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CLOUD BASED REAL ESTATE CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM

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Abstract

The rapid development of digital technology and cloud-based applications has created new opportunities for improving real estate management and strengthening customer relationships. However, many real estate organizations still depend on traditional methods for managing property, customer, payment, and installment information, which can lead to data duplication, manual effort, limited accessibility, and difficulties in maintaining accurate records. This paper proposes a Cloud-Based Real Estate Customer Relationship Management System designed to provide a centralized platform for managing real estate properties and customer-related information. The system provides separate functionalities for Administrators, Employees, Builders, and Customers. Administrators can manage users and property information, while employees can assist with customer and property management. Builders can access relevant property information, and customers can

view their property, payment, and installment details. The system is developed using TypeScript, Node.js, MongoDB, Mongoose, bcryptjs, and dotenv. A systematic development process involving requirement analysis, system design, implementation, testing, and evaluation is followed

Introduction

The rapid growth of information and communication technologies has significantly changed the way businesses manage their operations and interact with customers. Web-based and cloud-oriented applications are increasingly being used to store information, manage transactions, connect users, and improve accessibility to business services. The real estate sector is one of the important areas where digital technology can be applied to improve property management and communication between customers, employees, builders, and administrators. Real estate organizations traditionally depend on manual records, spreadsheets, and separate systems for managing property and customer information. Such methods can increase manual effort, cause data duplication, and create difficulties in maintaining accurate property, payment, and installment records. Customers may also face difficulties in accessing their property and transaction information in an organized manner.

To address these challenges, the Cloud-Based Real Estate Customer Relationship Management System is developed as a centralized CRM platform. The system provides a common digital environment for Administrators, Employees, Builders, and Customers, with role-based management of relevant information. It supports structured management of users, land properties, property status, payments, and

installments using TypeScript, Node.js, MongoDB, and Mongoose.

The system also incorporates secure password management using bcryptjs and environment-based configuration using dotenv. By organizing real estate information into interconnected database models, the proposed system provides a foundation for improving data consistency, reducing manual effort, and supporting efficient customer and property management.

Keywords

Cloud Computing, Real Estate Management, Customer Relationship Management (CRM), Customer Management, Lead Management, Property Management, SaaS, Cloud-Based Application, Database Management, Customer Enquiry Management, Appointment Scheduling, Data Security, Web Application, Sales Management, Customer Relationship Optimization.

Litecture Review

The development of digital technologies and customer relationship management systems has received increasing attention because information technology can improve communication, data accessibility, and business process management in the real estate sector. Cloud-based CRM platforms can provide organizations with centralized access to customer information, property records, and transaction-related data through online systems.

Research related to real estate information systems has highlighted the potential of digital platforms to improve property management and customer interaction. Such systems can help organizations maintain property information in a structured manner, reduce dependence on manual records, and provide better

access to customer and transaction information.

Studies on database-driven business applications have also demonstrated the importance of structured data management. A centralized database can support efficient storage and retrieval of customer and property information, while role-based access can help organizations manage different user responsibilities. Secure password management is also important for protecting user information and maintaining system reliability.

Based on these areas, there is a practical need for systems that combine property management, customer relationship management, payment tracking, and installment management in a single platform. The Cloud-Based Real Estate Customer Relationship Management System addresses this requirement by integrating user and property management with structured payment and installment data using TypeScript, Node.js, MongoDB, and Mongoose.

Problem Statement

Real estate property management often depends on traditional and decentralized methods for maintaining customer and property information. Managing property details, customer records, payments, and installment information manually can increase administrative workload and may result in data duplication or errors. Customers may also face difficulties in accessing their property details and transaction information in an organized manner. Administrators, employees, and builders require a centralized system to efficiently manage property-related information and maintain accurate records. Therefore, there is a need for **a** centralized, secure, user-friendly, and real-estate-oriented CRM platform that

connects different users and organizes property and customer data.

The Cloud-Based Real Estate Customer Relationship Management System **is** developed with the aim of addressing these problems through features such as:

- User registration and profile management
- Role-based user management
- Land and property management
- Property status management
- Customer and employee association
- Payment management
- Installment management
- Secure password management
- Centralized MongoDB database
- Property information management
- Customer transaction record management
- Centralized administration

System Architecture

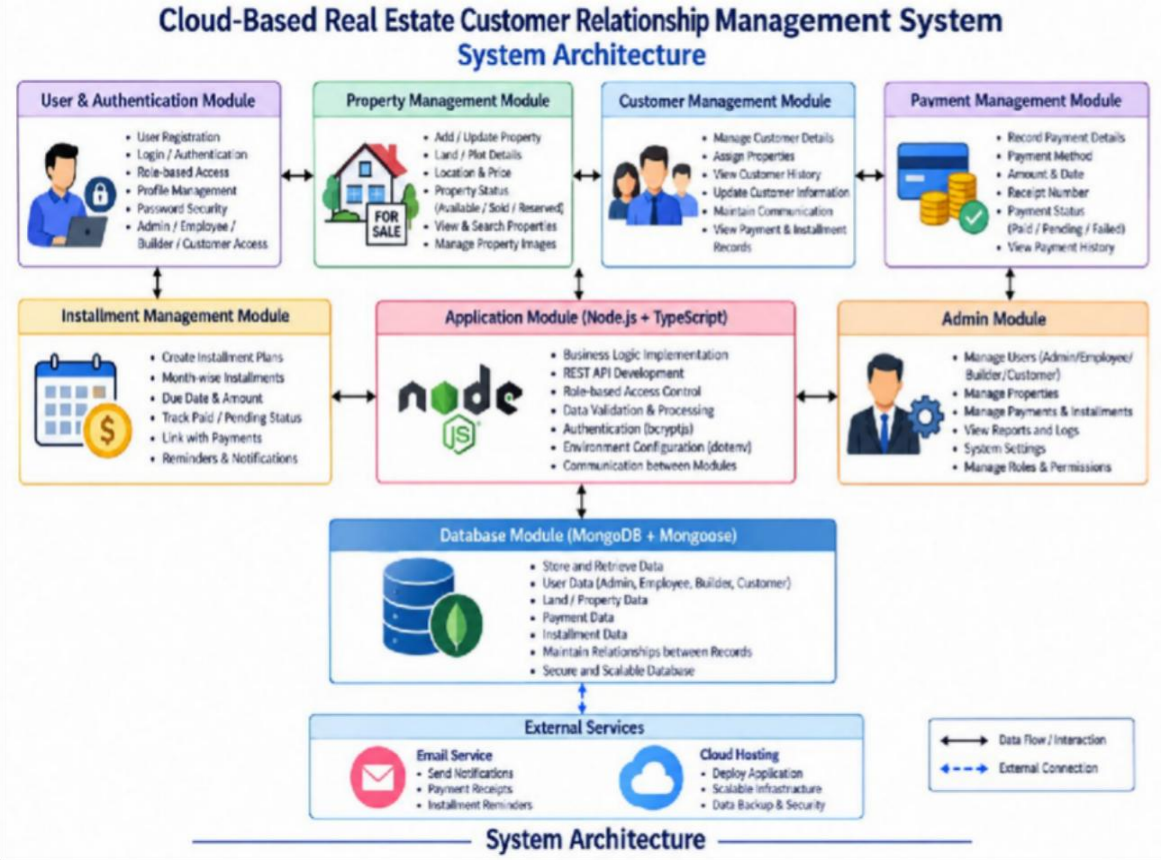
The proposed Cloud-Based Real Estate Customer Relationship Management System consists of multiple integrated modules that work together to provide a centralized platform for managing real estate customers, properties, and transaction information. The User and Authentication Module allows users to access the system according to their roles, including Admin, Employee, Builder, and Customer. The Property Management Module manages land details such as plot number, land size, owner name, price, location, description, and property status such as Available,

Sold, and Reserved.

The Customer and Employee Management Module maintains user information and associates customers and employees with relevant property records. The Payment Management Module is designed to store payment details including property, customer, employee, amount, payment method, receipt number, date, and payment status. The Installment Management Module maintains installment information such as month number, due date, amount, paid amount, payment status, and associated payment records.

The Admin Module provides centralized management of users and property-related information according to administrative responsibilities. The Builder Module provides access to relevant property information, while the Customer Module allows customers to access their associated property, payment, and installment information. The Database Module, implemented using MongoDB and Mongoose, stores and manages User, Land, Payment, and Installment records while maintaining relationships between the entities.

The Application Layer, developed using TypeScript and Node.js, handles the business logic and communication between users and the database. bcryptjs is used for secure password hashing, while dotenv is used for environment-based configuration. This integrated architecture provides a structured foundation for real estate customer relationship management, property tracking, and transaction data management.



Modules

The proposed Cloud-Based Real Estate Customer Relationship Management System is divided into several interconnected modules to provide a structured and centralized real estate management environment. Each module performs a specific function while sharing data with other modules to efficiently manage users, properties, customers, payments, and installment information.

User Module

- User registration and login

- Profile and contact information management

- Role-based access for Admin, Employee, Builder, and Customer
- Access to property, payment, and installment information according to user role

Property Management Module

- Provides detailed land and property information
- Manages plot number, land size, price, location, and owner details
- Updates property status such as Available, Sold, and Reserved
- Maintains customer and employee associations with properties

Payment Management Module

- Conducts aptitude, technical, and placement assessments
- Evaluates student responses
- Stores assessment scores

Customer Management Module

- Generates interview questions using Gemini AI
- Evaluates technical and HR responses
- Provides interview scores and feedback

Property Management Module

- Analyzes student resumes using AI
- Generates ATS score and identifies missing sections
- Provides resume improvement suggestions

Career Readiness Module

- Analyzes and manages customer information, property details, and transaction records

- Maintains customer interactions, property associations, payments, and installments
- Identifies customer requirements and supports efficient property and transaction management

Placement Readiness Module

- Manages property payment and installment information
- Records payment amount, method, receipt number, date, and transaction status
- Tracks installment due dates, amounts, paid amounts, and payment status
- Maintains payment and installment records associated with customers and properties

Admin Module

- Manages users, customers, employees, builders, and property information
- Manages land records, property status, payments, and installment information
- Provides centralized control over CRM data and system settings

Reports and Analytics Module

- Displays property, customer, payment, and installment information
- Generates reports related to property and customer transactions
- Provides insights into property status, payment records, and installment performance

Methodology

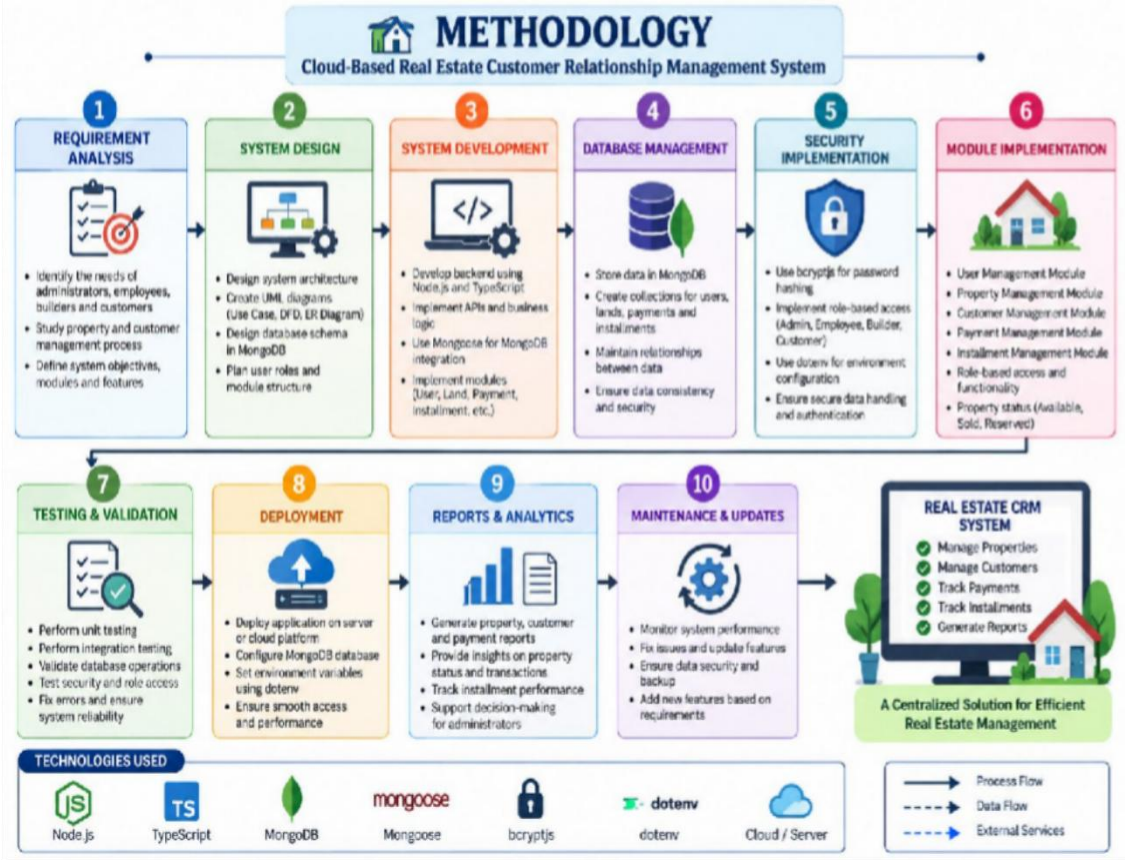
The methodology of the Cloud-Based Real Estate Customer Relationship Management System follows a structured approach to provide an organized, secure, and efficient platform for managing real estate properties and customer information. Initially, user information such as profile details, roles, customer records, employee

details, and builder information is collected through the system. Property information including plot number, land size, price, location, owner details, and property status is then stored in the MongoDB database.

The system provides role-based access for Administrators, Employees, Builders, and Customers, allowing each user to access relevant information according to their responsibilities. The Property Management Module manages properties with statuses such as Available, Sold, and Reserved, while the Customer Management Module maintains customer and property associations. The Payment and Installment Management Modules store payment amounts, payment methods, receipt numbers, due dates, installment amounts, and transaction statuses.

The application is developed using TypeScript and Node.js, with Mongoose used for communication with the MongoDB database. The system uses bcryptjs for secure password hashing and dotenv for environment-based configuration. The collected information is organized into structured User, Land, Payment, and Installment models to maintain data consistency and relationships.

Finally, the system is evaluated through data validation, database operations, security checks, and system testing. The methodology helps reduce manual record management, improve data organization, and provide a centralized foundation for managing real estate customers, properties, payments, and installments efficiently.



Step 1 — Data Collection

- ➢ Student profile, skills, projects, and certifications are collected.
- ➢ Course progress, assessment results, interview responses, and resume information are recorded.

Step 2 — Training and Assessment

- ➢ Students complete videos, notes, and quizzes.
- ➢ Aptitude, technical, and placement-readiness assessments are conducted.

Step 3 — AI-Based Evaluation

- ➢ Gemini AI generates mock interview questions.
- ➢ Student responses are evaluated for technical knowledge, communication, and

confidence.

- ➢ Resumes and career-readiness information are analyzed using AI.

Step 4 — Placement Readiness Calculation

- ➢ Performance data from different modules is combined.
- ➢ Overall readiness score is calculated.
- ➢ Students are classified as Ready, Training, or Not Eligible.

Step 5 — Reports and Feedback

- ➢ Performance reports and certificates are generated.
- ➢ Personalized feedback and improvement recommendations are provided.
- ➢ Administrators can monitor student performance through analytics.

Step 6 — Deployment and Maintenance

- ➢ The Flask application is integrated with MySQL and deployed for use.
- ➢ Courses, assessments, AI configurations, reports, and placement criteria can be updated when required.

Results and Analysis

The developed Cloud-Based Real Estate Customer Relationship Management System was evaluated to assess its functionality, reliability, and effectiveness in managing real estate customer and property information. The results demonstrate that the system provides a structured foundation for managing users, properties, payments, and installment information through a centralized database.

- ➢ Users can be created with different roles such as Admin, Employee, Builder, and Customer, and their profile information is stored successfully.

- Property records including plot number, land size, price, location, owner details, and property status are stored and managed successfully.
- Property statuses such as Available, Sold, and Reserved can be maintained according to the property condition.
- Customer and employee information can be associated with relevant property records using database relationships.
- Payment information including amount, payment method, receipt number, date, and transaction status is structured for effective payment management.
- Installment information including due date, amount, paid amount, and payment status is maintained through a dedicated database structure.
- User passwords are securely stored using bcryptjs hashing, improving the security of user information.
- MongoDB successfully stores and retrieves user, land, payment, and installment information through Mongoose.
- Role-based user management helps organize access and responsibilities for different types of users.
- Data validation helps maintain unique user email addresses, unique plot numbers, and valid role, property-status, payment-method, and transaction-status values.
- The system provides a centralized structure for managing customer, property, payment, and installment information.
- Testing of the implemented database models and data operations confirmed that the major components function according to their

defined structures.

Advantages

- Provides a centralized platform for managing real estate customers, properties, payments, and installments.
- Reduces manual effort and improves the organization of property and customer records.
- Provides role-based access for Admin, Employee, Builder, and Customer.
- Improves property tracking through status management such as Available, Sold, and Reserved.
- Helps maintain accurate and structured payment and installment records.
- Enhances data security through password hashing and environment-based configuration.
- Provides organized relationships between customers, employees, properties, payments, and installments.

Disadvantages

- Provides a centralized platform for managing real estate customers, properties, payments, and installments.
- Reduces manual effort and improves the organization of property and customer records.
- Provides role-based access for Admin, Employee, Builder, and Customer.
- Improves property tracking through status management such as Available, Sold, and Reserved.
- Helps maintain accurate and structured payment and installment records.
- Enhances data security through password hashing and environment-based

configuration.

- Provides organized relationships between customers, employees, properties, payments, and installments.

Applications

- **Real Estate Companies** – Manage customers, properties, payments, and installment information through a centralized platform.
- **Property Developers and Builders** – Maintain property details, availability, sales status, and customer associations.
- **Real Estate Sales Teams** – Manage customer information and track property-related transactions efficiently.
- **Property Management Organizations** – Organize land records and monitor property statuses such as Available, Sold, and Reserved.
- **Customer Service Departments** – Access customer property, payment, and installment information for better customer support.
- **Real Estate Finance Management** – Maintain payment and installment records, including amounts, due dates, payment methods, and transaction status.
- **Small and Medium Real Estate Businesses** – Replace manual registers and spreadsheets with structured digital record management.
- **Cloud-Based Real Estate Operations** – Provide a foundation for centralized access to real estate information across authorized users.

Outcomes

- Centralized Customer Management: Maintains all customer details, contact information, and property preferences in a centralized cloud-

based platform.

- Lead Management: Helps real estate agents record, track, and manage potential customers and their enquiries.
- Property Management: Provides an organized way to store and manage property details, availability, prices, and locations.
- Improved Customer Relationships: Helps agents maintain better communication with customers through timely follow-ups and updates.
- Appointment Scheduling: Allows agents to schedule property visits, meetings, and customer appointments.
- Cloud-Based Accessibility: Enables authorized users to access customer and property information anytime and from anywhere through the internet.
- Time and Cost Efficiency: Reduces manual paperwork and simplifies daily real estate business activities.
- Data Security: Provides secure access to customer information through authentication and access control.
- Report Generation: Generates reports related to customers, property enquiries, leads, and sales activities.
- Better Decision-Making: Helps administrators and agents analyze customer enquiries and property-related information for effective business management

Future Scope

The Cloud-Based Real Estate Customer Relationship Management System can be further enhanced with advanced technologies and additional features to improve its functionality, scalability, security, and usefulness.

- **Advanced Customer Management:** Integrate advanced CRM features to track customer interactions, preferences, enquiries, and property interests.
- **Online Payment Integration:** Integrate secure online payment gateways to allow customers to make property and installment payments digitally.
- **Automated Installment Reminders:** Provide automatic notifications and reminders for upcoming and overdue installment payments.
- **Advanced Property Search:** Introduce filtering and search options based on location, price, land size, property status, and other property characteristics.
- **Real-Time Notifications:** Provide notifications for property status changes, payment confirmations, installment due dates, and customer activities.
- **Advanced Analytics:** Introduce dashboards and analytical reports for property sales, customer activity, payment records, and installment performance.
- **Mobile Application:** Develop Android and iOS applications to allow customers, employees, builders, and administrators to access CRM services through mobile devices.
- **Cloud Deployment:** Deploy the complete application and database on cloud platforms to support remote access, scalability, and centralized management.
- **AI-Based Customer Insights:** Use Artificial Intelligence to analyze customer preferences and property interests and provide relevant

property recommendations.

- **Enhanced Security:** Implement additional security mechanisms such as multi-factor authentication, audit logs, data encryption, and improved access control.

Conclusion

The Cloud-Based Real Estate Customer Relationship Management System provides an organized and centralized platform for managing real estate customers, properties, payments, and installment information. The system integrates user management, property management, customer management, payment tracking, and installment management within a single application. The use of TypeScript, Node.js, MongoDB, and Mongoose provides a structured approach to storing and managing real estate information. Security is supported through bcryptjs for password hashing, while dotenv is used for environment-based configuration. Customers, employees, builders, and administrators can be managed through defined roles and database relationships. The system helps reduce dependence on manual records and improves the organization of property and customer information. Testing of the implemented components demonstrated that the defined database models, validation rules, relationships, and data operations function according to their intended structure. Overall, the Cloud-Based Real Estate Customer Relationship Management System provides a practical foundation for modern real estate data management. Future enhancements can include complete REST API integration, online payment processing, automated installment reminders, notifications, advanced reports and analytics, and full cloud deployment.

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