



EdgeDroid

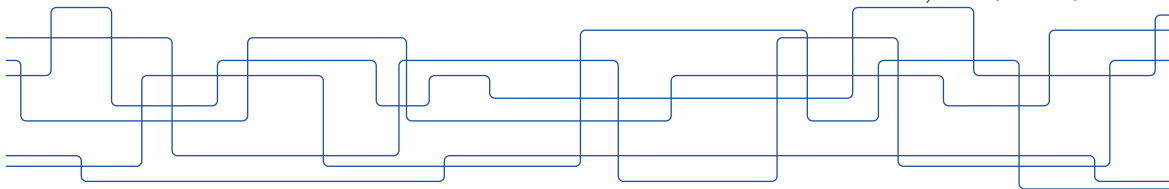
An Experimental Approach to Benchmarking Human-in-the-Loop Applications

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HotMobile'19 Session 5: February 28th 2019, Santa Cruz, CA







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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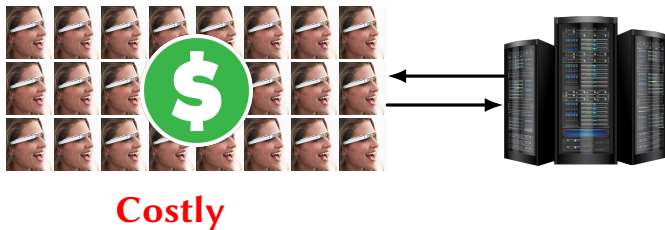


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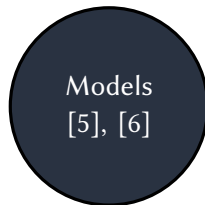
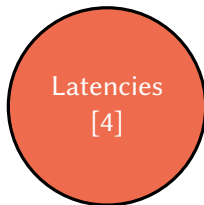
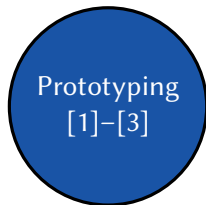
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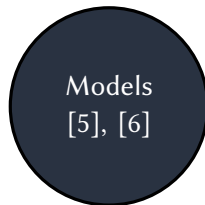
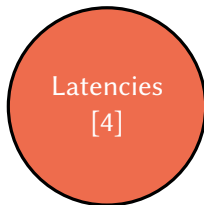
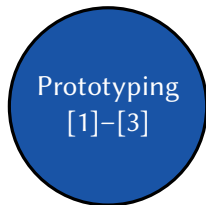


Costly, poor repeatability

Previous & Related Work



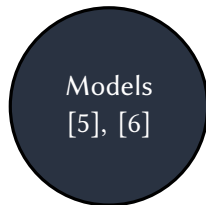
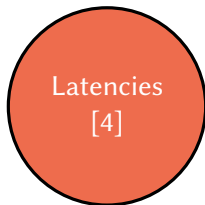
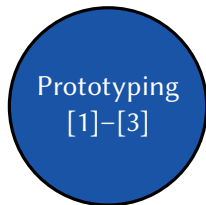
Previous & Related Work



Our Contributions

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

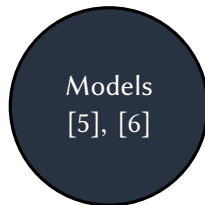
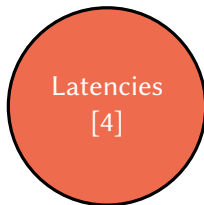
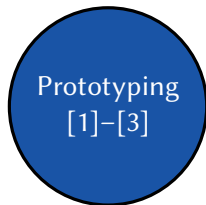
Previous & Related Work



Our Contributions

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

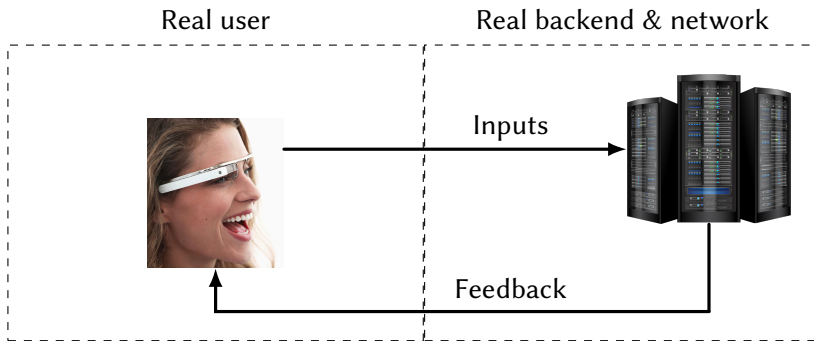
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Our Contributions

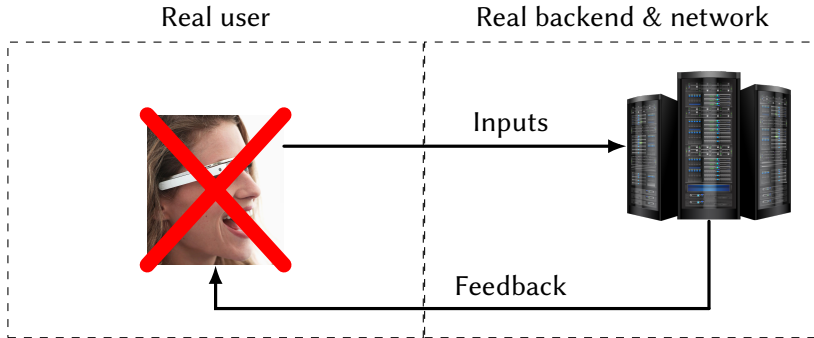
- ▶ A methodology for benchmarking human-in-the-loop applications.
 - ▶ EdgeDroid: A benchmarking tool-suite.
 - ▶ Experiments and measurements which show the effectiveness of the approach.
-

Approach



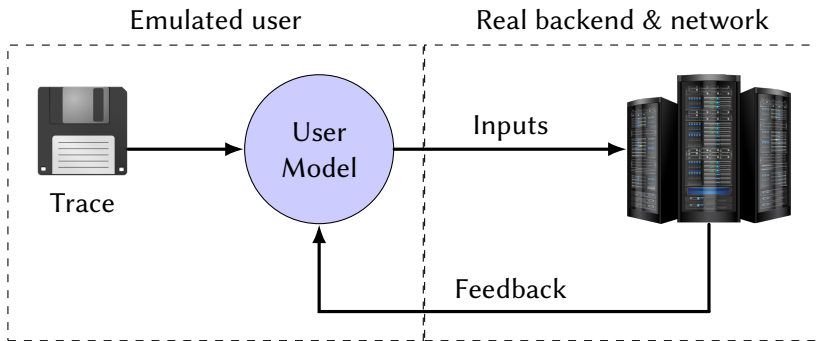
Benchmarking human-in-the-loop applications is HARD

Approach



What if we could do away with the human users?

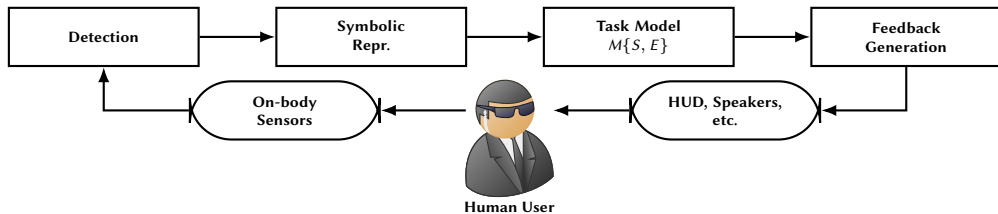
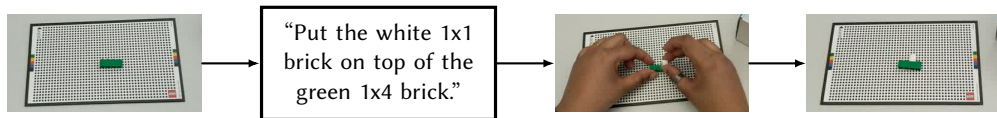
Approach



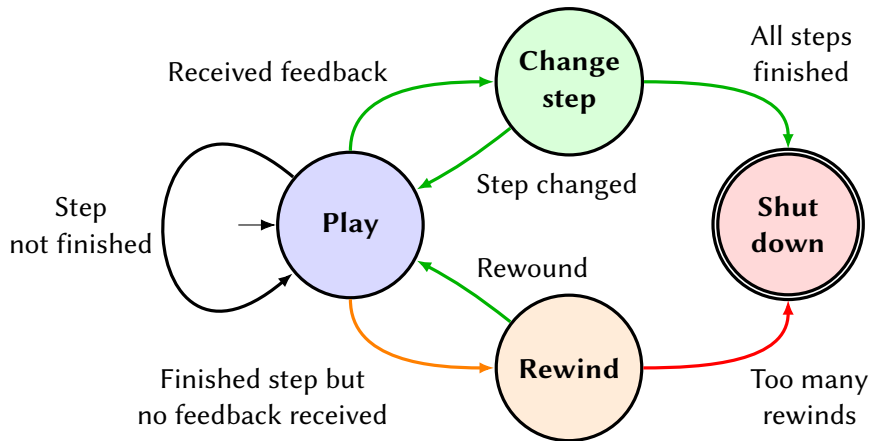
What if we could do away with the human users?

Repeatable, scalable!

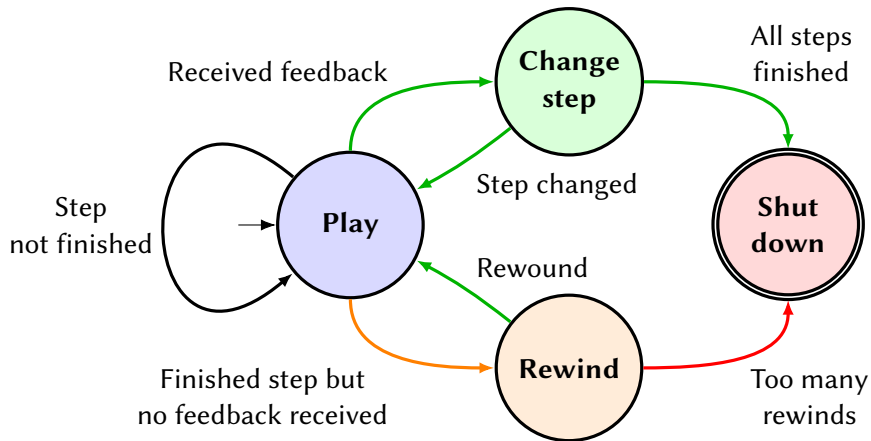
Task-guidance Cognitive Assistance



User Model

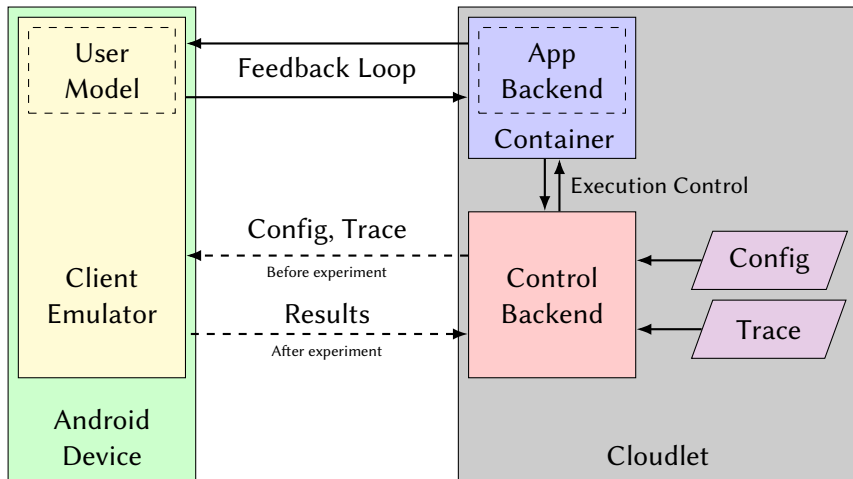


User Model



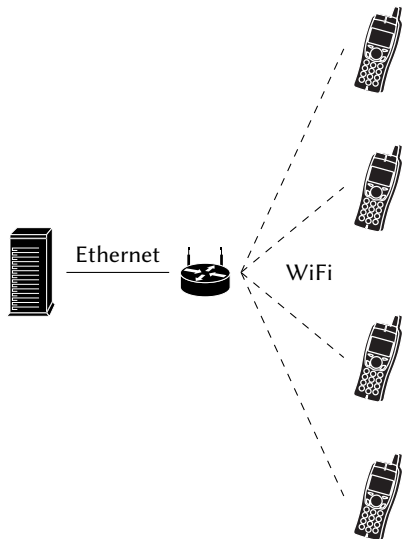
Currently working on a more thorough characterization of human behavior.

Implementation



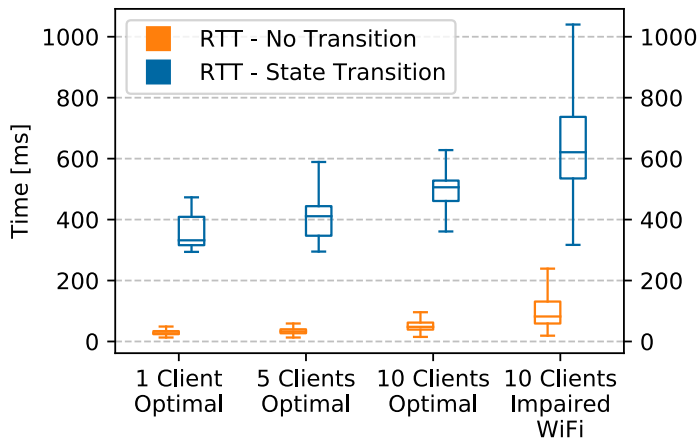
Evaluation

Insert pictures of LEGO Assistant



Results

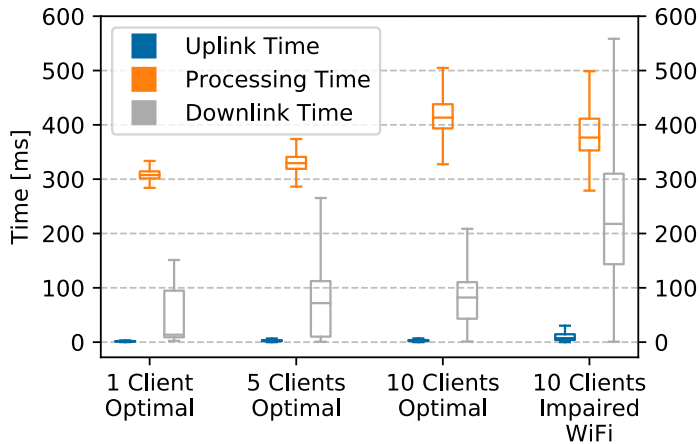
Figure labels



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

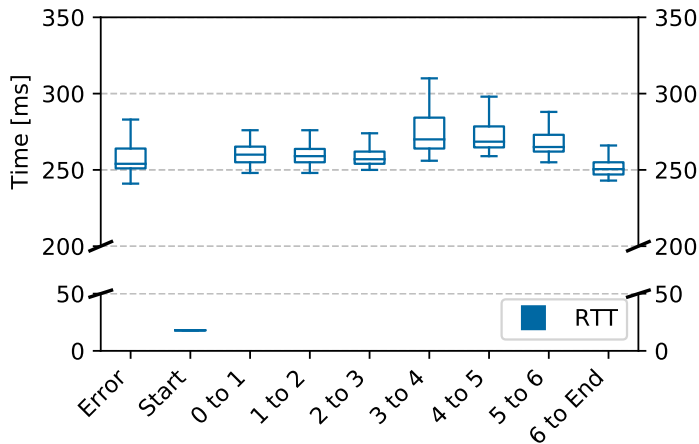
Results

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Results

Figure labels



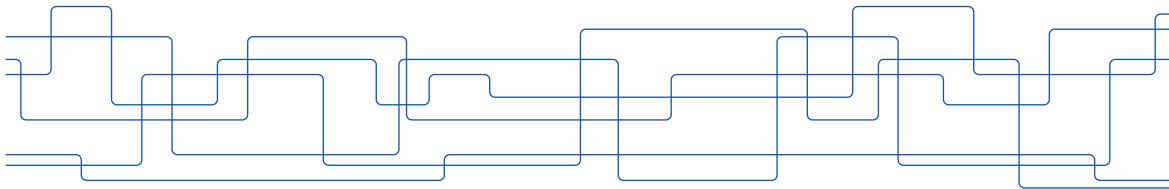
Conclusions

Future Work

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

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.
-

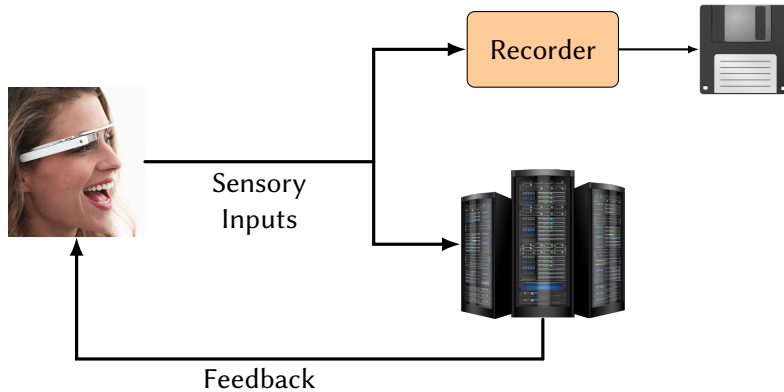


Requirements

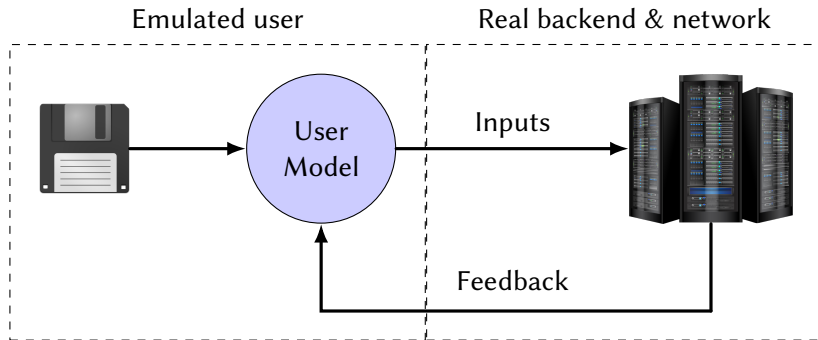
- ▶ Generate realistic, high-dimensional, real-time inputs.
- ▶ Correctly and realistically react to feedback.
- ▶ KPI: Delays.

**Trace of pre-recorded inputs
& a model of user behavior**

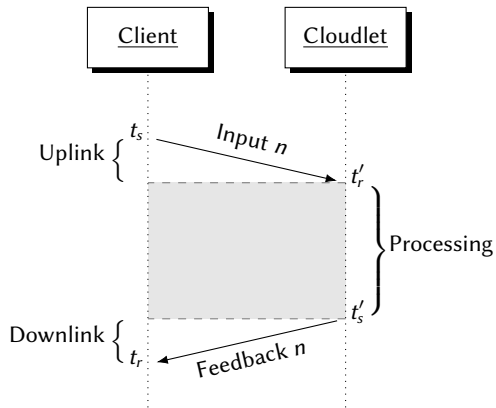
Tracing



Trace Replay



Timestamping



Clocks are synchronized previous to the experiment.

Timestamps at key points to obtain:

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

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

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

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

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