Generative AI, Visualization, and The Future of Managing Megaprojects

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AIRC-DAU Quarterly Research Forums

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AIRC-DAU Quarterly Research Forum - The Future Of Managing Mega Pr...

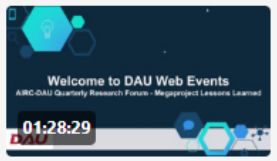
AIRC-DAU Quarterly Research Forum: The Future Of Managing Mega ProjectsThe Acquisition Innovation Research Center (AIRC) team is exploring how data visualization, Artificial Intelligence, and Machine Le...

1 Tag 1 Detail Explore

The Future of Managing Mega Projects (Benchmark Results)

The Acquisition Innovation Research Center (AIRC) team is exploring how data visualization, Artificial Intelligence, and Machine Learning can be combined with human knowledge transfer across teams to ...

1 Detail Explore



AIRC-DAU Quarterly Research Forum - Megaproject Lessons Learned 6.1...

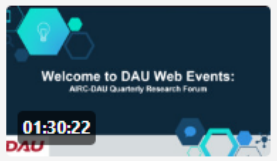
Megaproject success is strongly linked to successful management of project uncertainties. Management of project uncertainties fundamentally differs from the management of project risk. In particular, proje...

1 Tag 1 Detail Explore

AIRC-DAU Quarterly Research Forum 4a

Megaproject success is tied to the effective management of project uncertainties and the cultivation of a shared vision and action plan among team members and stakeholders. In this talk, we delve into the r...

1 Detail Explore



AIRC-DAU Quarterly Research Forum

Megaprojects are large-scale and highly complex, requiring leaders with a specific set of skills to see them successfully to completion. In this final Quarterly Research Forum by the AIRC research team, we...

1 Tag 1 Detail Explore

1. State of the practice in commercial megaprojects
2. Case Studies: benchmarking megaprojects
3. Megaprojects lessons learned and playbook
4. **AI and visualization approaches to improve megaproject management**
5. Competencies for development of megaproject leaders

What is a Mega-Project?

"large-scale, complex ventures that typically cost $1 billion or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people."

- Oxford Handbook of Megaproject Management (Flyvbjerg, ed., 2017)

"often produce mega-systems that operate with dimensions of behavioral complexity, pluralistic multi-actor decision-making, high criticality, and volatility of the external environment."

- Engineering Mega-Systems (Stevens 2017)

"often combine uncertainty with the difficulties of long time horizons and nonstandard technologies."

- S. Lenfle and C. Loch, "Has Megaproject Management Lost its Way: Lessons from History." in The Oxford Handbook of Megaproject Management

The DoD has long-been a sponsor of megaprojects, and also continues to transition from more standalone platform centric systems to mega-systems.

UNCERTAIN OUTCOMES: "FAT TAILS"

The table shows cost overruns for twenty-five project types covering sixteen thousand–plus projects. Overrun is measured as (a) mean cost overrun, (b) percentage of projects in the upper tail (defined as ≥ 50 percent), and (c) mean overrun in the tail. Overrun is measured in real terms.

Flyvbjerg, Bent; Gardner, Dan. How Big Things Get Done (p. 191). Crown.

Many defense related projects are in areas that tend to have large mean cost overruns and a fat-tailed cost overrun distribution.

PROJECT TYPE	(A) MEAN COST OVERRUN (%)*	(B) % OF PROJECTS IN TAIL (≥ 50% OVERRUN)	(C) MEAN OVERRUN OF PROJECTS IN TAIL (%)
Nuclear storage	238	48	427
Olympic Games	157	76	200
Nuclear power	120	55	204
Hydroelectric dams	75	37	186
IT	73	18	447
Nonhydroelectric dams	71	33	202
Buildings	62	39	206
Aerospace	60	42	119
Defense	53	21	253
Bus rapid transit	40	43	69
Rail	39	28	116
Airports	39	43	88
Tunnels	37	28	
Oil and gas	34		

1. Why do we see these uncertain outcomes?

2. What data/indicators should have told us we would experience large overruns?

Most Common Causes of Fat Tail Behaviors

1. Underestimation of, or refusal to acknowledge uncertainty:

Complexity
How we learn

- Assumption: the design and project plan can be fully defined at the beginning
- Impossible to plan for all uncertainties, leading to control conflicts on decisions around uncertainty

2. Stakeholder neglect or mismanagement:

Stakeholder Alignment
How we lead

- Megaprojects/systems are coalitions of active partners and other non-active stakeholders
- Stakeholder conflicts are a major source of project problems. Ignoring stakeholders or creating forced agreements are common conflict areas. These conflicts are often unpredictable.

3. Inflexible contractor management:

Misrepresentation & Bias
How we plan

- Many organizations have to cooperate; transparency, honesty and incentives are needed
- Many megaprojects fail because they are bid incorrectly or dishonestly, or just "priced to win"; win-win strategies must be developed.

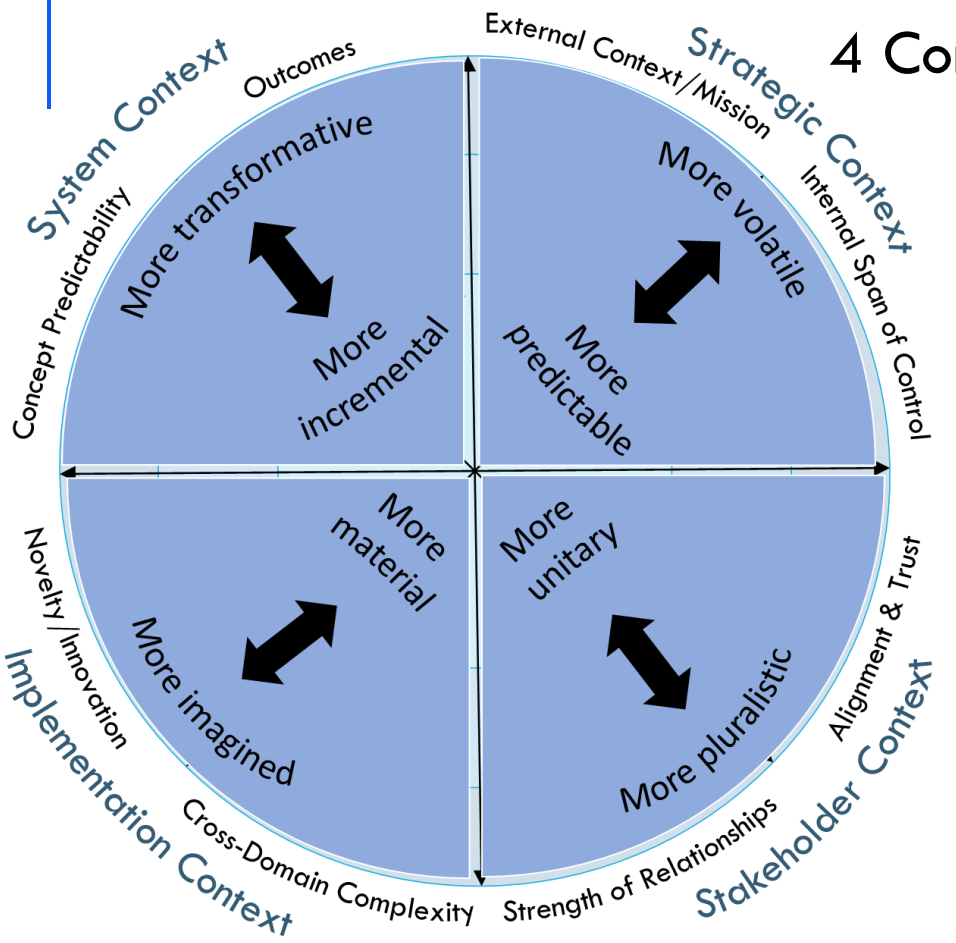
Interactions across these causes enhance project failure models

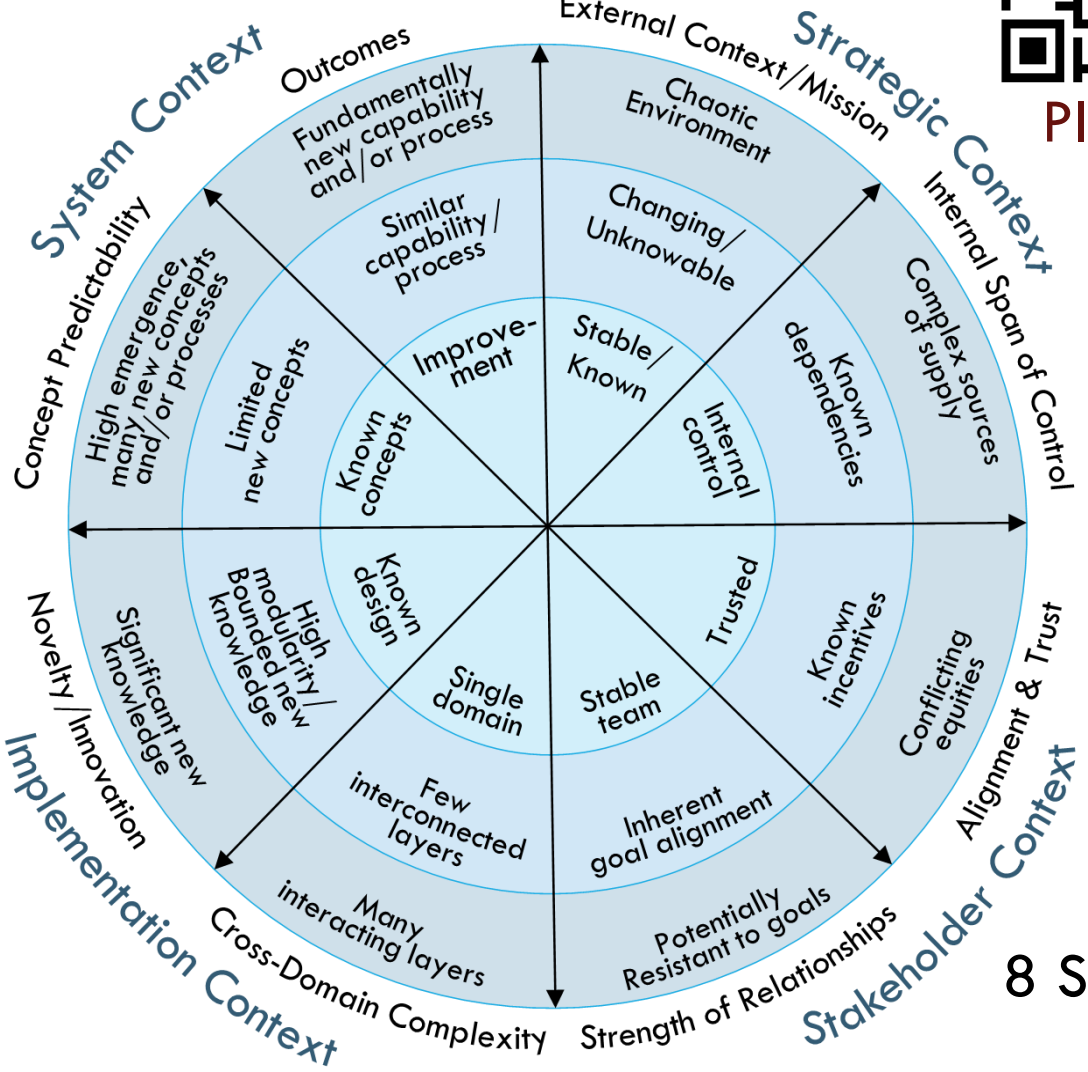
S. Lenfle and C. Loch, "Has Megaproject Management Lost its Way: Lessons from History." in The Oxford Handbook of Megaproject Management.

MEGAPROJECT UNCERTAINTY FRAMEWORK

Playbook

4 Contexts

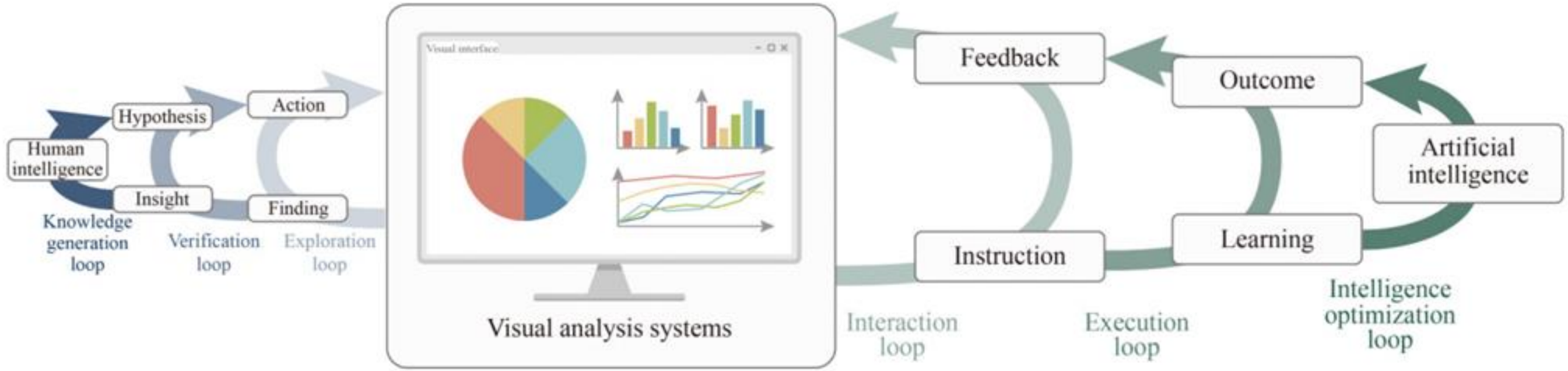




8 Strategies

Adapted from Stevens, R. (2011). Engineering Mega-Systems: The Challenge of Systems Engineering in the Information Age.
Schindler, S. (2019). Contemporary Megaprojects: Organization, Vision, and Resistance in the 21st Century.

AI and Vis

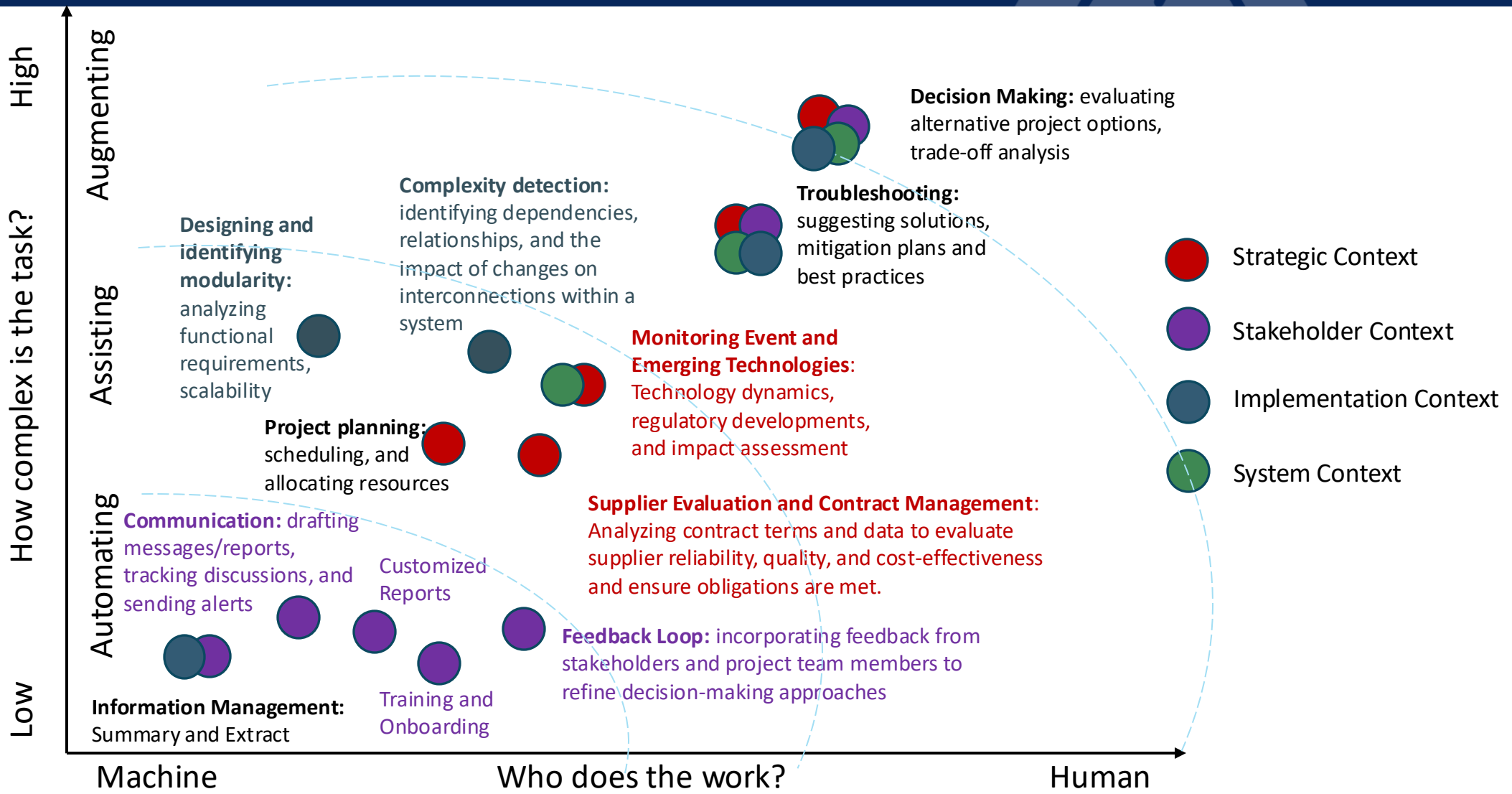


Two-way communication between human intelligence and AI:

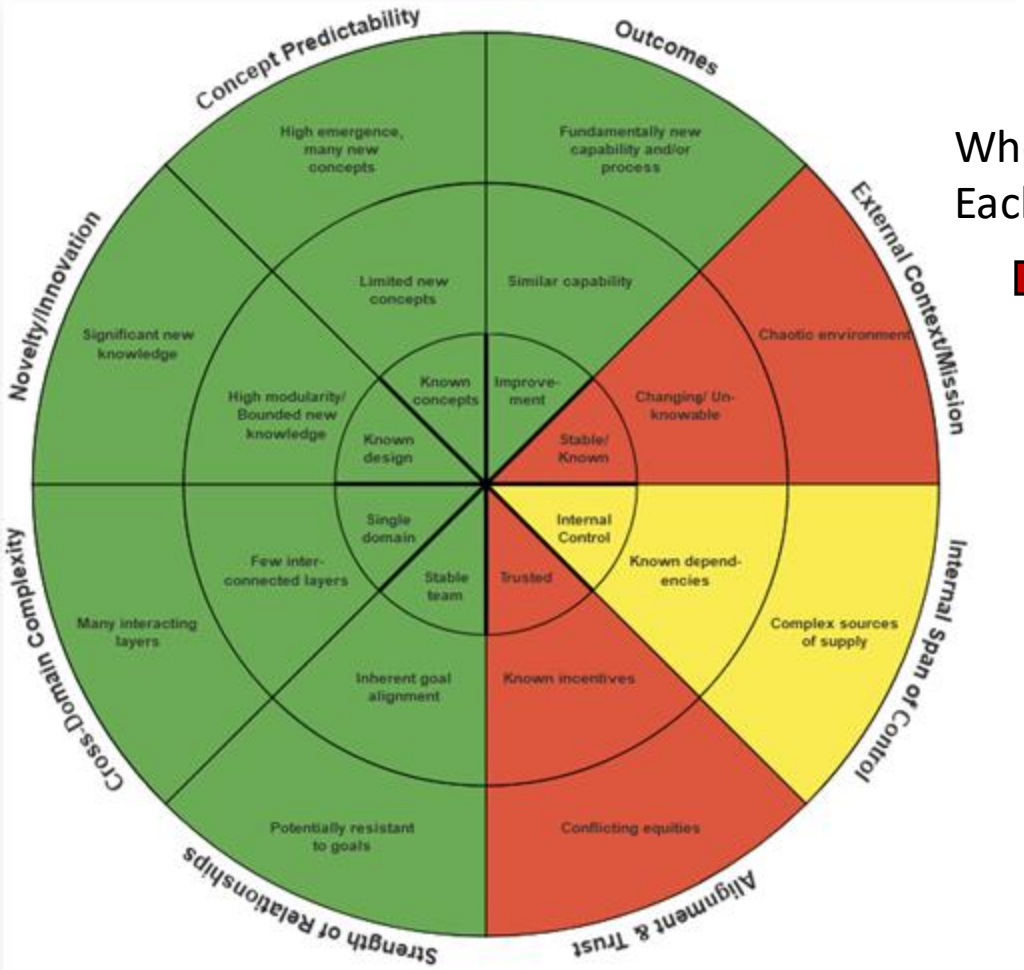
- Interaction Loop: **AI receives both explicit and implicit instructions** from users via visual analysis systems, interpreting and responding to these instructions.
- Execution Loop: AI autonomously executes instructions, **learning from its interactions to improve performance**.
- Intelligence Optimization Loop: Continuous learning and improvement of AI models is based on user interactions and feedback.

VIS+AI: integrating visualization with artificial intelligence for efficient data analysis https://link.springer.com/article/10.1007/s11704-023-2691-y

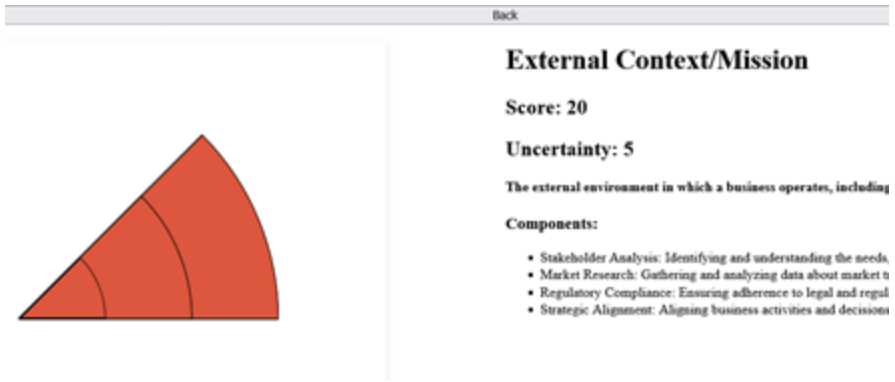
LLM IN MEGAPROJECT MANAGEMENT



UNCERTAINTY FRAMEWORK DASHBOARD

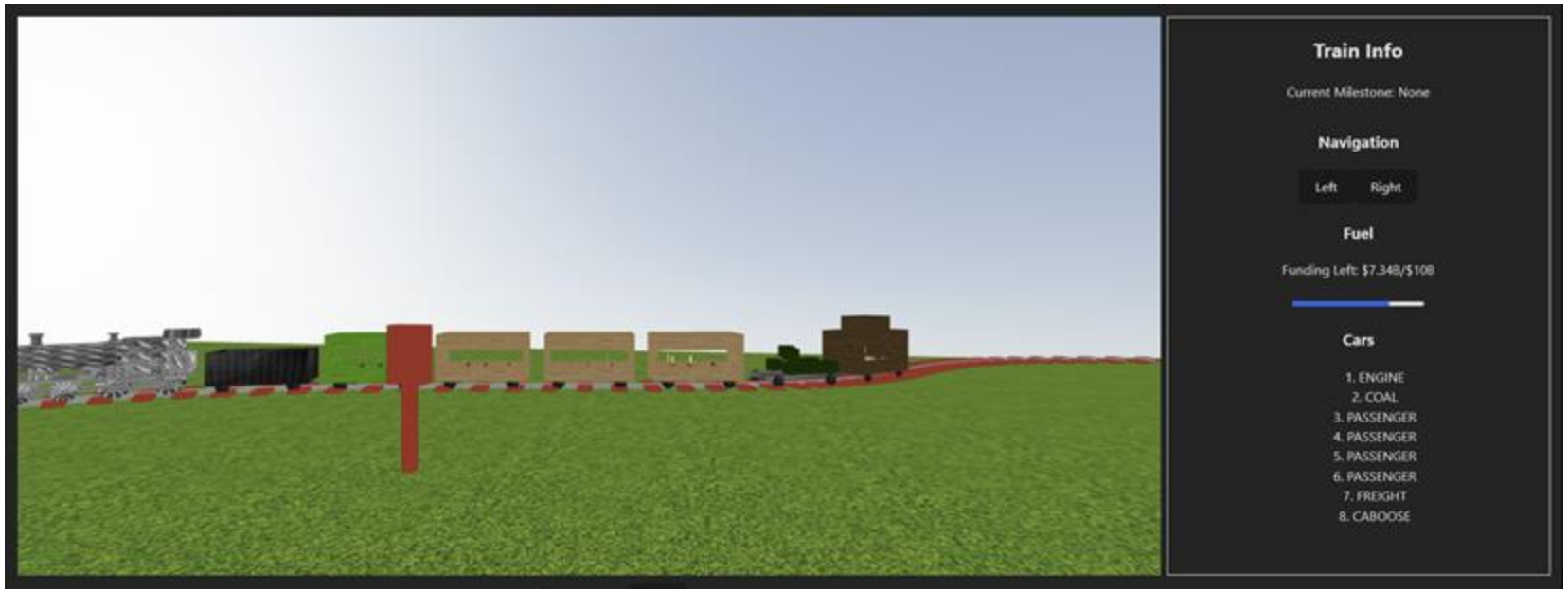


When Click Each Section



Metaphor Display – The Train Metaphor

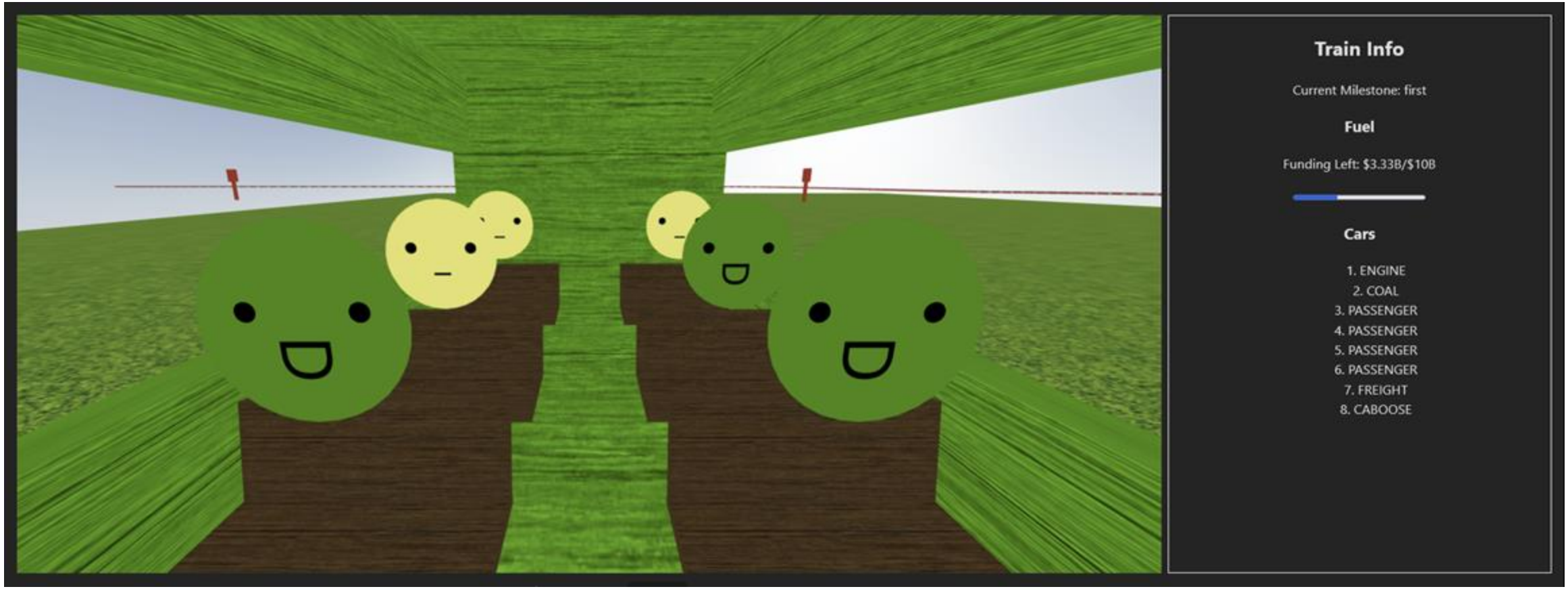
Why: Metaphors help to visualize abstract concepts, making it easier for team members and stakeholders to have a shared vision and common language for discussing project's progress and challenges.



What: We used a train metaphor as a representation of project progression through various challenges and milestones.

How: Compare the engine to the leadership driving the project, the cars to project components, and the passengers to stakeholders, all moving along the project timeline track.

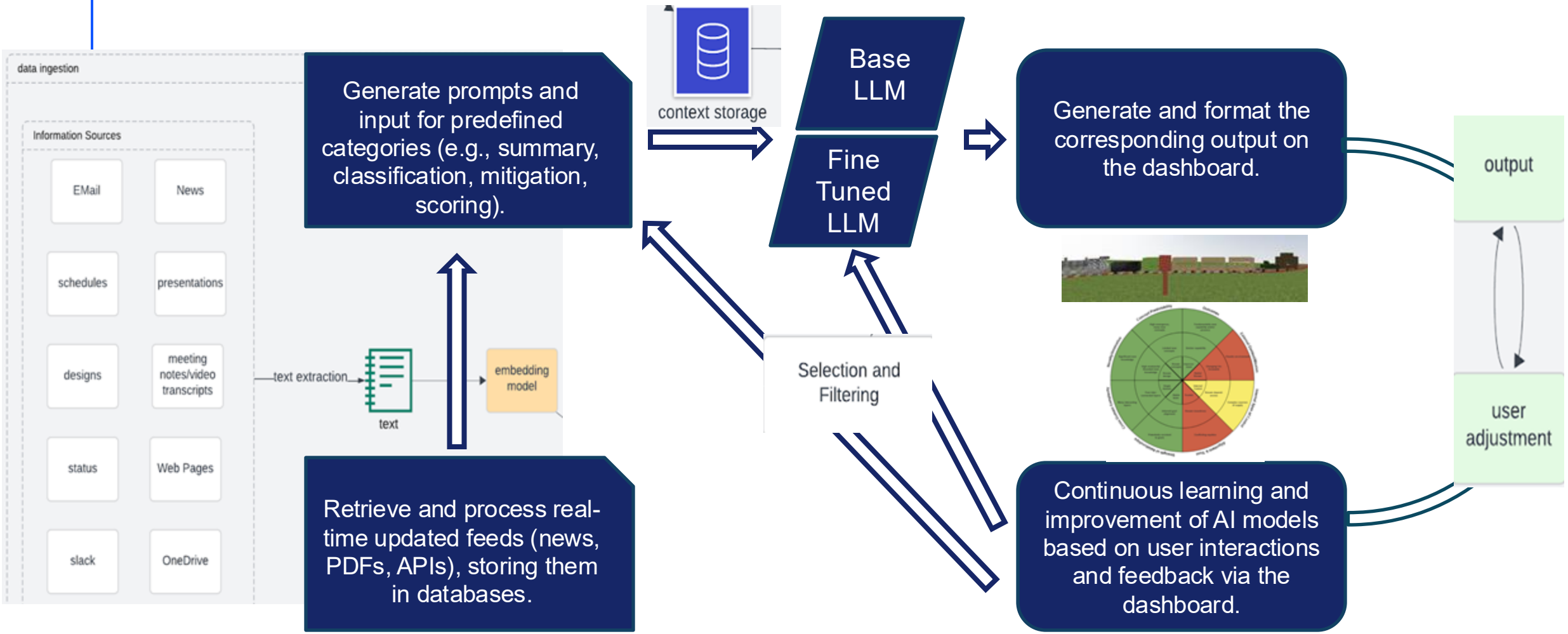
Train Metaphor – Passenger Cars



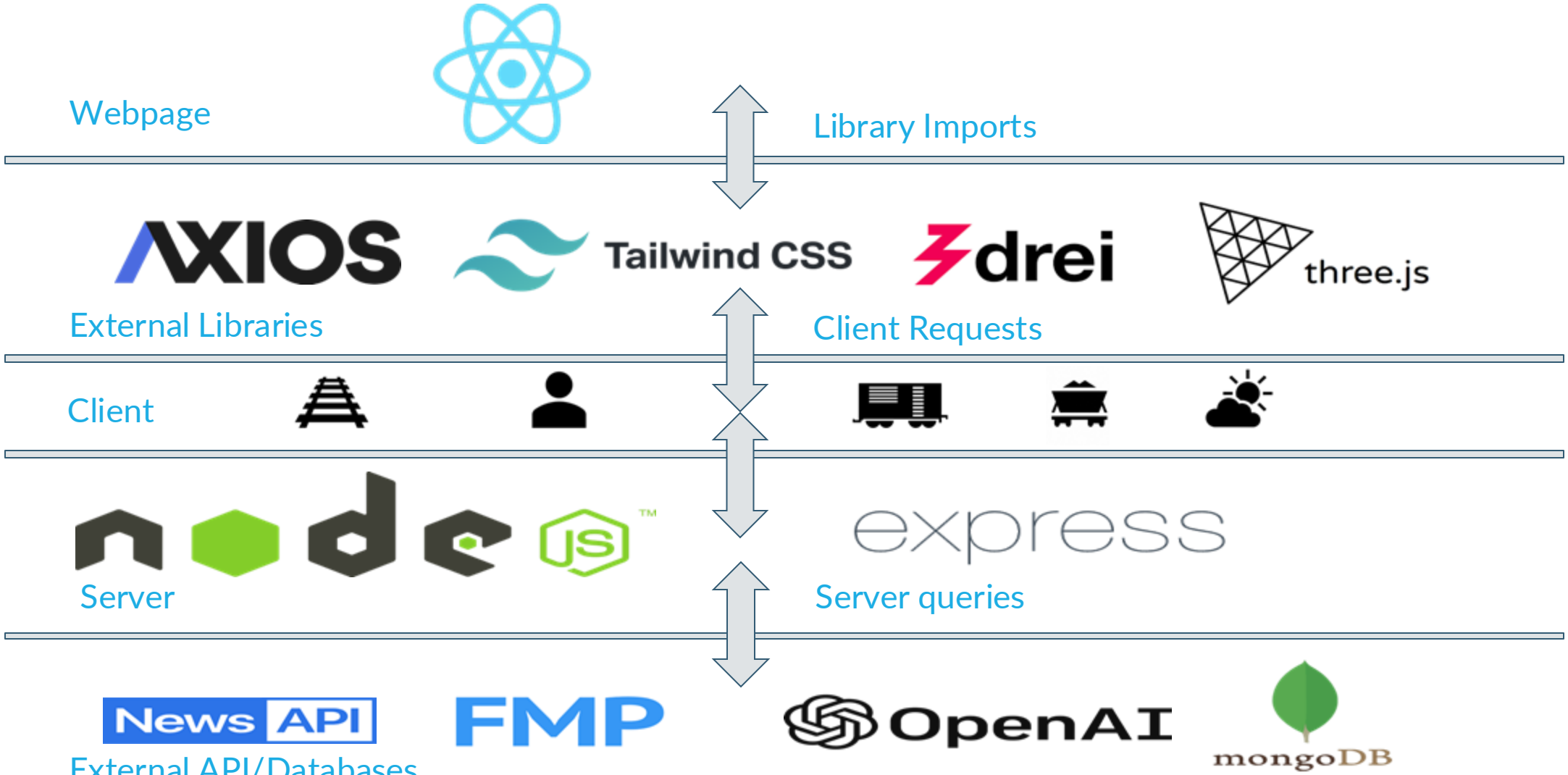
Passenger Cars

Interior view of passenger car with stakeholders' satisfaction level and interactions

LLM Implementation for Dashboard



Tech Stack


Webpage
Library Imports
AXIOS
Tailwind CSS
drei
three.js
External Libraries
Client Requests
Client
express
Server
Server queries
News API
FMP
OpenAI
mongoDB
External API/Databases

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QUESTIONS?