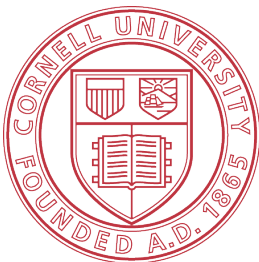


Sorry Dave, I'm Afraid I Can't Do That: Explaining Unachievable Robot Tasks Using Natural Language

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High-Level Tasks:

Carrying meals to patients
Delivering medical records
Patrolling patient rooms

-
-
-



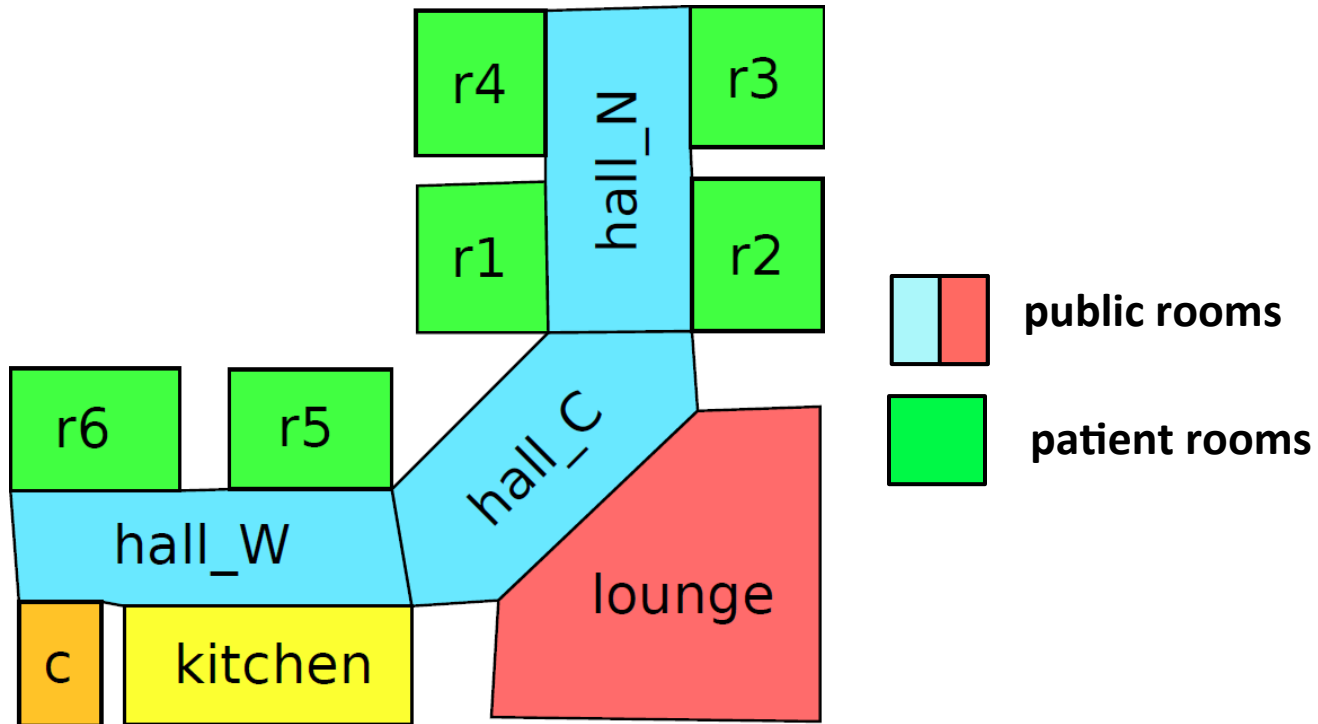
High-Level Tasks:

Carrying meals to patients
Delivering medical records
Patrolling patient rooms

Challenges:

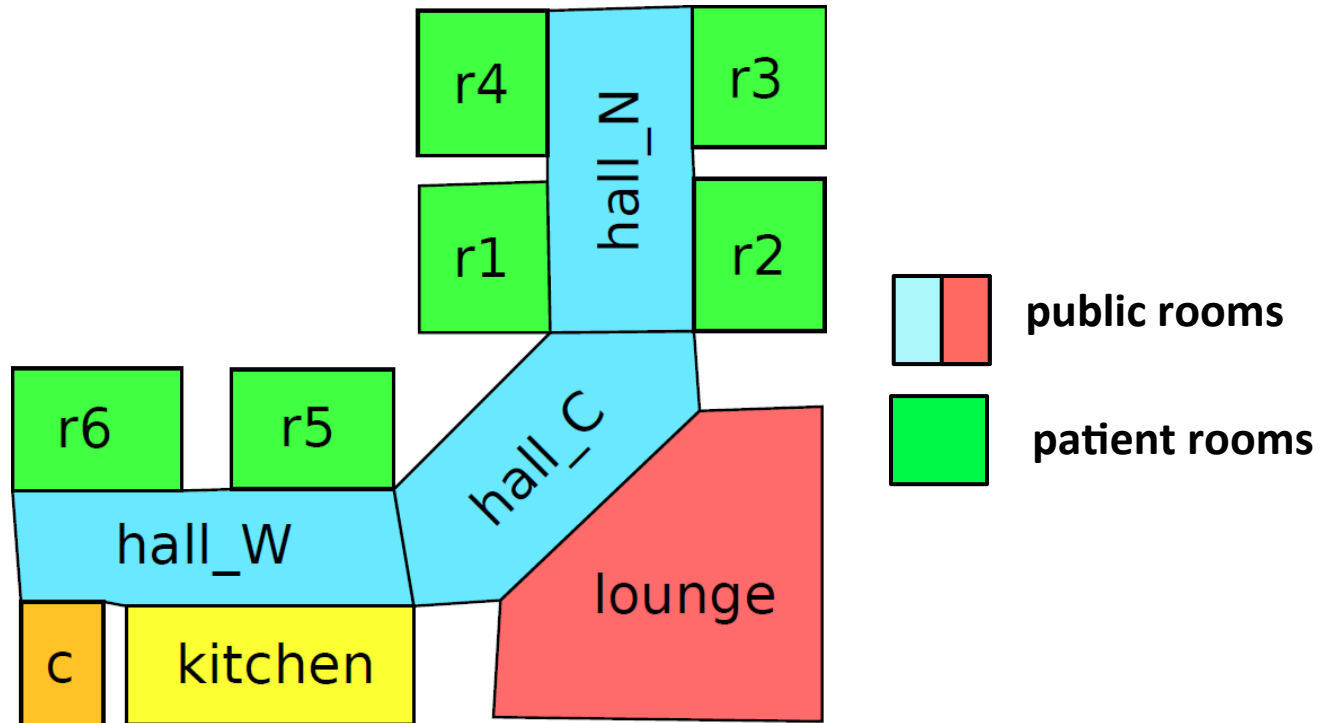
Easy to instruct
Does as it is told*

Example



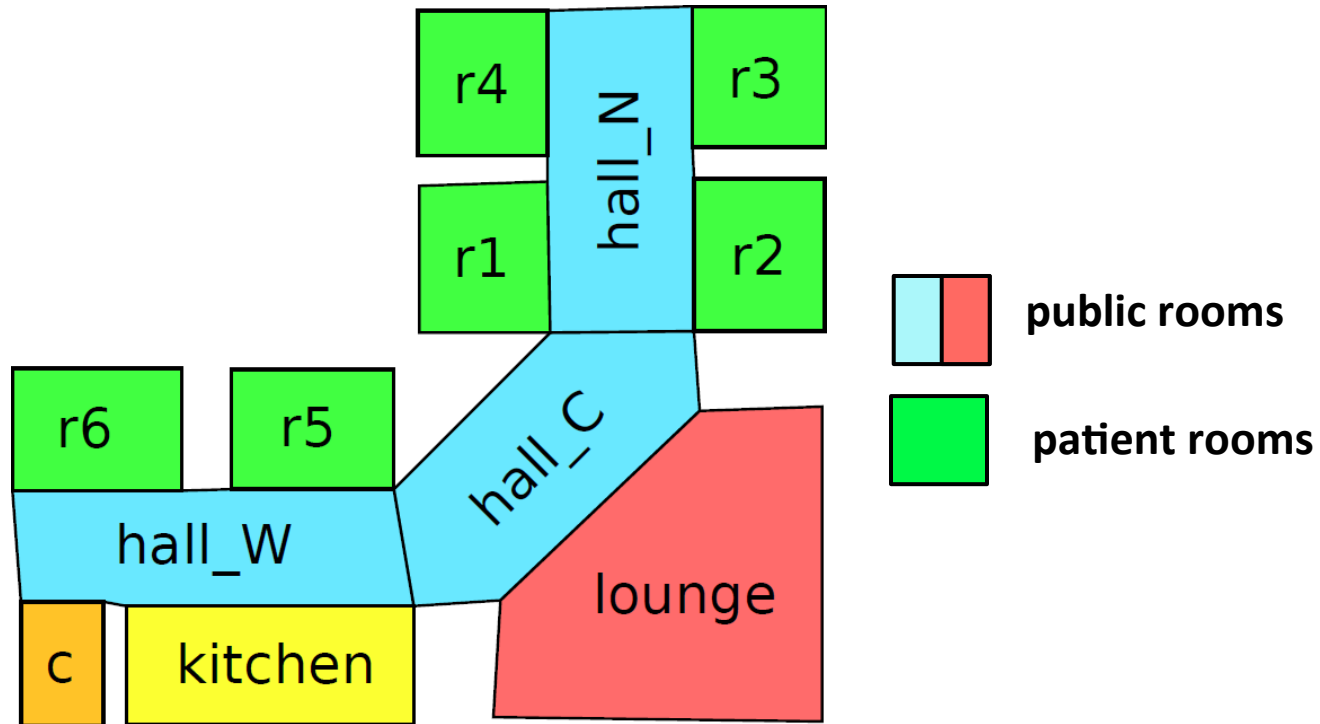
Carry meals from the kitchen to all patient rooms.

Example



Start in the closet. Carry meals from the kitchen to all patient rooms. Don't go into any public rooms.

Example



~~Start in the closet. Carry meals from the kitchen to all patient rooms. Don't go into any public rooms.~~

Approach (Highlights)

Approach (Highlights)

- Natural language pipeline



Approach (Highlights)



The image displays two windows from a simulation. The 'Simulation Status' window shows a top-down view of a robot's environment. The robot is a small white circle located in the 'hall_c' area. The environment consists of several rooms: 'hall_n' (yellow), 'hall_w' (orange), 'kitchen' (green), 'lounge' (blue), 'hall_c' (purple), and 'close' (yellow). There are also several rooms labeled 'r1' through 'r6' in various colors (green, red, yellow, orange). The 'Dummy Sensor Handler' window shows a similar top-down view of the robot's field of view, with various sensor points labeled 'p1' through 'p11' in different colors (yellow, orange, purple, green, red). A large red rectangle is visible at the bottom of this window, likely representing a sensor's range or a specific sensor type.

User: What are you doing?
System: I'm currently trying to "Follow the target to 'hall_n'."
User: What are you doing?
System: I'm currently trying to "Follow the target to 'kitchen'."
User: What are you doing?
System: I'm currently trying to "Follow the target to 'hall_c'."
User: What are you doing?
System: I'm currently trying to "Follow the target to 'hall_n'."

Approach (Highlights)

- Natural language pipeline
- Provably correct controller via synthesis
(when one exists)

Approach (Highlights)

- Natural language pipeline
- Provably correct controller via synthesis
- Minimal cause of unsynthesizability
 - Unsatisfiable core (using PicoSAT)
 - Explained in natural language

Analysis Output:

The problematic goal is 'Carry meals from the kitchen to all patient rooms.'. The system cannot achieve the sub-goal "Deliver 'meal' to 'r1'.".

The statements that cause the problem are:

'Carry meals from the kitchen to all patient rooms.' because of item(s): "Deliver 'meal' to 'r1'.".

"Don't go into any public rooms." because of item(s): "Do not go to 'hall_c'.".

No further analysis available.

SLURP Traceback:

- ▶ Start in the closet.
- ▼ Carry meals from the kitchen to all patient rooms.
 - ▼ Action: 'carry', Argument: 'meal', Source: 'kitchen', Destination: 'rooms'
 - ▶ Nothing is carried or delivered at the start.
 - ▶ Only pick up if you can carry more.
 - ▶ Only drop if you are carrying something.
 - ▶ Stay where you are when picking up and dropping.
 - ▶ Pick up 'meal' in 'kitchen'.
 - ▼ Deliver 'meal' to 'r1'.

```
(([]((next(s.mem_deliver_r1) <-> (s.mem_deliver_r1 | (next(s.r1) & next(s.drop))))))
```

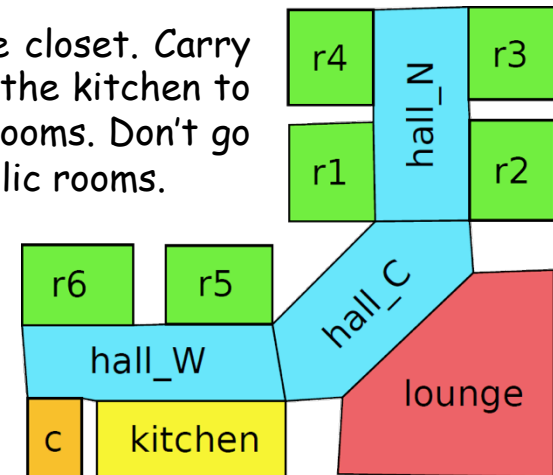
```
(([]<>(s.mem_deliver_r1))
```

- ▶ Deliver 'meal' to 'r2'.
- ▶ Deliver 'meal' to 'r3'.
- ▶ Deliver 'meal' to 'r4'.
- ▶ Deliver 'meal' to 'r5'.
- ▶ Deliver 'meal' to 'r6'.
- ▼ Don't go into any public rooms.
 - ▼ Action: do not 'go', Location: 'rooms'
 - ▼ Do not go to 'hall_c'.

```
(([](!s.hall_c))
```

- ▶ The robot does not begin in 'hall_c'.
- ▶ Do not go to 'lounge'.
- ▶ The robot does not begin in 'lounge'.

Start in the closet. Carry meals from the kitchen to all patient rooms. Don't go into any public rooms.



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15:30—18:00 Interactive Presentation (#3), Lichthof

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