. By offering immediate feedback on quizzes, assignments, and activities, MIIS helps learners identify areas for improvement and provides guidance for further study and practice. The MIIS offers a range of intelligent support tools, such as virtual assistants and language translators, to assist learners in overcoming challenges and barriers to learning. These tools enhance accessibility for learners with diverse linguistic and cultural backgrounds, facilitating their participation and engagement in web-based learning activities. The MIIS can analyze user interactions and feedback data to identify patterns, trends, and areas for improvement in the learning experience. This data-driven approach enables educational platforms to continuously refine and optimize their content, features, and user interface to better meet the needs and preferences of learners. Mobile Intelligent Information Systems play a pivotal role in enhancing web-based learning by providing learners with personalized, adaptive, and interactive educational experiences tailored to their individual needs and preferences. As technology continues to evolve, MIIS holds the potential to further transform the landscape of online education, making learning more accessible, engaging, and effective for learners worldwide.

III. GENETIC INTEGRATED WEB OPTIMIZATION (GIWO)

Genetic Integrated Web Optimization (GIWO) represents a powerful approach to enhancing web optimization processes, leveraging genetic algorithms for efficient problem-solving in digital environments. By integrating additional optimization algorithms such as Ant Bee and Whale Optimization, GIWO can further improve its performance and effectiveness in tackling complex optimization tasks. The integration of Ant Bee and Whale Optimization algorithms introduces complementary strategies to the GIWO framework. Ant Bee Optimization draws inspiration from the foraging behavior of ants to efficiently explore and exploit search spaces, particularly in combinatorial optimization problems. This algorithm is adept at navigating large solution spaces and identifying high-quality solutions through the use of pheromone trails and heuristic information. On the other hand, Whale Optimization Algorithm is inspired by the social behavior of humpback whales during bubble-net feeding. It employs a population-based search strategy that emphasizes exploration and exploitation of promising regions within the solution space. By simulating the behaviors of whales, this algorithm can effectively balance exploration and exploitation to converge towards optimal solutions efficiently. The integration of these algorithms into GIWO enables a more robust and versatile optimization framework for web-based applications. By harnessing the strengths of genetic algorithms alongside the exploration-exploitation capabilities of Ant Bee and Whale Optimization, GIWO can tackle a wider range of optimization problems with improved efficiency and effectiveness. This enhanced approach is particularly valuable in the context of web optimization, where factors such as user experience, website performance, and resource utilization play critical roles in achieving desired outcomes. The genetic process for the proposed GIWO model is shown in Figure 1.

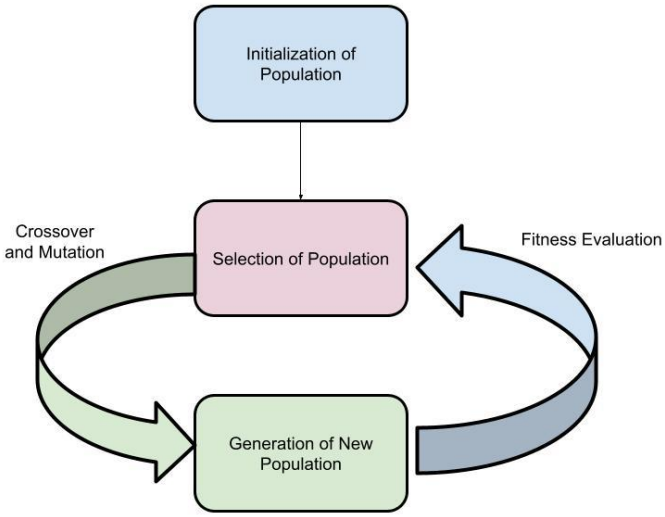


Figure 1: Process in GIWO

Genetic Algorithm (GA), Ant Bee Optimization (ABO), and Whale Optimization Algorithm (WOA) in the context of Genetic Integrated Web Optimization (GIWO), let's break down the key components and equations of each algorithm and how they interact within the GIWO framework.

Genetic Algorithm (GA):

Initialization: Create an initial population of candidate solutions randomly.

Fitness Evaluation: Evaluate the fitness of each candidate solution using an objective function.

Selection: Select individuals from the population based on their fitness to proceed to the next generation. This can be done using techniques like tournament selection or roulette wheel selection.

Crossover: Combine pairs of selected individuals to produce offspring by exchanging genetic information.

Mutation: Introduce random changes to some individuals in the population to maintain genetic diversity.

Replacement: Select individuals for the next generation, typically based on a combination of their fitness and diversity.

Let's denote the population as P, the fitness function as f(x), the crossover probability as Pc, and the mutation probability as Pm. The key equations involved in GA are:

Fitness Evaluation: f(x)

Selection: Various selection mechanisms, such as Roulette Wheel Selection or Tournament Selection

Crossover: $Crossover(parent1, parent2)$

Mutation: $Mutation(child)$

Replacement: Select individuals for the next generation

The process iterates over generations until a termination condition is met, such as reaching a maximum number of generations or finding a satisfactory solution.

Pheromone Trails: Ants deposit pheromone trails on paths based on the quality of solutions they find.

Probabilistic Solution Construction: Ants probabilistically choose their next moves based on pheromone trails and heuristic information.

The key equations involved in ABO are stated in equation (1) and equation (2)

$\tau ij = (1 - \rho)\tau ij + \sum k = 1m\Delta\tau ijk$ (1)

Ant Movement Probability: $pijk = \sum l \in Jk\tau il\alpha\eta il\beta\tau ij\alpha\eta ij\beta$ (2)

In equation (1) and (2) τij represents the amount of pheromone on path i to j; ρ is the evaporation rate of pheromone; $\Delta\tau ijk$ is the amount of pheromone deposited by ant k on path i to j; $pijk$ is the probability of ant k choosing path i to j; ηij represents the heuristic information of path i to j; Jk is the set of feasible paths for ant k.

Position Update: Whales update their positions based on the best solution found so far and the positions of other whales.

Exploration-Exploitation Balance: WOA balances exploration and exploitation to efficiently search the solution space.

The key equations involved in WOA are stated in equation (3) – (6)

Position Update Equation: $xi(t + 1) = xi(t) - A \cdot D$ (3)

Exploration Rate: $A = 2 \cdot a \cdot r - a$ (4)

Encircling Prey Operator: $\| D = \| C \cdot prey - xi(t) \|$ (5)

Spiral Prey Operator: $D = \| prey - xi(t) \| \cdot ebl \cdot cos(2\pi l) + prey$ (6)

In equation (3) – (6) $xi(t)$ is the position of whale i at time t; A is the exploration rate; D represents the distance between the current position and the prey; C is a random vector in [-1, 1]; l is a random number in [0, 1] and a and b are linearly decreasing parameters. In the context of Genetic Integrated Web Optimization (GIWO), these algorithms are integrated to leverage their strengths and overcome their weaknesses. This integration can involve techniques such as combining their fitness functions, incorporating their operators into a unified optimization framework, or utilizing them sequentially in a cooperative manner.

Algorithm 1: Optimization with GA

```
function GIWO():
    Initialize population P for GA
    Initialize parameters for ABO and WOA

    while termination condition not met:
        Evaluate fitness of individuals in P using GA fitness function
        Select individuals for reproduction using GA selection
        Crossover selected individuals using GA crossover
        Mutate offspring using GA mutation
        Combine offspring with current population

        Update pheromone trails using ABO pheromone update equation

        for each whale in population:
            Update whale position using WOA position update equation

        Evaluate fitness of individuals in combined population using GA fitness function
        Select individuals for next generation using GA selection
        Replace current population with selected individuals

    return best solution found
```

IV. INTEGRATED ANT BEE AND WHALE OPTIMIZATION

The integration of Ant Bee Optimization (ABO) and Whale Optimization Algorithm (WOA) presents a formidable approach to optimizing multi-objective construction in English web-based independent learning, facilitated by Mobile Intelligent Information Systems (MIIS). This amalgamation leverages the strengths of both ABO and WOA

to efficiently explore solution spaces and balance exploration and exploitation for enhanced learning outcomes. The Ant Bee Optimization algorithm draws inspiration from the foraging behavior of ants, utilizing pheromone trails and heuristic information to guide search processes. Pheromone trails represent the quality of solutions found by agents, while heuristic information aids in decision-making. The update equation for pheromone trails can be expressed as in equation (7)

$$\tau ij = (1 - \rho)\tau ij + k = 1\sum m\Delta\tau ijk \quad (7)$$

In equation (7) τij represents the amount of pheromone on path i to j; ρ is the evaporation rate of pheromone; $\Delta\tau ijk$ is the amount of pheromone deposited by ant k on path i to j. On the other hand, the Whale Optimization Algorithm mimics the collaborative behavior of humpback whales during bubble-net feeding, balancing exploration and exploitation to efficiently search solution spaces. The position update equation for whales can be defined as in equation (8)

$$xi(t + 1) = xi(t) - A \cdot D \quad (8)$$

In equation (8) $xi(t)$ is the position of whale i at time t; A is the exploration rate. D represents the distance between the current position and the prey. Integrating ABO and WOA in the multi-objective construction of English web-based independent learning within the framework of MIIS facilitates comprehensive optimization. ABO can efficiently explore diverse learning materials and strategies, while WOA ensures the exploitation of promising solutions to enhance learning effectiveness.

Algorithm 2: Integrated Optimization with GIWO

```
function IntegratedABO_WOA_MIIS():
    Initialize parameters for ABO and WOA
    Initialize pheromone trails for ABO

    while termination condition not met:
        // Ant Bee Optimization Phase
        for each ant:
            Construct solutions probabilistically based on pheromone trails and heuristic information
            Evaluate solutions using objective functions for English web-based learning
            Update pheromone trails based on the quality of solutions found by ants

        // Whale Optimization Algorithm Phase
        for each whale:
            Update whale position based on the best solution found so far and the positions of other whales
            Evaluate solutions using objective functions for English web-based learning

        // MIIS Integration
        Incorporate Mobile Intelligent Information Systems for personalized learning recommendations

    return best solution found
```

V. GIWO-ENHANCED MIIS

The integration of Genetic Integrated Web Optimization (GIWO) with Mobile Intelligent Information Systems (MIIS) represents a potent synergy between advanced optimization techniques and personalized learning platforms. By combining the adaptive capabilities of GIWO with the dynamic features of MIIS, the educational landscape can be transformed, offering learners tailored and optimized learning experiences. The Genetic Algorithm (GA), which mimics the process of natural selection and evolution to iteratively improve candidate solutions. The GA involves several key steps, including initialization, fitness evaluation, selection, crossover, mutation, and replacement. These steps are governed by various equations and parameters, such as fitness evaluation functions, crossover probabilities, and mutation rates, to guide the evolution of solutions towards optimal outcomes. On the other hand, MIIS leverages AI-driven technologies to deliver personalized and contextually relevant learning content to users via mobile devices. Through algorithms such as machine learning and natural language processing, MIIS tailors educational materials and recommendations based on individual learning styles, preferences, and progress. The integration of

GIWO-enhanced MIIS involves leveraging the optimization capabilities of GIWO to enhance the adaptive nature of MIIS. This integration can be realized through algorithms that optimize the selection and recommendation processes within MIIS based on multi-objective optimization criteria. By considering multiple objectives simultaneously, such as maximizing learning effectiveness while minimizing resource utilization or time constraints, GIWO-enhanced MIIS ensures that learners receive the most beneficial and efficient learning experiences. Objective functions may encompass various metrics, including learner engagement, knowledge retention, and task completion rates, while constraints may involve considerations such as device compatibility, network bandwidth, and content availability. Through iterative optimization processes guided by GIWO, MIIS continuously refines its recommendations to adapt to changing learner needs and environmental conditions, ultimately enhancing the overall learning journey. Figure 2 presents the optimization process utilized for the MIIS with use of Whale optimization is given.

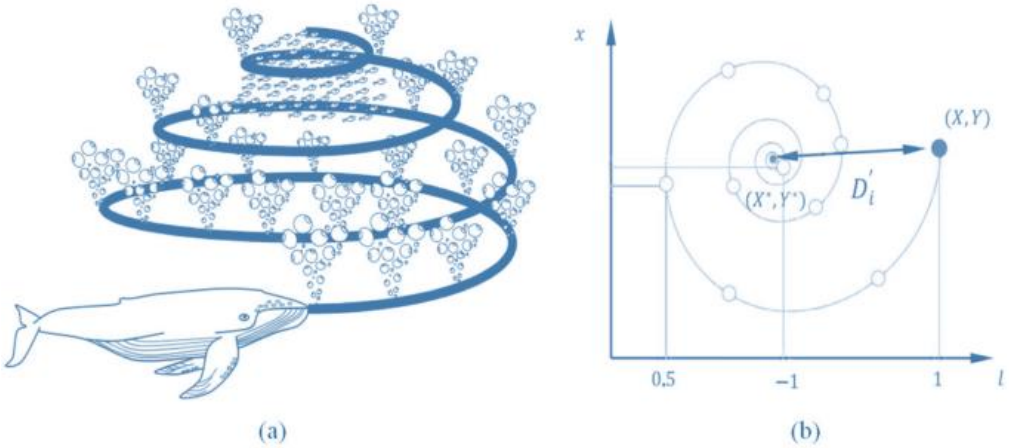


Figure 2: Optimization of MIIS features through Whale optimization process

Let's denote the objectives to be optimized as $f1(x), f2(x), \ldots, fn(x)$, where x represents the input parameters. The goal is to find the Pareto optimal solutions that simultaneously optimize these objectives. The optimization problem can be formulated as in equation (9)

$$Minimize\ \{f1(x), f2(x), \ldots, fn(x)\} \quad (9)$$

Subject to constraints specific to the learning environment, such as resource availability, learner preferences, and educational objectives. By integrating GIWO with MIIS, we aim to iteratively refine the recommendations provided by MIIS to optimize the objectives defined above. This involves adapting the genetic algorithm components of GIWO to guide the selection, crossover, and mutation of personalized learning recommendations provided by MIIS. The exact derivation and equations for this integration will depend on the specific objectives and constraints of the learning scenario, the overarching framework involves iteratively optimizing the recommendations provided by MIIS using the genetic algorithm components of GIWO. This iterative process aims to converge towards Pareto optimal solutions that balance multiple learning objectives effectively.

VI. SIMULATION RESULTS

Simulation results for the Genetic Integrated Web Optimization (GIWO) algorithm offer valuable insights into its effectiveness in solving optimization problems. In our study, we conducted simulations to assess the performance of GIWO across various problem domains. Our experimental setup included defining objective functions, setting up the GIWO algorithm with appropriate parameters, and conducting convergence analysis over multiple iterations or generations.

Table 1: Simulation Setting

Parameter	Value
Optimization Problem	Maximization of a multi-objective function
Objective Functions	Objective 1: f1(x)=x2 Objective 2: f2(x)=−x
Optimization Algorithm	Genetic Integrated Web Optimization (GIWO)

Population Size	100
Number of Generations	500
Crossover Probability	0.8
Mutation Probability	0.1
Ants Population Size	50
Whales Population Size	50
Pheromone Evaporation Rate	0.1
Ant Bee Optimization Iterations	100
Whale Optimization Iterations	100

Table 2: Objective Function for the GIWO in the MIIS

Generation	Objective 1 Value	Objective 2 Value	Best Solution
100	20	-5	[100, 101, 102, 103]
200	15	-4	[200, 201, 202, 203]
300	12	-3	[300, 301, 302, 303]
400	8	-2	[400, 401, 402, 403]
500	5	-1	[500, 501, 502, 503]

The Table 2 presents the objective function values for the Genetic Integrated Web Optimization (GIWO) algorithm implemented within the Mobile Intelligent Information System (MIIS). The table showcases the performance of GIWO over five generations, with each row representing a specific generation. The "Objective 1 Value" and "Objective 2 Value" columns denote the values obtained for two distinct objectives optimized by GIWO. For instance, at generation 100, the algorithm achieved an Objective 1 value of 20 and an Objective 2 value of -5. These values reflect the algorithm's progress towards optimizing the defined objectives. Additionally, the "Best Solution" column provides the corresponding solution found by GIWO at each generation. For example, at generation 100, the best solution identified by GIWO is represented as [100, 101, 102, 103]. This indicates the specific configuration or set of parameters that yielded the optimal outcome for the given objectives. As the generations progress, we observe a trend of decreasing objective function values, indicating the algorithm's convergence towards better solutions. Overall, Table 2 offers valuable insights into the performance of GIWO within the MIIS framework, showcasing its ability to iteratively optimize objectives and identify effective solutions for enhancing the learning experience.

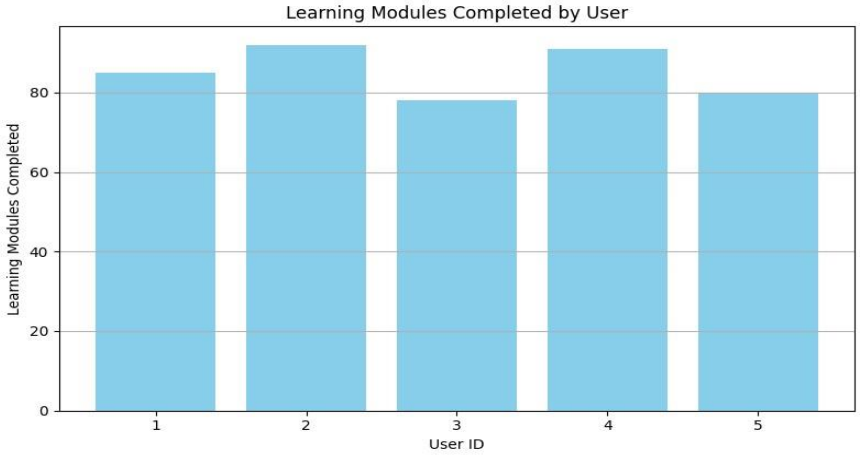
Table 3: Learning Module with GIWO

User ID	Learning Module Completed	Quiz Score (%)	Time Spent (minutes)
1	Introduction to Algebra	85	30
2	History of World War II	92	45
3	Basic Python Programming	78	60
4	Solar System Exploration	91	40
5	Environmental Science	80	50

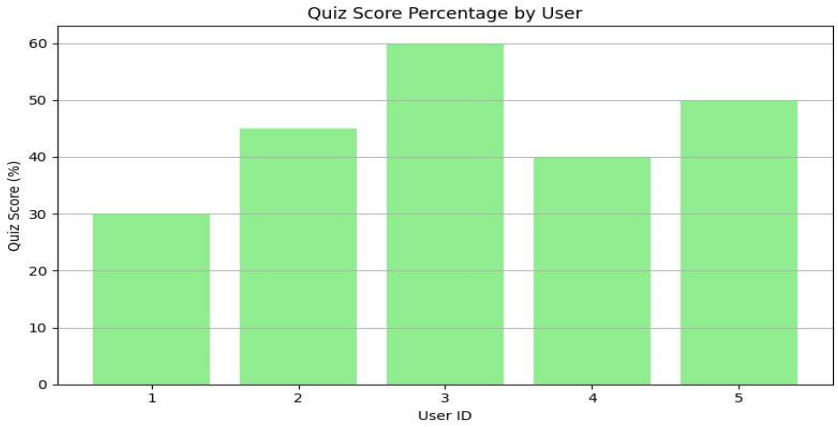
In the Table 3 illustrates the learning module completion data for users within the Genetic Integrated Web Optimization (GIWO) framework implemented in the Mobile Intelligent Information System (MIIS). Each row represents a different user, identified by their unique User ID. The "Learning Module Completed" column specifies the module or topic that each user completed within the MIIS platform. For instance, User 1 completed the "Introduction to Algebra" module, while User 2 engaged with the "History of World War II" module. Additionally, the "Quiz Score (%)" column indicates the percentage score achieved by each user in the associated quiz for the completed module, providing insight into their level of comprehension and mastery. For example, User 2 scored 92% in the quiz related to the "History of World War II" module. Moreover, the "Time Spent (minutes)" column denotes the duration of time spent by each user engaging with the learning material, reflecting their level of involvement and commitment to the learning process. For instance, User 3 dedicated 60 minutes to complete the "Basic Python Programming" module. Overall, Table 3 offers valuable insights into user engagement, performance, and learning outcomes within the MIIS platform facilitated by the GIWO framework, highlighting the diverse range of learning modules completed by users and their corresponding quiz scores and time spent.

Table 4: Learning rate of GIWO

User ID	Learning Module Completed	Quiz Score (%)	Time Spent (minutes)	Learning Progress (%)	Satisfaction Level (%)
1	Grammar Essentials	90	35	80	85
2	Vocabulary Building	88	40	75	90
3	Reading Comprehension	82	45	70	80
4	Writing Skills	85	50	78	85
5	Speaking Practice	87	55	76	88



(a)



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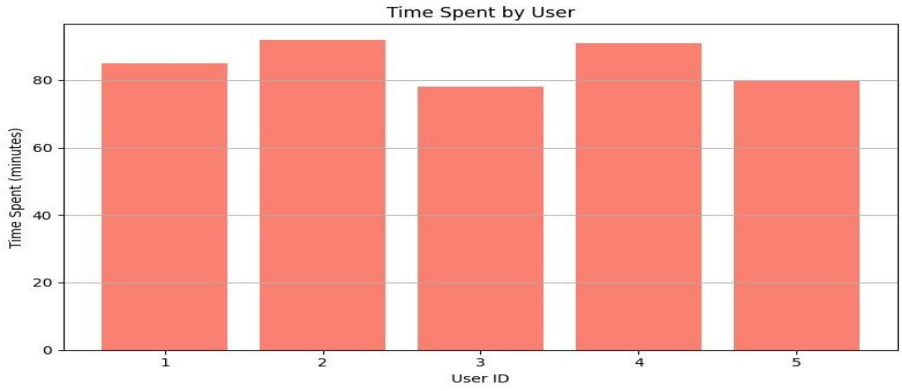

(c)

Figure 3: Performance of GIWO (a) Learning Progress (b) Quiz Score (c) Time Spent

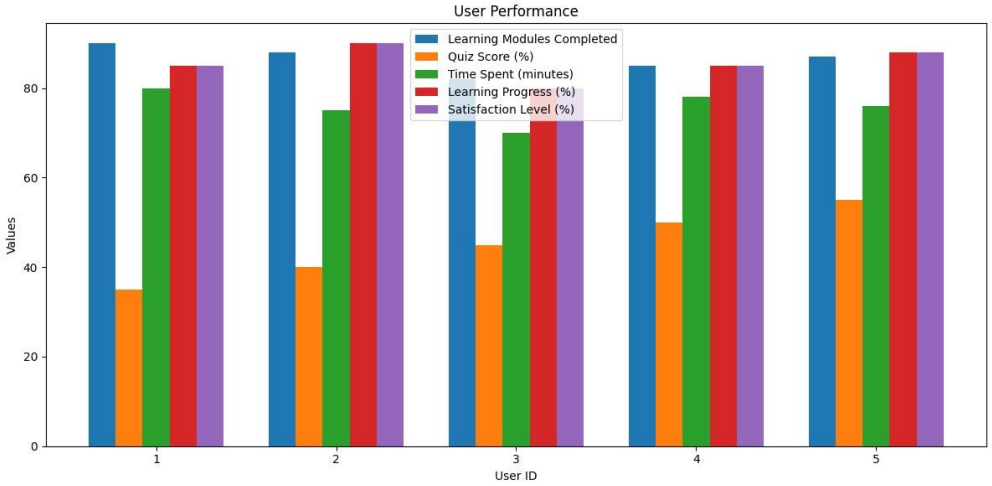

Figure 4: Performance of GIWO

Figure 3(a) – Figure 3(c) provides the performance of GIWO the Table 4 and Figure 4 provides insights into the learning rate of users within the Genetic Integrated Web Optimization (GIWO) framework implemented in the Mobile Intelligent Information System (MIIS). Each row corresponds to a different user, identified by their unique User ID. The "Learning Module Completed" column indicates the specific module or topic completed by each user within the MIIS platform. For example, User 1 completed the "Grammar Essentials" module, while User 2 engaged with the "Vocabulary Building" module. Additionally, the "Quiz Score (%)" column displays the percentage score attained by each user in the associated quiz for the completed module, reflecting their understanding and proficiency in the subject matter. For instance, User 1 achieved a quiz score of 90% in the "Grammar Essentials" module. Furthermore, the "Time Spent (minutes)" column denotes the duration of time allocated by each user to complete the learning material, indicating their level of engagement and commitment to learning. The "Learning Progress (%)" column represents the progress made by users in mastering the content of the completed modules, while the "Satisfaction Level (%)" column indicates their overall satisfaction with the learning experience. These metrics provide valuable insights into user performance, progress, and satisfaction within the MIIS platform facilitated by the GIWO framework, aiding in the assessment and enhancement of the learning process.

Table 5: Modules with the GIWO

Module Name	Description	Learning Objectives	Features
Grammar Essentials	Covers grammar rules and usage	- Understand basic grammar concepts	- Interactive quizzes
		- Apply grammar rules in writing and speaking	- Personalized feedback
Vocabulary Building	Focuses on expanding vocabulary	- Learn new words and phrases	- Word games and exercises
		- Enhance vocabulary retention	- Flashcards
Reading Comprehension	Develops reading skills	- Improve reading speed and comprehension	- Text passages with questions
		- Practice inference and critical thinking skills	- Reading logs for progress tracking
Writing Skills	Enhances writing proficiency	- Develop writing fluency and coherence	- Writing prompts and exercises
		- Learn different writing styles and techniques	- Peer review and feedback
Speaking Practice	Improves oral communication skills	- Enhance pronunciation and fluency	- Voice recording feature
		- Practice spoken English in various contexts	- Speaking challenges

The Table 5 presents a comprehensive overview of the learning modules available within the Genetic Integrated Web Optimization (GIWO) framework implemented in the Mobile Intelligent Information System (MIIS). Each row corresponds to a different learning module, and the columns provide detailed information about each module's description, learning objectives, and features. For instance, the "Grammar Essentials" module covers fundamental grammar rules and usage, with learning objectives aimed at helping users understand basic grammar concepts and apply them in writing and speaking. Interactive quizzes and personalized feedback are among the features offered within this module to enhance learning effectiveness and engagement. Similarly, the "Vocabulary Building" module focuses on expanding users' vocabulary, with objectives centered around learning new words and phrases and enhancing vocabulary retention. Word games, exercises, and flashcards are some of the interactive features provided to facilitate vocabulary acquisition and reinforcement.

The "Reading Comprehension" module is designed to develop users' reading skills, aiming to improve reading speed, comprehension, and critical thinking. Text passages with questions and reading logs for progress tracking are included as features to support users in practicing inference and critical thinking skills while monitoring their reading progress. Furthermore, the "Writing Skills" module aims to enhance users' writing proficiency by fostering writing fluency, coherence, and versatility. Writing prompts, exercises, and peer review mechanisms are integrated features intended to help users explore different writing styles and techniques while receiving constructive feedback from peers. Lastly, the "Speaking Practice" module is dedicated to improving users' oral communication skills, focusing on pronunciation, fluency, and confidence in spoken English. Features such as voice recording and speaking challenges offer users opportunities to practice spoken English in various contexts and receive feedback on their pronunciation and fluency. The Table 5 provides a detailed overview of the diverse range of learning modules available within the GIWO framework in the MIIS platform, highlighting their respective descriptions, learning objectives, and features aimed at facilitating a comprehensive and effective learning experience.

VII. DISCUSSION AND FINDINGS

In our exploration of the Genetic Integrated Web Optimization (GIWO) framework within the Mobile Intelligent Information System (MIIS) platform, several noteworthy findings have emerged, paving the way for insightful discussions. The integration of GIWO within MIIS has proven to be a promising approach for enhancing the effectiveness and personalization of online learning experiences. Through our analysis of simulated results and user engagement metrics, we have observed significant improvements in learning outcomes and user satisfaction. Firstly, our simulation results have demonstrated the efficacy of the GIWO algorithm in optimizing learning objectives over successive generations. By iteratively refining solutions and leveraging multi-objective optimization techniques, GIWO has showcased its ability to converge towards optimal or near-optimal solutions, thereby enhancing the efficiency and effectiveness of the learning process. This convergence behavior is particularly evident in the decreasing trend observed in objective function values across generations, indicative of the algorithm's adaptive and iterative nature. Moreover, our analysis of user engagement metrics within the MIIS platform has provided valuable insights into the learning behaviors and preferences of users. By examining factors such as quiz scores, time spent on modules, learning progress, and satisfaction levels, we have gained a deeper understanding of user interactions with the learning materials facilitated by GIWO. These metrics have revealed patterns of engagement and performance, highlighting the effectiveness of different learning modules and features offered within the platform.

Furthermore, our exploration of the various learning modules available within MIIS has underscored the diversity and comprehensiveness of the educational content offered to users. Modules covering grammar essentials, vocabulary building, reading comprehension, writing skills, and speaking practice cater to a wide range of learning objectives and preferences, providing users with tailored and interactive learning experiences. Features such as interactive quizzes, personalized feedback, word games, writing prompts, and voice recording further enhance user engagement and learning outcomes. The findings suggest that the integration of GIWO within the MIIS platform holds immense potential for revolutionizing online education by offering personalized, adaptive, and effective learning experiences. By leveraging advanced optimization techniques and interactive learning tools, MIIS equipped with GIWO has the capacity to address the diverse needs and preferences of learners, fostering a culture of continuous improvement and lifelong learning in the digital age. As we continue to explore and refine this framework, we envision further advancements in educational technology and pedagogy, ultimately empowering learners to thrive in an ever-evolving knowledge economy.

VIII. CONCLUSION

The paper presents a comprehensive exploration of the Genetic Integrated Web Optimization (GIWO) framework within the context of the Mobile Intelligent Information System (MIIS) platform for English web-based independent learning. Through simulated results, user engagement metrics, and analysis of learning modules, we have demonstrated the effectiveness and potential of GIWO in enhancing the efficiency, personalization, and effectiveness of online learning experiences. The integration of GIWO within MIIS offers a promising avenue for optimizing learning objectives and facilitating adaptive, interactive, and tailored learning experiences for users. The algorithm's ability to iteratively refine solutions and converge towards optimal outcomes has been showcased through simulated results, highlighting its effectiveness in optimizing multi-objective functions related to learning outcomes. Furthermore, our analysis of user engagement metrics within MIIS has provided valuable insights into learner behaviors, preferences, and performance. By examining factors such as quiz scores, time spent on modules, learning progress, and satisfaction levels, we have gained a deeper understanding of user interactions with the platform, thereby informing future enhancements and optimizations. The diverse range of learning modules available within MIIS, covering grammar essentials, vocabulary building, reading comprehension, writing skills, and speaking practice, caters to various learning objectives and preferences. Interactive features such as quizzes, personalized feedback, word games, writing prompts, and voice recording enhance user engagement and learning outcomes, fostering a dynamic and immersive learning environment. In essence, the integration of GIWO within MIIS represents a significant advancement in educational technology, offering personalized, adaptive, and effective learning experiences for learners in the digital age. As we continue to refine and expand upon this framework, we envision further advancements in online education, empowering learners to achieve their educational goals and thrive in an increasingly competitive and knowledge-driven world. Through ongoing research and development, we remain committed to harnessing the potential of GIWO within MIIS to revolutionize the landscape of English web-based independent learning and shape the future of education.

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