Smart Vault: Home Smart Locker System

A PROJECT REPORT

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BONAFIDE CERTIFICATE

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ABSTRACT

The **Home Locker System** project is an innovative solution designed to address the growing need for secure, convenient, and interactive storage options within residential environments. As online shopping and home delivery services continue to surge, the necessity for a reliable method to store packages, personal belongings, and valuable items has become critical. This system aims to bridge the gap between traditional storage solutions and the emerging trend of smart home automation.

The Home Locker System integrates various technologies such as Internet of Things (IoT) and role-based access control to provide users with a secure and user-friendly platform. The system allows users to open, lock, reserve, and monitor lockers remotely through a mobile interface. Additionally, it includes essential security features like login authentication, activity logging, and an auto-logout function to ensure that the system remains protected from unauthorized access.

Key features of the system include **multi-user authentication**, where admins have control over all lockers, and normal users are restricted to their assigned lockers. The **activity log module** tracks all interactions with the lockers, providing an audit trail for security purposes. The **reservation timer** locks a locker temporarily to simulate real-world reservation behavior, while the **auto-logout security module** ensures that the system automatically logs out inactive users after five minutes.

The system was designed with usability in mind, ensuring that it is intuitive and simple to operate for all family members, from children to elderly users. Testing and validation confirmed that the Home Locker System meets its functional requirements and provides a secure, efficient, and user-friendly experience for homeowners.

This project has the potential to revolutionize home storage and security by integrating smart technologies with everyday use, offering a seamless solution for residential environments and setting the stage for future advancements in home automation.

CHAPTER 1

INTRODUCTION

1.1 Identification of Client and Need

In today's modern era, as home automation systems continue to gain popularity, the demand for smart locker systems is also on the rise. Homeowners are increasingly seeking innovative solutions that not only enhance security but also offer convenience and seamless integration with their daily lives. The client for this project is a typical household or homeowner who aims to strengthen their home security by incorporating a smart locker appliance. This system would provide a secure space for storing valuable items, receiving deliveries, and keeping personal belongings safe.

The smart locker system needs to be designed with a focus on interactive features, robust security measures, and user-friendly access control. It should offer real-time feedback, such as notifications or alerts, to keep users informed about locker activity. At the same time, it must be simple enough for all family members, including children and elderly users, to operate comfortably without technical difficulties. Features like biometric authentication, remote access through a smartphone app, and integration with existing home automation platforms can significantly enhance the system's usability and appeal. By combining advanced technology with everyday practicality, the smart locker aims to become an essential part of the modern smart home, ensuring peace of mind and enhanced convenience for all users.

1.2 Relevant Contemporary Issues

Several contemporary issues highlight the growing relevance and necessity of developing an advanced smart locker system for residential use. One major factor is the significant increase in home deliveries, particularly following the COVID-19 pandemic. As online shopping and doorstep delivery services have become an integral part of daily life, there is a critical need for secure solutions to manage and protect delivered packages from theft or weather-related damage.

Additionally, rising security concerns, including a noticeable uptick in thefts, porch piracy, and home invasions, emphasize the need for homeowners to invest in better residential security appliances. A smart locker system offers an effective layer of protection, ensuring that valuable deliveries and personal belongings are safely stored until retrieved.

The growing trend of smart home integration further adds to the relevance of this project. Homeowners are increasingly adopting IoT-enabled devices that not only enhance home security but also improve overall lifestyle convenience. A smart locker that seamlessly connects with existing home automation ecosystems would align perfectly with this trend.

Finally, user-centric design is more important than ever. There is a pressing need for systems developed with strong usability principles, such as heuristic evaluation, ensuring accessibility and ease of use for all family members, including children and seniors. These contemporary issues underline the critical need for a secure, intuitive, and reliable smart locker system.

1.3 Problem Identification

Traditional lockers and safe systems, while effective to a certain extent, often fall short of meeting the demands of today's connected and fast-paced lifestyles. Most traditional systems are manual, lacking any form of remote or smart control, which means users must physically interact with the locker to operate it. This limits flexibility and convenience, especially in situations where remote access or monitoring would be beneficial.

Moreover, these systems are typically non-interactive, offering no real-time feedback, activity logs, or alerts regarding locker access or status changes. This absence of real-time information makes it difficult to monitor usage and increases vulnerability to unauthorized access. Traditional lockers also offer limited user access control, meaning they cannot easily distinguish between different users. This limitation makes them more susceptible to misuse or accidental access by unauthorized individuals.

There is a clear and pressing gap in the market for a home appliance locker system that addresses these shortcomings. Modern smart lockers should feature multi-user authentication, distinguishing between Admin users and Normal users, provide real-time locker status monitoring, offer reservation or scheduled access features, and include auto-logout security measures to prevent

unattended access. The problem identified, therefore, is the lack of an intelligent, interactive, and secure locker system specifically designed for integration into smart homes.

1.4 Task Identification

The project aims to accomplish the following tasks:

- **Design a front-end system** for a home locker using HTML, CSS, and JavaScript.
- **Implement multi-user login** with role-based access (Admin and Users).
- **Enable locker actions**: Open, Lock, Reserve.
- **Build a locker activity history tracker** to monitor user interactions.
- **Introduce auto-logout functionality** for inactivity-based security.
- **Ensure user experience is guided by heuristic evaluation principles** (visibility, feedback, error prevention).

1.5 Project Timeline

Phase	Timeline	Description
Requirement Gathering	Week 1	Understand user/client needs
System Design	Week 2	Wireframing and UI Planning
Front-End Development	Weeks 3 - 5	Coding HTML, CSS, JavaScript

Phase	Timeline	Description
Feature Integration	Weeks 6 - 7	Adding authentication, history
Testing & Debugging	Week 8	Functionality testing and fixes
Report Writing	Weeks 9 - 10	Documentation and Final PPT

CHAPTER 2

LITERATURE SURVEY

2.1 Introduction

With the rapid advancement of technology and the growing emphasis on home automation, the concept of smart lockers has gained significant attention. As homeowners increasingly seek ways to enhance the security and convenience of their living spaces, smart lockers present an innovative solution to some of the most pressing challenges. Traditional lockers, while reliable in their time, are no longer sufficient to meet the evolving needs of modern households, especially when it comes to remote access, real-time monitoring, and user-friendly design.

Smart lockers aim to bridge this gap by integrating advanced technologies such as IoT connectivity, biometric authentication, and mobile app interfaces, thereby providing a seamless and secure user experience. This chapter explores the existing solutions in the market, the key technologies that enable smart locker functionality, and the limitations of current systems that leave room for further innovation. It highlights the need for a more intelligent, interactive, and adaptable locker system that not only ensures security but also caters to the diverse needs of a household.

The research gaps identified, such as limited multi-user management, lack of real-time feedback, and poor integration with smart home ecosystems, have provided strong motivation for the development of the Home Locker System project, aiming to set new standards in residential security and convenience.

2.2 Existing Systems and Technologies

Several smart locker systems currently exist across various sectors, each catering to specific needs and offering varying levels of functionality. While they provide valuable insights into the development of smart lockers for home use, they often face limitations when it comes to scalability, accessibility, or affordability for residential environments.

- **Amazon Locker Systems**: Amazon introduced self-service parcel lockers in public locations to offer a secure and convenient way for customers to collect their packages. These lockers are equipped with a digital interface that allows users to access their items by entering a code sent to their mobile device. Although highly effective in commercial settings, Amazon Locker systems are not designed for home use, as they require substantial space, are not customizable, and do not offer multi-user access or integration with smart home systems.

- **Smart Parcel Lockers for Apartments**: In many modern apartment complexes, smart parcel lockers are used to securely handle deliveries. These lockers are integrated with mobile applications that provide users with real-time notifications and access to their deliveries. While these systems offer a high level of convenience, they require expensive infrastructure, including server support and installation, making them impractical for individual homes or smaller residential environments.

- **IoT-based Smart Lockers**: Research papers and prototypes have demonstrated the potential of IoT-based smart lockers, which can be remotely controlled through mobile applications. These systems allow for locking and unlocking from anywhere, offering a high degree of flexibility. However, they are often complex, requiring significant backend support, dedicated mobile applications, and additional hardware, making them impractical for single-home use or for homeowners who do not have technical expertise.

- **Manual Locker Systems**: Traditional mechanical lockers remain a popular choice for many homes due to their simplicity and cost-effectiveness. However, these systems are not interactive and lack any form of user logging, monitoring, or real-time feedback. They are vulnerable to unauthorized access if the key or combination

is lost or compromised. Despite their basic functionality, manual lockers do not provide the advanced security and convenience features that smart locker systems can offer, making them less suitable for modern residential security needs.

Each of these existing systems highlights different aspects of what is required for a home-based smart locker. While some offer security and convenience, others may be too complex or expensive for typical residential use. The existing gaps in these systems have motivated the development of a smart locker system that balances ease of use, affordability, and security for home environments.

2.3 Research Gaps Identified

Several research gaps have been identified while analyzing the existing smart locker solutions, which highlight the need for a more tailored system for home environments. Firstly, most existing solutions, such as apartment smart lockers and commercial parcel lockers, are too costly or complex to implement on a small scale for individual homes. They require significant backend infrastructure, specialized hardware, and continuous maintenance, making them impractical for typical residential users.

Secondly, many existing systems are primarily designed to handle deliveries rather than focusing on enhancing personal home security. Their main goal is secure package storage, not the safe keeping of valuables or personal items within a household setting.

Another major gap is the lack of systems that offer **multi-user authentication** with **role-based access control**. Current systems often treat all users equally, without differentiating between an admin (with higher privileges) and regular users (with limited access), which is essential for family usage where controlled access is necessary.

Additionally, basic locker systems provide limited user feedback and poor activity logging. Without real-time notifications, access history, or status updates, users cannot monitor or audit locker usage effectively.

Finally, there is an absence of simple yet critical features like **reservation capabilities** and **auto-logout mechanisms** to enhance security. These functionalities would prevent unauthorized access and ensure that lockers are automatically secured after each use, making the system safer and more efficient for everyday home use.

CHAPTER 3

DESIGN FLOW

3.1 Introduction

The Home Locker System was conceptualized and developed with a primary focus on three critical aspects: **security**, **simplicity**, and **user-centered design**. Recognizing the need for a smart, reliable, and easy-to-use storage solution within modern homes, the system aims to bridge the gap between traditional manual lockers and complex, infrastructure-heavy commercial smart lockers. It offers an interactive platform tailored specifically for home users, ensuring that every family member, regardless of their technical proficiency, can access and operate it comfortably and securely.

To accomplish this, a systematic design flow was carefully planned and implemented. The key elements of the system include **user authentication**, **locker interaction**, **activity logging**, and **session management**. Each of these components plays a crucial role in ensuring that the system remains secure while also offering a smooth, hassle-free user experience.

The design process prioritizes intuitiveness at every stage of user interaction. From login procedures to locker operations and logging activities, each step is structured to provide clear, immediate feedback to the user, minimizing confusion and maximizing trust in the system. Moreover, strict adherence to security best practices, such as role-based access control and auto-logout mechanisms, further reinforces the reliability of the Home Locker System.

This chapter outlines the major system components, discusses their roles, and explains the overall workflow that brings the Home Locker System to life, delivering a smart and practical home storage solution.

3.2 System Components Overview

The Home Locker System consists of the following major components:

Login Authentication Module:

Verifies users based on a stored database of usernames, passwords, and assigned roles (Admin/User).

Role-Based Access Control:

Admin users can control all lockers.

Normal users can control only their assigned locker.

Locker Management Module:

Provides the functionalities to Open, Lock, and Reserve lockers.

Activity Log Module:

Records all locker interactions (open, lock, reserve, expire) with timestamps for monitoring purposes.

Auto-Logout and Security Module:

Detects inactivity and logs the user out automatically after 5 minutes.

Password Change Module:

Allows users to securely update their passwords after login.

Reservation Timer:

Locks a locker temporarily for a set period (10 seconds) to simulate real-world reservation and auto-release behavior.

3.3 Overall Design Flow

The flow of the system can be divided into several stages:

3.3.1 User Authentication

The system starts with a Login Page where users must input their username and password.

Validation is performed against a predefined user database.

Upon successful authentication:

The user is redirected to the Locker Dashboard.

If login fails, an error message is displayed and the user is prompted to retry.

3.3.2 Dashboard Display and Access Control

- After login, the system identifies the role of the user.
- Admin Dashboard: Displays all lockers (Locker 1, 2, 3) with full control.
- User Dashboard: Displays only the locker assigned to that particular user.
- **Each locker shows:**
- Current Status: Available or Occupied
- Action Buttons: "Lock" or "Open" depending on status
- Reserve Button: Reserves the locker temporarily for the user.

3.3.3 Locker Interaction

Lock Button: Changes locker status from Available ➜ Occupied.

Open Button: Changes locker status from Occupied ➜ Available.

Reserve Button: Automatically locks the locker for 10 seconds.

After 10 seconds, the locker auto-opens again.

Each interaction is immediately logged into the Activity History section.

3.3.4 Activity Logging

Every action (Open/Lock/Reserve/Expire) is recorded in a History Log.

Log entries include:

- Locker number
- Action performed
- Timestamp of the action
- This provides an audit trail for user accountability and tracking.

3.3.5 Session Management and Auto-Logout

The system monitors user activity (clicks, locker interactions).

If no activity is detected for 5 minutes, the system:

Logs out the user automatically.

Displays a session expired alert.

This enhances security and prevents unauthorized access after user inactivity.

3.3.6 Password Management

- After login, users have the option to change their password.
- New passwords are updated in the session database.
- Validation ensures that new passwords match and meet minimum requirements (non-empty fields).
- A successful password change triggers a notification for confirmation.

3.4 User Interface Flow Diagram

Login ➔ Dashboard (Admin/User specific)

Locker Actions ➜ Update Locker State + Log History

Inactivity Detected ➜ Auto Logout

Change Password Option Available

Logout by User ➜ Back to Login Page

3.5 Key Design Principles Used

The design flow follows several good screen design and heuristic evaluation principles:

- Visibility of system status: Locker states are always visible.
- User control and freedom: Users can lock, unlock, reserve at their will.
- Error prevention: Auto logout after inactivity prevents unauthorized usage.
- Consistency and standards: Uniform button labels ("Lock", "Open", "Reserve") across lockers.
- Recognition over recall: Users see available actions without remembering anything.

3.6 Techniques

Role-Based Access Control (RBAC):

The system uses RBAC to manage access levels. Admin users have control over all lockers, while normal users can access only their assigned lockers. This ensures that sensitive features and data are restricted to authorized personnel only.

Login Authentication:

Users must authenticate themselves with a username and password to access the system. The passwords are securely stored using hashing algorithms to prevent unauthorized access.

Mobile Interface Development:

A mobile application is used for locker control. It allows users to remotely lock, unlock, and reserve lockers. The app communicates with the locker system using simple HTTP requests and status updates for real-time feedback.

Activity Logging:

Every user interaction (lock, unlock, reserve) is logged with timestamps in an activity log, allowing admins to track actions for security purposes.

Auto-Logout Mechanism:

The system automatically logs users out after 5 minutes of inactivity to prevent unauthorized access and enhance security.

Reservation Timer:

A reservation feature is implemented where lockers can be reserved for a set time (e.g., 10 seconds). This simulates a real-world reservation and auto-release behavior to avoid locker conflicts.

Database Management:

The system uses a simple database to store user credentials, locker statuses, and logs. The database is queried to validate users and monitor locker availability.

CHAPTER 4

RESULTS ANALYSIS AND VALIDATION

4.1 Introduction

The **Home Locker System** project was developed with the goal of providing a smart, interactive, and secure locker solution tailored for home environments. The system was designed to address the increasing need for enhanced home security, easy access to stored items, and seamless integration with modern home automation technologies. Upon successful implementation of the system, it was subjected to rigorous testing and analysis to ensure its functionality, usability, security, and overall efficiency.

The objective of the testing phase was to evaluate how well the system meets the core requirements of the project, including secure user authentication, seamless locker management, real-time activity logging, and effective role-based access control. In addition to functional correctness, the system was also evaluated for its ease of use, ensuring that it is intuitive for all family members to operate, from adults to children and elderly users.

Security was another critical aspect, as the system needed to protect user data and prevent unauthorized access. Stress tests and security audits were performed to identify and mitigate any vulnerabilities. The testing phase also involved assessing the system's overall performance, including response times for user commands (e.g., opening, locking, and reserving lockers), stability under various conditions, and compliance with industry security standards.

This chapter presents the results of the testing process, provides an in-depth analysis of the system's performance, and validates the solution based on a series of pre-defined testing parameters. The findings help confirm the system's ability to function securely, efficiently, and intuitively for home users.

4.2 Functional Validation

Each of the core functionalities implemented in the Home Locker System was tested manually to verify correct working.

Feature Tested	Expected Result	Actual Result	Status
User Login (Admin/User)	Correct authentication and dashboard access	Successfully authenticated and redirected to role-based dashboard	✅ Passed
Role-Based Locker Control	Admin accesses all lockers; user accesses assigned locker	Correct locker visibility and access control observed	✅ Passed
Locker Open/Lock Actions	Locker status changes and	Status updated instantly with correct color	✅ Passed

	updates on screen	coding and buttons	
Reservation Timer	Locker locks for 10 seconds, then auto-releases	Correct timer operation and notification on expiration	☑ Passed
Activity Logging	All locker actions recorded with timestamp	Activity log displays real-time updates accurately	☑ Passed
Auto Logout	Logout after 5 minutes of inactivity	Auto logout successfully triggered and session closed	☑ Passed
Password Change	Update password after login	New password accepted and authentication updated	☑ Passed

4.3 Usability Analysis

The system design followed important heuristic evaluation principles to ensure usability:

- **Visibility of System Status:**
- Locker states (Available/Occupied) are always visible immediately after actions.
- **User Control and Freedom**:
- Users have control over lockers through clear, labeled buttons.
- **Error Prevention:**
- Session timeout ensures automatic logout, preventing unauthorized access.
- **Consistency and Standards:**
- Uniform interface design, consistent button placement, and notifications.
- **Recognition rather than Recall:**

Users do not need to remember locker states or operations; all options are directly visible.

Test users reported positive feedback on ease of use, system clarity, and quick responsiveness.

4.4 Security Validation

Security was a critical aspect of the Home Locker System. The following security mechanisms were validated:

Authentication:

Only registered users could access the system.

Role-Based Access:

Admin could access all lockers; users could only manage their assigned locker.

Password Protection and Change:

Passwords could be updated securely by users.

Auto-Logout:

Session expired after 5 minutes of inactivity, minimizing risk of unauthorized access.

No unauthorized actions were detected during security validation.

4.5 Conclusion of Results

The Home Locker System met all functional, usability, and security goals successfully.

The system behaved reliably under different test cases, provided a simple yet effective user experience, and offered a cost-effective solution to smart home locker management.

The validation process confirmed that the system is ready for real-world deployment in a residential environment, with opportunities for further enhancement using IoT integration.

CHAPTER 5

CONCLUSION AND FUTURE WORK

The **Home Locker System** project successfully developed a smart, secure, and user-friendly solution for modern households. With the growing need for enhanced home security and convenient storage solutions, the system addresses several important concerns faced by homeowners today, including safe package delivery, personal item storage, and overall home security. The system integrates various features like role-based access control, activity logging, reservation timers, and automatic logout, ensuring that it meets security best practices while remaining accessible and easy to use.

Throughout the development and testing phases, the system demonstrated its capability to meet the functional and security requirements set out in the project's objectives. The user authentication and role-based access control mechanisms provided robust security, ensuring that only authorized users could access the lockers and manage the system. The activity log module contributed to effective monitoring, recording every interaction with the lockers for future reference. Moreover, the integration of an auto-logout feature after periods of inactivity further enhanced security by ensuring that users' sessions would be terminated automatically, reducing the risk of unauthorized access.

Usability was another key focus during development. The system was designed to be intuitive, enabling all users, regardless of technical expertise, to interact with it effortlessly. Testing confirmed that the system met this criterion, with users easily navigating through the locker management features, such as opening, locking, and reserving lockers. Furthermore, the inclusion of simple features like password change capabilities and reservation timers ensured that the system could be customized to meet individual user preferences.

Key Achievements:

- **Security**: Robust authentication, role-based access control, and activity logging ensure that only authorized users interact with the system and can monitor all activities securely.

- **Usability**: Simple and intuitive design suitable for users of all technical backgrounds.

- **Efficiency**: Real-time locker management (open, lock, reserve) and auto-logout feature improve security and user experience.

- **Customization**: Features like password change and reservation timers provide flexibility for different user preferences.

- **Monitoring and Auditing:** Detailed activity logs ensure transparent monitoring of locker usage, crucial for both security and troubleshooting.

Future Work and Enhancements: While the system has proven successful, several areas for future improvement exist:

- **Mobile App Integration**: Enhance the mobile interface for better user experience and smoother integration with home automation systems.

- **Voice Control**: Add integration with voice assistants like Amazon Alexa and Google Assistant, allowing users to control lockers using voice commands.

- **Machine Learning:** Implement machine learning algorithms to predict user behavior, which can optimize locker availability and access based on usage patterns.

- **Large-Scale Deployment**: Adapt the system for larger-scale homes, multi-unit apartments, or small businesses, with features for managing multiple lockers across several locations.

- **Real-Time Delivery Integration:** Collaborate with delivery services to automate package delivery to specific lockers, assign lockers dynamically based on availability, and provide real-time tracking updates.

- **Advanced Security Features:** Incorporate biometric authentication and facial recognition for even more secure and seamless access.

- **Scalability and Cloud Support:** Develop a cloud-based system for centralized management of multiple home lockers, which could support remote monitoring, updates, and management across multiple locations.

In addition, future versions of the Home Locker System could include integration with delivery services to allow real-time delivery tracking and automatic locker assignments based on availability. Further testing and feedback from real-world users would help refine the system and ensure it evolves to meet the future needs of smart home security and convenience.

In conclusion, the Home Locker System successfully achieves its goal of providing a secure, efficient, and user-friendly solution for residential storage needs. With ongoing development and future enhancements, the system has the potential to become an integral part of smart home ecosystems, offering unmatched convenience and security for homeowners.

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