IntelliAgent — Enterprise Agentic AI Platform (Project-1)

Main takeaway: Build a production-grade, agentic AI platform that connects securely to enterprise systems via MCP, augments with high-precision hybrid RAG, and orchestrates task-specific multi-agent workflows using LangGraph. The solution reduces knowledge discovery time, automates document- and process-heavy workflows, and provides measurable ROI with end-to-end observability and governance.

1) Real-world problem and the impactful solution

Problem statement
Knowledge work is slowed by siloed systems, fragmented data, and manual, repetitive processes. Knowledge workers spend 1–3 hours per day searching for information and re-creating work, leading to 20–40% productivity loss and frustration, with additional drag from compliance/reporting and unproductive meetings. Poor knowledge-sharing and onboarding inefficiencies cost enterprises millions annually. While genAI adoption is rising, many organizations still struggle to operationalize value at scale and achieve systematic cost/revenue impact. Document-heavy workflows lack automation, causing errors, delays, and compliance risk.[1] [2] [3] [4] [5] [6] [7] [8] [9]

Impactful solution
IntelliAgent is an enterprise-grade, multi-agent AI platform that:

- Uses LangGraph to orchestrate reliable, stateful, tool-using agents for complex workflows and team handoffs.[10] [11] [12]
- Implements high-precision hybrid RAG (vector + keyword + graph augment) to retrieve accurate, governed knowledge from private corpora and systems.
- Integrates enterprise systems with the Model Context Protocol (MCP) for standard, secure, auditable tool/data access across Slack, GitHub, Drive, Postgres, etc..[13] [14] [15] [16] [17]
- Adds multi-modal capabilities for unstructured documents and images.
- Provides hardened identity, RBAC, audit trails, and telemetry; production CI/CD; and observability (latency, cost, quality) to reach measurable outcomes like reduced time-to-answer, fewer errors, and automated throughput.[2] [6] [18]

Quantifiable business outcomes (target metrics to measure and report)

- Reduce knowledge search time by 60–75% and duplicate effort by 50% via hybrid RAG and MCP connectors.[3] [5] [1]

- Cut document processing cycle times by 70–90% with automation and IDP patterns, reducing errors by 60–80%.[6] [7] [9] [2]
- Improve developer/analyst task completion time by 20%+ via AI assistance and automation.[19] [20]
- Increase service-level and compliance assurance with auditability and access controls; reduce manual compliance reporting time by 50%+.[2] [6]
- Achieve sub-second retrieval latency at P95 for common knowledge queries; 99.9% uptime for the core APIs.

2) Name and core idea

Name: IntelliAgent — Enterprise Agentic AI Platform

Core idea
A secure, extensible platform for enterprise-grade agentic workflows. IntelliAgent combines:

- LangGraph-based multi-agent orchestration for robust stateful workflows and tool use.
- Hybrid RAG (semantic + sparse + graph-aware retrieval) over enterprise knowledge.
- MCP to standardize integrations and safely expose tools/data to agents, eliminating N×M connector complexity.
- Full-stack app (Next.js 15 + FastAPI) with real-time UX, observability, and governance to run in production on Ubuntu 24.04 and Kubernetes.

Primary use cases

- Assistants for engineering, support, legal, finance: question answering, drafts, code review, triage.
- Intelligent document flows: intake, classify, extract, validate, summarize, file, and route.
- Process automation: ticket enrichment, incident postmortems, compliance evidence gathering.
- Data concierge: natural language access to BI/data sources with lineage and guardrails.

3) Tech stack (Ubuntu 24.04) and why each is used

Agentic and RAG layer

- LangChain v0.3 (>=0.3,<0.4): LLM ops, embeddings, splitters, tool interfaces.[21]
- LangGraph v0.6.x: stateful, resilient agent graphs, memory, interrupts, runtime; latest supports tool-updating graph state and advanced durability.[22] [11] [12]
- LangSmith (hosted or self-hosted): tracing, evals, prompt/version mgmt, OpenTelemetry support for observability and quality.[11]

LLMs and embeddings

- OpenAI GPT-4.1/4o or equivalent; local LLM via Ollama for private/offline flows.

- Sentence/embedding models via langchain-openai or huggingface integration for semantic search.[21]
- Vision OCR: tesseract + rapidocr; optional LLM-V for image/doc Q&A.

Retrieval and storage

- Postgres 16 LTS for metadata, RBAC, audit logs.
- Redis 7 for caching, queues, rate limiting.
- Elasticsearch 8 or OpenSearch 2.x for keyword search;
- Chroma/Qdrant for vector search; hybrid retrieval with reciprocal rank fusion.

Enterprise integration (MCP)

- MCP servers for Slack, GitHub, Google Drive, Postgres, HTTP automation.[14] [15] [16] [13]
- Benefits: standard tool listing/calling, consent flows, JSON-RPC/HTTP transports, uniform auth and metadata.

Backend platform

- FastAPI 0.118.x (latest stable series; semantic versioning caveats) for high-perf Python APIs, async tool endpoints, streaming responses.[23] [24] [25]
- Python 3.11 on Ubuntu 24.04 for performance and ecosystem compatibility.
- Celery/Arq for async jobs (document pipelines, offline evals).

Frontend and UX

- Next.js 15.1 (React 19) with App Router, Server Actions, improved caching semantics and turbopack dev; TypeScript; Tailwind CSS; shadcn/ui for accessible components.[26] [27] [28] [29]
- WebSockets/EventSource for real-time agent streams and traces.

DevOps and runtime

- Docker, Kubernetes (K8s 1.29+), Helm charts; GitHub Actions CI/CD.
- Observability: Prometheus, Grafana, Loki; OpenTelemetry export from LangSmith and backend.[11]
- Secrets: HashiCorp Vault or SOPS; SSO via OAuth2/OIDC; mTLS for internal services.
- IaC: Terraform for AWS (EKS, RDS, ElastiCache/OpenSearch) or GCP/Azure equivalents.
- Feature flags and config via environment and typed settings.

Why this stack

- Aligns with latest LangChain v0.3, LangGraph 0.6.x guidance and modern Next.js 15 semantics.[27] [29] [22] [21]
- MCP ensures standardized, future-proof integrations across data/tools, with formal security guidelines.[15] [16] [13]

- FastAPI offers strong async performance and streaming correctness with new fixes in 0.118. [23]
- Hybrid search (Elasticsearch + vector DB) reflects best practice for enterprise RAG and is aligned with doc automation benefits and productivity outcomes. [18] [9] [6] [2]

4) Interview pitch (concise)

What is the project?
IntelliAgent is a production-grade, agentic AI platform for enterprises. It orchestrates stateful multi-agent workflows with LangGraph, retrieves governed knowledge via hybrid RAG, and connects to enterprise systems through the Model Context Protocol (MCP) to automate knowledge work and document-heavy processes.

Why was it built / need?
Enterprises lose significant time and money due to siloed systems, manual document processing, and duplicated knowledge work. AI adoption is rising, but many lack robust orchestration, integrations, and governance to realize value at scale. IntelliAgent closes this gap with secure, measurable, and maintainable agentic automation. [4] [8] [1] [3]

How it was built?

- Designed multi-agent graphs in LangGraph with tool calling, memory, and interrupts for human-in-the-loop.
- Implemented hybrid RAG (vector + keyword + reranking) and optional graph augment for high-precision retrieval.
- Integrated systems via MCP servers (Slack, GitHub, Drive, Postgres) with consent, RBAC, and audit trails. [16] [13] [15]
- Built FastAPI microservices with Next.js 15 UI for real-time collaboration, deployed on Kubernetes with end-to-end observability and CI/CD.
- Instrumented tracing, evals, and OTEL via LangSmith to iterate on quality and cost. [11]

5) Phases and roadmap (with enhancements)

Phase 0 — Foundations (Week 0)

- Repo scaffolds (frontend, backend, agents, infra), dev containers, Makefile, pre-commit, lint/format/type checks.
- Package pins for Ubuntu 24.04; Python 3.11; Node 20; Docker buildx; compose profile.

Phase 1 — Core RAG and data pipelines (Weeks 1–3)

- Document ingestion: sources (files, Drive MCP), text-splitting, OCR for PDFs/images, PII redaction, metadata lineage.
- Indexing: embeddings to vector DB; keyword to Elasticsearch/OpenSearch; hybrid retriever with RRF and rerank.
- Guardrails: content filters, conf thresholds, citations, grounding checks.

- Metrics: ingest throughput, index latency, retrieval precision@k.

Phase 2 — Agentic orchestration (Weeks 4–6)

- Task-specific agents: Q&A agent, doc-processing agent, triage agent, code-review agent.
- LangGraph graphs: planner → retriever → solver → verifier; shared memory and tool nodes; interrupts for HIL.[12] [11]
- Tooling: MCP tool registry; scoped credentials; rate limiters and retries; streaming token UI.
- Evaluation harness with LangSmith datasets: answer correctness, groundedness, toxicity; A/B prompt versions.[11]

Phase 3 — Integrations and security (Weeks 7–8)

- MCP servers configured for Slack, GitHub, Drive, Postgres; consent UIs; per-tool scopes.[13] [15] [16]
- AuthN/Z: OIDC SSO, role-based access (user, analyst, admin), project spaces, attribute-based policies.
- Audit and compliance: request logs, tool calls, resource lineage, retention windows.

Phase 4 — Productization and observability (Weeks 9–10)

- Next.js 15 app: chat, tasks, document workbench, evaluations dashboard; real-time streams; server actions for mutations.[29] [27]
- FastAPI APIs: async endpoints for queries/jobs, batch pipelines, streaming responses.[23]
- Monitoring: Prometheus/Grafana/Loki; cost dashboards; latency SLOs; OpenTelemetry exports from app and LangSmith.[18] [11]
- CI/CD: GitHub Actions (tests, security scans, Docker build, Helm deploy); progressive delivery (canary/blue-green).

Phase 5 — Performance, scale, and SRE (Weeks 11–12)

- Caching strategies (Redis, in-graph caches), sharding indexes, autoscaling workloads, concurrency tuning.
- Load testing, chaos/latency injection, error budgets; SLO review and optimizations.
- Hardening: secret rotation, vulnerability scans, CSP, mTLS, backup/restore drills.

Enhancements (post-MVP)

- Graph-aware/GraphRAG augmentation for complex relational knowledge and tool dependencies.[30] [31] [32]
- Advanced IDP: table extraction, layout analysis, signature/checkbox detection; confidence auditing.[9]
- BI-native agent: semantic SQL over Postgres/warehouse with row-level security; governed analytics concierge.
- Multi-modal: vision-LLM for visual doc Q&A and UI automation on screenshots.
- Cost and policy: quota policies, per-team budgeting, shadow-mode policy simulation.

6) Exact implementation strategy per step/sub-step

Below are selected critical steps with concrete execution details. Every step includes acceptance criteria and metrics.

1. Ingestion and preprocessing

- Implement file adapters: local, S3/GCS, Drive MCP. Use chunked, resumable uploads; compute sha256 per file.
- OCR: tesseract for PDFs/images, fallback rapidocr; persist text + page coords.
- Cleaning: normalize whitespace, detect language, remove boilerplate; redact PII using regex + NER.
- Chunking: recursive character splitter tuned per doc type (e.g., 800–1200 tokens overlap 100).
- Acceptance: ingest 10k docs/hour on a 4-core node; <5% OCR error rate on English docs; lineage stored per chunk.

2. Indexing and hybrid retrieval

- Vector DB: upsert embeddings keyed by content_id + chunk_id; store metadata (source, path, ts, owner, tags).
- Keyword: index to Elasticsearch (BM25) with analyzers (English, code-aware tokenization where applicable).
- Retriever: RRF combine top-k semantic and keyword hits, optional reranker (cross-encoder) for top-50 to top-10.
- Acceptance: P95 retrieval <300 ms per modality; offline eval: +10–20 pp precision@5 vs naive semantic-only.

3. Agent graphs (LangGraph)

- Graph template: nodes for Retrieve, Plan, Solve, Verify, and ToolInvoke. State carries query, citations, scratchpad, and policy context; edges conditional on verifier pass/fail.
- Interrupt points for approvals: tool calls requiring elevated scopes trigger HIL gate; UI shows intent, parameters, and scope; proceed/deny yields next edge.[11]
- Tool nodes: MCP tool registry; mapping includes JSON Schemas; sandboxed HTTP; retries with exponential backoff.
- Acceptance: deterministic replays, resumability from last checkpoint; <1% orphaned tasks; <2% tool-call errors after retries.

4. MCP integration

- Configure standard MCP transports (HTTP or SSE) with OAuth/OIDC tokens; per-tool scopes, consent logs.[14] [15] [16]
- Tool listing: UI renders available tools per workspace; request consent on first use; store consent artifact and TTL.
- Tool call path: serialize input schema, submit call_tool; log result and resource metadata; enforce rate limits per tool.

- Acceptance: each tool gated by consent; all calls recorded with user, time, scopes; revocation takes effect within 1 minute.

5. Security and governance

- RBAC: org → projects → roles; attribute policies on resources (owner, sensitivity).
- Secrets: store in Vault; short-lived tokens; rotate keys quarterly.
- Data in transit: TLS 1.3; at rest: AES-256 for volumes/DB; signed audit logs.
- Acceptance: penetration test with zero critical findings; verify least-privilege on all service accounts.

6. Quality and evals (LangSmith + custom)

- Build curated Q/A datasets from real documents; add adversarial and ambiguous cases.
- Metrics: groundedness, factuality, answer coverage, citation correctness; cost per answer, latency distribution.
- CI gating: block promotion if groundedness <0.9 or regression >5% on key tasks.[11]
- Acceptance: weekly eval runs; dashboards track trends; A/B prompt variants with significant lifts retained.

7. Frontend (Next.js 15) and API (FastAPI)

- Real-time chat/console: stream agent tokens and events; show tool cards with inputs/outputs; allow re-run and compare.[27] [29]
- Server Actions for safe mutations; form enhancements; suspense/streaming for partial prerender.
- FastAPI: async endpoints for ask, plan, run, status; StreamingResponse for tokens; background tasks for long jobs.[23]
- Acceptance: P95 end-to-end answer time <2.5s for FAQ-scale queries; error states observable; retries surfaced to user.

8. Observability and SRE

- Export traces to Grafana Tempo/OTEL; metrics to Prometheus; dashboards for RAG hit ratios, tool-call latency, costs.[18] [11]
- SLOs: availability 99.9%; P95 latency budgets by operation; error budgets enforced in rollout policy.
- Acceptance: load test 1000 concurrent users sustained; automatic scale-out meets SLO; rollback within 5 minutes on SLO breach.

7) Exact project directory structure and file purposes

Mono-repo layout (all paths relative to repo root):

- /docs
  - architecture.md — System context, data flows, threat model.
  - rag-eval.md — Evaluation plan, datasets, metrics.

- ops-runbook.md — SRE runbook: incidents, playbooks, backups.
- security-policies.md — RBAC, consent, data retention policies.

- /infra
  - /terraform
    - main.tf, variables.tf, outputs.tf — Provision VPC, EKS, RDS, Elasticache/OpenSearch.
  - /helm
    - values.yaml — Chart defaults for api, web, workers; HPA, PDB.
    - api/, web/, worker/ — Charts for each service.
  - /k8s
    - namespaces.yaml — Logical envs (dev, prod).
    - ingress.yaml — Ingress rules, TLS.
    - secrets.yaml — ExternalSecret references to Vault.
- /backend
  - pyproject.toml — Pins: fastapi0.118.*, langchain>=0.3,<0.4, langgraph0.6.*, uvicorn, pydantic v2, redis, psycopg, elasticsearch, qdrant-client, opentelemetry.
  - /app
    - main.py — FastAPI app factory, routers mount, OTEL middleware, CORS, security.
    - settings.py — Typed settings (pydantic v2) for DBs, providers, features.
    - auth.py — OIDC middleware, RBAC enforcement, token validation.
    - routes/
      - chat.py — POST /ask (streaming), GET /history, POST /run-task.
      - docs.py — Upload, list, reindex; batch operations.
      - tools.py — MCP tool list, consent endpoints, revoke.
      - admin.py — Policies, roles, projects, audit search.
    - agents/
      - graph_factory.py — LangGraph builder for planner→retriever→solver→verifier with interrupts.
      - nodes/
        - planner.py — Decomposes tasks to sub-goals.
        - retriever.py — Hybrid search call and citations.
        - solver.py — LLM synthesis with citations and policies.
        - verifier.py — Groundedness checks, policy guardrails.
        - tool_node.py — MCP call orchestration, retries.
      - memory/

            - state.py — Typed graph state; checkpointing config.
            - store.py — Redis/Postgres-backed memory adapters.
        - rag/
            - ingest.py — Connectors (local, S3, Drive MCP), chunking, PII redaction.
            - index.py — Vector + keyword indexing pipelines.
            - retriever.py — RRF fusion, reranking, filters.
            - ocr.py — OCR pipeline for PDFs/images.
        - mcp/
            - client.py — MCP host client (HTTP/SSE) with OAuth/OIDC.
            - registry.py — Tool registration per project/workspace.
            - consent.py — Consent flows, scopes, TTL, audit hooks.
        - db/
            - models.py — SQLAlchemy models: Users, Projects, Consents, Docs, Chunks, Audits.
            - schema.sql — Migrations DDL (Alembic alternative).
            - queries.py — Typed query utilities.
        - evals/
            - datasets.py — Load/curate eval sets.
            - runners.py — Run LangSmith evals; export metrics.
        - telemetry/
            - otel.py — Tracing exporters; metrics; log bridges.
- /frontend
    - package.json — Next 15.1, React 19, Tailwind, shadcn/ui.
    - next.config.ts — Type-checked config; caching headers.
    - app/
        - layout.tsx — Shell, auth providers, theme.
        - page.tsx — Dashboard: tasks, recent chats.
        - chat/[id]/page.tsx — Real-time chat with streamed tokens; tool-cards.
        - documents/page.tsx — Upload/reindex; status.
        - tools/page.tsx — MCP tools, consent UI, revoke.
        - admin/page.tsx — Roles, policies, audit search.
        - api/route handlers — Server Actions for mutations and background jobs.
    - components/
        - ChatStream.tsx — SSE/WebSocket stream renderer.
        - ConsentDialog.tsx — Tool consent UX with scopes.

        - TraceViewer.tsx — Lightweight trace timeline viewer.
    - lib/
        - client.ts — API client with auth; retry/backoff.
        - auth.ts — OIDC/OAuth client flows.
- /workers
    - worker.py — Celery/Arq worker for long-running ingest/evals.
    - tasks.py — Ingest/index tasks, OCR jobs, batch eval tasks.
- /deploy
    - Dockerfile.api — Multi-stage build for FastAPI; non-root user; uvicorn config.
    - Dockerfile.web — Next.js production build; output standalone.
    - compose.yaml — Local dev profiles for api/web/db/redis/es/vector.
    - Makefile — make dev, test, build, push, deploy, seed.
- /tests
    - unit/ — Agents, RAG, MCP, RBAC tests.
    - integration/ — API tests, streaming, tool calls.
    - load/ — Locust/k6 scripts for concurrency and SLOs.
- .github/workflows
    - ci.yml — Lint, type-check, tests, SAST, build images.
    - cd.yml — Helm upgrade, canary, health checks, rollback on SLO breach.

What code goes where (short, exact):

- agents/graph_factory.py: defines LangGraph nodes, edges, state, interrupts, and persistence.
- rag/retriever.py: implements RRF fusion combining vector and BM25, optional cross-encoder rerank.
- mcp/client.py: wraps call_tool and list_tools with auth and telemetry; handles transport and retries.
- routes/chat.py: exposes POST /ask streaming endpoint invoking graph entry node with current state and policies.
- frontend/app/chat/[id]/page.tsx: renders streamed tokens; displays tool invocations; supports approve/deny interrupts.
- telemetry/otel.py: configures OTEL exporters and attaches trace context to requests, tool calls, and LLM spans.

8) Resume pointers and README (per IITB playbook style)

Resume bullets (Action verb + technical + quantitative impact + business outcome)

- Architected a LangGraph multi-agent workflow with hybrid RAG (vector+BM25+rerank), improving precision@5 by 18pp and reducing average time-to-answer by 62% across 100k+ documents, boosting knowledge worker efficiency by 35% within pilot teams.[2] [18] [11]
- Integrated enterprise systems via Model Context Protocol (Slack, GitHub, Drive, Postgres) with consented tool scopes and RBAC, eliminating bespoke connectors and cutting integration effort by 70%, while enabling auditable, least-privilege tool use.[15] [16] [13]
- Built FastAPI + Next.js 15 real-time app with streaming responses and Server Actions; achieved P95 E2E latency of 2.3s and 99.9% API uptime under 1k concurrent users on Kubernetes with autoscaling.[27] [23]
- Implemented document automation (OCR, classification, extraction) and verification agents; reduced document cycle times by 78% and manual errors by 65%, accelerating compliance/reporting workflows.[6] [9] [2]
- Established LangSmith-driven evaluations and OpenTelemetry tracing; prevented regressions by CI gates on groundedness (≥0.9) and cut average answer cost by 24% via prompt/runtime optimizations.[18] [11]
- Deployed production CI/CD with Helm/Terraform, Vault-managed secrets, and SRE SLOs; reduced MTTR by 58% using proactive alerting and canary rollbacks.

Short README (what, why, how, usage)

What
IntelliAgent is a secure, enterprise agentic AI platform that connects to business systems via MCP, retrieves governed knowledge with hybrid RAG, and orchestrates multi-agent workflows for knowledge Q&A and document/process automation.

Why
Enterprises waste significant time due to siloed systems, manual documentation, and duplicated knowledge work. IntelliAgent measurably reduces time-to-answer, automates document flows, and adds governance, observability, and security to scale AI value across functions.[1] [4] [6] [2] [18]

How

- Multi-agent orchestration with LangGraph and human-in-the-loop interrupts for high-stakes actions.[12] [11]
- Hybrid RAG over private corpora using vector + BM25 + reranking; citations and grounding checks.
- Standardized, consented tool access via MCP servers for Slack, GitHub, Drive, Postgres with RBAC and audit trails.[16] [13] [15]
- Next.js 15 + FastAPI services, deployed on Kubernetes with full telemetry and CI/CD.

How to use (developer)

- docker compose up to start api/web/redis/postgres/es/vector locally.
- Open http://localhost:3000, sign in (OIDC dev), upload sample docs, connect MCP tools, and ask questions in Chat.
- Approve tool calls when prompted; review citations and traces; inspect evaluations in the Eval dashboard.
- Configure policies and roles in Admin; monitor SLOs in Grafana.

Note on evidence and alignment

- Productivity, document automation, and adoption statistics used for outcome targeting and executive messaging draw from reputable analyses and surveys; final reported resume metrics must come from platform telemetry and customer/pilot measurements.[4] [1] [6] [2] [18]

Citations used in this document reflect trends, capabilities, and version recency:

- Knowledge work/productivity drag and time spent.[5] [1]
- Document automation benefits (efficiency, errors, compliance, cycle time).[7] [9] [6] [2]
- AI/genAI adoption trends and scaling value challenges.[8] [4]
- Developer productivity lift with AI assistance.[20] [19]
- LangChain v0.3, LangGraph capabilities and updates, LangSmith features.[22] [21] [12] [11]
- MCP specification and security principles.[13] [14] [15] [16]
- FastAPI recent changes; Next.js 15 updates.[29] [27] [23]

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