FlexVAA: A Flexible, Passive Van Atta Retroreflector for Roadside Infrastructure Tagging and Identification

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FlexVAA: Objective and Challenges

Objective

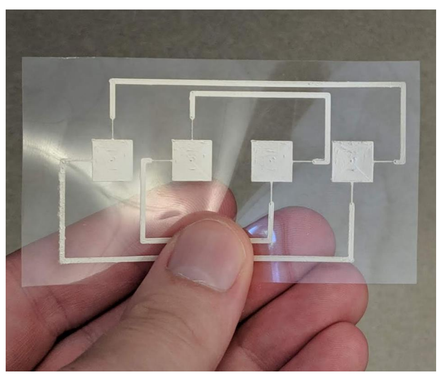
- To produce **flexible, passive wireless retroreflectors** that can be attached to any surface to help autonomous systems recognize roadside infrastructure**.**

Motivation

- How can we enhance existing retroreflective tags to be fully passive without impairing existing operations?

Challenges

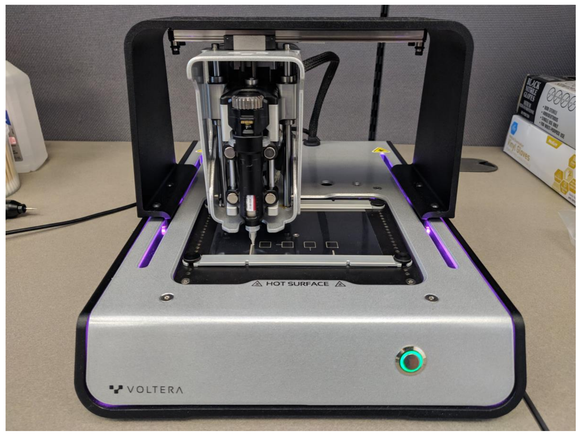
- Existing solutions typically rely on an active element or rigid PCB-based surfaces.
- Existing infrastructure often requires modification to implement these solutions.



Van Atta Array Design

Van Atta Array to re-radiate incident energy

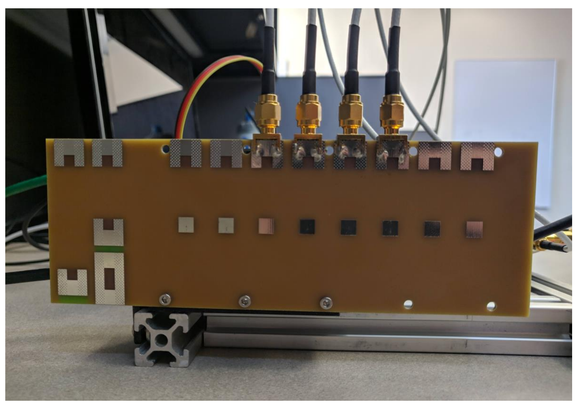
- Van Atta Arrays are phased-array designs that re-radiate energy back in the direction of the signal source.
- FlexVAA can be manufactured out of a single layer of conductive ink, using a Commercial-Of-The-Shelf (COTS) printing process. This allows for speedier and lower-cost manufacturing compared to traditional PCB manufacturing.

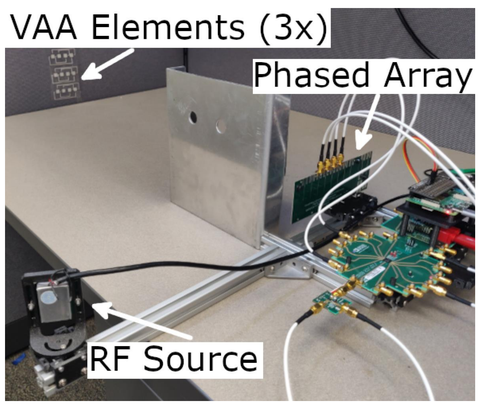


10.5 GHz Phased-Array Transceiver

Design of transceiver to test FlexVAA tags

- A phased-array antenna attached to a digital beamformer, receiving re-radiated energy from the FlexVAA elements attached to a surface.





- Raspberry Pi receives data from the beamformer and processes it.

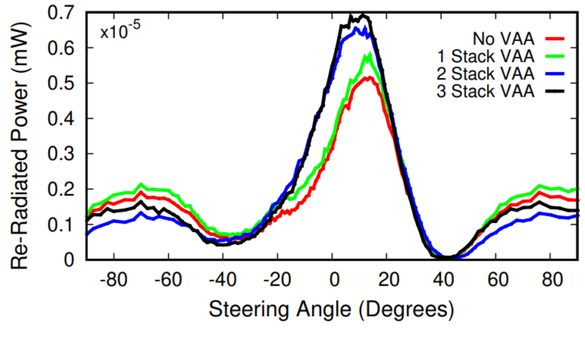
Preliminary Results and Conclusion

Reflected power

- FlexVAA results show that vertically stacking three tags yields a 1.27 dB increase in received signal strength versus a flat wall.

Conclusion

- FlexVAA tags successfully re-radiate incident power.
- Functional tags can be produced with a COTS printing process.
- Further improvements may increase FlexVAA tag performance.



Future works

- Refine the printing process for better, more consistent tag performance.
- Experiment embedding data into reflected FlexVAA signal to differentiate between multiple tags and identify different road signs.