BUILD A MULTI-AGENT APPROACH FOR A LARGE LANGUAGE MODEL (LLM) TO IMPROVE RESPONSES AND BY USING RETRIEVAL-AUGMENTED GENERATION (RAG) TO CONSIDER OWN DATA IN QUERIES

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MOTIVATION

- Many tools on the market, chatbots are everywhere
- But no local, open-source, multi-agent tool that can easily be extended
- Use Case: Blog Post Generation
  - But: Can easily be changed and extended

BACKGROUND INFORMATION

LARGE LANGUAGE MODELS & TOKENIZATION

- LLM: AI Systems that are able to understand and use human language
- How? Always predicting the next word in a sentence based on context
  - Uses the Transformer architecture, which understands the relationships between words[1]
  - Many providers: OpenAI, Google, Meta, …
  - Used here: *llama3.1:8b-instruct-q8_0* – can be downloaded and run locally [2]
- Based on Tokenization: Data sets transformed into small sequences and are embedded[3]

RETRIEVAL-AUGMENTED GENERATION & EMBEDDING

- RAG: Two-phase AI Framework used for retrieving facts from other sources, like a website or a database[4]
  - Used to reduce LLM hallucinations and improve answer quality by providing a knowledge source

- Embedding: Vectorization of tokenized objects like text, picture and audios to continuous vector space[5]
  - Can then be used for vector calculations
  - Embedding model used in this implementation: *mxbai-embed-large*

MULTI-AGENT SYSTEMS & CREWAI

- Multi-Agent Systems: Multiple LLM Agents working together to perform a task[6]
  - Each agent powerful and can act on its own
  - Communication and task distribution most important aspects of framework

- CrewAI: Framework for multi-agent systems[7]
  - Enables users to assemble their „dream team“
  - Based on a LLM of choice

PROMPT ENGINEERING & OTHER SOFTWARE AND FRAMEWORKS

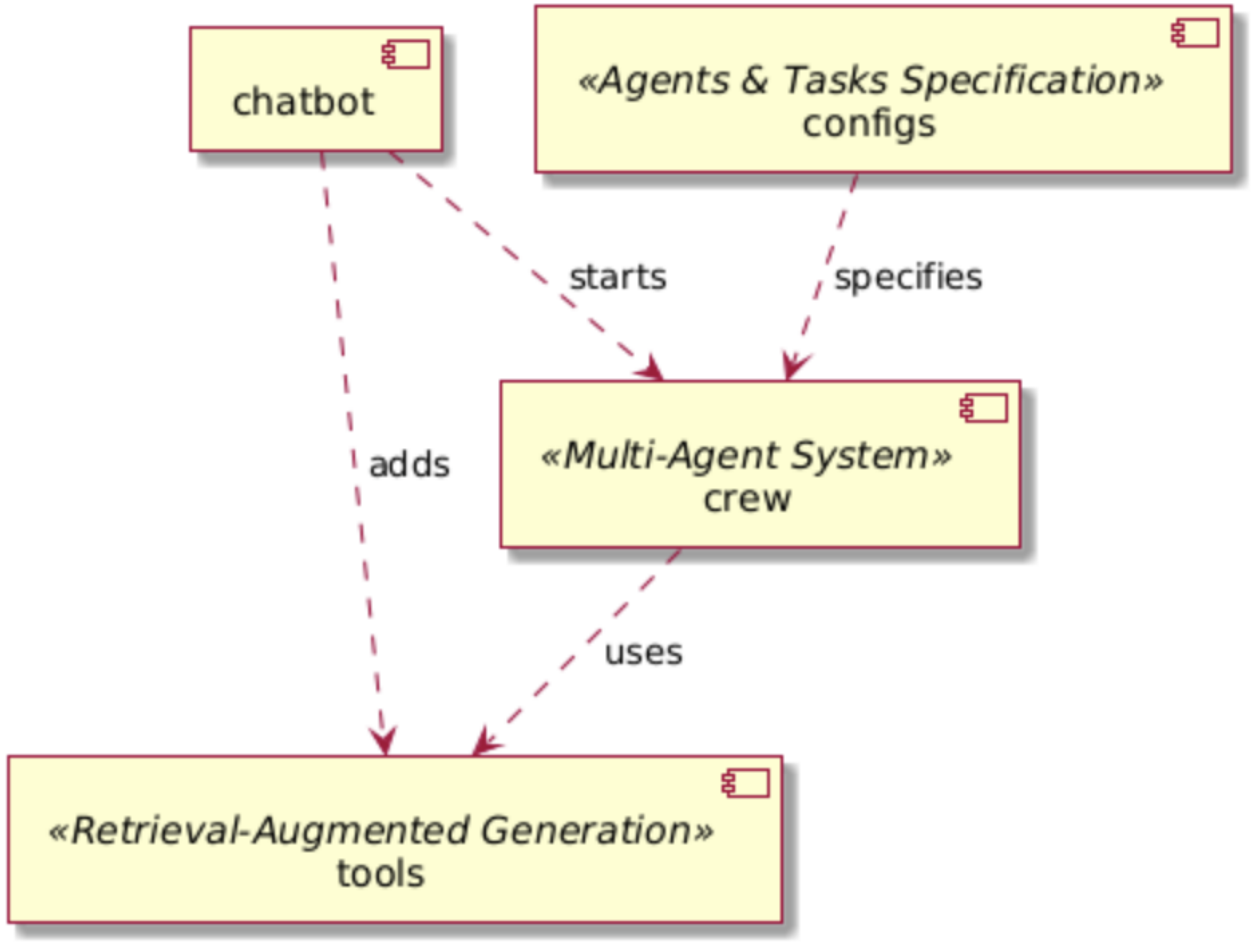
- Prompt Engineering is the making of queries to improve LLM responses by using thoughtfully crafted natural language
  - Many techniques around nowadays, eg. Chain-of-thought[8]

Other Software and Frameworks:

- LangGraph by LangChain[9]
- OpenAI Swarm, Autogen, Magentic-One, …
- Many LLMs and embedding models, Ollama is just one of them
- And there are chatbots a dime a dozen

DEMO

ARCHITECTURE



IMPLEMENTATION

RESULTS & EVALUATION

RESULTS & EVALUATION

- What were the primary objectives of the project and were they achieved?
  - Create a local, open-source, multi-agent tool that can easily be extended - Yes
- What methods and technologies were used and how effective were they?
  - CrewAI, Ollama, Telegram Chatbot - Partially effective (Except for Telegram Chatbot)
- What are the limitations of the implementation?
  - Very slow, and telegram chatbot can be hard to adapt
- Based on the project's outcomes, what future research do you recommend?
  - Try to improve speed by using a different framework and LLM
  - Try to make a user interface (eg. website) that adapts the whole tool for a specified use case for the user

LITERATURE

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THANK YOU FOR YOUR ATTENTION!