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GUnify: A Comprehensive and Optimized Event Management Solution Utilizing the Deflate Compression Algorithm

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ABSTRACT:

This study focuses on the development of the GUnify Information Management System as a platform to validate the effectiveness of the Deflate compression algorithm in optimizing storage requirements for associations with limited resources. GUnify addresses the challenges of managing memberships, events, web portals, and financial reports, providing a cost-effective solution for organizations unable to procure high-end computing resources. Integrating the Deflate algorithm significantly reduces data storage and transmission costs while maintaining performance and functionality. Developed iteratively using Agile Scrum methodology, GUnify adapts to evolving organizational needs and fosters stakeholder collaboration. Its architecture includes Membership Management, Event Management, Web Portal, and Finance Management modules, enabling process automation and enhanced data integrity. The Deflate algorithm ensures efficient storage and retrieval of key data such as member profiles, event schedules, financial reports, and transaction histories. Workflow diagrams illustrate how automation reduces manual tasks and supports decision-making. Additionally, the system's software quality was rigorously evaluated using the ISO 25010 standard, ensuring compliance with criteria such as functional suitability, performance efficiency, usability, reliability, security, and maintainability. This study demonstrates that the Deflate algorithm is a viable solution for optimizing storage and operational efficiency in resource-constrained environments, making GUnify a practical and scalable tool for association management.

Keywords: Deflate Compression Algorithm, ISO 25010, DevOps, Agile Scrum Methodology, Microservices

INTRODUCTION

In response to the operational demands of non-profit management, the GUnify Information Management System is an innovative solution designed to streamline core activities such as membership management, event coordination, and financial reporting. Many non-profit organizations face challenges due to manual processes, leading to operational inefficiencies, data inconsistencies, and delays in critical workflows. These issues highlight the need for a centralized system to improve communication, enhance transparency, and optimize resource utilization.

Inspired by best practices in non-profit management and recent advancements in data automation (Ritchie & Stankosky, 2021; Powell & Stein, 2020; Dodd & Mahoney, 2019), GUnify adopts a user-centric approach, consolidating multiple management functions into a single, seamless platform. The system is designed to address the unique needs of resource-constrained organizations, providing a cost-effective and scalable solution to support their missions effectively. The GUnify Information Management System centralizes and automates key operational processes, including membership management, event coordination, and financial transactions.

The Membership Management Module handles member registration, profile updates, and communication, ensuring accurate and up-to-date records. The Event Management Module facilitates planning, scheduling, participant tracking, and post-event evaluations with automated notifications and attendance tracking. The Finance Management Module supports financial transactions, including donation tracking, fund allocation, expense monitoring, and financial reporting, ensuring transparency and accountability. The system is developed as a web-based platform with role-based access control, ensuring secure and proper user permissions. Automated notifications inform members and administrators about membership renewals, event schedules, and financial

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updates. Data consistency mechanisms maintain accuracy across modules, while an Agile Scrum methodology ensures iterative development and adaptability to evolving needs. A Microservices Architecture is implemented to provide modularity and scalability, and DevOps practices with CI/CD enhance system stability and deployment efficiency.

The scope of GUnify excludes payroll processing, human resource management, and real-time banking transactions, focusing instead on exportable financial reports and integrations with external accounting tools. By leveraging Enterprise Architecture principles, the system improves collaboration, enhances interoperability, and accommodates future organizational growth.

This study also emphasizes using the Deflate compression algorithm to optimize storage requirements, making GUnify a viable solution for organizations without access to high-end computing resources. The system's software quality is rigorously evaluated using the ISO 25010 standard, ensuring compliance with criteria such as functional suitability, performance efficiency, usability, reliability, security, and maintainability.

GUnify addresses operational inefficiencies and is a case study applying modern software engineering practices to non-profit management. It demonstrates how technology can empower resource-constrained organizations to achieve their goals effectively.

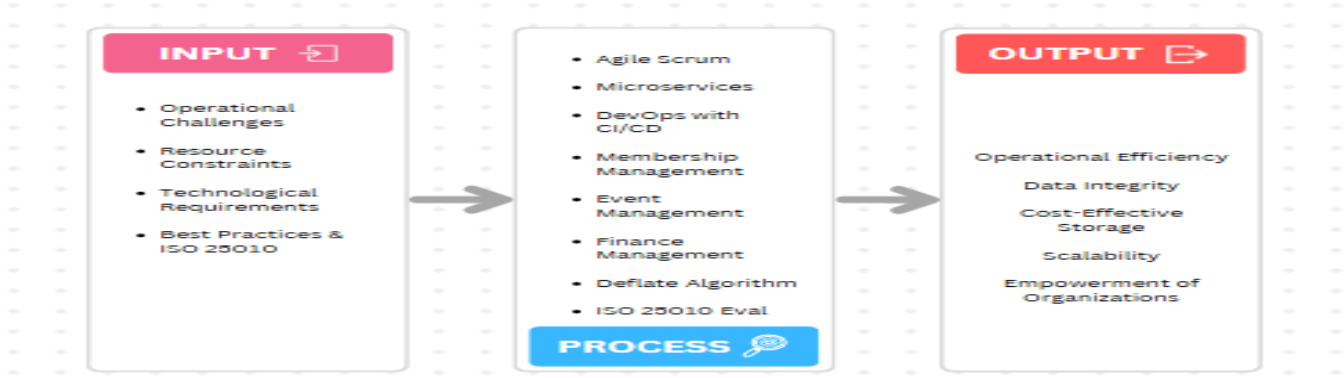
CONCEPTUAL FRAMEWORK

This study positions the GUnify Information Management System as a transformative solution for non-profit organizations. It addresses operational inefficiencies by integrating advanced technologies and rigorous quality standards. By leveraging the Deflate compression algorithm, GUnify optimizes storage and transmission requirements, making it a viable solution for organizations without access to high-end computing resources. The system's development is guided by Agile Scrum methodology, Microservices Architecture, and DevOps practices, ensuring scalability, adaptability, and continuous improvement. The ISO 25010 standard is a critical framework for evaluating GUnify's software quality, ensuring it meets essential criteria such as functional suitability, performance efficiency, usability, reliability, security, and maintainability. Adherence to ISO 25010 guarantees that GUnify is effective, robust, and user-centric.

Through its modular design—encompassing Membership Management, Event Management, and Finance Management modules—GUnify centralizes and automates key operational processes, enhancing data integrity, transparency, and decision-making. The system's ability to reduce manual workloads, improve resource allocation, and provide real-time updates demonstrates its potential to empower resource-constrained organizations.

Ultimately, this study validates the Deflate compression algorithm as a practical solution for optimizing storage and operational efficiency. At the same time, GUnify is a case study in applying modern software engineering practices to non-profit management. By addressing the unique challenges of non-profits, GUnify exemplifies how technology can drive organizational effectiveness and sustainability.

Figure 1. Conceptual Framework



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Statement of the Problem

The researcher aims to answer the following research questions.

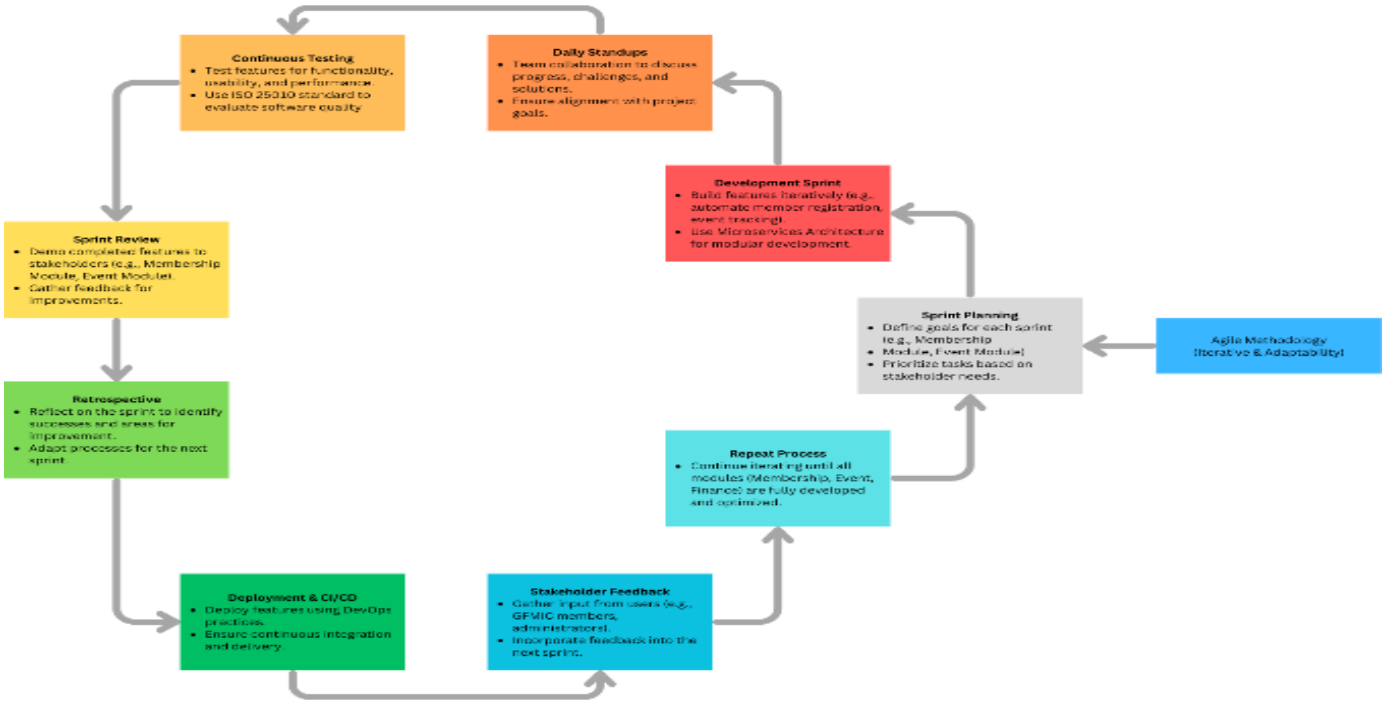
1. What inefficiencies arise from manual membership, event, and financial management processes, and how does GUnify automate these processes to improve efficiency?
2. How do data inconsistencies and fragmentation impact decision-making, and how does GUnify ensure data accuracy and consistency?
3. What challenges does a lack of transparency in financial tracking pose, and how does GUnify improve financial reporting?
4. What barriers do resource constraints and high storage costs create for non-profits, and how do the Deflate Compression Algorithm and ISO 25010 standard help GUnify optimize resource allocation?
5. What issues arise from disjointed workflows and unreliable systems, and how do the Deflate Compression Algorithm and ISO 25010 standard ensure GUnify integrates workflows and maintains system reliability?

METHODOLOGY

The researchers used two types of research designs: descriptive and developmental. In descriptive research, the study aims to evaluate the proposed system using criteria and indicators based on the ISO Standard Model.

Regarding the developmental type, GUnify Information Management System combines the Agile Scrum methodology, microservices architecture, and DevOps practices to address the organization's need for efficient, adaptable, and user-centric management solutions. Each approach is carefully selected to enhance collaboration, increase operational flexibility, and ensure the system's long-term scalability. The Agile Scrum framework is especially beneficial for this project because it emphasizes incremental progress, collaboration, and continuous feedback. Figure 2 illustrates how GUnify used Agile Scrum.

Figure 2. Agile Scrumas utilized in GUnify



The Agile Scrum methodology plays a central role in developing the GUnify Information Management System, ensuring an iterative, collaborative, and adaptive approach to addressing the operational challenges of non-profit organizations. By breaking the project into short, time-boxed sprints, the development team focuses on delivering specific features incrementally, such as the Membership Management, Event Management, and Finance Management modules. This iterative process allows for continuous refinement based on stakeholder feedback,

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ensuring the system evolves to meet organizational needs effectively. Close collaboration with stakeholders during sprint planning, daily standups, and sprint reviews ensures alignment with user requirements and priorities. Agile Scrum's adaptability accommodates changing needs, enabling the team to incorporate new requirements or adjustments seamlessly. Continuous testing, guided by the ISO 25010 standard, ensures the system meets high-quality criteria, including functional suitability, performance efficiency, and reliability.

Integrating Microservices Architecture and DevOps practices further enhances modularity, scalability, and deployment efficiency. Regular retrospectives foster continuous improvement, allowing the team to proactively refine processes and address challenges. Through this user-centric and iterative approach, Agile Scrum ensures that GUnify delivers a robust, scalable, and high-quality solution tailored to the unique needs of resource-constrained organizations.

RESULTS AND DISCUSSION

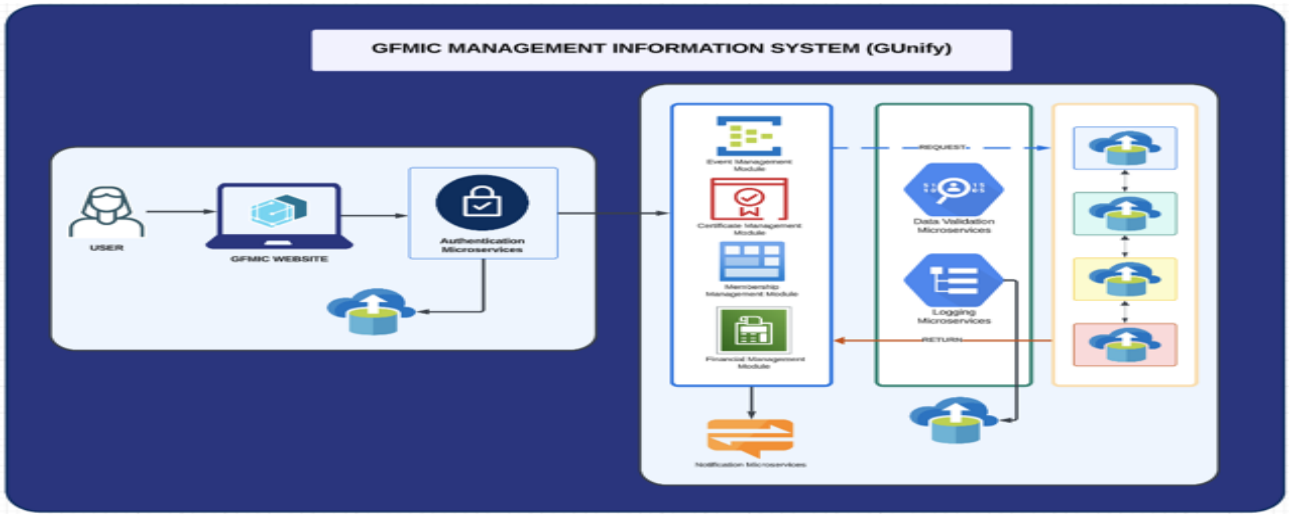
The results and discussion section highlights the effectiveness of the GUnify Information Management System in addressing the operational challenges faced by non-profit organizations. By integrating the Deflate Compression Algorithm and adherence to the ISO 25010 standard, GUnify significantly improves data management, resource optimization, and system reliability. The system's modular architecture and automated workflows streamline membership, event, and financial management, enhancing efficiency and transparency. These outcomes validate GUnify as a scalable and cost-effective solution for resource-constrained organizations, empowering them to achieve their goals effectively.

Automating processes to improve efficiency

Manual processes in membership, event, and financial management often lead to inefficiencies such as delays, errors, and redundant tasks. For example, manually updating member records, tracking event registrations, and managing financial transactions can result in data entry mistakes, miscommunication, and time-consuming workflows. These inefficiencies hinder productivity and strain limited resources.

GUnify addresses these challenges by automating core processes through its modular architecture. The Membership Management Module automates member registration, profile updates, and communication, ensuring accurate and up-to-date records. The Event Management Module streamlines event planning, scheduling, and participant tracking with automated notifications and attendance management. The Finance Management Module automates financial transactions, including donation tracking, fund allocation, and expense monitoring, reducing manual errors and improving transparency. By automating these tasks, GUnify significantly reduces administrative workload, minimizes errors, and enhances operational efficiency. Figure 3 shows Gunify's system architecture to support this narrative.

Figure 3. System Architecture of Gunify (Pilot tested by GFMIC, Inc.)



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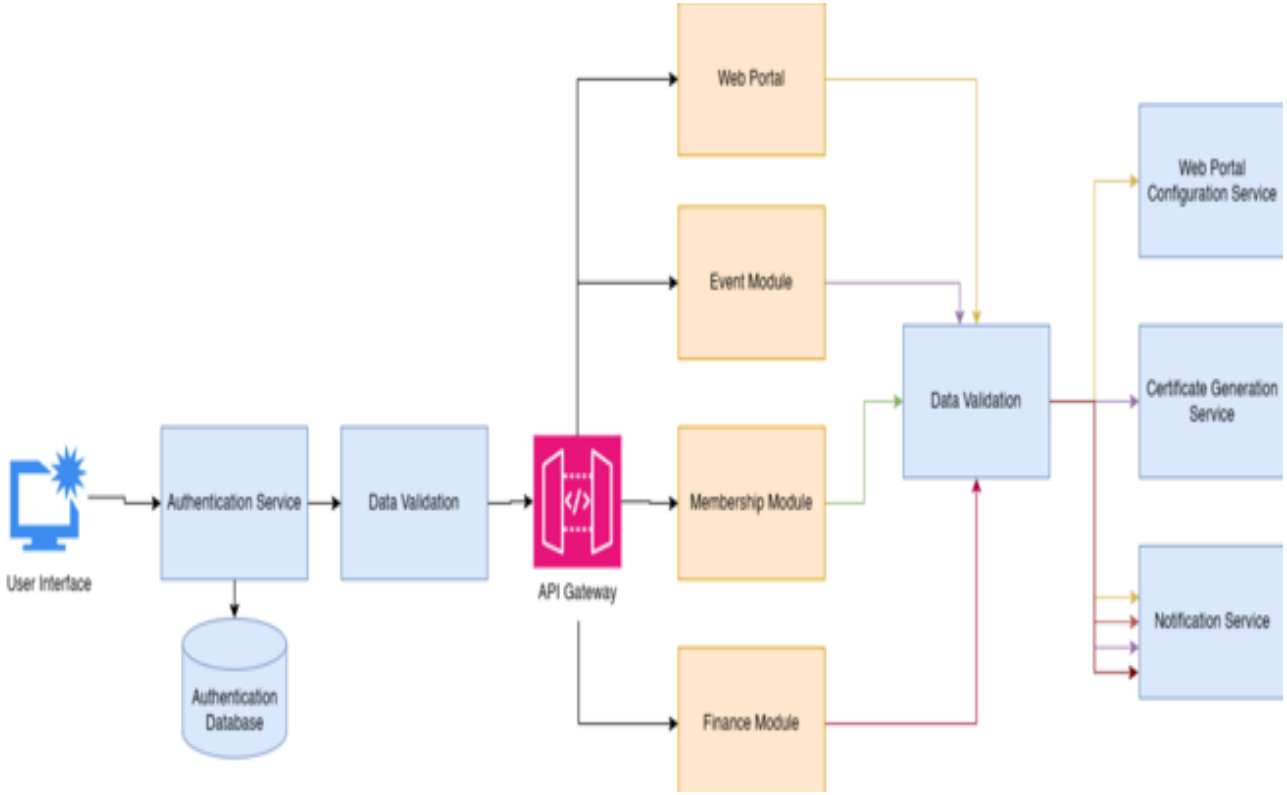
Data accuracy and consistency

Data inconsistencies and fragmentation can severely impact decision-making by providing incomplete or inaccurate information. For example, mismatched member records, outdated event details, or conflicting financial reports can lead to poor strategic decisions, missed opportunities, and reduced organizational effectiveness.

GUnify ensures data accuracy and consistency through its Data Validation Microservices, which validate and standardize data across all modules. The system's centralized database integrates member profiles, event schedules, financial reports, and transaction histories, ensuring a single source of truth. The ISO 25010 standard also guides the system's development, emphasizing reliability and maintainability. By maintaining consistent and accurate data, GUnify enables informed decision-making and enhances organizational trust.

Figure 4. Microservices Architecture of GUnify



Improved financial reporting

A lack of transparency in financial tracking can lead to accountability issues, mismanagement of funds, and reduced stakeholder trust. Manual financial processes often result in incomplete records, delayed reporting, and difficulty tracking expenses or donations.

GUnify improves financial transparency through its Finance Management Module, which automates financial transactions and reporting. The module tracks donations, allocates funds, monitors expenses, and generates real-time financial reports. These reports provide stakeholders clear insights into financial activities, ensuring accountability and trust. The system's adherence to the ISO 25010 standard further ensures security and reliability in financial operations, enhancing transparency and confidence in financial management.

Optimization of resources

Resource constraints and high storage costs pose significant challenges for non-profits, limiting their ability to manage data efficiently and scale operations. These barriers can lead to compromised system performance, increased operational costs, and difficulty meeting organizational goals.

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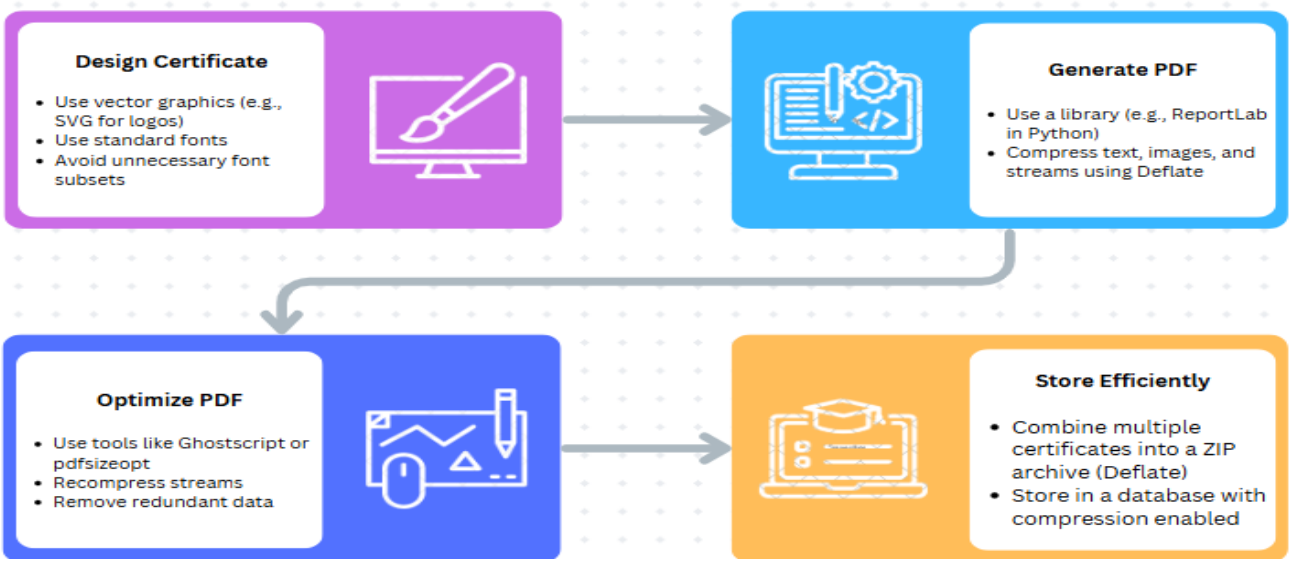
GUnify addresses these challenges by integrating the Deflate Compression Algorithm, which optimizes storage requirements by reducing file sizes without data loss. This algorithm is particularly effective for compressing text, binary data, and structured documents, making it ideal for managing membership records, event certificates, and financial reports. By minimizing storage needs, GUnify reduces costs and ensures efficient resource allocation.

The workflow for generating and optimizing certificates using the Deflate compression algorithm involves several key steps to ensure minimal storage allocation while maintaining high quality. It begins with designing the certificate using efficient elements such as vector graphics for logos and seals, which are resolution-independent and compress well. Standard fonts should be used, and unnecessary font subsets should be avoided to reduce redundancy. Once the design is ready, the certificate is generated as a PDF using a library that supports Deflate compression for all streams, such as reportlab in Python. All text, images, and other elements are compressed internally using Deflate to minimize file size during this step.

After generating the PDF, further optimization is performed using tools like Ghostscript or pdfsizeopt to recompress streams, remove redundant data, and ensure the file is as compact as possible. For example, Ghostscript can apply settings prioritizing size reduction while maintaining compatibility. Finally, the optimized certificates are stored efficiently by combining multiple certificates into a single ZIP archive (which uses Deflate compression by default) or storing them in a database with compression enabled. This workflow ensures that the certificates are both storage-efficient and high-quality, making it ideal for scenarios where significant storage allocation is a concern. Figure 5 below supports this discussion.

Figure 5. Certificate Generation Using Deflate Compression Algorithm



The ISO 25010 standard also ensures the system's performance efficiency and scalability, enabling it to operate effectively even in resource-constrained environments. The Deflate algorithm and ISO 25010 standard enable GUnify to deliver a cost-effective, scalable solution for non-profit organizations.

Integration of workflows to maintain system reliability

Disjointed workflows and unreliable systems can lead to operational inefficiencies, data silos, and frequent system failures. These issues disrupt workflows, hinder collaboration, and reduce overall productivity.

GUnify integrates workflows and ensures system reliability through its microservices architecture, modularizing system components for seamless interaction. The Deflate Compression Algorithm enhances system performance by optimizing data storage and transmission, ensuring efficient workflows even with limited resources. The ISO 25010 standard ensures the system's reliability, maintainability, and security, providing a robust foundation for consistent operations.

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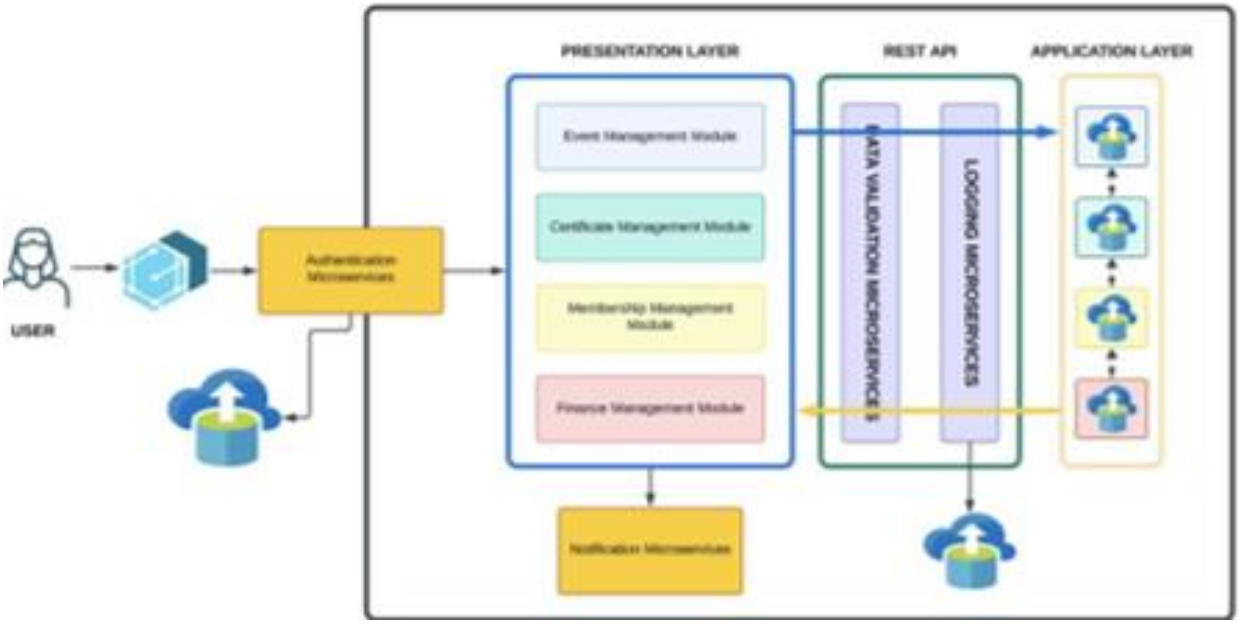
Figure 6. Integration Mechanism of Gunify



By combining these technologies, GUnify ensures smooth workflow integration, real-time data synchronization, and reliable system performance. This approach enhances operational efficiency, supports collaboration, and ensures the system remains dependable for users.

CONCLUSIONS

The development and implementation of the GUnify Information Management System demonstrate its effectiveness in addressing the operational challenges faced by resource-constrained non-profit organizations. By integrating the Deflate Compression Algorithm, GUnify optimizes storage requirements, significantly reducing data storage and transmission costs while maintaining high performance and functionality. This makes it a practical solution for organizations unable to procure high-end computing resources. Furthermore, the system's adherence to the ISO 25010 standard ensures exceptional software quality, as evidenced by a survey of 20 IT experts, which yielded a 4.3 Likert scale rating—indicating "very acceptable" performance across criteria such as functional suitability, usability, reliability, and security. GUnify's modular architecture, encompassing Membership Management, Event Management, and Finance Management modules, automates workflows, enhances data integrity, and improves transparency, empowering organizations to achieve their missions effectively. The combination of Agile Scrum methodology, Microservices Architecture, and DevOps practices ensures scalability, adaptability, and continuous improvement. Ultimately, GUnify validates the Deflate algorithm as a viable solution for optimizing storage and operational efficiency while serving as a model for leveraging modern software engineering practices to drive organizational sustainability and success.

Table 1. ISO 25010 (Gunify Quality Test)

Criteria	**Average Rating (Likert Scale)**	**Verbal Interpretaion**
Functional Suitability	4.4	Very Acceptable
Performance Efficiency	4.3	Very Acceptable
Usability	4.5	Very Acceptable
Reliability	4.2	Very Acceptable
Security	4.3	Very Acceptable

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Maintainability	4.1	Very Acceptable
Overall Rating	**4.3**	Very Acceptable

This table highlights the high level of acceptance and satisfaction among IT experts, further validating GUnify's robustness and alignment with international software quality standards.

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