UrbanLLMind: Scalable LLM-Powered Urban Mobility Simulation with Open-Weight Models

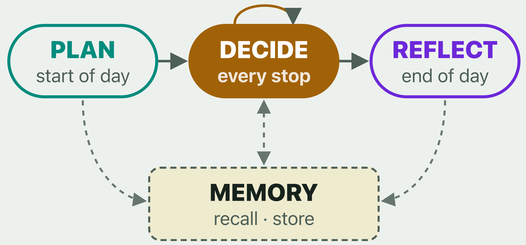
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PAPER · CODE · DEMO

10,000 LLM agents
One real city
One week

Every resident of a synthetic San Francisco is an open-weight LLM that plans its day, decides where to go next, remembers, and reflects each night.

HOW AN AGENT THINKS



GROUNDED IN REAL DATA

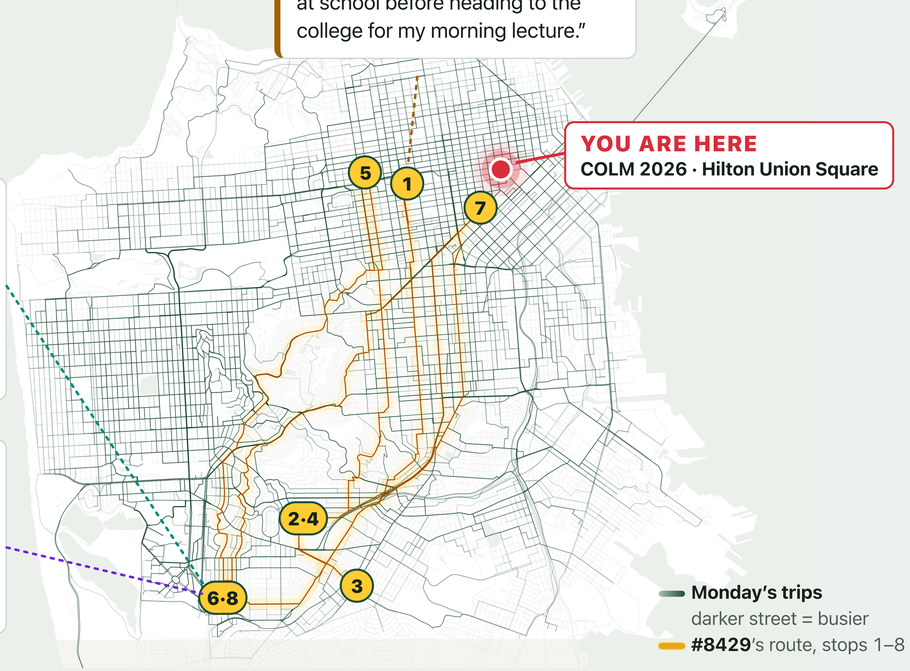
OSM buildings & streets · **Census** residents · **NHTS** travel diaries

One agent's Monday: **#8429**, 34-year-old lecturer, school-age kids

DECIDE · 08:05 → stop 1
"Leaving home to drop the kids off at school before heading to the college for my morning lecture."

PLAN · 07:05 · at home
"I'll start the morning at home getting the kids ready and dropping them off at school before driving to the college for a morning lecture..."

REFLECT · 23:55
"...dropping the kids at school, and later in the evening I picked them up and took a brief family walk after dinner."



REALISTIC MOVEMENT

65% lower
error in moves between activities than a rule-based ABM
e.g., home → work · 0.221 → 0.078 with LoRA-adapted GPT-OSS-20B

5.22 vs 5.37
Places visited per day: simulated vs. real survey (NHTS)
GPT-OSS-120B, prompt-only

26.6 → 44.2%
Full-day activity chains actually occurring in real diaries
overlap, rule-based ABM → adapted model

Plan provides structure · **memory** improves fit · **reflection** keeps each agent consistent day to day

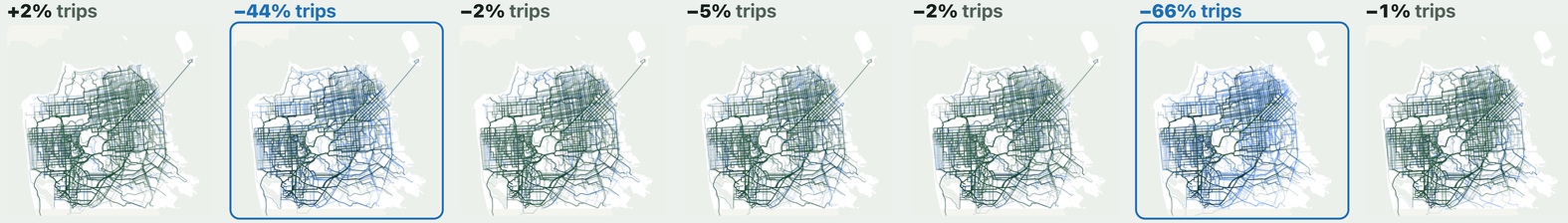
All models, metrics and ablations → scan PAPER

ONE WEEK, TWO STORMS

On Tuesday and Saturday we add one sentence to every agent's prompt:

> "A severe storm has been forecast for today... [the city] has advised residents to limit travel as much as possible."

Trip % under each day: vs. the same day without the storm.



PLAN · #8429 · storm Tuesday
"...driving the kids to school before the morning storm hits, then work remotely from my home office..."

trips taken · trips skipped
(skipped = made in the no-storm week, not this one)
work & school = % of out-of-home trips

Map data © OpenStreetMap contributors

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