AGORA: Future of Embedded Retail Technology

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Product location in retail

Planograms and their purpose

- Stores track product placement and inventory via 2D/3D planograms, detailing every product's physical location
  - Helps the store manager and clerks know where a misplaced item should actually be located
  - Valuable tool for making marketing decisions in connection to the product placement in the store
- Appropriate layout of the product placement can enhance
  - Shoppers' visual experience and satisfaction
 - Store's evenue and promotions of brands and products

Problem with Current Planograms

- Planograms become obsolete due to several reasons
  - Restocking, new products, seasonal changes
- Today's planogram construction is manual
  - Stores employ clerks for manual daily walk-though and inventorying, on a shelf-by-shelf basis
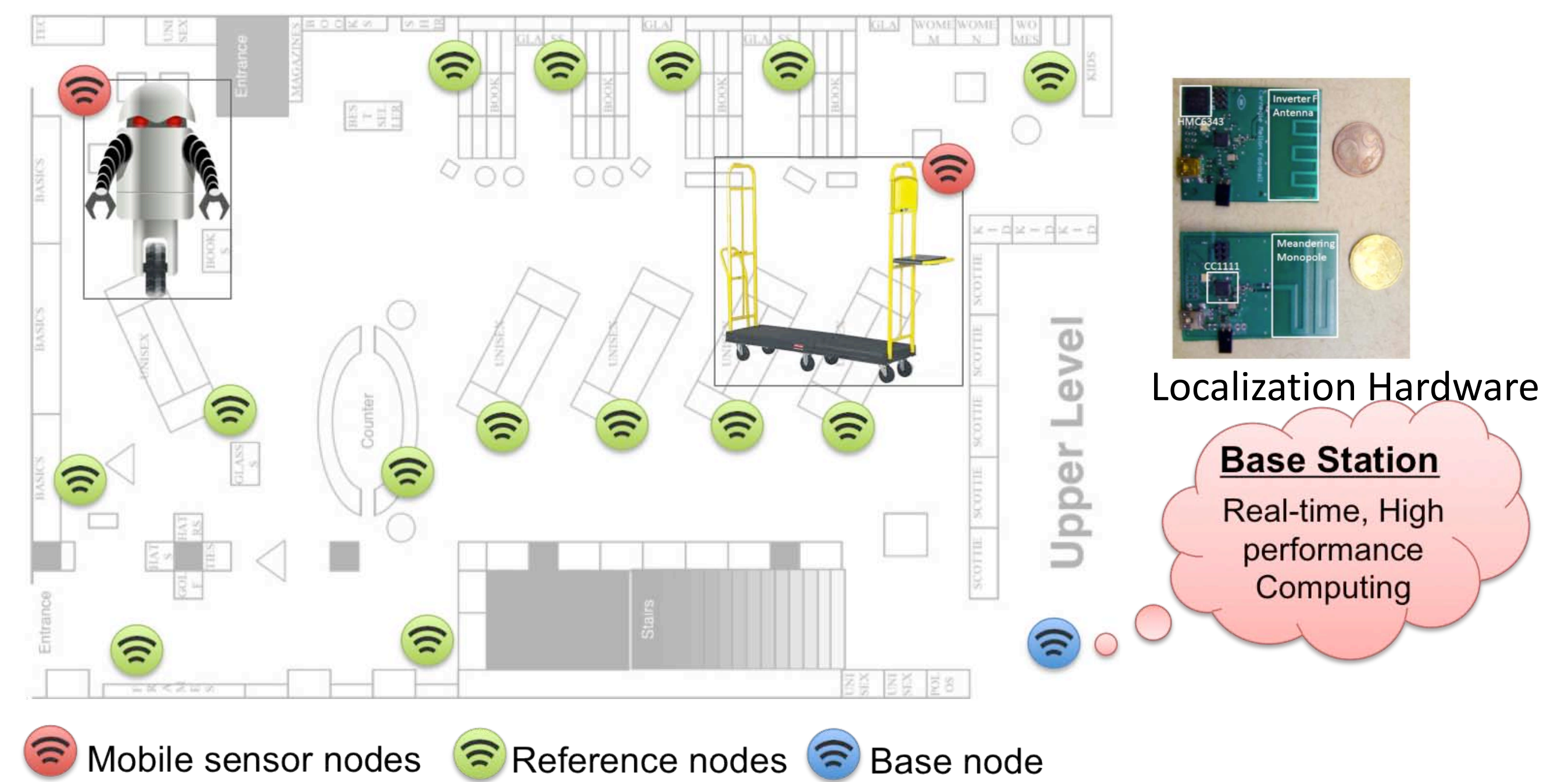 - Time-consuming, error-prone

Automated planogram construction

- Retail-centric robot equipped with
  - Sensors for product identification, precise in-store localization, in-store navigation
- Deployment of the technology via a pilot at the **CMU Store**
- Integration with the CMU Store's mobile app (for customers to discover product locations on their own)
- Generation and maintenance of planograms in real-time
- Queryable planogram (by store staff and shoppers)
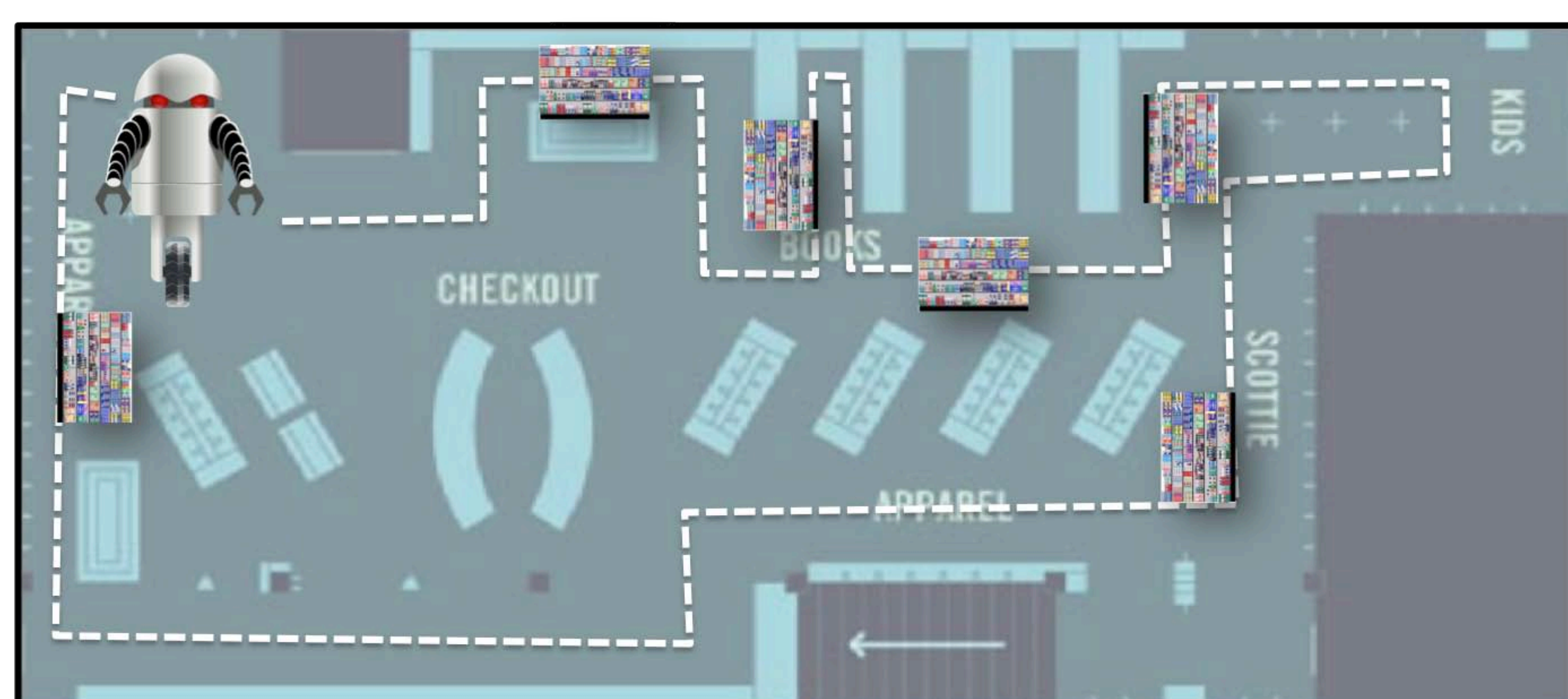
In-store localization

- Previously developed high-precision localization algorithms for tracking game-time assets in football
- Three types of nodes
  - Mobile sensor nodes (MSN) on robots and restocking carts
  - Reference nodes in areas of interest (aisles, aisle-gaps, aisle end-caps, strategically located shelves)
  - One or more base nodes that act as a data aggregator

Localization Hardware

Base Station
Real-time, High performance Computing

🔴 Mobile sensor nodes   🟢 Reference nodes   🔵 Base node

- MSN incorporates 3-axis orientation/acceleration sensing and communicates sensed values to a neighboring reference node, which forwards the data to a base node
- Base node sends the data to a base station
- Base station integrated with a back-end cloud platform

Big-data cloud processing/storage

- Back-end cloud platform for storage and processing of
  - Product information, barcodes, images of products
  - Shopper behavioral patterns, traffic patterns in stores
  - Planogram "stitching" in real-time
  - Associative "upsell" of related products
- Large number of overlapping images of shelves and aisles using pan-tilt calibrated cameras on the robot
- Synergistic combination of on-board **embedded** data-processing along with back-end **cloud** processing

Visual interaction with planogram

Camera
- Gesture
- Emotional
- Eye-tracking
- Interaction

Screen
- retail environment navigation

Intel Signage

Cloud Computing
- Retail centric robot navigation (offline)
- Panoramic retail navigational environment construction (offline)
- Gesture recognition and interaction (real-time)
- Smartphone-Signage Interactions (real-time)
- Store Item data-base (offline)
- Shopper's experience collection (real-time)