# HabitFlow - Project Report

# Habit Tracking Application

**Course:** CCCS106 Application Development / Information Assurance / Software Engineering
**Institution:** Camarines Sur Polytechnic Colleges
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**Version:** 1.0.0

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# 1.Executive Summary

### Project Overview

HabitFlow is a secure, offline-first mobile habit tracking application developed using Python and the Flet framework for mobile phone platforms. The application enables users to build and maintain positive daily routines while providing enterprise-grade security controls, intelligent AI-powered categorization, and comprehensive analytics.

This report outlines the design and architecture of HabitFlow, the security model, and the implementation strategy based on the information assurance best practices, such as threat modeling, access control, cryptographic password storage, and a detailed logging strategy. The system focuses on user privacy by storing data locally, defense-in-depth security by design, and secure coding by extensive unit testing (62 tests, 88% coverage).

### Problem Statement

Animal shelters traditionally rely on fragmented tools spreadsheets, phone calls, paper forms, and social media leading to:

- Lack of structured tracking system – Without a systematic way to monitor progress, users lose motivation.
- Privacy concerns with cloud-based apps – Existing habit trackers often require uploading personal data to third-party servers.
- Complex, feature-heavy interfaces – Many apps overwhelm users with unnecessary complexity instead of simplifying habit formation.
- No intelligent categorization – Users manually organize habits, adding friction to the process.

**Solution**
HabitFlow addresses these challenges by providing:

- Simple, intuitive mobile interface – Minimal steps to add and track habits daily.
- Local-first architecture – All data remains on the user's device; no cloud transmission required.
- AI-powered smart categorization – Automatic category suggestions as users type habit names.
- Comprehensive analytics – Streaks, completion rates, and category breakdowns to visualize progress.
- Enterprise-grade security – bcrypt password hashing, account lockout protection, security logging.

**Target User**

- Students – Track study habits, exercise routines, sleep schedules.
- Professionals – Monitor productivity habits, exercise consistency, work-life balance.
- Health-conscious individuals – Build and maintain wellness routines.

## Framework Chosen & Rationale

| Component | Choice | Rationale |
|---|---|---|
| **UI Framework** | Flet (Python + Flutter) | Cross-platform (Android/iOS) support from single Python codebase; rapid development; native Material Design 3. |
| **Database** | SQLite (local) | Embedded, zero-configuration; ACID compliance; thread-safe connections; no server required. |
| **Password Security** | bcrypt | Industry-standard; automatic salt generation; configurable work factor (10 rounds default). |
| **Testing Framework** | pytest + pytest-cov | Comprehensive assertion library; built-in fixtures; detailed coverage reporting. |
| **UI/UX Design** | Material Design 3 | Consistent cross-platform look-and-feel; accessibility guidelines; modern design patterns. |
| **Language** | Python 3.8+ | Familiar to team; extensive security libraries; rapid prototyping; readable code for maintenance. |

**Alternative Considered**

| Alternative | Why Not Chosen |
|---|---|
| **React Native / Flutter** | Requires JavaScript/Dart expertise; longer learning curve for team; less suitable for quick prototyping. |
| **Web-based (Flask/Django)** | Not mobile-native; browser dependency; poor offline capability; not aligned with mobile-first requirement. |
| **Firebase / Cloud backend** | Compromises privacy (cloud storage); adds infrastructure complexity; contradicts offline-first design. |
| **PostgreSQL** | Overkill for local app; requires server setup; adds deployment complexity. |
| **Argon2 (password hashing)** | bcrypt is more universally supported; equally secure for our use case; simpler library integration. |

## Implemented Feature & Scope

| Feature | Status | Details |
|---|---|---|
| **User Authentication** | ✅ Implemented | Email/password registration, secure login, password validation (min 6 chars). |
| **Habit CRUD** | ✅ Implemented | Create, read, update, delete habits with metadata (name, category, frequency). |
| **Daily Tracking** | ✅ Implemented | Mark habits complete via checkbox toggle on Today screen. |
| **Basic Analytics** | ✅ Implemented | Current streak, completion rate, per-habit statistics. |
| **Data Storage** | ✅ Implemented | Local SQLite database with user data isolation via foreign keys. |
| **User Preferences** | ✅ Implemented | Theme selection (light/dark), password management, account deletion. |

**Enhanced Features**

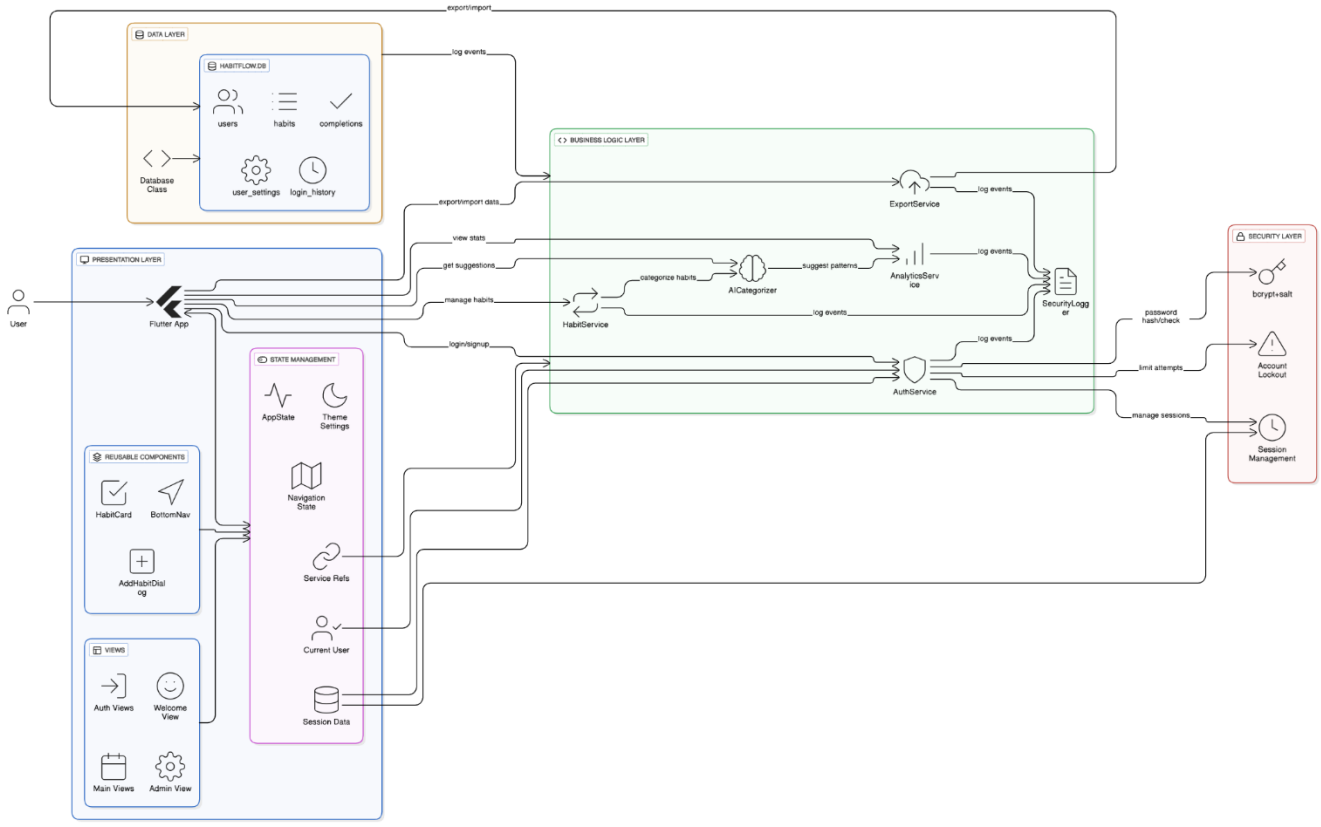
| Feature | Status | Details |
|---|---|---|
| **AI Categorization** | ✅ Implemented | Rule-based on-device AI suggests categories using keyword matching, regex patterns, fuzzy matching. |
| **Account Lockout** | ✅ Implemented | 5 failed attempts → 15-minute lockout to prevent brute-force attacks. |
| **Security Logging** | ✅ Implemented | All login attempts recorded with timestamp and success/failure |

| Feature | Status | Details |
|---|---|---|
| | | status in login_history table. |
| **Advanced Analytics** | ✅ Implemented | Weekly stats, category breakdown, best day analysis, longest streak tracking. |
| **Data Export** | ✅ Implemented | JSON backup export from Settings screen for user-controlled backup. |
| **Admin Dashboard** | ✅ Implemented | Admin users can view user list, disable accounts, access security logs. |

**Out of Scope ( Future Work )**

- Cloud sync – Planned for v2.0; requires backend infrastructure.
- Push notifications – Planned for v2.0; requires notification service.
- Wearable integration – Planned for v4.0; requires wearable SDKs.
- Multi-language UI – Currently English-only; planned for v3.0.
- Web client – Planned for future; currently mobile-only.

# System Architecture & Module Overview



**Module Description**

| Module | Path | Purpose | Key Classes |
|---|---|---|---|
| **Views** | app/views/ | Mobile UI screens | WelcomeView, AuthView, TodayView, HabitsView, StatsView, SettingsView, AdminView |
| **Components** | app/components/ | Reusable UI elements | HabitCard, AddHabitDialog, BottomNav, ThemeToggle |
| **Services** | app/services/ | Business logic | AuthService, HabitService, AnalyticsService, ExportService, SecurityLogger, AICategorizer |
| **Models** | app/models/ | Data structures | User, Habit, Completion, LoginAttempt |
| **Storage** | app/storage/ | Database abstraction | Database (SQLite manager, thread-safe) |
| **State** | app/state/ | Global app state | AppState (singleton with current user, theme, cached data) |
| **Tests** | app/tests/ | Unit/integration tests | test_auth_service.py, test_database.py, test_habit_service.py, test_analytics_service.py |

**Data Flow Example: Adding a Habit**

1. User enters habit name in UI → AddHabitDialog component
2. AI categorization triggered → AICategorizer service analyzes name, suggests category
3. User confirms or overrides category → UI sends to HabitService
4. HabitService validates input → Checks for duplicates, enforces business rules
5. Data persisted to SQLite → Database.insert_habit() via parameterized query
6. AppState updated → Cached habits refreshed
7. UI re-renders → HabitsView and TodayView refresh to show new habit

# Threat Model & Security Controls

**Threat Modeling (STRIDE)**

| Threat Category | Specific Threat | Potential Impact | Mitigation |
|---|---|---|---|
| **Spoofing** | Unauthorized login / credential guessing | Account takeover, data access | bcrypt + 5-attempt lockout + 15-min delay |
| **Tampering** | SQL injection via user | Data modification, | Parameterized SQLite queries |

| Threat Category | Specific Threat | Potential Impact | Mitigation |
|---|---|---|---|
| | input | data breach | |
| **Tampering** | Database file modification | Data corruption | File permissions, SQLite integrity checks, CASCADE DELETE constraints |
| **Repudiation** | User denies actions (habit creation, deletion) | Accountability loss | Habit creation/deletion timestamps, audit logs possible in v2.0 |
| **Information Disclosure** | Password theft / plaintext storage | Account compromise | bcrypt hashing with salt; passwords never stored plaintext |
| **Information Disclosure** | Session hijacking | Unauthorized access | Session token not used; app-level user tracking only; no cross-device sessions in v1 |
| **Denial of Service** | Brute-force login | Availability impact | Account lockout after 5 failed attempts |
| **Elevation of Privilege** | Regular user accesses admin features | Unauthorized access to user management | Role-based access control; admin check before dashboard access |

**Security Controls Implemented**

- **Authentication & Authorization**
  - Password Hashing
  - Algorithm: bcrypt (Blowfish cipher)
  - Salt: Automatic per-password (10 rounds)
  - Validation: Minimum 6 characters enforced at registration
  - Never plaintext: Hashed passwords only stored in database
- **Account Lockout**
  - Failed attempts threshold: 5
  - Lockout duration: 15 minutes
  - Counter reset: On successful login
  - Implementation: Checked in AuthService.login() before password verification
- **Login Logging**
  - Table: login_history
  - Fields: user_id, timestamp, ip_address (optional), success/failure
  - Purpose: Audit trail; manual inspection for suspicious patterns
- **Role-Based Access Control (RBAC)**

- Admin users: Can access admin dashboard, view security logs, manage users
- Regular users: Can only access their own habits and settings
- Enforcement: Role check before sensitive operations in service layer

**Data Protection**

- **Local Storage Only**
  - Data stored on device in SQLite; no network transmission
  - Privacy by design: No cloud sync in v1
- **Parameterized Queries**
  - All SQL uses placeholders (?) to prevent injection
  - Example: SELECT * FROM users WHERE email = ? with bound parameters
- **Foreign Key Constraints**
  - Enforced at database schema level
  - Prevents orphaned records (e.g., habits without users)
  - CASCADE DELETE: Deleting user removes all related habits, completions, logs
- **Input Validation**
  - Email format validation
  - Password length/complexity checks
  - Habit name length limits (prevent overflow)
  - Category enum validation (only predefined categories allowed)
- **Cryptography**
  - Hashing Algorithm: bcrypt
  - Standard: Based on Blowfish cipher
  - Work factor: 10 rounds (configurable)
  - Output: 60-character hash with embedded salt
  - Collision resistance: Not applicable (one-way function)
- **No encryption of data at rest (by design)**
  - Justification: All data is non-sensitive habit names; privacy comes from local-only storage
  - Future consideration: End-to-end encryption if cloud sync added

**Audit & Logging**

- **Security Event Logging**
  - Logged events: Login attempts (success/fail), failed lockout, admin actions (future v2.0)
  - Storage: Separate login_history table
  - Retention: No automatic purging (manual admin review)

# Design Decisions & Trade-offs

### Key Design Decisions

| Decision | Rationale | Trade-off |
|---|---|---|
| **Local SQLite over cloud database** | Privacy-first; offline-capable; simple deployment | No automatic cross-device sync; v1 limited to single device |
| **Rule-based AI over ML model** | Deterministic; no training data needed; runs offline | Less adaptive; English-only; no learning from user feedback |
| **Single-user focus (v1)** | Simplicity; lower security complexity; faster development | No team/social features; future expansion needed for collaboration |
| **Material Design 3** | Modern UX; accessibility; cross-platform consistency | Limited customization; follows Google standards (may not suit all users) |
| **bcrypt over Argon2** | Proven track record; library support; sufficient security level | Slightly slower than Argon2 (by design); less modern |
| **No server-side authentication** | Privacy; offline-first; no backend infrastructure | No password recovery feature; users must remember credentials |

### Alternatives Considered & Rejected

| Alternative | Why Rejected | Impact |
|---|---|---|
| **PostgreSQL with cloud backend** | Breaks privacy promise; infrastructure costs; scope creep | Cloud sync would be v2.0+ only |
| **Token-based session management** | Unnecessary complexity for local app; tokens would need storage | App-level state management simpler for v1 |
| **End-to-end encryption** | Adds complexity; premature for local-only v1 | Reconsidered if cloud sync added in v2.0 |
| **ML categorization** | No training data; expensive to compute on mobile; overkill for v1 | Rule-based approach sufficient; ML planned for v3.0 |
| **Web-first approach** | Mobile is primary use case; browser-based less native | Desktop/web client deferred to future |

# Trade-off Analysis

### Security vs. Usability

- Decision: Require strong passwords (min 6 chars) but not enforce uppercase/numbers/symbols
- Rationale: Balance security (prevent weak passwords) with usability (avoid excessive requirements that users circumvent)

### Privacy vs. Features

- Decision: Local-only storage in v1 instead of cloud features
- Rationale: Privacy is more important for v1; cloud sync requested but deferred to v2.0 when infrastructure can be properly secured

**Complexity vs. Functionality**

- Decision: Rule-based AI instead of ML model
- Rationale: Keep v1 simple and lightweight; ML categorization planned for v3.0 once user base provides training data

## Limitations & Future Work

| Limitation | Impact | Severity |
|---|---|---|
| **No cloud sync** | Data stuck on one device; users lose data if phone lost | High |
| **No push notifications** | Users must manually open app; may forget to track | Medium |
| **Rule-based AI only** | Categorization can misclassify ambiguous habits; doesn't improve over time | Medium |
| **English-only UI** | Excludes non-English speakers; habit names must be typed in English | Low-Medium |
| **Single-user design** | Cannot share progress with friends; no team accountability | Medium |
| **No password recovery** | Users locked out if they forget password (no reset email) | Medium |
| **Limited admin features** | Basic user management only; no advanced analytics or compliance reporting | Low |
| **No wearable integration** | Cannot pull data from fitness trackers or smartwatches | Low |

**Identified Risks & Mitigations**

| Risk | Likelihood | Impact | Mitigation |
|---|---|---|---|
| **Data loss (device damage/loss)** | Medium | High | JSON export feature; user responsibility to backup |
| **Password compromise** | Low | High | bcrypt hashing + account lockout + login logging |
| **Brute-force attack** | Low | Medium | 5-attempt lockout + 15-min delay prevents scalable attacks |
| **SQL injection** | Very Low | Critical | Parameterized queries + input validation |

| Risk | Likelihood | Impact | Mitigation |
|---|---|---|---|
| **Concurrent access issues** | Low | Medium | SQLite connection pooling + transaction management |
| **Large data set performance** | Low | Medium | Efficient queries; pagination planned for v2.0 |

# Future Roadmap

**Version 2.0**

- Cloud backup with optional sync (Firebase or custom backend)
- Push notifications for daily reminders
- Widget support for home screen quick access
- PDF export for progress reports
- Multi-language UI (Filipino, Spanish)

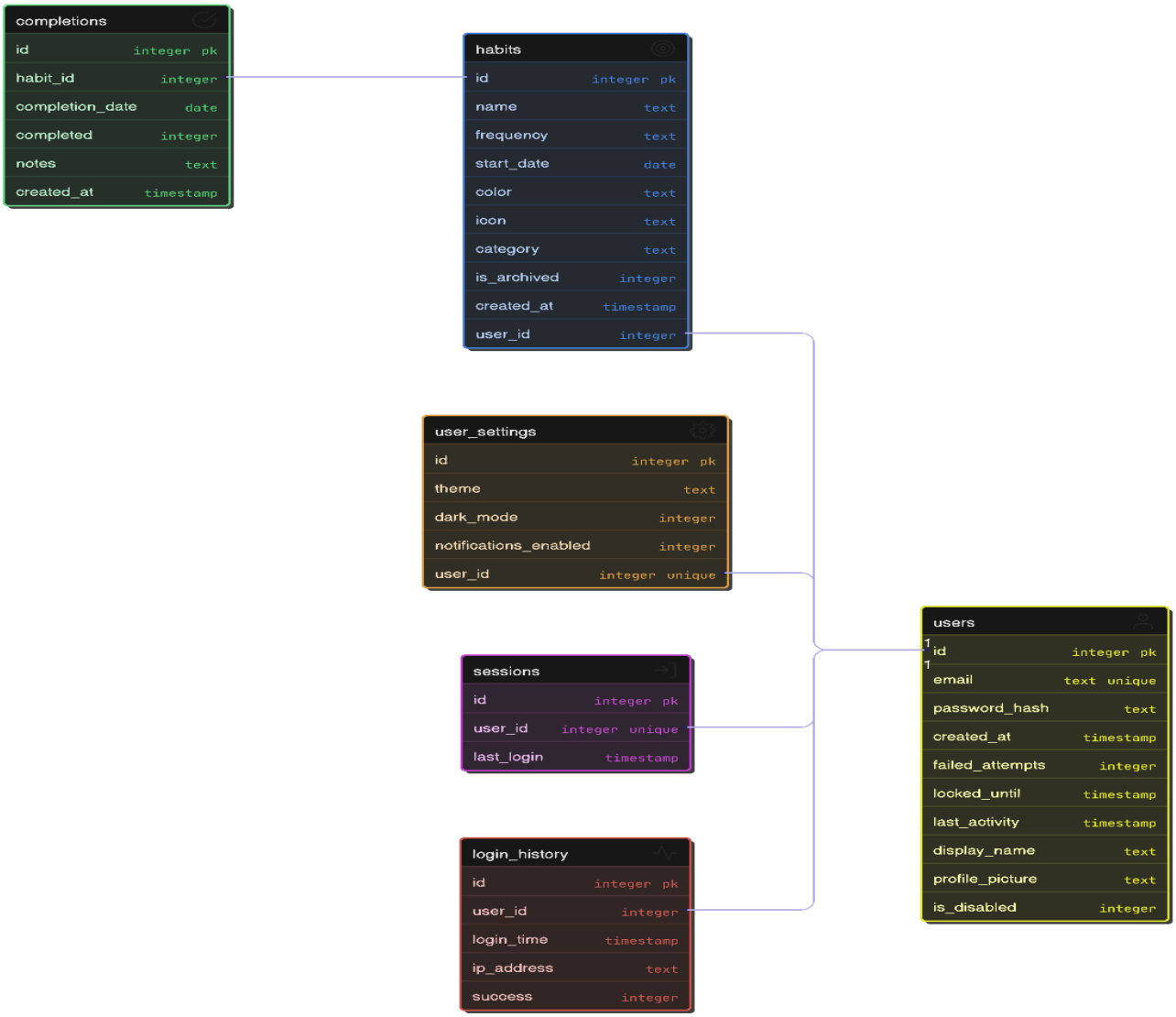
**Version 3.0**

- Social features: share streaks, friend accountability groups
- Gamification: badges, levels, leaderboards
- ML-powered predictions: identify at-risk habits
- Calendar integration (Google, Apple)
- Advanced admin dashboard: analytics, compliance reports

**Version 4.0**

- AI coaching assistant with personalized recommendations
- Wearable integration (Apple Watch, Fitbit, Garmin)
- Enterprise/team features for workplace wellness programs
- End-to-end encryption for cloud-synced data
- Multi-platform deployment (web, desktop apps)

# Technical Documentation




# Setup & Installation

Prerequisites:

- Python 3.8 or higher
- pip package manager
- ~100 MB disk space

**Installation Steps:**

1. **Clone repository:**

```
git clone https://github.com/lililhuan/Habit-Flow.git
cd Habit-Flow
```

2. **Create virtual environment (recommended):**

```
python -m venv venv
source venv/bin/activate  # macOS/Linux
venv\Scripts\activate      # Windows
```

3. **Install dependencies:**

```
pip install -r requirements.txt
```

4. **Run application:**

```
flet run app/main.py
```

**Configuration (Optional):**

- Copy .env.example to .env
- Adjust settings: database path, admin emails, security parameters

**How to Run Tests**

**Run all tests:**

```
pytest
```

**Verbose output:**

```
pytest -v
```

**Coverage report (terminal):**

```
pytest --cov=app --cov-report=term-missing
```

**Coverage report (HTML):**

```
pytest --cov=app --cov-report=html
# Open htmlcov/index.html in browser
```

**Run specific test file:**

```
pytest app/tests/test_auth_service.py
```

# Testing & Quality Assurance

**Test Plan & Coverage**

| Module | Test File | Test Count | Coverage | Focus Areas |
|---|---|---|---|---|
| **Authentication** | test_auth_service.py | 15 | 90% | Password hashing, login/logout, account lockout, registration validation |
| **Database** | test_database.py | 12 | 90% | CRUD ops, foreign keys, cascading deletes, thread safety, connection pooling |

| Module | Test File | Test Count | Coverage | Focus Areas |
|---|---|---|---|---|
| **Habit Management** | test_habit_service.py | 20 | 86% | Habit creation, editing, deletion, AI categorization, user isolation |
| **Analytics** | test_analytics_service.py | 15 | 83% | Streak calculation, completion rates, category stats, trend analysis |
| **Models** | (Inline tests) | – | 91%+ | Data validation, edge cases |

Total: 62 passing tests, ~88% overall coverage

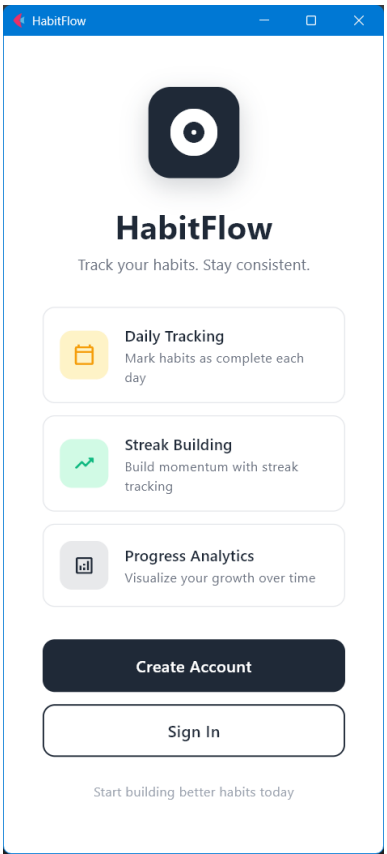
**Test Results Summary**

```
============================= test session starts ==============================
platform win32 -- Python 3.11.0, pytest-7.4.0
collected 62 items

app/tests/test_auth_service.py ..... 15 PASSED
app/tests/test_database.py ..... 12 PASSED
app/tests/test_habit_service.py ..... 20 PASSED
app/tests/test_analytics_service.py ..... 15 PASSED

============================== 62 passed in 2.34s ==============================
```

# HabitFlow User Manual

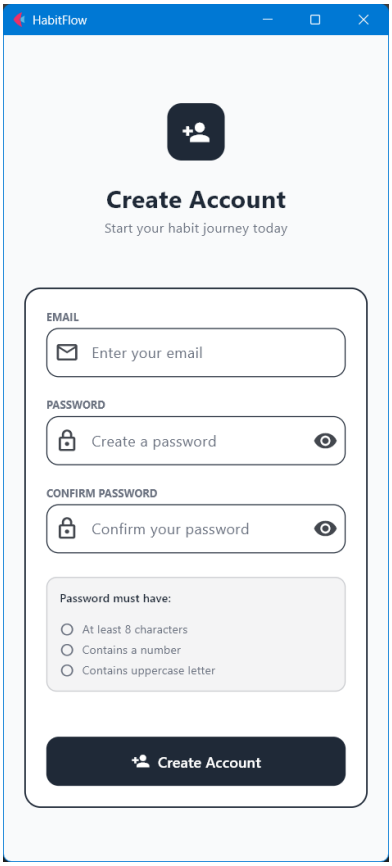



**Welcome Screen**

From the welcome screen you can:

- Read the key features: Daily Tracking, Streak Building, Progress Analytics.
- Tap **Create Account** to register, or **Sign In** if you already have an account.

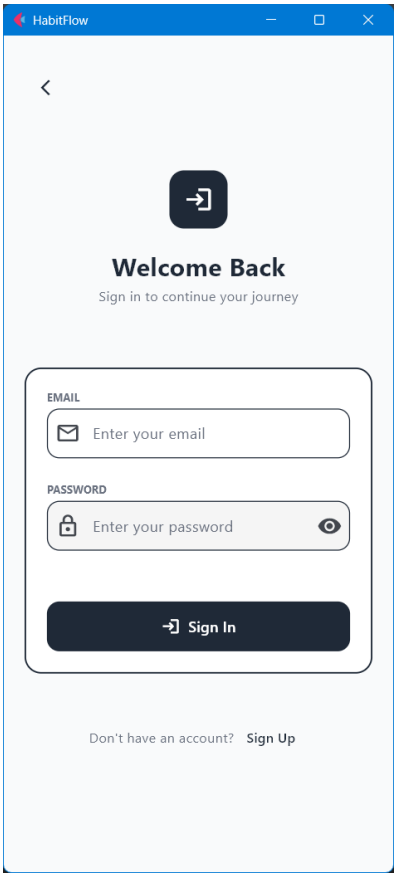
## Creating an Account




Steps:

1. Enter a valid email address.
2. Create and confirm your password.
3. Make sure the password meets the requirements shown on screen (length and complexity).
4. Tap **Create Account** to finish registration.

## Signing In

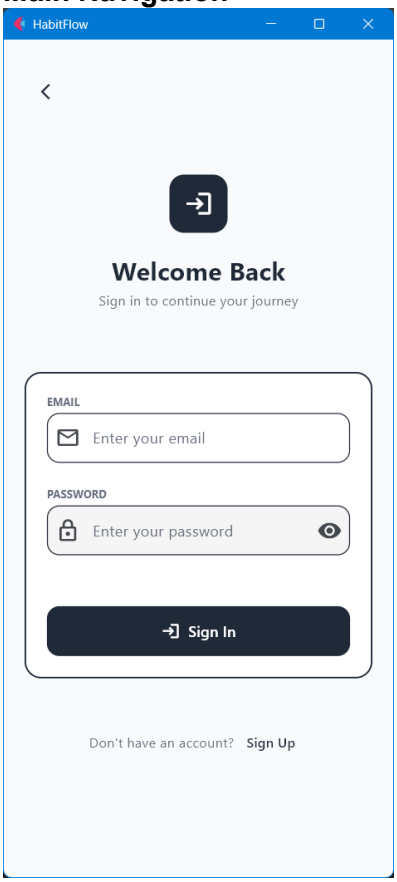



Steps:

1. Enter the email and password you used at registration.
2. Tap **Sign In** to open your HabitFlow dashboard.

If you enter the wrong password too many times, your account may be temporarily locked as a security measure.

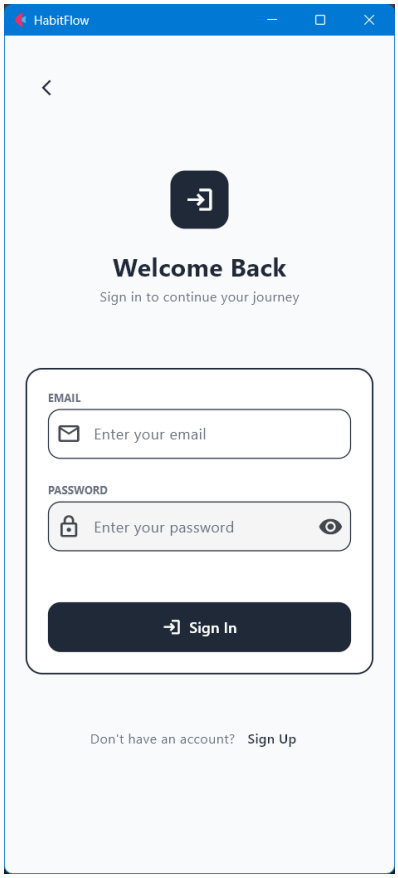
## Main Navigation




The bottom navigation bar contains:

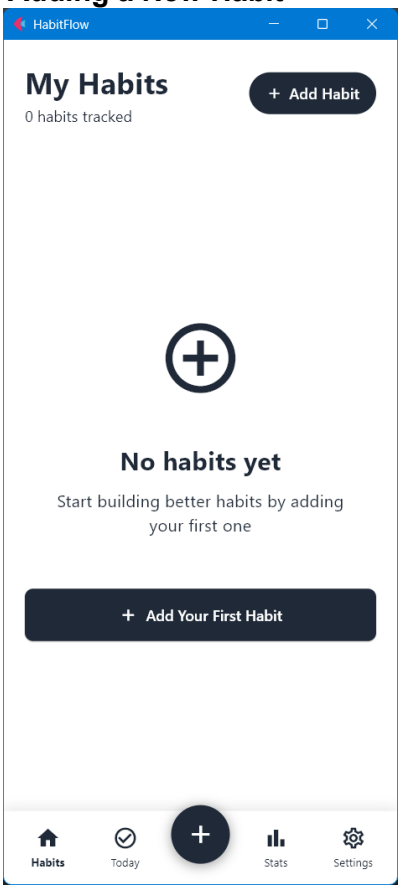
- **Habits** – manage all your habits.
- **Today** – view and complete today's habits.
- **Add (+)** – quickly add a new habit.
- **Stats** – see analytics and streaks.
- **Settings** – manage account, appearance, and data

## Core Features




- Tap **Add Habit** or **Add Your First Habit** to create a new habit.
- Use the list to review existing habits and open them for editing or deletion.

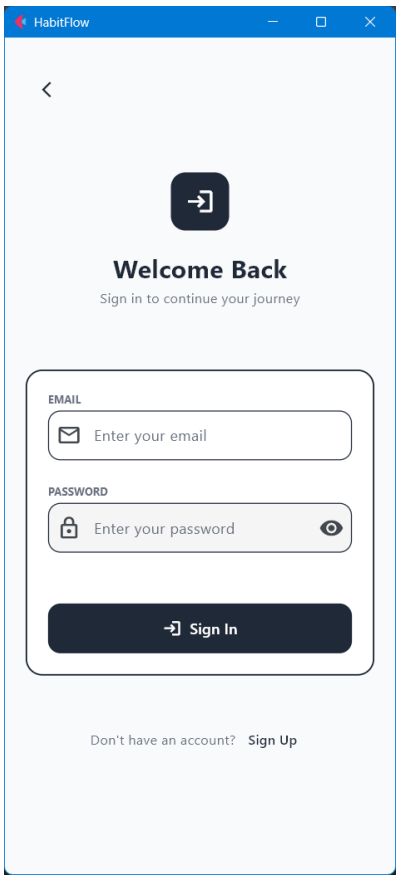
## Adding a New Habit




Steps:

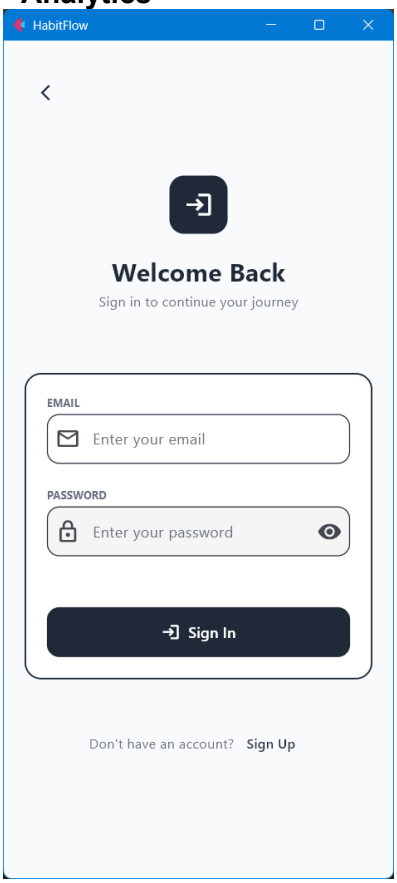
1. Enter the **Habit Name**.
2. Check the **Category (AI)** field; HabitFlow will suggest a category automatically based on the name, but you can change it manually.
3. Choose a **Frequency** (Daily, Weekly, or Custom).
4. Set the **Start Date**.
5. Tap **Create Habit**

## Today View & Daily Tracking




- The Today tab shows all habits scheduled for the selected date.
- Tap the checkbox on a habit card to mark it as complete.
- The progress bar and percentage at the top update automatically as you complete habits.

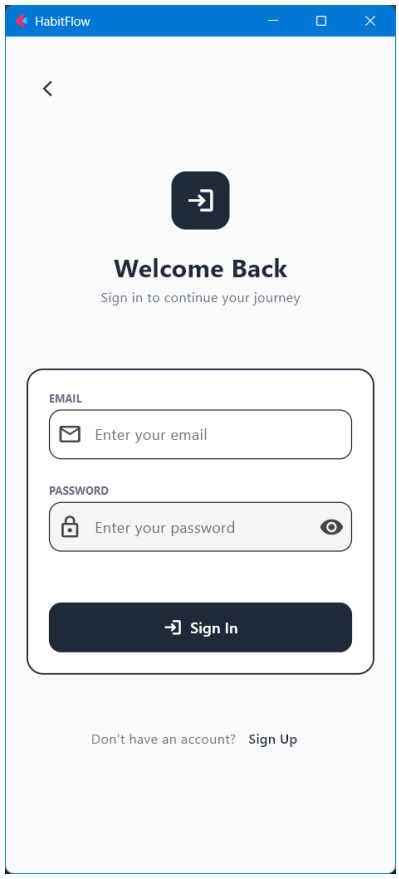
## Analytics




The **Stats** tab shows:

- Total habits and total completions.
- Average completion rate and best streak.
- Weekly progress chart and habit performance summaries.

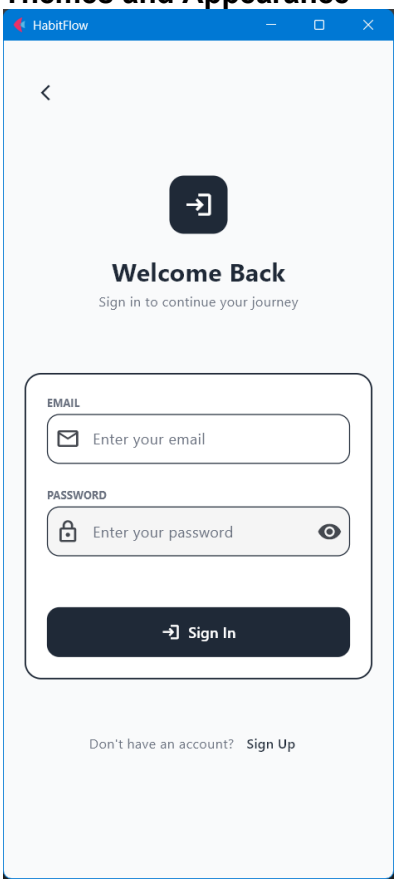
## Account Settings




From **Settings** → **Account** you can:

- View your email address.
- Sign out of your account.
- Change your password to keep your account secure.

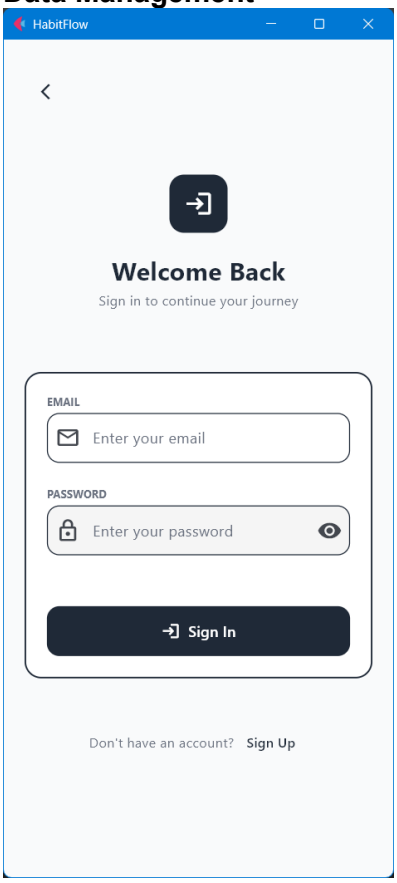
## Themes and Appearance




From **Settings** → **Appearance** you can:

- Toggle **Dark / Light Mode**.
- Choose from multiple theme colors like Ocean Blue, Forest Green, Purple Dream, and more.
- See a live preview when a theme is applied successfully.

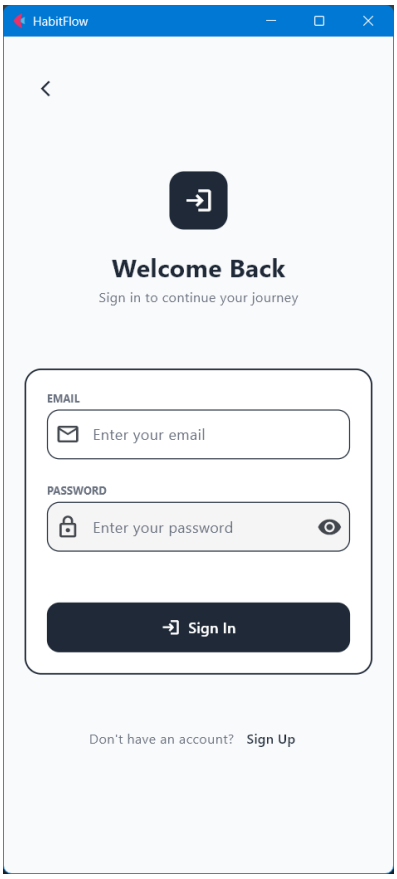
## Data Management




From **Settings** → **Data Management** you can:

- **Export Data** – download your habits and progress to a JSON file for backup.
- **Import Data** – restore from a previously exported backup.
- **Reset All Data** – remove all habits and completions but keep your account.
- **Delete Account** – permanently delete your account and all stored data.

## About & Storage Information

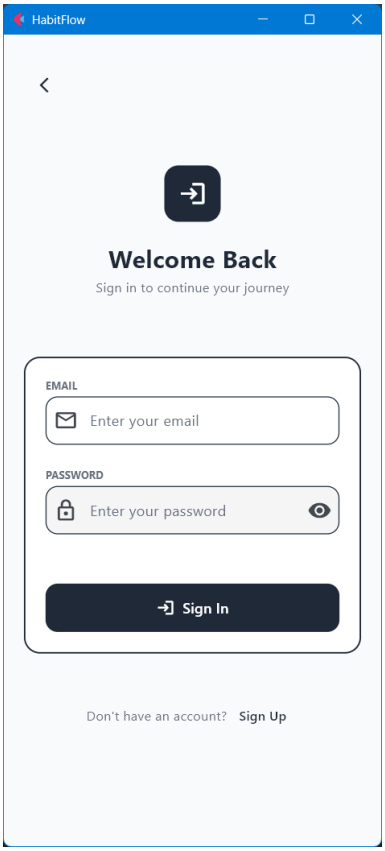



The About section shows:

- App version.
- Short description of HabitFlow.
- Storage summary (total habits/completions, storage location = Local Device).

# Admin Dashboard (for Admin Accounts)

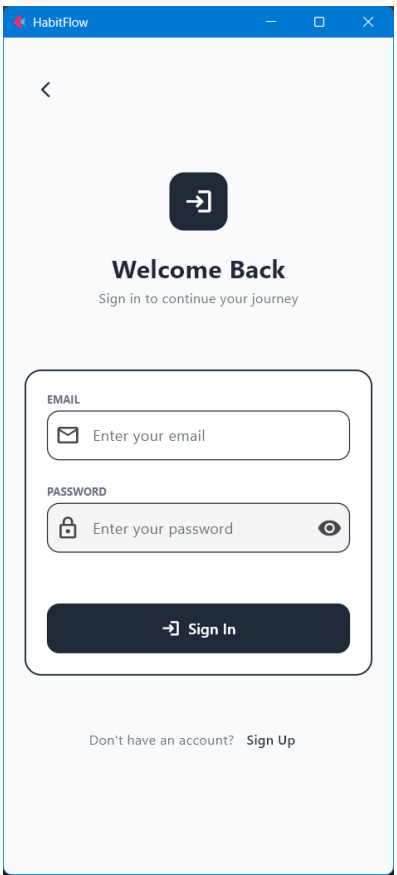
## User Management




The **Users** tab in the Admin Dashboard lets administrators:

- View all registered users with their email and basic stats (for example, number of habits).
- See which accounts are marked as **ADMIN**.
- Perform actions such as view-only, disable, or delete a user account depending on what controls your build exposes

## Activity Monitoring

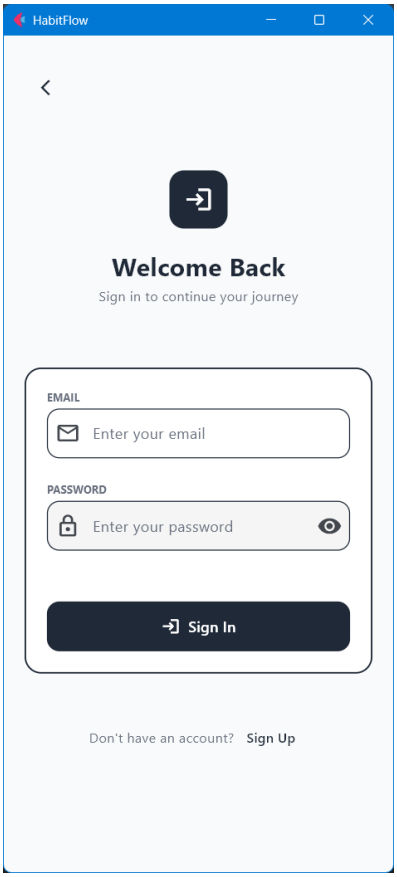



The **Activity** tab shows recent login activity:

- A list of login events with email address and timestamp.
- A quick status label such as **Success** for successful logins.

This view helps admins monitor whether accounts are being accessed as expected and supports manual security reviews.

### Security Logs




The **Logs** tab shows security-related events, such as:

- Successful logins, logouts, and sign-ups.
- Failed login attempts that may indicate incorrect passwords or attempted brute-force attacks.

Each entry includes the event type, email, and timestamp, and can optionally be exported for auditing.

### Tips for Effective Habit Tracking

- Start with a small number of habits (3–5) so you don't feel overwhelmed.
- Set realistic frequencies (daily or a few times per week) instead of "perfect" schedules you can't maintain.
- Check the Today view at a consistent time each day—morning or evening—to mark completions and review progress.
- Use the Stats tab weekly to see which areas you're improving in and which ones need attention.

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