K-NECT: A Youth Governance System
for Iriga City

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CHAPTER 1
INTRODUCTION

This chapter provides the overview of the project, including project context, purpose and description of the project, objectives of the project, the significance of the study, scope and limitations of the study, and the project dictionary.

1.1 Project Context

The rapid advancement of technology over the past decade has revolutionized various aspects of governance, administration, and community engagement. As societies evolve into more digitized landscapes, there is an increasing need to computerize traditional systems to ensure efficiency, security, and accessibility [1]. In the Philippine government, various agencies have adopted digital solutions to improve service efficiency. For instance, the Bureau of Internal Revenue (BIR) implemented the Electronic Filing and Payment System (eFPS) to streamline tax filing and payment processes [2], reducing manual paperwork and improving transaction accuracy. Similarly, the Department of Social Welfare and Development (DSWD) utilizes the Listahanan National Household Targeting System for Poverty Reduction, a computerized database that helps identify eligible beneficiaries for social welfare programs [3], enhancing efficiency and minimizing errors in data management. These technological innovations demonstrate the necessity of automating administrative processes to improve accuracy, accessibility, and service delivery.

Thus, the automation of government systems in the Philippines is supported by several legislative measures and executive directives aimed at enhancing public service

efficiency. The Republic Act No. 11032, also known as the "Ease of Doing Business and Efficient Government Service Delivery Act of 2018," mandates the adoption of automation and digital transformation in government transactions to reduce processing time, minimize human intervention, and improve public service delivery [4]. Additionally, the Department of Information and Communications Technology (DICT) has issued policies advocating for e-Government initiatives, such as the National Government Portal (NGP), which aims to integrate digital services across various government agencies. These legal frameworks emphasize the importance of automating administrative processes to ensure efficiency, transparency, and security in governance.

In local governance, particularly in youth organizations like the Sangguniang Kabataan (SK) and Katipunan ng Kabataan (KK), the need for an efficient and computerized system is essential to ensure comprehensive youth engagement, accurate record-keeping, effective communication, and streamlined administrative processes. The Sangguniang Kabataan serves as the governing body for the youth in every barangay, tasked with implementing programs and projects that benefit young constituents. Meanwhile, the Katipunan ng Kabataan consists of all registered youth members in a barangay, serving as the primary beneficiaries and participants of SK initiatives [5]. Given the volume of members and activities managed by the SK, a centralized and automated system is required to streamline administrative processes and enhance organizational efficiency.

Digital platforms, particularly web-based applications, play a crucial role in addressing the limitations of manual processes. These technologies enable users to access records, receive updates through SMS notifications, participate in events, and

communicate with relevant administrators efficiently. By digitizing data management and communication processes, organizations can enhance record-keeping accuracy, improve accessibility, streamline administrative tasks, and foster better engagement among members. Web-based applications provide universal accessibility through any internet-connected device, reducing dependency on physical documentation and manual transactions while ensuring compatibility across different platforms and devices.

Currently, the profiling and attendance monitoring of SK and KK members in Iriga City rely on traditional methods such as manual record-keeping and paper-based attendance logs. These conventional approaches present numerous challenges, including data loss, errors in information entry, difficulty in tracking attendance trends, and inefficient event coordination. Manual processes are time-consuming and prone to human error, which can lead to inconsistencies in records. Also, misplacement and document loss could happen, making it difficult for SK officials to retrieve important information when needed. Therefore, a computerized system is needed to address these challenges, ensuring a more efficient and reliable method of managing member records and participation data. Additionally, there is no existing system that allows members to receive real-time updates, access official documents, or send recommendations to their SK officials. The lack of a digital system makes it difficult for SK officers to manage their members effectively, monitor participation, and generate insightful reports for decision-making.

To address these issues, the researchers propose the development of K-NECT: A Youth Governance System for Iriga City. K-NECT stands for "Kabataan Connect," emphasizing the system's primary goal of connecting youth members with their local government officials and creating a more engaged and participatory youth governance

environment. This comprehensive web-based system will ensure accessibility and ease of use for different stakeholders, featuring integrated modules for profiling, community bulletin management, event scheduling with automated SMS notification, attendance monitoring with RFID technology, document storage, and analytics, to keep members informed and engaged [6].

The use of RFID technology within the attendance monitoring module further strengthens system functionality and accuracy. By replacing manual attendance logging with an automated system, the organization can improve the accuracy of participation records, facilitate better evaluation of member engagement, and optimize administrative workflows. Additionally, RFID technology enhances operational efficiency by automatically storing and updating attendance data, reducing administrative workload and ensuring data integrity.

1.2 Purpose and Description of the Project

The Youth Governance System for Iriga City is designed to address the inefficiencies in managing and monitoring the records of KK members and SK Officials. The existing manual system used by the Panlungsod na Pederasyon ng mga Sangguniang Kabataan Office presents challenges in tracking member participation, verifying attendance at events, and ensuring accurate documentation. These issues lead to data inconsistencies, difficulty in program implementation, and a lack of transparency in member engagement. To resolve these problems, this study aims to develop an automated web-based youth governance system that utilizes RFID technology to improve data management, attendance tracking, and governance.

Specifically, this study aims to provide an efficient, secure, and automated system

for managing KK members and SK Officials and monitoring their participation in youth-related activities. The system enables streamlined profiling, community bulletin management, event scheduling with automated SMS notification, attendance monitoring with RFID technology, document storage, and analytics, enabling centralized access to youth records through a web platform. By implementing this technology, SK Officials can focus more on youth development programs rather than manually managing records. The system also ensures that participation in SK programs is properly documented, allowing members to receive real-time updates and recognition for their involvement.

Apart from that, the proposed system is capable of enhancing efficiency, accuracy, and transparency in managing youth records. This is achieved through the automated approach that reduces and even eliminates errors associated with manual record-keeping and ensures that attendance and related data are accurately stored and retrieved with ease. In particular, the system includes the Profiling Module, which manages structured data for KK members and SK Officials, ensuring their records are securely organized and accessible. The Attendance Monitoring Module automates participation tracking using RFID, preventing proxy sign-ins and preserving reliable records of involvement. The Event Scheduling Module enables SK Officials to create, organize, and monitor youth activities efficiently. The Community Bulletin Module serves as a centralized platform for posting announcements and official updates, promoting transparency and engagement. The Document Storage Module provides secure access to files and records related to youth governance, improving convenience and accountability. Finally, the Analytics Module offers data-driven insights on participation trends and system usage, supporting informed decision-making and improved governance practices.

Meanwhile, the system will be divided into three user types: the User Side (KK Members), the Admin Side (SK Officers), and the Super Admin Side (Panlungsod na Pederasyon ng mga Sangguniang Kabataan Officers).

The User Side of the system will allow KK members to register and manage their personal information and member details through the Profiling Module, ensuring their data is up-to-date and securely stored. They can also track their past and current attendance records in youth-related programs and activities through the Attendance Monitoring Module, which will display timestamped RFID logs for transparency and accuracy. Through the Community Bulletin Module, KK members will be able to view all upcoming events they are eligible or invited to join, confirm their participation, and receive reminders for scheduled activities. In addition, the Community Bulletin Module will display official announcements, news, updates, and advisories posted by their respective SK Officials, keeping members informed about current and future initiatives. The Document Storage Module will allow users to access downloadable forms, certificates, and guidelines relevant to SK programs and services. Moreover, KK members will be given access to a Suggestion Box or Recommendation Box. This feature will allow them to submit anonymous feedback, program suggestions, or concerns to their SK officials, promoting active civic engagement and youth-driven governance. The Admin Side equips SK Officers with tools to manage youth governance. Using the Profiling Module, they can view, update, and verify KK member records to keep data accurate and complete. The Attendance Monitoring Module will allow them to validate attendance logs in real-time using RFID data, minimizing fraudulent entries and simplifying reporting. Within the Event Scheduling Module, SK Officers can create, update, and manage events by setting event names,

descriptions, target participants, venues, and timeframes. The Community Bulletin Module will serve as the central platform for News Management, where SK Officials can draft, edit, and publish official announcements, program updates, emergency notifications, and campaign awareness posts for visibility on the User Side. The Document Storage Module allows administrators to upload and organize essential documents such as guidelines, forms, reports, and activity documentation, ensuring ease of access for both users and SK Officers. Lastly, through the Analytics Module, SK Officers can generate visual reports and insights based on attendance patterns, event participation rates, member engagement levels, and submitted suggestions from the Recommendation Box. These reports will help guide data-driven planning, allowing SK Officials to evaluate the effectiveness of programs and improve future initiatives based on actual user feedback. The Super Admin Side will allow the Panlungsod na Pederasyon ng mga Sangguniang Kabataan Officers to oversee and monitor city-wide implementation of youth governance operations, assess data summaries, and ensure proper use of the Document Storage Module and other components.

Moreover, the proposed system ensures secure and efficient SK governance through its core modules. Profiling facilitates the proper organization of youth records. Community Bulletin ensures effective information dissemination. Event Scheduling manages the timeline and logistics of programs. Attendance Monitoring guarantees transparent documentation of participation. Document Storage supports accessibility and archiving of governance files. Analytics equips officials with valuable insights for planning and assessment.

Furthermore, the study is highly relevant in today's digital era, where automated systems play a crucial role in organizational management. By leveraging RFID technology,

the system supports data-driven decision-making through the Analytics Module, which provides insights on member participation. Meanwhile, the Community Bulletin Module ensures that KK members receive updates and announcements in real time, improving engagement and participation. The improved transparency and accessibility of records strengthen accountability among SK Officials, ensuring that they fulfill their responsibilities effectively. And lastly, after accomplishing the various stages of the software development life cycle, the system will be fully deployed to ensure it will be used and provide this automated solution to enhance and streamline the processes executed both by the SK Officials and KK members in Iriga City. This deployment will ensure that the transition from the manual system to an automated one is smooth and that the system is fully operational and accessible to all users. This optimization of monitoring and youth governance contributes to the overall development of youth leadership in Iriga City, setting a precedent for future technology-driven initiatives in SK operations.

1.3 Objectives of the Project

Generally, this study aims to develop a web-based youth governance system for Iriga City with RFID to streamline profiling, community bulletin management, event scheduling with automated SMS notification, attendance monitoring with RFID technology, document storage, and analytics within the Panlungsod na Pederasyon ng mga Sangguniang Kabataan Office, enhancing efficiency, transparency, and accountability in youth governance. Specifically, this study aims to:

1. Identify the challenges encountered in the current manual system of Panlungsod na Pederasyon ng mga Sangguniang Kabataan Office in terms of:

   1.1. Profiling and Registration of Sangguniang Kabataan and Katipunan ng

Kabataan Members

    1.2. Attendance Tracking during SK Programs and Activities

    1.3. Data Management and Security within the Panlungsod na Pederasyon ng mga Sangguniang Kabataan

2. Develop a web-based youth governance system for Sangguniang Kabataan and Katipunan ng Kabataan in Iriga City that could streamline their processes.

    2.1. Profiling

    2.2. Community Bulletin

    2.3. Event Scheduling

    2.4. Attendance Monitoring

    2.5. Document Storage

    2.6. Analytics

3. Test the system using black box testing techniques, focusing on:

    3.1. Unit Testing

    3.2. User Acceptance Testing

    3.3. Security Testing

4. Deploy the developed system to the Panlungsod na Pederasyon ng mga Sangguniang Kabataan Office of Iriga City.

1.4 Significance of the Study

The result of the study will benefit the following:

Panlungsod na Pederasyon ng mga Sangguniang Kabataan Office. This study will benefit the Panlungsod na Pederasyon ng mga Sangguniang Kabataan Office by streamlining process such as data management and ensuring accurate record-keeping of

KK members and SK Officials. The RFID system enhances security and efficiently monitors activities and attendance during events. This improved data management facilitates better planning, resource allocation, and program development for the youth in Iriga City. The system allows the Panlungsod na Pederasyon ng mga Sangguniang Kabataan to easily monitor the performance of SK Officials, ensuring that they fulfill their responsibilities effectively and actively participate in youth-related activities. This system ensures that the Panlungsod na Pederasyon ng mga Sangguniang Kabataan Office can effectively manage programs and provide better services to the Katipunan ng Kabataan.

Sangguniang Kabataan (SK) Officials. This study provides Sangguniang Kabataan (SK) Officials with an automated and efficient way to manage and verify the identity of registered KK members. By eliminating the manual record-keeping process of profiling and attendance tracking, SK Officials can focus on organizing projects and implementation that can benefit the youth community. The system simplifies the registration process for SK Officials, ensuring that all elected and appointed officials are properly recorded, verified, and monitored for their participation in youth-related activities. This promotes transparency, accountability, and efficient governance within the SK organization. Additionally, SK Officials can receive certifications and recognition for their active participation.

Katipunan ng Kabataan (KK). The implementation of this study will benefit the Katipunan ng Kabataan (KK) by providing them with an easier way to register, update their profiles, and access information about KK activities and programs via web platforms. The RFID technology can streamline attendance tracking at events and workshops, providing convenience and an easy verification process. Additionally, KK members will be able to

view upcoming events, announcements, and other important information through the Community Bulletin Board, ensuring they stay informed and engaged with the organization's initiatives.

Researchers. This study is significant to the researchers as it provides an opportunity to gain valuable insights into the operations of the Panlungsod na Pederasyon ng mga Sangguniang Kabataan and its role in youth governance. By conducting this study, the researchers aim to streamline and digitize the manual processes within the Panlungsod na Pederasyon ng mga Sangguniang Kabataan office, making record-keeping and management more efficient. Moreover, through the development of this proposed system, technical knowledge and skills were applied while improving collaboration, critical thinking, and creativity. Furthermore, this study serves as a platform for the researchers to enhance problem-solving abilities, innovate practical solutions, and contribute to technological advancements in local governance.

Future Researchers. This study may encourage future researchers to expand enhancements to the system, such as integrating new technologies, expanding its functionalities, or adapting it to different contexts. This study can serve as a foundation for future innovation in youth profiling and community-based management systems, resulting in a more organized and technology-driven governance model for the SK and Katipunan ng Kabataan. It may also inspire further research on the potential of RFID technology in community-based applications.

1.5 Scope and Limitations of the Project

This study focuses on the development of K-NECT: A Youth Governance System for Iriga City. The proposed system aims to enhance the data management, youth profiling,

participation monitoring, and record-keeping process of KK members and SK Officials, it will enhance the efficiency, transparency, and accountability of youth governance. Also, the system will utilize RFID technology for SK official and KK member identification and attendance monitoring, with data accessibility through web platforms. Moreover, the proposed system will be deployed at the Panlungsod na Pederasyon ng mga Sangguniang Kabataan office and across all 36 barangays in Iriga City, allowing barangay-specific youth profiling, event participation tracking, and SK official monitoring to ensure full functionality and usability. Furthermore, the proposed system will have a role-based access structure, which consists of the user side for KK members, the admin side for SK officials of each barangay, and the super admin side for Panlungsod na Pederasyon ng mga Sangguniang Kabataan officers. Along with this structure, the system will include multiple core modules. On the user side, the web application will include the Profiling Module, Community Bulletin Module, and Analytics Module. The admin and super admin sides will have access to the Profiling Module, Community Bulletin Module, Event Scheduling Module, Attendance Monitoring Module, Document Storage Module, and Analytics Module. Meanwhile, the researchers will employ Black-box testing, including Unit Testing, User Acceptance Testing, and Security testing, to evaluate the system's functionality. Unit Testing will assess individual modules to ensure they function correctly before integration. At the same time, User Acceptance Testing (UAT) will involve SK officials and KK members testing the system to verify that it meets their requirements, providing ease of use, proper access control, and accurate data management. Lastly, Security Testing will be conducted to identify and address vulnerabilities, ensuring that user data, system access, and sensitive information are protected from unauthorized access

or potential breaches.

However, this study will not include financial transactions that involve cash payments or expenses within the SK organization. Specifically, it will not cover event registration fees, fines and penalties, membership fees, fundraising and donations, refunds, financial aid distribution, sponsorships, or purchases of materials and services for SK programs. Also, the system will not include features for tracking lost RFID cards. This study will correspond to the solutions needed by the SK and KK organizations in Iriga City's 36 barangays.

1.6 Project Dictionary

The following are the technical terms that are relevant to this study, which are conceptually and operationally defined to give a clear channel of communication between the researchers and readers.

Access Control. A security mechanism that allows organizations to regulate and determine who has permission to access specific data and resources within the system [2]. In this study, access control is a security feature within the system that regulates user permissions, ensuring that only authorized individuals such as KK members, SK officers, or Panlungsod na Pederasyon ng mga Sangguniang Kabataan officers can access specific functionalities and data.

Attendance Monitoring. It refers to the process of monitoring and recording employees' working hours, including the time they report for work and their time off [3]. In this study, attendance monitoring refers to the process of tracking KK members and SK offcials' participation in meetings, programs, and events using the RFID system to ensure accurate and reliable records.

Automated Process. It refers to utilizing technology to streamline and eliminate manual, repetitive tasks within a business workflow [4]. In this study, an automated process refers to the use of digital tools, including RFID and system-generated reports, to streamline administrative tasks such as attendance tracking, profile management, and event coordination, reducing manual workload and errors.

Black Box Testing. A software testing technique that assesses the functionality of an application based solely on its specifications and expected outputs, without any knowledge of its internal code structure, logic, or implementation [5]. In this study, it refers to the technique that is used to evaluate and test the functionality of the proposed system.

Governance. It refers to the structured framework of authority, decision-making, and accountability within an organization, encompassing the mechanisms and relationships that define power distribution, delegation of responsibilities, and oversight to ensure alignment with institutional goals and ethical standards [1]. In this study, governance refers to the structure and processes implemented through the youth governance system that enable SK Officials and the Panlungsod na Pederasyon ng mga Sangguniang Kabataan Officers to efficiently manage, oversee, and evaluate youth-related programs and participation of KK members, ensuring transparency, accountability, and effective decision-making in youth affairs.

Katipunan ng Kabataan (KK). A youth assembly established in every barangay, aimed at fostering the social, political, economic, cultural, intellectual, moral, spiritual, and physical growth of young individuals across the nation [6]. In this study, Katipunan ng Kabataan (KK) consists of all registered youth members in a barangay within Iriga City who are eligible to participate in SK programs and initiatives. The system will enable KK

members to track their attendance, receive updates, and engage with SK activities.

Profiling System. A system developed by the department to assess various factors such as economic conditions, industry trends, and claimant attributes [7]. In this study, the Profiling System refers to a digital platform designed to store, manage, and update the personal records, participation data, and attendance of Katipunan ng Kabataan (KK) members within Iriga City.

Radio Frequency Identification (RFID). A wireless communication technology that utilizes electromagnetic or electrostatic interactions within the radio frequency range of the electromagnetic spectrum to uniquely recognize and identify an object, animal, or individual [8]. In this study, RFID technology will be used to automate attendance tracking of KK members by utilizing RFID-enabled ID cards, reducing manual errors and preventing fraudulent attendance records.

Sangguniang Kabataan (SK). The governing body representing the Katipunan ng Kabataan (KK) in each barangay. Its members are elected by the youth assembly through an electoral process overseen by the Commission on Elections (COMELEC) [6]. In this study, Sangguniang Kabataan (SK) refers to the youth council in each barangay responsible for implementing programs, projects, and initiatives that benefit young constituents. SK officers will use the system to manage records, track participation, and generate reports.

Transparency. The characteristic of being clear and easily visible. In the context of business or governance, it refers to openness, honesty, and accountability in operations, communications, and decision-making [9]. In this study, transparency refers to the system's ability to provide open and accessible information regarding SK activities,

ensuring accountability in event management, attendance records, and document access for

KK members and SK officials.

Web Application. A software program hosted on a remote server and accessed via

the internet through a web browser interface [10]. In this study, the web application is the

browser-based platform that enables KK members and SK officers to access the profiling

system, manage records, and perform administrative tasks from a desktop or laptop.

Notes

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CHAPTER 2

REVIEW OF RELATED LITERATURE AND SYSTEMS

This chapter discussed the analysis of the literature related to the study, the systems of various published literature, and the description of the structure of the entire study gathered from books, articles, algorithms or systems (software), and other research materials. This discussion of the manuscript contains a summary of the associated local and foreign literature and systems; it also includes the Synthesis of the Art, Gap Bridged by the Study, and Notes.

2.1 Related Literature and Systems

The following article presents a review of the literature relevant to the present study. It includes foreign and local literature on systems that provide necessary information for a better understanding of the implementation of web-based youth governance systems, electronic profiling systems, data management and security in governance systems, event management systems with SMS notification, the use of RFID technology in attendance monitoring, and evaluation of system using black box testing. This review also discusses the proposed system by the researchers and explains why it is important for them to study and understand these topics.

2.1.1 Web-Based Systems for Youth Governance

The adoption of web-based systems has significantly transformed governance and public service delivery, particularly in local government units (LGUs). These systems streamline administrative processes, enhance data accessibility, and improve decision-making, especially during challenging times such as the COVID-19 pandemic.

According to Lim [2022], the Barangay Integrated Management System (BIMS) was developed in Barangay 16, Bacolod City to enhance local governance through a unified web and mobile platform. The system streamlined service delivery, minimized face-to-face interactions, and enabled real-time management of resident profiles, complaints, appointments, and inventory [21]. It featured a centralized database for accurate data sharing between barangay offices and health centers. The BIMS improved operational efficiency, resource allocation, and supported data-driven decision-making through timely reports.

Likewise, Alinea et al. [2022] examined the development of a web-based household profiling system for Barangay Guinhawa, Quezon. The system was designed to provide barangay personnel with a solution that allowed access via web browsers [5]. The research integrated Node.js and PHP for web-based functionality and Firebase for real-time data synchronization. The study found that using this platform system improved data accuracy, accessibility, and efficiency, enabling barangay officials to update and retrieve household information seamlessly.

In addition, Sanchez [2021] conducted a study on the effectiveness of web-based profiling systems in demographic and socio-economic data collection. The system provided an interactive interface where barangay personnel could input, update, and analyze resident data [29]. The study concluded that web accessibility enables local government units (LGUs) to provide better services, respond quickly to residents' needs, and develop more accurate community programs. Apart from the resident profiling, Calderon et al. [2020] explored the application of web-based systems in data management

and governance. The research introduced a cloud-based profiling system that ensured secure data storage, accessibility, and integration with other government databases [9]. The study demonstrated that web platforms enhance collaboration, data transparency, and real-time monitoring, making them essential for modern governance and decision-making.

The integration of web-based systems in youth governance has significantly improved the effectiveness, accessibility, and accuracy of administrative functions in local government units. Their studies have proven that these digital innovations improve data management, allow for real-time tracking, and enhance service delivery by reducing redundancies and strengthening coordination among barangay officials. Moreover, mobile applications empower citizens by offering remote access to essential services, promoting greater civic participation, and ensuring continuity during emergencies such as the COVID-19 pandemic, and these advancements in technology continue to play a crucial role in shaping the future of public governance. Lastly, as technology continues to evolve, leveraging digital platforms in governance will be vital in fostering a more responsive, transparent, and efficient public service framework for the youth and the wider community.

2.1.2 Electronic Profiling Systems

The adoption of profiling systems has been instrumental in enhancing data management, record-keeping, and decision-making across various sectors. These systems streamline administrative tasks, improve accessibility, and ensure the accuracy and security of stored information.

Particularly in the study by Lacasandile et al. [2020], the researchers highlighted the significance of information and communications technology (ICT) in governance. The

study emphasized that an automated profiling system that could help barangay officials manage household data effectively [20]. The system facilitated budget allocation and decision-making by aggregating essential data, such as labor statistics, household income, and demographics. The functionality of the Barangay Information Profiling System (BIPS) was rated highly by users, with a mean score of 4.47 for ease of operation and 4.50 for system reliability, underscoring its efficiency in e-Governance applications.

Quindatan [2020] further supports the significance of computerized profiling. This system was designed to help barangay employees manage residents' data efficiently, reducing human error and processing time. By digitizing resident records, the system ensured improved accuracy, accessibility, and security, making it a viable alternative to manual data management methods [25]. The researchers concluded that automation enhances organizational efficiency and minimizes the workload of barangay officials. Moreover, a more specific study by Evangelista et al. [2023] explored the development of a profiling system designed based on the city's needs. The system integrated a comprehensive personal data profile, query mechanisms, and report generation features [13]. The study found that the system significantly improved public service delivery by facilitating secure and efficient data management. Furthermore, Jacobe et al. [2021] emphasized the use of statistical analysis in profiling systems. The system allowed authorized users to generate statistical reports based on demographic and socio-economic data [18]. This feature enabled LGUs to make data-driven decisions for community development. The research findings underscored that integrating analytics into profiling systems enhances their effectiveness and usability.

Meanwhile, Alinea et al. [2022] examined the role of mobile technology in profiling system by introducing a mobile application that facilitated real-time data entry and retrieval [5], at the same time, it ensures accessibility for barangay personnel. On the other hand, it was revealed that mobile-based profiling systems improve data accuracy, accessibility, and efficiency compared to traditional manual processes. Similarly, Sanchez [2021] conducted an ethnographic study which focused on demographic, economic, and socio-political aspects of a community. The study employed a descriptive research method to analyze residents' living conditions and access to services [29]. The findings confirmed that systematic profiling helps local government units (LGUs) design targeted interventions for marginalized communities, reinforcing the need for accurate and comprehensive profiling systems.

Beyond community profiling, Calderon et al. [2020] explored the application of profiling systems in commerce. The system utilized image processing technology to classify customer demographics, providing insights into purchasing behaviors [9]. The study demonstrated that profiling systems could be adapted for various industries to improve decision-making and operational efficiency.

In conclusion, the reviewed literature demonstrates the significant role of profiling systems in enhancing data management, decision-making, and service efficiency across various sectors. From barangay governance to commerce, the integration of automated profiling systems has proven to improve accuracy, accessibility, and security in handling critical information. Also, the adoption of mobile technology and statistical analysis has expanded the functionality and applicability of these systems, enabling more data-driven

and responsive solutions. Given the growing reliance on digital transition, the continued development and implementation of profiling systems remain essential for optimizing administrative processes, improving public service delivery, and supporting informed decision-making in diverse fields.

2.1.3 Data Management and Security in Government Systems

The adoption of digital technologies in government systems highlights the need for secure data management and data privacy, especially in youth governance. This is relevant to our study, entitled "K-NECT: A Youth Governance System for Iriga City", which must ensure the confidentiality, integrity, and availability of member data to facilitate efficient record-keeping and participation tracking. Implementing robust security measures is essential to protect against unauthorized access, cyber threats, and data breaches while also addressing regulatory compliance and privacy concerns. Studies on policy-driven security, encryption, and blockchain offer valuable insights into developing a secure and efficient KK and SK profiling system that upholds data protection and governance standards.

The Philippine Data Privacy Act of 2012 (RA 10173) serves as a fundamental law in protecting personal data privacy and security in the Philippines. It mandates both public and private institutions to establish data protection measures and comply with National Privacy Commission (NPC) regulations. Cheng [2023], emphasized that as digital transformation accelerates in government systems, compliance with the Data Privacy Act has become increasingly critical to prevent data breaches and unauthorized access [10]. Similarly, Pesito et al. [2021] examined the efficiency of Data Privacy Act compliance through a web-based self-survey approach, finding that institutions with structured

compliance mechanisms experienced fewer data security risks [8]. On the other hand, Pitogo [2021] analyzed government agency compliance, identifying challenges such as policy misalignment and lack of cybersecurity training [30], which could impact the KK and SK profiling system if privacy protections are not properly implemented. Ensuring compliance with the Data Privacy Act strengthens data security measures, preventing unauthorized access to sensitive information and maintaining trust and transparency in youth governance. The integration of RFID technology in the system must align with NPC privacy standards, ensuring that personal data is handled ethically and securely.

Farid et al. [2023] systematically reviewed digital information security management policies in academic libraries, highlighting the role of governmental entities in enforcing security standards for data management and cybersecurity within government institutions [14]. The findings suggest that a structured security management policy significantly improves data protection mechanisms and mitigates potential cyber threats. In contrast, Haraldsdottir and Gunnlaugsdottir [2022] argue that documenting personal information within a regulatory environment is inherently complex [16]. Their study suggests that excessive bureaucratic requirements often hinder efficient information security management instead of improving it.

With the rise of smart city technologies, real-time data collection has become essential for efficient governance. However, Ahmad et al. [2022] highlight that without strict access controls, smart city infrastructures are vulnerable to cyber threats and data exploitation [1]. Similarly, Chorley [2021] examined security risks in open government data systems, finding that while transparency improves governance, it also increases

exposure to cyber threats [11]. The study concludes that without proper encryption and authentication measures, government databases remain susceptible to breaches, reinforcing the need for strong encryption protocols and secure authentication processes in the KK and SK profiling system to prevent data manipulation and unauthorized access.

In their research, Alharbi et al. [2021] analyzed Saudi Arabia's e-government security framework, emphasizing the effectiveness of encryption techniques and dual-trust authentication models [4]. Their findings suggest that multi-layered security measures significantly reduce vulnerabilities and enhance data protection. Meanwhile, Giri and Shakya [2021] examined Nepal's e-government security framework, revealing weaknesses in policy implementation and technological infrastructure [15]. Their study found that limited cybersecurity expertise, outdated security measures, and poor risk assessment strategies leave e-government systems vulnerable to hacking attempts and data manipulation.

Alketbi et al. [2021] conducted a study on the potential of blockchain technology in government data security, demonstrating how its decentralized structure enhances transparency, trust, and data integrity [6]. Their study suggests that blockchain mitigates security risks by eliminating centralized vulnerabilities, making government transactions more secure. Nevertheless, Luthra et al. [2023] highlight that while blockchain offers enhanced data security and transparency, its implementation in government systems faces several challenges, including high costs, complex infrastructure requirements, and integration difficulties with existing databases. Their study emphasizes that governments struggle with aligning blockchain with current IT frameworks, making its adoption slow

and resource-intensive [22]. This highlights the need for the KK and SK profiling system to evaluate cost-effective security solutions that balance efficiency, affordability, and scalability.

The reliance on digital technologies in government systems highlights the need for robust data management and security frameworks, including structured security policies, encryption techniques, and emerging technologies such as RFID and blockchain to enhance protection against cyber threats. Nevertheless, challenges such as regulatory inefficiencies, technological limitations, and high implementation costs hinder the effectiveness of these measures. The KK and SK profiling system overcomes these limitations through integrating policy-driven security enforcement, encryption protocols, and RFID-based authentication, ensuring secure record-keeping and compliance with government data security standards. By leveraging insights from existing research, this system aims to enhance youth governance through a comprehensive, adaptable, and secure approach, ensuring data integrity, privacy protection, and cybersecurity resilience in the digital era.

2.1.4 Event Management Systems with SMS Notification

SMS-based alert systems have proven to be highly effective in enhancing service coordination, automating communication, and improving operational efficiency across various sectors. In event-driven platforms, particularly those catering to communities or organizations with dispersed users, SMS remains a reliable and accessible tool for disseminating time-sensitive information without dependency on internet connectivity.

Peji [2022] introduced Me-Connect, a web-based SMS alert system for MAPECON Cavite Highlands, developed to address inefficiencies in service scheduling and

communication with technicians and customers. The system allowed administrative staff to assign daily service tasks, notify technicians of their assignments, and confirm schedules in real time. One of its standout features was its ability to automate reminders and transaction logs, thereby reducing service delays and human error. The system's architecture included PHP for backend processing and MySQL for robust data management, ensuring secure and organized storage of customer and technician information. Evaluated through ISO/IEC 9126 standards, the system received an overall satisfaction score of 4.53, reflecting high reliability, usability, and efficiency [26]. This study underscores the relevance of SMS notification systems in structured event coordination, particularly in local service networks that demand fast, offline-capable communication mechanisms.

Similarly, Garibaldi et al. [2022] developed a mobile health emergency notification system, designed to assist elderly care monitoring through real-time alerts. Although the context differs, the technical design incorporated SMS to ensure continuity of communication during connectivity outages, a challenge shared by many decentralized or community-based platforms. The system utilized data redundancy techniques, allowing local data storage when the internet was unavailable and automatic synchronization once reconnected. This fail-safe mechanism guaranteed that emergency alerts would still reach recipients promptly, which is crucial in any environment where immediate response is necessary. Such architecture can inform the development of resilient SMS modules in broader event notification systems, particularly in community governance and public services [9].

Capuno et al. [2021] explored the deployment of iReserve, an online event reservation platform for Lipa City Cultural Center, integrated with an SMS notification feature. The system resolved inefficiencies in manual booking by automating confirmation texts, reminders, and cancellation notices. This ensured that users received up-to-date information about their reservations without needing to frequently check online platforms. The study emphasized that the real-time SMS functionality helped eliminate double-bookings and improved stakeholder coordination. Users praised the system's accessibility and convenience, particularly in contexts where mobile phones are the primary means of receiving updates. These findings demonstrate that SMS not only supports operational clarity but also enhances user satisfaction by reinforcing accountability and reducing uncertainty in event planning [11].

Moreover, Reyes et al. [2022] presented another relevant example through a web-based event management system developed for a nonprofit organization. Their system utilized a GSM modem to send SMS notifications, overcoming limitations posed by unreliable internet access. It featured an admin dashboard for event creation, user management, and announcement broadcasting. The integration of SMS alerts ensured that all registered users were promptly informed of upcoming events, meetings, and organizational updates. Importantly, the system provided a practical, low-cost solution to information dissemination in remote areas, highlighting its adaptability for various organizational settings. The study confirmed that systems utilizing SMS as a core communication channel are more inclusive and reduce the digital divide, an important consideration in public-sector applications involving youth engagement [32].

In conclusion, these studies affirm the utility of SMS-based notification systems in enhancing real-time communication, ensuring timely updates, and improving service delivery across diverse domains. Whether used in public health, city services, pest control, or nonprofit management, SMS technology provides a dependable channel for immediate outreach. In community governance platforms, particularly those aimed at youth participation and local activity coordination, these systems can significantly strengthen transparency, reduce administrative burden, and foster more consistent involvement among members.

2.1.5 Automated Attendance Monitoring Using RFID Technology

The integration of Radio Frequency Identification (RFID) technology in attendance and data management systems has been widely explored in various fields, including education and workplace monitoring. RFID-based systems streamline record-keeping, enhance security, and improve efficiency by automating traditional manual processes.

The study by Siddiqui et al. [2024] highlights the importance of real-time attendance tracking using RFID and cloud-based data storage. The system ensures efficient monitoring by automating attendance recording, reducing human intervention, and providing seamless access to records [31]. This study is relevant to the proposed profiling system for Katipunan ng Kabataan (KK) and Sangguniang Kabataan (SK) as it demonstrates the effectiveness of RFID in improving attendance tracking and data retrieval. Similarly, P. Kovelan et al. [2020] conducted a study which focused on IoT-enabled RFID-based attendance tracking system designed to minimize manual errors. The study highlights the integration of microcontrollers and GSM or Wi-Fi communication

modules to ensure seamless data transmission and storage, even during connectivity failures [19]. A key feature of this system is its redundancy mechanism, which allows data to be temporarily stored on a microSD card and uploaded in bulk once the communication channel is restored. This aligns with the objective of the proposed KK and SK profiling system, ensuring continuous and accurate data management despite network disruptions. The implementation of such a fail-safe mechanism enhances the reliability and efficiency of automated attendance tracking, reducing the workload for educators and administrators while improving institutional record-keeping processes.

Moreover, Qaiser et al. [2020] elaborates the various applications of RFID for attendance monitoring in universities. It automates student identification, tracks unauthorized entries, and integrates email and SMS notifications [24]. The capability of RFID to automate multiple administrative tasks provides valuable insights for the proposed system, which aims to improve youth profiling and participation monitoring. Furthermore, previous studies by B.M Sri Madhu et al. [2021] further supports the effectiveness of RFID in attendance management. By integrating IoT with RFID, the system reduces manual effort and improves accessibility through mobile applications [32]. This study reinforces the need for a web and mobile-based platform in the proposed KK and SK profiling system to facilitate remote access and management. Additionally, the study of Ahmed et al. [2024] highlights RFID's role in workplace efficiency, security, and attendance tracking [2]. The study emphasizes the benefits of cloud-based solutions, which are integral to the proposed system's goal of enhancing transparency and accountability in youth governance.

Likewise, Valdez et al. [2024] highlights the advantages of real-time attendance

updates and seamless database integration, reinforcing the effectiveness of RFID technology in monitoring student attendance [35]. The results of the study demonstrates that their system efficiently detects and records attendance with an average response time of 1.159 seconds, ensuring minimal latency in updating attendance records. The findings of this study align with previous study on RFID-based attendance tracking, particularly in enhancing efficiency and accuracy in institutional settings. This has also been explored in prior studies by Sruthy R et al. [2023] which discusses the security and efficiency aspects of RFID attendance systems. The study suggests that automated attendance systems improve academic and administrative decision-making by providing structured attendance reports [33]. This aligns with the objective of the proposed KK and SK profiling system to enhance efficiency in youth governance.

Therefore, the integration of RFID technology in attendance monitoring has proven to be an effective solution in various institutional settings, providing enhanced efficiency, security, and accuracy in record-keeping. The findings from previous studies demonstrate the reliability of RFID-based systems, particularly when combined with cloud-based solutions, IoT integration, and redundancy mechanisms. Given these advantages, the proposed Profiling System for Katipunan ng Kabataan and Sangguniang Kabataan in Iriga City with Radio Frequency Identification (RFID) will leverage RFID technology to streamline attendance tracking and data management, ensuring real-time monitoring, accessibility, and transparency. This enables timely reporting to support decisions in youth program planning. By implementing this automated approach, the system aims to reduce administrative workload, minimize errors, and improve governance efficiency. Also, the

integration of web and mobile technologies will enhance user accessibility, enabling administrators and youth members to conveniently access and manage attendance records through a secure and responsive platform.

2.1.6 Evaluation of System using Black Box Testing

A critical aspect of system development is black box testing, ensuring the functionality, reliability, and security of the software without examining its internal code structure. Black box testing in RFID-based applications has steadily increased over the years.

Hasanah et al. [2021] mentioned that black box testing is crucial in markerless augmented reality (AR) construction engineering, where extreme programming techniques ensure system reliability [17]. The study used Black-Box techniques for Functional Usability testing, highlighting how important RFID and IoT-based technologies require of accurate functional testing to ensure real-world applicability. Additionally, black box testing allows developers to evaluate user interactions and system responses more effectively, ensuring a seamless experience. Similarly, Rahim et al. [2021] examined how black box testing plays a role in automotive IoT applications. The study identified how RFID-enabled black box systems can enhance vehicle tracking and safety [26]. The researchers concluded that black box testing is essential for ensuring the functional correctness of IoT-based real-time tracking applications, which creates a standard for smart governance and security. However, Albahli & Andrews [2021] argued that Model-Based Testing (MBT) is a more effective black box testing methodology compared to traditional equivalence partitioning. Their study on smart home systems using RFID and mobile

applications suggests that event-driven finite state machine (EFSM) and controlled event-driven finite state machine (CEFSM) testing improves the detection of state-based errors better than black box testing alone[3].

Majid et al. [2022] examined the growth of web applications integrated with RFID led to an exploration of how black box testing methods can be enhanced with explainable artificial intelligence (XAI)[23]. The study highlighted that traditional black box testing fails to identify security vulnerabilities in web-based RFID tracking applications. It suggested incorporating machine learning-based white-box testing to improve coverage and reduce security loopholes. On the contrary, Rasool et al. [2022] emphasized that black box testing is sufficient for most web applications, particularly in Internet of Medical Things (IoMT) applications. Their research demonstrated that automated black box testing procedures reduce human error, ensuring faster system acceptance in RFID-based health monitoring systems. However, they acknowledged that black box testing alone cannot detect logic errors [28].

In addition to previous studies, Song et al. [2022] introduced an automated black box testing approach using high-level abstraction, addressing manual labor inefficiencies in functional system testing. Their research demonstrated an automated process that mitigates testing and reviewing issues through a compiler-like automation method, which generates independent test cases and formalized specifications. This process significantly reduces manual effort, improves accuracy, and enhances software reliability in industries like railway signaling and transit systems. Furthermore, it overcomes the common limitations of traditional black box testing, such as repetitive manual work, long test

execution times, and specification-related errors, by leveraging an automated testing simulation tool [12].

Furthermore, Anh et al. [2024] conducted a collaborative IoT school bus monitoring system study, integrating RFID tracking and mobile application development. The study compared black box testing with white box testing and found that black box testing is more efficient in testing real-time location tracking. However, they noted black box testing's inability to detect backend algorithmic failures, arguing for a hybrid testing approach [7]. On the other hand, Yalli et al. [2024] examined the role of black box testing in IoT-based authentication systems [36]. Thus, their study found that RFID-based security models require more dynamic testing techniques beyond traditional black box testing. While black box testing ensures functional correctness, it fails to uncover security loopholes that may arise due to poor encryption protocols.

Likewise, Susila et al. [2025] investigated the integration of customer data management into a web-based fishing profile application, addressing challenges in customer registration, visit history tracking, and service preference management. The researchers applied black box testing to verify system functionality, ensuring that all features of the fishing profile system operated correctly. Their findings confirmed that black box testing effectively validated the integration of customer data, enhancing operational efficiency and user experience [34]. The study emphasized the importance of functional testing in profiling systems, particularly those requiring secure and accurate data processing, which directly relates to the objectives of the current study. By ensuring that all system components function properly, black box testing plays a vital role in maintaining

data integrity and usability in profiling applications.

Lastly, Rahman et al. [2025] suggested that blockchain integration in RFID applications would require new testing methodologies. Their work proposed a Blockchain-Based IoT testing framework that integrates black box testing with smart contract verification. The study contradicts previous works by suggesting that black box testing alone is inadequate in blockchain-based mobile and web applications [27]. As a result, researchers and developers are actively seeking innovative testing strategies to address emerging security and performance challenges in modern digital systems. Black box testing remains a vital approach in evaluating RFID-based and IoT applications, ensuring functional correctness and system reliability. However, as highlighted by various studies, its limitations in detecting security vulnerabilities, logic errors, and backend failures necessitate hybrid approaches that integrate Model-Based Testing (MBT), AI-driven automation, and blockchain verification. As technology advances, the future of system testing will rely on automated and security-focused methodologies to address the growing complexity of modern applications, ensuring that RFID-based profiling systems, particularly in government and youth governance, maintain accuracy, security, and compliance with evolving data protection standards. A combination of black-box, white-box, and AI-enhanced techniques will be essential in creating more robust, secure, and efficient testing frameworks for government, healthcare, transportation, and smart technology systems.

2.2 Synthesis of the State-of-the-Art

After reviewing the related literature and existing systems, the significance of the

Youth Governance System, web and mobile-based systems for youth governance, RFID technology for attendance monitoring, and secure data management in government operations is evident. The implementation of the Youth Governance System has been widely used in governance, community management, and public service administration.

According to the studies conducted by Lim [2022] and Alinea et al. [2022], the role of web and mobile-based systems is important in modernizing barangay governance through centralized data management and improved accessibility. While Lim's Barangay Integrated Management System (BIMS) focused on general administration, this study tailors its approach to youth governance by integrating RFID for automated record-keeping, participation tracking, and real-time monitoring. Similarly, Sanchez [2021] and Calderon et al. [2020] highlighted the benefits of web-based profiling in enhancing data accuracy and accessibility. Based on these findings, this study introduces an RFID-enabled system designed specifically for SK governance, resolving challenges in manual record-keeping with automated attendance tracking, secure digital records, and structured reporting for data-driven decision-making. Additionally, Alinea et al. [2022] and Sanchez [2021] identified challenges in government web-mobile systems, such as data synchronization and cross-platform accessibility. However, in this study it integrates RFID and cloud-based storage, ensuring seamless real-time data synchronization across platforms. Unlike of the existing barangay profiling systems, it enhances transparency, efficiency, and accessibility, enabling SK officials to manage youth programs effectively while bridging the limitations of current digital and manual methods.

Moreover, Lacasandile et al. [2020] and Quindatan [2020] emphasized that

automated profiling benefits local government units (LGUs) by improving data accuracy, accessibility, and efficiency. Similarly, Evangelista et al. [2023] demonstrated how youth government system streamline public service delivery through data integration, ensuring efficient record-keeping and decision-making. These studies support the current research's aim which is to develop a structured Youth Governance System for Iriga City, facilitating better data retrieval and monitoring of youth participation.

In addition, The Philippine Data Privacy Act of 2012 mandates data protection compliance for government systems, as examined by Cheng [2023] and Pesito et al. [2020], making it essential for the Youth Governance System to ensure secure and ethical data handling. Ahmad et al. [2022] and Chorley [2021] emphasized the risks of real-time data collection, highlighting the need for encryption and access controls, which are integrated into the RFID-based system. Farid et al. [2023] and Alharbi et al. [2021] underscored the role of government agencies in enforcing security policies, while Alketbi et al. [2021] explored blockchain for securing transactions. Nevertheless, Luthra et al. [2023] noted challenges such as high costs and infrastructure complexity. This study adopts a secure centralized database with encryption and multi-layer authentication, ensuring data protection while remaining cost-effective.

Furthermore, recent studies have emphasized the role of SMS-enabled event management systems in improving organizational efficiency, user coordination, and real-time communication. Peji [2022], in the development of the Me-Connect system, demonstrated how SMS alerts can automate service notifications, streamline technician scheduling, and reduce manual intervention. The system was evaluated using ISO/IEC

9126 standards and received high ratings for functionality, efficiency, and reliability, reinforcing the effectiveness of SMS in enhancing service delivery and communication accuracy. Similarly, Capuno et al. [2021] developed iReserve, a web-based reservation platform with SMS features that eliminated double-bookings and improved user satisfaction through timely notifications. Reyes et al. [2022] also validated the use of SMS in web-based event management systems for nonprofit organizations, particularly in low-connectivity areas, affirming SMS as a cost-effective and inclusive tool for information dissemination. These findings support the integration of SMS notification in the proposed system to ensure effective and timely communication of SK events and activities, reducing information delays and fostering better youth engagement.

Lastly, several studies have explored the effectiveness of RFID technology in attendance monitoring and security. Relevant studies, including Siddiqui et al. [2024] and Qaiser et al. [2020] highlighted the effectiveness of RFID in automating attendance tracking, minimizing manual errors, and integrating cloud storage for real-time data management. These studies align with the current study's objective, to enhance the attendance tracking during SK programs and activities through RFID integration. Furthermore, the study by Ahmed et al. [2024] demonstrated RFID's role in ensuring workplace efficiency and security, reinforcing its application in youth governance for reliable attendance monitoring and access control.

By analyzing the findings from the previous studies, the present undertaking integrates key technological advancements and best practices in profiling, attendance tracking, and data security, ensuring the development of a reliable, secure, and efficient

profiling system designed based on the needs of Katipunan ng Kabataan and Sangguniang Kabataan in Iriga City.

2.3 Gap Bridged by the Study

The researchers will develop the study by considering the current state of the art, the related literature, and the systems in the conduct of this study. While similar studies have been conducted, the focus and scope of this research differ from previous studies. Despite the advancements in governance, profiling systems, attendance monitoring, and data management, existing studies lack a comprehensive solution developed for youth governance, specifically for the Sangguniang Kabataan and Katipunan ng Kabataan. Previous studies primarily focused on barangay-level systems without integrating attendance tracking and mobile accessibility. The present study will resolve these challenges by developing a web-based youth governance system, ensuring efficient member registration, event management, attendance monitoring, and secure data management for city-level Sangguniang Kabataan.

In previous studies, web-based systems have enhanced governance by improving efficiency, accessibility, and transparency in data management. However, studies by Lim [2022] and Alinea et al. [2022] identified limitations in barangay profiling systems, which focus on general resident records but lack specialized features for youth governance. While these systems streamline operations, they do not support youth participation tracking, event management, or automated attendance monitoring for the Sangguniang Kabataan and Katipunan ng Kabataan. Similarly, Sanchez [2021] and Calderon et al. [2020] highlighted inefficiencies in manual SK record-keeping, leading to delays and inconsistencies.

Although some barangays use digital profiling, most lack real-time accessibility, RFID-based attendance monitoring, and centralized data management for SK and KK. Alinea et al. [2022] and Sanchez [2021] also noted challenges in mobile governance, including data synchronization, system compatibility, and security concerns. While Calderon et al. [2020] and Lim [2022] explored web platforms for public services, they did not address youth-specific governance needs like digital attendance logging and participation analytics.

While the previous study, conducted by Evangelista et al. [2023] explored profiling systems for government use, these systems did not focus on tracking youth participation in governance activities. As a result, the proposed system will resolve these challenges by providing real-time attendance monitoring for SK programs and activities, improving transparency and accountability in youth governance. Moreover, existing RFID-based attendance systems, as discussed by Siddiqui et al. [2024] and Qaiser et al. [2020], primarily focused on academic and workplace settings. Thus, the current study extends RFID applications to the youth sector, ensuring accurate monitoring of youth engagement in governance.

At the same time, security remains a crucial aspect of data management in government systems. Cheng [2023] and Pitogo [2021] identified compliance challenges with the Philippine Data Privacy Act (RA 10173), including policy misalignment and insufficient cybersecurity training. Similarly, Ahmad et al. [2022] and Chorley [2021] highlighted vulnerabilities in real-time data collection and access control, leading to unauthorized access, data breaches, and manipulation of government records. Additionally, Farid et al. [2023] and Alharbi et al. [2021] emphasized the need for multi-layered security

policies in e-government systems. Meanwhile, Luthra et al. [2023] noted that high implementation costs and technical complexities hinder the adoption of advanced security solutions like blockchain in government data management. Hence, this study incorporates encryption, multi-factor authentication, and role-based access control to resolve these challenges to protect KK and SK member data. RFID-based attendance tracking ensures accuracy, while automated audit logs and secure cloud storage strengthen compliance with National Privacy Commission (NPC) regulations. Through these measures, the KK and SK Profiling System strengthens data security, prevents unauthorized access, and promotes transparency in youth governance.

Furthermore, recent studies on SMS-enabled event management systems reveal a gap in integrating communication tools in youth governance platforms. Peji [2022], Capuno et al. [2021], and Reyes et al. [2022] demonstrated the efficiency of SMS notification systems in improving service coordination, event scheduling, and user responsiveness, particularly in offline or low-connectivity areas. However, these systems were not specifically designed for youth government programs and did not combine SMS functionality with RFID-enabled attendance tracking. Thus, this study bridges the gap by integrating SMS notifications into an RFID-based youth governance system, offering real-time alerts for SK events, attendance prompts, and activity reminders to promote youth engagement and ensure timely communication. By merging participation tracking and automated messaging, the proposed system provides a holistic solution tailored to the operational demands of Sangguniang Kabataan.

Therefore, to address these issues, this study proposes the development of K-

NECT: A Youth Governance System for Iriga City, integrating key features such as RFID-based attendance monitoring to automate logging for SK meetings and events, real-time data accessibility through a cloud-based architecture, and centralized and secure data management to ensure data integrity across barangays. The system will also utilize a web platform for better accessibility, event scheduling with SMS notification for real-time updates, analytics to generate reports on attendance and engagement trends, seamless data synchronization for consistency across devices, and enhanced system security utilizing encryption, authentication protocols, and role-based access controls.

To address these limitations, this study introduces an innovative and secure digital solution tailored specifically for youth governance. By integrating RFID technology, web accessibility, SMS notifications, analytics, and robust data security measures, the proposed youth governance system ensures efficient record-keeping, real-time attendance monitoring, and enhanced data management for the Sangguniang Kabataan. Beyond improving administrative efficiency, the system strengthens transparency and accountability, empowering SK officials with accurate data for decision-making while safeguarding member information in compliance with privacy regulations. Lastly, this study contributes to modernizing youth governance, fostering greater participation, and setting a foundation for future technological advancements in SK operations.

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CHAPTER 3
TECHNICAL BACKGROUND

This chapter outlines the technologies, resources, and development environment used in the system. It covers hardware and software specifications, system architecture, and security measures. It also presents the testing plan, including strategies, methodologies, and tools for evaluating system performance.

3.1 Overview of Current Technologies to be Used in the System

The proposed system, K-NECT: A Youth Governance System for Iriga City, incorporates a set of modern technologies designed to enhance operational efficiency, security, scalability, and real-time data management. The integration of these technologies is aligned with the system's core objective of streamlining the processes involved in profiling, monitoring, and engaging youth members of the Katipunan ng Kabataan and Sangguniang Kabataan across the 36 barangays of Iriga City.

A key component of the system is Radio Frequency Identification (RFID) technology, which enables fast, contactless identification and attendance logging of members during youth programs and activities. RFID readers and tags are utilized to automate the capture of attendance data, reducing manual input errors and preventing fraudulent entries such as proxy sign-ins. This approach ensures accurate participation records and improves administrative efficiency. The system is further equipped with offline RFID capture functionality, which allows attendance data to be stored locally and synchronized to the cloud once internet connectivity is restored, ensuring data integrity in real-time and non-real-time scenarios.

The system also employs a Relational Database Management System (RDBMS) to

securely store and manage structured data. The use of a relational database ensures data consistency, referential integrity, and optimized querying capabilities for managing member profiles, attendance logs, events, and system-generated reports. This architecture supports efficient data retrieval, updates, and storage while enabling comprehensive analytics for administrative use.

Web-based technologies serve as the foundation for the system's user interface, allowing stakeholders to access functionalities via standard web browsers. The system utilizes responsive design principles to ensure cross-device compatibility, making it accessible on desktops, laptops, and mobile devices. Server-side scripting languages and web frameworks are used to implement dynamic content rendering, form validation, data processing, and real-time interactions, contributing to an intuitive and user-friendly experience for all system users.

To support scalability, availability, and data resiliency, the system leverages cloud-based infrastructure. Cloud storage is utilized for the secure hosting of system data and uploaded documents, enabling real-time synchronization across all user levels: KK members, SK officials, and the Panlungsod na Pederasyon ng mga Sangguniang Kabataan of Iriga City. This setup reduces the risk of data loss and ensures the system remains accessible across different devices, enhancing operational flexibility and continuity.

The system integrates SMS notification capabilities to deliver real-time updates and reminders about upcoming events, announcements, and other official communications. This functionality addresses the need for timely information dissemination, especially in communities with limited internet access. SMS integration ensures inclusivity and

enhances member engagement through a reliable, low-bandwidth communication channel.

To enforce proper access control and information security, the system adopts a Role-Based Access Control (RBAC) model. This security mechanism assigns permissions based on predefined roles: User (KK member), Admin (SK official), and Super Admin (Panlungsod na Pederasyon ng mga Sangguniang Kabataan officer), ensuring that each user accesses only the modules and data relevant to their role. This minimizes security risks and promotes data confidentiality.

Lastly, to strengthen system security and protect against unauthorized access, the system implements Two-Factor Authentication (2FA). This added layer of verification requires users to confirm their identity through a secondary authentication method (e.g., OTP via SMS), thereby safeguarding sensitive data and preventing unauthorized login attempts.

Collectively, the integration of RFID technology, web-based architecture, cloud storage, relational databases, SMS communication, RBAC, and 2FA supports the system's goals of improving transparency, accountability, and data-driven governance. These technologies ensure that the K-NECT system delivers a secure, scalable, and responsive platform for effective youth governance in Iriga City.

3.2 Resources

This section details the essential resources needed for the development and implementation of the K-NECT: A Youth Governance System for Iriga City. It provides a comprehensive overview of the required hardware, software, and other technical specifications to ensure the system's functionality, security, and scalability.

3.2.1 Hardware Specifications

The development of the K-NECT: A Youth Governance System for Iriga City requires a well-considered selection of hardware components to ensure efficient performance, system scalability, and uninterrupted operational efficiency. Given the nature of the system in handling sensitive youth data and facilitating real-time attendance monitoring, the choice of hardware significantly affects the system's overall stability, responsiveness, and processing capabilities. Selecting the appropriate hardware is vital, as it directly influences the system's reliability, responsiveness, and overall performance. Ensuring that the hardware specifications align with the system's requirements allows for an optimized user experience and streamlined profiling operations. The hardware components were selected based on their ability to support multitasking operations, ensure data integrity, and meet the demands of both the administrative and user-side components of the system.

Tables 1 and 2 present the list of hardware components required for both the development and deployment phases of the system. These components include essential computing resources such as processor, memory, storage, input, and output devices, which collectively enable the proper functioning and seamless performance of the system.

Table 1: Development Hardware Specifications

HARDWARE TOOL	SPECIFICATION
Processor	Intel Core i5 or higher
Memory	8GB RAM or higher
Storage	512GB Solid State Drive (SSD)
Input Device	Keyboard, Mouse, RFID Cards and Readers
Output Device	Monitor

Table 1 and 2 are just the same, if that was the case I suggest na 1 table nalang.

The development hardware tools listed in Table 1 are essential for building, testing, and optimizing the Youth Governance System. A high-performance processor and larger memory ensure the smooth operation of development tools, local servers, and integrated development environments (IDEs). Ample SSD storage supports fast data access and efficient handling of software assets and backups. Standard input/output devices facilitate coding, interface design, and debugging tasks.

Table 2: Deployment Hardware Specifications

HARDWARE TOOL	SPECIFICATION
Processor	Intel Core i5 or higher
Memory	8GB RAM or higher
Storage	512GB Solid State Drive (SSD)
Input Device	Keyboard, Mouse, RFID Cards and Readers
Output Device	Monitor

The deployment hardware listed in Table 2 is intended for the actual implementation of the system across the 36 barangays of Iriga City. A processor with at least an Intel Core i5 is recommended to ensure smooth system execution. To facilitate efficient data processing, a minimum of 8GB RAM is required, while a 512GB SSD provides sufficient storage for system files and records. Standard input devices such as a keyboard and mouse are essential for data entry, along with a monitor for a user-friendly interface. Additionally, an RFID reader is a crucial component for the system, as it enables seamless registration and verification of individuals using RFID technology. Selecting high-performance hardware ensures that the system can manage multiple user interactions efficiently without delays. The integration of an RFID reader enhances the automation of

the profiling process, improving accessibility and accuracy in record management. These hardware components are essential to achieving a seamless, scalable, and reliable youth Governance system. By investing in appropriately matched hardware resources, the system guarantees an optimal balance between performance, security, and usability, ensuring its successful deployment across all 36 barangays of Iriga City and supporting the long-term objectives of enhanced digital governance for youth organizations.

3.2.2 Software Specifications

Table 3: Development Software Specifications

SOFTWARE TOOL	SPECIFICATION
Operating Systems	Windows 10 or 11
Development Tools	Visual Studio Code, Visual Basic, Sublime
Database Management Systems (DBMS)	Firebase Realtime Database, MySQL, phpMyAdmin 8.1.0
Middleware Tools	XAMPP 8.1.xx, Node.js, Apache Tomcat
Testing Tools	HTML 5, CSS 3, Bootstrap v5.x

The development software tools listed in Table 3 are essential for building, testing, and optimizing the youth Governance system. A reliable operating system such as Windows 10 or 11 ensures compatibility with most development tools and provides a secure platform for programming and testing. Integrated Development Environments (IDEs) like Visual Studio Code, Visual Basic, and Sublime Text streamline the development process by offering efficient code writing, debugging, and project management features. Database management tools, including Firebase Realtime Database, MySQL, and phpMyAdmin 8.1.0, allow the development team to test data storage and retrieval functionalities in both online and offline environments. Middleware platforms such as XAMPP, Node.js, and Apache Tomcat are used to simulate server environments

locally, ensuring backend processes are functioning properly before the system is deployed. Testing is a critical component of the development phase. Tools such as Jest allow developers to write and automate unit tests to ensure each module behaves as expected. Selenium is used for automating user interaction simulations to validate usability, while OWASP ZAP helps identify security vulnerabilities such as XSS and SQL injection. These tools collectively ensure that the system is secure, functional, and ready for deployment.

Table 4: Deployment Software Specifications

SOFTWARE TOOL	SPECIFICATION
Operating Systems	Windows 10 or 11
Web Framework	CodeIgniter 4
Frontend Technologies	HTML5, CSS3, Bootstrap v5.x, Tailwind CSS v3.x
Authentication & APIs	Firebase Authentication, RESTful APIs
Supported Web Browsers	Google Chrome, Mozilla Firefox, Brave, Microsoft Edge

The deployment software tools listed in Table 4 are vital for running the system in a live environment. A stable operating system such as Windows 10 or 11 ensures the system operates reliably in Governance offices or barangay halls. The CodeIgniter 4 PHP framework handles backend processing, enabling structured application logic, database access, and secure API handling through its MVC (Model-View-Controller) architecture. For the frontend, HTML5 and CSS3 are the foundation of the web interface, while Bootstrap v5.x and Tailwind CSS v3.x are used to create responsive layouts and visually appealing user interfaces. These tools allow the system to function effectively across various devices, ensuring accessibility for both administrators and youth members. Firebase Authentication and RESTful APIs are used to manage secure logins and facilitate communication between system components. This integration ensures that only authorized

users can access sensitive information and perform system operations. The system also supports all major web browsers such as Google Chrome, Mozilla Firefox, Brave, and Microsoft Edge to ensure compatibility and a consistent user experience. The combination of these deployment tools guarantees that the K-NECT system runs smoothly, securely, and efficiently across all user levels and geographic locations. It supports real-time data updates, remote access, and reliable communication, ensuring the system remains functional and accessible throughout the 36 barangays of Iriga City.

3.2.3 Program Specifications

This section outlines the technical details and requirements for implementing the K-NECT: A Youth Governance System for Iriga City. It covers the system's operational flow, algorithms, data management, and user interactions. This section provides an in-depth look at how the system will be developed, including the frameworks and tools to be used, as well as any interfaces or protocols involved. It highlights the specific functionalities and logic that drive the system's performance and ensures that it meets the technical requirements. It also defines how each component contributes to the system's overall functionality.

Functional Requirements

Functional requirements define the core capabilities that the youth Governance system must perform in order to function efficiently. These include identity verification, data storage, and user role differentiation. Each function aims to improve the profiling process by ensuring accurate data handling and eliminating manual, error-prone procedures. The proposed system promotes structured community record-keeping and transparent youth

organization through its clear functional features.

Table 3 outlines the essential functional requirements for the proposed Youth Governance System, emphasizing its ability to securely manage and automate information related to members of the Sangguniang Kabataan (SK) and Katipunan ng Kabataan (KK) in Iriga City.

Table 5

Table 3: Functional Requirements

FUNCTIONAL REQUIREMENT	DESCRIPTION
RFID-based Identity Verification	Allows unique identification of each youth member through RFID tags, enhancing the accuracy of personal data and preventing duplication.
Automated Data Logging	Captures and stores member interactions automatically upon RFID scanning, reducing the need for manual input and potential errors.
Profiling Management	Allows registration, updating, and viewing of member profiles with role-based data access for security and accuracy.
Community Bulletin Posting	Enables admins to create, update, and publish community announcements, ordinances, and events to the bulletin board.
Event Scheduling and Notification	Allows creation and scheduling of SK/KK events, with automated SMS notifications for members.
Document Storage and Access	Provides secure upload and retrieval of official SK documents, including meeting minutes, certifications, and resolutions.
Role-Based System Access	Controls access permissions based on user roles (e.g., SK Chairperson, Secretary, Member), promoting secure and responsible system use.
Real-Time Data Synchronization	Ensures instant updating of member records and system logs across platforms for timely and reliable information access.
Notification System	Send SMS for upcoming events or profile updates to members and officials.
Analytics and Reporting	Generate summary reports on profiling, attendance, and event participation to support SK decision-making and transparency.

These functional components work together to create a reliable and efficient solution tailored for SK and KK governance. The RFID identity verification ensures individual recognition and prevents duplicate registrations. Automated data logging simplifies

attendance and interaction tracking. Through profiling management, accurate member data is securely maintained. The community bulletin improves information dissemination, while event scheduling ensures that all youth members are informed of relevant activities. Document storage guarantees easy access to official files, and role-based access ensures only authorized users can manage sensitive data. Real-time synchronization keeps the system up-to-date across all devices, while the notification system enhances communication and updates the user for incoming activities. Finally, analytics and reporting provide transparency and support in evaluating youth engagement, helping SK officials make informed decisions. By integrating these features, the system enhances the overall administration, accountability, and digital transformation of youth governance in Iriga City.

Non-Functional Requirements

Non-functional requirements define overall standards for system quality, performance, and usability. These specifications ensure that the Youth Governance System not only performs its primary functions but also provides a secure, responsive, and user-friendly experience for all stakeholders. The system must be scalable, able to handle increasing user traffic, and capable of supporting future enhancements. It should operate reliably and efficiently under various conditions, providing high availability and minimal downtime. Furthermore, it must ensure the integrity of stored information by incorporating robust security measures, such as data encryption and access controls.

Table 4 outlines the non-functional requirements of the proposed Youth Governance System, highlighting key performance standards and quality attributes

essential for reliable and efficient youth profile management. These requirements ensure that the system meets expectations for availability, security, responsiveness, and usability, supporting a seamless experience for all users and enabling long-term scalability and sustainability.

Table 4. Non-Functional Requirements

NON-FUNCTIONAL REQUIREMENT	DESCRIPTION
System Availability and Reliability	Guarantees continuous system availability for youth registration and information retrieval, minimizing service interruptions during official activities.
User-Friendly Interface	Ensures the interface is intuitive and accessible, allowing SK and KK members and barangay staff to easily navigate the system.
Data Security	Implements safeguards to protect member profiles and prevent unauthorized access to sensitive data.
System Responsiveness	Maintains optimal system speed, particularly during RFID scanning, data display, and record updating.
Data Accuracy and Backup	Supports real-time data consistency and includes automatic backup processes to prevent data loss or corruption.

System availability and reliability ensure that the profiling platform is available during official events such as registrations, meetings, and community programs. Also, a user-friendly interface is essential for engaging both computer literate youth and barangay officials while reducing the need for extensive training. Furthermore, safety protocols are implemented to protect confidential youth data, ensuring that only authorized personnel can modify or access member records. The system is also designed to be responsive, especially during real-time interactions such as RFID-based logins or record lookups, to improve overall user satisfaction. Finally, data accuracy and backup mechanisms help maintain reliable information storage by preventing loss from technical failures or human error. These non-functional requirements contribute to the system's goal of providing a trustworthy, secure, and efficient profiling solution for the SK and KK in Iriga City.

Addressing these quality standards ensures that the system is sustainable and scalable to meet long-term governance needs.

System Flowchart

The system flowchart illustrates the simplified processes of the K-NECT system, a digital tool designed to enhance youth governance in Iriga City. It includes important modules like profiling, community bulletin, event scheduling, attendance monitoring, document storage, and analytics to promote efficiency, transparency, and user-focused operations.
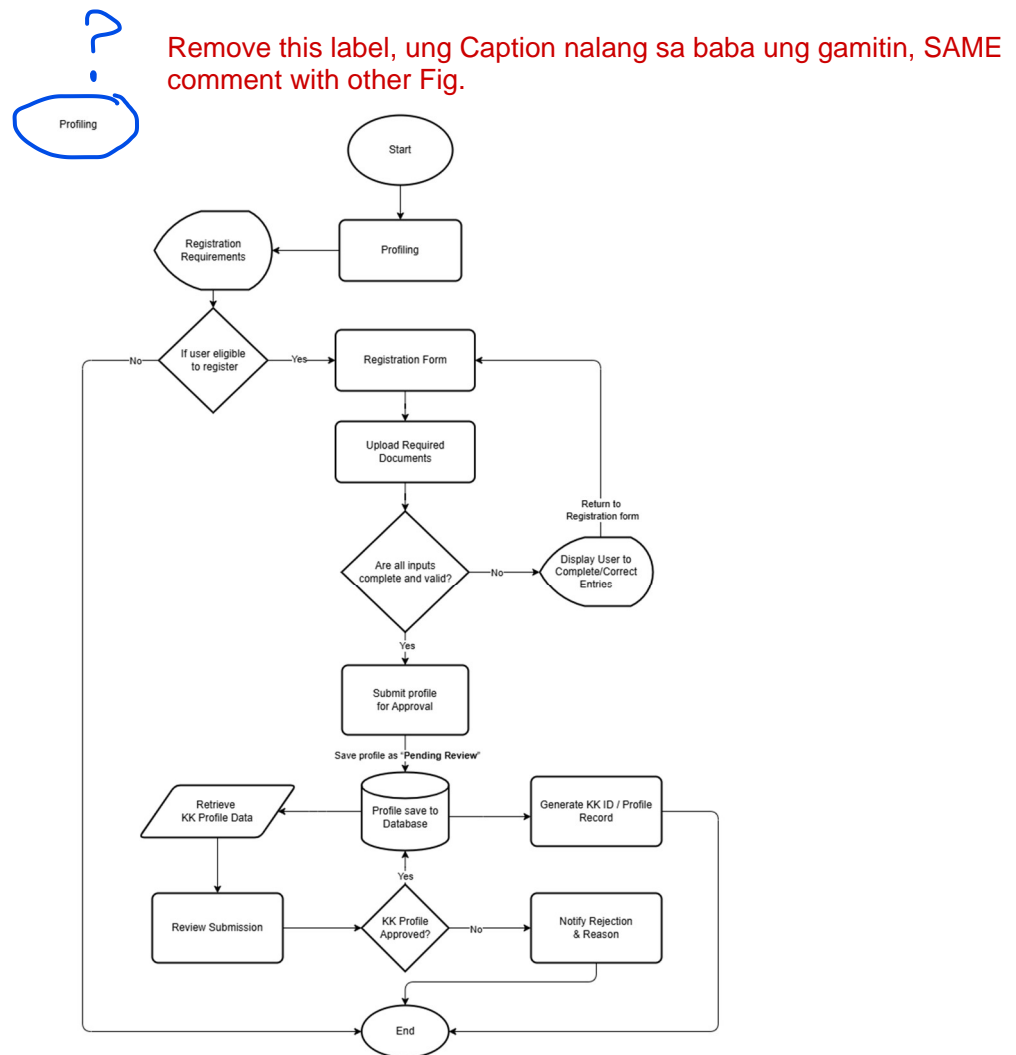
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Figure 1: Profiling Module Flowchart

This flowchart shows a clear and well-structured profiling and registration process for KK (Katipunan ng Kabataan) members. It starts with the user accessing the system through a profiling module, which serves as the starting point for youth registration. The first step verifies the registration requirements in order to determine user eligibility. If the user is not eligible, the process loops back, so that only qualified individuals can proceed. Once users are eligible, they are directed to complete a profiling form and then upload the required documents. The system subsequently validates whether all inputs are complete and correct. If there are errors or missing information, the user is prompted to review and correct their submission before they can continue. After all requirements are fulfilled, the system submits the user profile for approval and marks it as "Pending Review." This ensures that each registration is carefully checked and documented before proceeding to the next step. This information is then securely saved in the database, making it accessible to the admin or designated personnel. The review process helps maintain the integrity and accuracy of member records within the system. They retrieve the profile information for review, and if the submission is approved, the system generates an official KK ID as well as a profile record, indicating successful registration. However, if the profile is rejected, the system notifies the user of the decision along with the reason for rejection, so that the user can reattempt the process if necessary. Overall, this profiling flow is user-friendly and transparent, as it breaks down the registration into manageable stages while ensuring data accuracy and verification. It enhances member management through database integration, proper document handling, and automated notifications. Ultimately, it offers a secure and structured method to onboard and validate youth members within the KK system.
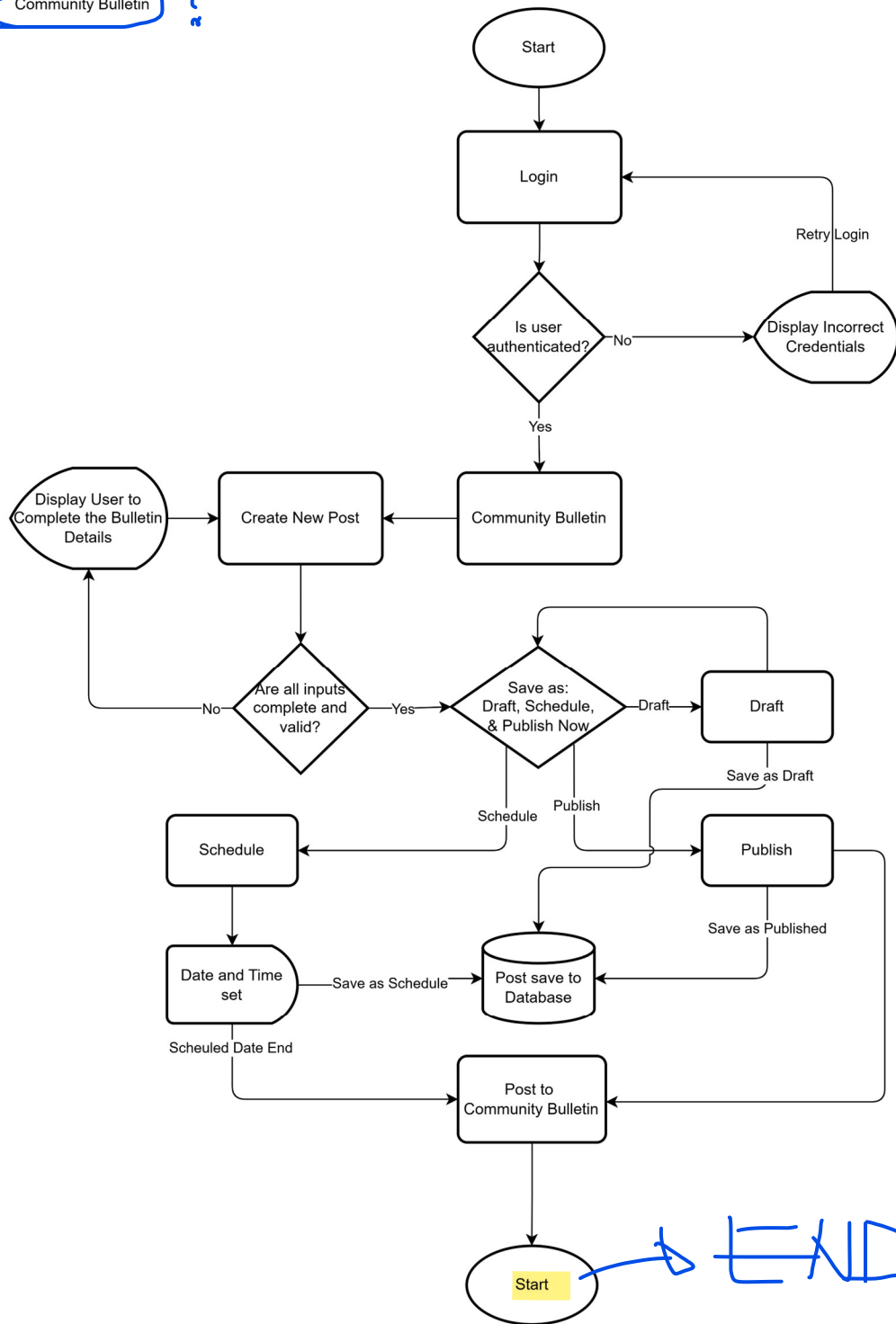
Figure 2: Community Bulletin Flowchart

This flowchart shows how the process, manage, and publish posts in the Community Bulletin of the KK and SK system. It starts with the user logging into the system, and if the admin enters the incorrect credentials, the system denies access, and prompting the user to try again, ensuring that only authenticated users can access the bulletin interface. Once logged in, users are redirected to the Community Bulletin dashboard, where they can create a new post. The system requires users to fill in the bulletin details, and if any necessary information is missing or incorrect, the user is prompted to revise the post before continuing. This step guarantees that only complete and correct entries are processed, helping to maintain the bulletin's integrity. After validation, users have three options for posting: save as a draft, schedule for later, or publish immediately. If saved as a draft, the post can be edited and finalized later. If scheduled, the user picks a date and time, and the post is stored in the database to be published automatically at that time. If the user chooses to publish, the system saves the content directly to the database and marks it as published. Each of these options allows the user to control when and how visible the post is based on its urgency or relevance. Scheduled posts are particularly useful for planning announcements ahead of time, like for events, programs, or deadlines. All finalized posts, whether scheduled or published, are stored in the system's database for record-keeping and then made visible to the community through the bulletin board. This ensures that important announcements are shared in a timely and organized way. By providing flexible publishing options and ensuring data accuracy, this bulletin system helps with efficient information sharing and boosts transparency and engagement in youth governance.
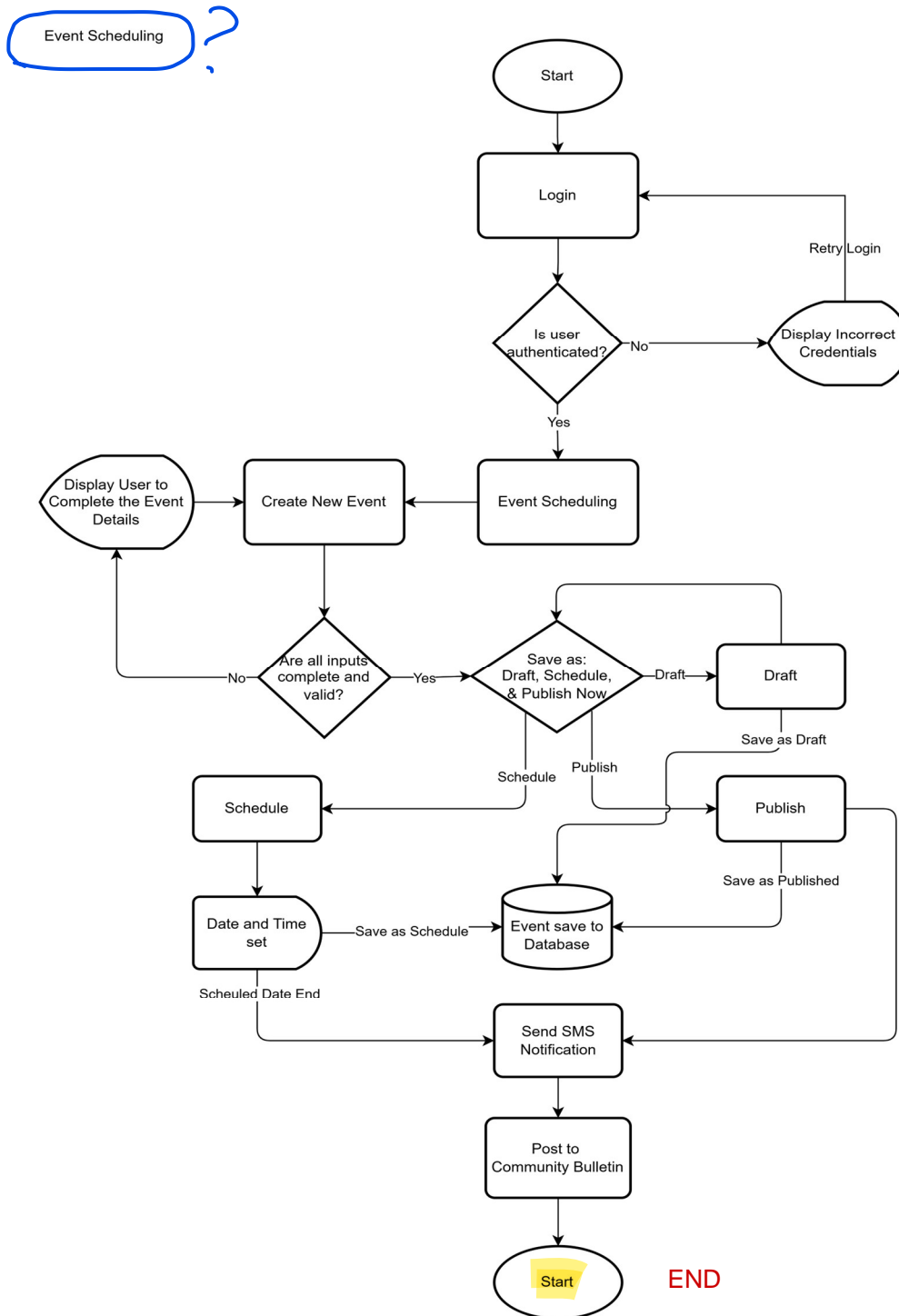
Figure 3: Event Scheduling Flowchart

This flowchart presents a simplified process for managing event scheduling within

the KK and SK system. It starts with a login step to verify user identity. If the user enters incorrect credentials, the system prompts to try again, make sure that only authorized users can proceed. Once authenticated, the user proceeds to the event scheduling interface. From there, the user begins creating a new event by filling in the necessary details. The system immediately checks if the input fields are properly completed and valid. If any required information is missing or inaccurate, the user is prompted to correct the form before continuing. This step helps reduce scheduling errors and ensures all necessary data is provided. After the information is validated, the user can choose to either save the event as a draft, schedule it for a future date, or publish it immediately. Drafts can be edited and reviewed later, while scheduled events require the user to set a specific date and time. Once finalized, the event details are saved in the database, keeping the information for official records. Each option, such as draft, schedule, or publish, is clearly labeled to guide users in managing their events effectively. This categorization also helps administrators monitor the status of events and prioritize tasks accordingly. After a successful save, the system sends SMS notifications to alert participants and stakeholders. This automated messaging feature reduces the need for manual follow-ups and ensures that important announcements reach the intended audience quickly. Finally, the event is posted to the community bulletin, making it visible to the public or target audience. By offering options to draft, schedule, and publish, this system provides flexibility in planning and ensures timely communication. The integration of SMS alerts and bulletin posting enhances community engagement and keeps everyone updated about upcoming events.
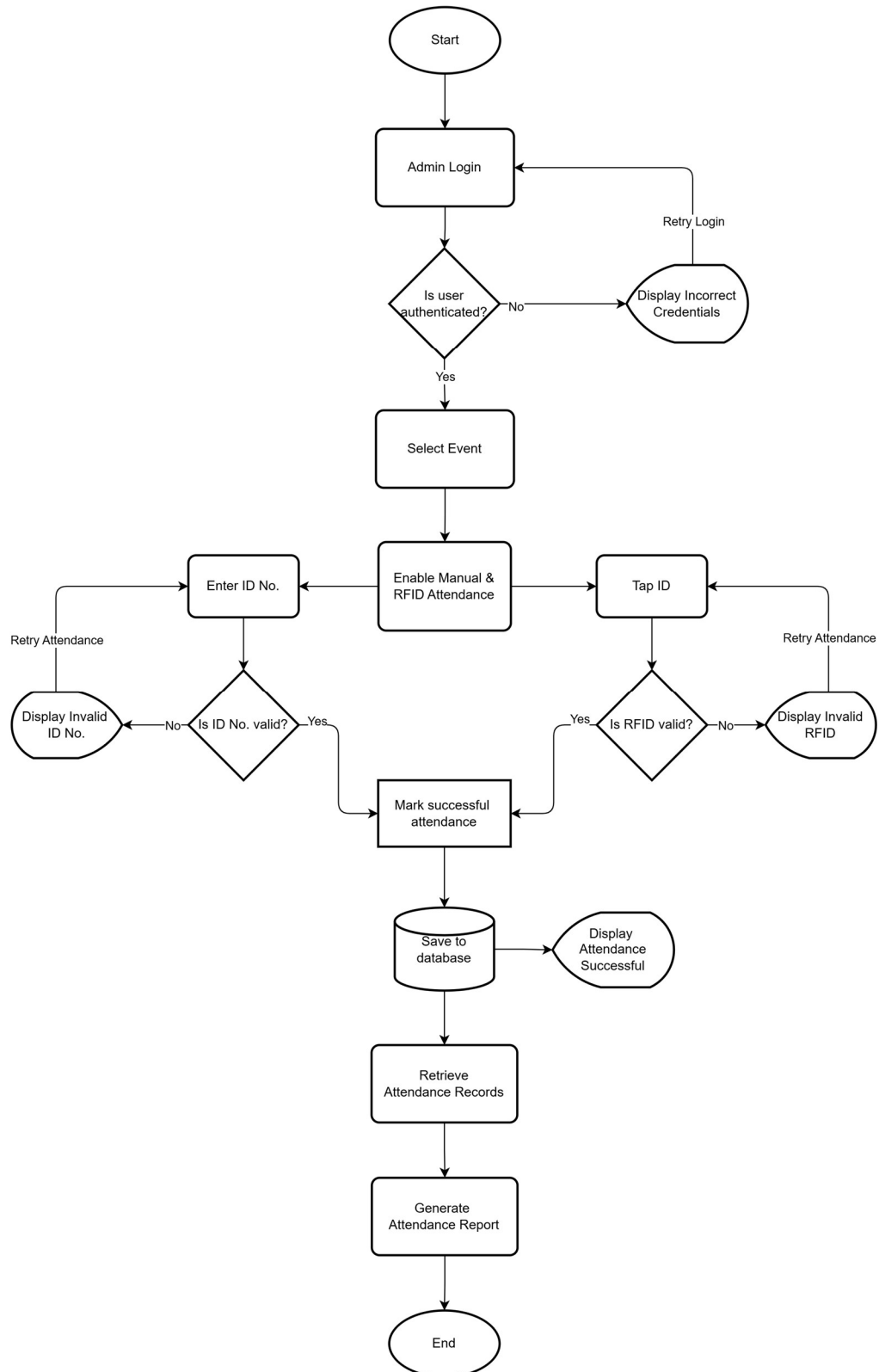
Figure 4: Attendance Monitoring Flowchart

The Attendance Monitoring Flowchart outlines the systematic process of tracking and recording participation of Katipunan ng Kabataan (KK) members during Sangguniang Kabataan (SK) programs and activities. The process begins with the initialization of the system, prompting the administrator to log in using valid credentials. Upon successful authentication, the administrator proceeds to select the scheduled event from the system interface, thereby activating the attendance module specific to that event. This module supports two input modes: manual ID number entry and RFID tag scanning. When a user inputs their ID number, the system verifies its validity; if the ID is invalid, an error message is displayed, prompting the user to re-enter the correct ID. Conversely, if the ID is valid, the attendance is marked as successful and stored in the centralized database. Similarly, for RFID-based attendance, the user scans their RFID-enabled ID card. The system then checks the RFID tag's validity and either displays an error message for invalid entries or confirms successful attendance for valid ones. In both methods, once the attendance is recorded, the system displays a confirmation message and securely stores the data. The administrator may later retrieve these records to generate attendance reports, which can be used for evaluation, documentation, and decision-making. This process ensures an accurate, efficient, and secure attendance monitoring mechanism that supports transparency and integrity in youth governance. Furthermore, it aligns with the objectives of the proposed K-NECT: A Youth Governance System for Iriga City, particularly its goal of automating attendance monitoring through RFID integration to improve data accuracy, minimize manual errors, and enhance administrative efficiency.
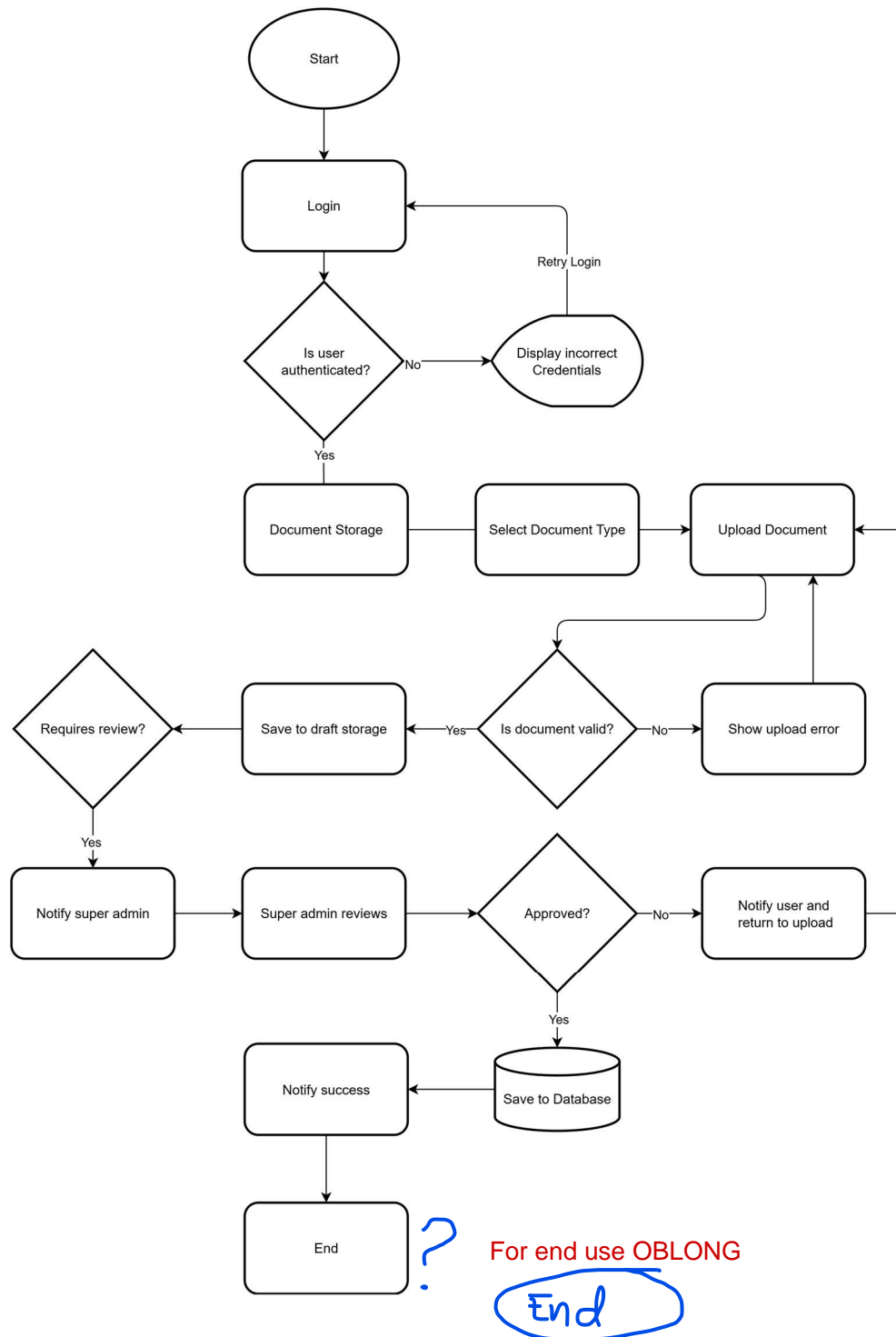
Figure 5: Document Storage Flowchart

This flowchart presents a secure and structured document storage process designed specifically for administrative users. It begins with the admin logging into the system, ensuring that only authorized personnel can proceed with uploading documents. Upon successful login, the admin selects the type of document to upload, allowing for proper classification and future retrieval. The selected document is then uploaded and subjected to a validation check to confirm compliance with required formats, completeness, and content standards. If any errors or discrepancies are detected, the system notifies the admin and prompts them to reupload the corrected document, ensuring data quality and integrity. Once validated, the document is temporarily saved in draft storage, and key metadata— such as upload date, document type, and uploader ID—is securely logged in the database for future reference and audit tracking. At this stage, the system determines if the uploaded document requires a review. If not, the file is immediately transferred to the final storage repository. However, if a review is needed, the system alerts the designated reviewer to assess the submission. Upon review, if the document meets all criteria, it is approved and moved to final storage. If rejected, the admin is notified along with the specific reason for disapproval and may reinitiate the upload cycle after corrections. This process ensures a clear, accountable, and user-centric method for handling official documents. It enhances operational transparency, promotes data compliance, and ensures all files are properly managed and accessible through integrated database logging and notification features.
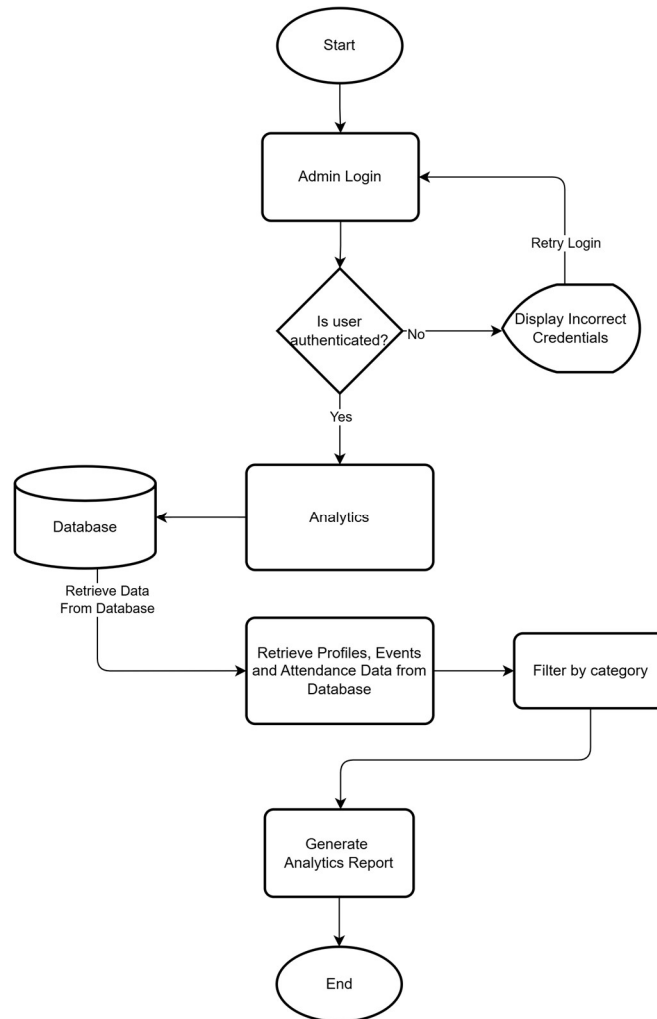
Figure 6: Analytics Flowchart

The Analytics Flowchart shows the step-by-step process of creating data reports to support informed decision-making in the proposed K-NECT: A Youth Governance System for Iriga City. The process begins when the system is started and the administrator logs in with valid credentials to ensure secure access. If the login fails, the system displays an error message for incorrect credentials and allows the administrator to try again until successful. After successful login, the administrator accesses the analytics module, which connects to

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the database to get the needed information, such as member profiles, events, and attendance records. The system then filters the collected data based on set categories or conditions to focus the analysis on relevant information. After filtering, the system generates an analytics report that includes details like participation trends, event attendance, and member involvement. These reports help SK Officials review program results, plan future activities, and keep the youth governance process open and accountable. This flowchart explains how data is securely retrieved, filtered, and processed into useful reports. It highlights how the system improves record-keeping, supports accurate reporting, and helps SK Officials make better decisions, which meets the goals of the K-NECT system to strengthen efficiency and transparency in youth governance.
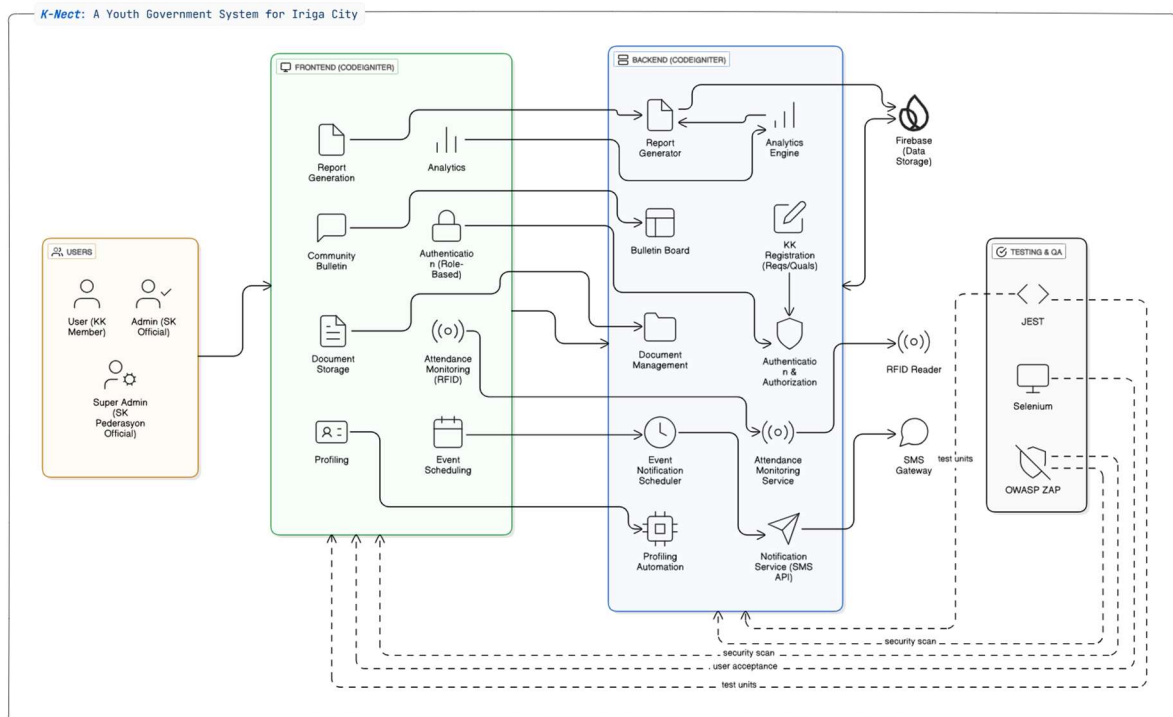

Figure 7: Architectural Diagram

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This architectural diagram illustrates the structure of K-NECT: A Youth Governance System for Iriga City, a comprehensive digital platform designed to enhance the governance and participation of the Sangguniang Kabataan (SK) and Katipunan ng Kabataan (KK). The system supports three user types: KK Members (KK), SK Officials, and SK Pederasyon Super Admin. These users access the platform through a role-based frontend built in CodeIgniter, which provides interfaces tailored to their responsibilities and access levels. The frontend includes Profiling, Document Storage, Community Bulletin, Event Scheduling, RFID-based Attendance Monitoring, Analytics, Report Generation, and secure Role-Based Authentication. Through these features, youth members can register, participate in events, and stay informed. At the same time, SK Officials and Super Admins can manage data, plan activities, monitor participation, and generate analytical reports to ensure transparency and efficiency. On the other hand, the backend, also powered by CodeIgniter, manages the system's core operations. It oversees user authentication and authorization, handles KK registration with integrated requirement and qualification checks, and manages the bulletin board for announcements. Furthermore, it supports event scheduling through an automated notification scheduler and processes real-time attendance via the RFID Monitoring Service. The backend also connects with a Notification Service that utilizes an SMS API to keep users informed, while Firebase serves as the central data storage, ensuring seamless synchronization across components. To maintain performance, security, and reliability, the system includes a dedicated Testing and Quality Assurance layer. Tools such as JEST and Selenium are used for unit and interface testing, whereas OWASP ZAP performs vulnerability scans. Altogether, this multi-layered

architecture enables real-time tracking, secure access control, and efficient communication. By automating administrative processes, ensuring accurate data handling, and delivering timely insights, K-NECT empowers SK and KK leaders to foster active youth engagement, support decision-making, and uphold accountability across the barangays of Iriga City.

3.2.3 Programming Environment

The programming environment comprises the essential tools, programming languages, development frameworks, and runtime environments used in building and maintaining the K-NECT: A Youth Governance System for Iriga City integration. These technologies ensure that the system is efficient, scalable, and user-friendly, offering both web-based administrative capabilities and for youth members. The system's environment is designed to support dynamic data interactions, real-time RFID tracking, and secure role-based access control. The front end focuses on intuitive design and cross-device compatibility, while the back end is structured to manage data securely, process attendance logs, and handle user authentication seamlessly.

Front End

The front end of the Youth Governance System is responsible for delivering a responsive, accessible, and interactive interface for users, including SK officials and KK members. It is designed using standard web technologies that ensure usability across devices and screen sizes. These technologies facilitate various functions such as member registration, event listing, attendance viewing, and profile management.

HTML5. HyperText Markup Language version 5 defines the structure and layout of the system's user interface. It organizes essential components such as forms for event

creation, tables for displaying attendance logs, and buttons for data submission. HTML ensures that content is properly structured, making it easier for users to navigate and interact with the system[9].

CSS3. Cascading Style Sheets version 3 manages the visual design and presentation of the user interface. It controls the color scheme, layout spacing, font styling, and overall aesthetics of the platform. CSS enhances the system's look and feel, contributing to an intuitive experience especially for non-technical users such as barangay youth leaders[10].

Tailwind CSS v3.x. Tailwind CSS v3.x is utilized as a front-end framework to build responsive layouts and customizable UI components. It simplifies interface development through a utility-first approach, allowing precise control over styling directly in HTML. With built-in responsive design and flexible configuration, Tailwind ensures the web interface adapts smoothly to both desktop and mobile devices[14].

Back End

The back end of the system manages core functions such as database operations, authentication, API communication, and RFID log handling. It is structured for web interactions while ensuring data integrity and security. The technologies used here form the backbone of system operations, enabling real-time updates and secure user management.

PHP. PHP is the primary server-side scripting language used to handle system logic, form submissions, and backend processing tasks. It communicates with databases to retrieve, store, and update member records and attendance logs[15].

CodeIgniter 4. This lightweight PHP framework is used to structure the application

using the Model-View-Controller (MVC) design pattern. It simplifies routing, enhances security, and improves scalability by organizing the backend logic into manageable components [4].

Firebase. Firebase is a cloud-based backend platform used for real-time database operations, authentication, and data storage. It allows seamless synchronization of data between users and devices, supporting functions such as storing member profiles, RFID attendance logs, and event information. Firebase's real-time capabilities and robust security rules make it ideal for scalable and responsive applications.

XAMPP. XAMPP serves as the local development and testing environment, combining Apache, MySQL, PHP, and phpMyAdmin. It enables developers to test system functionality offline before actual deployment, ensuring reliability and performance[1].

C++. The system uses C++ to interact with the RFID hardware components. It facilitates the reading and processing of RFID tags through built-in libraries and protocols such as SPI. This integration allows real-time attendance logging and seamless communication between RFID readers and the system's backend [5].

3.3 Testing Plan

This section outlines the testing strategies and methodologies used to evaluate the functionality, reliability, and security of the K-NECT: A Youth Governance System for Iriga City. The testing framework includes black box testing techniques to ensure that the system meets user expectations and functions efficiently under various conditions. The testing process is structured into three testing phases: Unit Testing, User Acceptance Testing (UAT), and Security Testing, each test aimed to verify system efficiency and

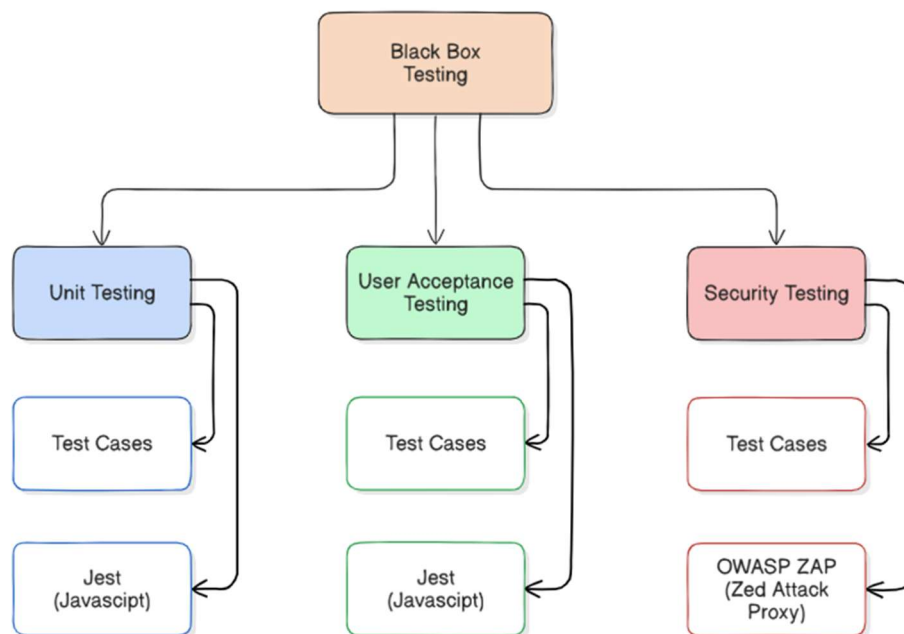stability. Figure 8 illustrates the testing plan implemented in this study.

Figure 8. <u>Testing Plan</u>

Figure 5 presents the Black Box Testing strategy that will be used for this study, which consists of three testing phases. First, Unit Testing focuses on verifying individual system components, such as modules for attendance tracking, profile management, and RFID integration. Test cases are designed to validate each module's functionality, while Jest, a JavaScript testing framework, is used to automate and execute these test cases so that each component functions correctly before integration. Subsequently, User Acceptance Testing (UAT) is conducted to ensure that the systems meet the needs of the end-users. In this phase, SK officials and KK members participate, utilizing predefined test cases and real-world scenarios to validate usability, access control, and data accuracy. Selenium is also used for automating the simulation of user interactions with the web interface, enhancing test coverage and reliability. Finally, Security Testing is implemented

to identify vulnerabilities, ensure secure access control, and protect sensitive data from potential threats. This involves evaluating the system's resistance against attacks such as SQL injection, cross-site scripting (XSS), and unauthorized access. Tools such as OWASP ZAP (Zed Attack Proxy) are employed to scan the application for known vulnerabilities and simulate common cyberattacks. Specific test cases are crafted to ensure data confidentiality, integrity, and system robustness against unauthorized access or malicious activities. Security Testing is vital in safeguarding user data and ensuring the system adheres to cybersecurity standards.

3.3.1 Types of Testing

Software testing uses methods like unit testing, user acceptance testing (UAT), and security testing to ensure system reliability, functionality, and performance. These tests help detect bugs, validate user requirements, and assess system behavior under pressure, ensuring accurate data handling, secure access, and smooth user experience.

Unit testing. Unit testing forms the foundational phase of the system validation process, focusing on verifying individual modules in isolation before integration. Key components such as user login, account management, RFID attendance tracking, and event generation undergo thorough examination to ensure proper functionality. The user login module authenticates only valid users and prevents unauthorized access, with test cases written in Jest to evaluate scenarios such as correct credential input, invalid login attempts, and session handling. The account management feature is tested to validate the successful creation, modification, and deletion of user profiles, covering both standard and edge case inputs. For the RFID attendance tracking module, Jest test cases simulate tag scanning

events to confirm accurate logging, duplication prevention, and database updates in real time. Similarly, event generation is verified by ensuring that input data leads to correct event creation and proper reflection in the database. These unit tests, executed using Jest's robust mocking and assertion functionalities, ensure that each module performs reliably in isolation, under both expected conditions and exception scenarios.

User Acceptance Testing (UAT). User Acceptance testing serves to validate the system's compliance with the functional requirements and usability expectations of its end users, particularly Sangguniang Kabataan (SK) officials and Katipunan ng Kabataan (KK) members. During this phase, stakeholders interact with the operational system to perform representative tasks such as user authentication, event generation, and RFID-based attendance scanning. These interactions assess whether system responses, including real-time data updates, logical navigation flow, and task execution efficiency, effectively support the intended workflows. Feedback is collected through direct observation, structured user interaction, and formal evaluation instruments to identify usability challenges, performance limitations, or areas needing refinement. The insights gathered during UAT guide iterative improvements, ensuring the system fulfills both technical specifications and user expectations. This phase confirms the system's readiness for deployment by validating its reliability, functionality, and alignment with end-user requirements.

Security Testing. Security testing ensures that the system is protected against potential cyber threats and unauthorized access. This phase focuses on identifying vulnerabilities in authentication, input handling, and data storage. By using tools like

OWASP ZAP, testers simulate real-world attack vectors such as SQL injection and cross-site scripting to evaluate the system's resilience. The goal is to safeguard sensitive information, verify proper session handling, enforce role-based access control, and prevent data breaches. Successful security testing affirms that the system maintains confidentiality, integrity, and availability under various threat scenarios.

3.3.2 Testing Tools and Framework

Testing tools and frameworks are essential for evaluating software functionality and performance. This will help to automate, manage, and execute test cases, ensuring accuracy, consistency, and efficiency throughout the development lifecycle. The following tools and frameworks will be used in testing the Youth Governance System:

Test Cases. Test Cases are structured scenarios outlining inputs, actions, and expected outcomes to validate functionality [13]. They ensure systematic coverage of requirements, such as verifying RFID scan accuracy or profile data storage. Test Cases are documented sets of conditions, variables, and expected outcomes used to determine if a software feature is working correctly[3]. By providing a systematic approach to validate each system component against predefined requirements. For this study entitled "K-NECT: A Youth Governance System for Iriga City", test cases will be designed to verify functions such as RFID scanning, user registration, and data storage operations.

Jest. Jest is an open-source JavaScript testing framework developed by Facebook, designed for both unit and integration testing in JavaScript applications, including React, Node.js, and Vue.js [7]. It offers a complete testing solution with minimal configuration, featuring built-in assertion libraries, mocking capabilities, and code coverage reports. For

the proposed study, the Youth Governance System, Jest will automate test case execution, validating both front-end functionality and back-end logic, particularly in attendance tracking and integration with RFID systems.

Within the diagram/Figure wala kaung Selenium, ang meron ay Jest, kindly double check po

Selenium. Selenium is a widely used open-source framework for automating web browser interactions, ideal for conducting User Acceptance Testing (UAT). Selenium supports various programming languages such as Java, Python, and JavaScript, and can simulate real user actions like clicks, form submissions, and navigation flows [12] For the Youth Governance System, Selenium will be used to replicate actual user behavior, ensuring that the system meets end-user requirements and performs as expected in real-world scenarios during UAT.

OWASP ZAP (Zed Attack Proxy). OWASP ZAP is an open-source web application security scanner developed by the Open Worldwide Application Security Project (OWASP). It is designed to detect common vulnerabilities such as SQL injection, cross-site scripting (XSS), and broken authentication mechanisms[10]. OWASP ZAP will be used in Security Testing to scan the Youth Governance System for security flaws and simulate real-world cyberattacks. This ensures that the application safeguards sensitive data, enforces proper access control, and remains resilient against potential threats. The tool's automated and manual testing features make it suitable for continuous vulnerability assessment throughout the development lifecycle.

Notes

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