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SmartSwap: A Campus-Centric Marketplace for Stationery Exchange using Flutter and Firebase

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Abstract - Students often face challenges in managing and exchanging stationery items on campus. Existing methods such as WhatsApp groups, notice boards, or large e-commerce platforms are inefficient, unverified, and pose privacy and trust risks. This research proposes SmartSwap, a student-centered mobile application providing a secure, verified, and eco-friendly system for exchanging and purchasing stationery. Implemented using Flutter for frontend and Firebase services (Authentication, Firestore, Storage, and Realtime Database) for backend functionality, SmartSwap enables student verification via institutional email, structured product listings, in-app messaging, and administrative moderation. By formalizing the exchange process, SmartSwap aims to reduce waste, promote affordability, and foster campus community engagement.

Key Words: SmartSwap, Flutter, Firebase, Campus Marketplace, Stationery Exchange, Student-Centric Systems, Sustainability

1.INTRODUCTION

Students often overspend, duplicate purchases, or discard stationery due to unstructured exchange methods. Platforms like WhatsApp or notice boards are unverified, insecure, and inefficient. According to recent studies, students in India spend an average of $50–$100 per semester on stationery, with approximately 20% of items going unused or discarded.SmartSwap addresses these issues with a campus-exclusive, secure platform using Flutter (frontend) and Firebase (backend). The system encourages eco-friendly practices, affordability, and community engagement. Figure 1 shows the system architecture.

2. System Design

The body of the paper presents the main findings, methodology, implementation, and evaluation of the SmartSwap project. All sections are numbered, and acronyms are defined at first occurrence.

2.1 System Overview (Sec. 2.1)

SmartSwap is a campus-centric mobile application designed to facilitate secure and verified exchange of stationery among students. The system addresses limitations in existing informal channels like WhatsApp groups and notice boards.

Key Features:

- Verified student access via institutional email.
- Structured product listings with categories, condition, and price.
- In-app messaging for private communication.
- Admin moderation for listing approval and dispute resolution.

2.2 System Architecture (Sec. 2.2)

The architecture uses a client-server model, where Flutter provides the frontend interface, and Firebase provides backend services (Authentication, Firestore, Storage, Realtime Database).

As shown in Fig. 1, the system flow begins with user authentication, followed by listing creation, messaging, and transaction confirmation. Admins oversee moderation and handle disputes.

2.3 Database Design (Sec. 2.3)

Firebase Cloud Firestore is used to store structured data, while Realtime Database manages chat and live notifications.

Table 1: SmartSwap Database Collections

Collection	Description
Users	Student details, email verification, profile picture
Products	Item details, category, condition, price, availability
Transactions	Records of exchanges, reserved and sold items
Chats	Messages exchanged between students

2.4 Workflow and Algorithms (Sec. 2.4)

2.4.1 Authentication Workflow (Sec. 2.4.1)

1. Student enters institutional email and password.
2. Firebase Authentication validates domain and credentials.
3. If valid, access is granted; otherwise, an error is displayed.

2.4.2 Search and Filter Algorithm (Sec. 2.4.2)

1. User selects filters: category, condition, price.
2. Firestore indexed query retrieves matching items.
3. Results are displayed in descending order of recency.

2.4.3 Transaction Flow (Sec. 2.4.3)

- Item status progresses: Available → Reserved → Sold.
- Reserved items block other users from booking.
- Admin can override in case of disputes.

2.4.4 Chat Workflow (Sec. 2.4.4)

1. Messages are sent via in-app chat interface.
2. Stored in Firebase Realtime Database.
3. Notifications delivered using Firebase Cloud Messaging (FCM).

2.5 Implementation (Sec. 2.5)

2.5.1 Frontend (Sec. 2.5.1)

- ListView Builder: Displays dynamic product lists.
- Card & Container: Represents individual product items.
- Navigator: Manages page transitions.
- Provider: Handles state management across app screens.

2.5.2 Backend (Sec. 2.5.2)

- Authentication: Email validation.
- Firestore: Stores user, product, transaction data.
- Storage: Manages images securely.
- Realtime Database: Supports real-time chat and notifications.

2.6 Testing and Evaluation (Sec. 2.6)

2.6.1 Unit Testing (Sec. 2.6.1)

All modules—listing creation, chat, and authentication—are tested individually to ensure expected outcomes.

2.6.2 Integration Testing (Sec. 2.6.2)

Ensures seamless communication between frontend and backend, including Firestore queries, storage retrieval, and notification delivery.

2.6.3 Usability Testing (Sec. 2.6.3)

- Pilot testing with 30 students.
- Metrics include ease of navigation, time to post listings, messaging efficiency.

Table 2: Pilot Testing Metrics

Metric	Excellent	Good	Poor
Ease of Navigation	20	8	2
Posting a Listing	18	10	2
Messaging Experience	22	6	2

2.7 Expected Outcomes (Sec. 2.7)

- Verified, campus-exclusive marketplace for stationery exchange.
- Reduced search and transaction time.
- Improved trust, privacy, and security.
- Positive environmental impact by promoting reuse.
- Potential cost savings for students.

Table -1: Sample Table format

Features	Existing System	SmartSwap
Access	Open/informal groups	Verified campus-only
Listings	Unstructured	Structured with categories, price
Communication	Phone/chat apps	In-app messaging
Moderation	None	Admin approval
Privacy	Low	High, no direct contacts

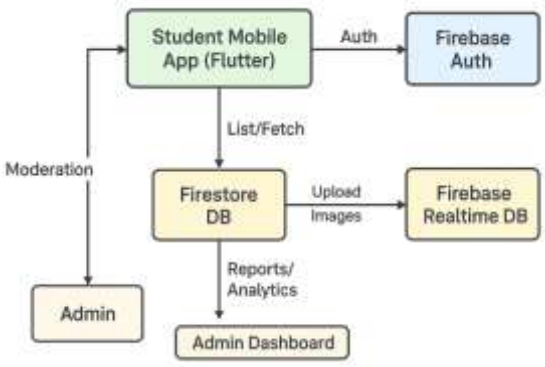

Fig -1: Architecture of SmartSwap

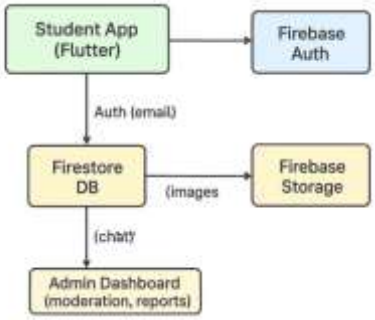

Fig -2: WorkFlow of SmartSwap

3. CONCLUSIONS

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