Power Consumption and Scalability of a Millimeter Wave Reconfigurable Intelligent Surface

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Background:

- Future wireless communications systems sacrifice obstacle penetration for speed.
- Reconfigurable intelligent surfaces (RISs) can help by reflecting signals around obstacles and concentrating them at targets.
- This is done by reflecting with different phase shift at different locations, creating an interference pattern with specific maxima (beams).
- The more individual elements are used in the RIS, the more powerful this effect is.
- RISs put less stress on the power grid than other options because they do not produce radio frequency power.

Objective:

- Design and fabricate a motherboard to facilitate scaling of the RIS.
- Determine the power consumption of the RIS.

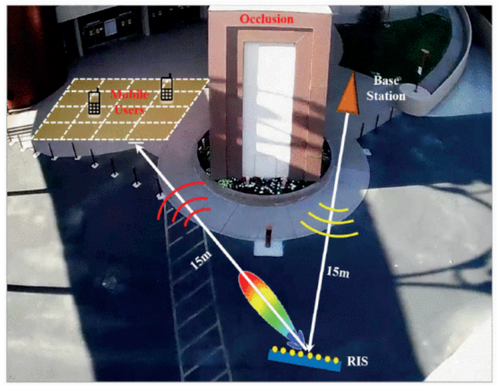

Figure 1:
RIS operation principle†.

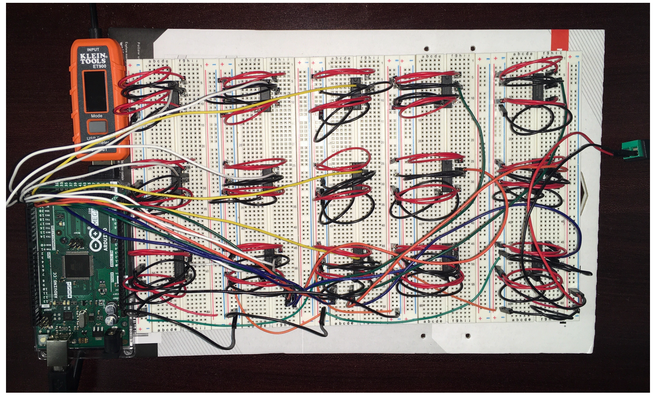

Figure 2: Power consumption test setup.

Results:

- The motherboard has been fabricated (Figure 3a and b), allowing the RIS to be scaled for higher performance.
- Eight micro connectors allow four tiles to be connected to the microcontroller through the motherboard.
- The RIS was modeled on a breadboard to measure power consumption (Fig. 2).
  - Idle microcontroller consumes approximately 0.5 W.

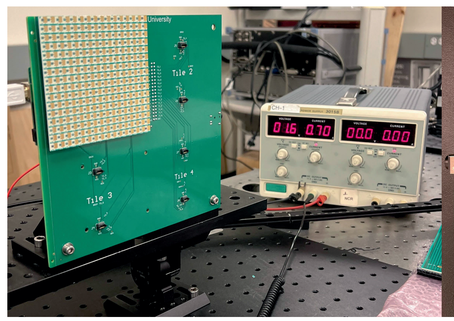

Figure 3a: Motherboard tile side.

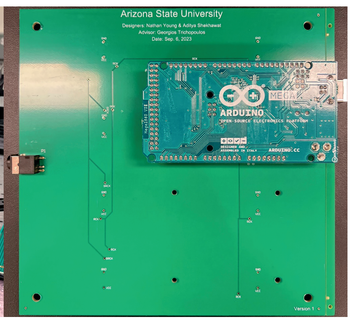

Figure 3b: Motherboard microcontroller side.

† G. C. Trichopoulos et al., "Design and Evaluation of Reconfigurable Intelligent Surfaces in Real-World Environment," in IEEE Open Journal of the Communications Society, vol. 3, pp. 462-474, 2022, doi: 10.1109/OJCOMS.2022.3158310.

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