Real Estate Pro – Website for Property Search

GE19612 - PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP PROJECT REPORT

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BONAFIDE CERTIFICATE

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ABSTRACT

By connecting buyers and sellers (or agents) in a smooth and effective manner, our website makes real estate purchases and sales easier than ever. Setting up viewing schedules, uploading images and videos, and updating property listings are all easy tasks for agents and sellers. Customers may now plan visits that suit their needs and view the most recent information at all times. Buyers can explore properties with detailed media, such as images and videos of the house and the neighbourhood, thanks to a seamless, user-friendly experience. They can use the platform to compare houses according to location and pricing, enabling them to make informed, cost-effective choices.The website provides you with all the information you require to feel secure in your decisions, whether you're searching for a new residence or an investment. One of the most notable features is the integrated chat box, which facilitates quick and simple contact between buyers and sellers. Customers don't have to leave the platform to arrange viewings, ask questions, or obtain additional information. By bringing the parties together in one location, this feature helps to eliminate the typical back and forth. Together, these capabilities make the website an easy-to-use and practical way to handle real estate transactions. By facilitating communication, property viewing, and speedy decision-making, it reduces the inconvenience of conventional procedures in real estate. This website offers everything you need to make the transaction easy, quick, and stress-free, whether you are buyingselling.

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LIST OF ABBREVIATIONS

S. No	ABBR	Expansion
1	AI	Artificial Intelligence
2`	API	Application Programming Interface
3	AJAX	Asynchronous JavaScript and XML
4	ASGI	Asynchronous Server Gateway Interface
5	AWT	Abstract Window Toolkit
6	BC	Block Chain
7	CSS	Cascading Style Sheet
8	DFD	Data Flow Diagram
9	DSS	Digital Signature Scheme
10	GB	Gradient Boosting
11	JSON	JavaScript Object Notation
12	ML	Machine Learning
13	RF	Random Forest
14	SQL	Structure Query Language
15	SVM	Support Vector Machine

CHAPTER 1

INTRODUCTION

1.1 GENERAL

The real estate sector has experienced a dramatic transformation due to the widespread adoption of internet technologies. Traditionally, property transactions were facilitated by real estate agents through in-person meetings, printed brochures, and telephone negotiations. However, the shift toward digital platforms has revolutionized how buyers and sellers interact. Online real estate platforms now offer instant access to thousands of property listings, virtual tours, and price comparisons, all from the comfort of a user's home. Despite these advancements, several gaps remain in existing systems, such as a lack of real-time communication tools, limited personalization, and outdated listing data.

"Real Estate Pro" addresses these limitations by introducing a seamless, user-centric platform where buyers and sellers can interact, schedule viewings, and make informed decisions based on up-to-date property data. The platform is designed to reduce friction in real estate transactions by offering intuitive navigation, real-time updates, and media-rich property listings. By bridging the information gap and enabling smoother communication, this project aims to enhance the overall experience for users, providing a comprehensive and accessible solution to modern realestatechallenges.

1.2 OBJECTIVE

The objective of the "Real Estate Pro" project is to design and develop an intelligent, comprehensive, and user-friendly web application that transforms the traditional real estate process into a modern, efficient, and accessible experience for all stakeholders. This platform aims to address the existing inefficiencies in the real estate domain by integrating advanced features such as real-time property listings, rich multimedia content, dynamic search filters, and secure communication tools into a single responsive system. The system will streamline property discovery, enhance buyer-seller interactions, and significantly reduce the delays caused by manual coordination, outdated listings, and lack of direct communication channels. It focuses on creating a seamless user experience through intuitive interface design and real-time synchronization of data, allowing users to browse, compare, and manage properties with ease. The platform will also enable scheduling of property viewings directly through the application, provide personalized recommendations based on user preferences, and support secure login and data protection to ensure user privacy. Overall, the objective is to eliminate the barriers in conventional real estate transactions and provide a technologically advanced solution that can scale with market demands while promoting transparency, efficiency, and convenience.

1.3 EXISTING SYSTEM

Some online platforms do exist, but they often lack features such as real-time communication, scheduling, and personalization. They depend on manual updates by agents and do not provide users with immediate insight into property availability or updates. These gaps create a disconnect between buyers and sellers, extending the sales cycle and reducing user satisfaction. This project proposes a centralized, intelligent platform that resolves these limitations, offering a streamlined user experience with enhanced communication, data accuracy, and search capabilities.

CHAPTER 2
LITERATURE SURVEY

[1] Real estate listings and search features on the internet Traditional real estate deals frequently involved going to properties in person or depending on agents to give information about the properties. Property listings are now more widely available to a wider audience because to the growth of online real estate platforms. Digital platforms have streamlined the property search process, giving purchasers a convenient option to select listings based on price, location, and other preferences, according to studies by Hernandez et al. (2018). Additionally, these platforms enable sellers to instantly change property facts, guaranteeing that listings stay up to date and pertinent.

[2] Integration of Media and Virtual Tours Real estate transactions have changed dramatically as a result of the incorporation of excellent images, videos, and virtual tours. According to research by [Liu & Chen, 2020], virtual tours can assist buyers in making well-informed purchases by offering a more immersive picture of homes. By eliminating the need for in person visits and allowing purchasers to evaluate the property from the comfort of their homes, virtual tours and photo galleries streamline the process. The move to media-rich listings has been essential to enhancing the purchasing experience, particularly for individuals who are unable to physically inspect properties.

[3] Comparing Prices and Searching by Location Comparing property prices across different areas is one of the major hurdles for buyers, and it may be challenging and time-consuming. [Choi & Lee, 2019] stress the importance it is to incorporate price comparison tools into real estate platforms so that purchasers may evaluate properties that fit their budget. These systems assist purchasers in making better judgments by providing a thorough analysis of real estate costs across multiple neighbourhoods, which may result in happier clients and speedier sales.

[4] Tools for Communication in Effective Transactions Digital real estate platforms

have brought about a number of important advances, one of which has been direct connection between buyers and sellers. Integrated messaging systems in real estate apps facilitate quicker responses to questions and lessen the communication gap between parties, according to a study by Smith and Brown (2017). This integration facilitates a more seamless transaction process by enabling purchasers to arrange viewings, negotiate conditions, and ask questions all within the site. Additionally, these systems give buyers and sellers a more responsive environment for interaction by providing real-time communications.

[5] The research article "A Real Estate Valuation Model Using Boosted Feature Selection" by Kankawee Chanasit and others suggests a better approach to real estate value estimation when data is incomplete or high-dimensional. The simple Artificial Neural Networks (ANNs) are excellent predictors of complex, non-linear interactions but may be un-interpretable and get worse as the number of useless features becomes excessively large. To overcome this, authors propose a new **Boosted Feature Selection** approach by combining AdaBoost.R2 (boosting algorithm) with an **Improved Garson's Algorithm (IGA)** as feature sensitivity analysis. It selects the most significant features one at a time by tuning their weights in terms of prior prediction errors. It was tested on the synthetic data sets (Friedman data set) as well as on actual data sets (Boston Housing, Home2nd of Thailand, and Zillow Prize data). Experimental outcome proved that proposed technique was far better than conventional feature selection methods like Recursive Feature Elimination (RFE), RReliefF, and Mutual Information (MI). It indeed did simplify the models, improved the prediction quality, but with fewer errors. Most notably, the approach allowed the most dominant traits in setting housing prices to be established, providing insight into different property markets. In practice, the model performed quite adequately by placing in the bottom 24% of the Zillow Prize competition, which is a sign that it could be employed practically. The study also illustrated that the ANN model, with appropriate feature selection, can outperform conventional tree-based models such as XGBoost, particularly under time-evolving data patternsDesigning Interfaces and User Experience The user interface (UI) and user experience (UX) design of any real

estate platform are critical to its success. The usability and appeal of online real estate platforms are greatly enhanced by sensible UI/UX design, according to a study by [Williams & Nguyen, 2021]. Easy-to-use platforms with uncomplicated communication tools, obvious search filters, and basic property viewing options increase customer happiness and engagement. Regardless of their level of technological proficiency, buyers and sellers may both utilize the site effectively thanks to this emphasis on seamless design.

[6] The paper "Developing a Mobile Application for Smart Real Estate Information" by A. C. Aydinoglu and R. Bovkir outlines the process of creating a mobile GIS based application for the management of urban real estate information. Land administration will be based on robust, complete, and interoperable land and property information. Geographic Information Systems (GIS) offer effective means for spatial analysis in the form of enhanced land assessment, urban planning, and investment. Researchers created a mobile application, Smart Real Estate, by combining multiple datasets of environmental characteristics, public facilities, cultural characteristics, transport, land use, and socio-economic variables. Six theme groups contain twenty parameters like schools, health centers, transport stops, parks, and socio economic variables like people and education. GIS analysis like slope, aspect, density, and Euclidean distance calculation was utilized to create thematic surfaces. Fuzzy logic was treated similarly for dealing with uncertainty in everyday life.

[7] The article "Public Real Estate Management System in the Procedural Approach – A Case Study of Poland and Slovakia" by Marta Gross, Ryszard Źróbek, and Daniela Špirková acknowledges research on public real estate management in Poland and Slovakia from the procedural approach. The research seeks to establish how the concepts of good governance can help public real estate management systems. Although specific to individual countries, both are comparable in nature because both are post-socialist. The research compares three best practices: sale of public assets, registration of rights, and public-private partnerships (PPPs). Sale of assets has to be executed by open procedures in Poland, whereas in Slovakia empty state buildings have to be disposed off first to public institutions. The Polish system was more open

as well as anti-corruption policy. However, the Slovakian system performs better with more online services and faster procedures despite its faster registration process in Poland. In the case of PPPs, Poland precedes Slovakia because it has more dynamic projects, more liberal legislation, and more entrenched political support, primarily for the construction of infrastructure. It follows secondly by Slovakia because it has delayed implementation of its projects, along with weak political backing. The 0–1 system of scoring was utilized with the goal of comparison of both nations based on indices of efficiency worth 13 and 8, respectively, for Poland and Slovakia.

[8] The working paper "Searching for Property with a Smartphone – Trends, Promises and Perspectives" by Veronika Lang and Peter Sittler discusses the increased relevance of smartphone apps in searching property in the German-speaking nations. As there has been increased use of smartphones and apps, property business has undergone a sudden shift to mobile technology. The study compares the availability, content, functionality, and capability of Austrian, Swiss, and German real estate applications and contrasts the two Austrian applications- immobilien.net and wohnnet.at--in complete detail. The study determines that iOS is largest in size with more real estate applications to use than Android systems. None of the applications have Augmented Reality (AR), and geo-coding of the properties is absent in most, and only 10% of Austrian listings of properties are geo-coded. The applications were checked on operating systems, number and quality of property information, degree of information, ease of use, and property types available. Testing identified immobilien.net as targeting Vienna inner suburbs, with AR capability but only with very limited Austro-wide coverage. Wohnnet.at has wider Austro coverage with no AR functionality. Both suffered from partial address and restricted search functionality customisation.

[9] The article "A Systematic Review of Smart Real Estate Technology: Drivers of, and Barriers to, the Use of Digital Disruptive Technologies and Online Platforms" authored by Fahim Ullah, Samad M. E. Sepasgozar, and Changxin Wang provides insights about how digital disruptive technologies influence the real estate sector. The research tackles 213 papers comprehensively to explore the application of nine mega technologies—drones, IoT, cloud computing, SaaS, big data, 3D scanning, wearable

technology, VR/AR, and AI/robotics—the Big9 for Smart Real Estate (SRE) construction. SRE is explained along the Big9 dimensions of technology innovation, user centricity, and sustainability. The analysis selects key stakeholders—consumers, agents and associations, regulators and government, and support industries—and follows the path of how digital technologies address their needs to avert post purchase or rental regret. Technology Adoption Model (TAM) is adapted in order to evolve a conceptual model that links Big9 technologies, online dissemination platforms, and needs of stakeholders. The research acknowledges that although property has a gigantic market, it trails all companies in exploiting technology. It focuses on developing sophisticated distribution platforms such as websites, mobile applications, and social networking platforms to get to as many consumers as possible with sophisticated property information.

[10] Mingzhao Li, Zhifeng Bao, Timos Sellis, Shi Yan, and Rui Zhang's "HomeSeeker: A Visual Analytics System of Real Estate Data" presents HomeSeeker, a visual analytics system that can help homebuyers to search for and locate real estate markets. HomeSeeker is proposed as a reaction to counteract some typical drawbacks of current commercial systems like a deficiency of geo related information, insufficient learning support on local markets, and insufficient multidimensional comparative support. HomeSeeker integrates heterogeneous data sources such as property attributes, distance to transit, school districts, amenities, and populations. HomeSeeker can learn incrementally for new users and handles natural, coherent visualizations. The most significant visualization tools in HomeSeeker are choropleth maps, dot maps, glyphs on maps, several coordinated views, parallel coordinates, geo-coded scatter plots, boolean tables, image cards, word clouds, and spider charts. System architecture facilitates navigation within regions, suburbs, and properties at profile-based, suburb-level, and property-level views. Properties may be filtered against and compared against user-specified requirements such as price, amenity proximity, and school grade. Actual case studies illustrate that users, either investor or first home buyer, may choose suitable properties by iteratively filtering candidates against specific requirements

[11] Article "Real Estate Politik: Democracy and the Financialization of Social Networks" by Joanne Cheung describes how social networking site business models erode the ideal of democracy. Cheung draws a parallel between commodification of human land for money and of human attention for corporate profit through such sites as Facebook. Spaces are construed to refer to privately owned public space where private interest rather than public concern prevails, i.e., property development for pecuniary gain maximisation. Accounts explain how platforms monetize social interaction (liking, sharing) to generate user engagement through mechanisms concealing moral responsibility and stripping users of agency. Platform-based business models commodify mundane conversation, amplifying system polarization and inequalities. Algorithmic reward systems encourage content that supports confirmation bias and limiting users' exposure to dissent, eroding the basis for democratic debate. Cheung discloses contrasted histories of extractive platform business model and colonial land use, and city design codes, land trusts, and Indigenous land control as templates to reconfigure digital space. The expert boundaries are forced to be reworked on democratic lines, the communal ownership models negotiated out of corporate monopolies, and the extraction stewardship.

[12] The article "Real Estate Recommendation Approach for Solving the Item Cold Start Problem" by Jirut Polohakul, Ekapol Chuangsuwanich, Atiwong Suchato, and Proadpran Punyabukkana deals with new real estate unit recommendation in web applications. The item cold-start problem arises when there are no new units that have interaction history and thus are less suitable for using usual recommendation techniques. The authors suggest a new solution using a content-based model and a session-based recommendation algorithm to address this problem with good performance for warm-start items. Their approach is trained in a session-based manner altered by accounting for sequential user behavior and context to predict user profiles. They utilize NARM's attention mechanism and the latent cross (LC) method to effectively process contextual features. Following the prediction of a user profile, an appropriate filtering module utilizing a weighted cosine similarity nearest-neighbors algorithm suggests suitable properties. The used dataset is comprised of more than 13

million interactions of Thai real estate search engine. Experimental findings indicate that the system proposed works amazingly well in cold-start and warm-start situations. While it will not be a best performer in either case individually, it is a good compromise by outperforming most of the conventional methods which operate on a single dimension. Comparisons with baseline models of Item-KNN, NARM, STAMP, and content-based models illustrate the challenge of doing extremely well on both cold- and warm-start recommendation at the same time.

[13] The article "A Real Estate Valuation Model Using Boosted Feature Selection" by Kankawee Chanasit et al. presents a novel method of real estate price estimation using an Artificial Neural Network (ANN) with boosted feature selection. Conventional real estate information such as Thailand data usually are sparse but high-dimensional data, and therefore feature selection is very crucial. Authors blend the boosting algorithms with the enhanced Garson's algorithm (IGA) for the sensitivity analysis to incrementally choose significant features. The strategy is designed to preserve interpretability with improved prediction ability and lower computational cost. Friedman dataset real and synthetic datasets (Boston Housing, Home2nd, and data for the Zillow Prize competition) were utilized during analysis in the research. Experiments indicate that their model always performs better compared to other standard feature selection methods such as RFE, RReliefF, and Mutual Information (MI) to identify crucial features with more accurate prediction errors. Their model ranked in the top 24% of the Zillow Prize competition. The model integrates IGA and AdaBoost.R2 in a way that ANN dynamically adjusts feature selection parameters based on sample error. BIGA technique suggested learns intrinsic informative features which are capable of dealing with local variation and data anomaly. Findings indicate feature selection improves the performance of ANNs over tree models, particularly in noisy market trends. [14] Managing Viewing and Scheduling A logistical problem in the past has been scheduling property viewings and making sure that buyers and sellers agree on a time. Real estate platforms with scheduling systems built in make it simpler for buyers to view properties at times that work for them and for sellers to handle numerous inquiries (Evans et al., 2018). The purchasing process is sped up by

automated scheduling technologies, which also guarantee that viewings are scheduled without conflict and minimize human error.

[15] Real Estate Recommendation Method for Solving the Item Cold-Start Issue is a paper that explains how to solve one of the most common issues in recommendation systems when there are new items and sparse interaction data. For the topic of real estate, the research explains how traditional systems perform poorly when users start developing interest in new and old properties at the same time. The authors recommend a hybrid approach using a session-based recommendation model, content filtering, and context to solve cold-start and warm-start scenarios quite effectively. The method predicts a session-based to next interacted item encoded feature prediction for user profile enabling without identifiers. The model uses sequential click streams and capitalizes on context features like location or device type via the latent cross (LC) approach. The model proposes the application of a nearest neighbors strategy and weighted cosine similarity to predicted user profiles. Performance is measured in terms of recall metrics Recall@K and MRR@K against a collection of reasonable cold-start-warm-start trade-off baselines. Experiments are performed on real data on a Thai property portal, with over 13 million interactions, 3 million users, and nearly 7,000 items.

[16] The article "An End-to-End Named Entity Recognition Platform for Vietnamese Real Estate Advertisement Posts and Analytical Applications" targets problems of getting structured information from Vietnamese real estate ads. The article proposes an end-to-end platform that can harvest, clean, process, and analyze real estate data. The design consists of two primary modules: Noise Filtering and Named Entity Recognition (NER). The Noise Filtering module removes low-quality posts using a highly optimized PhoBERTlarge model with an F1 score of 0.8697. The NER module retrieves effective features like property type, location, and price from PhoBERT-based transformer high performance posts. The above modules combined help to produce a high-quality dataset, addressing noisy, inconsistent, or incomplete listings problems of real estates. The used training data are 24,695 Vietnamese real estate listings on large websites, labeled based on professional guidelines using Doccano.

Approximately 58.3% of samples were applied for NER training in preprocessing. Some of the challenges in the Vietnamese language such as the utilization of abbreviations, free-text style, and the entity boundary challenge are explained in the paper. Experimental outcomes show that transformer-based models perform better than conventional methods like BiLSTM-CRF for this problem. PhoBERT models with Vietnamese data only attains the best overall performance. Ablation analysis also shows that the noise filtering module added further enhances the NER performance up to 13.81%. Production deployment of the platform includes auto-pipelines in Apache Airflow and hosting over PostgreSQL and Redshift databases. Superset dashboards are implemented within the platform to display trends like property distribution per region, price bands, demand types, and property types. The system processed more than 400,000 records within production and support data-driven decisions within real estate firms. Finally, the paper also mentions some limitations in convenience of acquisition of exact address details and potential system weaknesses which are expected to emerge in the future. Future research aims to maximize module performance as well as expand the amount of information that is recovered.

[17] Paper "Explainable and Fair AI: Balancing Performance in Financial and Real Estate Machine Learning Models" forms a framework by combining fairness and transparency with ML models such as LightGBM and XGBoost for loan decisions and prediction of house prices. The study identifies towards the absence of practices for fairness and explainability in finance and property sectors where discriminatory models have profound societal consequences. The study uses fairness techniques such as Calibrated Equalized Odds and Intersectional Fairness coupled with explainability tools such as SHAP (SHapley Additive exPlanations) and Partial Dependence Plots (PDPs). The authors conducted a large number of experiments on publicly available datasets with fairness constraints while not significantly harming model accuracy. LightGBM was found to be slightly better than XGBoost in the trade-off between fairness and accuracy. Data preprocessing involved cleaning, feature engineering, and normalization. The models were tested on accuracy, precision, recall, F1-score, and fairness measures such as Disparate Impact and Equal Opportunity Difference. SHAP

and LIME methods gave global and local explanations of predictions that pointed out major features such as Credit History and Applicant Income for loan approval and Overall Quality and Living Area for house prices. The findings highlight that the addition of fairness constraints marginally impacts performance but yields humongous ethical gains. The article also illustrates how SHAP and LIME complement each other, where SHAP provides global information and LIME provides local interpretability. New studies are applying fairness-aware learning in real estate, comparing fairness-led LightGBM and XGBoost models, preventing the compromise between fairness and accuracy, and proving the scalability of fairness-aware AI systems. It also suggests directions for future research in the form of adversarial fairness techniques and fairness-aware explanation tools.

[18] The paper "Foundational AI in Insurance and Real Estate: A Survey of Applications, Challenges, and Future Directions" offers an extensive overview of applications, challenges, and future directions of Artificial Intelligence (AI) in insurance and real estate. It points to the intensifying influence of AI through technological developments like machine learning, deep learning, natural language processing (NLP), and computer vision. Applications include risk assessment, fraud detection, property valuation, dynamic pricing, to smart building management, all promoting efficiency and decision-making. Among the most crucial issues that are realized are interpretability of the model, ethics and compliance, scalability, and data quality. The article presents the argument that while AI is forecasted to revolutionize sectors, sectors will have to grapple with privacy threats, data bias used to train the system, and challenges faced when trying to integrate AI in current systems. It points to regulatory measures such as the Fair Housing Act and GDPR that affect the implementation of AI. Future directions are dynamic pricing with reinforcement learning, explainable AI for regulatory compliance, and smart sustainable buildings with AI. Interfacing with technologies such as IoT, AR/VR, and blockchain will further drive these industries. Future research directions the paper suggests are standardizing datasets, generalizing models to markets better, making algorithms fairness aware, and increasing interdisciplinary collaboration between technologists,

ethicists, and lawyers. It generates value primarily by concentrating attention onto insurance and real estate markets, plugging gaps such as absence of standardized benchmarks, domain explainability needs, and transferability across markets. The paper suggests that responsible AI should be developed on the pillars of transparency, ethical behaviour, good governance, and frequent skill refreshests. Overall, this survey emphasizes that sustainable, explainable, and fair AI solutions have the potential to bring tremendous power to insurance and property competitiveness and innovation while ensuring societal and moral norms. It provides a guide to scholars, researchers, and lawmakers on the way AI's future value added to the industry can affect.

[19] The article "Optimal Real Estate Pricing and Offer Acceptance Strategy" by Gonen Singer and Eugene Khmelnitsky discusses the issue of the optimal expected revenue of the seller, under a series of offers acceptance in real estate markets. Contrary to static models with stable offers distributions, the authors propose a dynamic model in which listing price adjusts the quantity and offer distribution. The seller at every level of selection posts a listing price, receives bids, and chooses to take the highest bid or persist, incurring holding and communicating costs. Optimal stopping is applied in the model in listing price and holding-back price strategies. Increasing the listing price statistically achieves the impact of increasing amounts of offers but decreasing offer rates, placing a price-demand trade-off. The authors construct a threshold-based optimal policy for both finite and infinite time horizons. For the infinite time horizon, a stationary policy is constructed in which the reservation price is calculated by maximizing expected revenue with equalization of marketing costs. For the finite time horizon case, policies are repeatedly updated at each stage as the deadline for sales draws near. Numerical value calculations of market value estimates imply that with higher offer spread (i.e., with more distinct assets), listing and reservation prices should be greater from the perspective of the sellers. Sellers can charge more as there is greater market demand, and sellers' holding costs being greater imply selling faster at lower prices. Validation of the model is done through an actual case study of Ames house prices in Iowa. Linear regression is applied to predict market values and determine the best reservation and listing prices as per them. Results show

sellers' gains due to dynamic adjustment of strategies with market feedback and time constraints. The study shows that a theory-of optimal-stopping-based dynamic pricing and acceptance policy yields significantly better performance for the seller. Future research can investigate non-stationarity in the offer distribution and learning based adaptive selling policies to achieve optimal real estate selling policies.

[20] The paper "Can Web Search Queries Predict Price Change on the Real Estate Market?" by Anna Baj-Rogowska and Nina Rizun deals with the possibility of utilizing web search volume, as discovered with the help of Google Trends Search Volume Index (SVI), in order to predict changes in real estate prices, or, at least, on the Polish market. It combines cross correlation analysis and machine learning (ML) classification techniques to predict house price rises, falls, or none. Unlike other approaches, the research uses SVI statistics in "credit to purchase property" and "property" to train ML models and shows it is possible by utilizing online search behaviours as a single predictor variable that has adequate time-lag to inform decision-making. The approach involves gathering Google Trends and Polish House Price Index (HPI) data from 2011-2019, timestamp difference adjustment, and expert selection and cross-correlation methods for cleaning keywords. Cross-correlation analysis identifies that there exists a four-month lag window under which search activity precedes price change.

CHAPTER 3

PROPOSED SYSTEM

3.1 GENERAL

The proposed system, "Real Estate Pro," is an advanced web-based platform designed to transform the way real estate transactions are carried out. Unlike conventional property dealing methods that rely heavily on face-to-face interactions, paperwork, and third-party intermediaries, this system provides a comprehensive digital environment where buyers, sellers, and agents can connect, communicate, and close deals with minimal friction. The platform is created with a strong focus on user convenience, accessibility, and efficiency by integrating tools for listing management, property search, personalized recommendations, and real-time messaging.

At its core, the system addresses several major challenges observed in existing real estate applications, including scattered information, lack of personalized filters, inefficient communication channels, and slow update cycles. Real Estate Pro solves these issues by offering a centralized hub where listings are updated in real-time, users can apply dynamic filters based on preferences such as price range, property type, and location, and both parties can interact instantly through an integrated chat interface. This drastically reduces the turnaround time for inquiries, scheduling visits, and finalizing deals.

From a technological perspective, the platform leverages modern web development frameworks and tools that ensure responsive design, scalable architecture, and secure handling of user data. It supports interactive media content, including high-resolution images, videos, and 360-degree virtual tours, allowing buyers to explore properties remotely in detail. Additionally, the system is equipped with robust backend services that ensure smooth data transactions, fast retrieval, and synchronization across user sessions.

Another notable feature of the proposed system is its emphasis on accessibility. The platform is optimized for multiple device types, including desktops, tablets, and smartphones, making it easy for users to engage with the system from anywhere. It also considers the inclusion of features like user role management, availability calendars, property tracking, and notification systems that keep users updated with the latest listings and activity related to their interests.

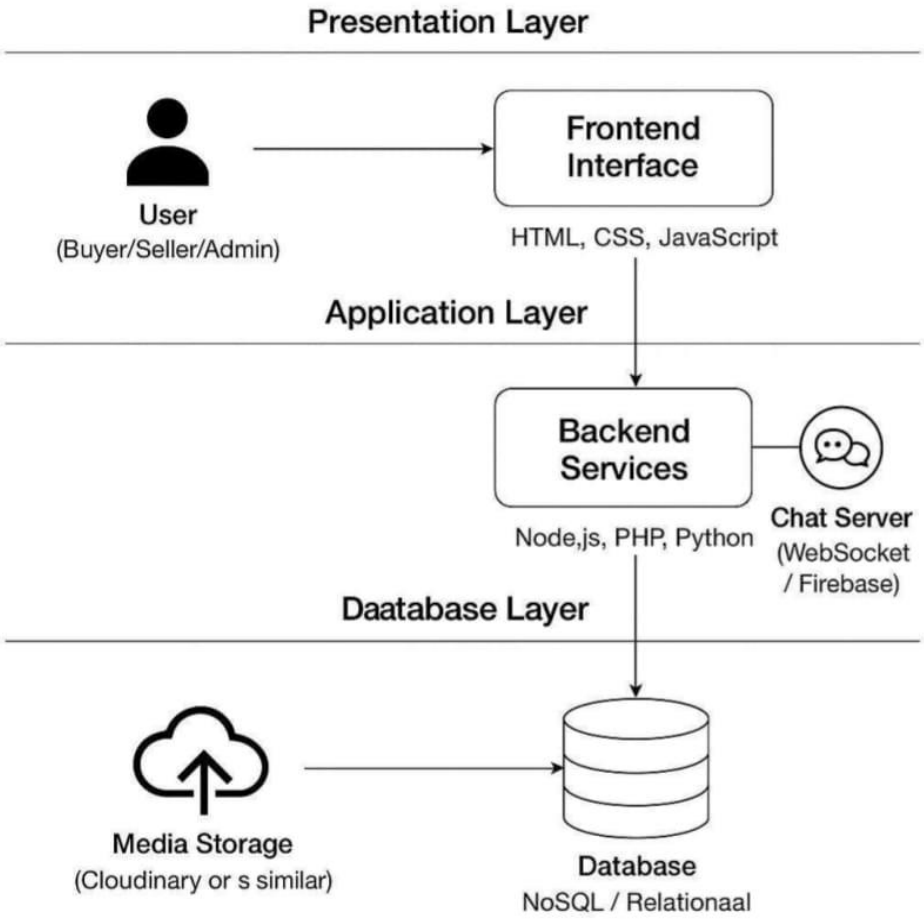
In summary, Real Estate Pro is a holistic solution tailored to modernize the real estate market through the integration of smart technologies, real-time services, and a user-first design approach. By bringing together powerful tools in one intuitive platform, it empowers users with all the resources they need to confidently navigate the property landscape.

3.2 SYSTEM ARCHITECTURE DIAGRAM

The architecture of the "Real Estate Pro" system is built upon a robust, multi-tier model that separates the application into three core layers—presentation, application, and data. This structure promotes modularity, scalability, and security, allowing for efficient management of user activities, data flow, and real-time communication.The **presentation layer** is implemented using HTML5, CSS3, and JavaScript, delivering a responsive and user-friendly interface. It enables users to perform actions such as property searches, viewing listings with rich media, updating profiles, and engaging in real-time chat. This layer ensures accessibility across a wide range of devices including desktops, laptops, tablets, and smartphones.The **application layer**, developed using Node.js and Express.js, acts as the brain of the system. It processes requests, handles the business logic, performs validations, and facilitates communication between the frontend and the database. All APIs used in the system are designed to be RESTful, ensuring secure and efficient data exchange.

The **data layer** uses MongoDB, a flexible NoSQL database that stores property listings, user data, messages, and scheduling information. Its dynamic schema design allows for rapid development and scaling. Indexing and querying mechanisms ensure quick retrieval of property data and communication history.

Fig 3.1: System Architecture



3.3 DEVELOPMENTAL ENVIRONMENT

3.3.1 HARDWARE REQUIREMENTS

To ensure the proper performance and reliability of the Real Estate Pro platform during both development and deployment stages, a basic yet efficient hardware setup is required. The system is designed to be lightweight and browser-based, which means it can run smoothly on standard hardware configurations. However, to facilitate smooth development, debugging, and testing of various features such as media uploads, real-time messaging, and responsive front-end interfaces, the following hardware specifications are recommended:

Table 3.1 Hardware Requirements

COMPONENTS	SPECIFICATION
PROCESSOR	Intel Core i5 or higher
RAM	8 GB RAM
POWER SUPPLY	+5V power supply
DISPLAY UNIT	LED Display / Projector
AUDIO INPUT	High-quality Microphone

3.3.2 SOFTWARE REQUIREMENTS

Software requirement defines the tools, platforms, and frameworks required to develop and execute the system. This encompasses both backend and frontend components, NLP and gesture mapping AI libraries, and rendering engines for animation of the avatars.

Table 3.2 Software Requirements

COMPONENTS	SPECIFICATION
OPERATING SYSTEM	Windows 10 / Mac os or linux
FRONTEND	HTML5,CSS,JAVASCRIPT
BACKEND	JAVA
DATABASE	SQL
BROWSER	GOOGLE CHROME
VERSION CONTROL	GIT
TESTING TOOLS	POSTMAN

3.4 DESIGN OF THE ENTIRE SYSTEM

3.4.1 ACTIVITY DIAGRAM

The activity diagram for the Real Estate Pro platform provides a visual representation of the primary user interactions within the system. It helps in understanding the workflow and logic involved from the moment a user accesses the platform to the completion of tasks such as property search, viewing scheduling, .

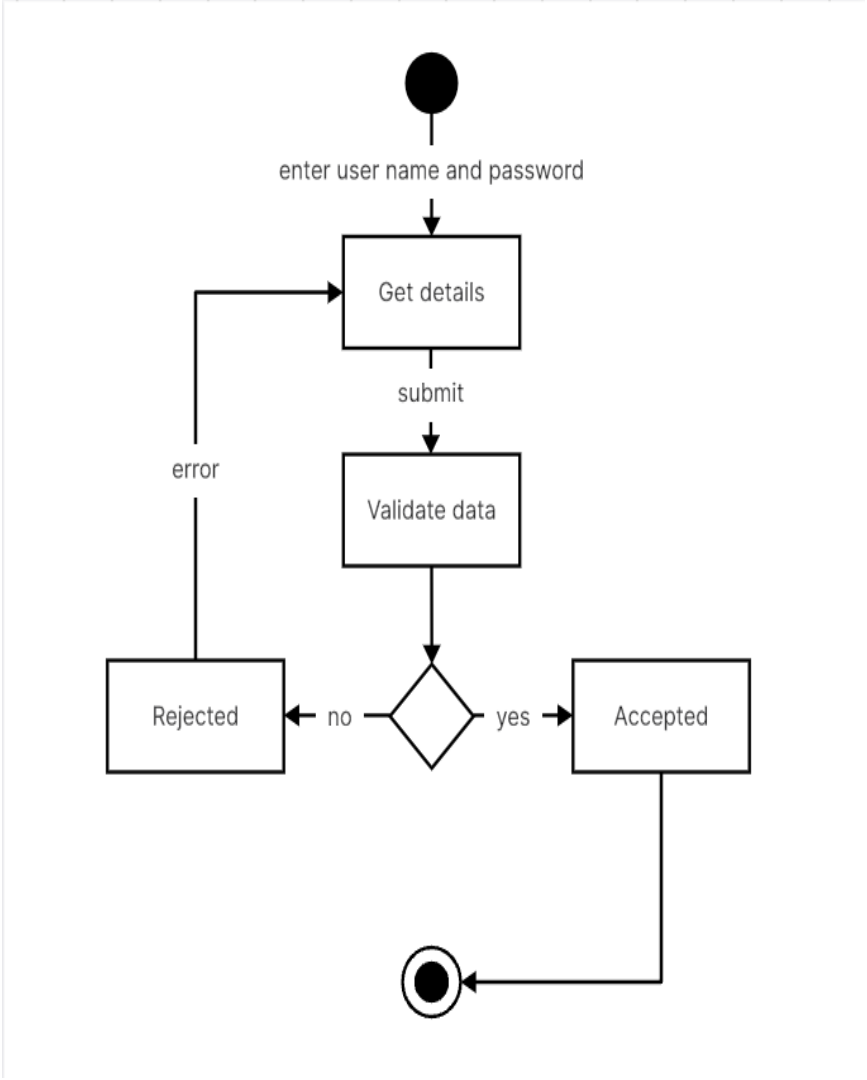


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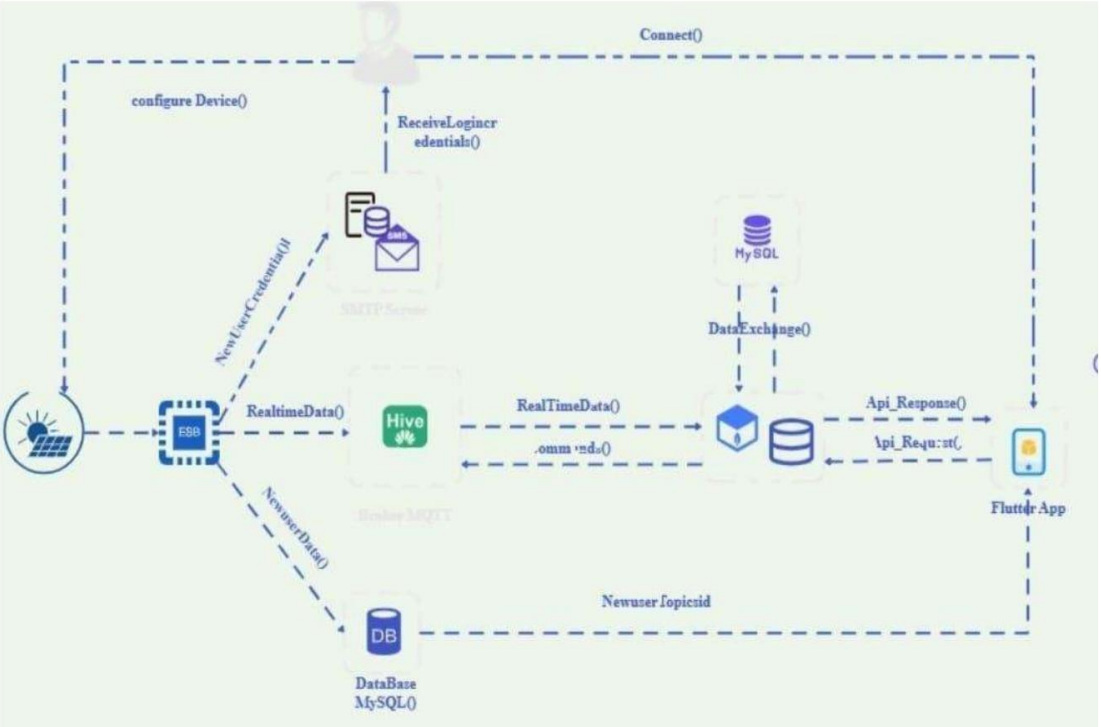
Fig 3.2: Activity Diagram

3.4.2 DATA FLOW DIAGRAM

The Data Flow Diagram of the Real Estate Pro system outlines the logical flow of information between various components and user interactions. When a user registers or logs in, their credentials are sent to the authentication module, which verifies the data and allows access to the platform. Buyers can then apply search filters such as location, price, and amenities, which are processed by the backend and used to query the property database. Sellers can submit property listings, which are validated and stored for public viewing.

Fig 3.3:Data Flow Diagram



3.5 STATISTICAL ANALYSIS

The Real Estate Pro platform not only offers tools for efficient property management but also incorporates statistical analysis to continuously improve its features, performance, and user engagement. One of the key components of the platform's backend is the ability to collect and analyze user behavior data in real time. This includes tracking the number of property views, duration of visits to listing pages, most frequently used search filters, and the properties with the highest interaction rates. Such data enables the platform to generate insights into user preferences, such as the most searched locations, budget ranges, and property types.

User engagement metrics such as click-through rates, saved listings, and inquiry rates provide an in-depth understanding of which properties are receiving the most attention. In addition to tracking general behavior, the system also logs chat activity, response times between users, and the average number of messages exchanged per property. These statistics help sellers and agents understand user interest and responsiveness.

Scheduling data is also analyzed to determine peak viewing times, which assists sellers in optimizing their availability and helps the platform recommend optimal time slots to potential buyers. Conversion metrics, such as the percentage of property views that lead to scheduled appointments or finalized sales, are crucial in measuring listing performance and the overall effectiveness of the platform.

Furthermore, the system tracks backend performance indicators such as query response times, page load speeds, and server uptime to ensure the technical reliability of the platform. Anomalies or drops in performance can trigger alerts for administrators, allowing them to address issues proactively. Security-related statistics, such as login attempts and access logs, are also monitored to detect unusual activity and prevent unauthorized access.

All statistical data is collected and stored in compliance with privacy standards, ensuring that personal user information remains confidential. Dashboards with visual charts and reports are generated periodically for administrators and stakeholders,

allowing data-driven decisions to be made regarding future feature updates, marketing strategies, and system improvements. In conclusion, statistical analysis plays a vital role in the Real Estate Pro system by transforming raw user data into actionable insights that drive continuous enhancement of the platform's functionality, user satisfaction, and business outcomes.

Conversion rates, another vital metric, measure how many views translate into actions such as inquiries, scheduled viewings, or transactions. This helps stakeholders understand platform effectiveness and identify listings that may require enhancement. These insights are visualized through dynamic dashboards using charts, graphs, and heatmaps.

Furthermore, the system includes user feedback forms and optional surveys that collect qualitative data, which is processed and categorized for trend analysis. All statistical operations are performed under strict data privacy compliance, with encrypted storage and anonymized reporting to protect user confidentiality.

Overall, statistical analysis acts as a backbone of Real Estate Pro's continual improvement cycle. It not only assists in technical maintenance and business strategy but also ensures the platform evolves alongside user expectations, delivering a more intuitive, relevant, and optimized real estate experience for all its users.

CHAPTER 4

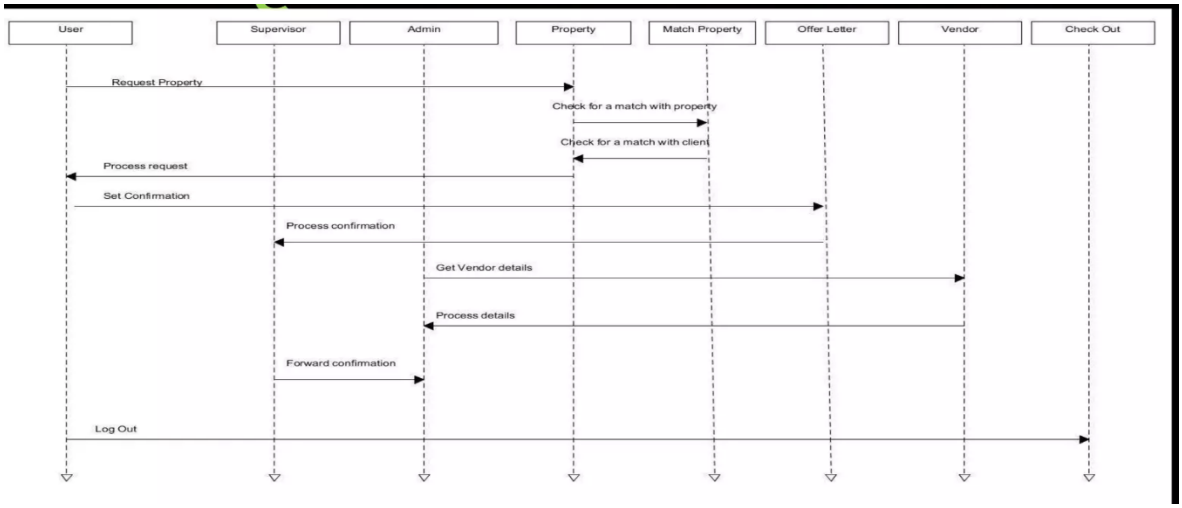
MODULE DESCRIPTION

The Real Estate Pro platform is divided into several interconnected modules, each responsible for a core functionality of the system. The architecture ensures modularity, scalability, and performance, with clear separation of concerns between frontend, backend, and database layers. The system supports a wide range of features such as property listing, user registration, search and filter, scheduling, and live messaging, all powered by a robust backend and real-time communication framework.

4.1 SYSTEM ARCHITECTURE

4.1.1 USER INTERFACE DESIGN

The User Interface (UI) is developed using HTML5, CSS3, and JavaScript to create a clean, responsive, and interactive experience. The interface is designed for both buyers and sellers, enabling intuitive navigation across modules such as search filters, listing pages, media viewers, and chat windows. Special focus has been placed on accessibility and mobile responsiveness to ensure smooth performance.



4.1.1 BACK END INFRASTRUCTURE

The backend of the platform is built using Node.js and Express.js, handling user authentication, database interactions, real-time messaging, and scheduling. The server communicates with a MongoDB database to perform CRUD operations and ensure persistent data storage. WebSocket integration allows for real-time updates and message delivery, while RESTful APIs manage search results, listing updates, and appointment confirmations.

4.2 DATA COLLECTION AND PREPROCESSING

4.2.1 Dataset and Data Labelling

The datasets used by the system must connect the spoken language with corresponding gestures in the sign language according to each individual sign language, for example ISL, ASL, BSL. Therefore, these datasets may also involve manual gestures i.e. hand shapes/motions and non-manual features like facial expressions, etc.

4.2.2. Data Preprocessing

Before any search or comparison is done, the platform cleans incoming data by removing duplicates, correcting format inconsistencies, and validating fields. This ensures high data quality and accurate filter-based results.

4.2.3 Feature Selection

The most relevant features such as property type, location, price, number of bedrooms, amenities, and user activity history are extracted and prioritized for personalized recommendationSs and search ranking.

4.2.4 Classification and Model Selection

Although the current system does not include AI-based classification, future updates may involve incorporating machine learning models to predict buyer preferences and automatically classify listings based on similarity scores and popularity metrics.

4.2.5 Performance Evaluation and Optimization

Performance of the modules is measured through response time tracking, user feedback scores, successful appointment bookings, and reduction in bounce rates. Metrics are analyzed monthly to determine system strengths and areas for improvement.

4.2.6 Model Deployment

For future ML integrations, deployment will be handled using model APIs and serverless functions. Models can be updated continuously with new interaction data to improve recommendations.

4.2.7 Centralized Server and Database

All modules are connected to a centralized MongoDB database which stores all user and property-related information. The server architecture ensures secure communication and fast data retrieval through indexing and optimized queries.

4.3 SYSTEM WORK FLOW

4.3.1 User Interaction:

Users start by registering or logging into the system. Upon successful authentication, they access their dashboard where they can manage properties, search for listings, or initiate conversations with other users.

4.3.2 Search and Filter properties:

Buyers can search and filter listings based on location, budget, size, and amenities. Results are pulled from the database in real time and displayed in a responsive grid view with thumbnails and key details.

4.3.3 Sign Language Animation:

Interested users can select available time slots and schedule visits for chosen properties. The system checks for conflicts and updates both user dashboards with confirmation.

4.3.4 Real-Time Display and Feedback:

A built-in chat system allows buyers and sellers to communicate instantly. Messages are sent and received using WebSocket protocols and stored in the database for retrieval.

4.3.5 Continuous Learning & Improvement:

The platform collects feedback through optional rating and review forms after each interaction. This information is used to improve property recommendations, user interface updates, and overall experience.

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CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENT

6.1 CONCLUSION

The Real Estate Pro platform represents a comprehensive and well-engineered solution to the challenges that have historically plagued the real estate industry. Traditional methods of property transactions often suffer from inefficiencies such as outdated listings, poor communication, limited accessibility, and lack of centralized data. Real Estate Pro addresses these pain points by delivering a digital-first, user-friendly system that enables buyers, sellers, and agents to engage in a seamless property discovery and transaction process. The platform's ability to consolidate key features like search filtering, media-rich listings, schedule coordination, and real-time messaging within a single responsive interface significantly enhances user convenience and interaction.

From a technical standpoint, the system demonstrates scalability and flexibility through its modular architecture, RESTful APIs, and NoSQL database structure using MongoDB. The use of real-time technologies such as WebSockets allows for instant communication and updates, while the application’s responsive UI ensures cross-device compatibility. The platform also includes built-in mechanisms for performance monitoring and user behavior tracking, which contribute to system stability and ongoing optimization.

Moreover, the platform’s emphasis on accessibility and user-centric design enables users to explore, evaluate, and act on property decisions more efficiently than ever before. Sellers and agents benefit from a dynamic dashboard to manage their listings, while buyers are empowered with tools to make quick comparisons and direct inquiries.

6.2 FUTURE ENHANCEMENT

While the current system provides a robust and reliable platform for property listing, search, communication, and scheduling, there are numerous opportunities to enrich its capabilities in the future. One of the foremost enhancements is the integration of Artificial Intelligence (AI) and Machine Learning (ML) technologies. These can be used to provide advanced property recommendations based on user behavior, historical data, and trending locations. Predictive analytics could inform both buyers and sellers about optimal pricing, future value estimation, and competitive market analysis.

Augmented Reality (AR) and Virtual Reality (VR) technologies can revolutionize the way users experience property tours by providing immersive 3D environments for walkthroughs. Such features will be particularly advantageous for international clients or users who are unable to attend in-person viewings. Additionally, the system can include drone-captured video footage integration for aerial property inspection and surrounding neighborhood views. Blockchain technology can be adopted to ensure secure and immutable records of transactions, title deeds, and ownership verification. Smart contracts can be introduced to automate processes such as rental agreements, purchase confirmations, and escrow settlements. These blockchain features would add a layer of transparency, trust, and security, reducing fraud and simplifying complex legal procedures.

Localization and internationalization features are also important. By supporting multiple languages, currencies, and region-specific regulations, the platform can be expanded globally, enabling cross-border real estate transactions. In parallel, biometric authentication (fingerprint, facial recognition) and two-factor authentication will improve user security, ensuring that only verified users can participate in high-stakes property deals.

Mobile application development is another significant enhancement area. With dedicated Android and iOS applications, users can manage their property transactions on-the-go. Push notifications, geolocation-based suggestions, and voice-assisted searches can significantly improve mobile engagement.

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