**1. Frontend (Website UI)**

| **Purpose** | **Tools** | **Why?** |
| --- | --- | --- |
| Core Framework | **React.js** or **Next.js** | Dynamic interfaces, SEO-friendly |
| Styling | **Tailwind CSS** | Rapid UI development |
| State Management | **Zustand** or **Redux Toolkit** | Simple global state |
| Swipe Mechanics | **react-swipeable** | Tinder-like gestures |
| Animation | **Framer Motion** | Smooth transitions |

**2. Backend & APIs**

| **Purpose** | **Tools** | **Why?** |
| --- | --- | --- |
| Server | **Firebase** (BaaS) or **FastAPI** (Python) | Fast setup or custom control |
| Database | **Firestore** (NoSQL) or **PostgreSQL** | Real-time updates / Structured data |
| Auth | **Firebase Auth** | Google/email login in minutes |
| Movie Data | **TMDB API** (free) | 50k+ movies with metadata |
| Recommendations | **TensorFlow Recommenders** (TFRS) | Hybrid AI models |

**3. AI/ML Pipeline**

| **Step** | **Tools** | **Why?** |
| --- | --- | --- |
| Data Cleaning | **Pandas** | Handle missing genres/ratings |
| Text Processing | **TF-IDF** (Scikit-learn) | Extract key plot keywords |
| Embeddings | **BERT** (Hugging Face) | Understand movie semantics |
| Content Filtering | **Cosine Similarity** | Find similar movies |
| Collaborative | **Matrix Factorization** (Surprise) | "Users like you also liked..." |

**4. Deployment & DevOps**

| **Purpose** | **Tools** | **Why?** |
| --- | --- | --- |
| Hosting | **Vercel** (frontend) + **Firebase/Render** (backend) | Free tiers available |
| CI/CD | **GitHub Actions** | Auto-deploy on git push |
| Monitoring | **Sentry** (errors) + **Google Analytics** | Track clicks/swipes |

**5. Testing**

| **Type** | **Tools** | **Why?** |
| --- | --- | --- |
| Unit Tests | **Jest** | Test React components |
| E2E Tests | **Cypress** | Validate user flows |
| Load Testing | **k6** | Check API performance |

**Key Advantages of This Stack**

1. **Fast MVP**: Firebase + Vercel = deploy in hours
2. **Scalable**: From 100 to 100k users
3. **Cost-Effective**: Free tiers for TMDB/Firebase/Vercel
4. **Accurate AI**: Hybrid filtering beats single-method approaches

**Alternatives**

* **For Python Lovers**: Replace React with **Streamlit** (but less interactive)
* **For Privacy**: Use **Supabase** instead of Firebase
* **For Simplicity**: Google’s **Recommendations AI** (paid, no-code)

Need help choosing based on your team’s skills? Ask me! 🛠️

give as paragraphs and points

**Tools and Technologies for Movie Recommendation Website**

**1. Frontend Development**

* **Framework**: **React.js** (with **Next.js** for better SEO and server-side rendering).
* **Styling**: **Tailwind CSS** for rapid, utility-first styling.
* **State Management**: **Zustand** (lightweight) or **Redux Toolkit** (for complex state).
* **Swipe Mechanics**: **react-swipeable** for Tinder-like movie swiping.
* **Animations**: **Framer Motion** for smooth transitions (e.g., swipe effects, loading states).

**2. Backend & APIs**

* **Backend Framework**:
  + **Firebase** (Backend-as-a-Service) for quick setup (Auth, Firestore, Cloud Functions).
  + **FastAPI** (Python) or **Express.js** (Node.js) for custom backend control.
* **Database**:
  + **Firestore** (NoSQL, real-time updates).
  + **PostgreSQL** (for structured relational data).
* **Authentication**: **Firebase Auth** (Google/email login) or **JWT** (custom token-based auth).
* **Movie Data API**: **TMDB API** (free, extensive movie metadata).

**3. AI/ML & Data Processing**

* **Data Cleaning**: **Pandas** (Python) for handling missing values and standardization.
* **Feature Extraction**:
  + **TF-IDF** (Scikit-learn) for keyword-based movie similarity.
  + **BERT** (Hugging Face) for deep semantic understanding of movie plots.
* **Recommendation Models**:
  + **Content-Based**: Cosine similarity on genres/directors.
  + **Collaborative Filtering**: Matrix Factorization (Surprise or LightFM).
  + **Hybrid Model**: **TensorFlow Recommenders (TFRS)** for combining both approaches.

**4. Deployment & DevOps**

* **Frontend Hosting**: **Vercel** (optimized for React/Next.js) or **Netlify**.
* **Backend Hosting**: **Firebase Hosting**, **Render**, or **Railway**.
* **CI/CD**: **GitHub Actions** for automated testing and deployment.
* **Monitoring**:
  + **Sentry** for error tracking.
  + **Google Analytics** for user behavior insights.

**5. Testing & QA**

* **Unit Testing**: **Jest** + **React Testing Library** (for components).
* **End-to-End Testing**: **Cypress** (for user flows like swiping and saving).
* **Load Testing**: **k6** (to check API performance under traffic).

**6. Collaboration & Project Management**

* **Version Control**: **GitHub** (with GitHub Projects for tracking).
* **Documentation**: **Notion** or **Markdown** (in-code docs).
* **Team Communication**: **Slack** or **Discord** for real-time coordination.

**Why This Stack?**

✅ **Fast Development**: Firebase + Vercel allows quick deployment.  
✅ **Scalable**: Works for small to large user bases.  
✅ **Cost-Efficient**: Free tiers available for most tools.  
✅ **Accurate Recommendations**: Hybrid AI model improves personalization.

**Alternatives**

* **For No-Code AI**: Google’s **Recommendations AI** (paid).
* **For Privacy-Focused Apps**: **Supabase** (open-source Firebase alternative).
* **For Python-Based UI**: **Streamlit** (but limited interactivity).

Here's a **ready-to-build code implementation** for your movie recommendation website, organized by key components:

**1. Frontend (React.js + Next.js)**

**Movie Card Component** (components/MovieCard.js)

jsx

Copy

Download

import { useSwipeable } from 'react-swipeable';

export default function MovieCard({ movie, onSwipe }) {

const handlers = useSwipeable({

onSwipedLeft: () => onSwipe('dislike'),

onSwipedRight: () => onSwipe('like'),

trackMouse: true

});

return (

<div {...handlers} className="bg-white rounded-lg shadow-md p-4">

<img

src={`https://image.tmdb.org/t/p/w500${movie.poster\_path}`}

alt={movie.title}

className="w-full h-64 object-cover rounded-t-lg"

/>

<div className="p-4">

<h3 className="text-xl font-bold">{movie.title}</h3>

<p className="text-gray-600">{movie.release\_date.split('-')[0]}</p>

</div>

</div>

);

}

**Swipe Feed Page** (pages/index.js)

jsx

Copy

Download

import { useState, useEffect } from 'react';

import MovieCard from '../components/MovieCard';

export default function Home() {

const [movies, setMovies] = useState([]);

const [loading, setLoading] = useState(true);

useEffect(() => {

async function fetchMovies() {

const res = await fetch('/api/movies');

const data = await res.json();

setMovies(data);

setLoading(false);

}

fetchMovies();

}, []);

const handleSwipe = (action, movieId) => {

console.log(`${action} movie ${movieId}`);

*// Send to backend API*

fetch('/api/swipes', {

method: 'POST',

body: JSON.stringify({ movieId, action })

});

};

if (loading) return <div>Loading...</div>;

return (

<div className="max-w-md mx-auto py-8">

{movies.length > 0 ? (

<MovieCard

movie={movies[0]}

onSwipe={(action) => handleSwipe(action, movies[0].id)}

/>

) : (

<p>No movies found</p>

)}

</div>

);

}

**2. Backend API (Next.js API Routes)**

**TMDB Proxy API** (pages/api/movies.js)

javascript

Copy

Download

import axios from 'axios';

export default async function handler(req, res) {

const { data } = await axios.get(

`https://api.themoviedb.org/3/movie/popular?api\_key=${process.env.TMDB\_KEY}`

);

res.status(200).json(data.results);

}

**Swipe Handler API** (pages/api/swipes.js)

javascript

Copy

Download

import { getFirestore } from 'firebase-admin/firestore';

import { initializeApp } from 'firebase-admin/app';

const app = initializeApp();

const db = getFirestore(app);

export default async function handler(req, res) {

if (req.method === 'POST') {

const { movieId, action } = req.body;

await db.collection('swipes').add({

movieId,

action,

timestamp: new Date()

});

res.status(200).json({ success: true });

} else {

res.status(405).end();

}

}

**3. AI Recommendation (Python)**

**Content-Based Filtering** (recommend.py)

python

Copy

Download

import pandas as pd

from sklearn.feature\_extraction.text import TfidfVectorizer

from sklearn.metrics.pairwise import cosine\_similarity

def get\_recommendations(movie\_id, movies\_df):

tfidf = TfidfVectorizer(stop\_words='english')

tfidf\_matrix = tfidf.fit\_transform(movies\_df['overview'])

cosine\_sim = cosine\_similarity(tfidf\_matrix, tfidf\_matrix)

idx = movies\_df.index[movies\_df['id'] == movie\_id].tolist()[0]

sim\_scores = list(enumerate(cosine\_sim[idx]))

sim\_scores = sorted(sim\_scores, key=lambda x: x[1], reverse=True)[1:6]

return movies\_df['id'].iloc[[i[0] for i in sim\_scores]].tolist()

**4. Firebase Setup**

**Firebase Config** (lib/firebase.js)

javascript

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import { initializeApp } from 'firebase/app';

import { getFirestore } from 'firebase/firestore';

const firebaseConfig = {

apiKey: process.env.NEXT\_PUBLIC\_FIREBASE\_API\_KEY,

authDomain: process.env.NEXT\_PUBLIC\_FIREBASE\_AUTH\_DOMAIN,

projectId: process.env.NEXT\_PUBLIC\_FIREBASE\_PROJECT\_ID

};

const app = initializeApp(firebaseConfig);

export const db = getFirestore(app);

**5. Deployment**

**Vercel Configuration** (vercel.json)

json

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{

"rewrites": [{ "source": "/api/(.\*)", "destination": "/api/$1" }],

"env": {

"TMDB\_KEY": "@tmdb\_key",

"FIREBASE\_CONFIG": "@firebase\_config"

}

}

**Key Features Implemented**

1. **Swipe Interface**: Tinder-like card swiping
2. **TMDB Integration**: Real movie data
3. **Firebase Backend**: Stores user swipes
4. **Content Filtering**: Python similarity engine

**How to Run**

1. Install dependencies:

bash

Copy

Download

npm install react-swipeable firebase axios

1. Set environment variables:

bash

Copy

Download

echo "TMDB\_KEY=your\_tmdb\_key" >> .env.local

1. Run development server:

bash

Copy

Download

npm run dev

**Next Steps**

* Add user authentication
* Implement collaborative filtering
* Deploy to Vercel

Here's a **complete, ready-to-build implementation** of your movie recommendation website with Next.js, Firebase, and TMDB API. Follow these steps to launch your site:

**1. Setup & Installation**

bash

Copy

Download

*# Create Next.js app*

npx create-next-app movie-recommender

cd movie-recommender

*# Install dependencies*

npm install firebase react-swipeable axios @heroicons/react tailwindcss

*# Initialize Tailwind CSS*

npx tailwindcss init -p

**2. Project Structure**

Copy

Download

/movie-recommender

├── components/

│ ├── MovieCard.js

│ ├── Navbar.js

│ └── LoadingSpinner.js

├── pages/

│ ├── index.js (homepage)

│ ├── login.js

│ ├── api/

│ │ ├── movies.js (TMDB proxy)

│ │ └── swipes.js (Firebase handler)

├── lib/

│ └── firebase.js (Firebase config)

├── styles/

│ └── globals.css

├── .env.local (environment variables)

└── vercel.json (deployment config)

**3. Complete Code Implementation**

**A. Firebase Configuration (**lib/firebase.js**)**

javascript

Copy

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import { initializeApp } from "firebase/app";

import { getFirestore } from "firebase/firestore";

import { getAuth, GoogleAuthProvider } from "firebase/auth";

const firebaseConfig = {

apiKey: process.env.NEXT\_PUBLIC\_FIREBASE\_API\_KEY,

authDomain: process.env.NEXT\_PUBLIC\_FIREBASE\_AUTH\_DOMAIN,

projectId: process.env.NEXT\_PUBLIC\_FIREBASE\_PROJECT\_ID,

storageBucket: process.env.NEXT\_PUBLIC\_FIREBASE\_STORAGE\_BUCKET,

messagingSenderId: process.env.NEXT\_PUBLIC\_FIREBASE\_MESSAGING\_SENDER\_ID,

appId: process.env.NEXT\_PUBLIC\_FIREBASE\_APP\_ID

};

const app = initializeApp(firebaseConfig);

export const db = getFirestore(app);

export const auth = getAuth(app);

export const provider = new GoogleAuthProvider();

**B. Frontend Components**

**1. Movie Card (**components/MovieCard.js**)**

jsx

Copy

Download

import { useSwipeable } from 'react-swipeable';

import { HeartIcon, XIcon } from '@heroicons/react/outline';

export default function MovieCard({ movie, onSwipe }) {

const handlers = useSwipeable({

onSwipedLeft: () => onSwipe('dislike'),

onSwipedRight: () => onSwipe('like'),

trackMouse: true

});

return (

<div className="relative max-w-sm mx-auto">

<div {...handlers} className="bg-white rounded-xl shadow-lg overflow-hidden">

<img

src={`https://image.tmdb.org/t/p/w500${movie.poster\_path}`}

alt={movie.title}

className="w-full h-96 object-cover"

/>

<div className="p-4">

<h3 className="text-xl font-bold">{movie.title}</h3>

<p className="text-gray-600">{movie.release\_date?.split('-')[0]}</p>

<p className="mt-2 text-sm line-clamp-2">{movie.overview}</p>

</div>

</div>

<div className="flex justify-center gap-12 mt-4">

<button

onClick={() => onSwipe('dislike')}

className="p-3 rounded-full bg-red-100 text-red-500"

>

<XIcon className="h-8 w-8" />

</button>

<button

onClick={() => onSwipe('like')}

className="p-3 rounded-full bg-green-100 text-green-500"

>

<HeartIcon className="h-8 w-8" />

</button>

</div>

</div>

);

}

**2. Main Page (**pages/index.js**)**

jsx

Copy

Download

import { useState, useEffect } from 'react';

import { auth } from '../lib/firebase';

import MovieCard from '../components/MovieCard';

import LoadingSpinner from '../components/LoadingSpinner';

export default function Home() {

const [movies, setMovies] = useState([]);

const [loading, setLoading] = useState(true);

const [user, setUser] = useState(null);

useEffect(() => {

const unsubscribe = auth.onAuthStateChanged(user => setUser(user));

return unsubscribe;

}, []);

useEffect(() => {

async function fetchMovies() {

try {

const res = await fetch('/api/movies');

const data = await res.json();

setMovies(data);

} catch (error) {

console.error("Failed to fetch movies:", error);

} finally {

setLoading(false);

}

}

fetchMovies();

}, []);

const handleSwipe = async (action, movieId) => {

if (!user) return;

await fetch('/api/swipes', {

method: 'POST',

headers: { 'Content-Type': 'application/json' },

body: JSON.stringify({

userId: user.uid,

movieId,

action

})

});

*// Remove swiped movie*

setMovies(prev => prev.slice(1));

};

if (loading) return <LoadingSpinner />;

return (

<div className="min-h-screen bg-gray-50 py-8">

{user ? (

movies.length > 0 ? (

<MovieCard

movie={movies[0]}

onSwipe={(action) => handleSwipe(action, movies[0].id)}

/>

) : (

<p className="text-center text-xl">No more movies to show!</p>

)

) : (

<div className="text-center">

<h2 className="text-2xl font-bold mb-4">Please sign in to start swiping</h2>

<button

onClick={() => auth.signInWithPopup(provider)}

className="bg-blue-500 text-white px-6 py-2 rounded-lg"

>

Sign In with Google

</button>

</div>

)}

</div>

);

}

**C. Backend APIs**

**1. TMDB Proxy (**pages/api/movies.js**)**

javascript

Copy

Download

import axios from 'axios';

export default async function handler(req, res) {

try {

const { data } = await axios.get(

`https://api.themoviedb.org/3/movie/popular?api\_key=${process.env.TMDB\_KEY}&language=en-US&page=1`

);

res.status(200).json(data.results);

} catch (error) {

console.error("TMDB API error:", error);

res.status(500).json({ error: "Failed to fetch movies" });

}

}

**2. Swipe Handler (**pages/api/swipes.js**)**

javascript

Copy

Download

import { db } from '../../lib/firebase';

import { getFirestore, collection, addDoc } from 'firebase/firestore';

export default async function handler(req, res) {

if (req.method !== 'POST') {

return res.status(405).json({ error: 'Method not allowed' });

}

try {

const { userId, movieId, action } = req.body;

await addDoc(collection(db, 'swipes'), {

userId,

movieId,

action,

timestamp: new Date()

});

res.status(200).json({ success: true });

} catch (error) {

console.error("Firebase error:", error);

res.status(500).json({ error: "Failed to record swipe" });

}

}

**4. Environment Variables (**.env.local**)**

bash

Copy

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NEXT\_PUBLIC\_FIREBASE\_API\_KEY=your\_firebase\_key

NEXT\_PUBLIC\_FIREBASE\_AUTH\_DOMAIN=your-project.firebaseapp.com

NEXT\_PUBLIC\_FIREBASE\_PROJECT\_ID=your-project-id

TMDB\_KEY=your\_tmdb\_key

**5. Deployment to Vercel**

1. Push code to GitHub
2. Create Vercel account and import project
3. Add environment variables in Vercel dashboard
4. Deploy!

**Next Steps to Enhance Your App**

1. **Add Recommendation Engine**
   * Implement the Python content-based filtering script as a Firebase Cloud Function
   * Create API endpoint to fetch personalized recommendations
2. **User Profiles**
   * Add profile pages showing swipe history
   * Implement preference settings (favorite genres)
3. **Social Features**
   * Friend system
   * "Matched Movies" (films both you and friends liked)
4. **Advanced Features**
   * Dark mode toggle
   * Loading skeletons for better UX
   * Infinite scroll for movie feed

**Troubleshooting Tips**

* **Firebase Errors**: Double-check your Firebase config and enable Firestore
* **TMDB Issues**: Verify your API key has proper permissions
* **Swipe Lag**: Optimize images with next/image

Here's a **step-by-step implementation guide** with environment setup instructions to build your movie recommendation website:

**1. Environment Setup**

**A. Local Development**

1. **Install Node.js** (v18+):
   * [Download Node.js](https://nodejs.org/)
   * Verify installation:

bash

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node -v && npm -v

1. **Choose a Code Editor**:
   * Recommended: [VS Code](https://code.visualstudio.com/) with extensions:
     + ES7+ React Snippets
     + Tailwind CSS IntelliSense
     + Firebase
2. **Create Firebase Project**:
   * Go to [Firebase Console](https://console.firebase.google.com/)
   * Click "Add Project" → Enable **Firestore Database** and **Authentication** (Google sign-in)

**2. Project Implementation Steps**

**Step 1: Initialize Project**

bash

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*# Create Next.js app*

npx create-next-app@latest movie-recommender

cd movie-recommender

*# Install dependencies*

npm install firebase react-swipeable axios @heroicons/react tailwindcss

*# Initialize Tailwind*

npx tailwindcss init -p

**Step 2: Configure Firebase**

1. Add Firebase config to .env.local:

bash

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NEXT\_PUBLIC\_FIREBASE\_API\_KEY=your\_api\_key

NEXT\_PUBLIC\_FIREBASE\_AUTH\_DOMAIN=your-project.firebaseapp.com

NEXT\_PUBLIC\_FIREBASE\_PROJECT\_ID=your-project-id

NEXT\_PUBLIC\_FIREBASE\_STORAGE\_BUCKET=your-bucket.appspot.com

NEXT\_PUBLIC\_FIREBASE\_MESSAGING\_SENDER\_ID=your-sender-id

NEXT\_PUBLIC\_FIREBASE\_APP\_ID=your-app-id

TMDB\_KEY=your\_tmdb\_key

*(Get these values from Firebase Project Settings → "Your apps" → Web app config)*

1. Create lib/firebase.js (as shown in previous code).

**Step 3: Build Frontend**

1. Replace pages/index.js with the provided code.
2. Create components/MovieCard.js.
3. Add a loading spinner (components/LoadingSpinner.js):

jsx

Copy

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export default function LoadingSpinner() {

return <div className="text-center py-20">Loading movies...</div>;

}

**Step 4: Implement APIs**

1. Create pages/api/movies.js (TMDB proxy).
2. Create pages/api/swipes.js (Firebase handler).

**Step 5: Test Locally**

bash

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npm run dev

* Open http://localhost:3000
* Sign in with Google → Test swiping

**3. Deployment Environments**

**Option A: Vercel (Recommended)**

1. Push code to GitHub.
2. Sign up at [Vercel](https://vercel.com/" \t "_blank).
3. Import your GitHub repository.
4. Add environment variables in Vercel dashboard.
5. Deploy!

**Pros**:

* Automatic CI/CD
* Free tier includes HTTPS, global CDN

**Option B: Firebase Hosting**

1. Install Firebase CLI:

bash

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npm install -g firebase-tools

firebase login

1. Initialize hosting:

bash

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firebase init hosting

1. Deploy:

bash

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npm run build

firebase deploy

**4. Post-Deployment Steps**

1. **Enable Firebase Rules**:  
   In Firebase Console → Firestore → Rules tab:

javascript

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rules\_version = '2';

service cloud.firestore {

match /databases/{database}/documents {

match /swipes/{swipe} {

allow create: if request.auth != null;

}

}

}

1. **Set Up TMDB API**:
   * Get free API key from [TMDB](https://www.themoviedb.org/settings/api)
   * Add to Vercel/Firebase environment as TMDB\_KEY
2. **Monitor Usage**:
   * Firebase Console → "Usage" tab
   * Vercel → "Analytics"

**5. Development Workflow**

1. **Feature Branches**:

bash

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git checkout -b feature/swipe-animations

1. **Testing**:
   * Unit tests: npm test (with Jest)
   * Manual testing: Chrome DevTools → Device toolbar
2. **Debugging Tools**:
   * Firebase Emulator Suite (for local Firestore testing)
   * Next.js built-in error overlay

**Key Files Structure**

Copy

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movie-recommender/

├── .env.local

├── components/

│ ├── MovieCard.js

│ └── LoadingSpinner.js

├── lib/

│ └── firebase.js

├── pages/

│ ├── api/

│ │ ├── movies.js

│ │ └── swipes.js

│ └── index.js

├── public/

├── styles/

└── package.json

**Troubleshooting Checklist**

* **Blank Page**: Check Firebase auth initialization
* **CORS Errors**: Verify TMDB API key is correct
* **Swipes Not Saving**: Inspect Firestore rules and network tab

**Next Steps After Launch**

1. Add **analytics** (Google Analytics 4)
2. Implement **server-side rendering** for SEO
3. Set up **email notifications** for new movie matches

Here's a **simplified Step 1** to get you started immediately:

**Step 1: Local Environment Setup**

\*(5-minute quickstart)\*

**1. Install Node.js**

* Download from [nodejs.org](https://nodejs.org/) (LTS version)
* Verify installation in terminal:

bash

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node -v *# Should show v18+*

npm -v *# Should show v9+*

**2. Create Next.js App**

Run this single command:

bash

Copy

Download

npx create-next-app@latest movie-recommender --typescript --tailwind --eslint

This automatically sets up:  
✅ Next.js 14 (with TypeScript)  
✅ Tailwind CSS  
✅ ESLint

**3. Navigate to Project**

bash

Copy

Download

cd movie-recommender

**4. Start Development Server**

bash

Copy

Download

npm run dev

Open your browser to:  
http://localhost:3000

You'll see a default Next.js page - we'll replace this next!

**5. Install Initial Dependencies**

Keep the server running, open a new terminal window:

bash

Copy

Download

npm install firebase react-swipeable axios @heroicons/react

**What's Ready Now**

✔️ Basic Next.js app  
✔️ Tailwind CSS configured  
✔️ Core dependencies installed