

RELTRACK: A Web-based System for Inventory, Appointments, and Sales Forecasting Based on Predictive Analytics and Linear Regression for REL Glass and Aluminum Works

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ABSTRACT

A web-based inventory management systems have emerged as a powerful tool that enable businesses to streamline operations, enhance efficiency and increase overall productivity. in the context of business, scheduling an appointment for a service-based company is important to gain potential clients and gain profit. digital scheduling tools has benefits such as real-time updates and automated reminders. sales forecasting is the process of predicting future revenue based on market trends, historical data, and other relevant factors, has always been an essential tool for leading strategic decisions and business success. this study implies that a linear regression model effectively forecasts sales performance by identifying relationships between key variables. the findings demonstrated that linear regression not only predicts future revenue but also guides strategic business decisions. the company rel glass and aluminum works focuses on selling glass and aluminum products and offers different services such as installation, repair, measurement and consultation. it was established in 2021 and was founded by the lo family.

This study uses an applied research and developmental research design. the researcher proposed a web-system that aims to solve the issues of rel glass and aluminum. the developers will create a web-system that handles inventory such as tracking stock-in and stockout real-time, appointment tracker which is designed to list all client schedules and a sales forecasting module helps the business owner to be guided on business decision making. the researchers will use surveys, interviews and observation to collect data. the sdlc methodology chosen is agile model. agile model is a flexible and easy to execute project planning guide for developing the software system of reltrack. the agile model can be broken into 6 stages which consist of requirements gathering, design, development, testing, implementation and maintenance. the study involves 2 respondent groups which includes 80 users and 20 it experts, making a total of 100 participants in the study. the system is evaluated using iso 25010 includes functional suitability, usability, reliability, performance efficiency, security and portability.

The reltrack system was developed by researchers to help rel glass and aluminum works change its manual record management into a web-based inventory, appointment, and sales management system. the system integrates multiple business functions in order to manage clients, suppliers, and inventory all in one place. it also has built-in sales prediction features that help stakeholders make better decisions.

The system met the iso 25010 software quality standards in all six categories. according to the evaluation findings from 100 respondents which are grouped into two, users and technical experts. the technical experts show a significantly lower mean score of 3.4 compared to the user's total mean score which is 3.6 the weighted means across the two groups range from 3.2 to 3.8. for future researchers, the system requires further improvement. reltrack system does not provide customer booking functionality, the current system solely rely on linear regression as the predictive model. reltrack is recommended to consider cloud migration for scalability of the business and could also consider modules for customer sentiment analysis, automated appointment reminders, and ai-based pricing optimization. lastly, continuous improvement to the system's interface and scalability is needed.

Keywords: Inventory, Appointment, Sales Management, Linear Regression, Forecasting, Web Application, Predictive Analytics, Sdlc, Iso 25010

INTRODUCTION

In today's digital age, it is important to manage inventory efficiently for businesses of all sizes. Web-based inventory management systems have emerged as powerful tools that enable businesses to streamline their operations, enhance efficiency and increase overall productivity (Guleria, 2023). Businesses that are small to medium-scale typically do not utilize technology-driven inventory management systems, which often results in their inability to keep up with competitors. In the context of business, scheduling an appointment for a servicebased company is important to gain potential clients and gain profit. In an article, it shows that digital scheduling tools have some benefits. The benefits include real-time updates. Updates are instantaneously reflected across all devices connected to the scheduling calendar. Digital scheduling tools also come with automated reminders, meetings or tasks are instantly sent via notification on devices. Lastly, choosing digital scheduling tools improved time management. Time is crucial in every business, one missed time will greatly affect the track of the business (Guest Contributor, 2024). Sales forecasting, the process of predicting future revenue based on market trends, historical data, and other relevant factors, has always been an essential tool for leading strategic decisions, improved resource allocation, and making sure that business owners can meet customer demand effectively (Garcia, 2023). According to Chen, Dong, and Wang (2022), a linear regression model effectively forecasts sales performance by identifying relationships between key variables such as price, advertising, and distribution. Their findings demonstrated that linear regression not only predicts future revenue but also guides strategic business decisions.

REL Glass and Aluminum Works was established in 2021 and was founded by the Lo Family. The business is located at Countryside, Brgy. Sta. Lucia, Pasig City. The business focuses on selling glass and aluminum products and offers different services such as installation, repair, measurement and consultation. In the current setup of REL Glass and Aluminum Works the business owner ensures that essential materials such as glass and aluminum are well stocked and readily available. When a potential client requests a service (i.e. installation of glassdoor) a staff member is sent to the client's location to check it, take measurements, and gather necessary details. After assessing the place, a quotation is prepared and presented to the client. If the client agrees with the proposed cost, a down payment is required to begin the work and pay the remaining balance at the end of the service. However, if the client does not accept the quotation the process is discontinued, and no further steps are taken.

REL Glass and Aluminum Works often struggle with tracking their products effectively. Another challenge faced by the business owner is managing appointment schedules which are important for identifying potential clients who can be visited for quotations and job fulfillment. Lastly, with many businesses now adopting AI-driven systems to stay competitive, REL Glass and Aluminum Works need a data-driven approach to support business decision-making.

The researcher proposed a web-system that aims to solve the issues of REL Glass and Aluminum. The developers will create a web-system that handles inventory such as tracking stock-in and stock-out real-time to effectively control the stocks of glass and aluminum products. The website also includes an appointment tracker. This module is designed to list all client schedules ensuring that each client is properly attended to by the staff and provide them with accurate quotations and visits to the residences who avail the services. Lastly, adding a sales forecasting module helps the business owner to be guided in business decision making to decide whether to buy more stocks for the next month or the current stock is sufficient for the next month.

REL Glass and Aluminum Works often face several challenges in managing the business operations. The main problem that the company encounters is the use of manual records of inventory management. The business owner struggles on recording data through a logbook which makes the workflow inefficient and prone to human errors.

This study aims to address the problem of the traditional inventory system of the business. Implementing a web-based system for REL Glass and Aluminum Works provides faster, reliable and accurate inventory management, scheduling appointments, and providing sales forecasts.

1. To design and develop an inventory management module that allows the business owner to monitor, update and track glass and aluminum materials efficiently.
2. To design and develop an appointment scheduling feature that enables the business owner to manage client appointments internally.
3. To design and develop a sales forecasting module using linear regression to help the business owner predict future sales based on historical data
4. To design and develop a web-system that uses predictive analytics to guide the business owner in making well-informed business decisions.
5. To design and develop a system that satisfy the quality of the system using ISO 25010 standards in terms of: Functional Suitability, Performance Efficiency, Usability, Security, Maintainability, Portability.

Scope

This study focuses on the development of RELTrack, a web-based system designed exclusively for the use of the business owner of REL Glass and Aluminum Works. The study covers:

1. The inventory module allows the admin to monitor stock levels. It records stock-in and stock-out transactions and tracks available materials in real time.
2. The appointment module is designed for internal use only allowing the business owner to manually set and manage schedules for client appointments.
3. The sales forecasting module uses linear regression to generate sales predictions based on historical data entered into the system.
4. The sales forecasting feature uses at least a year of historical sales data.
5. The system is accessible via web-browser
6. The system provides comprehensive reporting capabilities through generated reports and an interactive dashboard, enabling users to analyze and visualize data effectively which includes inventory report, appointment report and sales forecasting visualization.

Limitation

The RELTrack is a web system that serves as an inventory system, appointment scheduling and sales predicting platform for small to medium business owners. Unfortunately, there are some limitations which include:

1. The system is limited to single-user access, with only the business owner authorized to use its features.
2. The system does not provide customer booking functionality.
3. The web application uses only Linear Regression. It does not look into more sophisticated models such as neural networks or deep learning.
4. The system only provides quarterly (next 3 months) sales predictions based on historical data.
5. The system requires a stable internet connection to access the website and its features, as it is a web-based application.

THEORETICAL FRAMEWORK

The system is formed and guided by different theories and concepts which include:

General System Theory

General Systems Theory (GST) is an interdisciplinary paradigm that tries to comprehend the fundamental principles controlling the genesis, function, and preservation of both natural and social systems. A system is defined in the area as a set of connected pieces or parts that form a complicated whole (Issitt, 2024).

In the RELTrack, GST is utilized to connect different modules such as inventory system, appointment tracker and sales forecasting as one system.

Inventory Control Theory

The technique of tracking stock levels while keeping an eye on client demand is known as inventory control. This enables companies to guarantee that they have the right items in the right quantities at the right times (Schwarz, 2024).

The RELTrack will utilize an inventory management system to track stock levels of current products such as glass and aluminum aiming for a real-time and efficient product monitoring system.

Operations Management Principles

The second principle of Operations Management is Organization. It suggests that everything in a production facility is connected to everything else. In order for the process to produce a profitable result, each of these components must be reliable and consistent.

The RELTrack will utilize an appointment tracker to make the business more organized in terms of tracking potential clients which could lead to profit.

Econometric Theory

Econometric Theory focuses on the use of statistical and mathematical models to forecast future trends and test hypotheses in economics (Hayes, 2024). Econometrics heavily rely on the linear regression model which is widely used to explain and predict the relationship between a dependent variable and one or more independent variables.

The system will rely on Linear Regression to predict sales that will guide business owners in well-informed decision-making.

Conceptual Framework

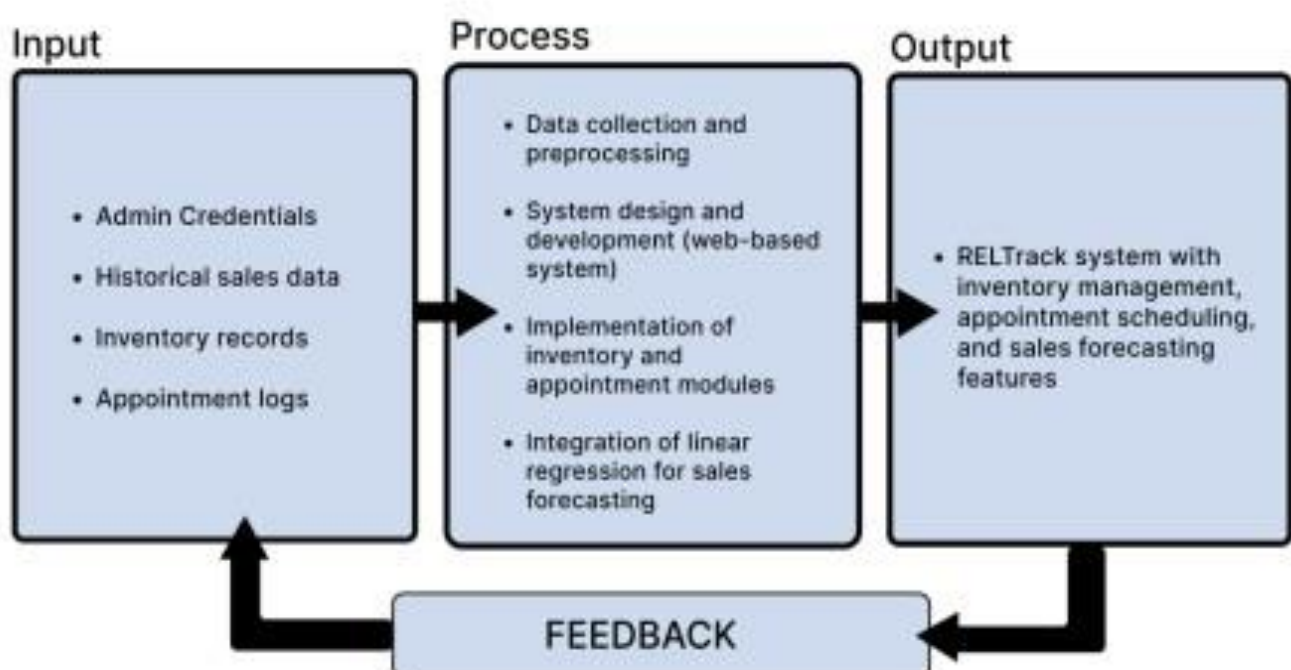


Figure 1: The IPO Model

Input: The input phase involves collecting historical sales data, inventory records, and appointment logs, which serve as the foundation for developing the system. This data is gathered from the company's sales and inventory management records, as well as the appointment scheduling information, to provide a comprehensive dataset for the system.

Process: For the process phase, the system will undergo data collection and pre-processing, followed by the design and development of a web-based platform. This includes integrating a linear regression model to enable sales forecasting, as well as implementing modules for inventory management and appointment scheduling. The system will analyze trends in the historical sales data and generate forecasts based on linear regression techniques, providing insights for decision-making.

Output: The output is the RELTrack System, a webbased application that offers inventory management, appointment scheduling, and sales forecasting features. It enables REL Glass and Aluminum Works to efficiently manage business operations, improve decision-making, and make informed predictions based on data analytics.

Significance Of the Study

This study is significant to the following:

To REL Glass and Aluminum Works Company – Provides an efficient tool for managing inventory, appointments, and forecasting sales, enabling datadriven decision-making.

To I.T. Students – Enhances understanding of system development processes, web-based technologies, and the application of linear regression for sales forecasting.

To Future Researchers – Serves as a reference for similar studies in web-based systems and sales forecasting using linear regression

REVIEW OF RELATED LITERATURE

Herlina et al. in (2023) created a web-based application for inventory management which uses PHP and MySQL to improve the management of stock data. The system sought to minimize human mistakes and enhance the precision of data entries. The system design incorporated the waterfall development model and UML which enabled the application to manage item data efficiently by processing incoming and outgoing transactions and generating reports. The research found that these management systems lead to substantial improvements in both inventory control and data integration capabilities.

Zhang (2023) conducted research on the comparison of sales forecast models that consisted of multiple linear regression analysis and ARIMA time series analysis. The models were validated by sales history. The researchers demonstrated that multiple linear regression outperformed ARIMA (RMSE (root mean square error) was lower than that of ARIMA), indicating that it can be applied to sales forecasting. The study points out the importance of the selection of proper models that have a deep dependency on the properties of the data in the perspective of sales forecasting.

A study conducted by Suresh and Sivakumar (2019) aims to find the effectiveness of schedule management plans on the effectiveness of project management. The research methodology used is a quantitative type. The instrument used was a survey, which was collected from different employees working in service sector organizations. 300 were selected using a random sampling technique from 10 service sectors in different parts of India. Most participants are from the sectors of different departments such as operations, finance and marketing. The survey questionnaire focuses on likert-scale data. The data was analyzed using SPSS software. The result shows that a schedule management plan offers the ability to monitor various project tasks and aids in time management for each project. This helps to increase staff productivity in addition to providing the advantages of efficient resource use, timely project completion, and successful outcomes. According to the analysis, time management is largely the main benefit of a schedule management plan.

In recent years, cloud-based Software-as-aService (SaaS) platforms have become increasingly prevalent in inventory and sales management. For example, Zoho Corporation offers a fully integrated SaaS suite that supports SMEs with minimal infrastructure investment and configurable modules, demonstrating scalable usage in a variety of business contexts (Rai & Kunte, 2024). Similarly, platforms such as Shopify provide cloud-based inventory management functionality with real-time multilocation tracking, device-agnostic access, and channel integration. These systems represent benchmarks for cost-effective, scalable, and accessible inventory and sales solutions. In contrast, the proposed RELTrack system is designed as a Windows-based, locally deployed solution; examining and contrasting such SaaS alternatives highlights opportunities for future enhancement, including reduced infrastructure dependency and improved branch or franchise scalability.

Synthesis

The different related literature and studies provide a positive impact that such creating systems like inventory management, appointment tracker and sales forecasting system helps business to grow. The system that the researchers are conducting is supported by different articles, journals and studies.

METHODOLOGY OF THE STUDY

This study uses applied research and developmental research design. Applied research design was utilized to solve practical problems where in the REL Glass Aluminum and Works uses manual inventory tracking, scheduling appointments and sales management. Another research design approach used was the developmental research to design, develop and evaluate the RELTrack web-system.

Overall, the researchers ensured that the system development was both grounded in real business needs and supported by data-driven evaluation methods.

The researchers will use surveys, interviews and observation to collect data. The interviews were conducted with the business owner to identify the existing problems in the current manual process. Surveys were also handed out to the staff and owner, this is to establish a checklist which helps to further get important data. Lastly, observation was also made to allow the researchers to document and identify inefficiencies and repetitive tasks that could be improved through automation.



Figure 2: SDLC Model

This figure shows the methodology used to present the Software Development Life Cycle (SDLC) of the RELTrack system. The SDLC methodology chosen is the Agile Model, which emphasizes flexibility, collaboration, and continuous improvement through iterative development cycles known as sprints. The Agile

model was divided into six recurring phases which are requirements gathering, design, development, testing, implementation, and maintenance and executed repeatedly across several sprints to gradually build the RELTrack system.

Requirement Gathering: this phase focuses on building the blueprint of the web-system, presenting the possible timeline of the project, and planning the distribution of tasks based on the programmers, researchers, testers etc. This phase also contains the collection of information and data from the possible users of the system, focusing on a user-centric approach. The users were interviewed by the researchers to gather and collect data that could help in creating the blueprint of the web-system.

1. **Designing:** The researchers design the initial wireframe of the web-system using different designing tools such as Figma and Canva. The researchers also focus on the other aspects of the documentation including creating the data flow diagram, use case diagram, and data storage and processing.
2. **Development:** This is where developers will start to code both the front-end and back-end of the web system. The front-end consists of the user interface of the system such as the buttons, text field, the nav-bar and other things that the user can see on their screen. On the other hand, back-end consists of building the logic and functionality of the system, making sure that users can get accurate and correct predicted sales to guide them for data-driven decisions.
3. **Testing:** This is where the testers test the functionalities and the UI making sure that the website is perfectly working before the real users explore the web-system.
4. **Implementation:** This is where the developers will deploy the website to the real-world. Users can now use the web-system for predicting sales that can help the stakeholders to make better business decisions.
5. **Maintenance:** The developers are open for changes and software updates making sure that the demands of the users meet their needs.

Future large-scale expansions of RELTrack may consider structured Agile frameworks such as the Scaled Agile Framework (SAFe) to improve coordination and scalability across multiple development teams.

The Database Design of the RELTrack focuses on the efficient management and retrieval of inventory and sales data. A well-designed database schema ensures data security, performance, and integrity, crucial for supporting the system objectives and goals.

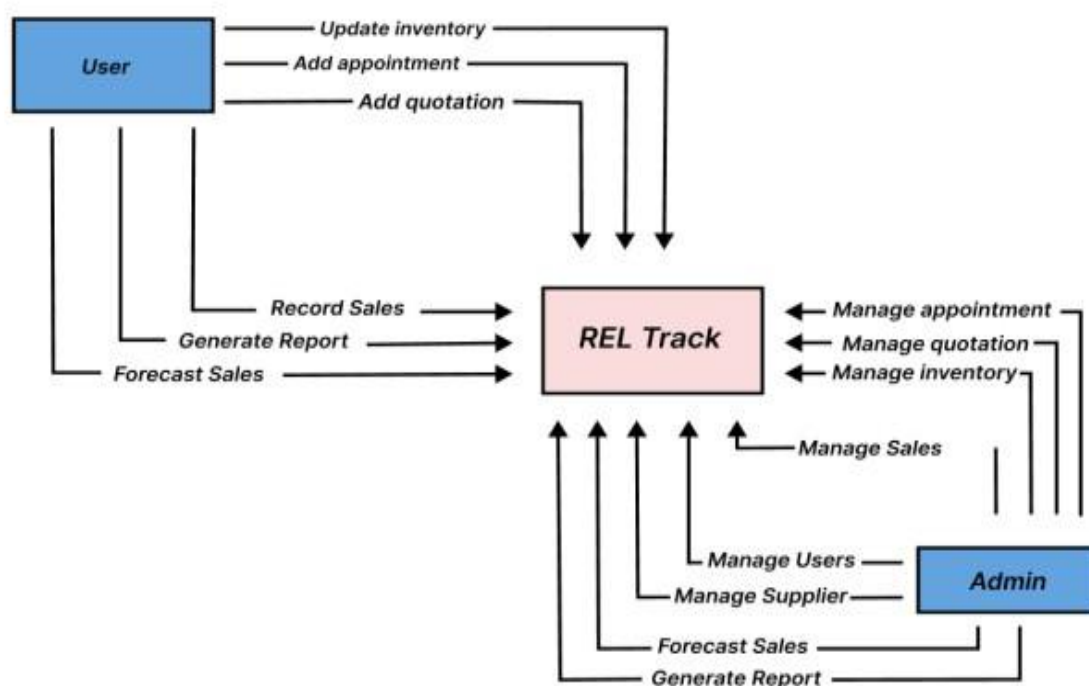


Figure 3: Context Diagram Respondents of the Study

The study involves 2 respondent groups: (a) Users (b) IT experts. User respondents were selected due to their involvement in business operations and decision-making, while IT Experts were chosen based on their background in information technology, system management, and software development. The evaluation includes 60 Users and 40 IT experts, making a total of 100 respondents participating in the study.

The study employs simple random sampling to ensure unbiased selection. Slovin's Formula is used to determine the sample size

Development And Evaluation Procedure

The RELTrack system is developed using a combination of frontend and backend technologies, ensuring seamless inventory management, appointment scheduling, and accurate sales forecasting. The chosen tools and frameworks provide a reliable and efficient environment for managing glass and aluminum business operations with predictive analytics.

Version Control

- Git

Backend

- PHP 7.4+
- MySQL/MariaDB
- bcryptjs

Frontend

- Bootstrap 5
- jQuery
- DataTables

Other Tools.

- Concurrently

Hardware Used/ Requirements

The hardware used in developing the websystem includes:

Computer Requirements

- Processor - Intel/AMD, at least 2.0 GHz, Dual Core or higher
- RAM – 4GB or higher
- Storage – 500GB SSD/HDD
- Resolution – 720 (1280 x 720 pixels) or higher
- Web browser connected to internet

The process of critically analysing a product is called evaluation. It entails gathering and examining data regarding the features, functions, and results of a product. Its goals are to evaluate a product, increase its efficacy, and/or provide information for purchasing decisions (Patton, 1987).

Two evaluation techniques were used in the study. The first approach evaluated the application's usability and user satisfaction. The second approach assessed the application's usefulness and technical performance. Only one evaluation form is used, specifically following the ISO 25010 standards for assessment, even though two evaluation methodologies are used.

In this study, the system is evaluated to satisfy the ISO 25010 criteria such as:

1. Functional Suitability
2. Usability
3. Reliability
4. Performance Efficiency
5. Security
6. Portability

Data Analysis Plan

In this study, the ISO 25010 software quality model is used as a guide to evaluate the developed system. It provides a standard set of criteria to assess the quality and performance of software. The following characteristics from ISO 25010 are considered in the evaluation:

1. Functional Suitability – Checks if the system performs the functions it was designed to do.
2. Usability – Focuses on how easy the system is to use.
3. Reliability – Measures the system's consistency and stability.
4. Performance Efficiency – Evaluates how fast and efficient the system works.
5. Security – Assesses how well the system protects data from unauthorized access or misuse.
6. Portability – Refers to how easily the system can be used or moved to different devices or environments without problems.

The statistical tool required to ascertain the level of agreement or disagreement among several questionnaire questions or assertions is the weighted mean, also known as the average mean. It calculates the weighted mean for each item by multiplying the weighted point by the sample size, which yields the sum of all products. The total number of items is then divided by the population size.

One quantitative analysis data gathering method used in research and evaluations to gauge people's attitudes, beliefs, or perceptions is the Likert scale. Respondents are shown a series of statements or questions on this scale. Numerical values are assigned to the responses, enabling quantitative data analysis. "Strongly agree" and "strongly disagree" are the two options on a standard Likert scale. A 4point Likert scale, with weights ranging from 4 (meaning "strongly agree") to 1 (meaning "strongly disagree"), is employed in this study.

The System

The output of the study is a web-based system called RELTrack. The RELTrack system is an inventory management system with built-in appointment tracker, sales management and a sales predictive feature. The primary goal of the system is to streamline the record-keeping process of inventory and sales from manual labor to digital minimizing human error and improving the efficiency of the business model. The business focuses on inventory management tailored for companies in the glass and aluminum industry. The system supports their

workflow starting from managing inventory, scheduling appointments, and creating quotations for buyers. Once a buyer agrees to the quotation, the project can be carried out and the sales are recorded in the system. In addition, it also includes a sales forecasting feature to assist the business owner in making better business decisions.

The system is built using the following development tools such as Bootstrap 5, JQuery, DataTables for the front end while PHP, MySQL, bcryptjs, Python, Flask, scikit-learn in the backend and for the version control the developer uses Git.

The system is evaluated using the ISO 25010 standards.



Figure 4: Login Page

This image shows the login page of the RELTrack system, where users securely enter their credentials to access the platform.

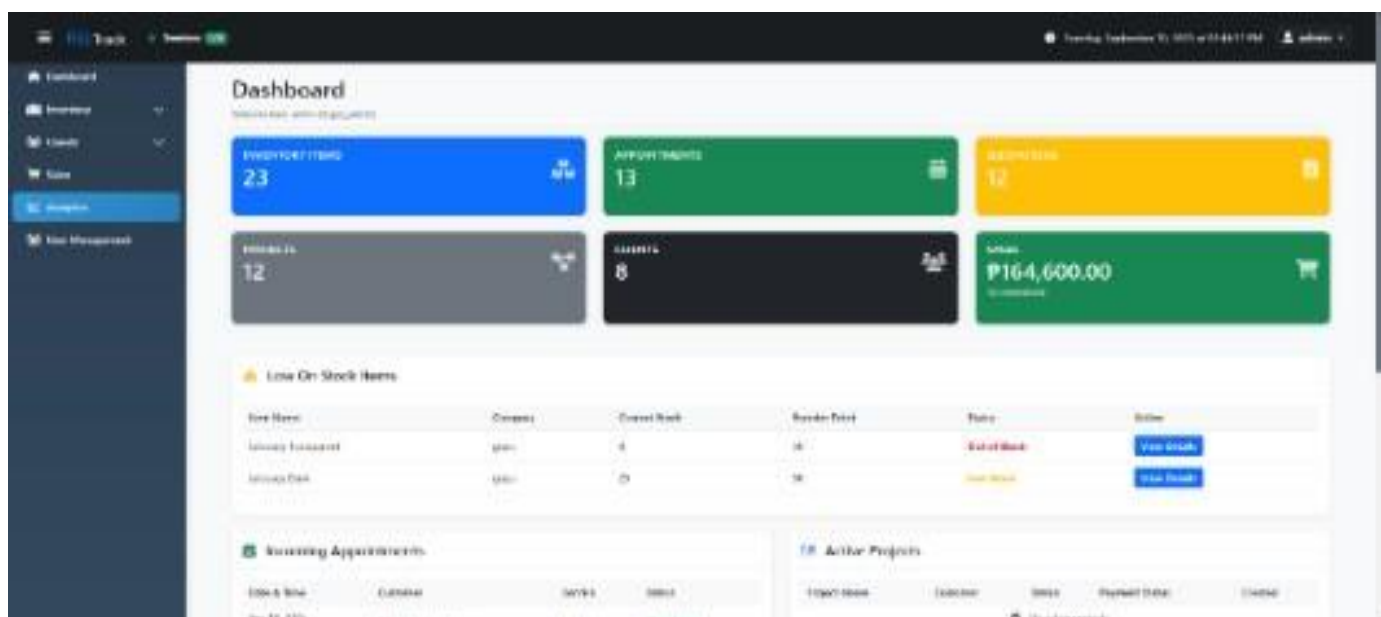


Figure 5: Admin Dashboard

This image displays the dashboard, providing an overview of key metrics through summary cards, tables, and interactive graphs for quick insights.

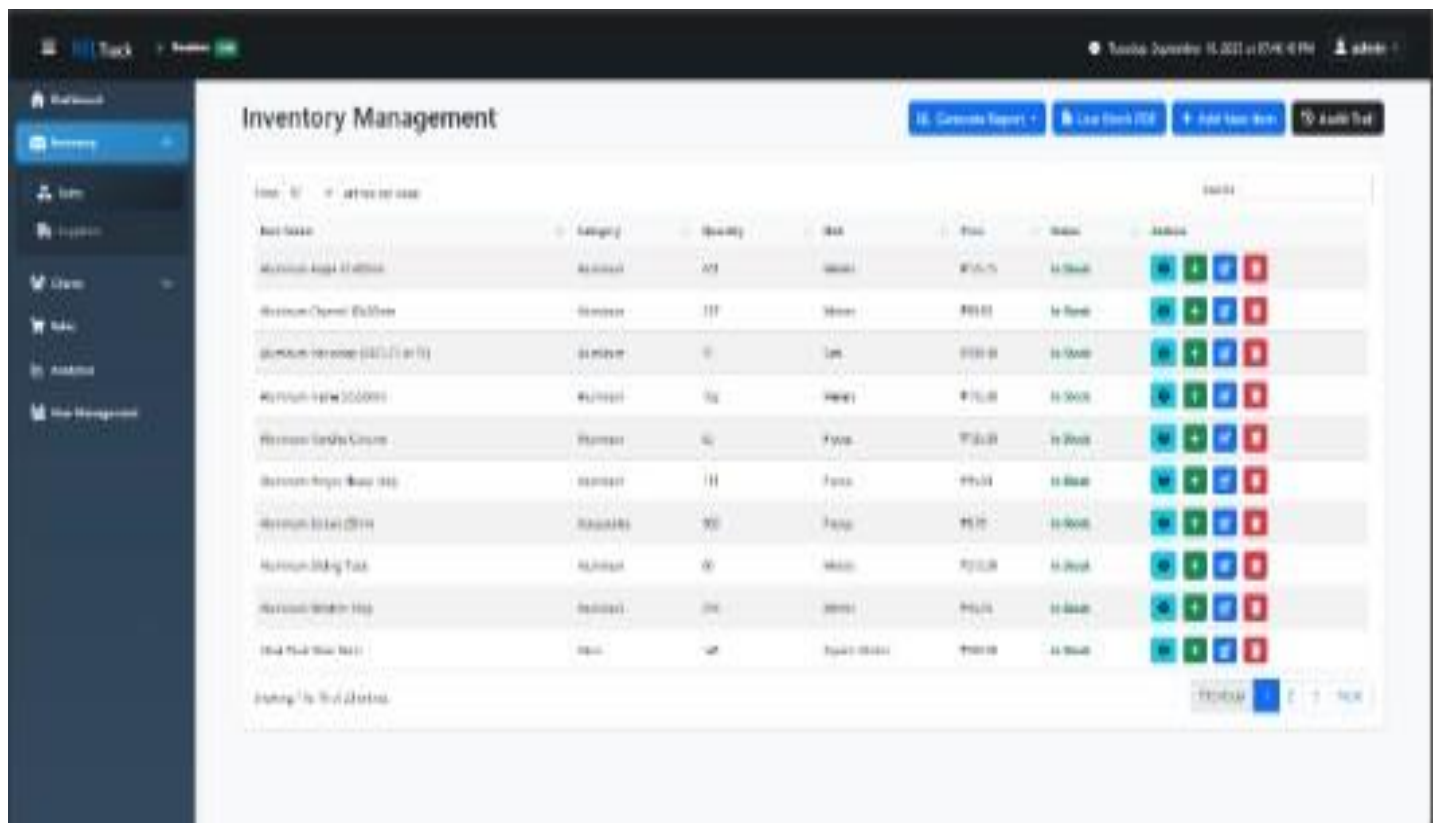


Figure 6: Inventory Management Module (Admin)

This image presents the inventory management module, featuring a table of inventory items and action buttons to add, edit, or delete records.

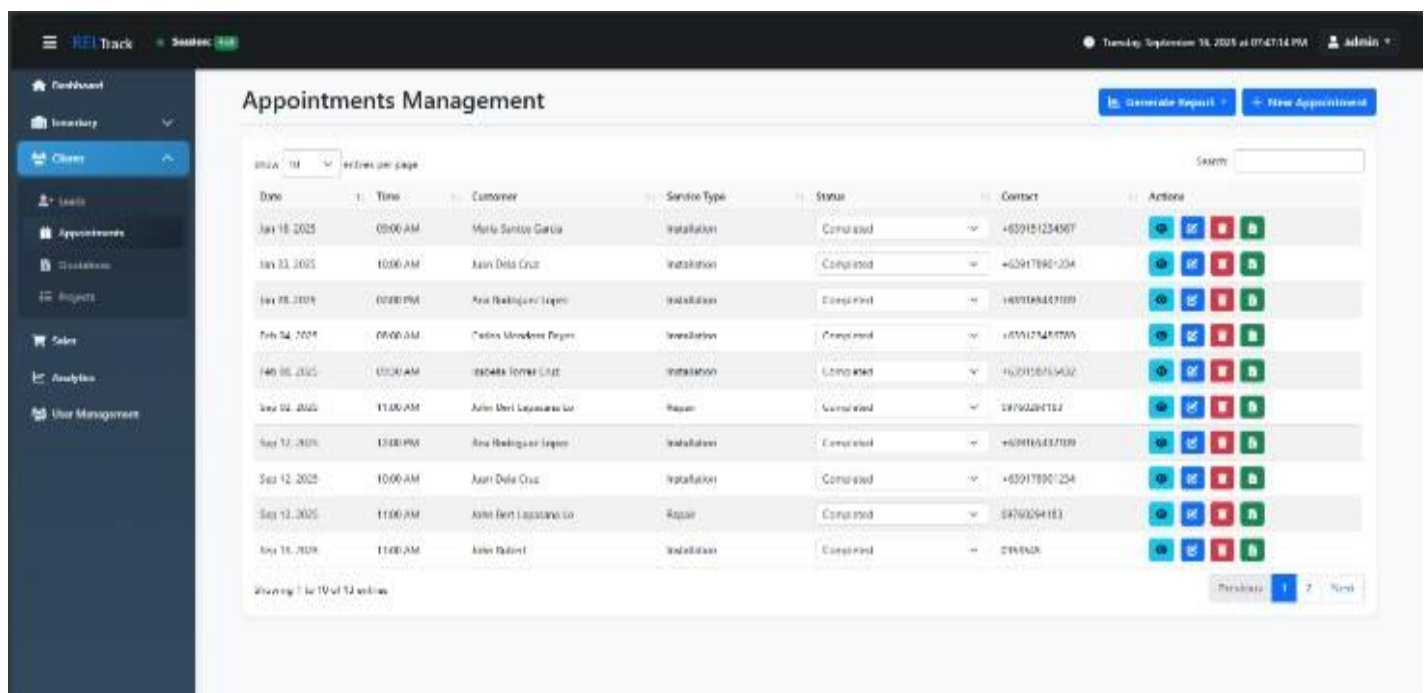


Figure 7: Appointment Management Module (Admin)

This image presents the appointments management module, listing all appointments and providing controls to schedule, update, or cancel them.

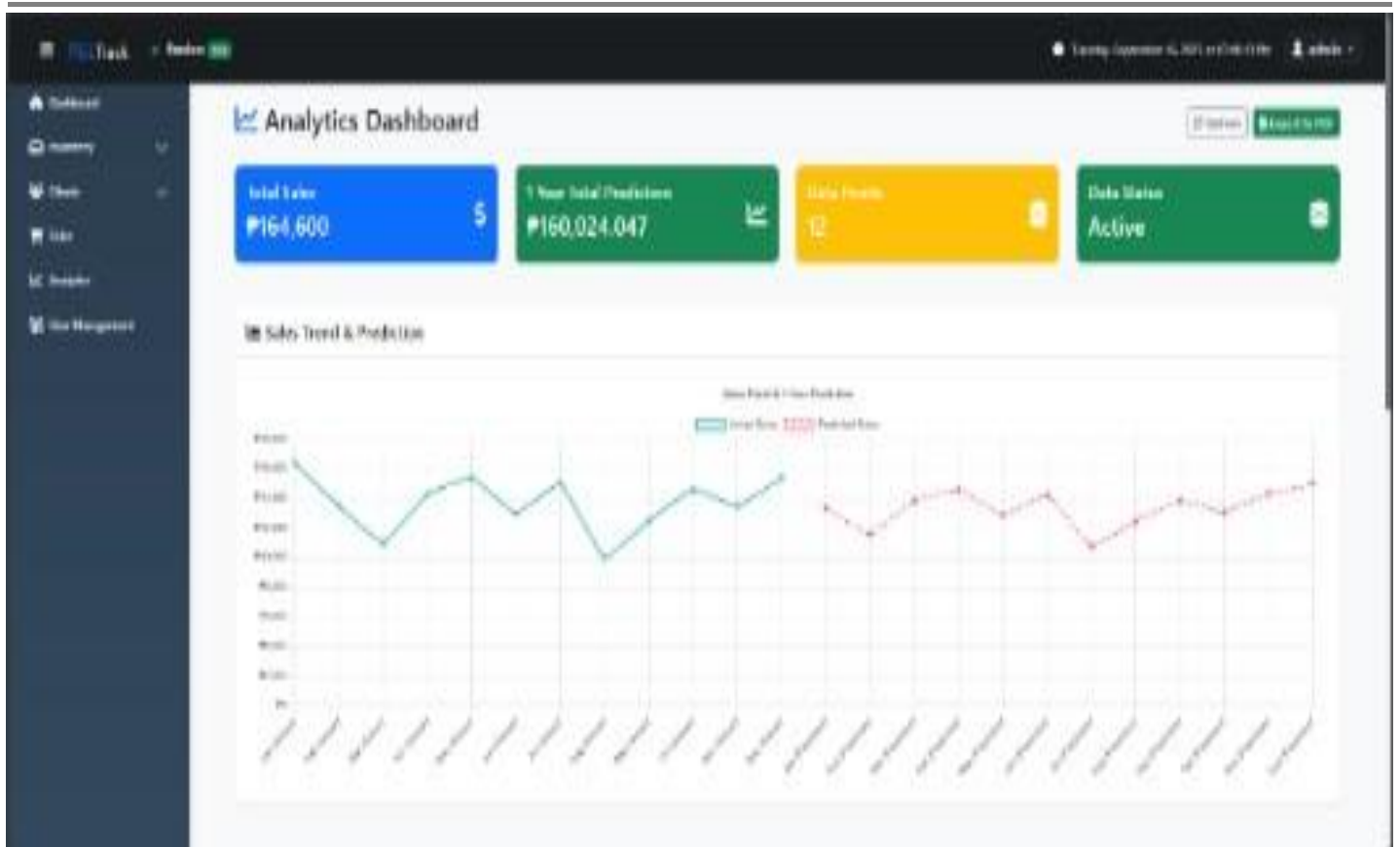


Figure 8: Project Reports and Analytics

This image shows the reports and analytics module, featuring KPI cards, tables, and interactive graphs for detailed data analysis and reporting.

ASSESSMENT: SUMMARY OF RESPONDENTS ON THE SYSTEM

These section presents the evaluation results of 100 respondents, composed of 60 users and 40 technical evaluators, based on the ISO 25010 software quality model.

Criteria (ISO25010)	Respondents (100)			
	Users (60)		Technical (40)	
	WM	VI	WM	VI
1. Functional Suitability	3.7	SA	3.5	SA
2. Usability	3.7	SA	3.4	SA
3. Reliability	3.8	SA	3.5	SA
4. Performance Efficiency	3.5	SA	3.3	SA
5. Security	3.6	SA	3.5	SA
6. Portability	3.3	SA	3.2	SA
Overall Average Mean	3.6	SA	3.4	SA

Table 1: Summary and Comparison of Evaluations of Respondents

Table 1 shows that across all six criteria (Functional Suitability, Usability, Reliability, Performance Efficiency, Security, and Portability) the weighted mean values ranged from 3.2 to 3.8 for both groups. User respondents reported an overall average mean of 3.6, while the technical respondents reported a slightly lower average of 3.4. Despite minor variations in scores, the verbal interpretation across all criteria was consistently rated as Strongly Agree, indicating that both user and technical respondents strongly affirmed the system's compliance with the identified software quality attributes.

Ethical Considerations

The study guarantees the confidentiality and integrity of the data obtained from participants. Information provided by respondents is secure, and no personally identifiable information is shared without permission. Respondents are allowed to leave the study at any moment without facing any repercussions, in accordance with the principles of voluntary participation. Strict adherence to data security protocols guards against misuse and illegal access to information. Lastly, in order to preserve the study's integrity, all results are presented truthfully and accurately, free from prejudice or manipulation.

Summary

The RELTrack System was developed by researchers to help REL Glass and Aluminum Works change its manual record management into a webbased inventory, appointment, and sales management system. RELTrack integrates multiple business functions in order to manage clients, suppliers, and inventory all in one place. It also has built-in sales prediction features that help stakeholders make better decisions. The system offers a user-friendly interface and strong security features such as session expiration and two-factor authentication.

The system was evaluated by two major groups, users and technical experts using ISO 25010. The results of the evaluation show that the system is highly effective in managing inventory, tracking appointments, handling sales, and forecasting future sales.

CONCLUSION

The evaluation results from 100 respondents, 60 users and 40 technical experts shows that the system met the ISO 25010 software quality standards across all six criteria: Functional Suitability, Usability, Reliability, Performance Efficiency, Security, and Portability. The users gave an overall mean score of 3.6, while the technical evaluators provided a slightly lower mean of 3.4, with weighted means ranging from 3.2 to 3.8. There is a minor difference were observed between the two groups, both consistently rated the system as Strongly Agree, therefore the RELTrack system meet the required software quality attributes.

RECOMMENDATION

This study provides a functional web-based system for managing inventory, appointment scheduling, sales management, and sales forecasting for the stakeholders. However, further improvements are still recommended to enhance its efficiency, scalability, and usability.

While RELTrack currently operates as a Windows-based solution, it may encounter limitations in cost efficiency and scalability as the business grows. Therefore, it is recommended to migrate the system to a cloud-based infrastructure such as Google Cloud, AWS, or Microsoft Azure. Cloud migration would enable better scalability, improved accessibility across multiple branches or future franchise locations, and cost-effective maintenance.

RELTrack also does not provide a customer booking functionality, which could be valuable for making the business operation more productive and efficient in handling customer inquiries. Furthermore, the system currently relies solely on Linear Regression as its predictive model. Although Linear Regression is effective for basic forecasting, it may not provide optimal accuracy for more complex sales patterns. Future researchers are encouraged to explore more advanced machine learning algorithms, such as Random Forest or Neural Networks, to improve prediction accuracy and provide deeper analytical insights.

Lastly, future enhancements may include additional modules for customer sentiment analysis, automated appointment reminders, and AI-based pricing optimization. These features would strengthen the system's business intelligence capabilities and enhance customer engagement. It is also recommended to continuously improve the system's interface and scalability to ensure that it can accommodate larger datasets and adapt to the growing needs of the business.

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