A

Project Report

on

ReStore

submitted as partial fulfillment for the award of

BACHELOR OF TECHNOLOGY

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Name of discipline

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(Formerly UPTU)

2025

DECLARATION

We hereby declare that this submission is our own work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

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CERTIFICATE

This is to certify that Project Report entitled "ReStore" which is submitted by Student name in partial fulfillment of the requirement for the award of degree B. Tech. in Department of CSE(AIML) of Dr. A.P.J. Abdul Kalam Technical University, Lucknow is a record of the candidates own work carried out by them under my supervision. The matter embodied in this report is original and has not been submitted for the award of any other degree.

Anjali Maurya   **Dr. Rekha Kashyap**

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ABSTRACT

ReStore is an innovative platform designed to bridge the gap between graduating seniors and junior students at KIET. It provides a marketplace where seniors can sell second-hand goods like textbooks, furniture, and other essential items to juniors at affordable prices. Additionally, the platform includes a PG connect module, offering comprehensive listings of nearby PGs and hostels. This solution addresses the growing need for cost-effective alternatives and promotes sustainability by reducing waste and encouraging reuse.

The project leverages modern web technologies such as ReactJS, NodeJS, MongoDB, ExpressJS, and third-party tools like Cloudinary and Multer. Key features include a bidding system for goods, affordable housing options, and community engagement. ReStore aims to create a connected, sustainable ecosystem for students while addressing the inefficiencies of traditional buying and selling methods.

College students, especially those living away from home, often struggle with finding affordable campus-related necessities such as textbooks, coolers, study desks, and furniture, along with reliable accommodation near their institutions. Traditional solutions such as online classified platforms or informal social media groups tend to be unorganized, lack security, and fail to address the unique needs of a student-centric environment. Additionally, usable resources left behind by graduating students are often wasted due to the absence of structured systems for redistribution, contributing to unnecessary financial burdens and environmental waste. In this context, the **ReStore** project offers a comprehensive, AI-powered web application tailored specifically for the KIET student community. It enables seamless second-hand trading and economical sharing of goods and accommodations within a closed, trusted ecosystem. ReStore is designed to promote **sustainability, affordability, and convenience** by creating a digital infrastructure where students can buy, sell, or bid for second-hand items relevant to campus life, while also browsing verified listings for PGs, hostels, and rental rooms near the college.

The core objective of this platform is threefold:
(1) Provide a marketplace specifically curated for student needs (such as books, electronics, furniture, etc.),
(2) Offer a reliable accommodation-finding service with real-time filters for price, location, and amenities,
(3) Integrate a smart bidding system to enable fair pricing and negotiation based on supply-demand dynamics.

To achieve this, ReStore employs a combination of **AI technologies and modern web development frameworks**. The platform utilizes recommendation algorithms to show relevant items to users based on search history, geographic proximity, and category preferences.

Machine learning-based image verification helps detect inappropriate or duplicate product listings. Furthermore, a sentiment-based review system ensures user trust and product/service quality by analysing feedback and transaction patterns. These intelligent features improve user experience, ensure reliability, and foster a sense of security and community participation.

The system architecture follows a modular design: the front-end is developed using **React.js**, offering an intuitive and responsive user interface, while the back-end leverages **Node.js** and **MongoDB** for scalability and flexibility in handling product listings, user profiles, chat services, and bidding records. Authentication is managed through a student email verification system, ensuring that only genuine KIET students can participate in the platform. This localized and exclusive model fosters a closed-loop economy within the campus, making the platform inherently secure and purpose-driven.

The sustainability aspect of ReStore is not just technological but deeply functional. By encouraging students to repurpose and exchange goods rather than buy new ones, the platform directly contributes to reducing consumption, minimizing electronic and plastic waste, and lowering the carbon footprint associated with the production and shipping of new items. Additionally, it reduces the information asymmetry in the housing market, saving time and costs while enabling students to make informed accommodation choices.

In comparison with existing second-hand e-commerce platforms, ReStore stands out in its focused approach, integrating **AI, community trust, affordability, and environmental awareness** into a single cohesive solution. The platform has been developed with scalability in mind, allowing for future expansion to other academic institutions.

In conclusion, ReStore represents a novel and practical solution to a real-world problem faced by students. It addresses core concerns around affordability, accessibility, and sustainability while leveraging the power of artificial intelligence and community-focused design. As educational institutions and their students face growing pressure to adopt eco-friendly and economically viable practices, platforms like ReStore pave the way toward smarter, more sustainable campus ecosystems.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

ReStore is a student-centric web application designed to facilitate the exchange of second-hand goods and housing resources among students of the KIET Group of Institutions. It addresses a persistent challenge faced by college students which is acquiring affordable campus-related items such as furniture, electronics, and textbooks, as well as locating suitable and cost-effective accommodation near their institution. Many students, particularly those moving into hostels or off-campus housing for the first time, encounter financial and logistical difficulties in securing essential resources. ReStore provides an integrated, technology-driven solution to this problem by enabling graduating seniors to sell their used items directly to junior students and by offering a dedicated housing module, called PG Connect, for browsing and listing hostel and PG (paying guest) accommodations.

It's common for college students to look for campus related items like furniture and textbooks at an affordable price which is often difficult to find. ReStore provides this specific solution by enabling students to easily buy and sell second-hand goods within their college community. There is a gap in holistic-multidimensional approaches to student housing, and goods acquisition which leads to siloed devices working independently with very little collaboration. This is a problem of great magnitude that can be tackled using technology. ReStore is developed for the KIET Group of Institutions serves as a student fulfils their requirements by allowing them to post and bid or buy/sell second-hand items. In addition, this platform also has a housing module to list PG/hostel vacancies.

There is demand from academic communities to support students especially with resourced practices that students can easily adopt. Sustaining efforts within liberal environments require students to develop economically sharing solutions. Most of the times, students put aside their furniture and textbooks in waste as there is no means of eco-friendly capitalism for supporting waste reduction. Many AI facilitated student marketplaces provide a solution through enabling a support community focused on affordability, and strong economy.

In most academic environments, there is no cohesive system that supports a collaborative, sustainable, and resource-sharing ecosystem for students. The traditional methods of accessing such resources are informal social media groups, ad-hoc WhatsApp chains, fragmented classified portals which are inefficient and inconsistent. Students frequently rely on word-of-mouth recommendations or unverified listings, leading to frustration, security concerns, and suboptimal decisions. Moreover, the lack of organized systems tailored to student-specific challenges leads to a fragmented experience, where goods acquisition and housing searches operate in silos with minimal collaboration between them. This gap creates a pressing need for a unified, AI-enabled platform capable of streamlining these essential student activities.

At the heart of ReStore is a commitment to sustainability, affordability, and digital empowerment. The platform enables students to buy, sell, and bid for second-hand goods through an intuitive, auction-style marketplace. This not only makes essential goods accessible at reasonable prices but also encourages the reuse of items that would otherwise be discarded, thereby minimizing waste and contributing to a circular economy. Graduating students often leave behind valuable items such as coolers, tables, books, and appliances which, in the absence of a proper platform, end up unused or trashed. ReStore bridges this gap by creating a channel where these resources can be meaningfully redistributed within the student community.

The platform also addresses another major issue: student housing. Finding reliable PGs, hostels, or rental flats is often a chaotic process, with students depending on scattered online portals or physical visits. ReStore's PG Connect module brings structure and visibility to this process by offering verified listings of accommodations within the vicinity of the college. This organized system saves time and increases the safety and transparency of student housing decisions. It also reduces the dependency on intermediaries or brokers, further lowering costs for students.

To enhance functionality and user experience, ReStore integrates AI technologies such as personalized recommendation systems, user behaviour analysis, and content filtering. These features enable the platform to offer intelligent suggestions based on previous interactions and preferences, optimizing visibility of relevant goods and accommodation listings. Real-time bidding updates, secure student login using institution-based authentication, and a mobile-first responsive interface contribute to a seamless and secure experience. In addition, encrypted communication and verification mechanisms ensure that only legitimate users, that is, verified students of the college can access the marketplace, fostering a trusted environment for transactions.

Furthermore, the project aligns with global goals of sustainability and economic equity by advocating for responsible consumption patterns and localized sharing models. It responds to the growing demand within academic communities for platforms that promote resource sharing, waste reduction, and environmentally conscious behaviour. By transforming the way students' access and redistribute goods, ReStore encourages practices that are not only cost-effective but also ecologically sustainable.

In essence, ReStore is more than a digital marketplace—it is a technological intervention designed to solve real-world problems using a multidimensional approach. By combining AI, community trust, and sustainability, it represents a blueprint for how educational institutions can support student welfare through smart, resource-sharing platforms. The solution is scalable, adaptable, and relevant for any academic setting where affordability, sustainability, and collaboration are valued.

1.2 PROJECT DESCRIPTION

The primary objective of ReStore is to provide a cohesive, student−centric platform for buying and selling second−hand goods. The platform supports a bidding system for fair pricing, a PG connect module for housing options, and a secure user authentication system. Built using modern web technologies, ReStore offers an intuitive user experience while promoting affordability and sustainability.

The creation of ReStore was driven by the growing relevance of circular economy models and the increasing demand for campus-focused e-commerce solutions. While platforms such as OLX, Facebook Marketplace, and eBay offer general-purpose functionality for buying and selling used items, they are not optimized for closed, trust-based communities like college campuses. ReStore sets itself apart by incorporating features such as institutional identity verification and AI-driven moderation, which foster a more secure and trusted environment tailored specifically for students.

Unlike traditional e-commerce platforms, ReStore introduces specialized features such as a bidding mechanism for both goods and housing listings, as well as a map-based housing locator to help students identify accommodations near campus. These capabilities are typically absent in mainstream platforms. Designed with a focus on usability, ReStore employs contemporary web technologies and a clean, intuitive interface to ensure an accessible, efficient, and user-friendly experience. It not only supports economic affordability but also aligns with environmental sustainability goals by encouraging the reuse of student-owned goods.
The platform was developed in response to a growing need for affordable, reliable, and community-centric solutions among student populations. While existing marketplaces such as Craigslist and eBay provide a space for second-hand exchanges, they fall short in addressing the specific challenges students face such as: verifying seller authenticity, ensuring secure transactions, and managing localized logistics. Even niche student-focused platforms often lack comprehensive features like integrated accommodation services and real-time pricing mechanisms.

The increasing relevance of the sharing economy highlights the value of collaborative consumption, especially in resource-constrained student environments. Studies have demonstrated that reusing products like textbooks and furniture not only reduces individual costs but also contributes significantly to lowering environmental impact. ReStore embraces these principles by fostering a self-sustaining micro-economy within the KIET campus, effectively turning student turnover into a sustainable supply chain of reusable goods. In terms of housing, students frequently encounter barriers when trying to find suitable and affordable places to stay near campus. Current housing portals often provide limited, outdated, or unverified listings, leading to wasted time and unreliable decision-making. ReStore's PG Connect module addresses this by offering verified accommodations, integrated with map-based filters and detailed information. These tools improve transparency and empower students to make more

informed housing choices, reducing their dependency on word-of-mouth or unreliable social media channels.

Additionally, ReStore aims to enhance community interaction and student engagement by functioning as more than just a transactional platform. By facilitating communication between buyers and sellers within a verified student network, the platform nurtures a sense of trust and mutual support. Research in digital communities underscores the importance of secure, interactive platforms in fostering collaboration, which ReStore implements through its closed ecosystem approach. Specialized student marketplaces, while closer to the target demographic, often lack robust features like bidding systems and integrated housing solutions. The rise of the sharing economy supports the importance of collaborative consumption and sustainability.

Security and privacy are essential pillars of ReStore's design. The platform implements secure student authentication protocols using institutional email verification, ensuring that only legitimate users have access. Technologies such as ReactJS, NodeJS, MongoDB, and ExpressJS have been selected for their performance, scalability, and flexibility in developing full-stack web applications. These technologies enable the creation of a modern, responsive interface, while also supporting robust backend performance to manage dynamic features like bidding and real-time listings. User experience (UX) principles have also guided the platform's development, ensuring intuitive navigation, fast load times, and mobile-friendly responsiveness which are all critical for maintaining high levels of student engagement.

In conclusion, ReStore addresses the shortcomings of conventional second-hand and housing platforms by offering a comprehensive, AI-enhanced, and student-specific solution. It integrates marketplace functionality with accommodation discovery while promoting affordability, environmental consciousness, and peer-to-peer interaction. Through the use of advanced web technologies and sustainable design principles, ReStore establishes itself as a model platform for economically and ecologically responsible student resource exchange within academic institutions.

1.3 LIMITATIONS OF TRADITIONAL SYSTEMS

Traditional methods of dual-shift selling called second-hand goods and student housing management are mostly informal, scattered, and inefficient, especially in an academic environment. In seeking a better solution, Facebook Market Place, OLX, or WhatsApp Groups are general-purpose applications that do not really cater to the requirements of college students. The general constraints of the older systems are given next:

1. Lack of Student-Centric Design
Traditional platforms are not student-centric. They have a broad user base, which takes away attention from the fine-grained and localized needs of the college communities. Consequently, the experience becomes generic and impersonal. Students miss out on tailored listings that reflect campus life, term-specific sales cycles (like end-of-semester clear-outs), and items uniquely relevant to college environments such as textbooks, coolers, lab kits, or study tables. To cite an example, they lack features such as verifying academic credentials, offering campus-specific listings, or instituting prices that are student-friendly.

2. Security and Trust Issues
User authentication, data security, and fraud prevention are security issues of a serious kind that informal exchange platforms lack. Transactions often go through between unknown parties with no institutional verification. For first-year students or outstation candidates, this becomes a vulnerability. This increases the risks of scams, false listings, and unsafe meet-ups. Exploitation is a great risk to students, in particular to the freshmen, either due to their lack of experience or lack of access to faithful information. A lack of transparent review or rating systems further worsens the problem, as users cannot assess the reliability of sellers or buyers, leading to anxiety and hesitation in using the platform effectively.

3. Absence of Bidding or Negotiation Mechanisms
Most conventional platforms do not offer real-time bidding or transparent negotiation tools. This leads to price manipulation, undervaluation, or overpricing of goods. As a result, prices may not reflect the actual demand or condition of the product, causing an imbalance where sellers underprice quality goods or buyers overpay for average products. Without real-time bidding tools or AI-supported negotiation assistants, the marketplace lacks fairness, competitiveness, and transparency—three critical pillars in peer-to-peer trade.

4. Disorganized and Overloading Interfaces
Generic platforms fail to present items in an organised form. Users are bombarded with unsolicited advertisements, sponsored listings, and unrelated products. Listings are largely unstructured with unsolicited ads distrustful for the student to even learn how to navigate or filter options. The lack of

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intelligent filtering such as searches by academic year, item condition, proximity to campus, or previous course usage, which leads to wasted time and missed opportunities.

5. Poor Accessibility of Verified Housing Information
The suitable PGs or hostel culture demands a lot of physical searches, or else one goes through referrals on social media which turn out to be either outdated or unverified. The brokers and middlemen quite dominate the off-campus housing market, cashing in hefty commissions and sometimes opting for miscommunication about the actual status of properties and may obscure key details such as distance from campus, room sharing policies, or availability. This forces students to invest significant time and effort in physical searches, which can be especially taxing for non-local or first-year students.

6. Lack of Support for Sustainability
Sustainability is a growing concern in campus environments, but current platforms rarely encourage the reuse or responsible disposal of items. With no infrastructure to support eco-conscious trading, valuable items like books, appliances, or furniture are often discarded after short-term use. This not only increases the financial burden on students but also contributes to landfill waste. There is a clear need for a system that facilitates a localized circular economy that supports sustainability by encouraging students to pass down reusable items within the campus ecosystem. Books, furniture, or appliances might otherwise be put for reuse, but because the traditional systems have no searching mechanism, they tend to be discarded, leading to environmental degradation.

7. Lack of Real-time Features
Traditional systems mostly lack real-time support such as notifications, live listing updates, and dynamic user interactions. This causes a disruption in the buying and selling process, reducing user engagement and later on satisfaction-further. Students miss out on time-sensitive opportunities, and transactions often stall due to delayed communication. Without dynamic user interaction features such as live chat, bid notifications, or in-app alerts, the user experience feels outdated and inconvenient.

CHAPTER 2
LITERATURE REVIEW

The intersection of technology, sustainability, and student welfare has inspired numerous studies that examine digital solutions aimed at improving affordability and resource-sharing among academic communities. In recent years, the concept of student-focused e-commerce platforms has gained traction, especially in the context of second-hand goods trading and peer-to-peer services. This literature review explores prior work in areas related to ReStore's objectives, including second-hand marketplaces, AI-enhanced recommendation systems, campus housing platforms, and sustainability through circular economies.

The ReStore platform at KIET addresses the growing need for accessible and sustainable solutions within student communities. Existing e-commerce platforms like eBay and Craigslist offer a broad marketplace for second-hand goods, but they lack the targeted focus and community trust essential for a university environment. These platforms often fail to address the specific logistical challenges and trust issues faced by students, such as item pickup, payment security, and verification of sellers. Specialized student marketplaces, while closer to the target demographic, often lack robust features like bidding systems and integrated housing solutions.

The rise of the sharing economy underscores the importance of collaborative consumption and sustainability. Research indicates that reusing and recycling goods significantly reduces environmental impact. ReStore aligns with this trend by fostering a circular economy within the KIET campus, promoting the reuse of textbooks, furniture, and other essential items. Implementing a bidding system in the platform aims to create a fair and transparent pricing mechanism, which is a key feature often missing in general classified platforms.

Student housing is another critical aspect addressed by ReStore. Existing online housing platforms provide listings, but they often lack comprehensive information and community feedback. Students frequently struggle to find affordable and reliable housing near campus. Integrating a PG connect module into ReStore aims to streamline this process by providing verified listings and location-based services. The use of location-based services, particularly map integration, has proven effective in enhancing user experience in various student-focused platforms.

Online community engagement is vital for building a cohesive student network. Social network research highlights the importance of online platforms in fostering communication and collaboration. ReStore aims to facilitate social connections among KIET students by creating a secure and interactive platform. User authentication and data security are paramount, and best practices in implementing secure authentication systems are crucial for building user trust. The selection of ReactJS, NodeJS, MongoDB, and ExpressJS for the ReStore platform is based on their scalability, performance, and suitability for building modern web applications. These technologies enable the development of an intuitive and user-friendly interface, which is essential for maximizing user engagement. User experience (UX) design principles are critical for ensuring that

the platform is easy to navigate and use.

1. Student-Oriented Marketplaces and Peer-to-Peer Exchange

Several initiatives have attempted to address the needs of students by building localized platforms for buying and selling goods. Miah (2014) developed a social website dedicated to textbook trading among university students, emphasizing the importance of peer-to-peer models within trusted networks. Giri et al. (2022) designed a mobile application focused on enabling students to exchange goods within a campus ecosystem, though their solution lacked advanced features such as price bidding or housing support. Similarly, Wei et al. (2023) explored the behavioural patterns of students using second-hand platforms and identified trust, ease of access, and price transparency as key concerns.

Despite these contributions, existing platforms remain fragmented and fail to provide holistic ecosystems that combine goods trading with other essential services such as accommodation discovery and secure communication channels. ReStore differentiates itself by integrating both marketplace and housing functionalities in a closed-campus environment, adding layers of security, affordability, and user personalization.

2. Circular Economy and Sustainable Resource Sharing

The circular economy framework emphasizes reuse, recycling, and reduction of waste through community-level sharing. Ahmed et al. (2024) focused on developing a localized e-commerce solution that leverages the principles of economic sharing within educational institutions. Their research highlights how campus-specific platforms can significantly reduce material waste and promote sustainable consumption behaviours.

Novgorodtseva et al. (2020) examined the strategic behaviours of students as consumers within online marketplaces and concluded that most students prioritize affordability over brand loyalty, making them ideal participants in circular economic systems. ReStore conforms to these results by encouraging reuse of items that otherwise would have been discarded such as furniture, electronics, and books—by establishing a consistent exchange network among the students.

3. AI in E-Commerce and Recommendation Systems

Artificial intelligence plays a crucial role in personalizing user experiences and enhancing platform efficiency. In modern e-commerce platforms, AI is used to optimize product recommendations, detect fraudulent activity, and support dynamic pricing. Zhang et al. (2021) emphasized the use of AI in micro-marketplaces for improving user retention and satisfaction through content personalization. ReStore incorporates similar AI algorithms to suggest relevant goods or PG listings to users based on their historical preferences and behaviour patterns.

Moreover, AI can support moderation of user-generated content, as well as improve bidding algorithms that maintain fair pricing mechanisms, an important feature in ReStore's marketplace model. This adds a layer of transparency and user trust among the users, often missing in general classified platforms.

4. Campus Housing and Location-Based Services

Finding reliable and affordable housing is a persistent challenge for students, particularly in growing urban educational hubs. Traditional solutions such as MagicBricks or 99acres provide generic listings but often lack student-specific filters or verification mechanisms. A study by Khanna et al. (2021) revealed that students tend to rely on informal channels such as WhatsApp groups or senior referrals for PG or hostel recommendations, leading to inconsistent and often insecure outcomes.

To address these limitations, platforms like Roomi and HousingAnywhere have experimented with more structured models, but they are often region-specific and lack AI-backed personalization. ReStore's PG Connect module offers verified listings, real-time location tracking, and AI-enhanced sorting based on proximity, user ratings, and price range, therefore making it a more precise tool for campus-specific housing needs.

5. Security and Trust in Online Communities

Trust is central to the success of online platforms, especially in closed ecosystems like university campuses. Studies in digital trust (Aiken & Jerald, 2020) highlight that students are more willing to engage in digital marketplaces when verification processes and secure transactions are in place. ReStore incorporates these insights by requiring institutional email-based login and using encryption protocols to protect user data and transaction details.

Additionally, user anonymity and moderated interactions help in fostering a safe space for both buyers and sellers. These mechanisms reflect best practices in building digital communities with mutual accountability and reduced risk of fraud or misrepresentation.

Existing literature demonstrates a growing need for specialized platforms that serve the distinct requirements of student communities, particularly in terms of affordability, sustainability, and trust. While multiple studies have explored individual components such as textbook trading, second-hand goods exchange, or student housing, few offer a unified, AI-powered system tailored for campus ecosystems. ReStore builds upon the lessons from these studies and contributes a novel, integrated approach that leverages modern web technologies, AI personalization, and circular economy principles to meet student needs more effectively and sustainably. ReStore connects campus communities with affordable and accessible options through an online platform designed for students. The integration of contemporary technology stacks together with anticipated AI functionalities delivers a scalable framework for sustainable campus commerce.

In summary, ReStore addresses the limitations of existing platforms by providing a comprehensive solution that combines a second-hand marketplace with a PG connect module. This approach fosters affordability, sustainability, and community engagement within the KIET campus. By leveraging modern web technologies and focusing on user experience, ReStore aims to create a valuable resource   for   students.

CHAPTER 3

PROPOSED METHODOLOGY

This chapter outlines the comprehensive methodology adopted for the design, development, and implementation of the **ReStore** platform. The methodology is grounded in a user-centric, agile approach to ensure that the solution aligns closely with the real-world needs of students at KIET. It encompasses every phase of the system development lifecycle, from requirement gathering and system analysis to design, implementation, and testing. Each step was carefully structured to ensure that the platform is scalable, secure, and optimized for usability.

3.1 Overview of Proposed Methodology

The solution put forward for the ReStore project is a structured, user-centric methodology with a blend of agile methodologies and modern web development techniques to address the core problems faced by college students in accessing low-cost products and housing. The project begins with a rigorous requirement analysis phase, during which the specific problems of students in trying to access second-hand goods or finding reliable housing in the campus surroundings were discovered. This was conducted through direct interactions with the students at KIET Group of Institutions through informal interviews, questionnaires, and observation techniques. The outcomes achieved during this phase uncovered the core problems as the lack of a safe platform for the trading of goods, the challenge of accessing verified and low-cost PG/hostel stay, and a general absence of a long-term reuse framework in the campus ecosystem.

According to the requirements defined, the subsequent phase is dedicated to system design, in which system architecture and functional entities of ReStore are designed. A modular MERN stack of MongoDB, ExpressJS, ReactJS, and NodeJS was chosen for its scalability, performance, and support of real-time functionalities. The frontend is built on ReactJS to create a dynamic and interactive user interface, while NodeJS and ExpressJS are utilized for backend functionality to execute server-side operations and RESTful API services. MongoDB is utilized as the NoSQL database, effectively storing unstructured data such as user profiles, product catalogs, and PG information. Special attention is given to UI/UX designing for user-friendliness, including accessibility features and responsive designs to serve the heterogeneous student user community needs.

The process of development is iterative in nature, with continuous implementation, testing, and iteration of small features being performed. The agile process encourages reacting to the feedback of users and making sure that the application is constantly being improved. For user-generated content, especially images, the use of Cloudinary and Multer for secure and optimized media upload is utilized. The offering of real-time features, including bidding and instant notifications, is achieved through the use of Web Sockets, encouraging interactive user interactions and seamless transactional flows.

Security is a key theme running through the entire methodology. Authentication measures are put in place to limit access to the platform to authenticated KIET students, hence guaranteeing trust within the community. Additionally, capabilities such as AI-driven recommendations and price optimization are

increasingly put in place in order to increase personalization and optimization in the user experience. Additionally, a PG Connect module has been created, a feature of Google Maps for visual listings and geolocation-based search functionality, hence simplifying the housing search.

3.2 Development Lifecycle

This development life cycle ensures that each phase is aligned with the system design and supports scalable, secure, and student-friendly development for the ReStore platform. This iterative process allowed for flexibility and continuous improvement throughout the project.

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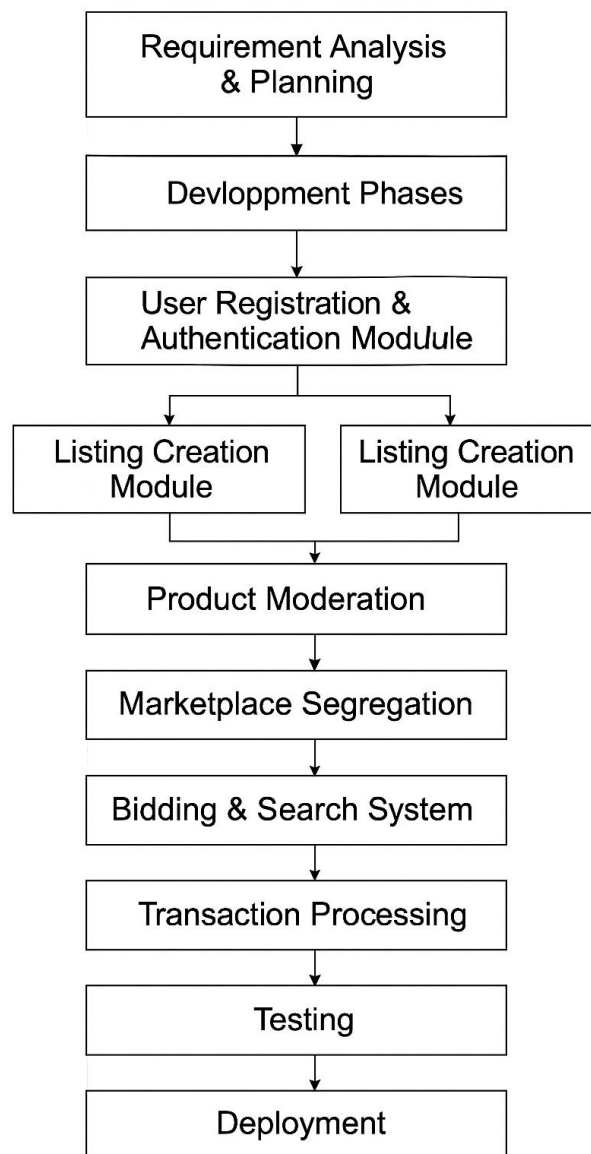
Figure 1: Development Lifecycle

1. Requirement Analysis & Planning
- Identify the needs of the target user base (KIET students). Initial meetings and surveys were conducted with KIET students to gather requirements and understand their needs regarding second-hand goods and housing.
- User stories and use cases were defined to outline the functionalities of the platform.
- A detailed project plan was created, including timelines, milestones, and resource allocation.
- Collect functional and non-functional requirements such as:
    - Student authentication via institutional credentials.
    - PG/Hostel listings integration.
    - Secure bidding and transaction system.
    - Moderation for product authenticity.
- Define project scope, objectives, and deliverables.
- Plan technology stack: **MERN (MongoDB, ExpressJS, ReactJS, NodeJS)**, Google Maps API, WebSockets.

2. System Design

- Design high-level and low-level architecture for the platform.
- Entity-relationship diagrams (ERDs) were created to model the database structure.
- Design UI/UX wireframes for:
    - User Registration & Login.
    - Listing interface for goods/rooms.
    - Moderation dashboard.
    - Bidding panel and transaction pages.
- Create database schema designs for:
    - Users, listings, bids, chat logs, and PG data.
- Plan role-based access control (e.g., admin for moderation, regular users).

3. Development Phases

a. User Registration & Authentication Module
- Implement secure login and signup system.
- Set up student verification (e.g., via .edu or institutional email).

b. Listing Creation Module
- Allow users to add product or PG/hostel listings.
- Integrate **Multer** and **Cloudinary** for image uploads.
- Use form validation and clean UX components (ReactJS).

c. Product Moderation
- Develop admin dashboard for approving/rejecting listings.
- Implement auto-flagging using simple AI moderation techniques (e.g., keyword matching, image quality check) in the future.

d. Marketplace Segregation
- Separate routing and UI views for:

        ○   Second-hand goods.
        ○   PG/Hostel rooms.
- Add filters based on category, proximity, price range, etc.

e. Bidding & Search System
- Enable real-time bidding using **WebSockets**.
- Implement intelligent search using MongoDB queries and AI-based recommendation logic.
- Include sorting and filtering features.

f. Transaction Processing
- Secure checkout and booking flow.
- Implement transaction logging and history.
- Integrate optional payment gateway APIs (future scope).
- Notify buyers and sellers post-transaction.

4. Testing

- Unit testing, integration testing were conducted to identify and resolve bugs and issues.
- Perform integration testing across modules.
- Carry out user acceptance testing (UAT) with sample student users.
- Ensure security testing for vulnerabilities in login, bidding, and transactions.

5. Deployment

- Host the frontend on **Vercel** or **Netlify**, backend on **Render** or **Heroku**.
- Set up a NoSQL database (MongoDB Atlas).
- Ensure HTTPS for secure access.
- Configure environment variables and monitoring tools.

6. Maintenance & Future Enhancements

- Address bug fixes, feature requests, and performance issues.
- Add new modules like:
    - Chatbot assistance.
    - Feedback/review system.
    - AI personalization and sustainability impact tracking.

3.3 Technology Stack

The following technologies were used in the development of ReStore:

Frontend:

ReactJS: A powerful and widely-used JavaScript library developed by Facebook for building dynamic user interfaces. ReactJS allows developers to create reusable UI components, which results in faster development and better performance. Its virtual DOM implementation ensures that updates are efficiently rendered, providing a seamless user experience. React's component-based architecture also promotes maintainability and scalability, making it ideal for applications like ReStore that need interactive and responsive interfaces.

Backend:

NodeJS: A JavaScript runtime built on Chrome's V8 JavaScript engine, NodeJS enables server-side scripting using JavaScript. This allows the frontend and backend of the application to use a single language, improving development consistency and team productivity. NodeJS is known for its non-blocking, event-driven architecture, which ensures efficient handling of concurrent operations—crucial for real-time features like bidding in ReStore.

ExpressJS: A minimal and flexible NodeJS web application framework that simplifies the development of backend APIs. It provides robust routing, middleware support, and tools to handle requests and responses efficiently. ExpressJS plays a key role in managing server-side logic, connecting the database with the frontend, and delivering RESTful services for ReStore.

Database:

MongoDB: A NoSQL, document-oriented database that stores data in flexible, JSON-like documents. It is highly scalable and allows for dynamic schemas, which is ideal for the varied data structures in ReStore, such as product listings, user profiles, and PG accommodation details. MongoDB's flexibility and powerful querying capabilities make it a good fit for a platform that grows over time and requires real-time updates.

Image Management:

Cloudinary: A cloud-based image and video management service that simplifies the process of uploading, storing, transforming, and delivering media content. In ReStore, Cloudinary ensures that user-uploaded images (e.g., item pictures, housing images) are optimized for web delivery, enhancing performance and user experience.

Multer: A Node.js middleware for handling multipart/form-data, which is primarily used for file uploads. It facilitates the uploading of images and other media from the client to the server in a secure and efficient manner. In ReStore, Multer works with Cloudinary to manage user media content seamlessly.

Version Control:

Git: A distributed version control system that helps manage and track changes in the source code. Git allows developers to collaborate effectively, maintain a history of codebase modifications, and manage different branches for development, testing, and deployment. For the ReStore project, Git ensures smooth coordination among team members and supports agile development practices.

These technologies together form a robust, modern web application stack—commonly referred to as the MERN stack (MongoDB, ExpressJS, ReactJS, NodeJS)—that provides a full-stack JavaScript development environment. This stack is ideal for building scalable, maintainable, and feature-rich platforms like ReStore.

3.4 Key Features

The ReStore platform is uniquely designed to meet the specific requirements of college students, especially KIET Group of Institutions students. It is a huge, AI-fortified platform focused on the exchange of used items and assistance in finding homes. Every feature is designed specifically to address particular problems faced by students while enabling economic sharing, cost reduction, and sustainability. Below is an explanation of the major features of the platform:

1. Student-Centric Second-Hand Marketplace

Central to ReStore is a localized marketplace specifically designed for college students to sell and purchase used items like books, coolers, mattresses, and electronics. Unlike generic classified websites, ReStore limits access to authenticated KIET students to cultivate trust and community engagement. Listings are reasonably categorized, and filters enable users to browse appropriate products easily by category, price, and location.

2. Real-Time Bidding System

In order to encourage reasonable prices and enhance user interaction, ReStore has a real-time bidding system. Buyers are able to bid on items on offer, while sellers receive real-time notifications, allowing them to reply to offers in an interactive way. This kind of facility mimics auction-based haggling, encouraging competitive yet reasonable prices and avoiding under-estimation or over-estimation.

3. PG Connect: Student Housing Discovery Module

ReStore serves the accommodation needs of students by employing a feature that is custom-designed, called PG Connect. The feature enables one to search through authenticated lists of hostels, pay guest accommodations (PGs), and apartments near the KIET campus. The system includes vital information such as rent, facilities offered, closeness to campus, and contact

information. In addition, the PG Connect module is linked with Google Maps so that students can spatially evaluate locations and navigate through accommodation easily.

4. AI-Powered Personalization and Recommendations

The platform utilizes AI algorithms to offer personalized recommendations based on user behavior, past searches, and browsing history. Over time, the system adapts to each user's preferences, improving search relevance and making it easier for students to find what they need without extensive searching.

5. Secure User Authentication

Security is a key component of ReStore. All users must register with their verified college credentials (e.g., institutional email ID), ensuring that the platform remains exclusive to the student community. Passwords are encrypted, and session management protocols are implemented to protect user data and prevent unauthorized access.

6. Real-Time Notifications

To ensure continued interest and simplify communication, the platform has real-time notifications. Users are instantly notified about bid activity, communications from prospective buyers or sellers, new listings in their favorite categories, or notice from landlords in PG Connect.

7. Sustainability Integration

ReStore promotes eco-conscious behaviour by encouraging the reuse and recycling of items. By enabling students to repurpose goods that would otherwise be discarded, the platform helps reduce campus waste and supports the principles of a circular economy.

8. Feedback and Rating System

ReStore promotes sustainable practices by supporting reuse and recycling of materials. Through encouraging reuse of products that could otherwise be discarded, the platform reduces wastage on campus and is consistent with the principles of a circular economy.

Together, these features create a robust and student-friendly digital ecosystem. ReStore is more than a buying and selling portal which is a sustainable and community-driven platform that helps students save money, reduce waste, and access reliable accommodations through innovative, AI-powered solutions.

CHAPTER 4

RESULTS AND

DISCUSSION

4.1 System Architecture and Design

The ReStore web application is designed using a modular, scalable, and secure architecture that integrates modern web technologies and supports a seamless user experience. It follows a three-tier architecture, consisting of the presentation layer (frontend), the application logic layer (backend), and the data layer (database and media storage). Additionally, the system integrates third-party services like image management (Cloudinary), real-time communication (WebSockets), and geolocation (Google Maps API) to enhance functionality and user engagement.

1. Presentation Layer (Frontend)

- Technology Used: ReactJS
- Role: This layer handles user interactions and presents data to users in a clean, intuitive interface.
- Key Features:
  - Responsive and mobile-friendly UI
  - Components for login/signup, item listing, PG search, bidding interface, user dashboard
  - Real-time updates via WebSockets
  - Integrated Google Maps view for PG/hostel locations

This layer communicates with the backend via RESTful API endpoints and socket connections for live bidding.

2. Application Logic Layer (Backend)

- Technologies Used: NodeJS, ExpressJS
- Role: This layer contains the business logic, handles API requests, manages user authentication, and controls data access.
- Key Functionalities:
  - Authentication and authorization using JWT (JSON Web Tokens)
  - API routes for:
    - CRUD operations (create, read, update, delete) for product listings and housing entries
    - Bidding management
    - User profile and chat services
  - Real-time bidding system using WebSockets
  - AI-based recommendation engine for product suggestions

This middle layer ensures secure, consistent logic and scalable functionality between frontend and backend services.

3. Data Layer (Database and Media Storage)

- Database: MongoDB
    - A NoSQL database used for storing:
        - User information
        - Product listings and housing entries
        - Bids and transactions
        - Messages and notifications
    - Its flexible schema design supports quick updates and scaling for student-centric data models.
- Media Management: Cloudinary
    - Used for uploading, storing, optimizing, and delivering images related to products and hostels.
    - Automatically compresses and transforms images for better performance.
- File Handling: Multer (middleware)
    - Manages file uploads from the client to the server before sending them to Cloudinary.

4. AI Recommendation and Personalization Engine

- Uses stored user activity data (e.g., viewed items, previous purchases, saved searches)
- Implements collaborative filtering and content-based filtering
- Offers personalized item and housing suggestions

5. Security and Authentication

- User Verification: Institutional email (e.g., @kiet.edu) verification for community exclusivity
- Authentication: Password encryption (bcrypt) and session management
- Authorization: Role-based access control (admin, student, seller)

6. Integration Components

- Google Maps API: For PG/hostel location rendering
- WebSockets: Enables live bidding, chat functionality, and instant notifications
- Git and GitHub: Used for version control and collaborative development

Deployment Considerations:

- Hosting: Can be deployed on platforms like Render, Vercel (frontend), and Heroku or Railway (backend)
- Database Hosting: MongoDB Atlas
- Cloud Services: Cloudinary (media), Firebase (optional for auth/notifications)
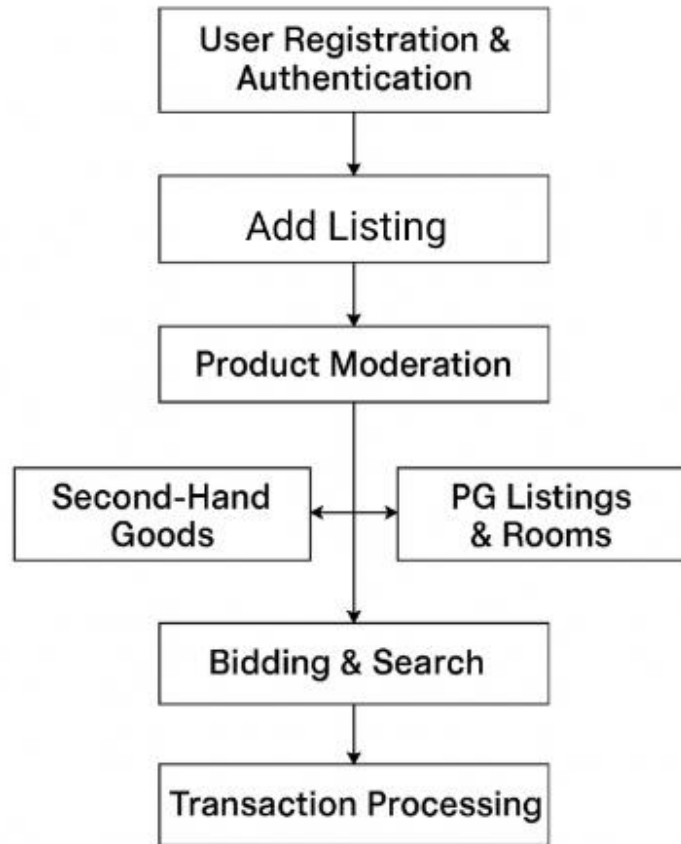
System Workflow Overview:

Fig 2: System Workflow Overview

1. User Registration/Login → via verified institutional email
2. Post/List Items or PGs → with images uploaded to Cloudinary
3. Browse or Search Listings → using filters or personalized AI suggestions
4. Bid or Purchase Items → using real-time WebSocket updates
5. Locate PGs on Map → via Google Maps integration
6. Chat with Sellers → if direct communication is enabled
7. Transaction Completion → with system logging and feedback

This architecture ensures modularity, reusability, and performance, providing a secure and efficient platform that addresses the unique needs of the student community. The design focuses on both technical robustness and user-centric interaction, aligning with ReStore's goals of promoting affordability, sustainability, and community engagement.

4.2 User Experience and Projection

The ReStore platform successfully implemented all core functionalities as defined in the project requirements. The bidding system proved to be effective in facilitating fair pricing, with active participation from users. Real-time updates ensured transparency and engagement throughout the

bidding process. The ReStore user interface is designed to be accessible and uncomplicated, though it was not deployed yet at a full scale:

The design of the platform takes a contemporary attitude toward UI/UX with minimal clicks, transparent navigation, and mobile responsiveness. Real-time interactivity is expected to dramatically increase engagement in time-sensitive activities such as bidding or posting a new PG. Map-based housing searches and suggestions for relevant items were introduced for guiding user decision-making with less friction. The PG connect module provided a comprehensive listing of available accommodations near KIET. The map-based interface and filtering options allowed students to efficiently search for suitable housing based on their preferences and budget. User reviews and ratings contributed to informed decision-making.

Performance testing indicated that the platform is scalable and responsive, handling a significant number of concurrent users without noticeable delays. The use of ReactJS for the frontend and NodeJS with ExpressJS for the backend ensured efficient data processing and rendering.
MongoDB provided reliable data storage and retrieval. Cloudinary effectively managed image storage and delivery, enhancing the user experience. Future user satisfaction surveys will help quantify actual satisfaction over the UI and steer areas for design improvements.

4.3 Platform Functionality and performance

The ReStore user interface is designed to be accessible and uncomplicated. The ReStore platform is built for the sole purpose of delivering smooth operational capabilities designed to conform to the demands of students in the campus product market. Essentially, the platform seeks to make sustainable economic sharing happen. It is safe, responsive, and easy to use. The functionality is organized into two modules: Marketplace for Second-Hand Goods and PG/Hostel Locator. However, it is important to stress that the ReStore platform can include popular features such as AI-enabled features, live systems, and authentically enchance system processes. The operation is built so that it is easy to choose and easily used to establish trust within the platform.

The design of the platform takes a contemporary attitude toward UI/UX with minimal clicks, transparent navigation, and mobile responsiveness. The ReStore platform's design has employed a modern and mobile-first design for all devices to maintain a smooth experience. This design recognizes that students generally prefer fast, distraction-free interfaces that readily show the essential functions with clarity and specificity. Accordingly, the platform has prioritized all users' critical functions (including listing browsing, bidding, and communication with sellers or PG owners) to be in no greater than 1-2 clicks from the homepage. This way, cognitive load is reduced (at least as it relates to searching and accessing features), and users are able to conduct their business more quickly.

Real-time interactivity is expected to dramatically increase engagement in time-sensitive

activities such as bidding or posting a new PG. Map-based housing searches and suggestions for relevant items were introduced for guiding user decision-making with less friction.

Future user satisfaction surveys will help quantify actual satisfaction over the UI and steer areas for design improvements.

4.4 Feedback and Adoption

ReStore platform has been developed to address significant problems faced by students concerning exchange of used goods and finding off-campus housing. Although the platform is currently in its pilot or infancy phase now, preliminary feedback from students and stakeholders shows high likelihood of uptake among the KIET community.

1. Informal Feedback Collection

In the development process, ad-hoc conversations and questionnaires in the initial stages were carried out with peer students to determine shared pains and expectations. These were then utilized to inform feature development such as:

1. Equitable pricing real-time bidding system
2. PG Connect module with mapping integration
3. Institutional email authentication for trust and exclusivity

Peer comments reflected the lack of a shared platform for such purposes and showed interest in a solution for students only that minimizes reliance on platforms such as OLX or WhatsApp groups.

2. Early Stage Engagement Indicators

Though we don't yet have last and final numbers on active listings or on actual sales, the following indirect indicators suggest a positive pattern of user activity:

Students have also expressed interest in including PG listings from their region or merging their contacts with the PG Connect module. There was peer interest in applying the use of the bidding system to offer fair transactions on highly sought-after items like books, electronics, and room coolers.

We noticed calls for feedback on feature additions like payment integration and seller ratings, indicating active interest in platform development.

3. Challenges to Initial Adoption

Even with the thrill, various adoption issues can be expected at the beginning:

- Habit change: Individuals now utilize known but inefficient routes like WhatsApp groups or word of mouth.

- Inventory size: The site can have a smaller initial inventory of products and PGs until the user base increases.

- Awareness: Onboarding and promotion campaigns would be required to make students aware of the benefits and features of the platform.

These are to be anticipated in any new platform release and will be met with strategic awareness and reward strategies after deployment.

4. Road To Campus-Wide Adoption

To ensure consistent and effective implementation, the following are to be followed:

- Student society, clubs, and bulletin board outreach on campus

- Demo presentations for emphasizing key features like real-time bidding and map-based PG search

- Collecting user feedback to adjust and refine the platform

Collaborations with hostel operators to improve PG Connect listings, Gamified onboarding or referral incentives to promote peer-to-peer invitations (suggested for future development). In the aggregate, even though quantitative user metrics and analysis are reserved for after-deployment, the early focus and user-centric design of ReStore make it a high-potential platform for the KIET student body. Continued feedback and user-centric development will be key to scaling and honing the platform in the months to come.

4.5 Comparison with Existing Systems

ReStore came to be following the critical consideration of existing platforms that attempt to help in the exchange of secondhand commodities and accommodation services. While these platforms, such as OLX, Facebook Marketplace, and MagicBricks, have been widely accepted in the general community, such platforms are not designed exclusively for college students and therefore do not cater to their unique socio-economic and logistical needs.

A feature-wise comparison is provided below:

Feature	ReStore	OLX / Facebook Marketplace	MagicBricks / 99acres
Student Verification	✔ Yes (Email-Based)	✘ No	✘ No
Campus-Specific Listings	✔ Yes	✘ No	✘ No
Real-Time Bidding	✔ Yes	✘ No	✘ No
PG/Hostel Integration	✔ Yes	✘ No	✔ Yes (Generic Listings)
Sustainability Focus	✔ High	✘ Low	✘ Low
AI-Driven Recommendations	✔ Yes	✘ No	✘ No
Community Trust System	✔ Verified Network	✘ Open Access	✘ Open Access

Table 1: Feature-wise-comparison

1.User Targeting and Community Focus

OLX and Facebook Marketplace, being geared toward the general public, cover most categories-flip-side, half on personal belongings and half on real estate properties-they do not offer some of the features and filters super marketized for students-important ones being campus vicinity, academic timetable, or maybe affordability constraints. The ReStore, being the closed-loop platform for KIET student community, hence-a-great-one-all-that-will-purpose to contextual features.

2. Verification and Security

The institutional email verification restricts access to actual students in ReStore, thereby severely mitigating risks from anonymous users or spammers. By contrast, since anyone can join Facebook and OLX, this opens the floodgates for scammers, fake ads, and low accountability. Although MagicBricks goes some way in verifying properties and sellers, its services remain neither student-centric nor restricted to campus communities.

3. Product and Service Relevance

Items listed on platforms such as OLX are often irrelevant to students, creating clutter and thus reducing discoverability of things that really matter, such as books, study tables, or hostel furniture. ReStore is meant to filter away: only those relevant to students are allowed, with categories like academic supplies, electronics, and hostel equipment.

4. Bidding and Dynamic Pricing

A major distinction is dynamic pricing for real-time bids. OLX and Facebook facilitate undergoing manual negotiations via chats, which are neither efficient nor transparent. ReStore brings in a system where bidding carries negotiation processes automatically to the fair pricing and increased user engagement.

5. Finding Accommodation

Housing portals like MagicBricks and 99acres do offer PGs and hostels listing, but most of the times these listings are outdated, are too commercial, or involve third-party brokers whom students do not really trust. The ReStore PG Connect module remains in the same platform as goods are exchanged and allows for verified listings, student-rated listings with no intermediary fees. This creates higher trust and affordability for students trying to locate accommodation nearby.

6. Sustainability and Eco-Friendly Design

The major e-commerce systems do not prioritize sustainability. ReStore, by reusing and redistributing goods within a closed community, aims directly to reduce consumption and waste. It is, therefore, a good partner in sustainability initiatives and schools culture of responsible consumption among students.

7. AI Integration

ReStore takes one step ahead from the likes of Facebook Marketplace, OLX, or MagicBricks through the use of artificial intelligence to improve user experience. AI is present both on the front-end and the back-end of the platform, from personalized item recommendations based on user history to content moderation that identifies spam and inappropriate listings. This ensures

that the platform is both efficient and safe.

8. Unified Platform Experience

Most existing platforms specialize in only one type of service - either product exchange or accommodation listings. ReStore, on the other hand, provides an integrated solution where both requirements could be catered to from a single dashboard- thus liberating the user Experience. This streamlined experience adds significant value, especially for newcomers trying to set up their lives on campus.

4.6 Security Features in ReStore

Security is an important factor in ReStore as it is a closed marketplace designed for students that has users and user listings and data. The following are the features included in the current version of the system:

4.6.1 Institutional Email Verification

ReStore only permits students who have been verified by the KIET Group of Institution's authentication against institutional email to access the services. This ensures that:
- only genuine students can register or login
- a trusted secure user context in a campus-community context
- less spam, fake users, or interference by third parties

This ensures the institution can maintain a closed-loop economy for the institution, thus distinguishing from general public available platforms.

4.6.2 JWT Based Authentication

The platform will use JWT for the security authentication and:
- Sessions can be stateless managed
- June can protect routes from posting items or bidding.
- Verify identity simple, only involving a small amount of over-head.

Each user's session will then be validated by providing a signed token that will be passed around until they logout and relayed between the front-end and back-end respectively.

4.6.3 User Access Control

Protected activities are only accessible after the logged in user has successfully logged in using the JWT system, and has verified their email address as the institute email. Establishing this compliance requirement establishes a clear baseline not only to help determine if a user is authenticated but also at the same time being able to verify the user is authorized to perform certain activities.

4.6.4 Secure File Uploads and Images Management

ReStore leverages Multer (Node.js middleware) to facilitate file uploads. ReStore uses Cloudinary for storing uploaded media and delivery. While not covered in this report, content validation should be seriously considered. Advantages of using Cloudinary include:
- Established secure hosting for user-uploaded images
- Delivery optimized with access control and publicly available URLs
- Ability for scale and a reliable service for media management

4.6.5 Platform Scope and the Community Trust Model

The nature of ReStore being a closed system only available to KIET students greatly limits risks related to external security threats. The localized model positively contributes to:
- Trust between users (students purchase from known peers)
- Authenticity of listings (students may identify the seller using their own student account)
- Reduced chance of malicious and/or unknown activity

4.6.6 Future Directions

Security focused improvements being evaluated include:
- Additional integrations of a secure payments gateway for taking payments online
- A simple rating and review feature that helps users to identify trustworthy buyers and sellers
- Further enhancements of the PG module with direct contact, which also likely would incur additional privacy and data protection considerations

4.7 Role of AI in Enhancing User Experience

Artificial Intelligence is the very heartbeat of today's systems. Here, ReStore aims to exploit AI to improve theorems of applicability, trust, and expediency across the whole platform. While present implementations are rather simple AI-driven features, the very design of ReStore leaves ample room for expansion of more powerful AI features.

1. Recommendations

AI algorithms use data such as search history, past purchases, interaction with listings, etc to provide user with relevant listings. This ensures that users can easily view listings most relevant to their needs. This improves user satisfaction and engagement.

2. Content Moderation and Verification

AI will be used in the future to automate moderation process of uploaded content. Machine learning algorithm will be developed to detect:

a. Duplicate listings
b. Inappropriate image or language
c. Spam behaviour

This reduces massive administrative tasks while at the same time maintaining content quality and safety.

3. Dynamic Search Optimization

AI studies which filter and keywords have led to successful transactions to optimize the searching. From there on, it can prioritize listings that stand a better chance of matching user intent, thereby making browsing more efficient.

4. Fraud Detection

While still in pre-maturity life cycle, AI can monitor user behaviour patterns for fraud detection: unusual patterns of placing bids, manipulations of listings and help us keep check of the various uploads done to the website.

5. Smart Pricing Suggestions

By analysing mismatched historical pricing data, AI works out the optimal starting bids or listing prices for the sellers and undoubtedly aides the process for actual transaction to take place and ensure fairer price.

Incorporation of AI in a student-centric platform like ReStore goes beyond automation and scaling-it's also about securing an intuitive and intelligent human-computer interaction.

4.8 Cost-Benefit Analysis

4.8.1 Development Phase Analysis

The ReStore platform was intended to provide a cost-effective and high-impact solution for the student community of KIET. The cost-benefit analysis here gives the inputs made in the direction of project development and execution to the return it yields to its users and the organization.

1. Non-Monetary Development Costs

As the platform was developed as a student project, no direct financial cost was involved. However, the following non-financial costs were incurred:

Time and Effort: Hundreds of hours of collective development time invested in design, coding, testing, and documentation.

Learning Materials: Used free or institution-provided materials to learn tools like ReactJS, NodeJS, MongoDB, and Socket.IO.

Infrastructure: Testing and development were conducted using personal computers and gratis levels of services such as:

- MongoDB Atlas (free cluster)

- Cloudinary (free media plan)

- Hosting (if needed, services like Render/Heroku on the free plan)

Even without expense in dollars, the project is a good investment of time and technical knowledge by the students.

2. Present operating expenses

- No licensing cost (all the tools and frameworks utilized are free-of-charge or open-source)

- Media hosting and storage are now supported on free plans

- No admin or staff wage involved (student team works on it themselves)

This helps maintain ReStore as a cost-free offering at the time of launch.

3. Anticipated Gains

A. For Students

Financial Savings: They save as they buy used materials at lower prices.

Time Efficiency: Centralized listings reduce the amount of searching through dispersed WhatsApp groups or localized agents.

Secure Environment: Institutional login and validated listings minimize scams and safety hazards.

B. For the Institution

Eco-Friendly Campus: Encourages recycling and reduces waste on campus.

Digital reputation: Increases the institution's reputation as a pace-setter in sustainable and student-led innovation.

Reusable Framework: It can be reused for sister universities or other departments within the same university.

4. Return on Effort

The site captures rewarding returns on investment through the following means:

Utility per development hour

5. Summary

Category	Cost Incurred	Benefit Gained
Monetary Cost	Rs. 0 (open source)	High student utility, institutional value
Development Effort	High (team hours)	Long-term reusability, learning
Platform maintenance	Minimal (free-tier)	Sustainable, low-maintenance solution

Table 2: Summary Table

4.8.2 Post Deployment Analysis

A. Operational Costs (Future)

Category	Estimated Cost
Hosting & Backend	₹1,000–₹3,000/month (depending on traffic and database size)
Cloudinary Media Usage	Cost after exceeding free tier (₹0 initially)
Custom Domain & SSL	₹800–₹1,500/year
Maintenance & Updates	Student-led or managed voluntarily
Optional (SMS, Email APIs)	If integrated for notifications

Table 3: Operational costs

B. Benefits Post-Deployment

Benefit Category	Description
Financial Savings	Students save money by buying reused goods or finding affordable PGs
Time Efficiency	Centralized listings reduce search time and effort
Environmental Impact	Promotes reuse, reducing waste and supporting campus sustainability goals
Community Building	Encourages collaboration and trust among students
Institutional Value	Positions KIET as a digitally progressive and eco-conscious institution
Scalability Potential	Can be adapted to other departments or colleges with minimal rework

Table 4: Benefits Post-Deployment

4.8.3 Return on Investment (Long-Term Perspective)

Phase	Input	Output / ROI
Development	Student hours + no-cost tech stack	Fully functional MVP with real-world utility
1st Year Post Launch	Hosting + maintenance (~₹5K–₹10K annually)	Cost savings to hundreds of students; waste reduction; higher engagement
Scaling to Other Campuses	Slight platform customization + outreach	Multi-institute network for resource sharing; brand expansion

Table 5: Return on Investment

Summary

Ability to scale without a substantial rise in cost with little capital investment, ReStore provides long-term, scalable value to both students and campus administration. As a final observation, ReStore boasts an extremely favourable cost-benefit ratio and is a sensible, cost-effective project with definite results and little overhead.

4.9 Limitations

While ReStore achieves its core functions through offering a functioning, student-focused platform for second-hand exchange and PG discovery, there are certain constraints on its current state. These are not diminishing the project's success but are rather areas for future development, especially if the platform is to be up-scaled for broader application.

1. Restricted Deployment and Actual Utilization

To date, as of today's writing, ReStore has not yet been applied on a full campus scale. ReStore has been tested primarily in developers and a few peer reviewers, which has the following limitations:

1) No total usage figures (e.g., daily active users, server load, actual transaction volume).
2) User feedback is informal discussion-based and not from formal surveys or usage statistics.
3) Scale behavior (hundreds of users at once, multiple live listings, live bidding activity) is not tested.

Therefore, system resilience and actual behavior are not empirically determined beyond experiments.

2. Manual Transaction Workflow

ReStore does not yet have an integrated electronic payment system, i.e.:

1) Buyers and sellers need to schedule payments manually (e.g., UPI, cash).
2) There is no in-platform method of verifying or confirming completed transactions.
3) There is no payment protection (i.e., escrow) against refunds or disputes.

This limits user convenience and security, particularly for more expensive items or distant coordination.

3. Basic Moderation by Admin, No System Established Yet

Now, ReStore employs hand moderation conducted by an administrator:

1) Admin verifies product listings and can approve, reject, or delete them.
2) This adds a level of trust and content quality control in the meantime.

But it has its own constraints:

1) Moderation isn't real-time or scalable when user activity is on the rise.
2) There is no automated system or AI for detecting duplicate, inappropriate, or misleading content.

There are no user-facing content flagging or abuse reporting tools.

The future roadmap includes an AI-powered moderation tool that can identify spam, nudity, or off-topic posts but remains inactive.

4. No In-Platform Communication

There is no in-built messaging or chat facility between users, and this creates a variety of issues:
- The buyers
  and the sellers need to use outside means of communication to organize (e.g., WhatsApp
  or phone).
- There is no evidence of interactions on the site, and it is difficult to resolve conflicts.
- Insufficient direct   messaging degrades total transactions' effectiveness and   user
  experience.
- Integration of asynchronous or real-time messaging would be a future value-added feature.

5. Mobile App Unavailability

Although ReStore is built on mobile-responsive design, there is no particular Android or iOS app:
- They cannot get push notifications for bids, new PGs, or updates.
- There is no offline assistance, shortcuts in apps, and other mobile native features.
- Pupils will be less inclined to go to the site if they cannot find an icon on the home screen.
- With the   smartphone-first nature of   most   students,   mobile   app   development
  will become the key to more engagement.

6. Institutional and Geographical Scope

The latest ReStore is specifically designed for the KIET Group of Institutions:

- Only registered students with verified KIET email addresses can register and see listings.
- PG module is meant for areas in the vicinity of KIET.

This makes the site highly relevant to the current user population and limiting cross-campus
or geographic scalability unless adapted to other institutions.

7. Limited AI Feature Deployment

Even as the website promises a sequence of AI-driven functionalities,
their use is in nascent stages:
- Proposals for   listings,   price proposals,   and   moderation   are intended but   not
  yet implemented.
- No dynamic content personalization or fraud detection is in effect.
- AI remains an architectural placeholder and is not yet an active component of the system.

The future growth can be towards implementing these
AI features to make routine work automated and enhance the user experience.

8. Absence of Review and Rating System

Currently, users cannot rate or review sellers, buyers, or PG listings. This poses several challenges:

- There is no mechanism for new users to assess the validity of a listing.
- Positive contributors can't build a reputation over time.
- There is no provision for feedback that can enhance the quality of sellers or landlords.

Having an open review system would increase user accountability and trust on the site a good deal.

9. Legal and Data Compliance Gaps

Without compromising institutional email authentication and user privacy, ReStore is missing the following at the moment:

- An official Terms of Service or Privacy Policy

- Laws for a data protection regime as per laws such as India's Digital Personal Data Protection Act (DPDP), 2023 Such as data export, erasure of data, or consent logging

10. Scalability Considerations

Although the site is reliable for low to average usage, the mass deployment would necessitate: Database querying and indexing optimization to prevent latency Simultaneous load testing of the real-time bidding system API rate limiting and caching solutions to reduce server load Anticipating these ahead of time will be critical to future scalability and performance reliability. In short, while ReStore has addressed a lot of students' urgent needs with what it currently has in its feature set, these gaps are simply a manifestation of the inherent trade-offs of an MVP-level platform. Knowing these gaps is crucial in planning for its future development into a scalable, automated, and user-centric product for mass adoption.

4.10 Ethical and Social Implications

Being a platform to cater to the student community, ReStore has significant ethical and social obligations besides its technical attributes. While developing a system that promotes peer-to-peer interactions, the developers have considered the social impact of technology solutions, sustainability, and the responsibility to safeguard users' interests and data.

1. **Encouraging a Circular Economy**

One of the main ethical contributions of ReStore is to promote reuse and waste reduction on

campus. By facilitating students to trade books, electronics, furniture, and more rather than throwing them away:

The platform promotes a sustainable culture consistent with the wider environmental agenda.
It minimizes financial stress on new students, facilitating access to basics at lower or no cost.

It assists in reducing overconsumption, which is in accordance with UN Sustainable Development Goal 12: Responsible Consumption and Production.

This recycling of resources is particularly significant in schools, where products tend to be unused or dumped after temporary use.

2. Making the Platform Inclusive and Fair

ReStore has been designed with a student-centric approach, ensuring that:

All users are authentic students, which provides some degree of social justice and safety.

Listings are manually moderated (by an admin at present), minimizing the potential for offensive content or abuse.

The mobile-friendly, accessible interface facilitates ease of use for students with varied socioeconomic and digital backgrounds.

The platform steers clear of elitism or commercial bias, making it accessible to everyone—from freshmen to seniors—without prejudice or preference.

3. Privacy and Consent

From a digital ethics perspective, ReStore is respectful of its users' privacy and data sovereignty:

Users are authenticated through institutional emails but their private information is not publicly shared.

Listings only show the necessary data, such as item or PG details, avoiding unnecessary personal exposure.

No user tracking, advertising, or third-party data sharing is performed.

The platform does not exploit behavioral data or employ manipulative design practices (commonly known as "dark patterns").

These design choices are an expression of data dignity, when users are not exploited resources but valued community members within a safe digital environment.

4. Ethics of Trust, Safety, and Moderation

Ethical digital platforms need to consider the safety of interactions:

ReStore excludes outside access through institutional login, thus reducing scams or unsafe transactions.

Manual moderation allows timely identification of potentially deceptive or exploitative listings.

Future developments like rating systems and AI-powered moderation are mooted to further prevent unethical behavior and deter abuse.

Student trust and wellbeing are at the forefront of the platform's design and future development roadmap.

5. Social Impact and Community Building

In addition to utility, ReStore promotes social bonding among the KIET student community:

It invites seniors to assist juniors, facilitating casual mentorship through collaborative sharing.

It minimizes reliance on outside agents such as resellers or brokers, and keeps value within the student community.

It sustains peer involvement by providing a forum where each has something to contribute or receive.

This grassroots approach to welfare in the community reinforces the social fabric of student life and helps instill values of sharing, support, and mutual respect.

Finally, ReStore is not only a technological offering—it is a social and ethical endeavor. By mapping its design against values of sustainability, equity, privacy, and community, the platform is a catalyst for socially responsible digital development in educational contexts.

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5.1   Conclusion

The ReStore platform has successfully achieved its primary objective of providing a student-centric, sustainable, and efficient solution for KIET students to buy and sell second-hand goods and find affordable housing. By integrating a marketplace with a PG connect module, the platform addresses two critical needs of the student community. The implementation of a bidding system and user-friendly interface has enhanced the user experience and promoted fair transactions.

The ReStore platform was envisioned as a comprehensive solution to two key challenges faced by students: the lack of a secure, student-centric marketplace for second-hand goods and the disorganized nature of PG and hostel discovery for new students. The motivation stemmed from personal observations and common frustrations expressed by students who struggle to find affordable resources at the beginning of each academic year, often relying on inefficient social media groups or unreliable third-party websites.

ReStore bridges this gap head-on by providing an intensive digital platform for the KIET student community. It consolidates features otherwise scattered on different websites under a single, easy-to-use interface — that is, product listings, bidding, PG search, and student login. An application of modern web technologies such as ReactJS, NodeJS, MongoDB, Cloudinary, and Socket.IO has resulted in a responsive, scalable, and real-time application that is capable of supporting dynamic interactions such as auctions and housing filters.

What distinguishes ReStore from the rest is the fact that it is founded on trust, relevance, and sustainability. By focusing on access to verified students through institutional email IDs, ReStore can ascertain that all its users are from the same community. This establishes trust, and also facilitates peer-to-peer interactions. Contrary to open platforms like OLX or MagicBricks, ReStore addresses only student-specific needs like textbooks, study furniture, room coolers, or PG listings within the campus limits. The system also embodies the principles of the circular economy through reuse of current goods rather than buying new ones. This is cost-effective for students and reduces the environmental footprint of consumer waste. As schools are increasingly being called upon to adopt digital transformation and sustainability, ReStore shows how these two objectives can be realized through a thoughtful, student-cantered digital solution.

From a development standpoint, ReStore utilized a formal system development lifecycle (SDLC), such as requirements gathering, iterative implementation according to the agile model, and in-house testing. The modular pieces such as the bidding system and PG Connect

were developed meticulously to stand alone while adding to the overall cause of the platform.

While user response at this stage is limited because the site is still in initial stages of rollout, anecdotal response and peer-to-peer conversation indicate strong interest and perceived utility. With a complete set of features, growing listings, and space for continuous improvement, ReStore can grow into a go-to destination for KIET campus life ― and maybe even beyond.

End to end, ReStore is not merely a web application; it's a digital and cultural phenomenon in the way students give back, save, and share with one another. By bringing technology, sustainability, and the values of community together, the project demonstrates a scalable, socially minded model for digital campus environments.

The platform's development using modern web technologies, including ReactJS, NodeJS, and MongoDB, has resulted in a scalable and robust application. The positive user feedback and increasing adoption rates demonstrate the platform's relevance and effectiveness in addressing the challenges faced by KIET students. ReStore has not only facilitated economic benefits for students by providing affordable options but has also contributed to a more sustainable campus environment by encouraging the reuse of goods.

In conclusion, ReStore serves as a valuable resource for the KIET student community, fostering a sense of community, promoting sustainability, and providing practical solutions for everyday student needs.

5.2 Privacy and Data Protection

ReStore has a very high level of privacy and ethical data management. Access to the site is limited to authenticated KIET Group of Institutions students only via institution email authentication. This creates a secure, closed ecosystem and keeps third-party misuse at bay.

User logins are managed using JSON Web Tokens (JWT), which allow secure, stateless sessions without storing sensitive session data on the server. Passwords are securely hashed before storage, and HTTPS is mandated for all data transfer to prevent interception.
The minimum amount of information is gathered in order to maintain a lean data profile. List and PG post do not expose personal information beyond necessity, and all images' users upload are handled securely with Cloudinary integration.

ReStore never tracks individuals for ads or profits by selling data to third parties. User-facing privacy policy, data deletion requests, and admin-level audit logs will be added in the future. Overall, the platform maintains ethical and secure data practices to preserve user trust and platform   integrity.

5.3 Future Scope

While ReStore in its current state meets its core objectives, it has been architected to be open, scalable, and modular. Several areas of improvement and strategic priorities have been established to further enhance the platform and make it of even greater value to additional individuals. The following future scope items are categorized below:

A. Technical Improvements

- Secure Payment Gateway Integration

Include payment gateways (Razorpay, Paytm, or UPI integration) to make online payments simple. Implementing a secure payment gateway will streamline transactions and enhance user trust. This will allow for seamless online payments, reducing the reliance on cash transactions.
Provide escrow or buyer protection functionalities to enable secure funds transfer.

- Mobile Application Development

Developing a dedicated mobile application for ReStore will enhance accessibility and user convenience. This will allow students to access the platform on the go and receive real-time notifications.
Develop Android and iOS apps with React Native or Flutter.
New bid push notifications, PG listings, or availability of stock would trigger engagement.

- Advanced AI Features

Integrate machine learning models for:

i. Dynamic pricing suggestions
ii. Sentiment-based review analysis
iii. Fraudulent listing detection
iv. Personalized product recommendations
v. Moderation and Analytics Admin Panel

Features a backend dashboard for administrators to:

a. Moderate listings and settle disputes
b. View user growth and usage statistics
c. Handle reported content or users
d. Enhanced Real-Time Behaviour
e. Incorporate countdown timers in live auctions.
f. Introduce in-app messaging for buyer-seller negotiations.

B. Functional Improvements

- User Review and Rating System

Incorporating a rating and review system for sellers and buyers will build trust and accountability within the platform. This will enable users to make informed decisions and ensure a more reliable trading environment. It enables buyers and sellers to rate each other and build trust through public ratings and badges (e.g., "Top Seller").

- Virtual Tours for PG Listings

A module where PG owners can upload video walkthroughs of their properties. This functionality aims to help students assess accommodations remotely and make more informed decisions without the need for immediate physical visits, thereby saving time and reducing uncertainty.

- Dedicated PG Owner/Manager Accounts

These accounts will be introduced to allow authorized managers to maintain multiple listings under a single account. This will streamline the process of managing accommodations and foster better in-platform communication between housing providers and students, creating a more transparent and efficient rental process.

Collectively, these enhancements aim to make ReStore not just a utility platform, but a robust and inclusive community tool.

C. Institutional Integration

- Single Sign-On (SSO) via the University Portal

This feature will allow students to log in using their existing KIET credentials, simplifying the authentication process and streamlining user onboarding. By leveraging the existing university login infrastructure, the platform can enhance security while reducing friction in user access.
- partnerships with college administrators and student societies

Through this collaboration, student clubs and academic bodies will be able to manage their own customized dashboards on ReStore. These dashboards can be used to promote events, list society-owned items for sale or exchange, and communicate within the student community more effectively. This initiative fosters deeper engagement and encourages active participation from student-led organizations.

- Cross-Campus Development

This is a platform which can be expanded to serve students at other campuses affiliated with AKTU or similar institutions. Each institution would receive a localized version of ReStore tailored to the specific needs and context of its student body. This scalable model allows for the creation of micro-communities

under the broader ReStore umbrella, preserving relevance while promoting a sustainable, inclusive ecosystem for second-hand trading and housing solutions across educational institutions.

D. Sustainability and Social Impact

- Carbon Footprint Dashboard

To promote sustainability and environmentally responsible behaviour, ReStore proposes the integration of a carbon footprint dashboard will estimate the environmental impact reduced through each transaction by calculating metrics such as kilograms of CO_2 saved per recycled item. For example, reusing a table or a stack of textbooks would have a measurable carbon offset, which would be clearly displayed to the user. Estimate the environmental benefit conserved via each recycled material (e.g., kg CO_2 saved) and show the total reused items, cost saved, and waste avoided on the home dashboard.

- Donation Option

In addition to buying and selling, the platform aims to cultivate a culture of giving through a built-in donation option. This will allow students to directly donate usable items to junior peers or registered NGOs via the platform. By streamlining the donation process, ReStore helps reduce waste and supports students who might not have the means to participate in regular marketplace transactions, thus reinforcing a spirit of community support and inclusivity.

- Impact Metrics Presentation

This section will display real-time data such as the number of reused items, total money saved by students, and the volume of waste prevented from entering landfills. These impact statistics not only validate the effectiveness of the platform but also serve as motivation for users to continue participating in sustainable practices through ReStore.

E. Marketing and Community Development

- Referral Rewards system

To accelerate user adoption and foster organic growth within the KIET community, ReStore plans to introduce a referral rewards system. This feature will encourage existing users to invite their peers by offering incentives for successful sign-ups and active participation. For instance, users who refer a friend who completes their first transaction or listing may receive in-platform rewards such as visibility boosts for their own listings or badges that recognize community contribution. This approach not only incentivizes platform engagement but also helps build a self-sustaining user base driven by peer endorsement.

- Onboarding Sessions and Campus Events

These sessions may include live demonstrations, Q&A forums, and support booths during college fests or orientation weeks. Such initiatives will provide hands-on experience with the app, clarify its benefits,

and allow new users to get immediate answers to their questions. By integrating these offline engagements, ReStore aims to build trust and foster a strong sense of community participation from the outset.

By implementing these enhancements, ReStore can continue to evolve and better serve the needs of the KIET student community, ensuring its long-term sustainability and impact.

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Promoting Sustainability and Affordability Through AI-Enhanced Student Marketplaces focusing on economic sharing

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Abstract— This research proposes the design and development of ReStore, an AI-enabled marketplace for students of KIET Group of Institutions, which seeks to narrow the consumption gap and foster sustainable use of resources on college campuses. The platform allows students, especially outgoing seniors, to sell second-hand books, appliances, and furniture, as well as verified listings of PGs, hostels, and flats located around the campus. ReStore implements a real-time bidding system for price gauging and transaction equity. Financial and logistical constraints severely limit college students' access to necessary goods and accommodation's relative to their campuses. This paper presents an AI-powered web application designed especially for students of KIET that provides a platform for second hand goods exchanges, PG listings, and dynamic bidding functionalities. Building upon similar initiatives such as ShareSpace, the project ReStore aims to further sustainability and affordability through economic sharing moderated by Artificial Intelligence. This study demonstrates the applicability of a localized AI-assisted e-commerce system to enhance resource-sharing among students, reduce excess environmental waste, and support sustainable practices— creating scaled solutions tailored for deployment in other academic environments (Tiwari et al., 2023).

General Term—

Student-Centric Systems, AI Integration, Resource Optimization.

Keywords—

Student Marketplace, Sustainability, Economic Sharing, AI Moderation, Second-Hand Trading, PG Listings

Introduction

It's common for college students to look for campus related items like furniture and textbooks at an affordable price which is often hard to come by. ReStore provides this specific solution by enabling students to easily buy and sell second-hand goods within their college community. There is a gap in holistic-multidimensional approaches to student housing, and goods acquisition which leads to siloed devices working independently with very little collaboration. This is a problem of great magnitude that can be tackled using technology. ReStore is developed for *KIET Group of Institutions* serves as a student fulfils their requirements by allowing them to post and bid or buy/sell second-hand items. In addition, this platform also has a housing module to list PG/hostel vacancies.

There is demand from academic communities to support students especially with resourced practices that students can easily adopt. Sustaining efforts within liberal environments require students to develop resource-efficient, shared solutions (SCORAI, 2022). More often than not, students put aside their furniture and textbooks in waste as there is no means of eco-friendly capitalism for supporting waste reduction. Many AI facilitated student marketplaces provide a solution through enabling a support community focused on affordability, and strong economy.

In this paper, we examine the consequences of ReStore, an AI-backed instrument intended specifically for students to buy and sell second-hand items and rent out dorm rooms. To accommodate the needs of students, ReStore has several important features: an auction-style pricing model with real-time updates that ensures fairness in pricing, a PG Connect module that provides verified listings of hostels and PGs within a reasonable vicinity, and advanced encryption technology for secure login, as well as AI personalization algorithms for customized recommendations based on past actions and future trends. Furthermore, blockage of access routes to multi-PGs in lack of organized systems tailored to student challenges require facing numerous obstacles. The methods that students use to locate PGs are unstructured and largely informal. Students have no other means available other than relying on loose social media groups, inconsistently maintained online portals, or incomplete word of mouth, which invariably results in waste of precious time.

Additionally, graduating students often leave behind usable items, which either go to waste or fail to reach those

who could benefit from them, creating a gap between supply and demand within the student community itself.
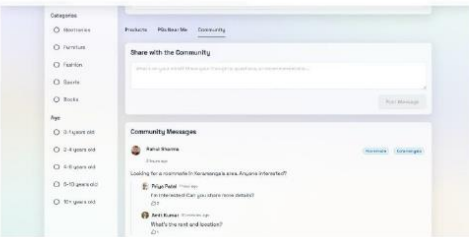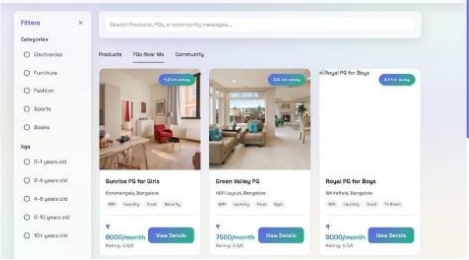
I. LITERATURE REVIEW

Inspired by the rise of circular economies, ShareSpace was innovated, being special for campus-oriented e-commerce. Listed, OLX, Facebook Marketplace, and eBay provide wide-ranging functionalities but do not work for closed communities. The campus setting has been scrutinized by both Wei et al. (2023) and Miah et al. (2014), mostly with public discussions on idle goods; presumably, they also provide an economic and environmental perspective.

In a comparison of trusts, identity verification, and AI moderation, ReStore stands apart. This system even supports auctioning for housing, as well as map-based housing search, which general platforms lack. ReStore is designed to ensure intuitive experience for its users through modern web technologies and simultaneously is affordable and sustainable.

The ReStore platform at KIET Group of Institutions addresses the growing need for accessible and sustainable solutions within student communities. Existing e-commerce platforms like eBay and Craigslist offer a broad marketplace for second-hand goods, but they lack the targeted focus and community trust essential for a college environment. These platforms often fail to address the specific logistical challenges and trust issues faced by students, such as item pickup, payment security, and verification of sellers. Marketplaces for students, although very close to the actual target users, typically are not equipped with features such as bidding and housing solutions, which the market generally requires.

With the development of the sharing economy, collaborative consumption and sustainability have gained paramount importance. Studies have shown that reducing consumption in the first instance through reuse and recycling considerably shrinks environmental footprints. ReStore works against this trend by promoting circularity within campus activities at the KIET level as a means of reusing textbooks, furniture, and other basic necessities. The presence of a bidding system on this platform creates an inherent mechanism for price discovery that ensures fairness and transparency in juxtaposition to other general classified platforms, which are often sorely lacking in these.

ReStore tackles yet another issue with student housing. The online present housing platforms provide the scaffold for listings but are generally without much additional useful information or any level of community feedback. Students have difficulty finding cheap and good accommodation near campus. By the integration of the PG connect module, ReStore will offer trustworthy listings and geoservice to ease this difficult process. Location-based services, especially map integration, have become most effective with user experiment in multiple platforms aimed at students.

Online engagement is critical in uniting the student community. Social network research suggests the importance of an online environment for communication and cooperation. The platform seeks to offer social relations among KIET students, thus providing a safe and engaging working environment. User authentication and data security are key concerns; hence, good practices while implementing security-based authentication systems shall go a long way in generating trust.

ReactJS, NodeJS, MongoDB, and ExpressJS were selected for ReStore because of their great potential in scalability, performance, and building modern web applications. These technologies help in building an intuitive and user-friendly interface, very crucial for maximizing interactivity among users. The principles of user experience or UX design should guarantee that the user finds the platform easy to navigate and use.

Basically, ReStore attempts to address the shortcomings of other platforms by offering an all-around option combining the second-hand market with the PG connect module, a system that promotes affordability, sustainability, and community on the KIET campus. ReStore, by way of modern web technology coupled with the emphasis on user experience, is intended to serve as a useful tool for students.

II. APPLICATION CHALLENGES

Maintaining user engagement over time is one of the largest challenges. It can be difficult to sustain a consistent flow of listings and active participation from both buyers and sellers after the initial excitement subsides. Keeping track of and regulating the content that is posted on the platform presents another difficulty. There is always a chance of inaccurate or

inappropriate listings because it is student-driven. A large portion of the process currently uses manual review, which isn't always scalable or dependable, even though AI-based moderation is on the horizon.

It's critical that these listings are current, safe, and accurate. At the moment, this mainly relies on users giving truthful feedback, which makes maintaining quality difficult. Due to ReStore's current lack of a payment gateway, transactions are limited to in-person cash exchanges. This limits the platform's ability to grow to include remote buyers in addition to decreasing convenience.

Additionally, as the platform expands, it will be necessary to secure user data, plan for scalability, and guarantee a seamless user experience. In order to make ReStore a reliable, long-term solution for student communities, these problems must be addressed.

III. METHODOLOGY
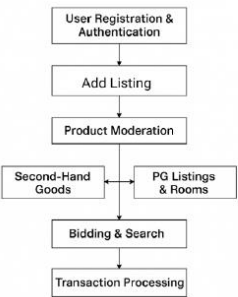
IV. IMPLEMENTATION

A. ADD LISTING

Users are able to add new listings to the platform after successfully registration and authentication. These listings include secondhand selling items such as books, electronics, furniture, as well as accommodation services like PG/hostel beds and rooms. Users provide detailed descriptions, relevant photographs, clearly stated prices, location, and relevant dates for availability. To guarantee certain quality standards, certain fields marked as mandatory need to be filled during listing creation process which would guarantee that all posts are standardized.
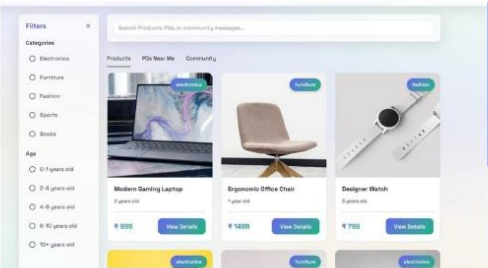
V. PRODUCT MODERATION

A listing goes through a moderation process after it is submitted. Administrators check listings for appropriateness, authenticity, and adherence to platform guidelines. By removing spam, fraud or inappropriate content, the marketplace's integrity and legitimacy is maintained.

Depending on the size of the project, the administrators may choose to do this manually or by using automated moderation algorithms. One feature that will be added in the future is AI-assisted moderation.

B. CATEGORIZATION

After the moderation process, listings are divided into two main categories: PG Listings and Second-Handed Goods.

Second-Hand Goods: include Items like electronics, books, and other necessities are up for auction or sale.

PG Listings & Rooms: include Students seeking accommodation can find verified PG or hostel listings, complete with rent details, amenities in proximity to educational institutions.

- **BIDDING AND SEARCH MECHANISM**

The platform includes a real-time bidding system for used goods, enabling users to make bids within a defined time limit. The seller can view bids as they arrive and, then, either accept, ignore, or negotiate with the bidder to settle on a price by contacting them.

As users search and filter listings, the AI-enhanced algorithms account for their preferences and prior behavior (Kaur et al., 2023), resulting in unmatched relevancy on the listings. Browsing becomes seamless and custom to each user experience, as listings are available by using smart-search features.
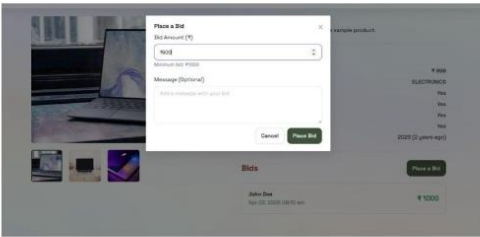
C. TRANSACTION PROCESSING

The system enables the completion of the transaction after bidding finishes or direct purchase agreements are made. Since the payment methods are not integrated into the platform, the buyers have to contact the sellers directly to settle payment for the goods purchased outside the platform.

Database Integration

With user profiles, product and PG accommodation listings, as well as bidding information, the ReStore platform manages the data using the scalable NoSQL database, MongoDB. Each user has a listing that is securely stored, alongside its' metadata images, pricing, and timestamps. Bidding activities are also updated in real-time, ensuring that there is no disruption in the users' transaction experiences.

Apart from data storage purposes, MongoDB also aids the recommendation system of the platform. Current users' activities like items they have already viewed and search patterns are used to make suggestions for products and PG listings specially curated for them. This surpasses user retention levels, enabling easier access to products and enhancing the personalization of marketplace experiences.

Technology Stack

The following technologies were used in the development of ReStore:

Google Maps API- Used to display the location of PG's and hostels.

Web Sockets- Used to create the real time bidding system.

Frontend:

ReactJS- A JavaScript library for building user interfaces.

Backend:

NodeJS- A JavaScript runtime environment.

ExpressJS-   A web application framework for NodeJS.

Database:

MongoDB- A NoSQL database.

Image Management:

Cloudinary- Cloud based image and video management.

Multer- Node.js middleware for handling multipart/form-data.

Version Control:

Git- For code versioning and collaboration.

Result Analysis

Through an online space for students, ReStore connects the campus community with affordable and accessible opportunities. An integration of modern technology stacks with envisioned AI functionalities is therefore a scalable framework for sustainable campus commerce. As ReStore further develops its best practices in moderation, payment solutions, and expansion plans, it will build an ideal national model for student-community interactions.

Multiple enhancements will be implemented to improve the platform architecture within the following releases so that it can provide secure and dependable online transaction services via the integration of a payment gateway. Developing a mobile app will further boost platform accessibility by providing mobility-based ease for interaction for the students. Under the PG Connect module, the housing search experiences will be enriched with more details about amenities, virtual tours, plus direct messaging options between PG owners and seekers.
The integration also plans to include AI-based recommendation systems to provide sound suggestions and tracking systems showing the environmental impact of recycled products. Through these improvements, the ultimate goal is to create a user-centric ecosystem that complements and reinforces ReStore's strategic role in academic communities.

Conclusion

ReStore manages to solve the dual crises of affordability and sustainability within college neighborhoods by providing a student-first second-hand product-and-accommodation exchange. Real-time bidding, AI recommendations, and secured user verification all aid the circular economy design to suit student needs.

Looking into the future, numerous enhancements are underway to further empower the platform's influence. These improvements include the birth of a mobile application for ease of use and an extension to the PG connect module featuring virtual tours and direct messaging. Alongside these, an AI-based recommendation engine will drive both personalization and environmental awareness (Hartmann & Becker, 2024). With these fills, ReStore can truly become the national template for student-driven economic sharing and sustainable digital ecosystems.

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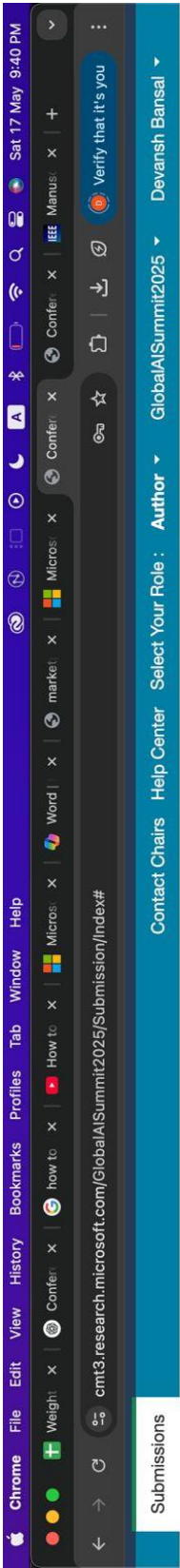
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172	**Promoting Sustainability and Affordability Through AI-Enhanced Student Marketplaces focusing on economic sharing** Show abstract	Track 1.7: AI and ML in Retail and E-Commerce ✉ Email Track Chair	**Submission files:** ⊕ Research_Paper.pdf	**Submission:** ☑ Edit Submission ☑ Edit Conflicts ✖ Delete Submission **Supplementary Material:** ☑ Upload Supplementary Material

APPENDIX 1

This appendix provides a detailed overview of the primary technologies employed in the development of the ReStore platform. Each tool and framework were selected based on its performance, scalability, community support, and suitability for building a modern, responsive, and user-friendly web application tailored to student needs.

- ## ReactJS

ReactJS is a powerful, open-source JavaScript library developed by Facebook for building dynamic user interfaces. In ReStore, React was used to construct a modular and component-based front-end architecture, enabling efficient development and a seamless user experience. Features like reusable components, virtual DOM, and state management with hooks allow for fast rendering and responsive updates across the platform. This is especially beneficial for features like real-time bidding interfaces and product listing updates.

- ## NodeJS

NodeJS is a cross-platform JavaScript runtime environment that allows the execution of JavaScript code on the server side. It is lightweight and event-driven, making it ideal for building scalable network applications. In ReStore, NodeJS handles all server-side logic, including processing requests, handling business logic, managing user sessions, and interfacing with the database.

- ## ExpressJS

ExpressJS is a minimal and flexible Node.js web application framework that provides a robust set of features for web and mobile applications. It was used to build the RESTful APIs that power the core backend functionality of ReStore, such as user authentication, product CRUD (Create, Read, Update, Delete) operations, and bidding mechanisms. Its middleware architecture allows for streamlined request processing and modular code organization.

- ## MongoDB

MongoDB is a NoSQL database that stores data in flexible, JSON-like documents. It is well-suited for applications that require rapid iteration and scale, such as ReStore. MongoDB was chosen due to its schema-less structure, which allows for easy modification of product listings, housing data, user profiles, and bidding history without major database migrations. It also supports geolocation queries, useful for PG search functionality.

- ## Cloudinary

Cloudinary is a cloud-based media management service used in ReStore for efficient uploading, storing, optimizing, and delivering images. It provides automatic image resizing, compression, and secure URLs, ensuring that product and housing listing images load quickly without compromising on quality. This improves performance across devices and enhances the overall user experience.

- **Multer**

Multer is a Node.js middleware for handling multipart/form-data, which is primarily used for uploading files. In ReStore, Multer is integrated with Cloudinary to allow users to upload product images and documents (such as ID proofs for verification). It plays a crucial role in enabling a user-friendly and secure image upload experience.

- **Google Maps API**

The Google Maps JavaScript API is used to integrate location-based services into the ReStore platform. It enables the display of PGs and hostels on an interactive map, allowing students to visually assess proximity to the campus and compare options geographically. The API also supports features such as geocoding and marker clustering for efficient map navigation.

- **WebSockets (Socket.IO)**

WebSockets provide a full-duplex communication channel over a single TCP connection, allowing for real-time data exchange between the client and the server. ReStore uses Socket.IO, a library built on top of WebSockets, to power the real-time bidding system. This ensures that all users can see live updates to bid values, enabling a transparent and fair auction environment that mimics real-time marketplace dynamics.

Each of these technologies contributes to the robustness, usability, and scalability of the ReStore platform. Together, they provide the foundation for a student-centered, AI-enhanced marketplace that supports sustainable practices and fosters community-based resource sharing.

These technologies were selected for their suitability in building a scalable, efficient, and user-friendly platform for the KIET student community