Bridging the controller design-implementation gap for image-based control systems

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1. Image-based Control (IBC)

- IBC systems are a class of data-intensive feedback control systems whose feedback is provided by image-based sensing [1].

2. Controller Design vs Implementation

Control Design Engineer

- Embedded Systems Engineer

- The timing values for the worst-case (WC) workload are used for controller design [2].

- Sensing task is a black box

- Controller design is a black box

3. Bridging The Gap

Can we jointly optimise control performance and platform resource utilisation considering workload variations?

4. Approach

- We propose a structured Scenario- and Platform-Aware Design (SPADe) flow for IBC systems (assuming it is a white box) [1] that:
  1. optimises control performance or quality-of-control (QoC),
  2. maximises effective resource utilisation and
  3. adheres to platform constraints (given allocation and fps).

5. Results & Conclusion

- SPADe maximises effective resource utilisation and improves the settling time for the control system compared to WC design.

- Considering workload variations is definitely beneficial for design.

6. Next Challenges

Extend SPADe approach for:
  1. (reconfigurable) pipelined controller design and implementation;
  2. approximated image processing algorithms; and
  3. communication-aware design for distributed IBC.

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References

