UNIVERSITY OF BARISHAL

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

WEB ENGINEERING PROJECT REPORT

AgroHelp – Smart Farming Platform

A Report Submitted in Partial Fulfillment of the Requirements for the

Course: CSE-2210: Web Engineering Lab

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Introduction

AgroHelp is a smart, user-friendly digital agricultural platform designed to empower farmers with the right tools, knowledge, and support. It aims to improve agricultural productivity by offering intelligent crop suggestions, step-by-step farming practices, automated cost analysis, and market insights. By making crucial farming information accessible in one place, AgroHelp helps farmers make better decisions with confidence.

Agriculture plays a vital role in Bangladesh's economy, employing the majority of the population and ensuring food security. However, farmers face challenges such as climate change, pest attacks, and fluctuating market prices. Many still rely on traditional practices, limiting productivity and profitability. AgroHelp addresses these issues by providing crop recommendations, cost estimation, market insights, and step-by-step farming guidelines. It also includes AI-powered leaf insect and disease detection to help farmers protect their crops.

The platform emphasizes accessibility and inclusiveness, allowing farmers with limited technical knowledge to use it easily. It connects farmers with experts, buyers, and financial institutions while sharing success stories to encourage modern farming practices. By combining technology with agriculture, AgroHelp promotes sustainable, data-driven farming that enhances productivity and supports rural development in Bangladesh.

Scope of Project

❖ Purpose & Goals

- Provide a smart and user-friendly platform to support farmers with accurate agricultural information.
- Suggest suitable crops based on soil conditions, weather patterns, and regional climate.
- Offer step-by-step farming guidelines to simplify planting, irrigation, fertilization, pest management, and harvesting.
- Help farmers estimate production costs and compare them with real-time market prices.
- Enable direct communication with agronomists, buyers, wholesalers, and rural banks.
- Share success stories of agri-entrepreneurs to inspire and encourage innovative farming.

❖ In Scope

- Farmer registration, login, and profile management.
- Crop and soil advisory system using environmental and regional data.
- Step-by-step farming guidelines covering all major stages of cultivation.
- Automated cost estimation and real-time market price comparison tools.
- Communication features for farmers to connect with experts, buyers, wholesalers, and financial institutions.
- Success stories and tips from agricultural entrepreneurs
- Integration of external APIs such as Gemini Ai.
- Secure data storage and management using MongoDB.
- Responsive web interface accessible on desktop, tablet, and mobile devices.

Relevance

Agriculture is the backbone of Bangladesh's economy, providing food, employment, and income for millions of people. Yet farmers continue to face persistent challenges such as reliance on traditional methods, lack of timely access to accurate agricultural advice, unpredictable weather due to climate change, pest and disease outbreaks, and limited awareness of real-time market prices. These issues often result in reduced productivity, higher costs, and lower profitability, leaving farmers vulnerable and less competitive in modern agricultural markets.

AgroHelp directly addresses these challenges by combining technology with agriculture in a way that is practical, accessible, and farmer-friendly. The platform offers personalized crop recommendations, step-by-step farming guidelines, automated cost estimation, and real-time market insights to support data-driven decision-making. It also enables farmers to connect with agronomists, buyers, wholesalers, and financial institutions, ensuring better access to knowledge, trade, and financial resources. By including multi-language support and success stories of agri-entrepreneurs, AgroHelp ensures inclusivity and encourages innovation among farmers across diverse regions.

The relevance of this project lies not only in solving immediate farming challenges but also in contributing to broader national goals. It aligns with the vision of Digital Bangladesh and supports sustainable agriculture by empowering farmers to adopt modern practices, reduce costs, and improve yields. Ultimately, AgroHelp enhances food security, promotes rural development, and strengthens the agricultural economy of Bangladesh.

Technology Stack

❖ Frontend

- **HTML5** – semantic markup structure for building the overall UI skeleton
- **JavaScript (ES6+)** – modern syntax, hooks, and async/await for handling data and component logic
- **React 19** – reliable UI development with modern hooks and functional patterns
- **React Router DOM (v6)** – client-side routing, nested routes, and role-based protected routes
- **Tailwind CSS 4** – consistent design system with utility-first classes for responsive layouts
- **Cloudinary** – secure and efficient image hosting for profile pictures and media
- **Native Fetch + Custom apiFetch wrapper** – REST API calls and server data handling

❖ Backend

- **Node.js (JavaScript runtime)** – server-side environment for executing JavaScript outside the browser
- **Express.js** – lightweight framework for building RESTful APIs
- **CORS –** enable cross-origin requests between frontend and backend
- **express-rate-limit** – protect API from abuse by limiting repeated requests
- **@google/generative-ai** – integrate Gemini AI for chat and vision features

❖ Database & Model

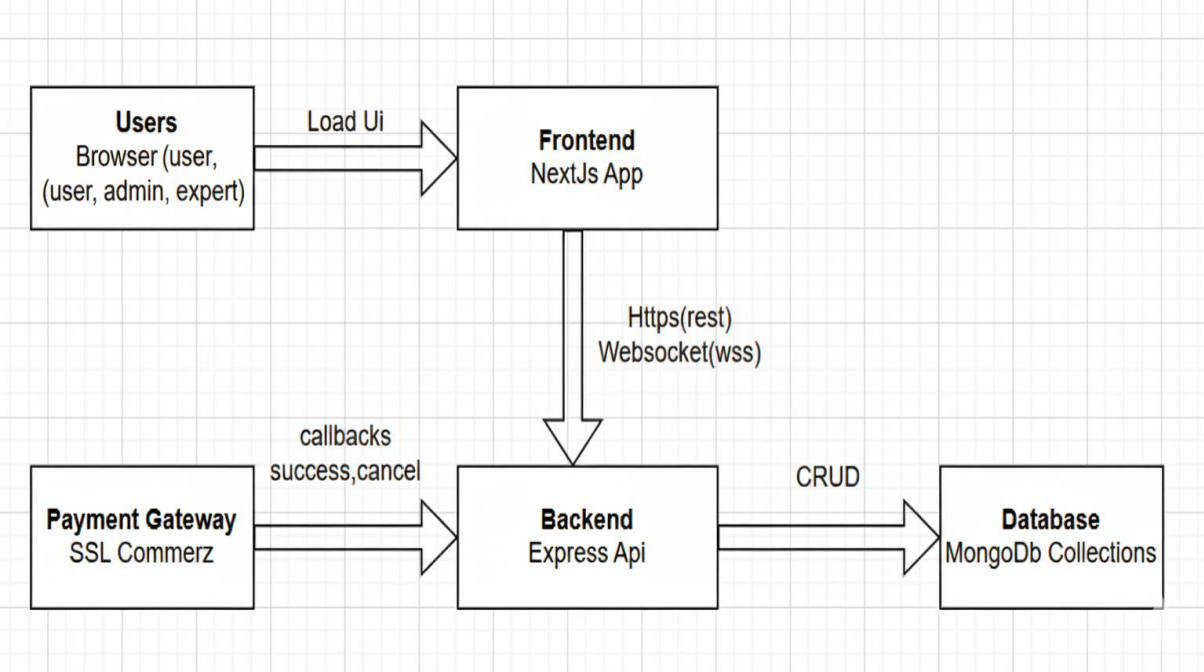
- **MongoDB (Atlas) -** flexible, document-based storage
- **Mongoose models –** Users (user/admin/expert), Advisories, Inputs, Markets, Questions, Stories.

❖ Authentication

- **JWT** - signed access token for stateless auth
- **bcrypt** - secure password hashing
- **Bearer token flow** - store token after login

System Architecture

Our platform uses a simple layered design so the experience feels fast and dependable. Users load a clean React interface in the browser and perform actions such as viewing advisories, market prices, inputs, questions, and stories. Every action talks to a single backend built with Node.js + Express over HTTPS (REST). The backend enforces business rules, authenticates requests with JWT, verifies passwords with bcrypt, and performs CRUD operations on MongoDB (Atlas). This clear separation—UI, API, and database—makes the app easy to understand, monitor, and scale.



Database Design

Below is a report-ready database design tailored to your actual Mongoose models. It explains the entities, how they relate, and which indexes matter for speed and integrity

Collections & Key Fields

1. **users**
   - **Core**: name, email (unique), password, role (buyer | seller | admin), isActive.
   - **Profile:** avatarUrl, phone, about, city, country.UX: wishlist (Listing refs or product refs).
   - **Security:** passwordChangedAt, sellerApprovedAt.
   - **System**: createdAt, updatedAt.
   - **Indexes:** unique email; compound { role, isActive }; createdAt (audits).

2. **advisories**
   - **Core**: title, message, type (disease | weather | tip)
   - **Targeting:** crops (string[]), locations (region | district), validFrom, validTo.
   - **Relations:** createdBy (User ref), verifiedBy (User ref, optional).
   - **UX:** attachments (url[]), tags (string[]).
   - **System:** createdAt, updatedAt.
   - **Indexes:** { type, status, validFrom }, text index on { title, message }, optional { crops, locations }.

3. **inputs**
   - **Core:** name, inputType (seed | fertilizer | pesticide | equipment), brand, note.
   - **Commerce:** price, currency, unit (kg | L | piece | bag | …)
   - **Seller & Location**: sellerId (User ref), marketName, district, upazila, geo (Point).
   - **UX:** images (url[]), specs (key/value map), tags (string[]), ratingAvg, ratingCount.
   - **System:** createdAt, updatedAt.
   - **Indexes:** { inputType, brand }, { price }, geo index on geo, text index on { name, note}.

4. **Markets**
   - **Core:** commodity, price, unit, date.
   - **Location:** marketName, district, upazila, geo (Point).
   - **Provenance:** source (manual | scrape | api), reportedBy (User ref).
   - **UX:** notes, tags (string[]).
   - **System:** createdAt, updatedAt.
   - **Indexes:** compound { commodity, date }, { district, upazila, date }, geo index on geo.

5. **questions**

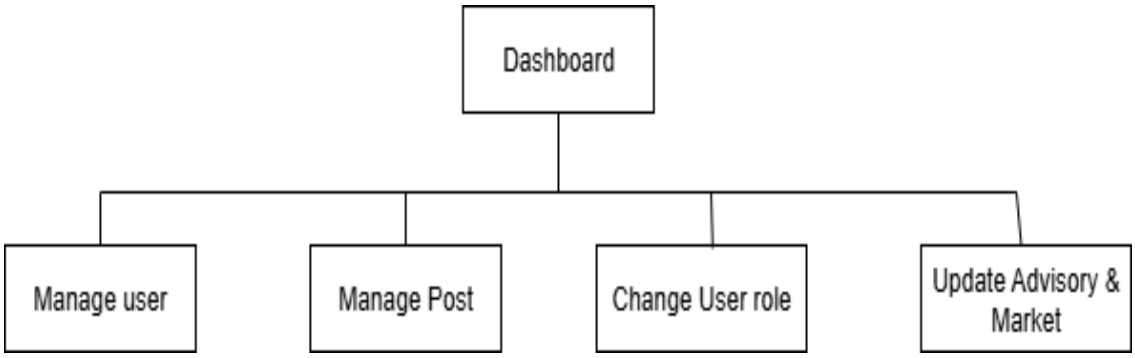
   Core: title, body, status (open | answered | closed).

   - **Classification:** crops (string[]), diseases (string[]), tags (string[]).
   - **Engagement:** views, upvotes, downvotes.
   - **Relations:** askedBy (User ref), acceptedAnswerId (Answer ref, optional).
   - **Embedded (optional):** answers[]: { body, author (User ref), createdAt, isAccepted }.
   - **System:** createdAt, updatedAt.
   - **Indexes:** text index on { title, body }, { status }, { askedBy }, { tags }, createdAt

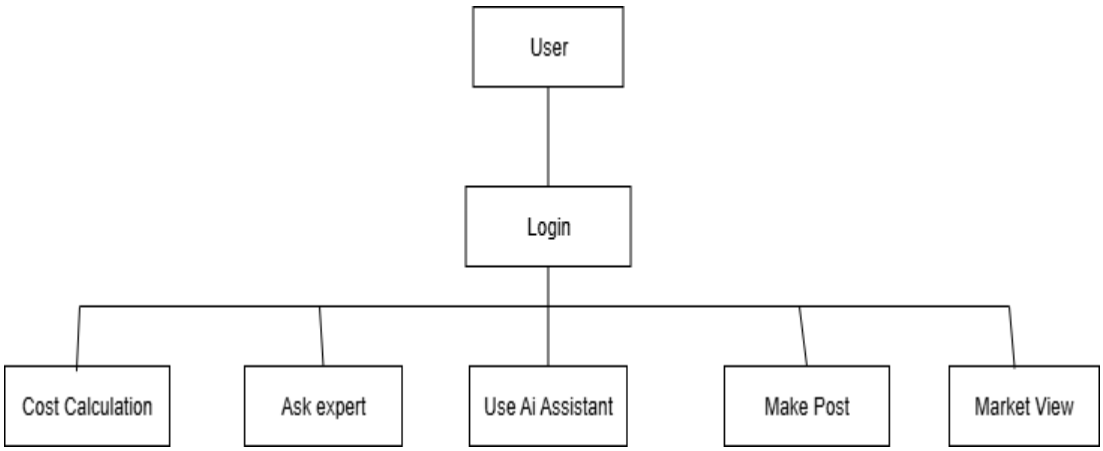
6. **stories**
   - **Core:** title, content, status (draft | published | archived).
   - **Author & Context:** author (User ref), category (success story), tags (string[]).
   - **Media & UX:** coverImage, images (url[]), likes, commentsCount.
   - **Publishing**: publishedAt.
   - **System:** createdAt, updatedAt.
   - **Indexes:** text index on { title, content }, { status, publishedAt }, { author }, { tags }.

Application Workflow

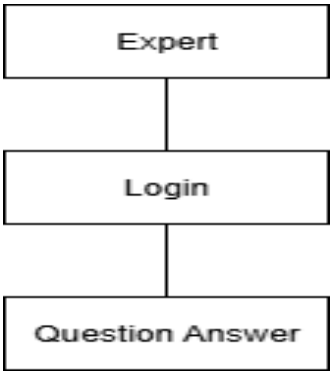
➢ Admin Dashboard:



➢ User Dashboard:



➢ Expert Dashboard:



Security and Privacy

AgroHelp protects farmer accounts, crop data, advisories, and market insights with simple rules. The goal is clear: only authorized users access the right information, recommendations are delivered safely, and sensitive data stays private.

❖ Security

- **Passwords –** never stored in plain text; hashed with bcrypt before saving
- **Login tokens –** managed with JWT over HTTPS, short expiry; password changes immediately invalidate old tokens
- **Roles:** Users, Experts and Admin permissions are checked on every protected API and every socket event.
- **Input checks –** all requests are validated and size-limited; user input is sanitized before storing or rendering to prevent injection or XSS
- **CORS & headers –** only approved frontend origins can access the API; strict security
- headers (HSTS, CSP, no-iframe, no-sniff) are enabled in production
- **Realtime safety –** socket connections verify JWTs and join only the user's assigned room/session; message length and rate are limited to prevent abuse

❖ Payments

- **IPN decides –** fees or dues are marked successfully only after the **SSLCommerz IPN** is received and validated with *val_id.*
- **No duplicates** – each tran_id is processed once (idempotent upsert), even if the gateway retries
- **User pages vs server truth** - success/cancel pages inform the user, but the final decision always comes from IPN confirmation on the server

❖ Privacy

- **Minimal data** – only essential information is collected (name, email, optional phone, academic or departmental details); no card data is stored by the system
- **User control** – all roles (users, experts and admin) can update their profile; users may also request account deletion or data export.
- **Sharing –** personal data is never sold; it is used solely to operate the platform and deliver the features chosen by users.

Advantages

1. For Farmers/Users

- **Timely advisories and updates –** get instant crop, disease, and weather guidance to protect harvests
- **Transparent market prices –** real-time commodity rates help farmers make fair selling and buying decisions
- **Easy access to inputs –** browse seeds, fertilizers, and tools with clear details from trusted providers
- **Profile and wishlist management** – maintain personal profiles, track subscriptions, and save preferred items
- **Community learning –** ask questions, share experiences, and learn from other farmers and experts

2. For Admin

- **Moderation tools –** manage users, advisories, market data, and stories efficiently
- **Role and access control –** assign roles (farmer, expert, admin) and approve expert accounts
- **Content management –** publish or archive advisories, update market information, and verify content
- **Audit and tracking –** monitor user and system activity with createdAt/updatedAt logs
- **Platform security –** JWT-based authentication and bcrypt password hashing ensure safe usage

3. For Experts

- **Answer farmer questions –** provide clear, practical solutions to agriculture-related problems
- **Track engagement –** monitor which questions have been answered and follow up when needed
- **Profile and credibility –** maintain expert profiles with verified credentials and areas of expertise
- **Secure authentication –** ensure trusted expert verification and approvals for reliability

Conclusion and Future Work

➢ Conclusion

AgroHelp is a smart and user-friendly digital platform designed to empower farmers in Bangladesh by providing timely information, expert guidance, and access to market and financial resources. By integrating crop recommendations, cost estimation, market insights, expert connectivity, and disease detection tools, it simplifies farming practices and enhances productivity. The platform promotes sustainable and profitable agriculture, helping farmers make informed decisions and improve their livelihoods. With future enhancements, AgroHelp has the potential to become an essential tool for modernizing agriculture and supporting the growth of Bangladesh's farming community.

➢ Future Work

In the future, AgroHelp can be expanded to include more advanced features to further support farmers. This may include:

1. **Integration with IoT devices** – enable real-time soil and weather monitoring
2. **Predictive analytics** – provide yield estimation based on data trends
3. **AI-based pest and disease prediction** – detect and warn farmers about risks early
4. **Partnerships with government and agricultural organizations** – offer subsidies, training programs, and up-to-date policy updates
5. **Livestock management** – expand the platform to cover animal health and production
6. **Post-harvest logistics** – support farmers with storage, transport, and market delivery solutions