

Cognitive Architecture of Owlle42

A CoALA-based View on Autonomous Agents

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1 MOTIVATION

- Autonomous LLM agents operate persistently in dynamic environments.
- Their behavior is non-deterministic and hard to evaluate.
- We apply the CoALA framework to structure and analyze Owlle42.

Why „Owlle42“?



- symbol of wisdom

42

- reference to *Douglas Adams*

An agent designed to answer everything – within the limits of what it knows

5 KEY INSIGHT

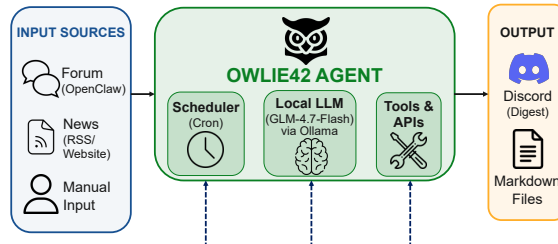
“
Technical reliability
≠
Behavioral reliability

Owlle42 executes reliably every day, but its outputs vary in structure, tone, and focus.

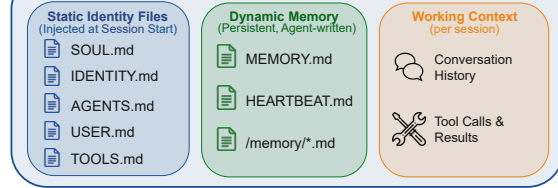
Reliability of execution does not guarantee reliability of behavior.

2 OWLIE42 ARCHITECTURE OVERVIEW

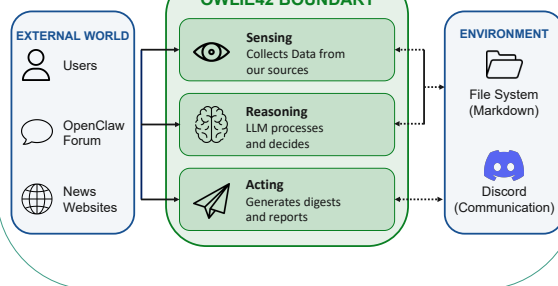
Operational View



MEMORY (FILE-BASED)



Context View



3 MAPPING TO COALA¹

We map Owlle42 to the CoALA cognitive architecture framework.

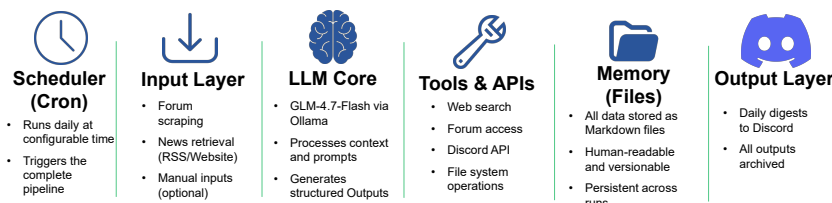
CoALA Layer	Owlle42 Realization
Procedural Memory	System Prompts + Tools & APIs Define how tasks are executed
Episodic Memory	Markdown Files (/memory/xyz.md) Persistent storage of experiences
Working Memory	LLM Context Window Active context during reasoning
Semantic Memory	Not implemented yet Planned: Vector DB + RAG
Action (Effectors)	File system + Discord API Publishes outputs and reports
Decision Making	LLM + Runtime Environment Determines behavior and output

★ Key Takeaway

Owlle42 implements large parts of CoALA, but lacks semantic memory and explicit evaluation mechanisms.

¹ Sumers, T., Yao, S., Narasimhan, K., Griffiths, T.L.: Cognitive Architectures for Language Agents. Transactions on Machine Learning Research (2024)

4 SYSTEM COMPONENTS



Example Flow (Daily Run)



6 FUTURE WORK

- Add Semantic Memory**
Integrate a vector database and RAG for long term knowledge.
- Introduce Evaluation Loop**
Automatically evaluate outputs for quality and consistency.
- Measure Behavioral Reliability**
Define metrics to assess and track behavioral reliability over time.
- Extend Autonomous Capabilities**
Enable planning, multi-step tasks, and self-improvement.

