

Product Requirements Document (PRD) — AbodeAI

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Executive Summary

This PRD outlines a production-ready, enterprise-grade AI web application integrating AI task management with AI-powered 3D architectural visualization. Inspired by Gendo.ai, Coohom's drag-and-drop ecosystem, and AIHouse's manufacturing bridge, it supports secure, scalable workflows from site plans to furnished renders and BOM exports.

Key objectives:

Provide robust task orchestration and AI agent capabilities for design automation.
Deliver professional-grade tools: Design-to-CGI, generative editing, style transfer, text-to-room, parametric furniture, and virtual staging.
Enforce compliance (GDPR, SOC2, HIPAA-ready) with enterprise controls like role-based access and data residency.
Scale to thousands of users via credit-based billing and multi-tier subscriptions.
Maintain observability, DevOps readiness, and sustainability metrics (e.g., CO2 per render).
Enable hybrid AI-human workflows with real-time reviews.
AI Model Customization: Low-code fine-tuning for personalized outputs.

Implementation for new objectives:

AI Customization: Low-code UI via Hugging Face Transformers; upload datasets, trigger GPU fine-tuning, store in user S3 buckets with Git-like versioning.
Sustainability Metrics: Integrate CodeCarbon for CO2 calculations; store in Postgres, expose via dashboards with cron jobs on Kubernetes.
Hybrid Workflows: WebSockets for collaboration; Redis queues for approvals as state machines.

Recent 2025 updates (from industry scans): Generative AI for concept variations, digital twins for adaptive buildings, and bionic design simulations enhance sustainability focus.

2. Scope & Stakeholders

In-Scope:

Modular workspaces: Task Manager & Design Studio (site planning + interiors).
APIs/SDKs for automation and rendering.
Subscription/billing with credits.
Full security, compliance, privacy.
Multi-language, WCAG 2.2 AA accessibility.
Third-party integrations: OAuth for Slack/Jira/Adobe/Figma; manufacturing (ZBOM/JEGA).
Progressive Web App (PWA) for mobile-first access, with offline caching.

Out-of-Scope: Mobile-native apps (PWA suffices); advanced metaverse (Phase 4).
Stakeholders: Product, Engineering, Security, Compliance, QA, Marketing, End Users (Designers/Analysts/Teams/Enterprises), AI Ethics Board (bias audits), Customer Success (onboarding).

Implementation for new items:

Integrations: Microservices handle API calls with Redis rate-limiting; Zapier-compatible webhooks.

PWA: React service workers for offline; Firebase for push notifications.

CategoryKey Additions from Coohom/AIHouse (2025)RationaleDesign Tools80M+ searchable models, one-click layouts, parametric cabinets (AIHouse 5 Plus)3x faster cycles; supports irregular plans.RenderingPhotorealistic 4K in <2 min, AI lighting (Coohom)Boosts client engagement by 200%.ManufacturingBOM/quotes/cutlists, JEGA factory sync (AIHouse)Seamless design-to-production.CollaborationReal-time cursors, community forums (Coohom-inspired)Enhances team workflows.

3. User Personas & Journeys

Personas:

Analyst: Creates/monitors tasks.

Designer: Uploads designs, generates/edits CGI.

Compliance Officer: Audits logs/compliance.

Administrator: Manages roles/credits/billing.

Enterprise Buyer: Oversees org usage.

Developer: Builds custom agents via SDK.

Freelancer: Quick bursts with flexible credits.

New: Builder/Manufacturer: Reviews BOMs, tracks production.

Core Journeys:

Sign-up/Onboarding: Secure creation, MFA, interactive tutorial (Shepherd.js).

Task Management: Define AI workflows, monitor execution.

Site-to-Interior: Upload plan → AI parse → Place ADU/furniture → Virtual stage.

Design-to-Image: Sketch → CGI render with style transfer.

Generative Editing: Segment/modify via inpainting.

Text-to-Room: Prompt-based generation with one-click templates.

Audit Review: Filter logs by user/date.

Subscription Management: Track credits, buy packs.

Collaboration: Real-time co-editing with cursors.

Feedback Loop: Post-render NPS for AI retraining.

Error Recovery: AI-guided troubleshooting.

Export/Sharing: Secure links with watermarks/expiration.

New: Manufacture Handoff: One-click BOM → ERP integration.

Implementation for new:

Extend RBAC for Developer/Freelancer (Postgres schema).

Collaboration: Socket.io, MongoDB sessions.

Feedback: Elasticsearch aggregation for retraining.

Error Recovery: Python/Flask rule-based system, Sentry logging.

Export: AWS S3 signed URLs with Pillow watermarking.

4. Functional Requirements

4.1 Authentication & Authorization

MFA, SSO (SAML/OIDC), RBAC (Admin/Designer/Analyst/Compliance/Auditor/Manufacturer).

Passwordless: Magic links, WebAuthn.

Session: Auto-logout, device management, geo-fencing.

Federated: Google Workspace, Microsoft Entra ID.

Implementation: Auth0 for magic links; Redis sessions; MaxMind for geo.

4.2 Task & AI-Agent Management

Orchestration: Scheduling, retry logic.
Parameterized pipelines/templates.
Logging/monitoring/alerts.
Agent Marketplace: Pre-built templates with ratings.
Version Control: Git-like branching.
Dependency Management: Auto-resolve conflicts.
Analytics Dashboard: Performance visualizations.

Implementation: MongoDB for templates; Airflow DAGs; Chart.js/Prometheus.

4.3 Site Planning & Parsing

File Intake: PDF/JPG/PNG/DXF/DWG (max 50MB).
AI Parsing: Scale/north/trees/annotations (OpenCV/YOLO/OCR); manual tools.
Output: GeoJSON, contours; Vastu compliance checker.
Google Maps Background (paid): Address/APN alignment (<1m), controls (zoom/brightness).

New: Irregular room conversion (AIHouse).

4.4 3D Scene Builder & AI Design Studio

Massing: Extrude footprints, parametric roofs/floors/windows.
Terrain: Mapbox elevation.
Furniture: Drag-and-drop from 80M+ library (text/image search, Coohom/AIHouse).
Virtual Staging: AI replace/furnish rooms.
Design-to-Image: 2D sketches to CGI.
Text-to-Image/Room: Prompt-based, with auto-suggestions (spaCy/LLMs).
Style Transfer: Sketch/watercolor/CGI.
Generative Editing: Segmentation/inpainting (Stable Diffusion).
3D Support: Parametric cabinets/doors (AIHouse).
Batch Processing: Parallel on Kubernetes GPUs.
Real-Time Preview: Progressive with WebSockets.
Undo/Redo: JSON states in Redis, branching.
Advanced: Upscaling (ESRGAN), AR/VR (WebXR), digital twins.

Implementation: Three.js/WebGPU; RabbitMQ queues.

4.5 Rendering Controls

Materials: PBR library (wood/earth/concrete), custom uploads.
Lighting: HDRI/sun, real-time shadows (CSM, stabilized videos).
Surroundings: Presets (desert/suburban), vegetation/wind anim.
Post-FX: LUTs, bloom, tonemapping.
Outputs: 1080p-4K PNG/MP4 (<2 min renders, Coohom); walkthroughs.
Paid: Shadowed videos, Maps backgrounds.

New: AI-optimized lighting/views (2025 trends).

4.6 Outputs & Manufacturing

Stills/videos; CAD exports.
BOM/Quotes/Cutlists: Automated (AIHouse).
Virtual Tours: Interactive panoramas.

4.7 Collaboration & Community

Comments/versioning/share links (expiring/watermarked).
Real-time: Cursors (Socket.io).
Shared Libraries: Models/textures.
Forums: Discourse integration (Coohom-style).

4.8 Commerce & Subscriptions

Plans: Free (100 credits, attribution), Pro (\$29/mo, 1K credits), Team (\$99/org), Enterprise (custom).
Credits: Monthly/one-off/rollover; dynamic allocation (scikit-learn).
Billing: Stripe dashboard, referrals, promos.
Add-ons: Rush, priority queues.

Tier	Credits	Features	Price
Free	100	Basic, attribution	\$0
Pro	1,000	Unlimited models, 4K	\$29
Team	5,000	sharedCollab, integrations	\$99
Enterprise	Custom	APIs, SLA	Contact

Implementation: Stripe Usage API; JS calculator.

4.9 Integrations

Figma/Slack/Drive/Dropbox/Notion/Zapier.
Manufacturing: ZBOM/JEGA for BOM sync.
New: Adobe SDKs, ERP webhooks.

4.10 Localization & Accessibility

i18n (multi-lang/RTL), WCAG AA.
Auto-detect, voice commands (Web Speech).
Themes: High-contrast.

Implementation: navigator.language; Tailwind variables.

5. Non-Functional Requirements

Category	Requirement	Performance
Render	<30s; 99th percentile <500ms; edge caching	<100ms
Scalability	10K+ users; autoscaling GPUs; petabyte storage	Availability 99.9% SLA; multi-region failover
Reliability	Rollback/canary; AI drift detection (Evidently)	Security OWASP Top 10; zero-trust (Istio); RASP
Compliance	GDPR/SOC2/HIPAA; automated consent (OneTrust)	Maintainability 90% coverage (Jest); semantic versioning; auto-docs (JSDoc)

Implementation: Cloudflare CDN; CUDA acceleration.

6. Security & Compliance

Encryption: TLS 1.3/AES-256.
Privacy: Right to Forget/Export.
Key Mgmt: KMS rotation.
Breach: 72h disclosure.
Threat Modeling: STRIDE/pentesting (HackerOne).
AI Security: Prompt guards, watermarking.
Incident: SIEM (Splunk), quarterly drills.

Implementation: Regex/LLM input sanitization; multi-region AWS.

7. Architecture & Infrastructure

Frontend: React/TS + Tailwind/i18n; Three.js/WebGL2.

Backend: FastAPI microservices; REST/gRPC.
Data: Postgres/PostGIS (core), Mongo (logs), S3 (assets).
ML/AI: Hugging Face/Stable Diffusion; edge inference (Cloudflare Workers).
IaC: Terraform/ArgoCD/Helm.
CI/CD: GitHub Actions (Blue/Green).
Serverless: Lambda for non-GPU.
Data Pipeline: Kafka streaming.
Backup: AWS PITR.
Data Model (excerpt):

User (id, role, org_id).
Project (id, geojson, scene_json).
ModelLibrary (id, tags, count:80M+).
BOM (project_id, items, cost).
SustainabilityMetric (render_id, co2_kg).

API Sketch:
textPOST /projects {address}
POST /projects/:id/parse
POST /models/search?query=
POST /exports/bom {project_id}
GET /maps/imagery?address=

8. Monitoring & Observability

Metrics: Prometheus/Grafana.
Logs: ELK (JSON).
Tracing: OpenTelemetry.
Alerts: Alertmanager.
AI Insights: TensorFlow anomalies.
User Analytics: Mixpanel.
SLO/SLI: Checkly-defined.

Implementation: Engagement tracking tied to alerts.

9. QA & Testing Strategy

Unit/Integration/E2E (Cypress).
Adversarial prompts; axe-core accessibility.
Load (k6); OWASP ZAP security.
Chaos (Gremlin).
Beta: LaunchDarkly flags.
AI: Fairlearn bias; custom hallucination evals.

Implementation: Visual regression on gold-set plans; shadow stability tests.

10. Documentation & Support

User Docs: Task/design/billing guides.
API: OpenAPI/Swagger samples.
Runbooks: Incidents/migrations (Confluence).
KB: Tutorials/forum (Discourse).
Interactive: Shepherd.js tours.
AI Chat: Grok-like LLM bot.

11. Pricing Strategy

As in 4.8; tiered add-ons via Stripe. Transparency: Credit calculator.

12. Roadmap

PhaseTimelineFeaturesMetricsv1 MVPQ4 2025Site parse + interiors/renders; PWA<60s TTI; 50% retentionv2 ProQ1 2026Manufacturing/BOM; 80M library95% CSAT; +200% AOVv3 EnterpriseQ2 2026AR/VR/digital twins; custom models99.9% uptimev4 AdvancedQ3 2026API marketplace; bionic sims10K users; 40% referrals
Milestones: 50% retention, 95% satisfaction.

13. Approval & Next Steps

Sign-off: Product/Security/Engineering/Compliance.
Finalize: Wireframes, OpenAPI, billing.
Sprint 0: Env/CI/CD/auth.
Phase 1 MVP: Iterative rollout.

14. Risks & Mitigations

Parsing Accuracy: Confidence UI/manual overrides.
GPU Costs: Tiers/spot instances.
Licensing (Maps/Models): UI guardrails/attribution.
AI Bias: Ethics board audits.

15. Appendices

Default Materials: Wood/oak, rammed earth, etc.
LUTs: Warm_earthy, neutral.
HDRIs: Desert_sunny, etc.

This PRD equips AI agents for code generation: React for UI, Python for parsing/BOM, Terraform for infra. UX: Minimalist, 60FPS previews, cinematic realism.