SOUTHERN COLORADO INSTITUTE OF TRANSPORTATION TECHNOLOGY

CSU PUEBLO

Automated Planning and Scheduling using LLMs: Case Study of US Railways

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Introduction

- **US railway system**: Vast and complex, with a network spanning thousands of miles and handling a massive volume of freight and passenger traffic.
- **Effective scheduling and planning**: Crucial for ensuring the safe and efficient operation of this system especially under natural hazards.
- **Large Language Models (LLMs):** A potential solution for automating and improving planning and scheduling in the US railway system. LLMs can process large amounts of data, learn complex patterns, and generate human-like text, making them suitable for addressing the challenges of railway planning.

Background

- **Automated planning** is a field of AI research concerned with developing algorithms and systems that create plans or sequences of actions to achieve specific goals.
- A key motivation for automated planning research is to automate the creation of plans such as needed in transportation systems
- Figure 1 shows a typical automated planning process.

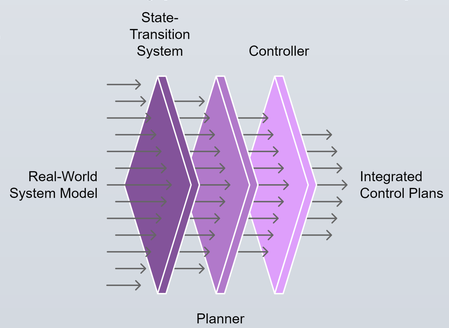


Figure 1 Automated planning process

Large Language Models (LLMs)

LLMs are a type of artificial intelligence (AI) model trained on vast amounts of text data. Figure 2 shows the potential application of LLMs in automated planning and scheduling.

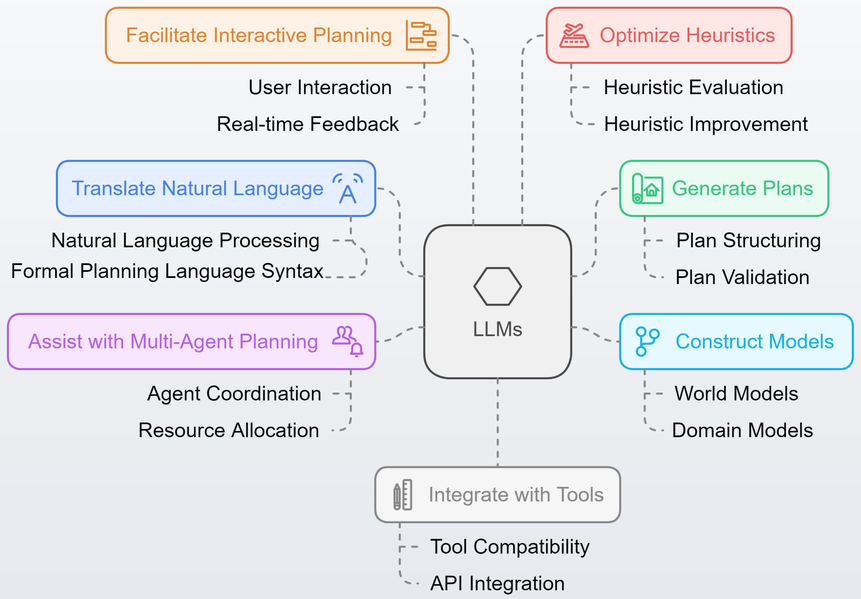
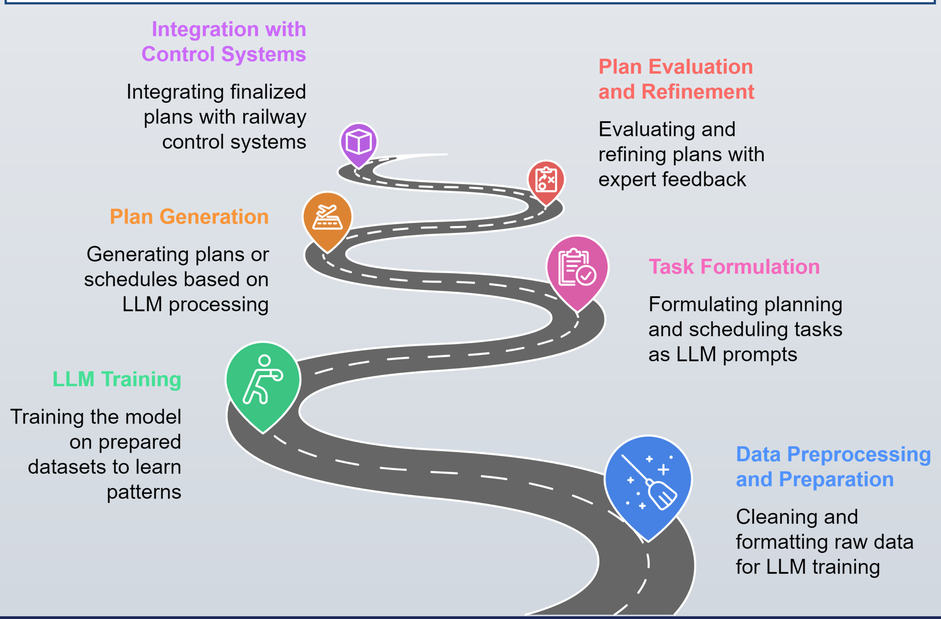


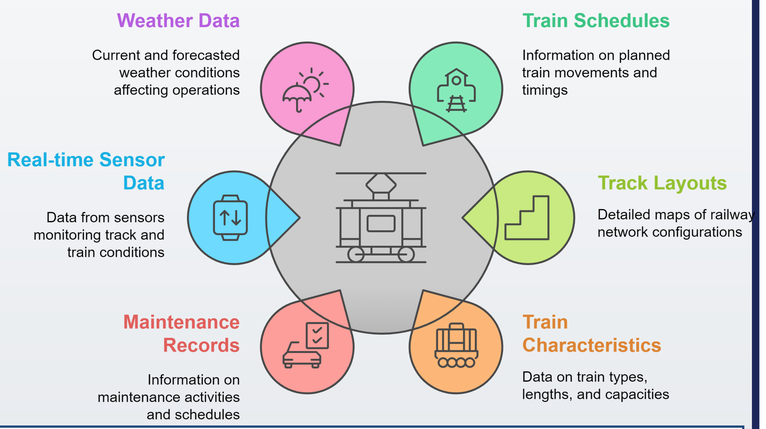
Figure 2 Areas of application of LLMs in railway automated planning

Methodological Framework



Data Collection and Model Training

The success of LLM-based planning and scheduling systems relies heavily on the availability of relevant and high-quality data. Below data sources have been identified for LLM model development and validation.



Summary and Future Work

The successful implementation of LLMs in the US railway system could lead to significant improvements in efficiency, safety, and flexibility. Key areas for future research:

- Developing specialized LLM architectures and training methods tailored to the specific challenges of railway planning and scheduling.
- Addressing the issue of grounding, ensuring that LLMs can connect their language understanding with real-world entities and concepts in the railway system.
- Exploring methods for incorporating domain-specific knowledge, such as railway regulations and operational constraints, into LLMs to improve the accuracy and feasibility of generated plans.

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