

Centimeter-scale Positioning of Passive UHF RFIDs:

A Novel Reader Technology and its Applications to Robotics & Retail

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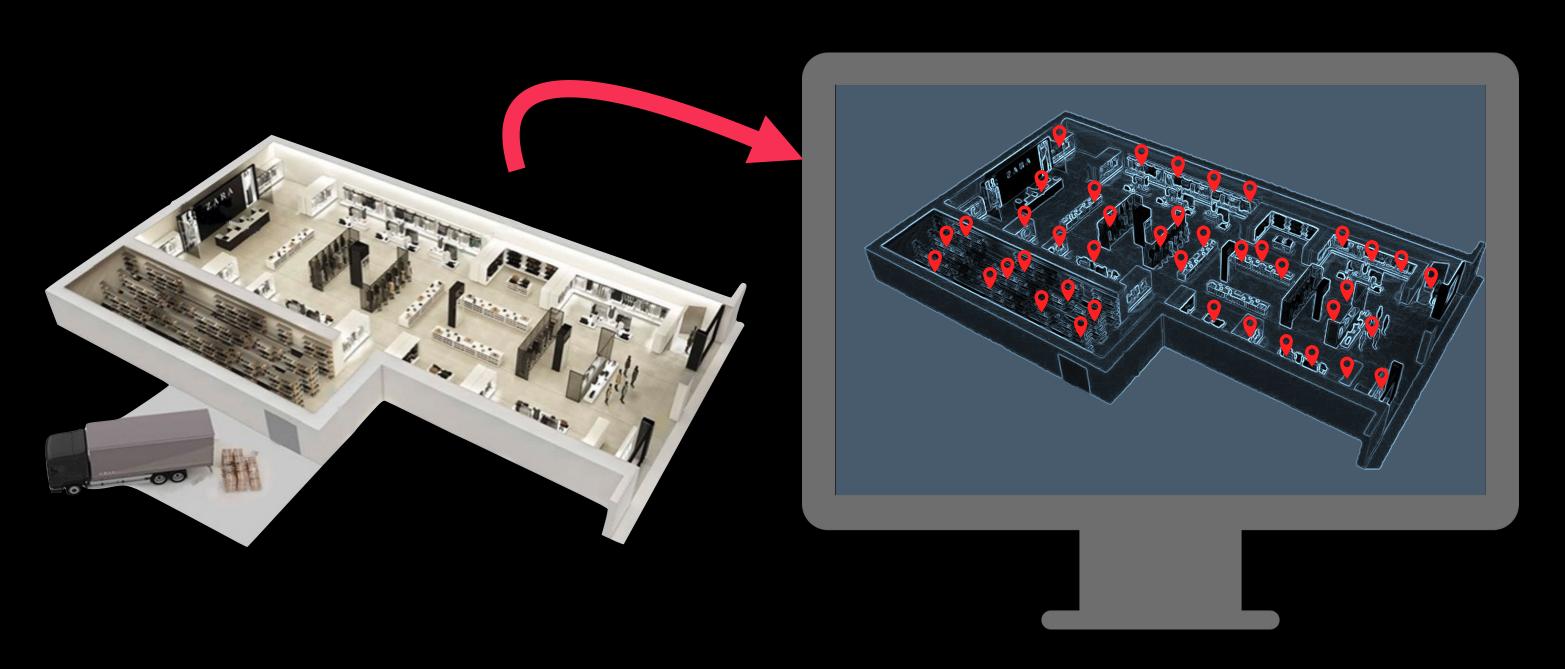


Significant Interest in Digital Twins



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Full item-level visibility

→ optimize processes, boost efficiency/utilization, & reduce costs

Can we reuse billions of already-deployed passive UHF RFID tags to create digital twins?

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Batteryless RFID



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Standard Reader



Batteryless RFID

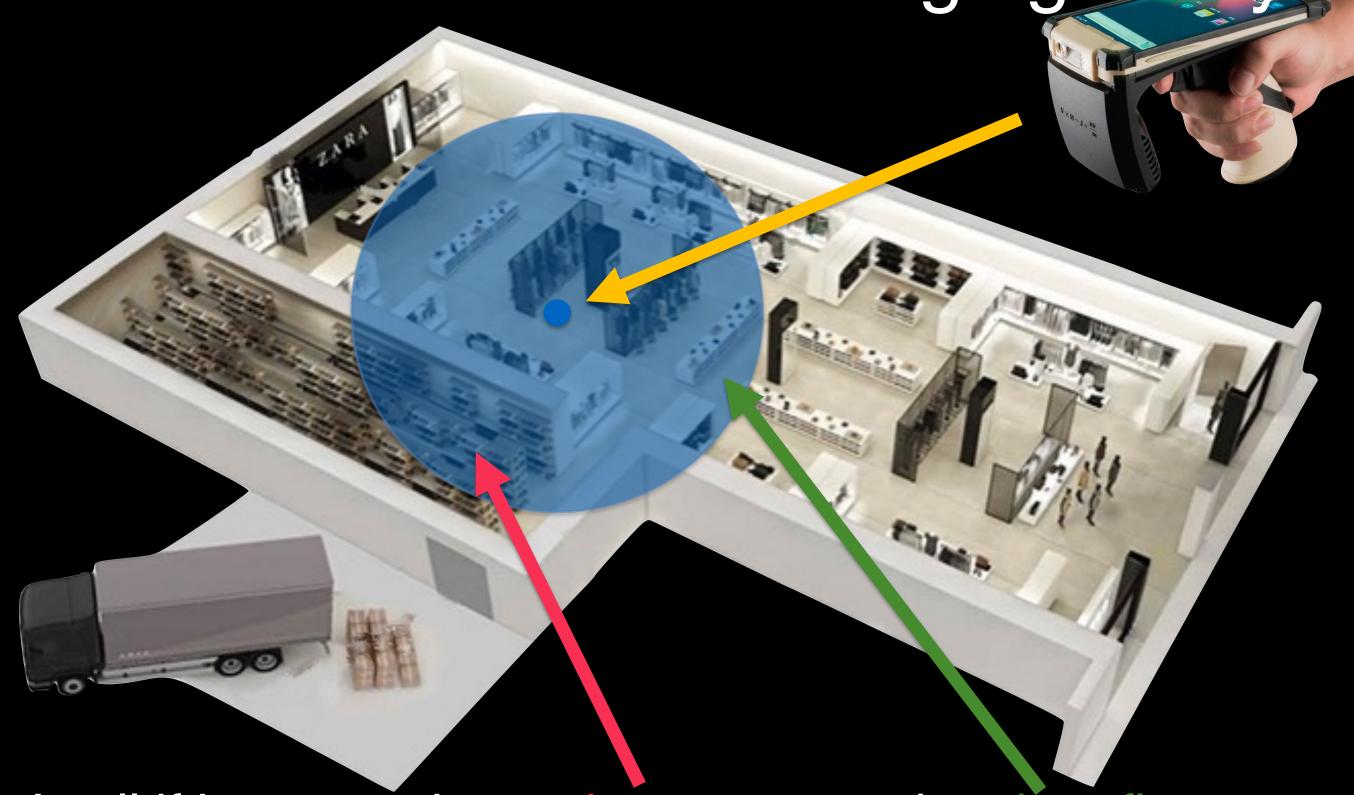


Reply to wireless reader with a unique identifier

But today's reader cannot locate tags

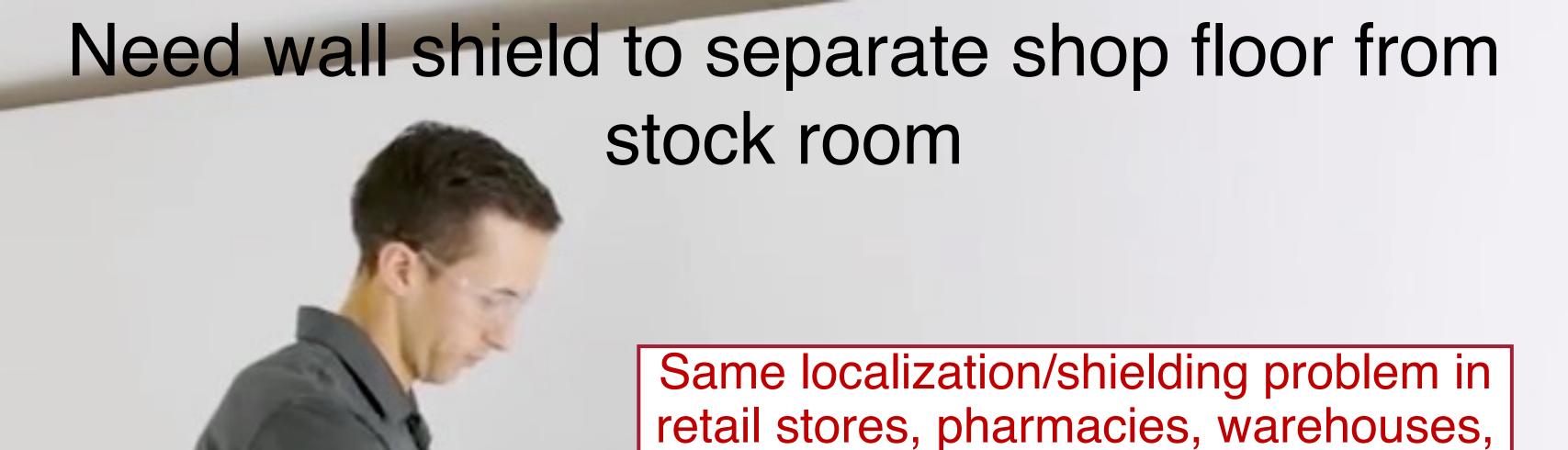
(with good accuracy, robustness, or cost-effectiveness)

RFID localization is challenging today



Can't tell if items are in stock room or on the shop floor

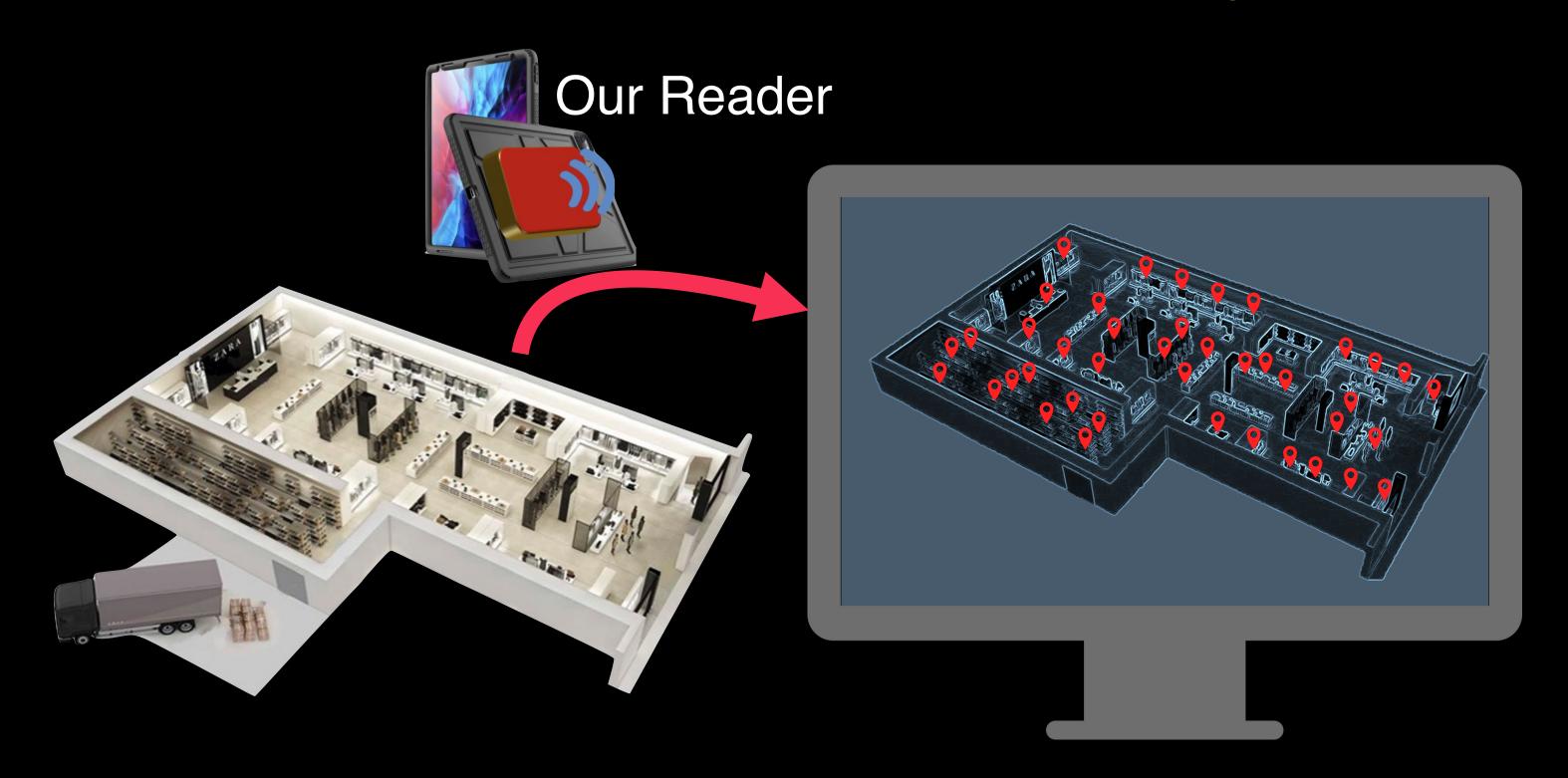
Need wall shield to separate shop floor from stock room

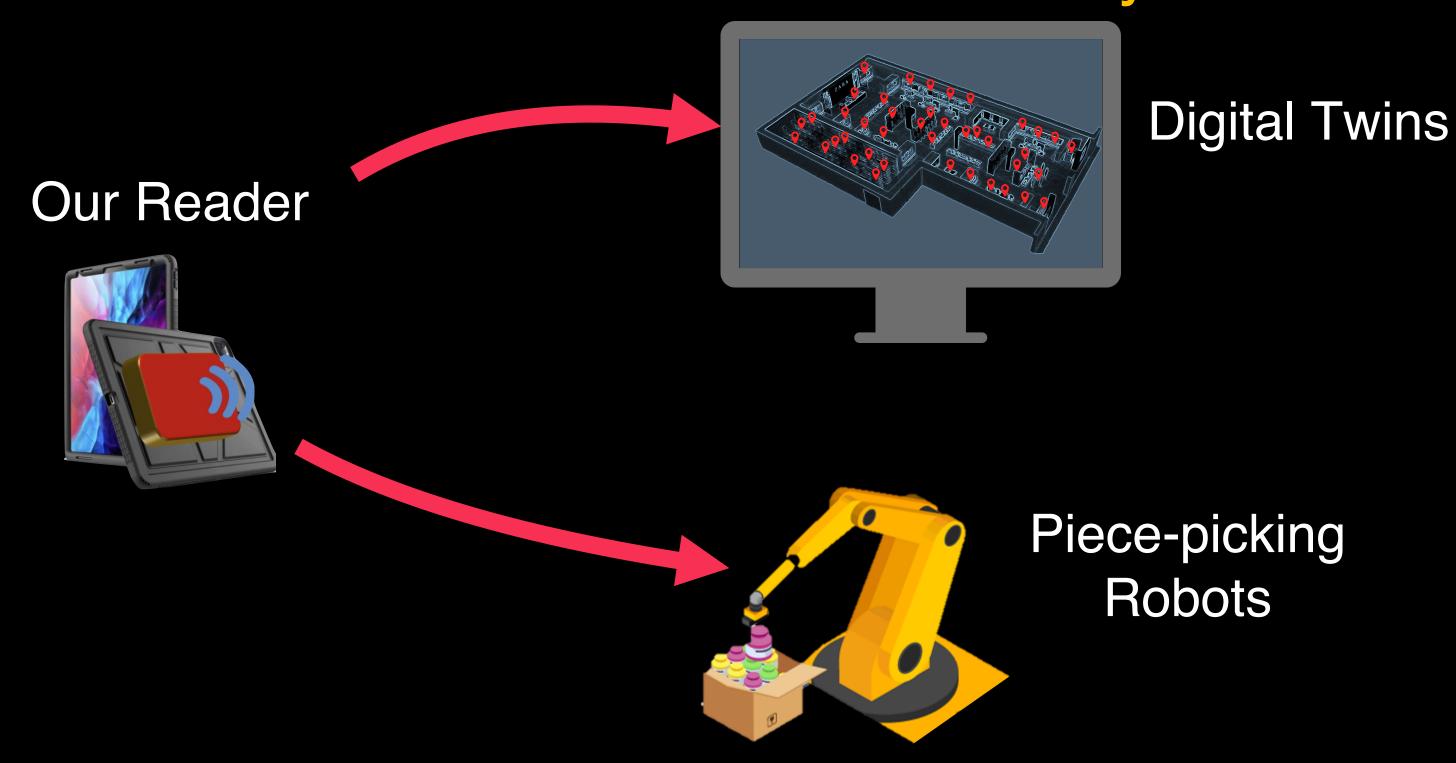


source: Avery Dennison

manufacturing plants...

without wall shielding
without hardware modification to the tags
without an extensive infrastructure





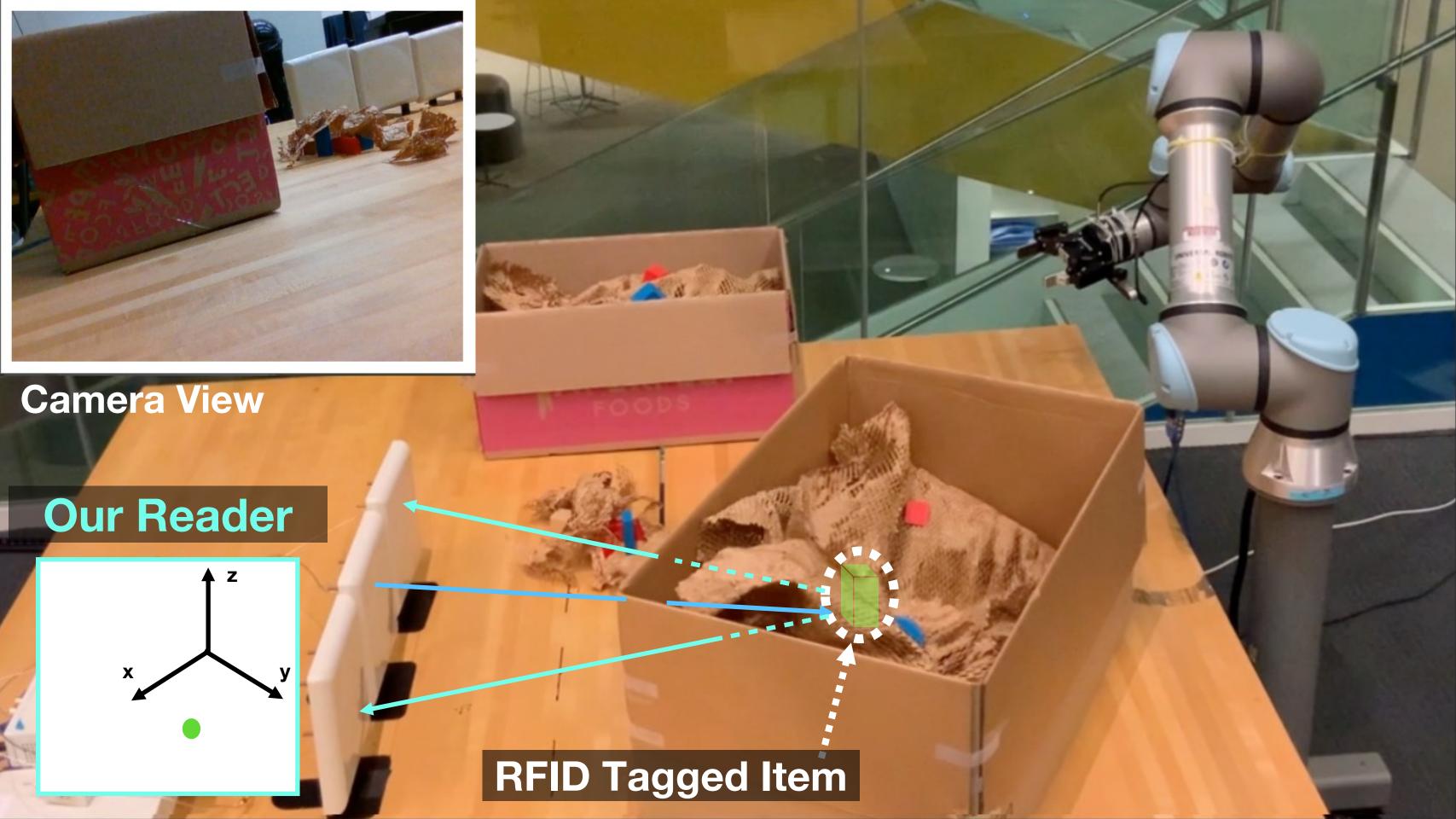
Piece-picking Robots



Consider a robot that need to retrieve a desired item

Fulfillment, processing returns, etc.

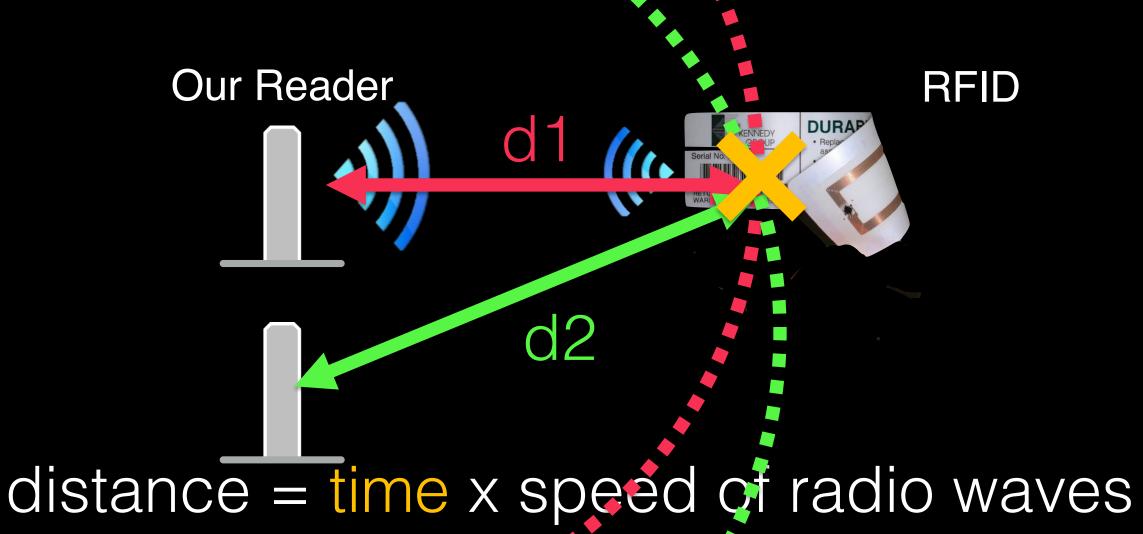






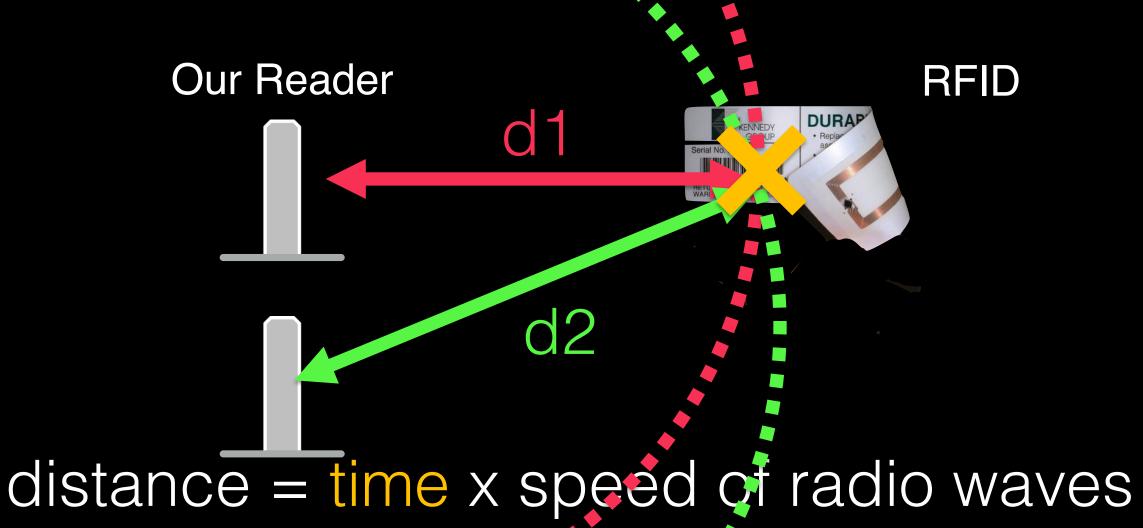
How does our reader locate RFIDs?

By measuring the time-of-flight: the time it takes the radio signal to the travel from the reader to the RFID and back



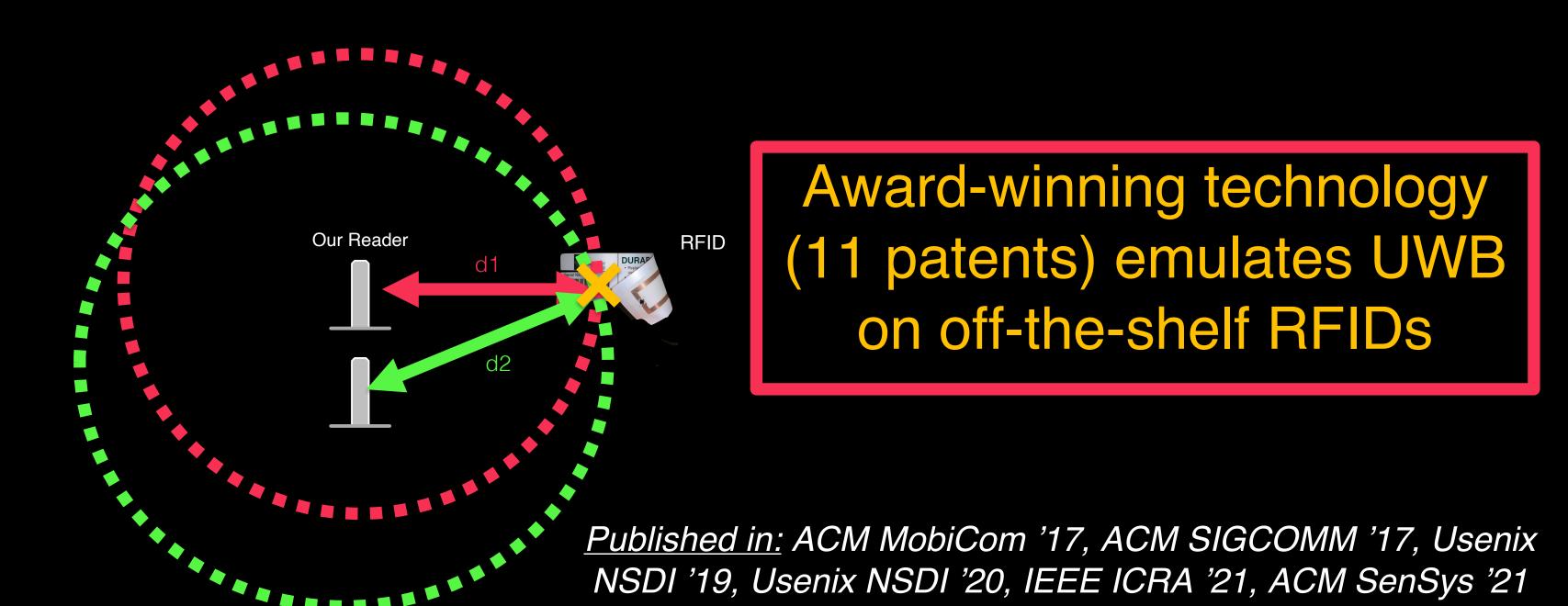
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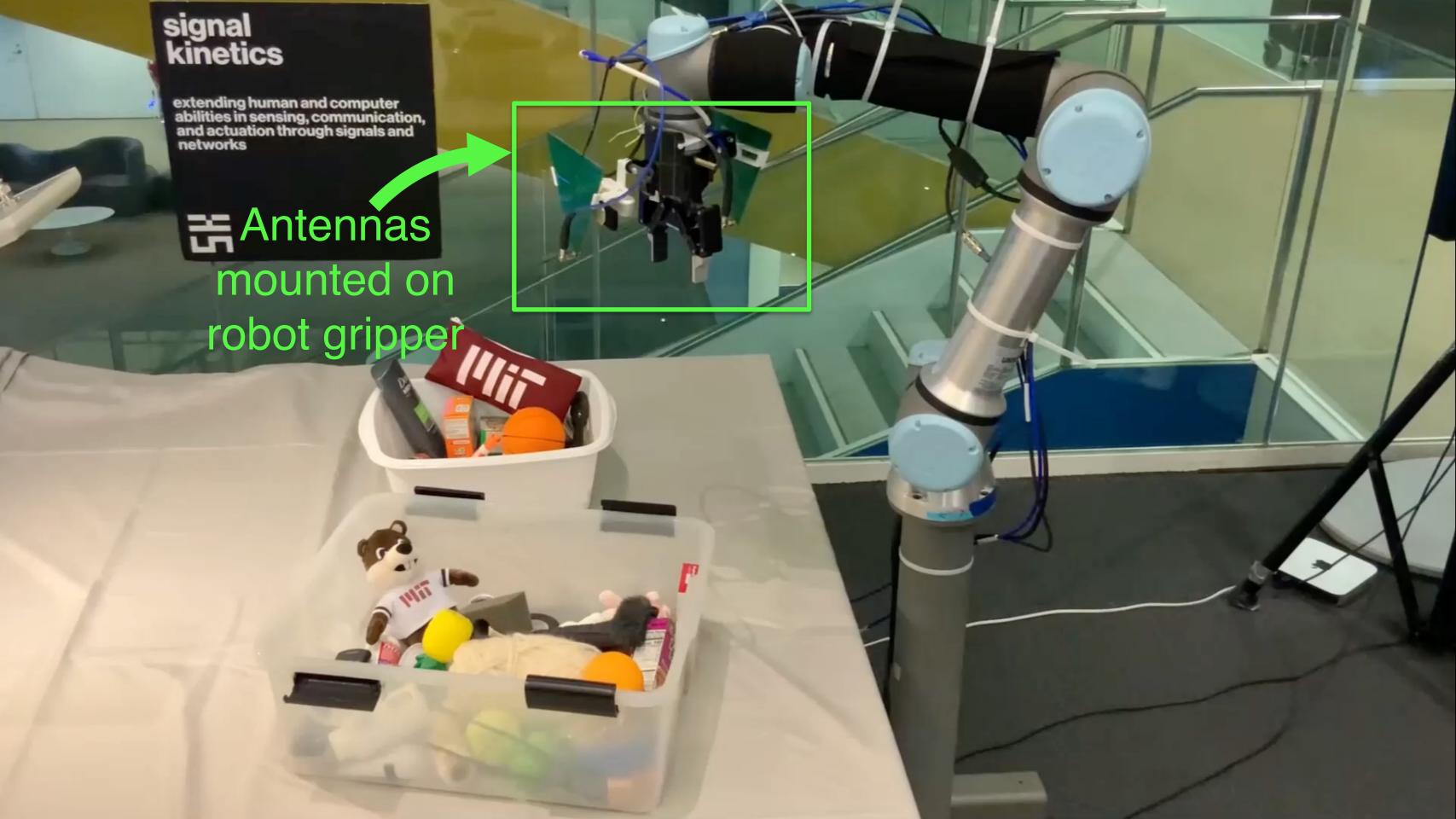


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From stationary to mobile localization





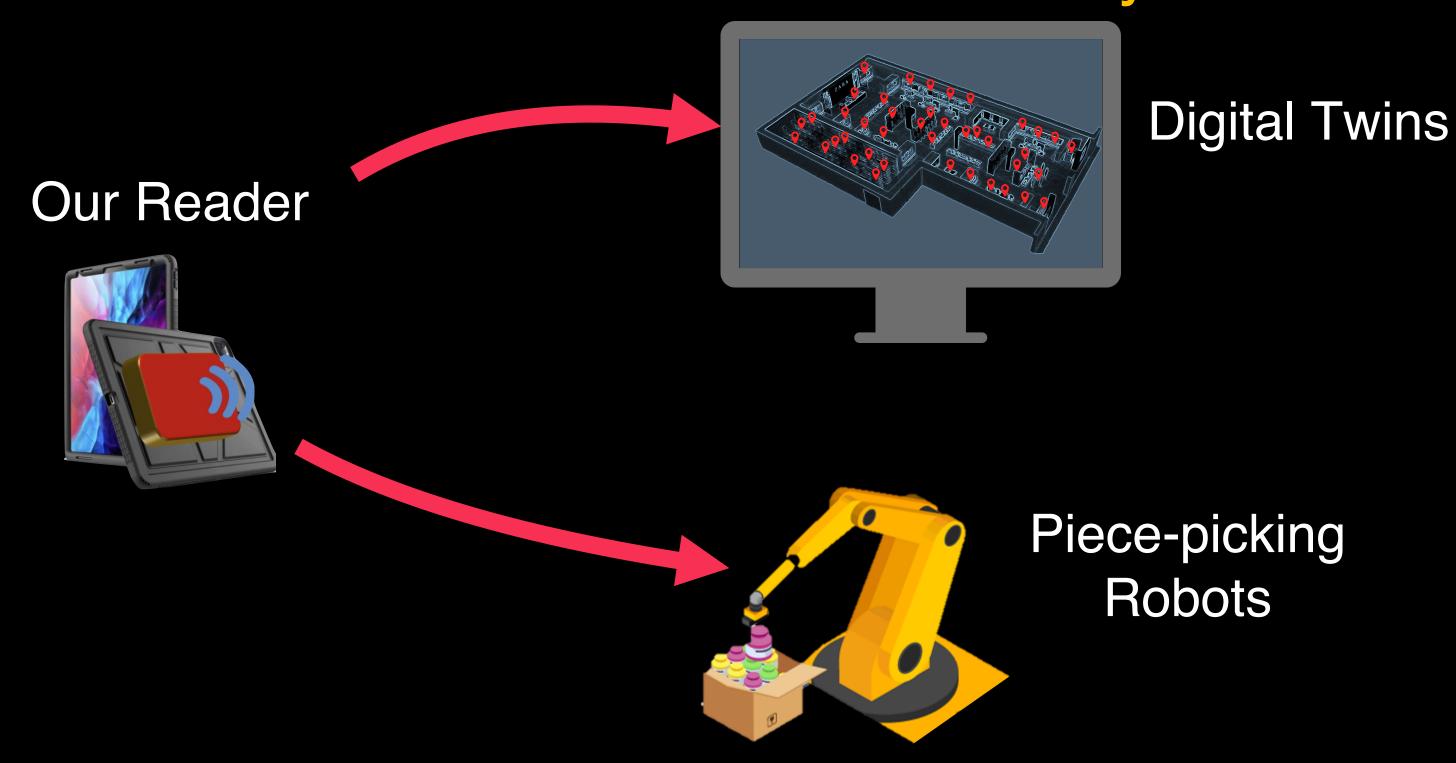


Piece-picking Robots

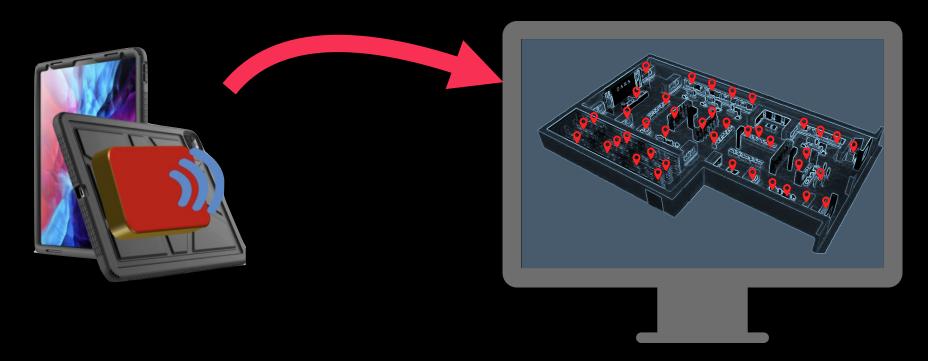


Consider a robot that need to retrieve a desired item

Fulfillment, processing returns, putwall, etc.



Digital twins cut costs & enable new services in retail



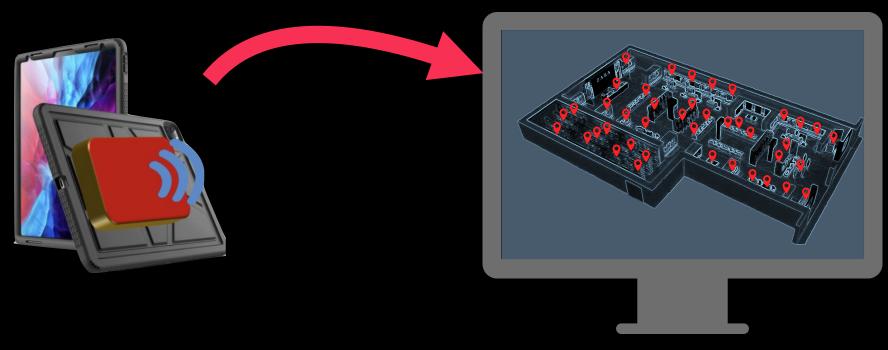
Item-level location tracking can speed up in-store operations by 5x

Retrieval & Putaway (60-80% of total labor)

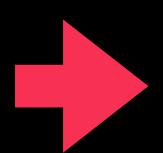
- Stockroom customer order
- Preparing BOPIS orders
- Managing misplaced items
- Replenishing shop floor

- Processing inbound shipments (less sorting)
- Processing returns
- Changing layout (fast fashion)

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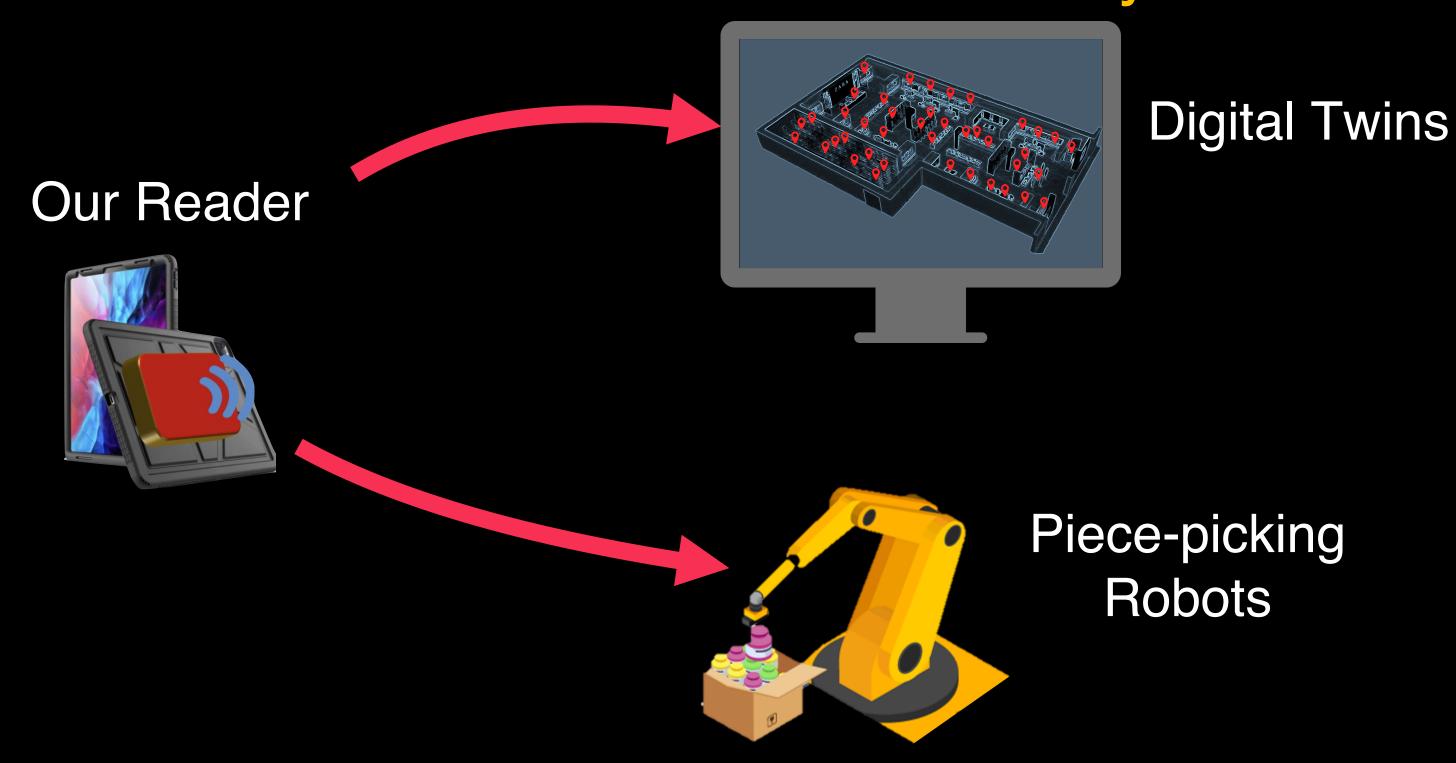
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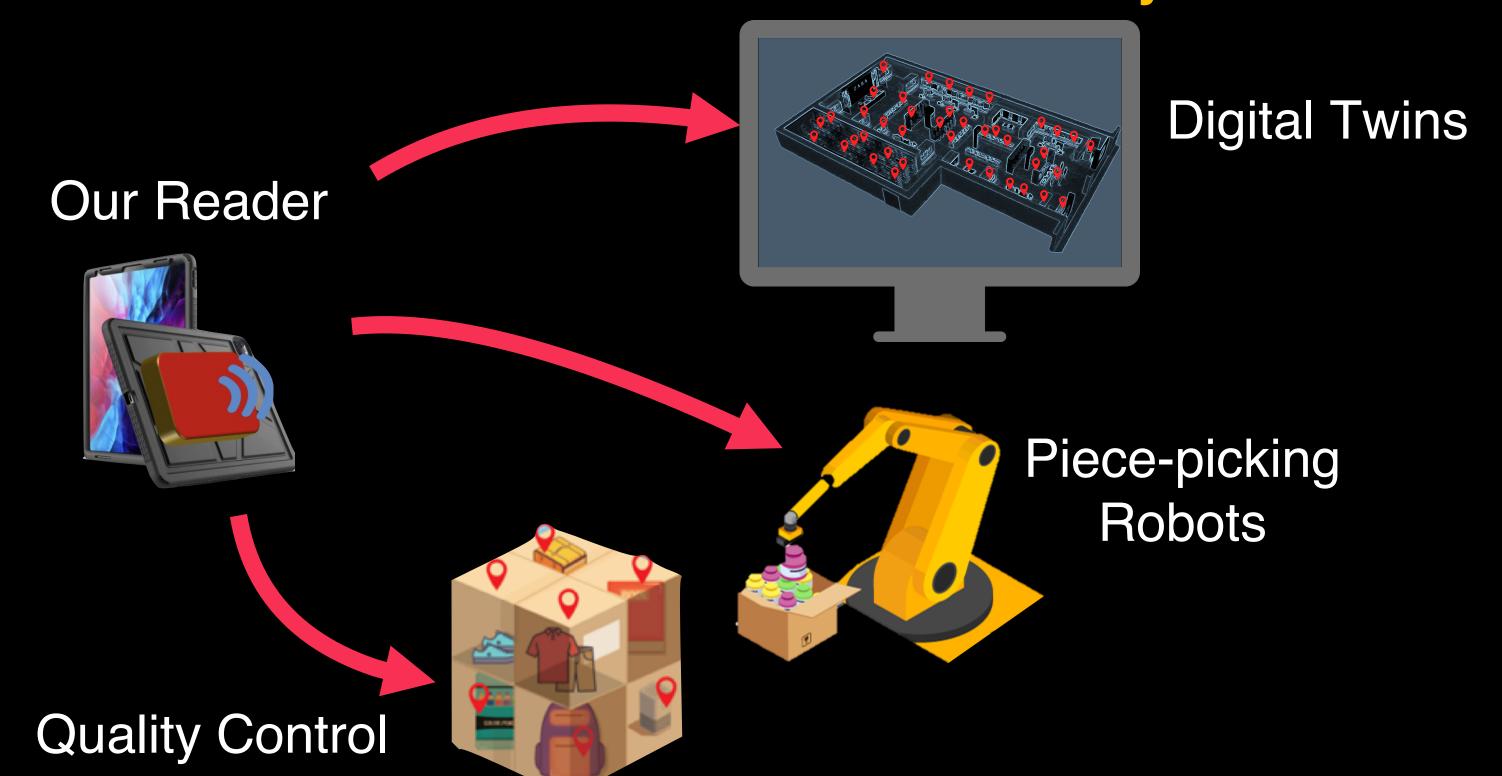


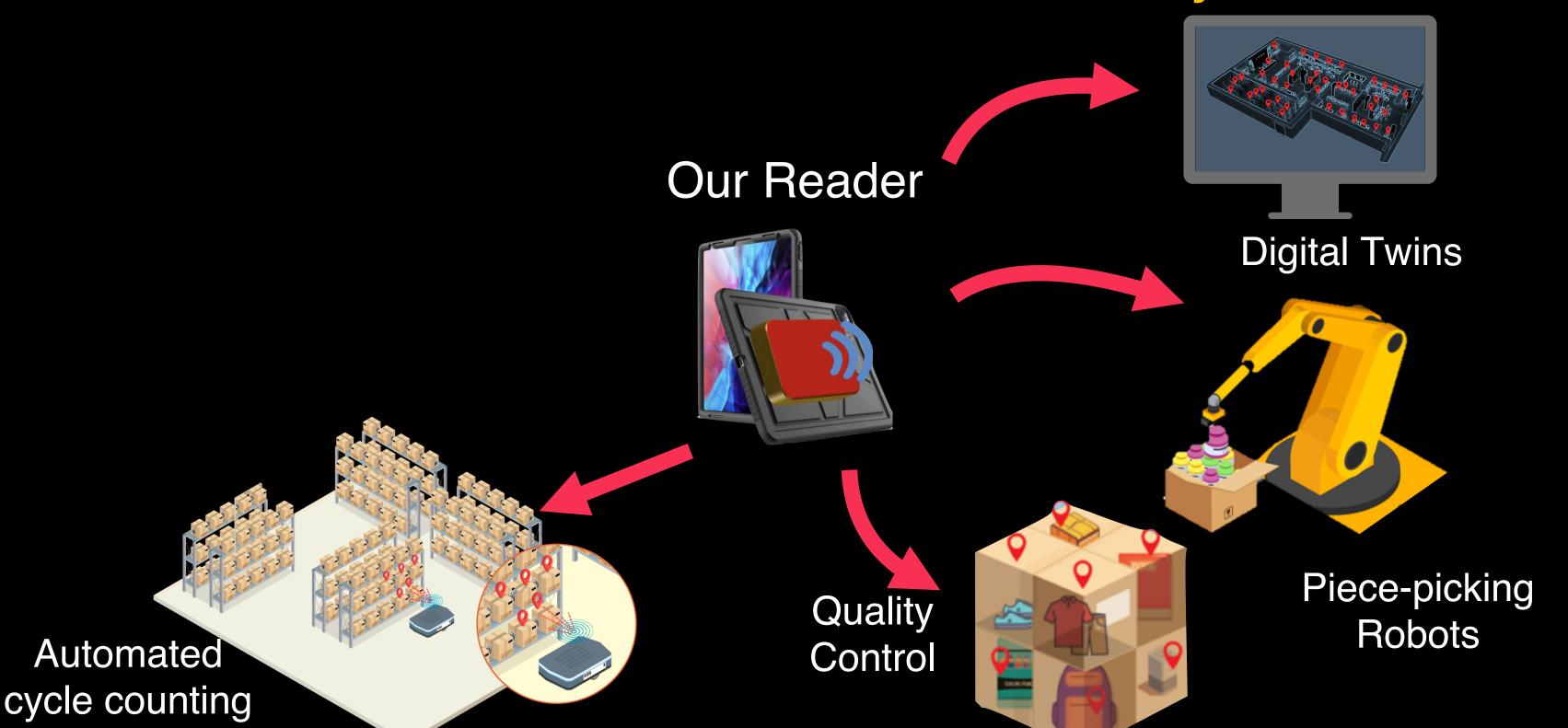
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Business Benefits

- Support BOPIS
- Omnichannel fulfillment
- Same-day delivery
- Resilience to labor fluctuations
- Faster training
- More accurate inventory







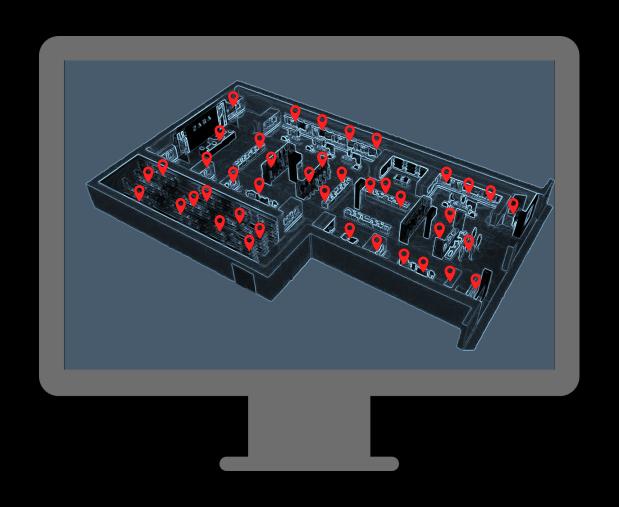






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