FixMyPlan: Leveraging Large Language Models to Fix Ill-Defined Models and Incorrect Plans

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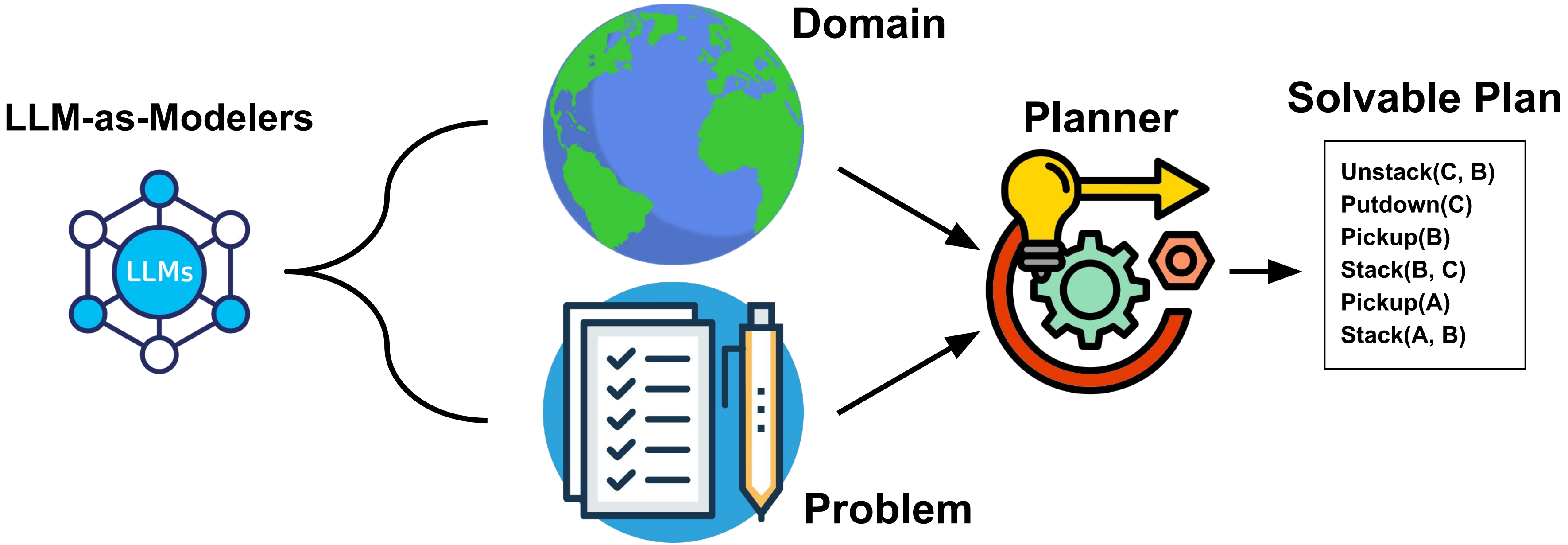
FRAMING THE PROBLEM

LLMs have made an impressive strides in generating formal representations such as PDDL:



LLM-as-Modelers

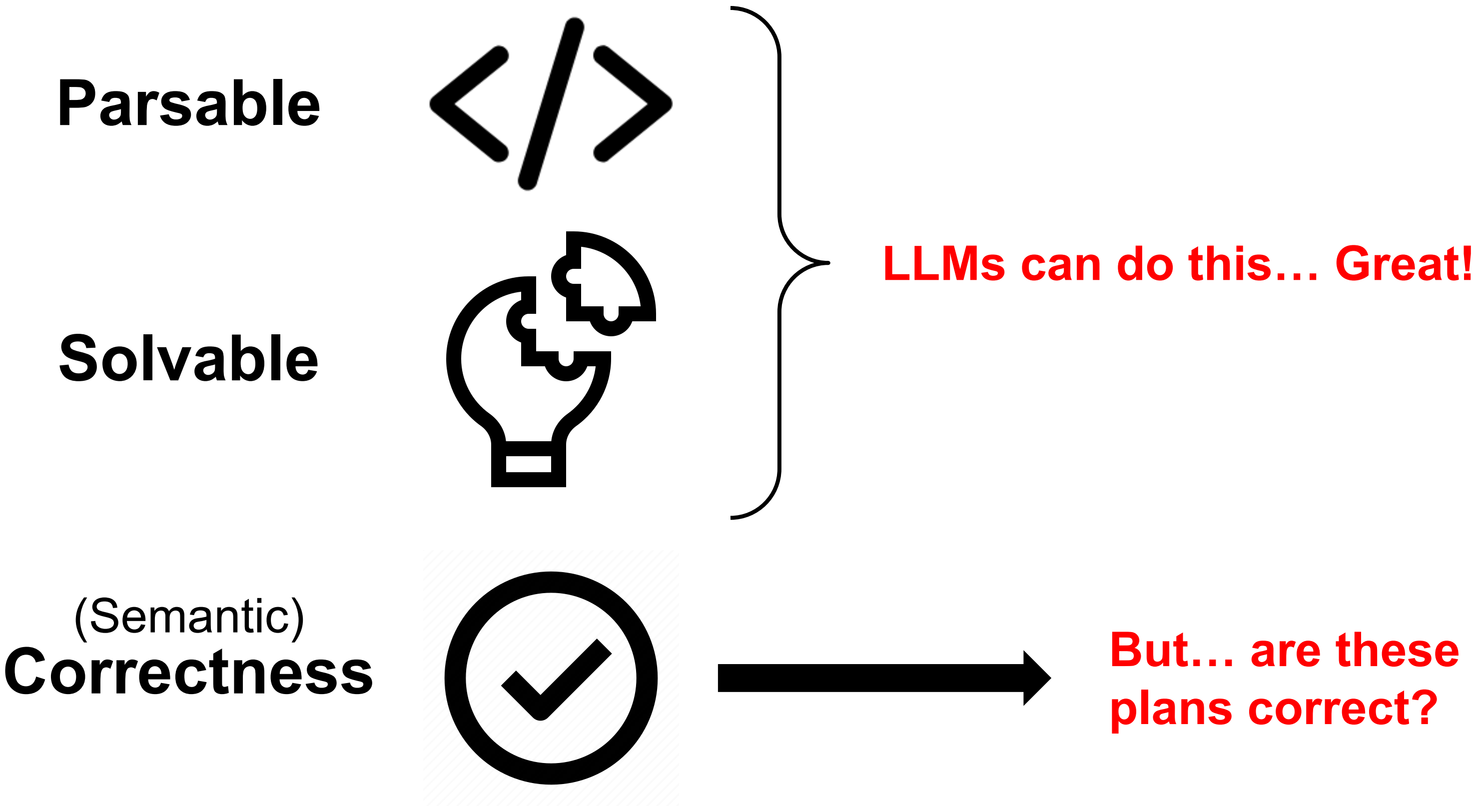
Domain

Problem

Planner

Solvable Plan

Unstack(C, B)
Putdown(C)
Pickup(B)
Stack(B, C)
Pickup(A)
Stack(A, B)



Parsable

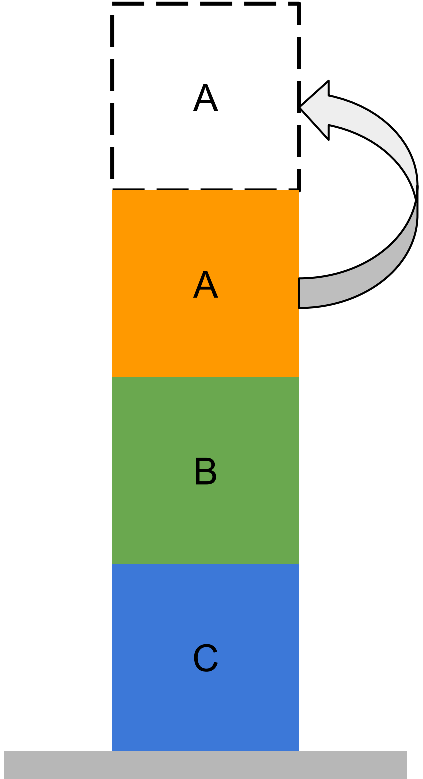
Solvable

(Semantic) **Correctness**

LLMs can do this… Great!

But… are these plans correct?

HUH?



Generated Plan Sequence

Step One

●
●
●

Stack(A, A) – Place **Block A** on top of **Block A.**

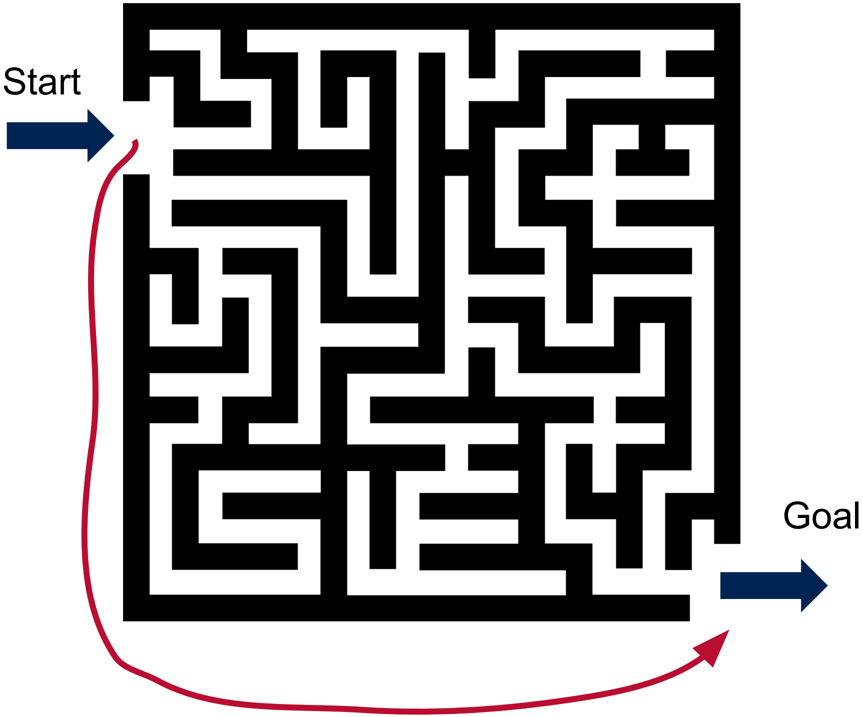
●
●
●

Step N

PROBLEM:
Plan output quality is **heavily dependent** on planning model quality

Even if we derive solvable plans from our planning models, **if the plans are not coherent, then what is the point?**

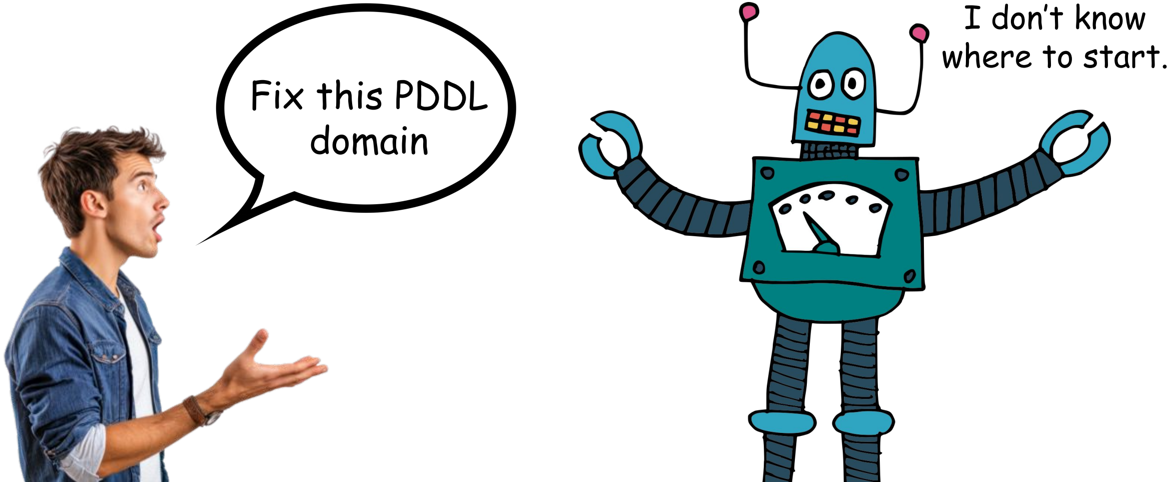
oops…



MOTIVATION

Prior research indicates LLMs struggle to directly correct semantic errors in PDDL domains (Gragera and Pozanco 2023; Patil 2024), **highlighting need for alternative approaches**

Adopting post-hoc approach, using generated plans as source of reliable feedback mechanism, enabling LLMs to detect and refine domain modeling errors more effectively



SOLUTION: FixMyPlan

Very reminiscent to LLM-Modulo approach!

→ First post-hoc approach of refining domains via plan analyzation

→ closed-loop framework that breaks down generated plan to detect semantic inconsistencies to fix underlying domain

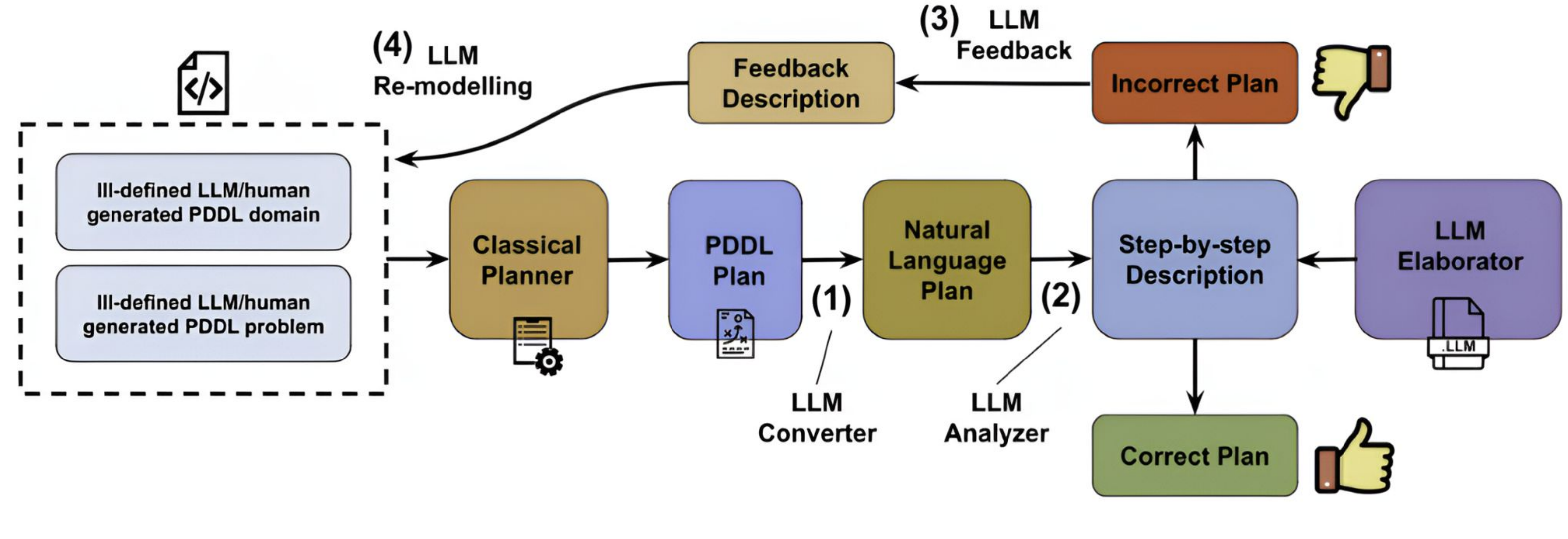
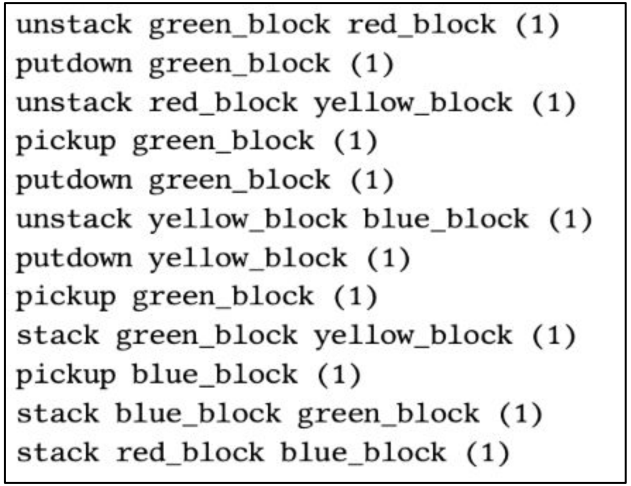


Figure 1: FixMyPlan general framework

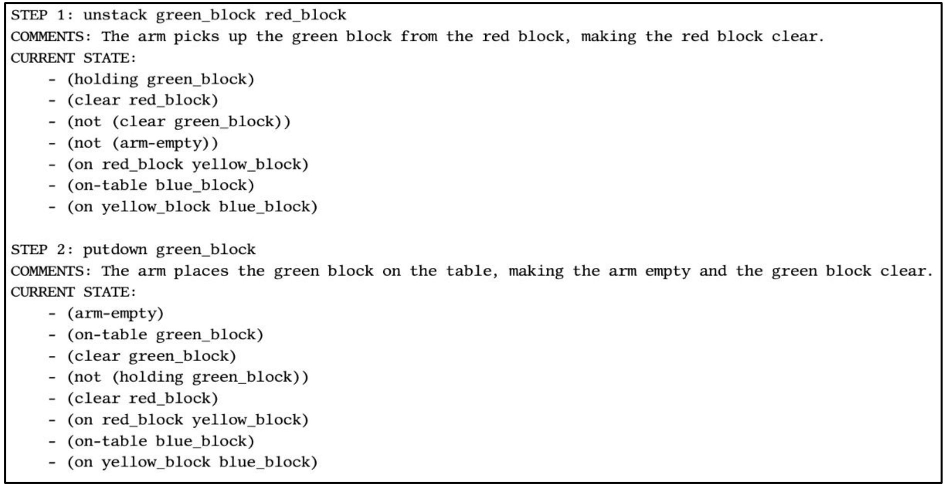
Example:

Original Flawed Plan



```
unstack green_block red_block (1)
putdown green_block (1)
unstack red_block yellow_block (1)
pickup green_block (1)
putdown green_block (1)
unstack yellow_block blue_block (1)
putdown yellow_block (1)
pickup green_block (1)
stack green_block yellow_block (1)
pickup blue_block (1)
stack blue_block green_block (1)
stack red_block blue_block (1)
```

Translated NL Plan (via LLM)



```
STEP 1: unstack green_block red_block
COMMENTS: The arm picks up the green block from the red block, making the red block clear.
CURRENT STATE:
    - (holding green_block)
    - (clear red_block)
    - (not (clear green_block))
    - (not (arm-empty))
    - (on red_block yellow_block)
    - (on-table blue_block)
    - (on yellow_block blue_block)

STEP 2: putdown green_block
COMMENTS: The arm places the green block on the table, making the arm empty and the green block clear.
CURRENT STATE:
    - (arm-empty)
    - (on-table green_block)
    - (clear green_block)
    - (not (holding green_block))
    - (clear red_block)
    - (on red_block yellow_block)
    - (on-table blue_block)
    - (on yellow_block blue_block)
```

Promising Outlooks:

- FixMyPlan pipeline performs **considerably on par with the baseline** at detecting and making correct domain fix
- Mystery domain showcases how **FixMyPlan enables LLMs to systematically analyze plan steps** through granular inspection, rather than **relying on retrieving from training corpus.**

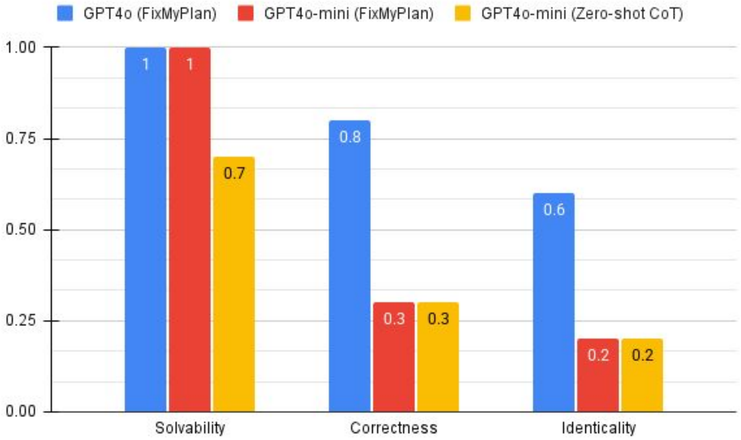


Figure 2: Mystery Logistics Domain. *Correctness* = validating plan via ground truth domain (VAL). *Identicality* = plan generated same as ground truth

CONCLUSION

FixMyPlan is a work in progress!

- Robust method to **tracking current predicate** states rather than tasking LLM
- **More efficient pipeline** — reuse of LLM translating (step 1) and LLM analyzer (step 2)
- **Increasing test dataset**

FixMyPlan is the first work to explore **post-hoc methods** for **identifying and correcting semantically incorrect plans** (In lens of LLM-as-Modelers)

→ Further research into addressing the **semantic integrity of PDDL model generation through LLMs, not only by detecting flawed plans but also by improving the underlying domain modeling process.**

Any Questions?