# AIRA - AI Risk Analysis

Paolo Palumbo Ettore Ricci

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# 1 Introduction

Effective Risk Analysis is crucial in project management. Correctly identifying potential risks allows teams to mitigate potential threats and exploit opportunities. This leads to the successful completion of projects within scope, time, and budget constraints.

Traditional methods of risk discovery are often slow and rely on human intuition, group dynamics, and experience. This can lead to biases, oversights, and incomplete coverage of potential risks.

- **Brainstorming** can be dominated by vocal or influential participants, leading to groupthink.
- **Pre-mortem analysis** relies on the imagination of team members, which may overlook less obvious risks.
- **Affinity diagrams** are an additional step that do not generate new risks by themselves, they instead rely on the creativity of participants.
- **Delphi method** can be effective but is time-consuming and may require multiple rounds to reach consensus, and it may still be biased by participants' perspectives.

To address these challenges, we propose AIRA, an AI-powered Risk Analysis tool that uses Large Language Models (LLMs) to speed up and enhance the risk discovery process. By leveraging the capabilities of LLMs and integrating them with Human-in-the-Loop (HITL) methodologies, AIRA aims to provide a more efficient and effective approach to risk analysis in project management.

# 2 Use cases

This tool is best used as an interactive and cooperative assistant to human risk analysts, rather than a fully automated risk discovery solution. This human-in-the-loop approach minimizes the risk of any obvious mistakes (hallucinations) made by the AI model, while still improving the speed and coverage of the risk discovery process while reducing human biases. The human feedback is required after every step of the process, thus minimizing the risk of positive error feedback loops. We developed AIRA with the aim of creating a tool that could be easily integrated into risk analysis meetings, improving collaboration of the team and the overall effectiveness of the risk discovery process.

The workflow of AIRA can be summarized in the following steps:

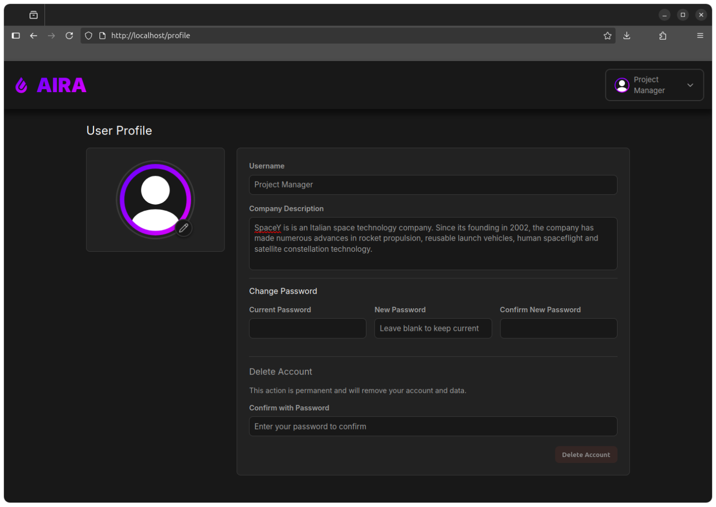
0. **Context Definition:** The user provides AIRA with the context of the project (Figure 1) and any relevant information about the company, industry, or domain (Figure 2). This information is used to tailor the risk analysis process to the specific needs of the project.

1. **Risk Discovery:** AIRA generates a list of potential opportunities and threats based on the provided context. This list is then presented to the user for review. The user can accept, reject, or modify the suggested risks, and can also provide additional risks that AIRA may have missed (Figure 3).

2. **Qualitative Analysis:** For each accepted risk, AIRA assists the user in performing a qualitative analysis by suggesting potential impacts and likelihoods. The user is presented with two editable graphs that visualize the impact and likelihood of each risk. The user can adjust the graphs as needed to reflect their assessment of the risk. Then, a risk score threshold can be set to filter out low-priority risks (Figure 4).

3. **Planning:** Finally, AIRA helps the user to develop contingency and fallback plans for the high-priority risks. AIRA suggests possible plans based on one of these strategies: avoid, mitigate, transfer, or accept for threats; exploit, enhance, share, or accept for opportunities. The user can review and modify the suggested plans as needed (Figure 5).

4. **Overview:** At the end of the process, AIRA provides a comprehensive overview of all identified risks, their qualitative analysis, and the associated contingency and fallback plans. This overview can be exported for documentation and further review (Figure 7).



Username: Project Manager

Company Description: SpaceY is is an Italian space technology company. Since its founding in 2002, the company has made numerous advances in rocket propulsion, reusable launch vehicles, human spaceflight and satellite constellation technology.

Current Password:

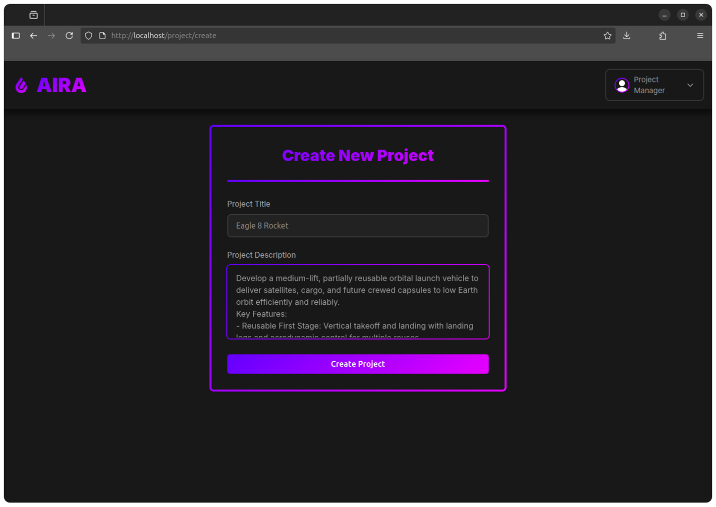
New Password: Leave blank to keep current

Confirm New Password:

This action is permanent and will remove your account and data.

Confirm with Password: Enter your password to confirm

Figure 1: AIRA Account Settings interface. Setting the Company Description is part of the Context Definition step, and helps AIRA tailor its risk analysis to the specific needs of the user's organization.



http://localhost/project/create

Create New Project

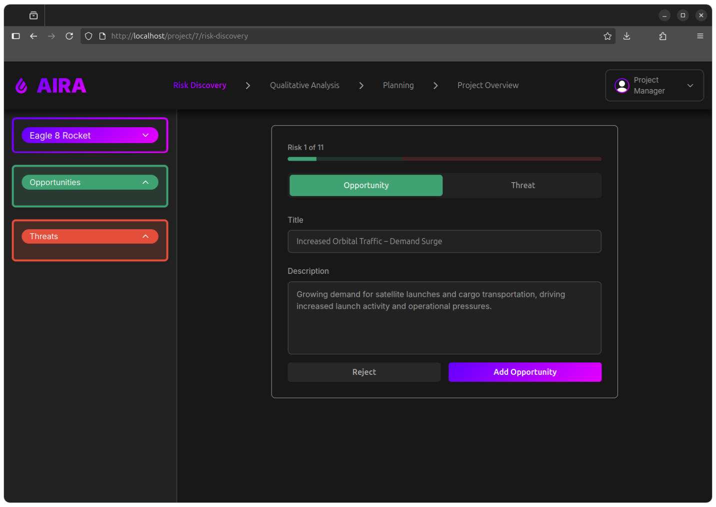
Project Title

Eagle 8 Rocket

Project Description

Develop a medium-lift, partially reusable orbital launch vehicle to deliver satellites, cargo, and future crewed capsules to low Earth orbit efficiently and reliably.
Key Features:
- Reusable First Stage: Vertical takeoff and landing with landing legs and aerodynamic control for multiple reuses.

Figure 2: AIRA Project Creation interface. Here the user can provide specific details about the project to be analyzed, further refining the context for AIRA's risk discovery process.



http://localhost/project/7/risk-discovery

Risk 1 of 11

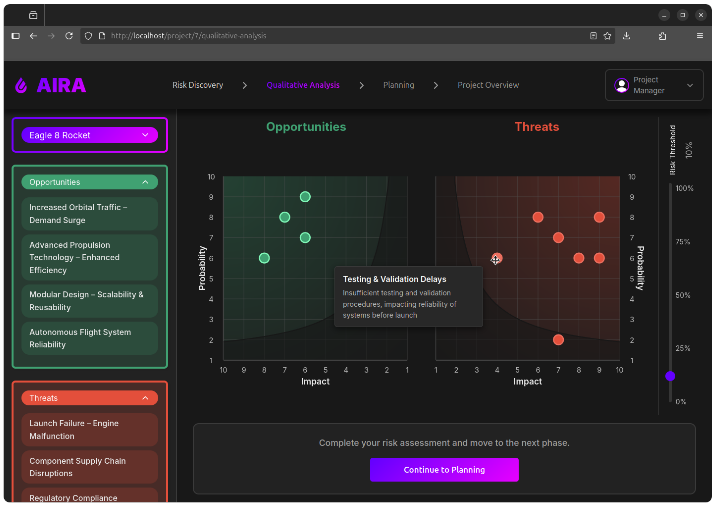
Title

Increased Orbital Traffic – Demand Surge

Description

Growing demand for satellite launches and cargo transportation, driving increased launch activity and operational pressures.

Figure 3: AIRA Risk Discovery interface. Here, AIRA presents the user with a list of potential risks identified based on the provided context.

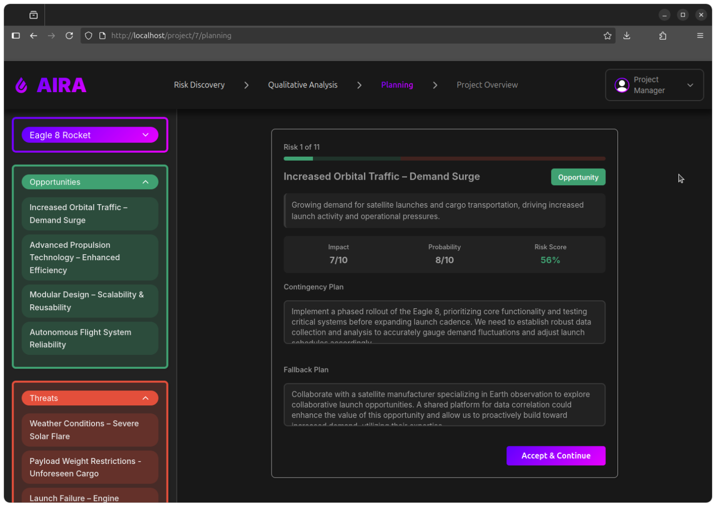

http://localhost/project/7/qualitative-analysis
AIRA
Risk Discovery
Qualitative Analysis
Planning
Project Overview
Project Manager
Eagle 8 Rocket
Opportunities
Increased Orbital Traffic – Demand Surge
Advanced Propulsion Technology – Enhanced Efficiency
Modular Design – Scalability & Reusability
Autonomous Flight System Reliability
Threats
Launch Failure – Engine Malfunction
Component Supply Chain Disruptions
Regulatory Compliance
Opportunities
Threats
Probability
10
9
8
7
6
5
4
3
2
1
Impact
10
9
8
7
6
5
4
3
2
1
Impact
1
2
3
4
5
6
7
8
9
10
Probability
Risk Threshold
10%
100%
75%
50%
25%
0%
Continue to Planning

Testing & Validation Delays

Insufficient testing and validation procedures, impacting reliability of systems before launch

Complete your risk assessment and move to the next phase.

Figure 4: AIRA Qualitative Analysis interface. Here, the user can review and adjust the impact and likelihood assessments for each identified risk.


http://localhost/project/7/planning
AIRA
Risk Discovery
Qualitative Analysis
Planning
Project Overview
Project Manager
Eagle 8 Rocket
Opportunities
Increased Orbital Traffic – Demand Surge
Advanced Propulsion Technology – Enhanced Efficiency
Modular Design – Scalability & Reusability
Autonomous Flight System Reliability
Threats
Weather Conditions – Severe Solar Flare
Payload Weight Restrictions - Unforeseen Cargo
Launch Failure – Engine
Opportunity
Accept & Continue

Risk 1 of 11

Increased Orbital Traffic – Demand Surge

Growing demand for satellite launches and cargo transportation, driving increased launch activity and operational pressures.

| Impact | Probability | Risk Score |
|---|---|---|
| 7/10 | 8/10 | 56% |

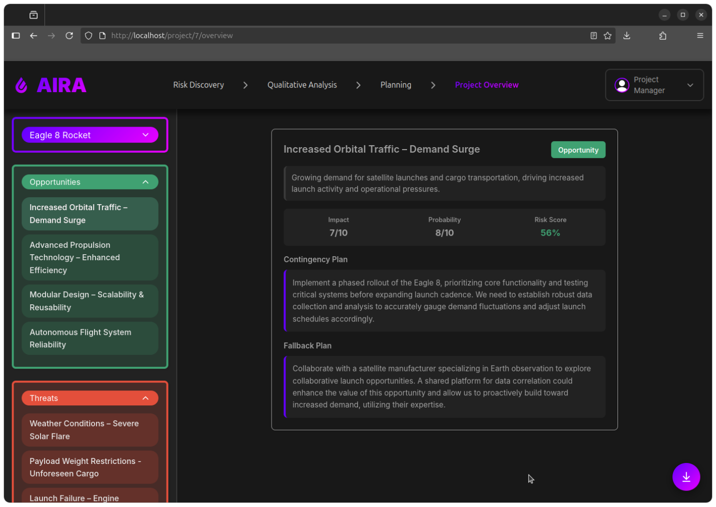
Contingency Plan

Implement a phased rollout of the Eagle 8, prioritizing core functionality and testing critical systems before expanding launch cadence. We need to establish robust data collection and analysis to accurately gauge demand fluctuations and adjust launch schedules accordingly.

Fallback Plan

Collaborate with a satellite manufacturer specializing in Earth observation to explore collaborative launch opportunities. A shared platform for data correlation could enhance the value of this opportunity and allow us to proactively build toward increased demand, utilizing their expertise.

Figure 5: AIRA Planning interface. Here, AIRA suggests contingency and fallback plans for high-priority risks, which the user can review and modify as needed.


http://localhost/project/7/overview
AIRA
Risk Discovery
Qualitative Analysis
Planning
Project Overview
Project Manager
Eagle 8 Rocket
Opportunities
Increased Orbital Traffic – Demand Surge
Advanced Propulsion Technology – Enhanced Efficiency
Modular Design – Scalability & Reusability
Autonomous Flight System Reliability
Threats
Weather Conditions – Severe Solar Flare
Payload Weight Restrictions - Unforeseen Cargo
Launch Failure – Engine

Increased Orbital Traffic – Demand Surge

Opportunity

Growing demand for satellite launches and cargo transportation, driving increased launch activity and operational pressures.

Impact 7/10

Probability 8/10

Risk Score 56%

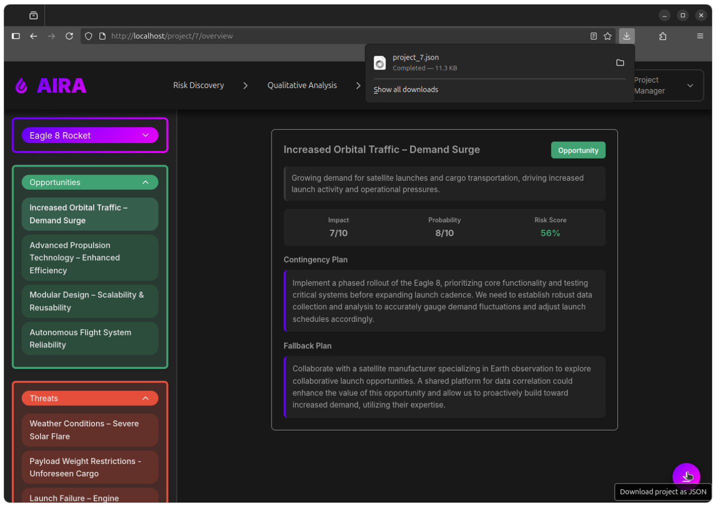
Contingency Plan

Implement a phased rollout of the Eagle 8, prioritizing core functionality and testing critical systems before expanding launch cadence. We need to establish robust data collection and analysis to accurately gauge demand fluctuations and adjust launch schedules accordingly.

Fallback Plan

Collaborate with a satellite manufacturer specializing in Earth observation to explore collaborative launch opportunities. A shared platform for data correlation could enhance the value of this opportunity and allow us to proactively build toward increased demand, utilizing their expertise.

Figure 6: AIRA Overview interface. Here, the user can see a comprehensive summary of all identified risks, their qualitative analysis, and the associated contingency and fallback plans.


http://localhost/project/7/overview
project_7.json
Completed — 11.3 KB
Show all downloads
AIRA
Risk Discovery
Qualitative Analysis
Project Manager
Eagle 8 Rocket
Opportunities
Increased Orbital Traffic – Demand Surge
Advanced Propulsion Technology – Enhanced Efficiency
Modular Design – Scalability & Reusability
Autonomous Flight System Reliability
Threats
Weather Conditions – Severe Solar Flare
Payload Weight Restrictions - Unforeseen Cargo
Launch Failure – Engine
Download project as JSON

Increased Orbital Traffic – Demand Surge

Opportunity

Growing demand for satellite launches and cargo transportation, driving increased launch activity and operational pressures.

Impact 7/10

Probability 8/10

Risk Score 56%

Contingency Plan

Implement a phased rollout of the Eagle 8, prioritizing core functionality and testing critical systems before expanding launch cadence. We need to establish robust data collection and analysis to accurately gauge demand fluctuations and adjust launch schedules accordingly.

Fallback Plan

Collaborate with a satellite manufacturer specializing in Earth observation to explore collaborative launch opportunities. A shared platform for data correlation could enhance the value of this opportunity and allow us to proactively build toward increased demand, utilizing their expertise.

Figure 7: AIRA Download feature. The user can export the comprehensive risk analysis report for documentation and further review by clicking the "Download" button.

# 3 Architecture

AIRA is designed with a microservices architecture, which allows for modularity, scalability, and ease of maintenance and deployment.

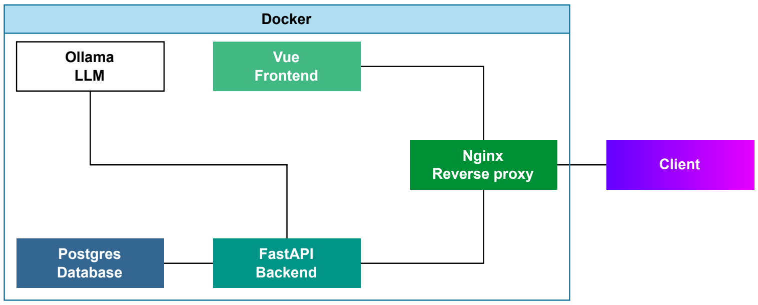


Figure 8: AIRA Architecture Diagram. This diagram illustrates the main components of AIRA and their interactions.

## 3.1 Frontend

We chose to implement the frontend using Vue.js, a progressive JavaScript framework for building user interfaces. Vue.js offers a component-based architecture, which allows us to create reusable UI components and manage the application state effectively. The frontend is responsible for providing an intuitive and user-friendly interface for users to interact with AIRA's features.

We put special attention in designing a good user experience for both PC and mobile devices, ensuring that users can access AIRA's functionalities seamlessly across different platforms.

We developed the frontend using TypeScript, a superset of JavaScript that adds static typing and other features to the language. TypeScript helps us catch errors early in the development process and improves code maintainability.

The user experience is account based, meaning that users have to create an account and log in to access AIRA's features. This allows us to personalize the experience for each user and store their project data securely.

## 3.2 Backend

The backend of AIRA is built using FastAPI, a modern, fast (high-performance) web framework for building APIs with Python. FastAPI is designed to be easy to use and provides automatic generation of interactive API documentation.

The backend is responsible for handling the core logic of AIRA, including processing user requests, managing data, and interacting with external services such as Large Language Models (LLMs) for risk analysis and the database for storing user and project information.

We chose FastAPI for its performance, ease of use, and strong support for asynchronous programming, which is essential for handling multiple concurrent requests efficiently. The backend exposes a RESTful API that the frontend consumes to provide a seamless user experience.

This API requires classic client-based authentication to be used, ensuring that only authorized users can access their data and AIRA's features.

## 3.3 Database

AIRA uses PostgreSQL as its primary database management system. PostgreSQL is a powerful, open-source relational database that offers advanced features, scalability, and reliability.

The database stores user information, project data, identified risks and the results of their analysis.

The storage uses a docker volume to ensure data persistence, this can be easily replaced with cloud-based storage solutions in production environments.

## 3.4 Large Language Models

AIRA leverages Large Language Models (LLMs) to provide its AI-powered risk analysis capabilities. We used Ollama's local LLMs for an easy and cheap deployment.

The performance can be further improved by using more powerful LLMs even hosted on the cloud. This can be easily achieved because of the OpenAI API used to interface with the LLMs, which provides a standardized way to interact with different models.

We chose Gemma3:1B-it-qat as the default LLM for AIRA, as it can be run locally even on laptops with no GPU (although slowly), enabling a good testing and demo experience. In production environments, more powerful models such as Gemma3:12B (local) or GPT-5 (cloud) can be used to improve the performance and accuracy of the risk analysis.

## 3.5 Proxy

To manage and route incoming requests to the appropriate services, AIRA uses Nginx as a reverse proxy server. Nginx is a high-performance web server that can also be used as a load balancer and HTTP cache.

While we used HTTP, in production environments Nginx can be easily configured to use HTTPS with SSL/TLS certificates to ensure secure communication between clients and the server.

We mapped the frontend to the root path ("/") and the backend API to the "/api" path, allowing for clear separation of concerns and easy access to AIRA's features.

# 4 Conclusion

We successfully developed AIRA, an AI-powered Risk Analysis web application that leverages Large Language Models (LLMs) to quicken and enhance the risk discovery process in project management. AIRA assists users through a structured workflow that includes context definition, risk discovery, qualitative analysis, planning, and overview. By integrating Human-in-the-Loop (HITL) methodologies, AIRA ensures that users remain actively involved in the risk analysis process, allowing for personalization and refinement of the results, avoiding LLMs pitfalls.

The current system could be improved by swapping the local LLMs with more powerful cloud-hosted models to enhance the quality of risk identification and analysis. Also, using more information about the current and past projects of the user could help tailoring the risk analysis even further.