2025

HDFC BANK

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Capstone Project Report : Digital - KYC

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PROGRAM ROLL NO – DT.32

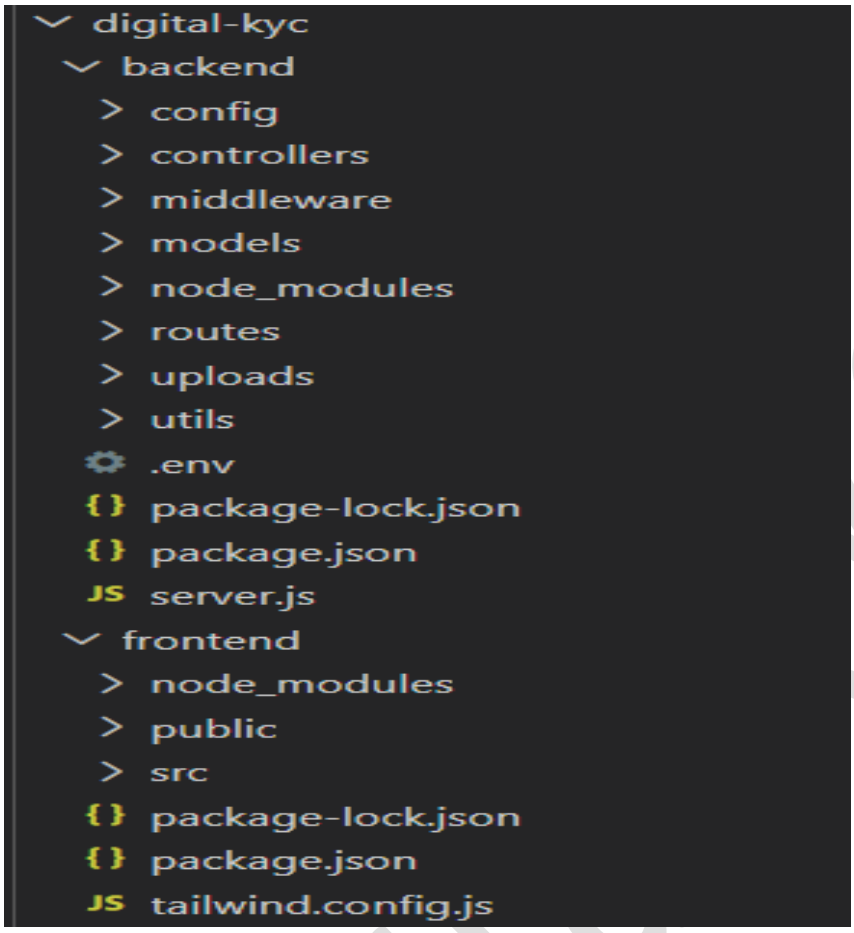
Introduction

- The Digital KYC (Know Your Customer) system is designed to simplify and modernize the customer onboarding process for financial services such as banking.
- Traditional KYC methods are slow, paper-based, and require physical verification, leading to delays and high drop-off rates.
- This project aims to create a **fully digital, secure, step-by-step KYC workflow** that users can complete from any device.
- The system includes multi-step forms, document uploads, identity verification, and automated progress tracking.
- A responsive and user-friendly React frontend ensures smooth navigation across the entire KYC journey.
- A Node.js + Express backend handles authentication, document processing, storage, and business logic.
- The system improves accuracy, reduces manual effort, and accelerates account creation while maintaining high security.
- The solution uses modern UI/UX principles, automated validation, and seamless PDF confirmation generation.
- The final KYC status and user information are displayed in a secure customer dashboard.
- Overall, this Digital KYC solution increases onboarding efficiency and enhances customer experience.

Objectives

• Reduce customer drop-off during onboarding
• Provide a clean, step-by-step KYC journey
• Enable secure document uploads with validation
• Auto-generate confirmation PDF upon completion
• Provide a professional, bank-like dashboard

Project Structure



Tech Stack

Frontend

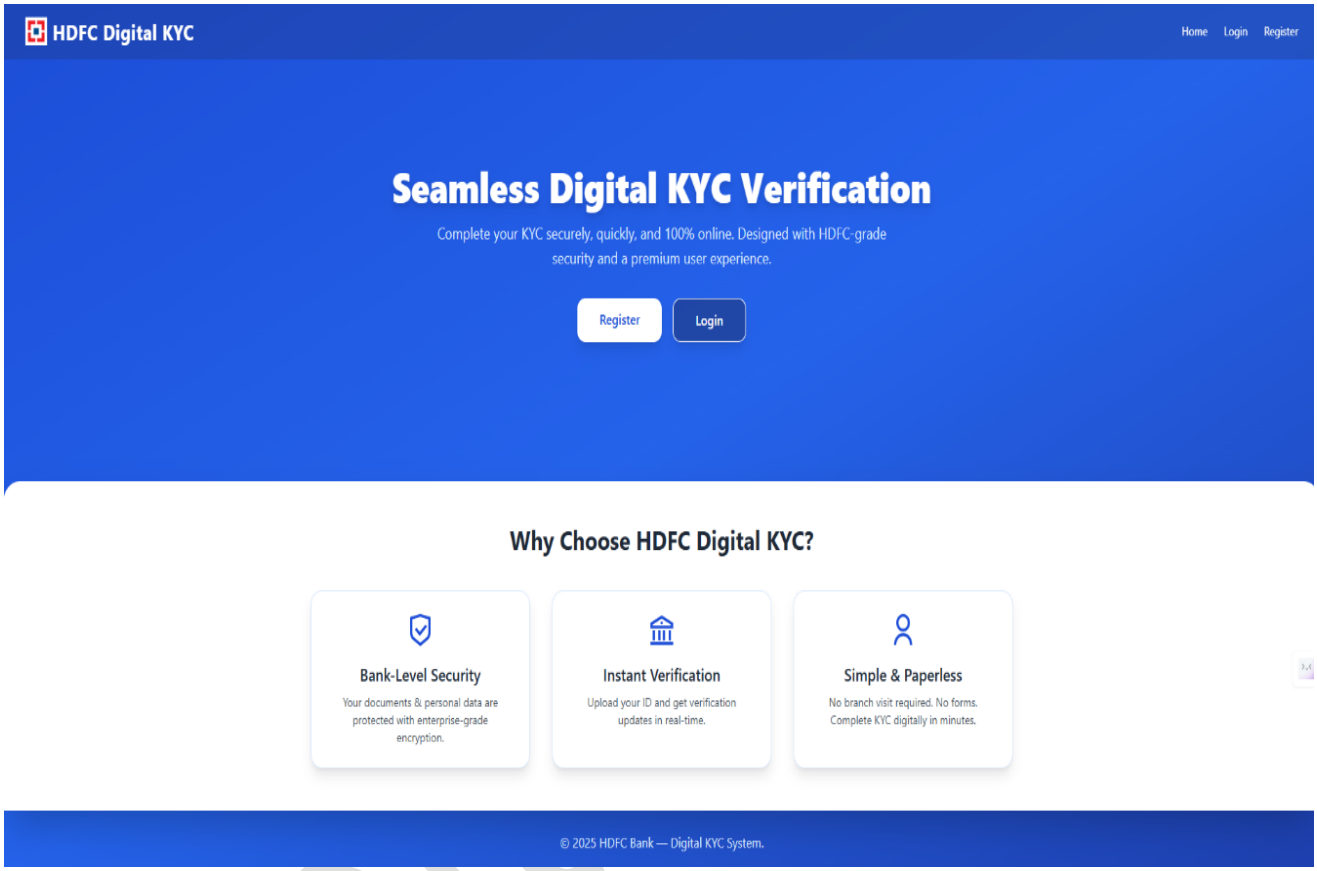
- React.js
- React Router
- TailwindCSS
- Framer Motion
- Axios
- jsPDF + html2canvas

Backend

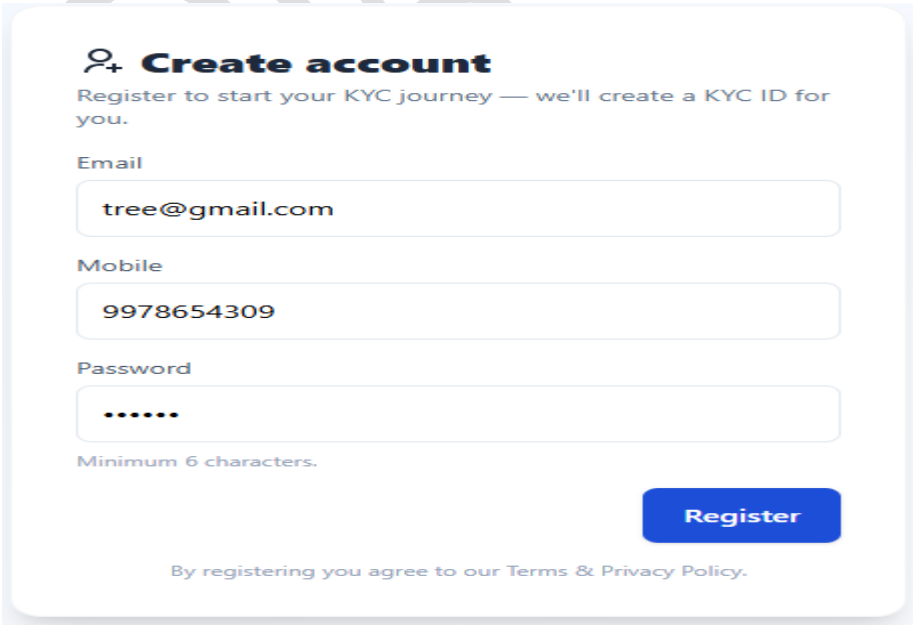
- Node.js
- Express.js
- Sequelize ORM
- MySQL
- Multer (file uploads)
- JWT authentication

Project Workflow

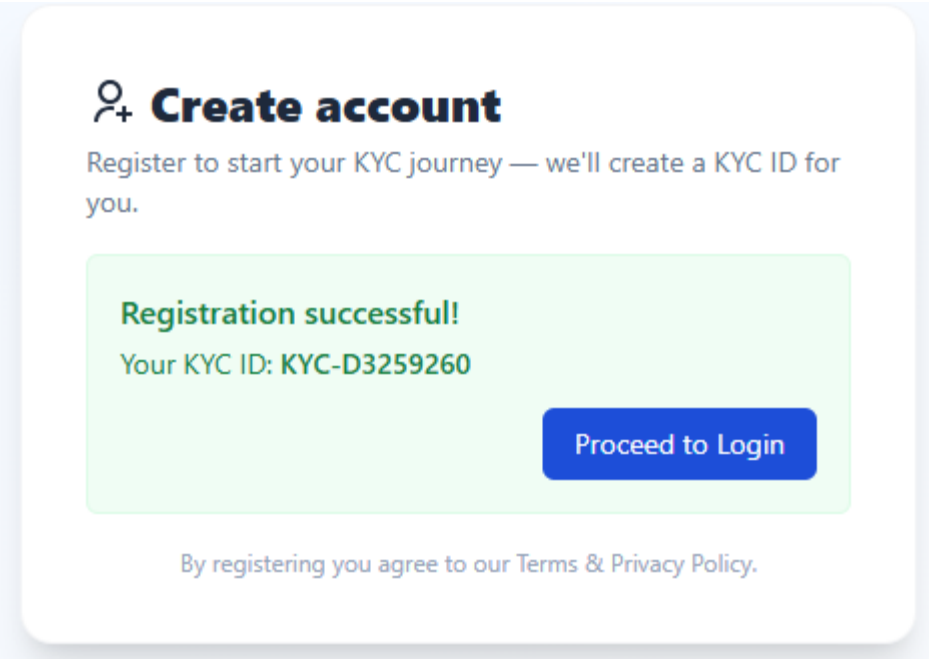
1.Opening Page



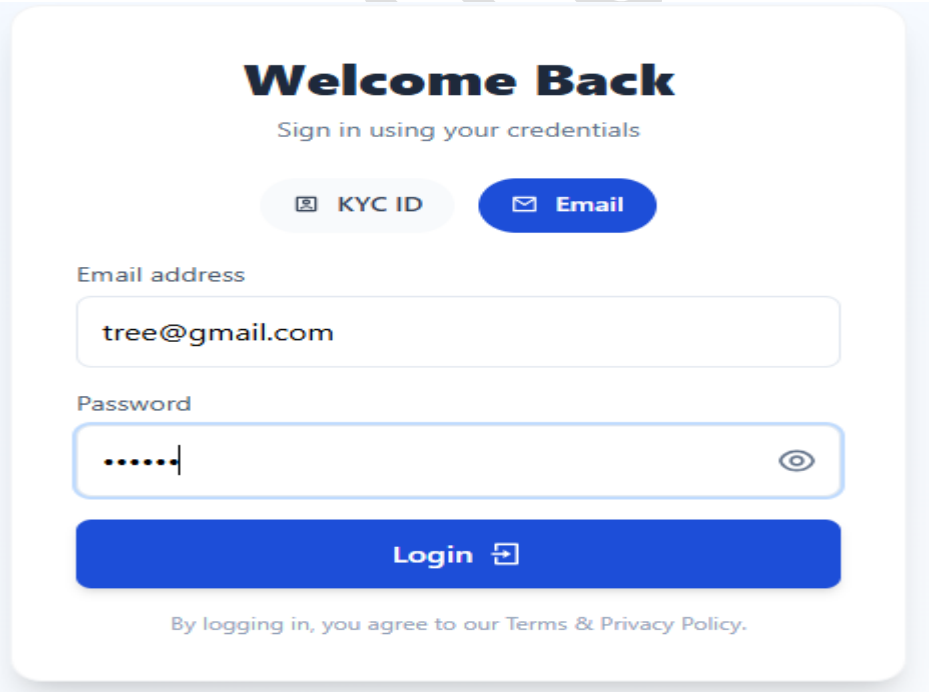
2. Registration Page after clicking on **Register** button



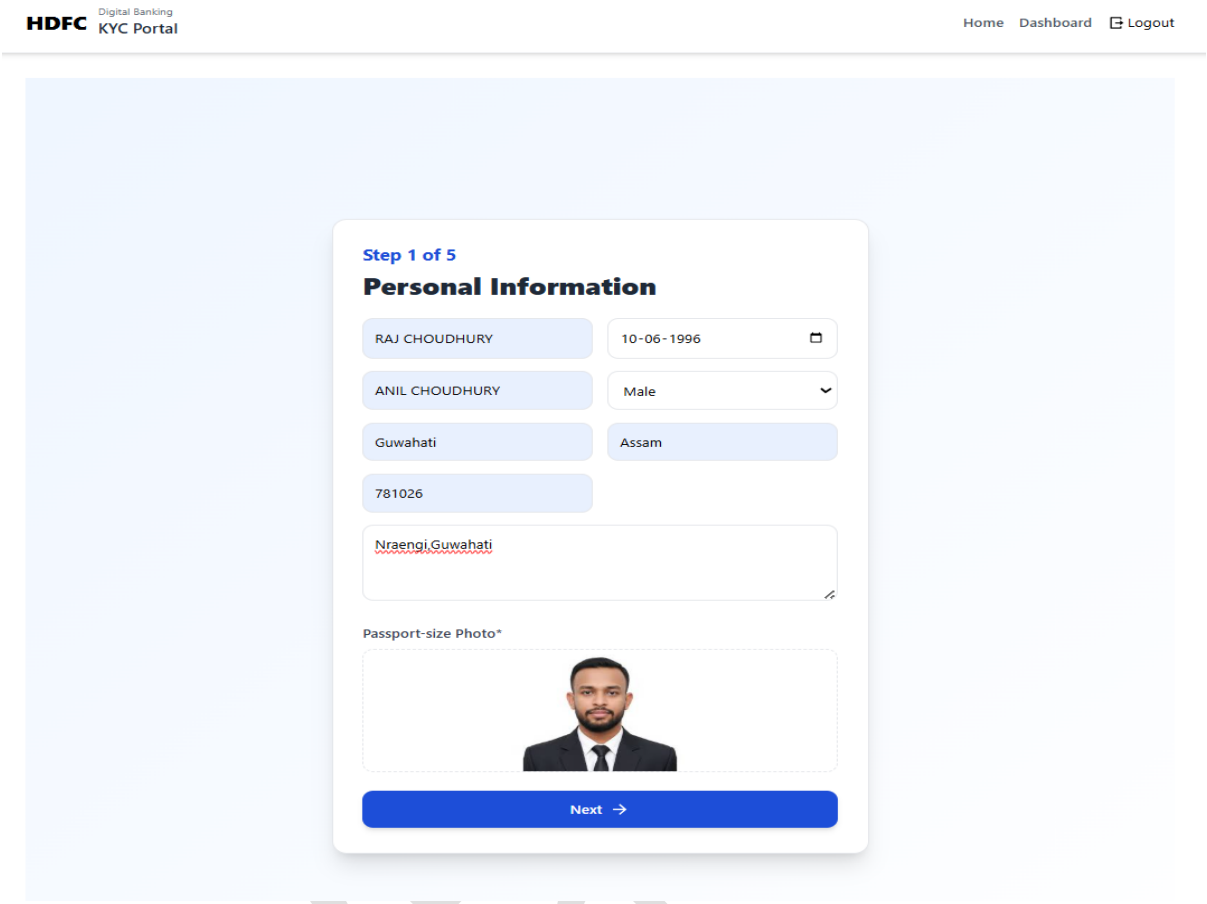
3. Registration successful.



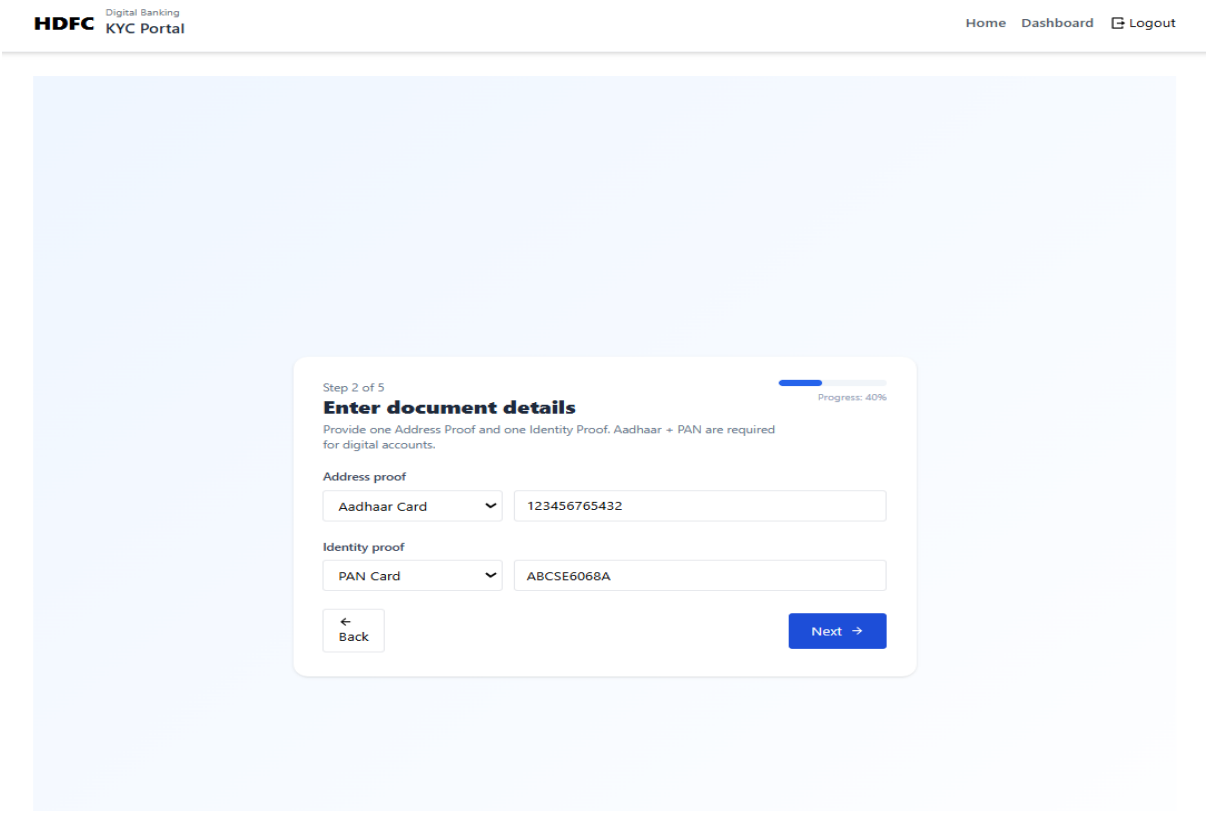
4. Login page after clicking on the **Proceed to Login** button.



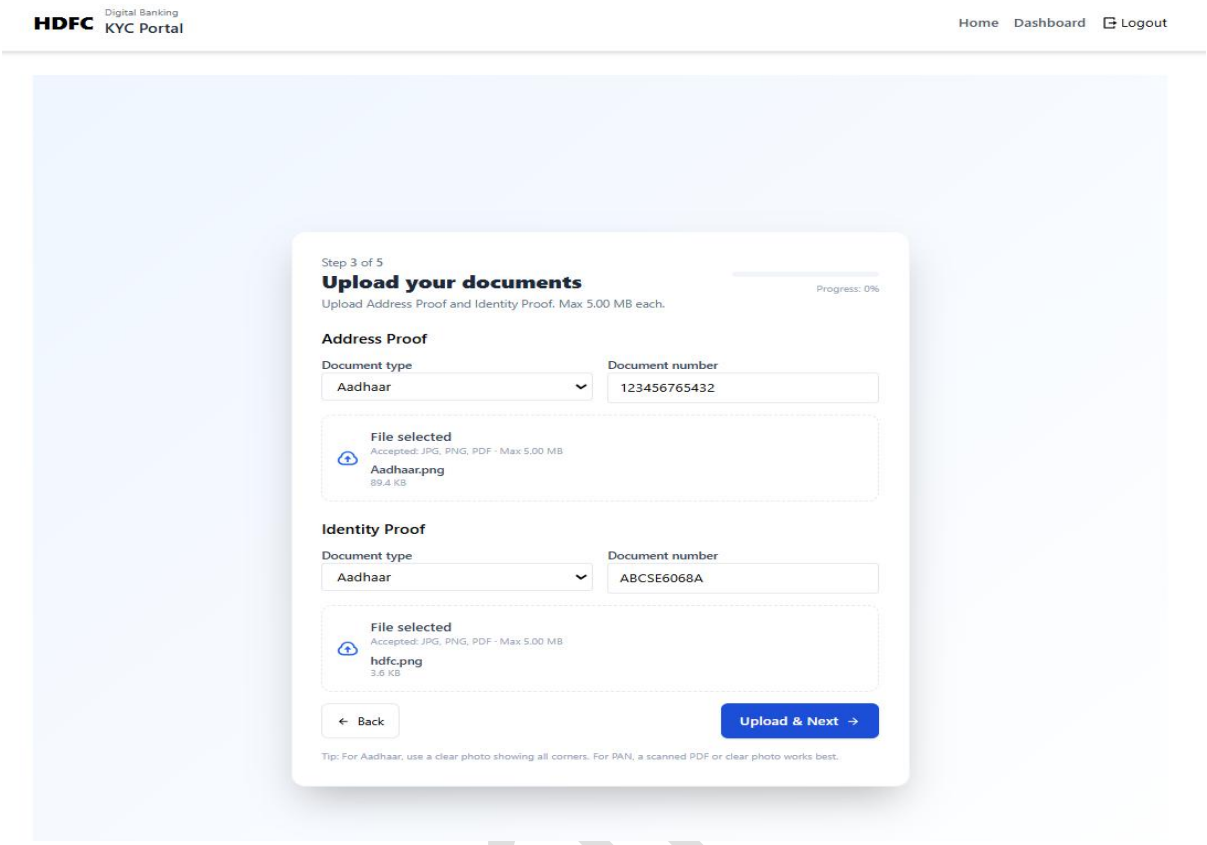
5. After successful login, the window of first step of the KYC opens. Here, we need to fill the personal Information.



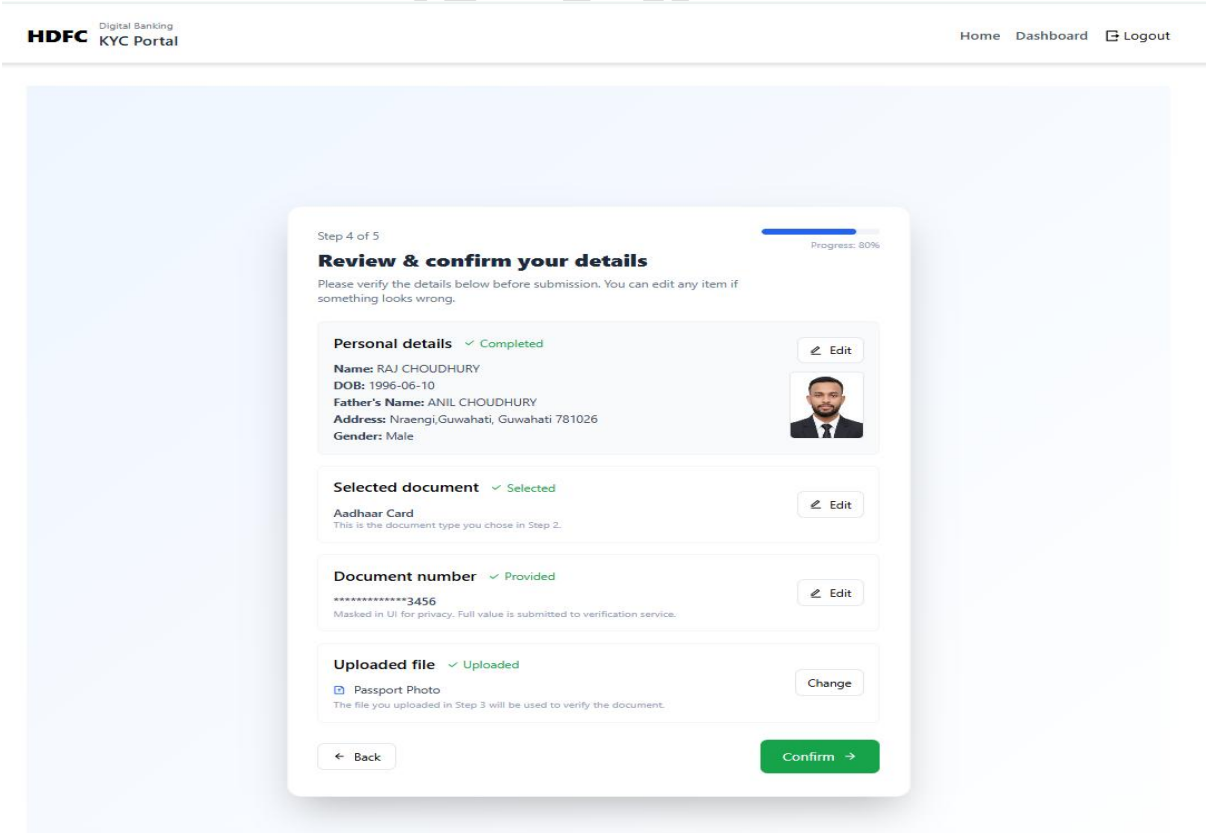
6. KYC step 2 – Document Selection.



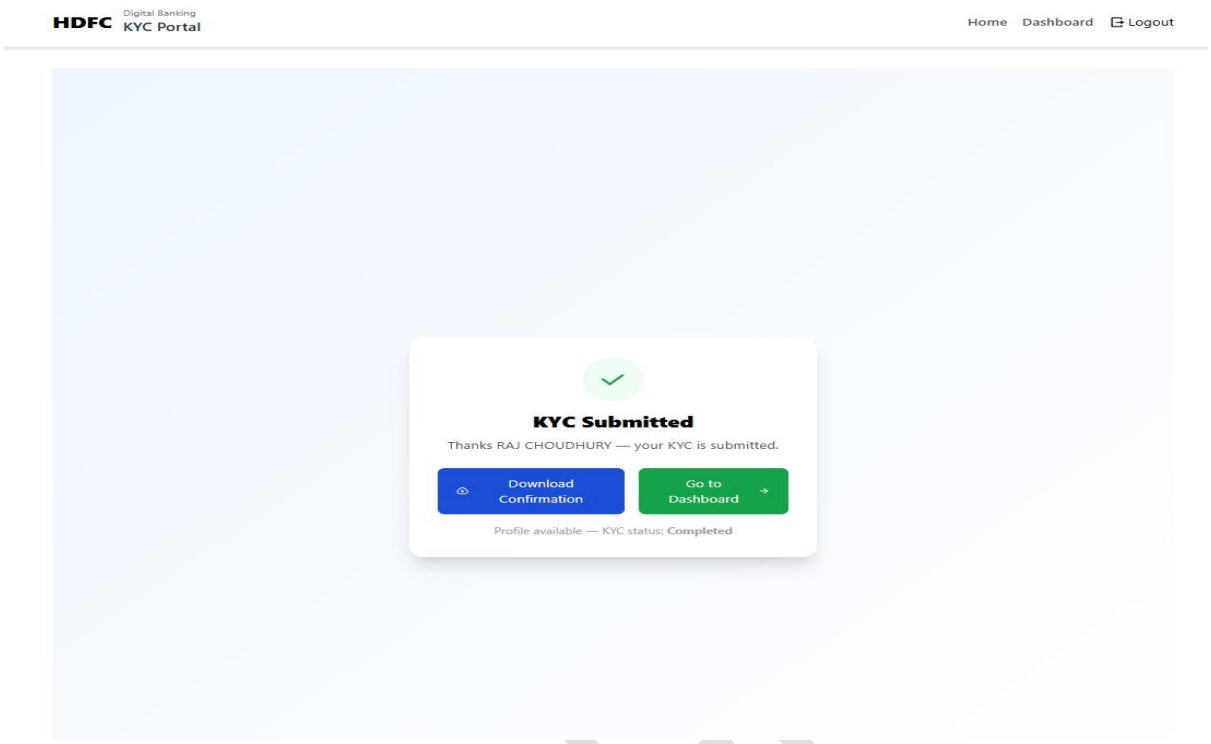
7. KYC Step 3 – Document Upload



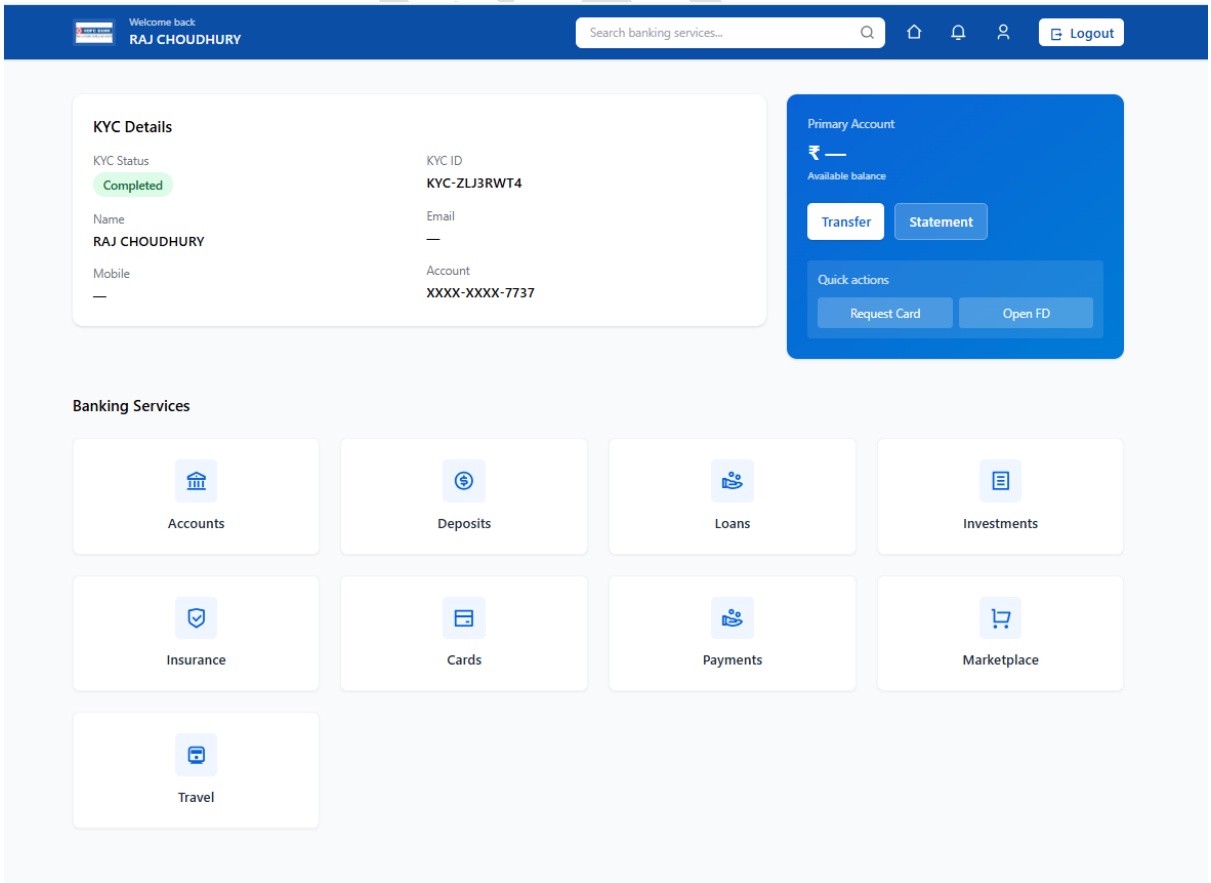
8. KYC Step 4 – Review & Confirmation



9. KYC Completed.



10. The dashboard with the account details opens after clicking on **Go To Dashboard** button.



Confirmation Page

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Digital KYC
KYC Confirmation

Congratulations, RAJ CHOUDHURY!

Your KYC submission is received and recorded. Keep this confirmation for your records.

Applicant:	RAJ CHOUDHURY
KYC ID:	KYC-ZLJ3RWT4
Account No:	XXXX-XXXX-7737
Status:	Completed
Submitted at:	12/10/2025, 7:46:44 PM
Document:	Aadhaar Card / **********3456

Important

Please retain this confirmation. Full document numbers were submitted to the server securely and are masked here for privacy.

Generated by HDFC Digital KYC System.

Frontend Design

- **Framework & libraries**
  - React (functional components + hooks) for UI and state management.
  - React Router for client-side routing (multi-step KYC flow).
  - TailwindCSS for utility-first styling and rapid theming.
  - Framer Motion for smooth micro-interactions and step transitions.
  - Axios for API requests; jsPDF / html2canvas used for client-side PDF generation.

- **Overall structure**
  - Single-page app with route-based pages: Landing, Register, Login, KYC steps (1–5), Result, Dashboard.
  - Shared Layout component for global header/footer; some pages (landing/dashboard) may use full-bleed layouts.
  - Lazy-loaded pages (React.lazy + Suspense) to reduce initial bundle size.

- **State & data flow**
  - Local component state (useState) for form inputs and small UI state.
  - useContext (AuthContext) to hold auth token, role and login/logout helpers.
  - LocalStorage caching for KYC step persistence (draft autosave) so users can resume.
  - Centralized API service (services/api.js) wrapping Axios and applying auth header via setToken.

- **Forms & validation**
  - Per-step validation rules (Aadhaar 12 digits, PAN regex, passport formats, file type/size).
  - Immediate inline error messaging and disabled/guarded Next buttons.
  - Accessibility: labels, focus states, keyboard support for drag/drop areas.
- **File upload UX**
  - Drag & drop + click-to-select file zones with file preview / filename & size.
  - Per-file client-side checks: MIME type whitelist (jpg/png/pdf) and max size (5 MB).
  - Upload progress bars (mapped to overall KYC progress when multiple files).
- **KYC progress**
  - Persistent progress bar across steps showing completion % (e.g., step-based mapping).
  - Visual completion ticks for completed sub-steps (personal details, documents selected, uploads done).

- **PDF confirmation**
  - Client-side generation of confirmation PDF (jsPDF/html2canvas) using on-screen review content to avoid blank pages/popups.
  - Single-click download that triggers a Blob-download, no navigations.
- **Security & UX considerations**
  - Avoid storing sensitive data in plain text; only non-sensitive draft fields in LocalStorage.
  - Mask sensitive numbers (account numbers show last digits only) in UI.
  - Rate-limit retry attempts on UI with clear user messaging (attempts left).
- **Performance & production**
  - Code splitting, route-level lazy loading, and caching of static assets.
  - Use environment variables for API URL; build-time minification.
  - Responsive design tested at mobile/tablet/desktop breakpoints.
- **Testing & quality**
  - Unit tests for critical form validation functions.
  - Manual E2E test flows for KYC happy-path and failure-path.
  - Linting (ESLint) and Prettier for consistent code style.

Backend Design

- **Platform & libraries**
  - Node.js + Express for REST API server.
  - Sequelize ORM for relational DB access (MySQL).
  - Multer for multipart file handling (uploads).
  - bcrypt for password hashing; jsonwebtoken (JWT) for auth tokens.

- **High-level architecture**
  - Stateless REST API endpoints serving the React frontend.
  - Persistent relational DB for users, KYCApplications, Documents, Attempts.
  - Local file storage under /uploads (or S3 for production) with generated randomized filenames.

- **Core models / tables**
  - Users — id, name, email, mobile, passwordHash, role, kycId.
  - KYCApplication — id, userId, status, failureReason, accountNumber, progress.
  - Documents — id, kycId, type (address/identity/passport/etc.), filePath, isValidated.
  - Attempts — id, kycId, step, count (for limiting retries).
  - Optional audit/logs table for actions and timestamps.

- **Key API endpoints**
  - POST /api/auth/register — create user + KYCApplication.
  - POST /api/auth/login — authenticate and return JWT.
  - GET /api/kyc/dashboard — returns user KYC summary and masked account number.
  - POST /api/kyc/upload — authentication + multer; stores file metadata; returns attemptsLeft.
  - POST /api/kyc/photo-match — runs simulation; updates status or rejects.
  - GET /api/kyc/result — final KYC status and failure reason.

- **Upload handling & validation**
  - Multer storage with disk (or S3) and randomized filenames.
  - File-filter to accept only jpg/jpeg/png/pdf and file-size limit (5MB).
  - Server-side validation of file type + basic content checks.
  - Attempts counter: increment Attempts per upload step and reject after max (e.g., 3).

- **Authentication & authorization**
  - JWT tokens signed with secret, short expiration (e.g., 1 day).
  - Middleware auth decodes token, loads user and KYCApplication and attaches to req.user.
  - Role checks if admin endpoints are added.

- **Business logic**
  - KYC state machine: Started → Documents Uploaded → Under Review → Completed / Rejected.
  - On successful completion, generate account number (pseudo-random with masked display) and set status Completed.
  - Create final confirmation record retrievable for PDF data.

- **Security controls**
  - Hash passwords with bcrypt (salted).
  - CORS configured to allow only the frontend domain.
  - Input validation for all request bodies to prevent injection & malformed data.
  - Sanitize filenames and store file metadata rather than exposing raw paths.
  - Use HTTPS in production; secure JWT storage & rotate secrets per policy.

- **Logging, monitoring & error handling**
  - Centralized error middleware that returns consistent error payloads.
  - Structured logs (timestamp, userId, route, error) and optional integration with log services (Papertrail, Loggly).
  - Return helpful but non-sensitive errors to clients.
- **Testing & reliability**
  - Unit tests for controllers and validation logic.
  - Integration tests for file upload endpoints and KYC flows.
  - DB migrations via Sequelize and schema version control.
  - Backups and retention policy for uploaded documents.
- **Scalability & deployment**
  - Containerize server (Docker) and use process manager (PM2) or Kubernetes in production.
  - Move uploads to object storage (S3) with CDN for performance.
  - Use connection pooling for DB; horizontal scaling behind load balancer.
  - Add rate-limiting middleware on public endpoints to prevent abuse.
- **Operational considerations**
  - Background worker queue (e.g., Bull) for CPU/IO heavy tasks (OCR, face-match in future).
  - Admin dashboard or alerting for rejected KYCs and manual review flows.
  - Endpoint to regenerate/download confirmation PDF server-side if needed (secure, authenticated).

Conclusion

- The Digital KYC portal successfully transforms a traditionally complex process into a streamlined, online, and user-friendly workflow.
- By combining React, TailwindCSS, Node.js, Express, and secure document handling, the system ensures high performance and reliability.
- The multi-step guided flow reduces user confusion, minimizes drop-offs, and ensures accurate data submission.
- Automated validations, progress tracking, and instant PDF generation provide a modern and professional onboarding experience.
- The final dashboard gives users clarity on their account status and personal details, increasing transparency and trust.
- The use of JWT authentication, hashed passwords, and controlled file uploads ensures strong system security.
- The modular structure of the project makes it scalable for future enhancements such as OCR, facial recognition, or real-time verification.

- Overall, the project demonstrates how digital transformation can significantly improve operational efficiency in customer onboarding.
- The Digital KYC system provides a solid foundation for banks aiming to adopt fully paperless and automated onboarding workflows.
- This project proves the feasibility and benefits of adopting modern full-stack development practices in financial technology solutions.

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