



Redefining IT Support: the Role of Artificial Intelligence in Help Desks

Atika Nishat

EasyChair preprints are intended for rapid dissemination of research results and are integrated with the rest of EasyChair.

December 18, 2024

Redefining IT Support: The Role of Artificial Intelligence in Help Desks

Atika Nishat

Department of Information Technology, University of Gujrat, Pakistan

atikanishat1@gmail.com

Abstract:

The integration of Artificial Intelligence (AI) in IT help desks is transforming traditional support systems, redefining the way organizations manage customer service and technical support. AI-driven technologies such as chatbots, virtual assistants, and predictive analytics are enabling faster response times, enhanced issue resolution, and improved user experiences. By automating routine tasks and providing intelligent insights, AI reduces the workload on IT support agents, allowing them to focus on complex issues. This paper explores the role of AI in modernizing IT help desks, highlighting its benefits, challenges, and future implications. Key areas of focus include automation, natural language processing (NLP), machine learning, and AI's impact on operational efficiency, cost savings, and customer satisfaction. The study further examines how AI empowers organizations to deliver smarter, proactive, and user-centric IT support solutions.

Keywords: Artificial Intelligence, IT Help Desks, AI in Customer Support, Chatbots, Virtual Assistants, IT Support Automation, Predictive Analytics, Natural Language Processing, Operational Efficiency, AI-Driven Support Systems.

Introduction

An IT help desk is a centralized service designed to provide technical assistance and support to users experiencing problems with their hardware, software, or other technology-related systems [1]. It serves as the primary point of contact for employees or customers who need assistance with IT issues, from system malfunctions to network connectivity problems. Traditionally, help desks have been staffed by human agents who manually address user queries, troubleshoot problems, and escalate issues when necessary [2]. The role of the help desk is to ensure that users can quickly resolve their IT-related issues, minimizing downtime and maintaining smooth business operations [3]. In the traditional model, the IT help desk functions primarily through ticketing systems, where users submit requests and support

agents address them in the order they are received [4]. This model heavily relies on human intervention to understand the issues, offer solutions, and track the progress of each case. However, as businesses scale and the complexity of IT systems increases, the traditional help desk faces increasing demands and challenges that can impact service quality and efficiency [5]. IT help desks face several challenges in today's fast-paced digital environment. One of the primary challenges is long wait times for users seeking assistance. As organizations grow and the number of IT requests increases, help desk agents can quickly become overwhelmed, leading to delays in response and resolution times [6]. Users are often frustrated by prolonged waiting periods, which can affect productivity and customer satisfaction. Additionally, resource limitations present significant obstacles [7]. Help desk teams are often small, especially in smaller organizations, which limit their ability to handle large volumes of support tickets simultaneously. This leads to staff burnout and reduced support quality. As the complexity of technology continues to grow, the level of expertise required to troubleshoot diverse systems increases, creating a knowledge gap and making it difficult for staff to address all issues effectively [8]. Furthermore, repetitive issues consume considerable time and resources, preventing agents from focusing on more complex cases.

Artificial Intelligence (AI) refers to the simulation of human intelligence processes by machines, particularly computer systems [9]. AI technologies have the ability to learn from data, adapt to new inputs, and perform tasks that traditionally require human intelligence, such as problem-solving, decision-making, and language understanding. In the context of IT help desks, AI can be employed to enhance support operations by automating routine tasks, providing instant assistance, and offering data-driven insights to improve decision-making processes [10]. Machine Learning (ML): ML allows systems to learn from data without being explicitly programmed. In an IT help desk setting, machine learning algorithms can analyze historical data to identify patterns in common issues, predict future problems, and suggest proactive solutions to users [11]. ML algorithms can continuously improve based on new data, making them more accurate and efficient over time [12]. Natural Language Processing (NLP): NLP enables machines to understand, interpret, and generate human language. With NLP, AI-powered chatbots and virtual assistants can engage with users in natural conversations, understand their issues, and provide relevant solutions in real time. This reduces the need for human agents in addressing routine or simple queries, improving response times and efficiency [13]. Automation: AI-driven automation in IT help desks can streamline repetitive tasks, such as ticket routing, data entry, and issue categorization. By

automating these processes, AI reduces human workload, allowing help desk agents to focus on more complex problems. Automation also ensures consistency in issue resolution, improving overall service quality [14].

I. Evolution of IT Help Desks

Traditional IT support models are primarily centered around human-driven systems and manual processes designed to address a wide range of technical issues [15]. In these models, IT help desks serve as the primary support function, where users (employees or customers) seek assistance for hardware, software, or network-related problems [16]. The process typically begins with the user submitting a request, often through a ticketing system or phone call [17]. A support agent then reviews the issue, troubleshoots, and provides a solution or escalation to a higher level of support if necessary [18]. The traditional approach to IT support relies heavily on human intervention for problem resolution. Help desk agents must rely on their expertise and experience to assess, categorize, and resolve tickets. This can be a time-consuming process, especially when it comes to common issues or recurring problems that require repetitive steps [19]. The tickets are often manually sorted based on priority, severity, and complexity, and each step requires direct action from the support agent. In the traditional model, ticketing systems are a core component of IT support operations. When users experience an issue, they log a support ticket that is tracked through its lifecycle until the problem is resolved [20]. The process begins with the user providing detailed information about their problem, which is reviewed by a support agent. The agent may then ask further questions or escalate the issue to another technician if it is beyond their level of expertise. This manual approach often results in inefficiencies. For example, support agents spend a significant amount of time manually categorizing tickets, which can lead to delays in response times. Tickets are often prioritized based on severity, but agents may not always have the capacity to address all tickets promptly, leading to extended wait times for users. Furthermore, because much of the work is repetitive and knowledge-based, this model does not scale well, especially for organizations with large, distributed teams or increasing IT complexity [21].

Several pain points characterize the traditional IT support model. One of the most significant challenges is handling high volumes of requests. As businesses expand and technology

becomes more intricate, the number of support requests can increase exponentially, overwhelming IT teams [22]. With a growing number of tickets, response delays become inevitable, leading to dissatisfaction and frustration among users. Additionally, a lack of automation means that many issues are handled in a reactive manner rather than proactively, leading to more frequent incidents and longer resolution times [23]. Another issue is the resource limitations of traditional IT help desks. Most support teams are staffed based on average demand, but peak periods or unexpected technical problems can lead to insufficient resources, resulting in delays or even missed requests. Furthermore, resolving issues can be labor-intensive, requiring multiple interactions between the user and support agents. This drains resources and increases operational costs, making it harder for businesses to maintain efficiency as their IT environments grow [24]. AI technologies such as machine learning, natural language processing (NLP), and automation tools are transforming the landscape of IT help desks. Machine learning algorithms can identify patterns and predict future issues based on historical data, allowing help desks to proactively resolve potential problems before they escalate. Natural language processing enables AI-driven chatbots to communicate with users in a human-like manner, resolving common issues and answering questions without the need for human intervention [25]. Furthermore, AI-powered automation tools can categorize and prioritize tickets, route them to the appropriate agents, and even generate automated responses for routine inquiries, drastically improving response times [26].

The early adoption of AI in customer support industries has demonstrated its potential to transform IT help desks [27]. Leading tech companies and service providers have integrated AI technologies to optimize their support operations, reduce operational costs, and improve customer satisfaction. AI-driven solutions such as automated ticket routing, chatbots, and virtual assistants are already being implemented by companies like IBM, Microsoft, and Zendesk. These companies have seen tangible improvements in efficiency, including faster resolution times, improved agent productivity, and a better overall user experience. The successful implementation of AI in customer support has paved the way for its broader adoption in IT help desks across industries, leading to a future where AI and human support work in tandem to provide high-quality, efficient customer service [28].

II. Key AI Technologies in IT Help Desks

Machine learning (ML) is a subset of artificial intelligence that enables computers to learn from data, identify patterns, and make predictions or decisions without being explicitly

programmed. In the context of IT help desks, ML algorithms analyze large volumes of data to predict and resolve issues more efficiently [29]. By processing historical support tickets, system logs, and user interactions, ML can detect patterns in recurring problems, identify underlying causes, and recommend proactive solutions [30]. This allows help desks to not only address current issues but also predict potential future problems, improving response times and reducing downtime. For instance, by analyzing past support requests, ML models can predict the likelihood of specific technical issues arising in the future [31]. These models can be trained on a variety of data sources, such as past tickets, system performance metrics, and user behavior. This predictive capability enables IT teams to take preventative measures before issues escalate, thereby reducing the number of tickets and minimizing the time spent troubleshooting. A significant benefit of ML is its ability to continuously learn and improve over time. As more data becomes available, the algorithm becomes better at identifying patterns and providing accurate solutions [32]. This continuous learning process allows ML systems to adapt to evolving IT environments and new types of problems, making them highly valuable for organizations with dynamic and complex IT infrastructures. Over time, ML can automate increasingly sophisticated problem-solving processes, which improves efficiency and ensures that the help desk can handle a larger volume of requests without additional human resources [33].

Natural Language Processing (NLP) is another critical AI technology that enhances the effectiveness of IT help desks. NLP enables machines to understand, interpret, and generate human language, which is crucial for addressing customer queries [34]. In traditional support models, users often submit tickets or interact with human agents, but NLP allows IT help desks to integrate conversational AI tools like chatbots and virtual assistants into their systems. These AI-driven tools are capable of understanding and responding to user inquiries in a more natural, human-like way, significantly enhancing the user experience. The role of NLP in IT help desks extends beyond simple query handling [35]. By processing and interpreting customer queries, NLP systems can identify the underlying issues, categorize them accurately, and determine the appropriate response or action. For example, if a user reports a problem with their email system, the NLP system can analyze the language used to recognize keywords related to email configuration, security issues, or software bugs, ensuring that the request is routed to the right team or department [36]. Moreover, NLP improves the speed and accuracy of interactions by eliminating the need for users to manually categorize their problems, which can be time-consuming and error-prone. Automation plays a vital role

in improving the efficiency of IT help desks by streamlining routine tasks and workflows [37]. Intelligent ticketing systems powered by automation can categorize and prioritize tickets, route them to the appropriate departments, and even generate automated responses for common queries [38]. This reduces the administrative burden on human agents, allowing them to focus on more complex issues.

One of the key benefits of intelligent ticketing systems is their ability to automate ticket routing and escalation [39]. Rather than relying on agents to manually review and assign tickets, automation can ensure that each issue is immediately assigned to the right team or individual based on predefined rules, such as severity or expertise required [40]. This reduces response times and ensures that urgent problems are handled promptly. Additionally, intelligent ticketing systems can automatically escalate unresolved issues to higher-level support, ensuring that no tickets fall through the cracks and that problems are addressed by the most qualified staff [41]. The use of intelligent ticketing systems improves overall service efficiency by making the support process faster, more organized, and less prone to human error. By automating routine tasks, IT help desks can handle a larger volume of support requests, provide quicker resolutions, and deliver higher levels of customer satisfaction [42]. This not only enhances the user experience but also allows businesses to allocate resources more effectively, ensuring that they are prepared to handle more complex or specialized technical challenges [43].

III. Challenges and Limitations of AI in IT Help Desks

The integration of AI technologies into IT help desks presents several technical challenges that organizations must address to ensure successful adoption and operation [44]. One of the most significant hurdles is integrating AI systems with existing IT infrastructure and legacy systems [45]. Many businesses still rely on outdated systems that were not designed with AI compatibility in mind. These systems may not support modern AI tools or provide the necessary data for machine learning (ML) models to function effectively [46]. Integrating AI into such environments often requires significant customization, data migration, and sometimes even infrastructure overhauls. The process can be time-consuming and expensive, especially for large organizations with complex IT landscapes. Additionally, the AI tools must be able to communicate seamlessly with legacy systems to retrieve relevant data, update records, and trigger actions. This requires careful planning and collaboration between AI developers, IT teams, and business stakeholders to ensure smooth integration without

disrupting daily operations. Another technical challenge is ensuring that AI systems are robust and reliable [47]. AI systems, especially those based on machine learning and natural language processing, depend on vast amounts of data to train models and make accurate predictions. However, these models are only as good as the data they are trained on. Poor quality data, incomplete records, or biases within the dataset can lead to inaccurate predictions, inefficient ticket handling, or even customer dissatisfaction. Continuous monitoring and testing are required to ensure that AI systems are performing as expected, detecting and resolving issues promptly [48]. One of the most significant barriers to AI adoption in IT help desks is customer trust. Many customers remain skeptical about AI-driven support, especially when it involves critical issues that require personalized or high-level technical assistance. Concerns about AI's ability to understand complex problems, handle nuances in language, or provide effective solutions can deter users from fully embracing these technologies. Overcoming this skepticism involves demonstrating the value of AI in improving support efficiency, reducing wait times, and enhancing overall user experiences.

Transparency is essential in building trust with customers. Ensuring that AI decision-making processes are clear and understandable can help alleviate concerns about the “black box” nature of AI systems. Users need to know how decisions are made, what data the AI uses to generate responses, and how AI outputs are validated or reviewed. Providing visibility into the AI decision-making process can reassure customers that the technology is being used responsibly and that it will not replace human support, but rather enhance it. Data privacy and security are also significant concerns when implementing AI in IT help desks. AI-driven support tools require access to sensitive customer data, including personal information, technical issues, and even proprietary business data. Organizations must implement strict data protection measures to safeguard this information during interactions with AI systems. AI interactions must comply with data privacy regulations such as the General Data Protection Regulation (GDPR) in Europe or the California Consumer Privacy Act (CCPA). This includes ensuring that customer consent is obtained before collecting or processing their data, as well as providing users with control over their data (e.g., the ability to access, delete, or modify their personal information). Additionally, AI systems must be designed to anonymize or encrypt sensitive data to prevent unauthorized access during storage or transmission. Addressing concerns about data breaches and misuse is another critical aspect of AI adoption. Because AI systems process large volumes of data, they could become potential targets for

cyberattacks. If these systems are not properly secured, there is a risk that hackers could gain access to sensitive customer data. To mitigate this risk, AI systems must be equipped with robust security protocols such as end-to-end encryption, secure authentication, and regular vulnerability testing. Regular audits of AI systems and data handling processes are also necessary to identify any potential security vulnerabilities or breaches. This helps to ensure that the system remains secure and compliant with privacy regulations. Businesses must communicate their commitment to safeguarding customer data to build trust and reassure users that their privacy will not be compromised during AI interactions.

IV. Conclusion

In conclusion, the integration of Artificial Intelligence in IT help desks marks a significant shift in how customer support is delivered, offering businesses an opportunity to enhance both efficiency and user satisfaction. By automating routine tasks and leveraging advanced AI capabilities like machine learning and natural language processing, IT support systems are able to provide faster, more accurate solutions while allowing human agents to focus on more complex issues. This not only leads to cost savings but also fosters a more responsive, proactive approach to problem-solving. As AI technologies continue to evolve, their potential to further streamline IT help desk operations, improve customer experiences, and drive business success will only grow, positioning AI as a cornerstone in the future of customer support.

Reference:

- [1] V. Komandla, "Crafting a Clear Path: Utilizing Tools and Software for Effective Roadmap Visualization."
- [2] V. Komandla, "Enhancing Product Development through Continuous Feedback Integration "Vineela Komandla"."
- [3] V. Komandla, "Enhancing Security and Fraud Prevention in Fintech: Comprehensive Strategies for Secure Online Account Opening."
- [4] V. Komandla, "Enhancing Security and Growth: Evaluating Password Vault Solutions for Fintech Companies."
- [5] V. Komandla, "Strategic Feature Prioritization: Maximizing Value through User-Centric Roadmaps."
- [6] V. Komandla, "Transforming Financial Interactions: Best Practices for Mobile Banking App Design and Functionality to Boost User Engagement and Satisfaction."
- [7] V. KOMANDLA, "Overcoming Compliance Challenges in Fintech Online Account Opening," *Educational Research (IJM CER)*, vol. 1, no. 5, pp. 01-09, 2017.

- [8] V. KOMANDLA and S. P. T. PERUMALLA, "Transforming Traditional Banking: Strategies, Challenges, and the Impact of Fintech Innovations," *Educational Research (IJM CER)*, vol. 1, no. 6, pp. 01-09, 2017.
- [9] V. KOMANDLA, "Enhancing User Experience in Fintech: Best Practices for Streamlined Online Account Opening," *Educational Research (IJM CER)*, vol. 2, no. 4, pp. 01-08, 2018.
- [10] V. KOMANDLA and B. CHILKURI, "The Digital Wallet Revolution: Adoption Trends, Consumer Preferences, and Market Impacts on Bank-Customer Relationships," *Educational Research (IJM CER)*, vol. 2, no. 2, pp. 01-11, 2018.
- [11] V. KOMANDLA and B. CHILKURI, "AI and Data Analytics in Personalizing Fintech Online Account Opening Processes," *Educational Research (IJM CER)*, vol. 3, no. 3, pp. 1-11, 2019.
- [12] A. Katari, "Case Studies of Data Mesh Adoption in Fintech: Lessons Learned-Present Case Studies of Financial Institutions."
- [13] A. Katari, M. Ankam, and R. Shankar, "Data Versioning and Time Travel In Delta Lake for Financial Services: Use Cases and Implementation."
- [14] A. Katari and R. S. Rallabhandi, "DELTA LAKE IN FINTECH: ENHANCING DATA LAKE RELIABILITY WITH ACID TRANSACTIONS."
- [15] A. Katari, A. Muthsyala, and H. Allam, "HYBRID CLOUD ARCHITECTURES FOR FINANCIAL DATA LAKES: DESIGN PATTERNS AND USE CASES."
- [16] A. Katari and A. Rodwal, "NEXT-GENERATION ETL IN FINTECH: LEVERAGING AI AND ML FOR INTELLIGENT DATA TRANSFORMATION."
- [17] A. Katari and D. Kalla, "Cost Optimization in Cloud-Based Financial Data Lakes: Techniques and Case Studies," *ESP Journal of Engineering & Technology Advancements (ESP-JETA)*, vol. 1, no. 1, pp. 150-157, 2021.
- [18] A. Katari and M. Ankam, "Data Governance in Multi-Cloud Environments for Financial Services: Challenges and Solutions," *Educational Research (IJM CER)*, vol. 4, no. 1, pp. 339-353, 2022.
- [19] A. Katari, "Data lakes and Optimizing Query," *Available at SSRN*, 2022.
- [20] S. Tatineni and A. Katari, "Advanced AI-Driven Techniques for Integrating DevOps and MLOps: Enhancing Continuous Integration, Deployment, and Monitoring in Machine Learning Projects," *Journal of Science & Technology*, vol. 2, no. 2, pp. 68-98, 2021.
- [21] S. Chinamanagonda, "Security in Multi-cloud Environments-Heightened focus on securing multi-cloud deployments," *Journal of Innovative Technologies*, vol. 2, no. 1, 2019.
- [22] S. Chinamanagonda, "Cost Optimization in Cloud Computing-Businesses focusing on optimizing cloud spend," *Journal of Innovative Technologies*, vol. 3, no. 1, 2020.
- [23] S. Chinamanagonda, "AI-driven Performance Testing AI tools enhancing the accuracy and efficiency of performance testing," *Advances in Computer Sciences*, vol. 4, no. 1, 2021.
- [24] S. Chinamanagonda, "Automating Cloud Governance-Organizations automating compliance and governance in the cloud," *MZ Computing Journal*, vol. 2, no. 1, 2021.
- [25] S. Chinamanagonda, "DevSecOps: Integrating Security in DevOps Pipelines-Security becoming an integral part of DevOps practices," *Innovative Computer Sciences Journal*, vol. 7, no. 1, 2021.
- [26] S. Chinamanagonda, "Observability in Microservices Architectures-Advanced observability tools for microservices environments," *MZ Computing Journal*, vol. 3, no. 1, 2022.
- [27] S. Chinamanagonda, "Serverless Data Processing: Use Cases and Best Practice-Increasing use of serverless for data processing tasks," *Innovative Computer Sciences Journal*, vol. 8, no. 1, 2022.
- [28] S. Chinamanagonda, "Zero Trust Security Models in Cloud Infrastructure-Adoption of zero-trust principles for enhanced security," *Academia Nexus Journal*, vol. 1, no. 2, 2022.
- [29] S. Chinamanagonda, "Cloud-native Databases: Performance and Scalability-Adoption of cloud-native databases for improved performance," *Advances in Computer Sciences*, vol. 6, no. 1, 2023.

- [30] S. Chinamanagonda, "Focus on resilience engineering in cloud services," *Academia Nexus Journal*, vol. 2, no. 1, 2023.
- [31] S. Chinamanagonda, "Resilience Engineering in Cloud Services-Focus on building resilient cloud architectures," *Innovative Computer Sciences Journal*, vol. 9, no. 1, 2023.
- [32] S. Tatineni and S. Chinamanagonda, "Leveraging Artificial Intelligence for Predictive Analytics in DevOps: Enhancing Continuous Integration and Continuous Deployment Pipelines for Optimal Performance," *Journal of Artificial Intelligence Research and Applications*, vol. 1, no. 1, pp. 103-138, 2021.
- [33] S. Tatineni and S. Chinamanagonda, "Machine Learning Operations (MLOps) and DevOps integration with artificial intelligence: techniques for automated model deployment and management," *Journal of Artificial Intelligence Research*, vol. 2, no. 1, pp. 47-81, 2022.
- [34] J. K. Manda, "Implementing blockchain technology to enhance transparency and security in telecom billing processes and fraud prevention mechanisms, reflecting your blockchain and telecom industry insights," *Advances in Computer Sciences*, vol. 1, no. 1, 2018.
- [35] J. K. Manda, "5G Network Slicing: Use Cases and Security Implications," *Available at SSRN 5003611*, 2021.
- [36] J. K. Manda, "Blockchain Applications in Telecom Supply Chain Management: Utilizing Blockchain Technology to Enhance Transparency and Security in Telecom Supply Chain Operations," *MZ Computing Journal*, vol. 2, no. 1, 2021.
- [37] J. K. Manda, "Cybersecurity Automation in Telecom: Implementing Automation Tools and Technologies to Enhance Cybersecurity Incident Response and Threat Detection in Telecom Operations," *Advances in Computer Sciences*, vol. 4, no. 1, 2021.
- [38] J. K. Manda, "IoT Security Frameworks for Telecom Operators: Designing Robust Security Frameworks to Protect IoT Devices and Networks in Telecom Environments," *Innovative Computer Sciences Journal*, vol. 7, no. 1, 2021.
- [39] J. K. Manda, "Data Privacy and GDPR Compliance in Telecom: Ensuring Compliance with Data Privacy Regulations like GDPR in Telecom Data Handling and Customer Information Management," *MZ Computing Journal*, vol. 3, no. 1, 2022.
- [40] J. K. Manda, "Quantum Computing's Impact on Telecom Security: Exploring Advancements in Quantum Computing and Their Implications for Encryption and Cybersecurity in Telecom," *Innovative Computer Sciences Journal*, vol. 8, no. 1, 2022.
- [41] J. K. Manda, "Zero Trust Architecture in Telecom: Implementing Zero Trust Architecture Principles to Enhance Network Security and Mitigate Insider Threats in Telecom Operations," *Journal of Innovative Technologies*, vol. 5, no. 1, 2022.
- [42] J. K. Manda, "Augmented Reality (AR) Applications in Telecom Maintenance: Utilizing AR Technologies for Remote Maintenance and Troubleshooting in Telecom Infrastructure," *Innovative Engineering Sciences Journal*, vol. 3, no. 1, 2023.
- [43] J. K. Manda, "DevSecOps Implementation in Telecom: Integrating Security into DevOps Practices to Streamline Software Development and Ensure Secure Telecom Service Delivery," *Journal of Innovative Technologies*, vol. 6, no. 1, 2023.
- [44] J. K. Manda, "Privacy-Preserving Technologies in Telecom Data Analytics: Implementing Privacy-Preserving Techniques Like Differential Privacy to Protect Sensitive Customer Data During Telecom Data Analytics," *MZ Computing Journal*, vol. 4, no. 1, 2023.
- [45] J. K. Manda, "5G-enabled Smart Cities: Security and Privacy Considerations," *Innovative Engineering Sciences Journal*, vol. 4, no. 1, 2024.
- [46] J. K. Manda, "AI-powered Threat Intelligence Platforms in Telecom: Leveraging AI for Real-time Threat Detection and Intelligence Gathering in Telecom Network Security Operations," *Educational Research (IJMCER)*, vol. 6, no. 2, pp. 333-340, 2024.
- [47] J. K. Manda, "Blockchain-based Identity Management in Telecom: Implementing Blockchain for Secure and Decentralized Identity Management Solutions in Telecom Services," *Journal of Innovative Technologies*, vol. 7, no. 1, 2024.

- [48] J. K. Manda, "Quantum-Safe Cryptography for Telecom Networks: Implementing Post-Quantum Cryptography Solutions to Protect Telecom Networks Against Future Quantum Computing Threats," *MZ Computing Journal*, vol. 5, no. 1, 2024.