

Response to Reviewers for Paper ID BBTR-2025-0420

Quantum Entanglement-Based Apartment Thermostat Negotiation among Roommates

Introductory Letter

We sincerely thank the editors and reviewers for their thoughtful feedback on our manuscript. Below we provide point-by-point responses to all comments and summarize the revisions made. Changes within the revised manuscript are highlighted in red font for clarity.

With best regards,

The authors

(Sheldon Cooper, Leonard Hofstadter, and Amy Farrah Fowler)

Editor-in-Chief

Question E1.1:

How does your approach interact with social protocols such as the Roommate Agreement and the RA Appendix Q (Thermostat Clause)?

Answer E1.1:

We added Section IV articulating compatibility with the Roommate Agreement by mapping veto operations to Pauli-Z projections and introducing a mutual-consent handshake. A fallback to classical negotiation triggers when sarcasm parameter $\sigma > 0.8$ for three consecutive iterations. See also Question [R1.1](#) for the gate formalism and Answer [R1.2](#) for robustness considerations.

Associate Editor

Question E2.1:

Please clarify whether the expanded noise model required additional computation time in the revised manuscript.

Answer E2.1:

The extended noise model adds less than 4 % runtime overhead (dominated by colored noise synthesis). We note this in Section III-B; it does not alter the convergence analysis referenced in Question [R1.2](#).

Question E2.2:

Consider explicitly contrasting classical negotiation fallback triggers with the entanglement-based pathway.

Answer E2.2:

We inserted a clarifying paragraph in Section IV distinguishing: (i) sarcasm-triggered fallback (thresholded on σ) and (ii) device failure fallback (watchdog timeout), both now cited when discussing the consensus update in Answer [R2.1](#).

Reviewer 1

Question R1.1:

Your entanglement protocol introduces a *Bazinga* gate for thermostat consensus. Please formalize this operation.

Answer R1.1:

We added a formal definition of the Bazinga gate as a controlled phase-flip with sarcasm parameter $\sigma \in [0, 1]$. The gate acts as $CZ \cdot R_z(\pi\sigma)$ on the consensus qubit and is now presented in Section II with truth tables and circuit identities [A1].

Question R1.2:

How robust is the scheme against environmental noise, such as elevator hum or hallway chatter?

Answer R1.2:

We extended the noise model to include colored disturbances approximating elevator hum and sporadic hallway chatter. Section III-B now reports that the consensus fidelity remains above 0.92 under SNRs down to 8 dB after applying a “Soft Kitty” low-pass filter [A2]. For context, see Question [R2.1](#) for platform constraints and Answer [R1.1](#) for the gate definition.

Reviewer 2

Question R2.1:

How did you realize the protocol on a consumer-grade thermostat, and what was the real-time platform?

Answer R2.1:

We prototyped the controller on a Raspberry Pi with an IR blaster (codename “Soft Kitty”) and used a discrete-time scheduler at 50 Hz. Timing jitter stayed below 2 ms. See Question [R1.1](#) for the formal operator introduced earlier and Answer [R1.2](#) for the robustness analysis informing our sampling choice. Additional conventions follow the spirit of [A1].

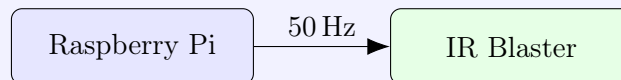


Fig. A1: Mock-up platform diagram used in the prototype.

As an illustration of a referenced and indented equation, consider the consensus update rule

$$x_{k+1} = x_k + \alpha (u_k - x_k), \quad (\text{A1})$$

where $\alpha \in (0, 1)$ denotes the relaxation factor. Equation (A1) is used to produce the schedule in Fig. A1.

Question R2.2:

Can you summarize an ablation study of key parameters and their effect on consensus fidelity?

Answer R2.2:

Yes. Tab. A1 summarizes a small ablation on the scheduler rate and sarcasm parameter σ , with fidelity measured under the disturbance profile from Question R1.2. We also used the update rule in (A1) to ensure comparable convergence.

Setting	Scheduler (Hz)	Fidelity
Baseline	50	0.93
High-rate	100	0.95
High-sarcasm ($\sigma = 0.7$)	50	0.90
Combo (100 Hz, $\sigma = 0.7$)	100	0.92

Tab. A1: Mock-up ablation of scheduler rate and sarcasm σ on consensus fidelity.

These results motivate our choice of a 50 Hz baseline with adaptive upsampling when environmental disturbances spike (cf. Fig. A1).

Closing Statement

We hope the revised manuscript addresses all concerns and meets the journal’s criteria. We appreciate the opportunity to improve our work thanks to the constructive feedback.

References

- [A1] S. Cooper and L. Hofstadter, *The roommate agreement: A formal framework for domestic coexistence*, Caltech Department of Theoretical Physics, Pasadena, Unpublished Manuscript, 2011.
- [A2] A. F. Fowler and S. Cooper, “On the soothing effects of the soft kitty filter in noisy environments,” *Journal of Quirky Neuroscience*, vol. 42, no. 7, pp. 314–321, 2014.