Information technology solutions to support volunteer projects

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Abstract

This article is dedicated to the development of an integrated information system designed to optimize volunteer management processes, addressing the need for a centralized platform that consolidates volunteer recruitment, activity planning, communication, training, and reporting functionalities. The study commences with a comparative analysis of existing volunteer automation systems and methodologies, establishing a foundation for the proposed system's unique design. A core focus is placed on the application of conceptual modeling, specifically utilizing Unified Modeling Language (UML) diagrams, to define the system's architecture and operational logic. The utilization of UML facilitates the formalization of system requirements, enabling precise calendar planning and resource allocation, critical for the successful execution of the IT project. This approach ensures that the resulting web-based application, characterized by its intuitive user interface, effectively supports volunteer coordination, inter-volunteer communication, and the streamlined resolution of operational challenges inherent in volunteer activities. The research underscores the significance of conceptual modeling as a pivotal tool in IT project management, promoting clarity and efficiency in the development of complex information systems.

Keywords

IT project, information system, volunteering, UML modelling, calendar schedule, Gantt chart

1. Introduction

Volunteering constitutes a fundamental pillar of modern society, serving as a cornerstone for the development and sustenance of diverse social, cultural, and civic initiatives. Defined as the voluntary contribution of time, skills, resources, and energy without expectation of monetary compensation, volunteering encompasses a spectrum of activities aimed at assisting those in need, improving social conditions, safeguarding the environment, and advancing the public good.

At its core, volunteering is grounded in altruism and characterized by the principles of voluntariness, selflessness, mutual aid, and social responsibility, driven by a desire to assist others and contribute to the betterment of society.

Volunteering encompasses a diverse spectrum of activities, including contributions to charitable organizations, social assistance programs, environmental conservation initiatives, educational endeavors, and more.

Volunteering constitutes a critical component of modern society, fulfilling several indispensable functions. Volunteers provide vital support and assistance to individuals facing adversity, offering a spectrum of services including financial aid, counseling, training, and educational support. Furthermore, volunteer efforts significantly contribute to community development by fostering positive social interactions and enhancing the overall quality of life. By engaging in volunteer work, individuals become more informed and responsible citizens, actively addressing social, environmental, and economic challenges within their communities. Moreover, volunteering serves as a catalyst for personal growth, enabling individuals to cultivate valuable skills in communication, collaboration, event organization, and project management.

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2. Related Works

Volunteering constitutes an indispensable component across a broad spectrum of modern societal domains, including healthcare and emergency response. Given the pervasive nature of volunteerism, a plethora of information management systems have been developed to facilitate and optimize various aspects of volunteer activities. In the article by Schönböck et al., a digital platform Engagement by Goals is proposed. The platform focuses on goal-oriented volunteering and aligns volunteers' motivations and competencies with the needs of critical infrastructure organisations. The development aims to enhance the resilience of the volunteer sector through the personalisation of participation and the creation of an inter-organisational ecosystem of interaction [1]. Furthermore, research conducted by authors in [2] explores the transformative potential of information and communication technologies within the realm of volunteer management. The authors posit that the integration of advanced workplace technologies will not only enhance task efficiency but also enrich the overall volunteer experience and amplify the impact of volunteer contributions on organizational operations.

Leaders of volunteer organizations prioritize the selection of volunteer management systems that incorporate the most critical functionalities. In his seminal work, Eli Samuels [3] identifies five key features essential for effective volunteer management software: a centralized volunteer database, comprehensive volunteer hours tracking and reporting capabilities, automated volunteer engagement mechanisms, robust communication channels, and detailed volunteer engagement profiles.

In the study by Husin et al., a web-based system entitled HELP'EM is presented, designed to automate volunteer management processes in Malaysia and developed according to the waterfall model [4]. The system demonstrated improved efficiency in volunteer coordination, engagement, and reporting, offering a practical approach to optimising administrative processes in the field of volunteer activity. In the article by Wadekar et al., a mobile system named V-Vibe is described, which ensures effective interaction between volunteers and organisations through an intuitive digital environment. The proposed solution eliminates communication gaps, automates registration and event scheduling, which contributes to increased engagement and effectiveness of volunteer initiatives [5]. Yigitbas et al. presented a virtual environment for collaborative UML modelling in virtual reality (VR), aimed at overcoming the limitations of two-dimensional visualisation and the lack of interactivity inherent in traditional tools. The experimental results indicated that although VR-based modelling is less efficient than classical approaches, it significantly enhances user engagement, the naturalness of interaction, and the sense of shared space among participants [6].

In the study by Osei, the impact of information systems on accounting management in non-profit and charitable organisations is analysed, particularly in relation to transparency, financial efficiency, and the achievement of organisational missions. The author identifies the key advantages and barriers to the implementation of information systems in the non-profit sector, emphasising their role in enhancing trust and accountability towards stakeholders [7]. In the research by Pu et al., the challenges of data integration within the framework of the Nonprofit Organization Research Panel Project (NORPP) are examined. The project is aimed at supporting research on non-profit organisations through large-scale panel surveys and the analytical platform NAIP. The authors analyse the technical challenges associated with data heterogeneity and quality and explore the potential of large language models (in particular, the GPT series) for automating data processing, schema adaptation, and quality control [8].

Vasileiou et al. presented a web application designed to support volunteering in higher education institutions is. The application was implemented with WordPress using modern web technologies. The system provides centralised information dissemination, analytics, and interaction among students, lecturers, and the local community, thereby enhancing engagement and the social impact of academic volunteering [9]. Robinson et al. review volunteer motivations in citizen

science, and best practices for retention through the functional capabilities of digital tools. The authors emphasise that alignment with volunteers' expectations and the proper functionality of ICT solutions are key factors for sustained participation and the long-term viability of citizen science projects [10].

In the work by Li and Tang, the optimisation of big data processing in volunteer computing environments is investigated through adaptive management of MapReduce workflows. The authors propose an initialization protocol that dynamically configures volunteer overlays, increasing performance by 36–71% and reducing computational resource usage by releasing redundant nodes during execution [11]. Angah et al. examined an approach to optimising management processes and implementing digital tools for standardising the collection of data on users' social needs within a large organisation. The use of electronic forms and automated information-processing workflows substantially increased participant engagement – from 0.4% to 15.9% - demonstrating the effectiveness of integrating modern technologies to improve communication, reporting, and coordination in the management of volunteer or social programmes [12].

The main communication challenges between non-profit organisations and volunteers are analysed in the article by Toncheva-Zlatkova. The main stages of effective engagement are outlinedand, the FLIGHT model is presented as a tool for the strategic management of the communication process. The author emphasises the importance of systematic communication at all stages of volunteer activity – from recruitment to completion of participation – to enhance management effectiveness and volunteer motivation [13]. Wu et al. described the use of information systems and spatial analysis tools (GIS) to enhance community engagement and overcome barriers to access socially important services. By combining public participation, digital platforms, and geoinformation technologies, the authors demonstrate how a systematic approach to data collection and analysis facilitates more precise engagement of target groups and the development of linguistically and culturally adapted communication strategies, thereby increasing community trust and participation [14]. Li et al. present the design and implementation of a volunteer service platform for college students, built using a collaborative filtering algorithm. The aim of the study is to enhance communication between volunteers and the recipients of volunteer activities, as well as to ensure accurate matching of events. The authors note that traditional volunteer platforms face challenges such as chaotic information management, low efficiency, and suboptimal volunteer-to-event matching. The proposed system utilises user data analysis to personalise recommendations, reducing the time required to identify suitable activities and promoting greater student participation in volunteer initiatives. Compared with existing solutions, the developed platform demonstrates higher performance, improved usability, and practical value for managing volunteer processes within educational organisations [15].

While volunteering constitutes a pivotal force for social development, its full potential often remains unrealized due to a dearth of systematic management frameworks. The effective organization and coordination of volunteer projects encounter significant challenges, particularly in the areas of resource allocation, communication, and performance evaluation.

This IT project endeavors to address the challenges inherent in managing volunteer activities by developing a user-friendly and functionally robust platform. This innovative solution aims to enhance the efficiency of volunteer engagement through streamlined planning, optimized task allocation, and facilitated communication between managers and volunteers. Furthermore, the proposed information system will enable robust reporting and performance monitoring, empowering volunteer organizations to optimize resource utilization, elevate the quality of volunteer services, and maximize their impact on society.

3. Purpose of the study

The primary objective of this research is to design and develop an information system specifically tailored to streamline and optimize volunteer management processes.

Volunteer automation software constitutes a suite of tools designed to streamline and optimize the management of volunteer projects, encompassing features such as automated volunteer registration, task assignment, and reporting mechanisms. This technology facilitates enhanced interaction among participants and ultimately contributes to increased effectiveness of volunteer initiatives.

The scientific novelty of this research lies in the innovative application of a unified, web-based platform to integrate and streamline the diverse activities inherent in volunteer project management. This system uniquely combines functionalities for volunteer recruitment, activity planning, communication, training, and reporting, thereby addressing the fragmentation commonly observed in existing volunteer management practices. A key advancement is the utilization of a comprehensive conceptual modeling approach, specifically employing UML diagrams, to elucidate and formalize the complex interactions and workflows within volunteer projects. This methodology not only facilitates efficient resource allocation and calendar planning but also enhances inter-volunteer communication and problem-solving capabilities. Furthermore, the development of an intuitive user interface, grounded in these conceptual models, enables the seamless coordination of volunteer efforts, significantly improving operational efficiency and project outcomes. This integrated approach, which leverages information technology to address the specific challenges of volunteer project management, represents a significant contribution to the field, offering a scalable and adaptable solution for diverse volunteer initiatives.

4. Materials and Methods

A comprehensive analysis of existing analogous systems constitutes a critical phase within the preliminary stages of software design. This rigorous investigation facilitates the identification and subsequent emulation of best practices employed in comparable systems. Furthermore, this analysis serves to mitigate the risk of replicating previously encountered pitfalls and enables the discovery of optimal solutions.

Moreover, this process facilitates the identification of potential avenues for improvement and innovation. Additionally, it provides valuable insights into the competitive landscape and the specific domain within which the target application will operate.

Table 1 presents a concise summary of the advantages and disadvantages inherent in existing web-based platforms designed for managing volunteer activities [16-19].

Table 1
A comparative analysis of the functionality of existing web platforms

Title	Feature	Advantages	Disadvantages
Volunteer-Match	A comprehensive web-based platform designed to facilitate volunteer recruitment and management. This platform empowers organizations to publish volunteer opportunities and enables volunteers to discover projects aligned	A comprehensive database encompassing a vast array of organizations and volunteers, facilitating efficient partner discovery. The platform offers a streamlined search function enabling users to locate projects based on specific categories and geographical regions. Its user-friendly	Limited capabilities for managing volunteers beyond the platform's scope. Inability to integrate with external volunteer management systems.

	with their specific interests and skill sets.	interface ensures a seamless experience.	
GivePulse	A comprehensive software solution designed to streamline volunteer management processes from recruitment to progress tracking. The system offers customizable features, including shift scheduling, calendar management, and a tailored database, empowering organizations to create and manage events efficiently while fostering effective communication with volunteers.	This platform, characterized by a user-friendly interface and intuitive design, empowers organizations to rapidly create and manage volunteer events, facilitating efficient participant engagement. Key features include streamlined volunteer registration, robust communication channels, and comprehensive progress tracking capabilities. Furthermore, the platform integrates with payment systems, enabling seamless collection of donations and streamlined event expenses.	The platform exhibits limited functionality compared to other volunteer management systems, particularly when applied to larger organizations or projects with complex structures. Notably, it lacks advanced features such as comprehensive analytics and sophisticated task scheduling capabilities.
Volonter.org	This platform employs a sophisticated matching algorithm to connect users with volunteer opportunities that align with their specific interests and skill sets, thereby fostering a sense of purpose and fulfillment among volunteers.	The platform offers a comprehensive repository of volunteer opportunities spanning charity events, social initiatives, and environmental campaigns. Its intuitive interface enables users to effortlessly filter and locate suitable volunteer roles based on location, type of work, and duration.	The platform faces potential challenges related to misunderstandings between volunteers and organizations, as well as security risks associated with the protection of personal data.
Dobro.ua	As Ukraine's premier online platform for charitable fundraising, this innovative solution introduces a new paradigm for systemic philanthropy. By emphasizing accountability, transparency, and civic engagement, the platform empowers individuals and organizations to support a wide range of charitable and social initiatives.	A digital system facilitating collaboration and communication between volunteers and organizations engaged in diverse charitable initiatives. The platform's user-friendly interface empowers volunteers to efficiently discover suitable opportunities based on geographic location, project type, and time commitment.	The platform suffers from a dearth of active volunteer projects and a lack of relevance in project offerings, hindering its ability to effectively match volunteers with suitable opportunities.

Web-based applications offer a suite of functionalities that streamline volunteer management, including centralized access to volunteer opportunities, tools for organizing and tracking volunteer activities, and efficient communication channels for seamless interaction between volunteers and organizations.

5. Presenting the main material

Volunteer management presents unique challenges that necessitate specialized approaches. Analysis reveals critical needs encompassing the coordination of volunteers, the identification and resolution of recurring logistical issues within the volunteer domain (e.g., registration, record-keeping, reporting), and the establishment of efficient communication channels and linkages among volunteers, organizations, and ultimately, recipients.

Prior to commencing any software development endeavor, a comprehensive assessment of requirements and potential challenges is imperative. This preliminary analysis serves to elucidate the specific objectives to be attained through the software and its alignment with the overarching business goals of the entity or organization. It acts as a crucial intermediary between technical capabilities and the genuine demands of end-users or the business itself. Furthermore, this process facilitates the identification of essential functionalities and features to be incorporated within the software, while simultaneously informing the determination of necessary technological resources, human capital, equipment, and other requisite resources for successful project implementation.

To optimize the management of volunteer activities, the automation of key processes is paramount. This necessitates the development of specialized volunteer management software capable of handling routine operational tasks, including registration, task scheduling, data acquisition, and reporting, thereby minimizing manual labor and enhancing overall efficiency. The seamless integration of communication tools is also indispensable for facilitating effective interaction among volunteers, organizers, project coordinators, and recipients. Consequently, the software should incorporate a suite of communication systems, such as Telegram bots, email, shared workspaces, or dedicated messaging platforms, to streamline information exchange. Furthermore, given the sensitive nature of data associated with volunteer management, robust data security measures are of paramount importance. This necessitates the implementation of safeguards to ensure the protection and regulatory compliance of all personal information. Finally, the software architecture must exhibit inherent flexibility and scalability to accommodate future enhancements and adapt to evolving organizational needs.

An information system designed to automate volunteer management encompasses several core functionalities. Firstly, it incorporates robust registration and authentication mechanisms, enabling the enrollment of new volunteers and authorizing access for existing users. Secondly, it facilitates comprehensive project and task management capabilities, including the creation, modification, and deletion of projects, as well as the efficient assignment of tasks to individual volunteers. Thirdly, the system incorporates robust task performance tracking mechanisms, fostering seamless interaction between volunteers and project coordinators. Finally, the system provides advanced reporting and analytics capabilities by aggregating and analyzing collected data to inform informed decision-making. Moreover, the system operates in both online and offline modes, ensuring real-time interaction and seamless data synchronization across various operational environments.

The system accommodates a diverse range of user roles. These include volunteers who register, actively participate in projects, and complete assigned tasks. Project coordinators are responsible for managing the lifecycle of projects, including task assignment and direct interaction with volunteers. System administrators oversee the management of user access and system security. Analysts and managerial personnel utilize the system for data analysis, report generation, and informed decision-making. Furthermore, sponsors and external partners can engage with the system to promote projects and provide financial support.

Figure 1 illustrates a block diagram depicting the architectural components of the information system for automated volunteer management.

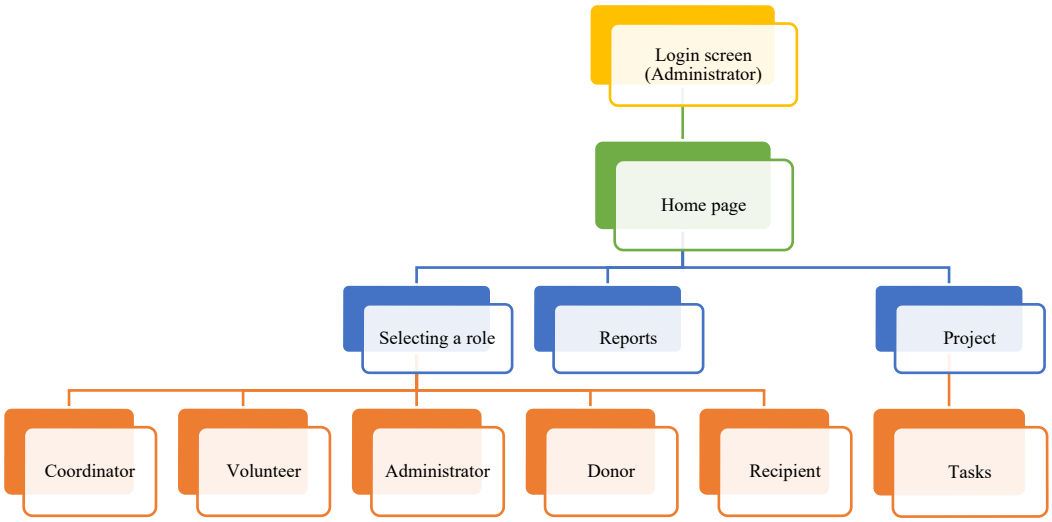

Figure 1: Structural diagram of the information system.

Project management systems offer significant advantages, encompassing the accurate estimation of project duration and individual task timelines, the construction of Gantt charts for visual project scheduling, the efficient distribution of tasks among project participants, and the proactive management of potential risks and financial constraints. The efficacy of IT project management is contingent upon the productivity of the project team, the meticulous formulation of task composition and structure, the equitable distribution of tasks among team members, and the rigorous implementation of quality control measures for task solutions [20].

The development of the application was preceded by the meticulous creation of a comprehensive calendar plan for the IT project, as depicted in Figure 2.

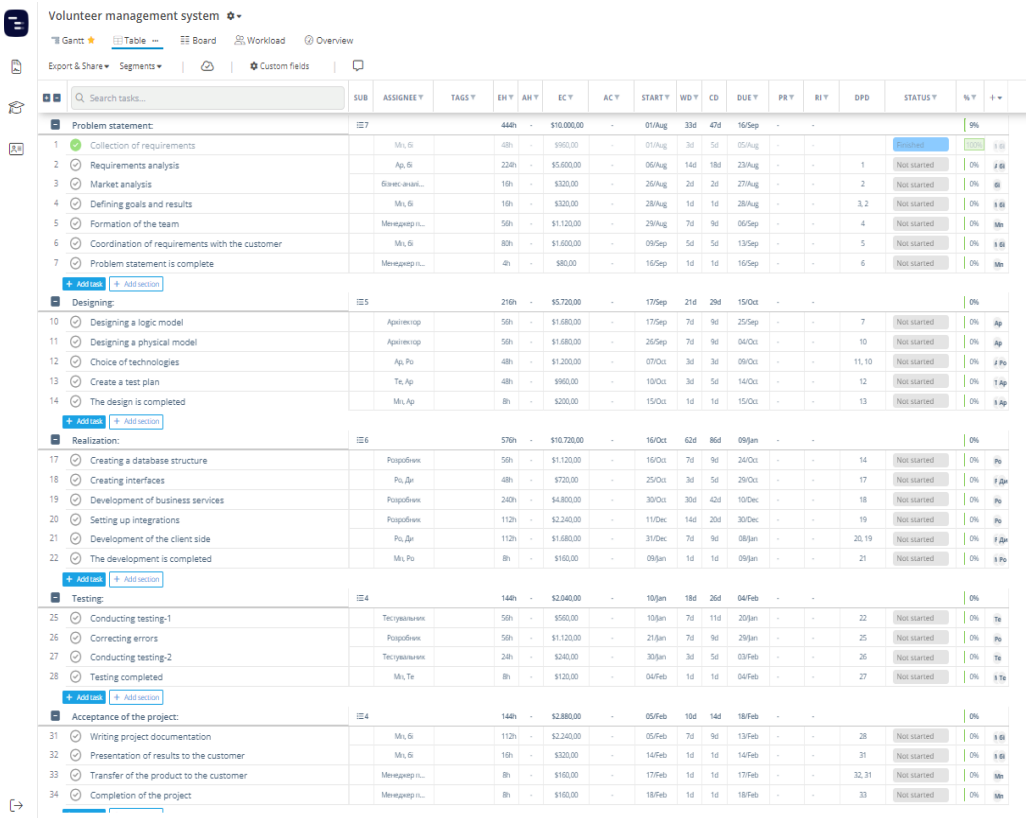

Figure 2: Calendar plan of the project.

An online Gantt chart was constructed using Instagantt to visually represent the IT project plan and timeline (Fig. 3).

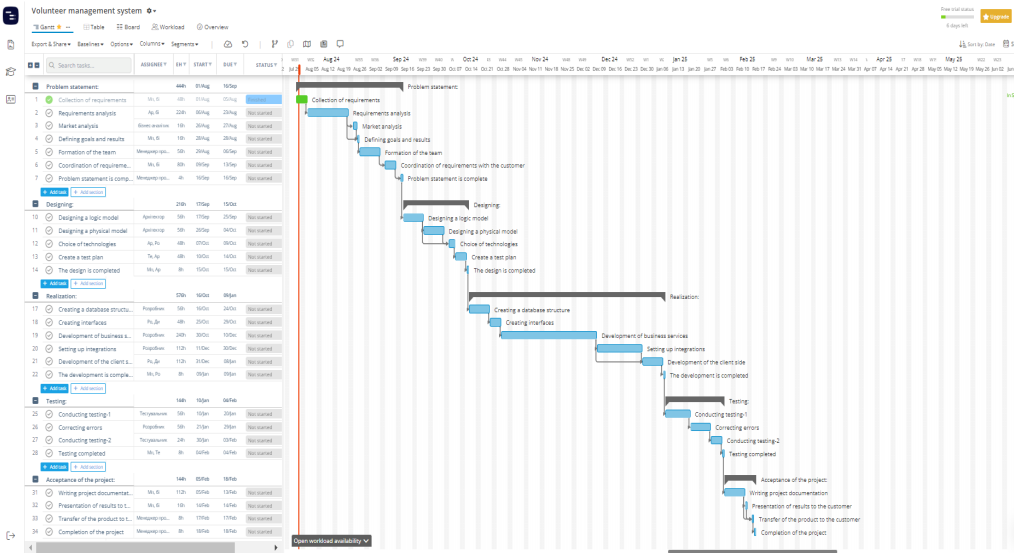

Figure 3: Gantt chart of the project.

The architectural design of the volunteer activity automation information system was meticulously undertaken employing the Unified Modeling Language (UML), a widely adopted industry standard for visually representing system abstractions through the utilization of standardized graphical notations. UML has garnered widespread recognition and acceptance within the software development community, serving as a foundational framework for most system and application software developers. Furthermore, UML enjoys robust support from a diverse array of object-oriented Computer-Aided Software Engineering (CASE) tools. A comprehensive understanding of UML principles is not only indispensable for system analysts and designers but also constitutes a critical skillset for software programmers and quality assurance professionals.

A use case diagram serves as a valuable tool for visually representing system requirements and facilitating a comprehensive understanding of user roles and their interactions with the system. To gain a deeper understanding of the system's functional capabilities, a use case diagram is employed to graphically depict the core business processes (Fig. 4). The primary objective of constructing a use case diagram is to establish the contextual boundaries of the subject area within the scope of system design, while concurrently addressing the critical need to develop an initial conceptual model of the system, paving the way for subsequent refinement and iterative improvement.

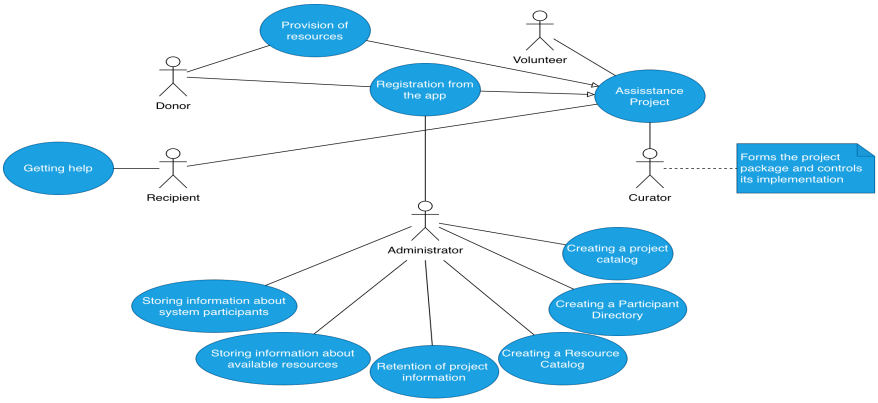

Figure 4: Use case diagram.

Class diagrams provide a robust mechanism for effectively representing the underlying structural composition of the system, thereby streamlining the development process and facilitating subsequent software product support. Figure 5 illustrates a UML diagram depicting the

class hierarchy of objects responsible for implementing the core processes within the information system designed for the automation of volunteer activities.

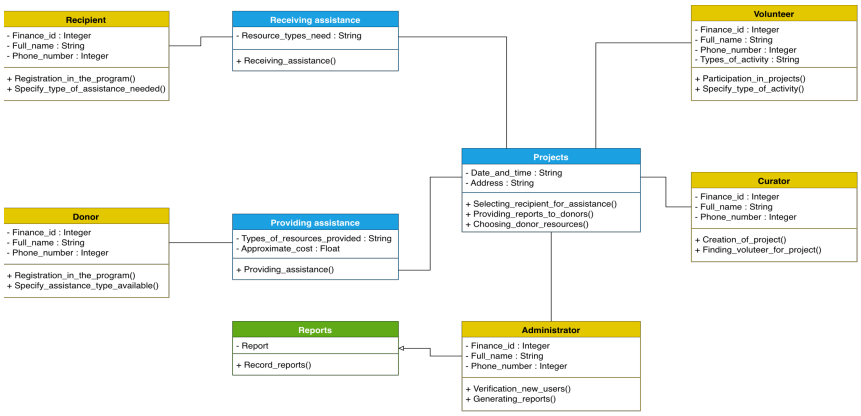

Figure 5: UML diagram of system object classes.

Consequently, volunteer organizations necessitate the implementation of an information system characterized by user-friendliness and ease of use for all stakeholders. This system must be meticulously designed to effectively address the specific requirements and needs of both volunteers and recipients. Furthermore, it must facilitate the seamless coordination of volunteer activities, enable the proactive identification and resolution of recurring logistical challenges within the volunteer domain (e.g., registration, record-keeping, reporting), and establish robust communication channels and linkages among volunteers, organizations, and, ultimately, the individuals in need of assistance.

To comprehensively assess the impact of the designed information system on volunteer activity, a hypothetical model of volunteer activity growth over the course of a year was used. This model illustrates the potential effect of implementing systemic engagement tools aimed at stimulating participation and increasing the level of volunteer activity. Typical indicators include the number of active volunteers, trends in their engagement, and seasonal fluctuations, which play a significant role in resource planning and initiative scaling.

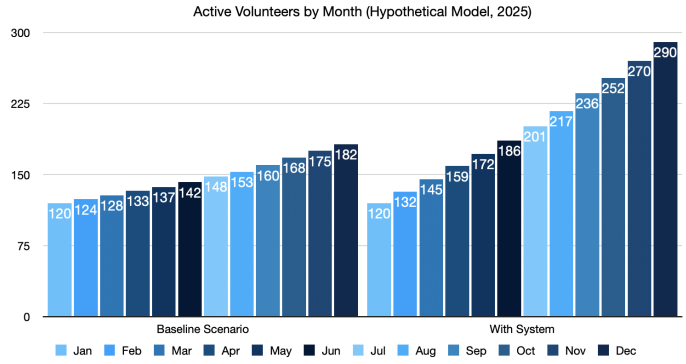

Figure 6: Active Volunteers by Month (Hypothetical Model, 2025).

The diagram shows a significant acceleration in the growth of active volunteers in the scenario with the introduction of an information system compared to the baseline scenario without additional engagement tools. The result highlights the importance of digitising volunteer management processes as a mechanism for improving the effectiveness and sustainability of volunteer programmes. Further steps include more detailed monitoring of dynamics, adaptation of incentive measures, and continuous optimisation of the system in order to maintain sustainable growth in activity and quality of interaction between all participants in volunteer projects.

6. Conclusions

Contemporary societal realities consistently underscore the paramount importance of collective action and mutual support during times of adversity. The inherent principle of reciprocity, encapsulated in the adage “ask and ye shall receive”, and “seek and ye shall find”, should serve as a guiding principle throughout human existence. The development of an effective information system for managing volunteer activities constitutes a crucial step towards operationalizing this fundamental principle, facilitating greater accessibility and engagement for all individuals within the broader societal framework.

This research investigates the design and development of an information system aimed at automating volunteer activities. A web-based application emerges as a potent technological solution for optimizing the multifaceted process of volunteer management. By leveraging the inherent advantages of web-based platforms, this system facilitates convenient accessibility to information pertaining to available volunteer opportunities, streamlines the organization and tracking of volunteer contributions, and significantly enhances communication and data exchange between volunteers and the respective organizations.

This research focused on investigating critical aspects of scheduling and resource management within the context of IT project execution, with the overarching objective of achieving project goals and objectives. To address these challenges, a comprehensive suite of software design methodologies was employed. These methodologies encompassed pre-project analytical assessments of product-related issues, rigorous requirements analysis, and the subsequent determination of a comprehensive list of functionalities based on identified user needs. Furthermore, the research leveraged the power of Unified Modeling Language diagrams for the effective modeling and visualization of intricate business processes.

The significance of this project extends beyond its immediate scope, encompassing several key benefits. These include the potential to enhance the overall efficiency of volunteer activities, facilitate more agile and adaptable planning and task allocation methodologies, foster seamless interaction and communication between managers and volunteers, and ensure robust mechanisms for comprehensive reporting and performance monitoring of project outcomes.

Consequently, this IT project introduces an innovative paradigm for managing volunteer activities through the strategic development of a web-based application. This novel approach effectively addresses and mitigates existing challenges encountered within the domain of organizing and coordinating volunteer projects. The findings and outcomes of this research possess the potential to exert a positive influence on the trajectory of the volunteer movement, fostering its growth and solidifying its position as a pivotal force within contemporary society.

Declaration on Generative AI

During the preparation of this work, the authors used ChatGPT for grammar and spelling checks, as well as for improving the clarity of certain passages. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the publication’s content.

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