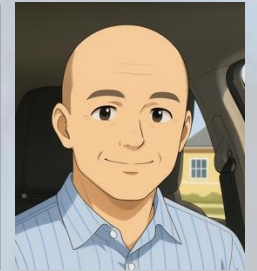


Context of collaborative
human-machine systems
architecture design for
enhanced functionality
awareness and balanced
command and control authority

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FT2025

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This presentation

- **Introduction**

- Motivation and prospects

- **Related work**

- Model synthesis and work products

- **Our approach**

- Stepwise method and visual-to-text

- **Pilot case study**

- Aircraft assets in large-scale SAR systems

- **Discussion**

- Chaining, responses and concerns

- **Conclusion**

- Questions most welcome

Introduction

Intelligent automation, man-machine coordination and AI

- **Motivation**

- Our motivation lies in the complexity and intricacy of systems that involve automation:
 - The issue of automation in operation is reflected in the design process,
 - Multi-domain stacking leads to higher cognitive effort and workload towards awareness in design.

- **Prospects of AI towards design**

- Language processing AI such as LLMs brings both advantages and issues...
 - Language processing works as enabler to heavy-lifting of design by the front-end,
 - At the same time, their probabilistic character attracts criticism for its lack of matter-of-factness.

- **Complexity and intricacy... Front-end heavy-lifting... how to answer questions.**

Related work

LLMs for model synthesis and work products

Reference	Prompt pattern & LLM type	Auxiliary resources	Answer results	Validation & correction
Tikayat Ray et al. [16]	BERT over source data	Reference requirements in documentation	Processed requirements on <i>boilerplates</i>	Requirement grammar structure inspection with demonstration
Ofsa & Topcu [17]	Single few-shot to GPT-3.5	Reference mission statement with prompt	List of mission stakeholders with descriptions	Comparison of results across several prompts under same prompt-to-answer treatment
Balu et al. [18]	Two few-shot to GPT-3.5	Reference requirements from RAG database	Processed system design requirements	Comparison of results across some different prompt-to-answer treatments
Cámara et al. [19]	Single one-shot to GPT-3*	UML-model references from research team	Processed UML models specifications	Comparison of prompt trials and review and correction of resulting UML-models

- **Input formulations, examples/templating and prompting approach... How to complete?**

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Related work

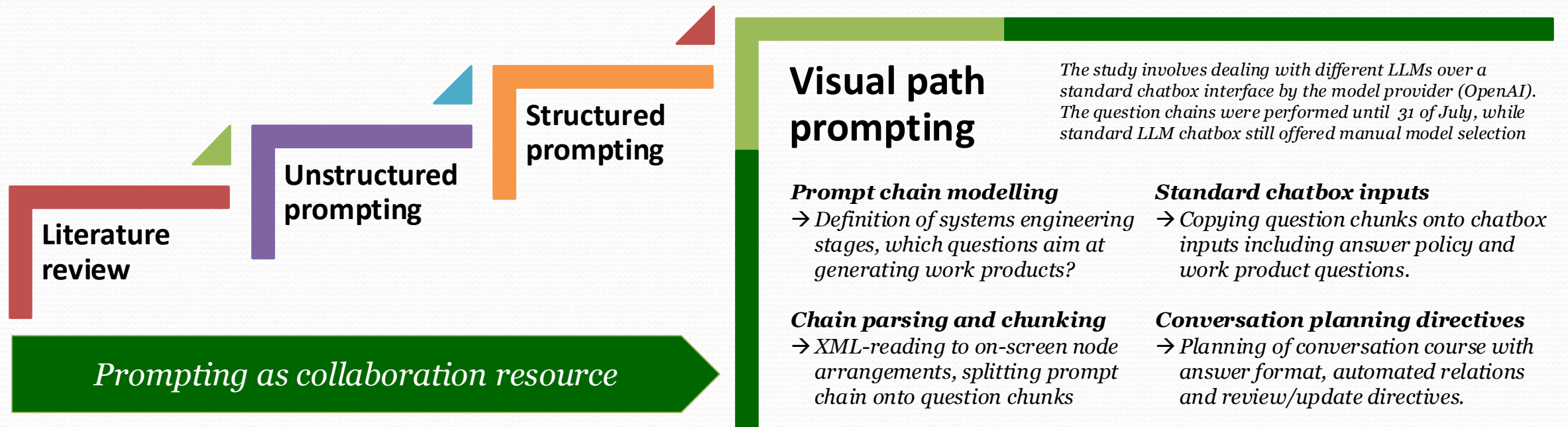
LLMs for model synthesis and work products

Reference	Prompt pattern & LLM type	Target task & design domain	Auxiliary resources	Answer results & validation
Norheim et al. [30]	No prompting found in work	Requirements engineering in aerospace	Available research datasets on requirements	Framing and benchmarking of requirement studies for LLM use
Nouri et al. [31, 32]	Multiple few-shot to custom GPT-4	Hazard analyses and synthesis of safety requirements	Document specifications and design figures from RAG database	Expert review indicates LLM as good for preliminary use, outputs need review
Geissler et al. [33]	Multiple few-shot to GPT-3.5T	Failure scenario estimation in safety engineering	Reference models, information and code from RAG database	Comparison across different prompt-to-answer treatments deemed satisfactory by team
Odu et al. [34]	Multiple one-shot to GPT-4o	Safety assurance argument synthesis in safety engineering	Processed GSN patterns and software engineering guides	Similarity of prompt outputs indicates difficulties with mixed-cardinality relationships

- **Requirements engineering, hazard analyses and safety assurance... How to make AI comply?**

Our approach

Experiment ways to plan and interact with the AI.



- **State-of-the-art, first prompt trials, preliminary manual conversations, prompt chain.**

Our approach

Experiment ways to plan and interact with the AI.



Visual path prompting

The study involves dealing with different LLMs over a standard chatbox interface by the model provider (OpenAI). The question chains were performed until 31 of July, while standard LLM chatbox still offered manual model selection

Prompt chain modelling

→ *Definition of systems engineering stages, which questions aim at generating work products?*

Standard chatbox inputs

→ *Copying question chunks onto chatbox inputs including answer policy and work product questions.*

Chain parsing and chunking

→ *XML-reading to on-screen node arrangements, splitting prompt chain onto question chunks*

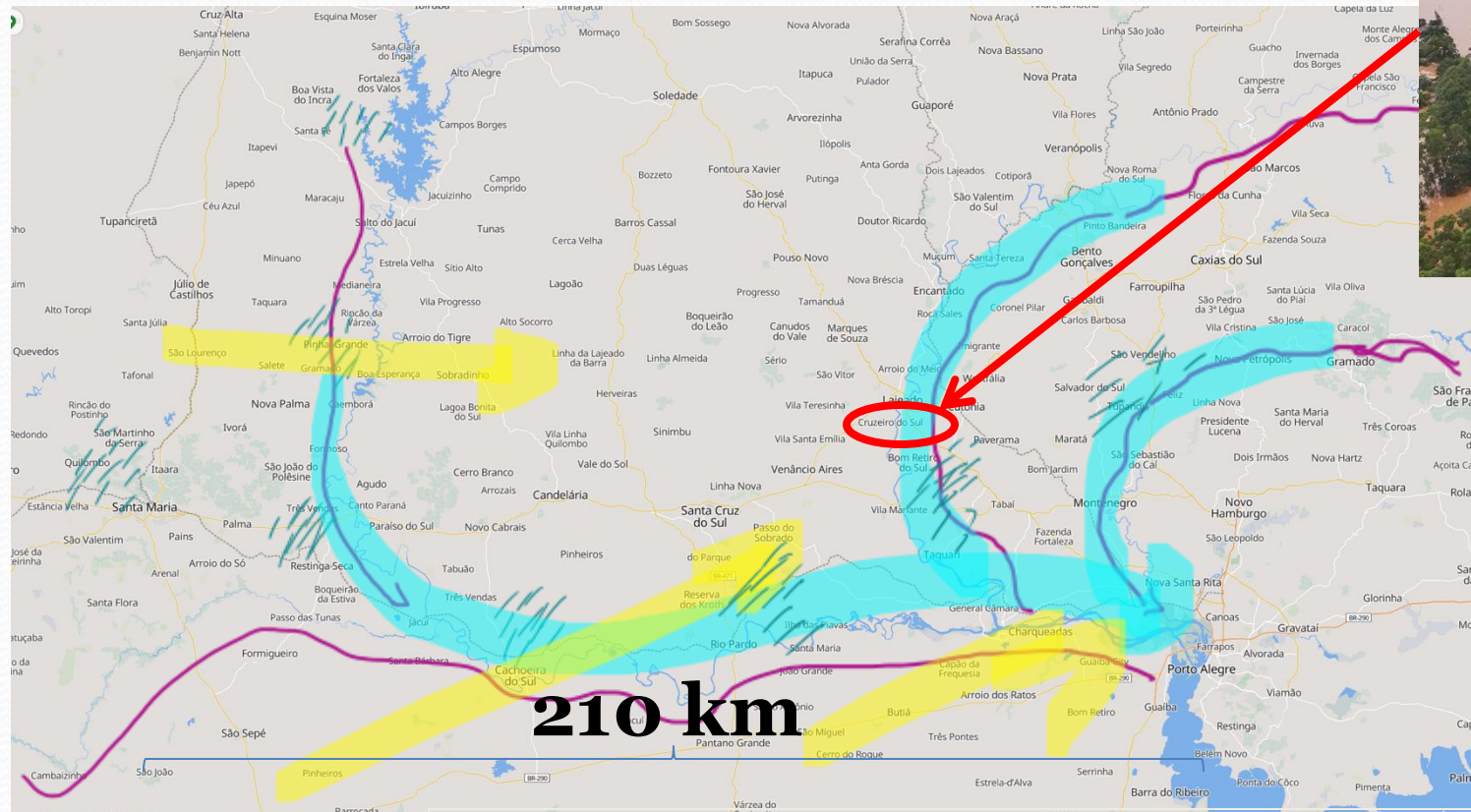
Conversation planning directives

→ *Planning of conversation course with answer format, automated relations and review/update directives.*

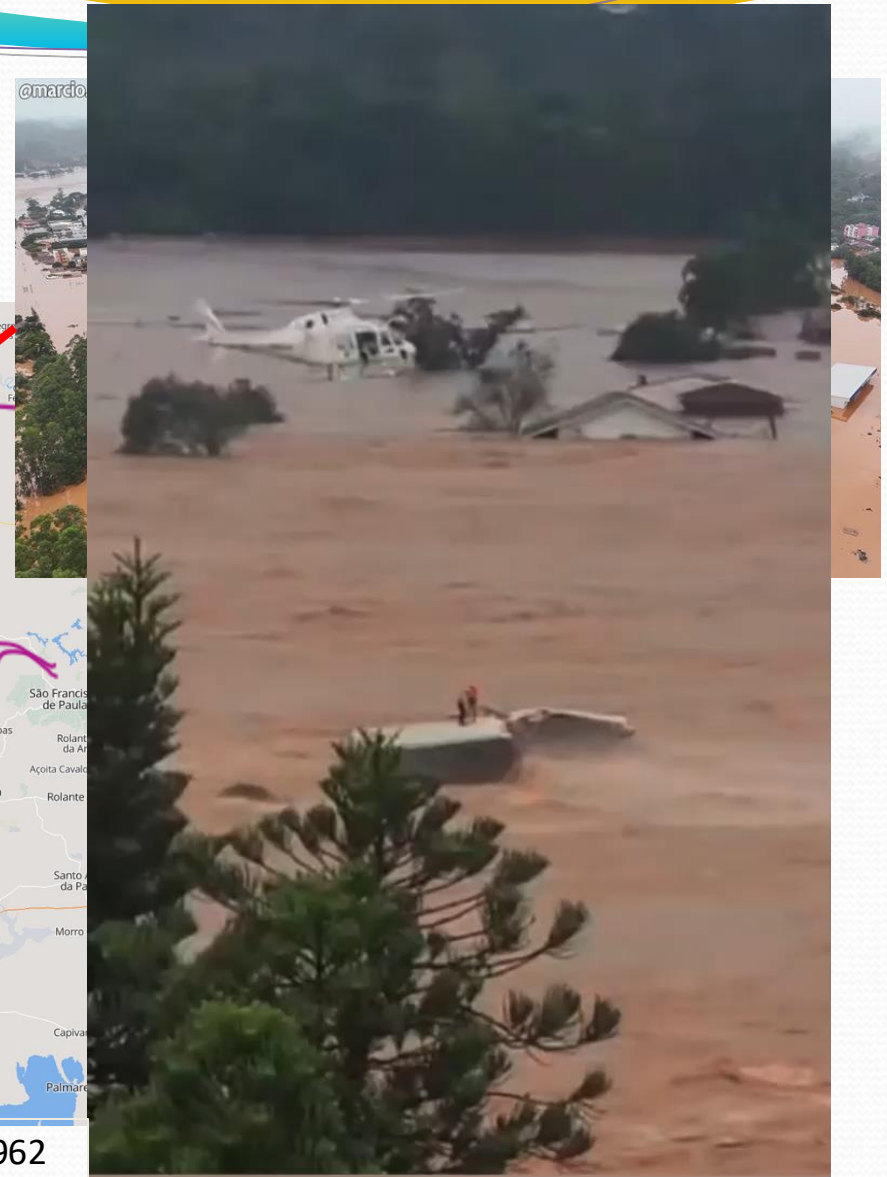
- **Language AI in engineering, current issues, preliminar exploration → Focus on the front-end.**

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Pilot case study



https://youtube.com/shorts/_qGznntThKo?si=2Qmav74AFzuY5962



Discussion

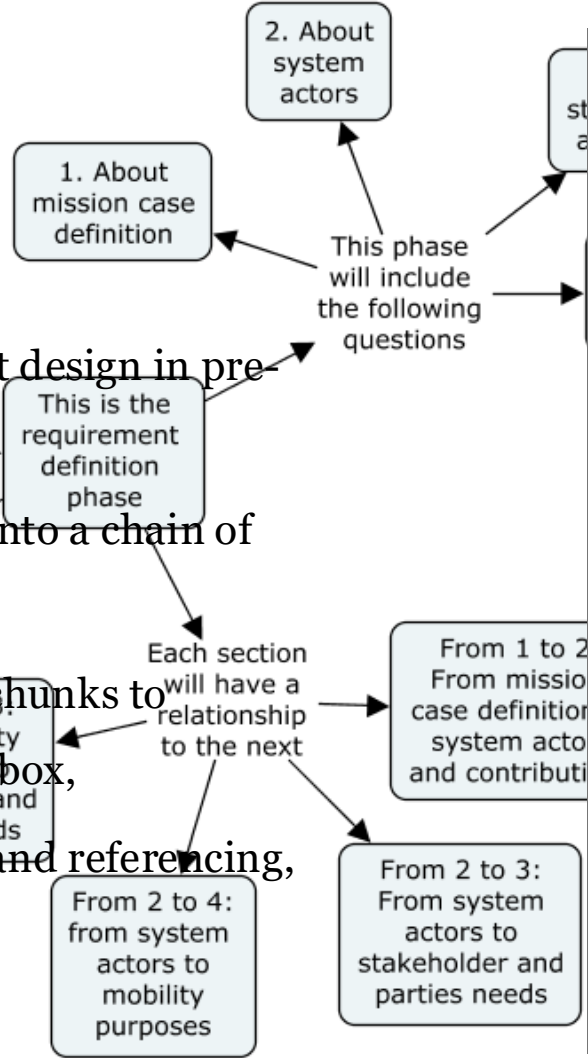
• Planning prompt chains

- Raise information input to aircraft design in pre-specification quality,

Pre-planned visual route parsed onto a chain of prompt questions,

- Prompt chain is split in question chunks to facilitate interaction with the chatbox,

Policy for tone, context structure and referencing, starting from *role*,



FT_2025_o4mini - Conversation structure setup

ChatGPT o4-mini

'mission_case_jacui_flood_20250625_15:25_r00'

20250625_15:25 UTC

My question:
Please incorporate this as reference mission case. Make a block documenting what you know and confirm you are clear for the next phase.

Answer:
Below is a documented reference case for the Jacuí River flood, to serve as a practical example for our search-and-rescue mission planning:

Reference Mission Case: Jacuí River Flood (Late April–Mid May 2024)

- Event Overview**
 - Timeline:** Flooding commenced 29 April 2024, peaked early May, and persisted into the second week of May.
 - Location:** Jacuí River basin, Rio Grande do Sul, Brazil, including tributaries (Taquari, Caí, Sinos).
- Triggers & Drivers**
 - Meteorology:** Stationary atmospheric block, end-of-El Niño transition,

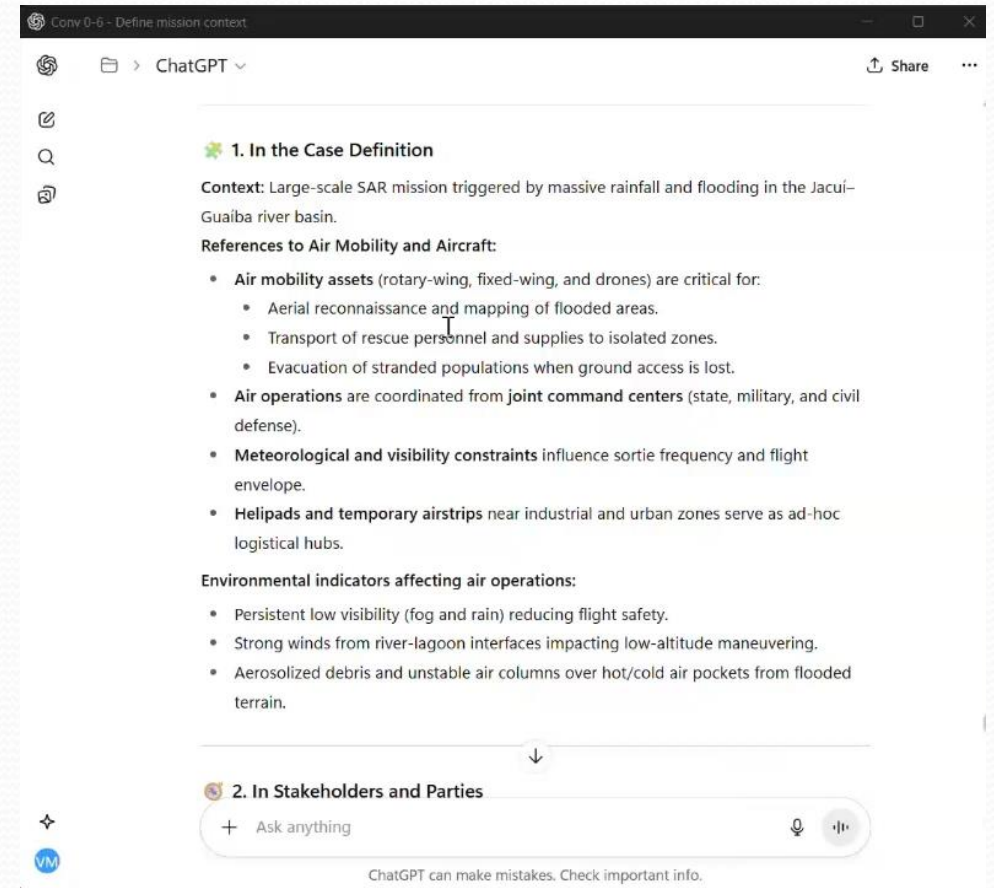
Ask anything

Tools

ChatGPT can make mistakes. Check important info.

Discussion

- **Modeling is a good output**
 - **AI can be used to help solve some of the most full**
generative AI models can help maintain problems,
 - **On the other hand, it can also be used to help**
assess the performance of a system, fully,
 - **It can also be used to help solve some of the most**
complex problems, such as those related to
operational efficiency, related to specific functions,
- **Directly as by the edit of model outputs**
for training in the loop activities chains.



Conclusion

Thank you for having me.

Questions most welcome.

