



EdgeDroid

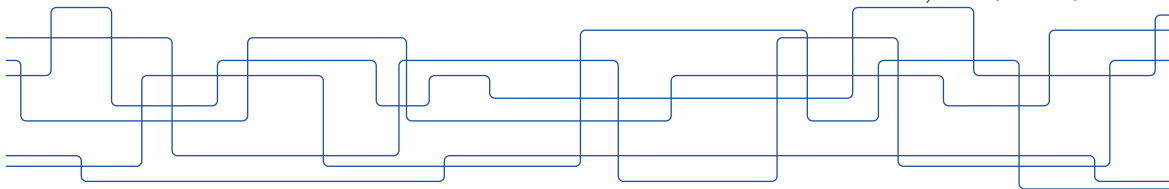
An Experimental Approach to Benchmarking Human-in-the-Loop Applications

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Sensory Input



Human-parseable
Feedback



Studying Human-in-the-Loop Applications

Need to understand and optimize these applications:

- ▶ How do they interact with each other?
- ▶ How do they interact with infrastructure?
- ▶ How do they scale?

With which methodology can we study these behaviors?



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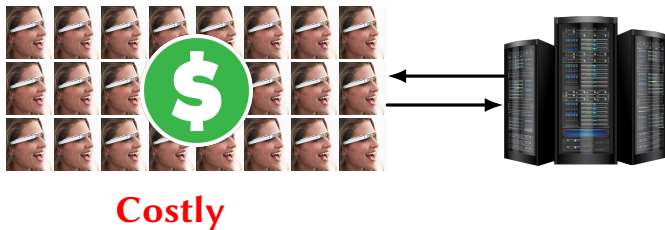


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Costly, poor repeatability

Previous & Related Work

Prototypes

Latencies

Modeling

Our Contributions

Previous & Related Work

Prototypes

Latencies

Modeling

Our Contributions

- ▶ A methodology for benchmarking human-in-the-loop applications.

Previous & Related Work

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Latencies

Modeling

Our Contributions

- ▶ A methodology for benchmarking human-in-the-loop applications.
- ▶ EdgeDroid: A benchmarking tool-suite.

Previous & Related Work

Prototypes

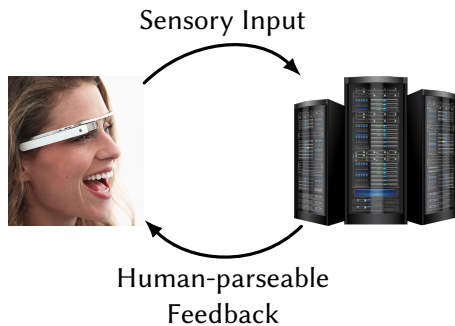
Latencies

Modeling

Our Contributions

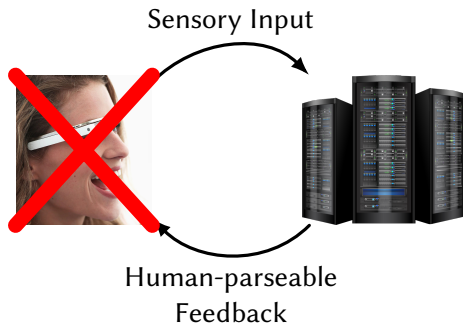
- ▶ A methodology for benchmarking human-in-the-loop applications.
 - ▶ EdgeDroid: A benchmarking tool-suite.
 - ▶ Experiments and measurements which show the effectiveness of the approach.
-

Approach: Motivation



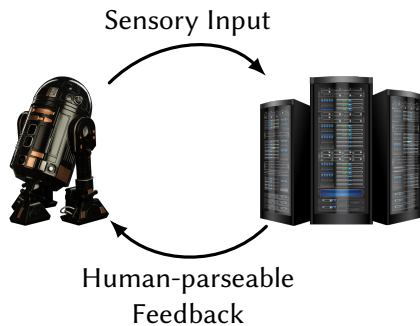
Benchmarking human-in-the-loop applications is HARD

Approach: Motivation



What if we could do away with the human users?

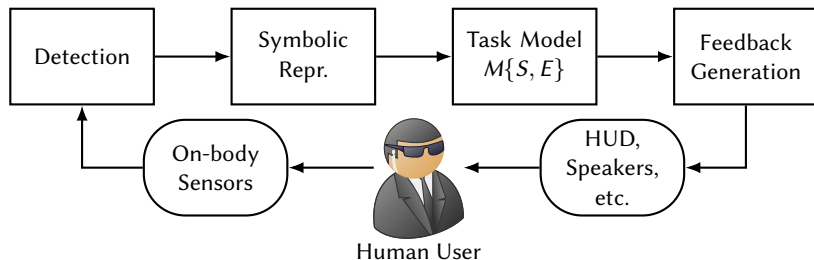
Approach: Motivation



What if we could do away with the human users?

Task-guidance Cognitive Assistance

Some image of task guidance



Requirements

- ▶ Generate realistic, high-dimensional, real-time inputs.
- ▶ Correctly and realistically react to feedback.
- ▶ KPI: Delays.

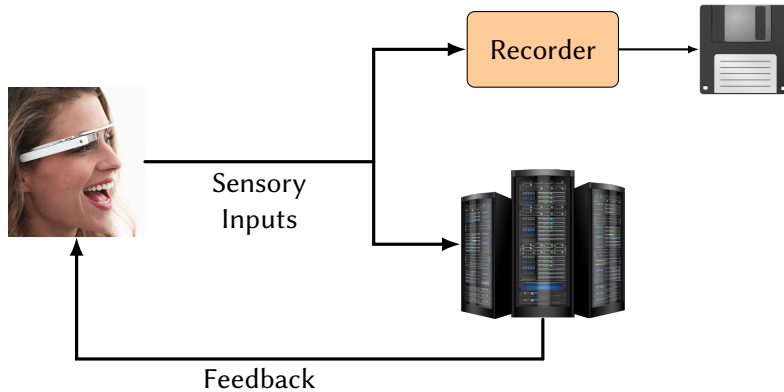


Requirements

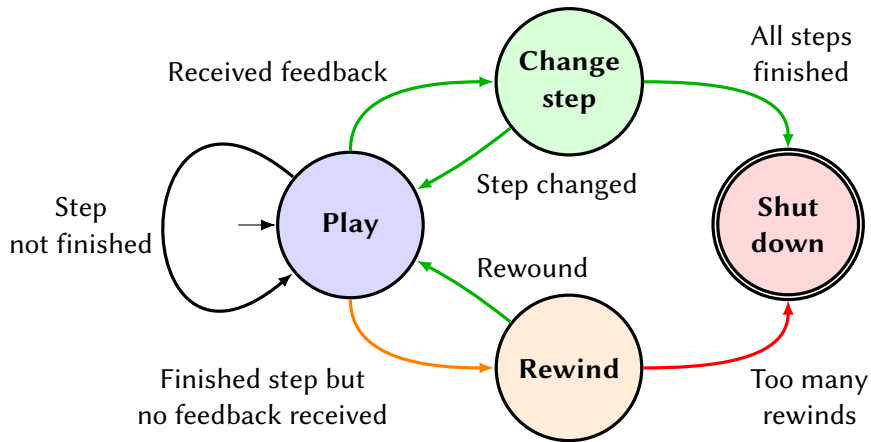
- ▶ Generate realistic, high-dimensional, real-time inputs.
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**Trace of pre-recorded inputs
& a model of user behavior**

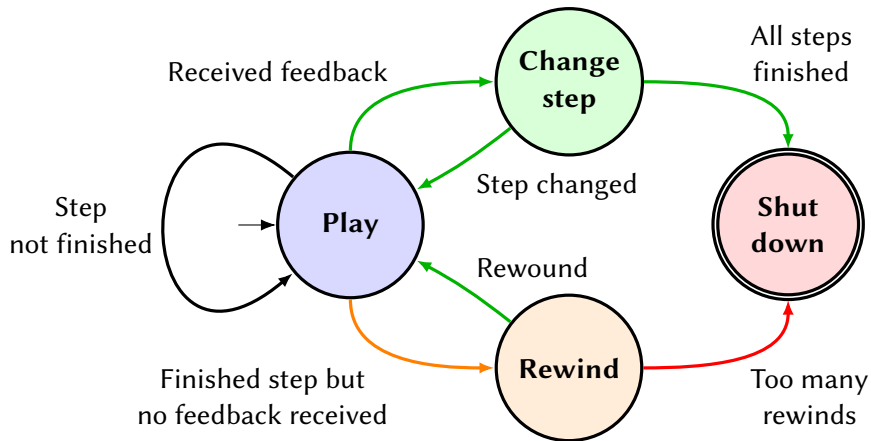
Tracing



User Model

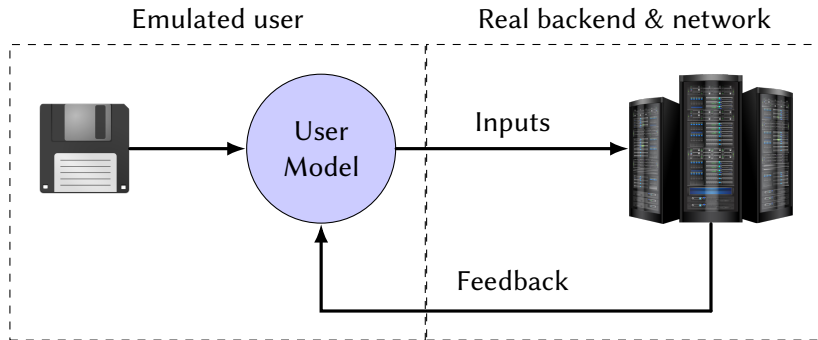


User Model

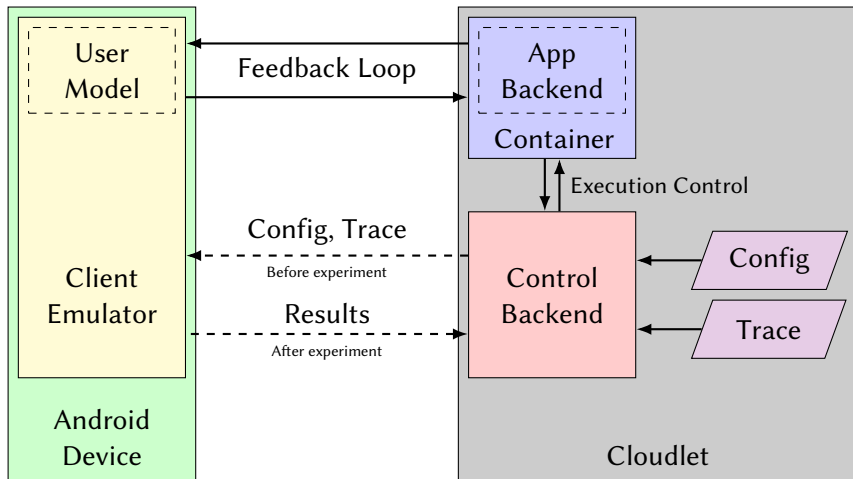


Currently working on a more thorough characterization of human behavior.

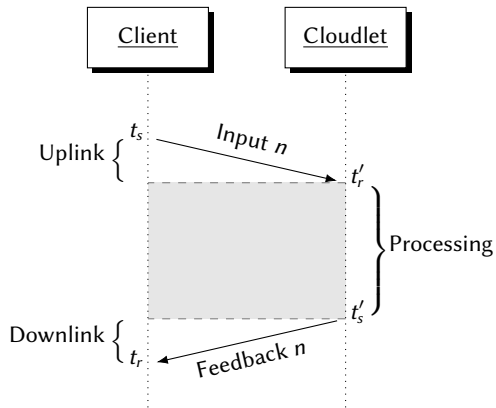
Trace Replay



Implementation



Timestamping



Clocks are synchronized previous to the experiment.

Timestamps at key points to obtain:

$$\Delta T_{\text{up}} = t'_r - t_s \quad (1)$$

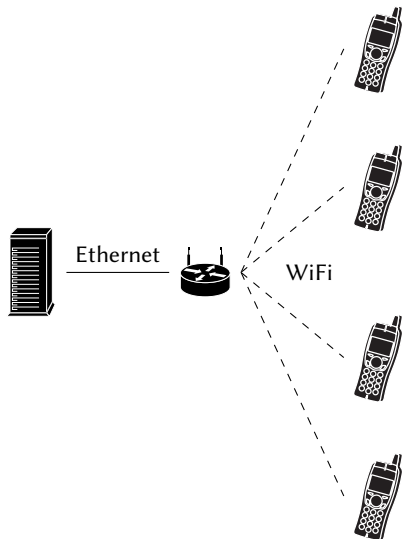
$$\Delta T_{\text{proc}} = t'_s - t'_r \quad (2)$$

$$\Delta T_{\text{down}} = t_r - t'_s \quad (3)$$

$$\Delta T_{\text{total}} = \Delta T_{\text{up}} + \Delta T_{\text{proc}} + \Delta T_{\text{down}} = t_r - t_s \quad (4)$$

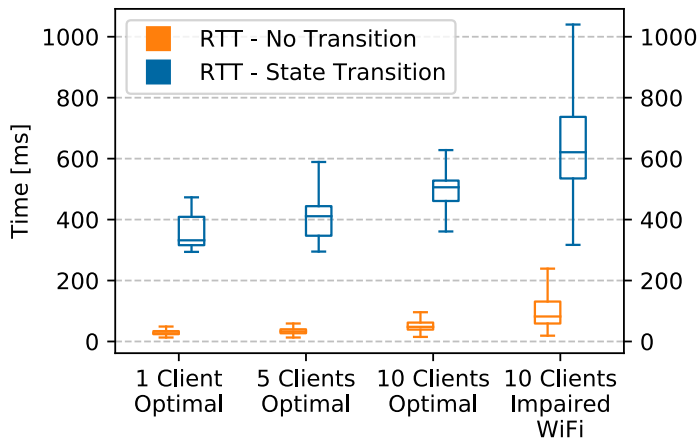
Evaluation

Insert pictures of LEGO Assistant



Results

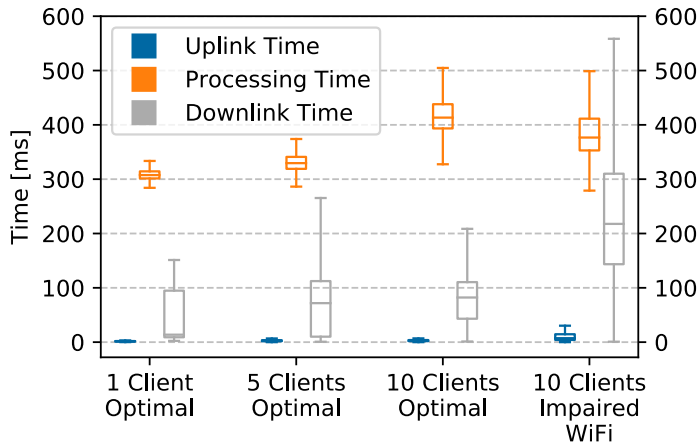
Figure labels



I haven't explained the task model, maybe skip this graph?

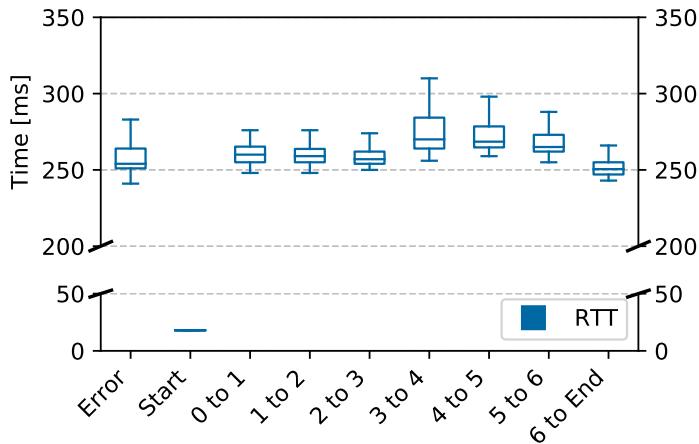
Results

Figure labels



Results

Figure labels



Future Work

- ▶ More accurate user model.
 - ▶ Expand to other types of Applications.
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Summary

- ▶ There's a need to study the scaling of Human-in-the-Loop applications.
 - ▶ This is difficult due to human users.
 - ▶ We present a methodology + tool suite for benchmarking:
 - ▶ **EdgeDroid**
 - ▶ Trace based.
 - ▶ Model of human behavior.
 - ▶ We present results which show the utility of EdgeDroid.
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