SMART INDIA HACKATHON 2025

रक्षा मंत्रालय
MINISTRY OF
DEFENCE
सत्यमेव जयते

- Problem Statement ID – 25245
- Problem Statement Title - Automated Comprehensive Technology Intelligence and Forecasting Platform
- Theme - Smart Automation
- PS Category - Software
- Team ID - 118191
- Team Name - Hexadecimal

IDEA/APPROACH DETAILS

PROBLEM

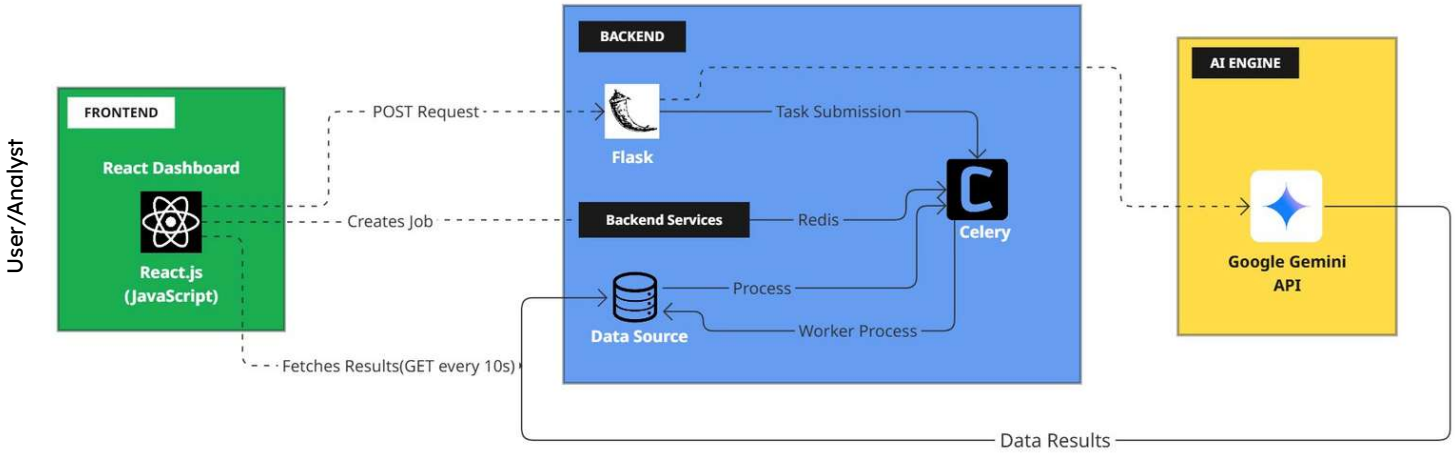
- Manual & Slow: DRDO's existing technology intelligence process is slow and antiquated.
- Scattered Data: DRDO's key technology data is fragmented across various unrelated sources.
- Need for Automation: DRDO requires an AI platform to access real-time, auto-generated technology insights.

SOLUTION

- Automated Data Collection: AETOS gathers research papers and patents from arXiv and Google Patents, among others.
- AI-Driven Analysis: Leverages Gemini to create strategic abstracts, approximate TRL, and identify key technologies and connections.
- Interactive Real-Time Dashboard: Offers interactive, search-enabled insights with end-to-end automation lowering human effort and time.

OUR APPROACH

- Dual Architecture: Ties together an Offline Intelligence Engine to conduct in-depth analysis and an Online Interactive Dashboard to provide live updates.
- Scalable & Event-Driven: Developed on top of React.js, Flask, Redis, Celery, and MongoDB with asynchronous task execution for scalability.
- Seamless Experience: Offers analysts an automated, rapid, and trustworthy end-to-end process from input to insights.



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TECHNICAL APPROACH

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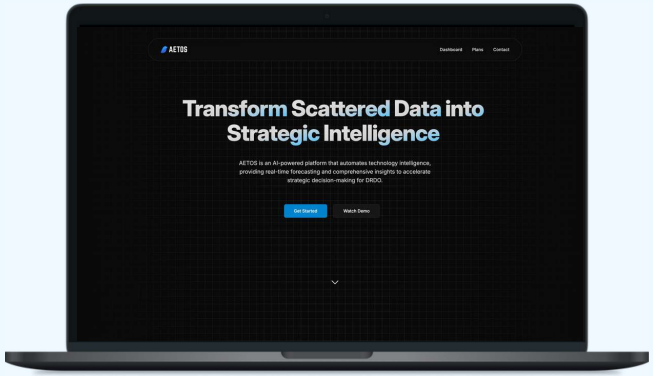
TECH STACK

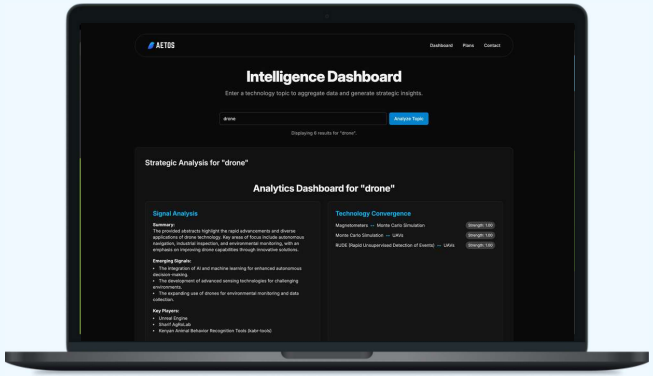
- Frontend→ React.js
- Backend → Python (Flask)
- AI Engine → Google Gemini API (gemini-2.0-flash-lite)
- Async Task processing → Celery & Redis
- Database & Integraton → MongoDB, requests, BeautifulSoup

WORK PROOF



AI Powered Analysis Pipeline

automates the aggregation of technology data from diverse global sources like patents, publications, and market reports.



FEASIBILITY & VIABILITY

FEASIBILITY

- Proven MVP: Already constructed and validated end-to-end, demonstrating architecture feasibility.
- Scalable Stack: React.js, Flask, Redis, Celery, MongoDB – modular & industry-standard.
- AI Integration: Google Gemini API offers accurate document analysis.
- Event-Driven Design: Asynchronous processing ensures smooth, real-time updates.
- Easy maintenance: Modular separation (frontend, API, worker, DB) enables easy upgrades.
- Expandable: Allows for future integration with additional data sources & more advanced analytics.

VIABILITY

- Directly Addresses DRDO Requirements: Automates laborious, manual intelligence collection.
- Centralized Platform: Discards dispersed, unstructured information.
- Strategic Impact: Gives TRL estimates & tech summaries for use in decision-making.
- Cost-Effective: Eliminates necessity for large teams of analysts and manual data labor.
- Continuous Monitoring: Facilitates near real-time monitoring of emerging technologies.
- Future-Ready: Scalable to global data sets, defense-specific stores, and multilingual sources.

CHALLENGES & RISKS

- AI Dependence: Quality of insights depends on Gemini model accuracy.
- Data Coverage: Limited availability of paywalled or limited research sources.
- Computation Cost: Heavy processing burden for big-sized analysis pipelines.
- Scalability Problems: Managing spikes in concurrent user queries requires solid infrastructure.
- Dynamic Updating: Needs frequent fine-tuning to maintain TRL scoring and relationship mapping up to date.
- Security Issues: Sensitive questions can necessitate robust data privacy measures.

Demo : https://youtu.be/lJUfEGNZ69A

Repo : https://github.com/abhaydesu/Aetos

Deployment : https://aetos0.vercel.app

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IMPACT AND BENEFITS

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ASPECT	TRADITIONAL TECHNOLOGY INTELLIGENCE	AETOS – OUR OBSERVATORY SYSTEM	IMPACT/BENEFITS
Data Collection	Manual, time-consuming, scattered across multiple sources	Automated aggregation from arXiv & Google Patents	Trust & Transparency
Timeliness	Insights take days/weeks to compile	Near real-time results on interactive dashboard	Time & Cost Savings
Analysis	Requires large analyst teams, subjective, slow	AI-powered (Gemini) summaries, TRL scoring, relationship mapping	Analyst Efficiency

BENEFITS

SOCIAL IMPACT
- Supports better collaboration among analysts, researchers, and policymakers.
- Democratizes access to complex technology intelligence.

ENVIRONMENTAL IMPACT
- Reduces resource wastage by eliminating redundant research efforts
- Supports future integration with green technologies monitoring (e.g., clean energy, climate)

ECONOMIC IMPACT
- Cost-effective alternative to large analyst teams and slow research cycles.
- Enhances India's capability to stay competitive in emerging technologies.

RESEARCH AND REFERENCES

- Technology Intelligence & Foresight
  - Porter, A. L. et al. (2018). Tech Mining for Emerging Technologies.
  - Daim, T. U., et al. (2020). Technology Roadmapping and TRL Assessments.
- Research & Patent Sources
  - arXiv.org – Open Access Research Papers
  - Google Patents
- TRL Framework
  - NASA Technology Readiness Level (TRL) Definitions.
  - European Commission TRL Guidelines.
- AI & Data Processing
  - Google Gemini API (Gemini 2.0 Flash Lite) – document summarization & analysis.
  - Celery & Redis – asynchronous task management.
  - MongoDB – scalable database for structured intelligence storage.
- Inspiration from Related Work
  - OECD (2023). Emerging Technology Trends Report.

WIPO (World Intellectual Property Organization) – Technology Insights from Patents.