Chapter 1

THE PROBLEM AND ITS SCOPE

Introduction

The air-conditioning industry plays an important role in today's world by providing comfort, supporting health, and boosting productivity in many different sectors (Siddiqui, 2022). Companies in this field are responsible for the production, repair, and maintenance of air-conditioning systems. As the industry continues to expand, having effective management systems has become relevant. These systems help establish clear policies, ensure compliance with standards, minimize risks, and promote continuous improvement. They also improve operational efficiency, reduce costs, and enhance customer satisfaction by encouraging better communication and coordination. Moreover, strong management systems help businesses stay competitive, engage employees more effectively, and adapt to changing market conditions—factors that are key to long-term success (Löfgren, 2023).

Management systems are vital for modern businesses, enabling efficient operations, automation, and data-driven decisions (Abubaker et al., 2024). This system integrates technologies such as RFID authentication to enhances attendance tracking, ensuring accuracy in payroll management, where precise time records are essential (Hossain et al., 2024). While businesses have traditionally used Microsoft Excel for record-keeping, manual data entry is prone to

errors (Sharma, 2024). A web-based system with RFID card authentication improves efficiency, reduces administrative workload, and provides insights into workforce management (Sindhu & Rani, 2021).

Despite the growing need for efficient management, 3Rs Air-conditioning Solution still relies on manual record-keeping, using pen and paper for data logging and calculators for payroll. This method is inefficient, time-consuming, and prone to errors, leading to payroll discrepancies and inaccurate financial reports (Lopez, 2023). Paper records also pose security risks, as they can be misplaced, damaged, or accessed by unauthorized individuals (Truesdale, 2023). As the company expands, manual data handling becomes unsustainable, limiting scalability and efficiency. The lack of automation hinders real-time access to information, slowing decision-making and reducing productivity. Additionally, attendance tracking remains inaccurate, increasing payroll disputes (Malak, 2025). Implementing a web-based system with plug and play RFID (Radio Frequency Identification) Card would enhance accuracy, efficiency, and overall business performance.

The SMART Air-Conditioning Service Transaction Management System replaces error-prone manual processes with automated Plug and Play RFID Card, ensuring accurate attendance records. It eliminates payroll discrepancies, prevents duplicate entries, and automates salary calculations based on real-time data. Enhanced security prevents fraudulent timekeeping and unauthorized access, improving efficiency, accuracy, and overall business performance.

Project Context

The project, “SMART Air-Conditioning Service Transaction Management System,” aims to enhance employee attendance tracking by improving accuracy and efficiency through Plug and Play RFID Card. It also streamlines salary computation by replacing traditional manual processes with an automated payroll system. Additionally, the system automates service request management, allowing customers to submit and track requests seamlessly. Furthermore, it integrates inventory management to monitor stock levels, track equipment usage, and prevent shortages, ensuring smooth business operations. The primary respondents and beneficiaries of this project include the employees, HR personnel, Administrative Manager, and Finance and Accounting Manager, who will experience reduced errors and improve workflow. The project started in February and expected to be finished by December. It will be conducted at 3Rs Air-Conditioning Solution in Can-asujan, Carcar, Cebu. The researchers propose this project to resolve inefficiencies, minimize payroll discrepancies, and strengthen security in attendance management. The project development process will follow a structured methodology, including system analysis, design, implementation, testing, and deployment, ensuring a functional and effective solution tailored to the company’s need.

Purpose and Description

The project entitled “Smart Air Conditioning Services Transaction

Management System" is intended to develop a new system design to automate manual operations, including attendance tracking using RFID card and payroll processing, enhancing efficiency, accuracy, and security.

This project aims to integrate Plug and Play RFID Card attendance and payroll management system for 3Rs Air-conditioning Solution for authentication to ensure reliable attendance record, reducing fraudulent timekeeping and payroll discrepancies. Additionally, the system automates service request management, allowing customers to submit and track service requests efficiently. It also incorporates inventory management to monitor stock levels, track equipment usage, and prevent shortages, optimizing operational workflow. By replacing traditional manual processes, this system significantly improves productivity and overall business management. Below are the benefits for various stakeholders:

Employees. This system will help employees by providing a transparent and reliable way to record their attendance, ensuring they receive accurate salaries based on their actual working hours.

HR Personnel and Finance and Accounting Manager. This system will help HR personnel and payroll administrators by automating attendance tracking and payroll computation, reducing errors, and improving efficiency on salary processing.

Management. This system will help the management gain better oversight of workforce attendance patterns, allowing them to make informed decisions regarding productivity, scheduling, and payroll budgeting.

Researchers. This project aims to advance the knowledge and abilities of the researchers in a way that will be beneficial to their academic studies.

Future Researchers. This project will help future researchers as a reference for further improvements in attendance and payroll systems. They can build upon the findings and recommendations to enhance system security, scalability, and integration with other HR and financial management tools.

Objectives

The study primarily aims to design and develop the "Air-Conditioning Enterprise Management System with Data Analytics" for the 3Rs Air-Conditioning Solution in Can-asujan, Carcar, Cebu. This system will automate key business operations, address inefficiencies in manual processes, and improve overall operational efficiency through integrated data-driven insights. Specifically, this capstone project aims to:

- Conduct a preliminary survey to gather relevant and necessary data for the project development, particularly on the actual setting of the 3Rs Airconditioning Solution.
- Analyze the gathered data to determine the desired functional requirements of the proposed system.
- Design and develop a comprehensive enterprise management system that automates key business processes, including attendance tracking, payroll processing, service scheduling, and inventory management. This ensures accuracy, efficiency, and security in daily operations.

- Integrate predictive and descriptive analytics into the system to support data-driven decision-making, such as forecasting peak service demand, identifying frequently requested services, and monitoring employee performance trends.
- Evaluate the system's performance using the International Organization for Standardization (ISO) 25010 software quality characteristics.
- Deploy the fully functional system to the target client.

Scope and Limitations

The Smart Air Conditioning Services Transaction Management System is designed as a web-based platform to automate key operational processes of 3Rs Air-Conditioning Solution. The system encompasses attendance monitoring, payroll processing, service scheduling, client-side booking services, and additionally an application side for the HR hiring applicants and for the applicants to apply, and inventory tracking, thereby enhancing the efficiency and accuracy of daily business operations.

The system incorporates Plug and Play RFID Card technology, the employees will have its unique card id number, to ensure secure and precise employee attendance tracking. Payroll processing is automated to account for work hours, overtime, deductions, and bonuses, reducing reliance on manual computations. Service scheduling and client-side booking are also integrated to facilitate more efficient management of customer appointments.

With respect to inventory tracking, the system does not monitor available stock in real time. Instead, it records the number of units and parts repaired, installed, and cleaned, thereby providing insights into business activity. Additionally, it tracks the revenue generated from these transactions, contributing to financial monitoring and managerial decision-making.

Despite these benefits, the system is subject to several limitations. Proper hardware maintenance is required to ensure the continued accuracy of Plug and Play RFID Card authentication and verification. A stable internet connection and reliable server performance are essential for the optimal operation of the platform. Furthermore, integration with third-party accounting or banking systems may require additional technical adjustments. Employees must also undergo training to maximize the utility of the system's features. Moreover, the accuracy of attendance tracking, payroll computations, and inventory records is dependent upon precise data entry and biometric enrollment.

On the client side, the booking services feature is constrained to installation services only. Requests for repair or cleaning services are not accommodated by the online booking module and instead require customers to directly coordinate with the Human Resources (HR) department or administrative personnel through the contact information provided on the company's website. In addition, the system is unable to manage detailed service arrangements, such as meeting planning or the customization of service procedures, which necessitates further communication between customers and company representatives.