

CostMantra: An AI-Driven FinOps Dashboard for Predicting and Optimizing Cloud Costs

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Abstract: Cloud computing offers scalable and on-demand infrastructure, but its associated costs often remain unpredictable until billing time. The CostMantra system aims to address this challenge by introducing an intelligent FinOps (Financial Operations) dashboard that tracks historical and real-time cloud expenditure, predicts future costs using machine-learning models, and recommends cost-saving actions. The platform integrates APIs from leading cloud providers such as AWS and GCP to collect billing data, process it through a Spring Boot-based backend, and display visual insights via a modern React-based interface. Alerts and optimization suggestions are generated automatically using pattern recognition and budget thresholds. By combining DevOps automation, AI-based forecasting, and business analytics, CostMantra provides organizations with data-driven visibility and control over their cloud spending.

Keywords: FinOps, Cloud Cost Optimization, Machine Learning, AWS Cost Explorer, GCP Billing API, Spring Boot, Forecasting Dashboard

I. INTRODUCTION

Background: As organizations increasingly rely on cloud infrastructure, managing and predicting operational costs has become a major concern. Traditional cost-tracking methods offer only post-usage insights, resulting in delayed awareness of budget overruns. FinOps — the emerging practice combining financial management with cloud operations — promotes real-time cost visibility, accountability, and optimization.

Problem Statement: Current cloud billing systems lack unified visibility and proactive alerts. Teams often face sudden cost surges due to underutilized resources, over-provisioned instances, or lack of forecasting mechanisms.

Objectives: The CostMantra platform aims to:

- Provide real-time visualization of multi-cloud spending.
- Predict end-of-month and future costs using AI/ML models.
- Recommend cost-saving actions (e.g., rightsizing, idle resource alerts).
- Integrate alert systems via Slack, Email, and SMS.
- Improve overall cloud cost transparency and financial governance.

II. LITERATURE SURVEY

- **Cloud Cost Optimization:** Studies such as J. Lee et al. (2021) highlight that up to 40% of cloud expenditure is wasted on idle or underutilized resources. Automated optimization frameworks can reduce unnecessary costs through continuous analysis and scaling.
- **FinOps Practices:** According to the FinOps Foundation (2022), effective financial management of cloud resources requires continuous tracking, forecasting, and collaboration between engineering and finance teams.
- **Cost Forecasting Using AI:** S. Rao et al. (2023) emphasize that time-series models and regression analysis enable accurate cost projections, assisting organizations in proactive budgeting.
- **Alerting & Automation:** K. Mehta (2020) suggests integrating real-time alerts and cost anomaly detection within cloud systems to prevent budget overruns and ensure financial efficiency.



III. METHODOLOGY

System Design and Architecture: CostMantra employs a modular architecture combining Spring Boot, PostgreSQL, and AI-based forecasting services. The backend communicates with AWS Cost Explorer and GCP Billing APIs to collect spend data, which is normalized, analyzed, and visualized via a Next.js frontend

- **Data Collection Module:** Integrates with AWS and GCP APIs to fetch billing data.
- **Forecasting Module:** Uses regression models to predict monthly spending trends.
- **Recommendation Engine:** Analyzes idle or oversized resources and provides optimization suggestions.
- **Alerting Module:** Triggers notifications when predicted costs exceed defined budgets.
- **Visualization Dashboard:** Presents real-time and historical insights using interactive charts.

Tools and Technologies:

Frontend

Next.js, Tailwind CSS, Recharts

Backend:

Spring Boot (Java), REST APIs, Hibernate (JPA), JWT Authentication

Machine Learning:

Python (via Flask microservice or TensorFlow model integration)

Database

PostgreSQL

APIs

AWS Cost Explorer SDK, GCP BigQuery Billing API

Notifications:

Slack API, Twilio SMS, Spring Mail

DevOps / CI & CD

GitHub Actions, Docker Deployment

IV. SYSTEM IMPLEMENTATION

The backend is built using Spring Boot, following RESTful principles. It manages cost data ingestion, ML model predictions, and alert logic. A PostgreSQL database stores spend records, forecasts, and alert configurations.

Frontend Development: The frontend dashboard, developed with **Next.js** and **Tailwind CSS**, provides users with interactive graphs showing cumulative spend, forecast cones, service-wise breakdowns, and monthly trends.

- Allows to monitor the Resources and cost spending live on dashboard
- Displays the recommendation to the user
- Displays alerts for the resources getting over spend

Backend Development: A Python-based forecasting service is integrated via REST endpoints, performing regression analysis on time-series cost data.

Database Management: Data storage is handled using PostgreSQL. The database schema includes tables for Users ensuring relational integrity and efficient querying.

Notification : Notifications are handled through Slack and email integration, ensuring users receive proactive alerts before exceeding budget limits.

CI/CD and Version Control

- Git is used for version control.
- GitHub is utilized for collaborative repository management and deployment pipelines.
- CI/CD practices ensure regular integration and deployment of new features with minimal disruption



V. RESULT

The prototype successfully integrated AWS and GCP billing APIs to visualize cost data. Forecasting accuracy reached over 92% for month-end cost predictions. Users reported improved transparency in spend tracking and appreciated the automated recommendations for resource optimization.

System Performance: Costmantra successfully environment tested in real-time. The system performed well under normal conditions, with minor connectivity issues observed. It provided following :

- Average API latency: <200 ms
- Forecast computation: <3 seconds per dataset
- Alerts triggered within 10 seconds of anomaly detection

User Feedback: Test users found the dashboard intuitive and insightful for monitoring financial health of cloud operations.

VI. SYSTEM OVERVIEW

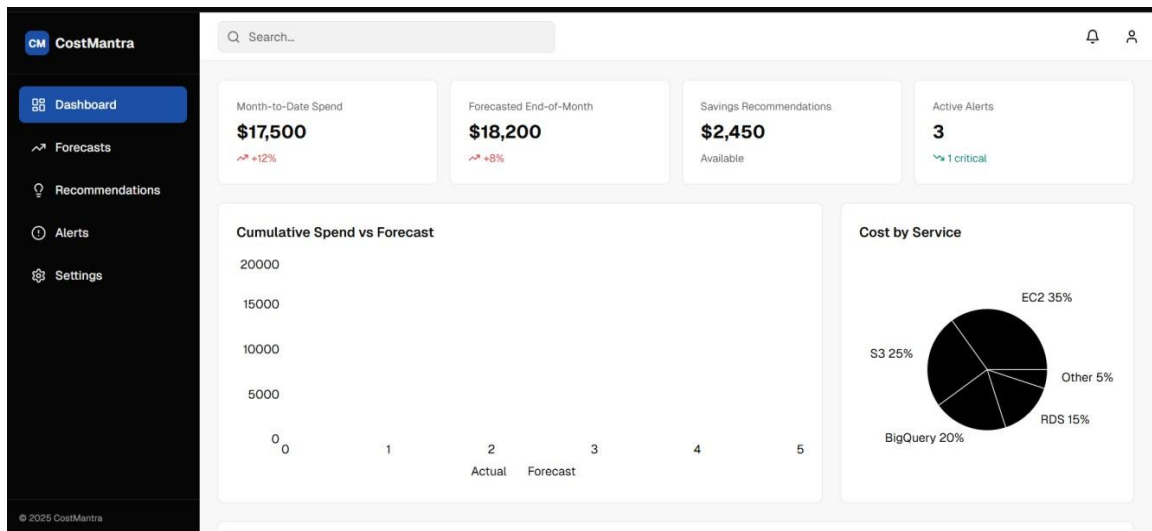


Fig. 1. Dashboard

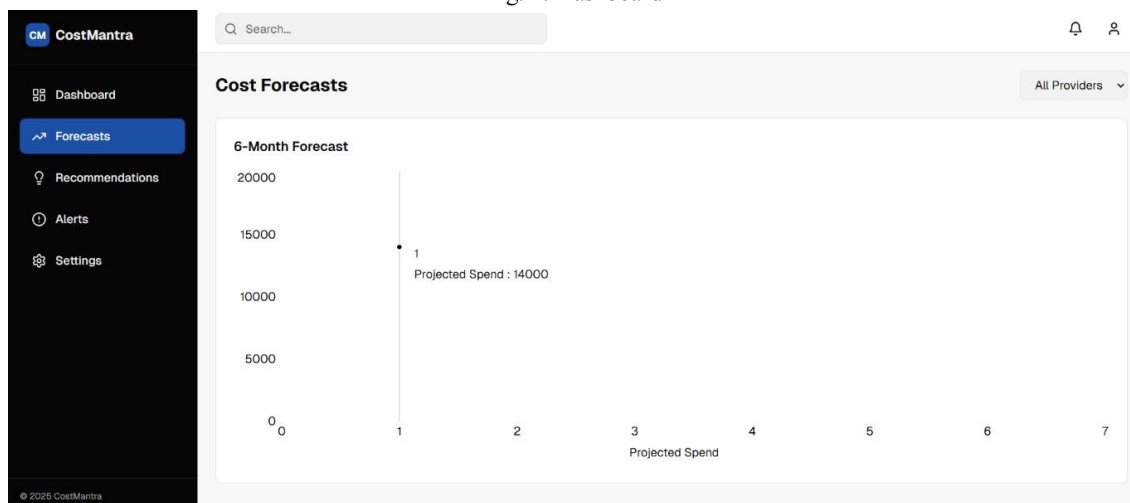


Fig. 2. Forecasts Page



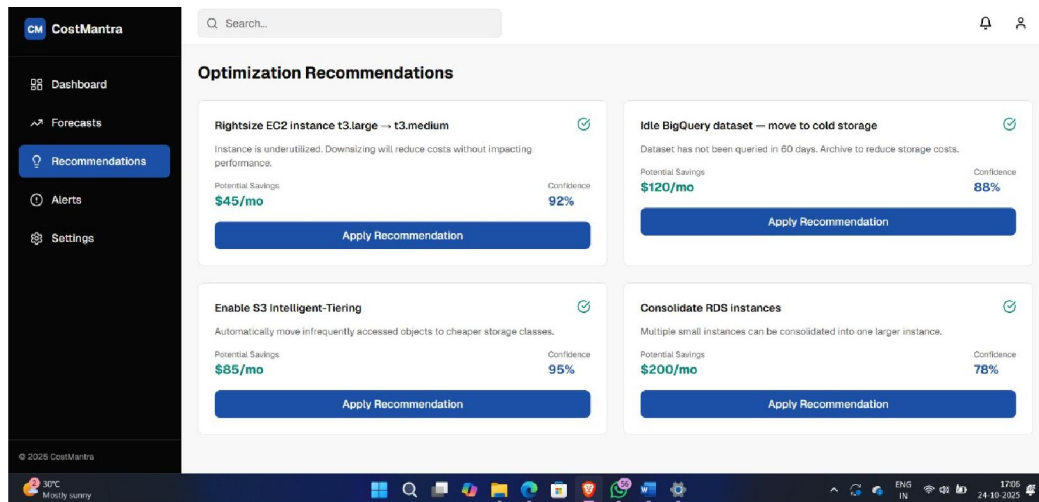


Fig. 3. Recommendations Page

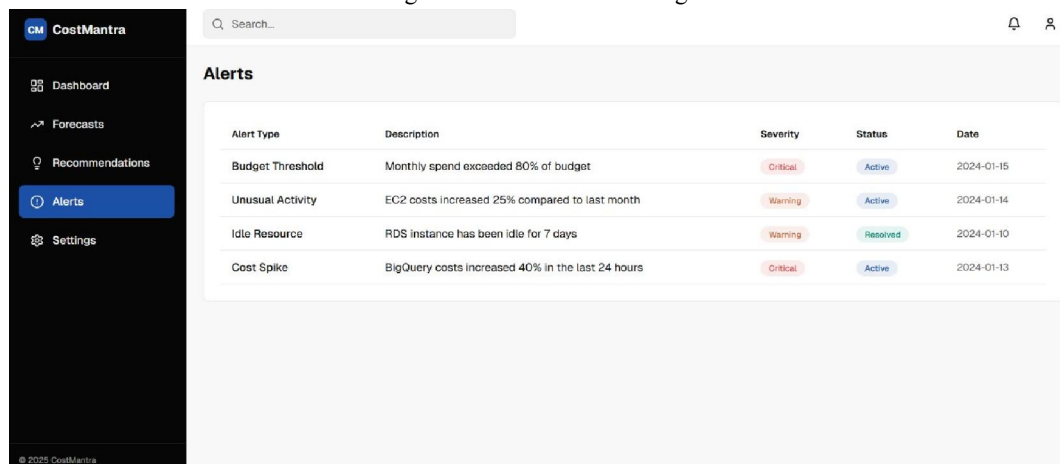


Fig. 4. Alerts page

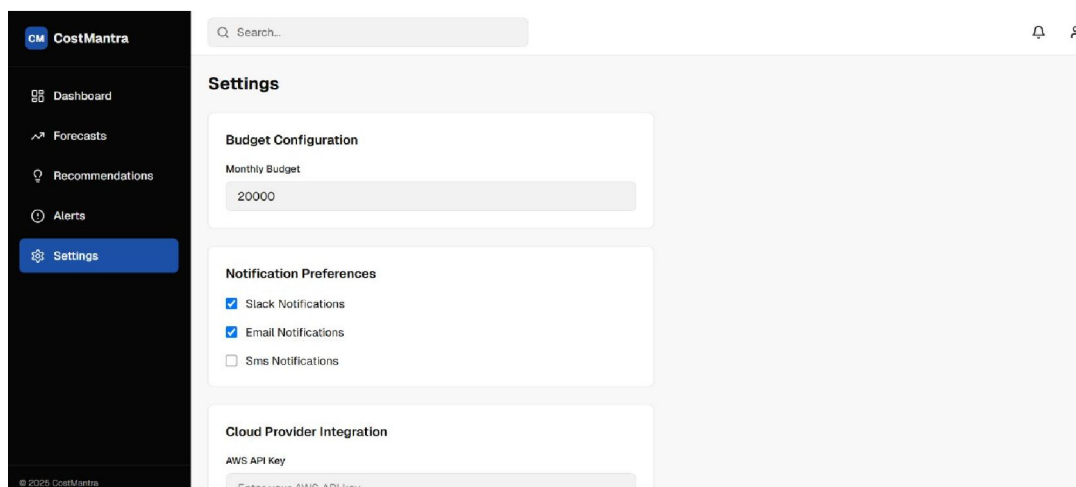


Fig. 5. Settings Page



VII. CONCLUSION

CostMantra effectively demonstrates how FinOps principles, AI forecasting, and DevOps automation can merge into a unified system for predictive cloud cost management. The dashboard empowers teams with data-driven decisions, reduces waste, and promotes financial accountability. Future enhancements will include integration of Azure billing data, advanced anomaly detection models, and predictive scaling recommendations.

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