**Goal:** By October 7, 2025, our goal is to deliver a production-ready microservices architecture for CRAD, including comprehensive user requirements documentation, detailed technical specifications, architecture diagrams, wireframes, high-fidelity mockups, and interactive prototypes. Ensure all deliverables meet stakeholder approval, usability standards, and technical performance benchmarks, with a minimum satisfaction score of 90% across all user roles and compliance with industry regulations.

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| **Objectives** | **Activities** | **KPIs** | **Timeline** |
| **1. User Requirements Documentation**  Create comprehensive user requirements documentation capturing all stakeholder needs. | * Day 1 (August 26, 2025): - * Day 2 (August 27, 2025): Develop comprehensive user personas for each role (super\_admin, agronomist, farmer, viewer) including demographic information, technical proficiency levels, primary goals, main frustrations, preferred devices, typical usage patterns, key responsibilities, and decision-making authority. Create journey maps for each persona showing touchpoints with the system throughout their typical workday. * Day 3 (August 28, 2025): Define detailed feature requirements for each role and service with explicit acceptance criteria, priority levels (must-have, should-have, could-have), complexity estimates, dependencies, and relevant regulatory considerations. Include specific data field requirements, validation rules, performance expectations, and cross-platform compatibility needs for each feature. * Day 4 (August 29, 2025): Document comprehensive workflow scenarios for critical user journeys including happy paths and exception cases. Create detailed sequence diagrams showing system interactions, decision points, error handling procedures, and expected outcomes. Include specific performance requirements for time-sensitive operations and data integrity considerations for critical transactions. * Day 5 (August 30, 2025): Develop comprehensive requirements traceability matrix linking each requirement to its originating stakeholder, affected microservices, associated user stories, relevant regulatory standards, acceptance tests, implementation priority, and risk assessment. Establish version control processes for requirements and formal change management procedures for requirement modifications. | * All user roles and permissions comprehensively defined with explicit documentation of access rights for each system function, data element visibility rules for each role, approval workflows requiring multiple roles, audit logging requirements for sensitive operations, and compliance with data protection regulations. Permission matrix must be validated through structured walkthrough sessions with the security team and representative users from each role. * Requirements successfully mapped to specific microservices with clear documentation of service boundaries, shared domain objects, inter-service dependencies, consistency requirements for distributed data, expected transaction volumes, and latency requirements. Service responsibility matrix reviewed and approved by the architecture team with all cross-cutting concerns explicitly addressed and documented resolution approach for identified boundary conflicts. | August 26-30, 2025 |
| **2. Software Requirements Specification:** Develop detailed technical specifications for all microservices. | * Day 6 (September 3, 2025): Create comprehensive functional requirements documentation for Web App (Next.js), including all UI components, state management strategies, and client-side validation requirements * Day 7 (September 4, 2025): Develop detailed API Gateway / BFF specifications, including authentication flows, request aggregation patterns, and service discovery mechanisms * Day 8 (September 5, 2025): Produce in-depth technical requirements for Farmer Profile, Soil & Sensor, and Recommendation services, including domain models, business rules, and service boundaries * Day 9 (September 8, 2025): Create extensive Knowledge Service specifications, including RAG implementation, vector database integration, and document processing pipelines * Day 10 (September 9, 2025): Establish comprehensive data persistence requirements for Drizzle + PostgreSQL, including schema design, migration strategies, and performance considerations | * Complete technical specifications for all microservices (minimum 5) with detailed interface definitions, error handling strategies, and performance requirements fully documented and peer-reviewed. * Comprehensive database schema documentation including entity-relationship diagrams, normalization analysis, indexing strategy, and data access patterns with performance benchmarks for critical queries. * Fully defined API contracts for all service interactions with OpenAPI/Swagger specifications, including request/response schemas, authentication requirements, rate limiting policies, and versioning strategy. | September 3-9, 2025 |
| **3. Architecture Diagrams**  Create comprehensive architecture diagrams documenting system design | * Day 11 (September 10, 2025): Develop comprehensive high-level system architecture diagram showing all services, databases, and external integrations with clear boundaries and communication patterns * Day 12 (September 11, 2025): Create detailed microservices interaction diagrams for each major workflow including request/response cycles, event flows, and error handling scenarios with sequence diagrams for complex interactions * Day 13 (September 12, 2025): Design extensive database schema diagrams based on Drizzle ORM models, including entity relationships, indexes, constraints, and partitioning strategies with performance annotations * Day 14 (September 15, 2025): Diagram comprehensive authentication and authorization flows showing token lifecycle, permission checks, and security boundaries with threat modeling annotations * Day 15 (September 16, 2025): Create detailed deployment architecture diagrams including containerization, networking, scaling strategies, and infrastructure components with resource requirements | * Complete set of architecture diagrams (minimum 15 diagrams) covering system overview, component interactions, deployment topology, security boundaries, and data flows with version control and change tracking * All data flows and service interactions thoroughly documented with latency estimates, throughput requirements, and failure scenarios including comprehensive circuit breaking and retry strategies * Architecture review completed with technical team resulting in documented feedback, risk assessment, mitigation strategies, and formal sign-off from lead architects and security team | September 10-16, 2025 |
| **4.Wireframes**  Create low-fidelity wireframes for all user interfaces | * Day 16 (September 17, 2025): Develop comprehensive wireframes for authentication screens including login, registration, password recovery, multi-factor authentication, and role-based redirects with annotations for validation rules and error states * Day 17 (September 18, 2025): Create detailed wireframes for farmer dashboard and profile management interfaces, including farm registration, field mapping, crop history tracking, yield data visualization, and user preference settings with responsive layouts for mobile and desktop * Day 18 (September 19, 2025): Design extensive wireframes for soil sample and sensor data views, including sample submission workflows, laboratory result displays, real-time sensor monitoring dashboards, historical trends analysis, and data export functionality with filtering and sorting controls * Day 19 (September 22, 2025): Create comprehensive wireframes for recommendation interfaces including crop suitability maps, fertilizer dosage calculators, irrigation scheduling tools, pest management advisories, and weather-adaptive planning tools with contextual help features * Day 20 (September 23, 2025): Design detailed wireframes for Super Admin console including document management system, knowledge base curation tools, user role administration, system configuration panels, and operational analytics dashboards with audit logging interfaces. | * Complete set of wireframes for all critical user flows (minimum 50 screens) with documented user stories, acceptance criteria, and interaction patterns, including error states, loading states, and empty states for all data-dependent views * Comprehensive user feedback collected from representative stakeholders (minimum 3 farmers, 2 agronomists, 2 administrators) with formal usability testing sessions, documented observations, severity ratings for identified issues, and prioritized enhancement recommendations * Information architecture thoroughly validated through card sorting exercises, tree testing, and navigation path analysis with quantitative metrics for task completion success rates, time-on-task measurements, and system usability scale (SUS) scores exceeding industry benchmarks. | September 17-23, 2025 |
| **5.Mockups**  Create high-fidelity mockups incorporating visual design | * Day 21 (September 24, 2025): Develop comprehensive design system and component library based on shadcn/ui, including typography scale, color palette with accessibility considerations, spacing system, responsive breakpoints, animation guidelines, icon library, and interactive component states with documented variants for all UI elements * Day 22 (September 25, 2025): Create extensive high-fidelity mockups for authentication and user profile screens, including login forms with multi-factor authentication states, registration flows with progressive disclosure, password management interfaces, profile editing views with avatar customization, notification preference settings, and account security dashboards with session management * Day 23 (September 26, 2025): Design detailed mockups for farm management and soil data visualization interfaces, including interactive field mapping tools with boundary drawing capabilities, soil sample registration workflows, historical sample comparison views, sensor data dashboards with real-time monitoring, trend analysis charts with customizable parameters, and geospatial data overlays with layer management * Day 24 (September 29, 2025): Create comprehensive mockups for recommendation interfaces and chat UI, including personalized crop recommendation cards, fertilizer application visualizations with dosage calculators, irrigation scheduling interfaces with weather integration, pest management advisory displays, and AI-powered chat interface with context-aware suggestions, document references, and multimedia support * Day 25 (September 30, 2025): Design elaborate mockups for administrative interfaces, including user management dashboards with role assignment workflows, system configuration panels with feature toggles, document management systems with versioning controls, knowledge base curation tools with tagging taxonomy, operational analytics dashboards with exportable reports, and audit logging interfaces with advanced filtering. | * Complete design system implemented with comprehensive documentation including 100+ reusable components, accessibility compliance to WCAG 2.1 AA standards, responsive behavior specifications for all viewports from mobile to large desktop, dark/light mode variations, and implementation guidelines for developers with code snippets and props documentation * Visual consistency achieved across all interfaces with measurable metrics including consistent color application validated through automated tools, typography hierarchy adherence verified through visual regression testing, component usage consistency audited across all screens, spacing system compliance evaluated through grid overlay analysis, and interaction pattern uniformity confirmed through comprehensive UI inventory assessment * Comprehensive stakeholder approval of visual design documented through formal design reviews with agricultural domain experts, quantitative feedback collected via structured evaluation forms, comparison against competitive analysis benchmarks, alignment verification with brand guidelines, and acceptance testing with representative end-users resulting in minimum 90% satisfaction scores across all user roles and demographic segments. | September 24-30, 2025 |
| **6. Prototypes**  Develop interactive prototypes demonstrating key user flows | * Day 26 (October 1, 2025): Create comprehensive interactive prototype for user onboarding and farm setup, including account creation, farm profile establishment, field boundary mapping, crop history input, soil characteristic logging, equipment inventory registration, and user preference configuration with multi-step validation and contextual help elements throughout the entire workflow * Day 27 (October 2, 2025): Develop detailed interactive prototype for soil sample submission and analysis workflow, including sample collection guidance with location tagging, barcode scanning integration, laboratory submission tracking, result notification system, historical comparison visualizations, trend analysis tools, and automated interpretation of findings with personalized recommendations based on soil composition metrics and regional benchmarks * Day 28 (October 3, 2025): Build extensive interactive prototype for crop recommendation and planning features, including AI-powered crop suitability analysis with climate modeling, seasonal rotation planning tools, yield prediction calculators, market trend integrations, resource requirement estimators, risk assessment visualizations, and collaborative planning interfaces with agronomist consultation capabilities and scenario comparison tools * Day 29 (October 6, 2025): Create sophisticated interactive prototype for fertilizer, pest management, and irrigation recommendations, including precision application mapping with variable rate technology support, pest identification through image recognition, treatment option comparisons with environmental impact assessments, weather-adaptive irrigation scheduling, water usage optimization tools, and integration with sensor networks for real-time soil moisture monitoring with automated adjustment suggestions * Day 30 (October 7, 2025): Develop comprehensive interactive prototype for document upload and knowledge management, including multi-format document processing, intelligent categorization with automated tagging, full-text search with semantic understanding, version control with change tracking, collaborative annotation tools, citation management for scientific resources, personalized content recommendations, and integration with the AI assistant for contextual information retrieval during user interactions. | * Comprehensive interactive prototypes for all key user flows (minimum 25 distinct flows) with fully functional navigation paths, realistic data interactions, error state handling, loading indicators, confirmation dialogs, progress tracking, and help system integration, validated through rigorous user testing with heuristic evaluation against Nielsen's usability principles, cognitive walkthroughs by UX experts, and comparative benchmark analysis against industry-leading agricultural technology platforms * Extensive user testing completed with diverse representatives from each role (minimum 5 smallholder farmers, 5 commercial farm managers, 3 agronomists, 3 agricultural extension officers, and 2 system administrators) across different agricultural regions, experience levels, and technology comfort zones, using standardized task scenarios, think-aloud protocols, post-task satisfaction surveys, and System Usability Scale (SUS) assessments, resulting in quantitative metrics for task completion rates, time-on-task measurements, error rates, and subjective satisfaction scores * Comprehensive documentation of all usability issues identified through testing, including severity ratings based on impact and frequency, detailed reproduction steps, affected user segments, underlying causes, recommended solutions with implementation complexity estimates, prioritization matrix based on business impact versus implementation effort, and validation plan for retesting after implementation, with all critical and high-priority issues addressed through prototype iterations before development handoff. | October 1-7, 2025 |