High capacity millimeter wave sensing for quasi-real-time imaging
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Abstract

- Current checkpoints are unable to keep up with the number of air travelers through security screening
- New standoff threat detection mechanisms can solve this problem such as millimeter waves
- New innovations in the field such as compressive sensing and metamaterials can increase the probability of detection of threats
- This work highlights the development of these technologies into a quasi-real-time 3D imaging system

Background

Current Checkpoint
- Millimeter wave scanning detector capable of ~300 people per hour
- Significant passenger divesture and re-collection
- Threat detection is not automated
- No cooperation amongst the different technologies used

Future Checkpoint
- Screening of 300+ passengers and carry-on belongings
- Passengers walk at a normal pace through checkpoint
- No divesture of clothing or removal of electronics from carry-on

Data and Analysis

Figure 1. Millimeter wave Imaging System
Figure 2. Current Checkpoint
Figure 3. Future Checkpoint
Figure 4. TSA Screeners
Figure 5. Custom DAQ Interface
Figure 6. Custom Switching Controller
Figure 7. Switch Data Collection
Figure 8. Illustration of the proposed MMA-based compressive reflector antenna (CRA)
Figure 9. Fabricated Meander-line MMA
Figure 10. Imaging Geometry
Figure 11. 3D Imaging with Kinect Overlay
Figure 12. Static Imaging of Plate
Figure 13. High capacity array of CRAs
Figure 14. Design parameters of a Single CRA
Figure 15. Reconstructed image
Figure 16. Singular value distribution
Figure 17. Sensing capacity
Figure 18. Multi-coded sensing system

Conclusion

- Baseline work to perform static imaging has been performed
- Future work will include improving this imaging by using high capacity multi-coded compressive sensing system

References


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