SGM 1/28

Needfinding

- Visited IKEA and Costco, and talked to employees about their inventory procedures
- Inventory arrives on trucks, item barcodes are scanned to verify counts. Pallets are put onto shelves using forklifts outside of store hours.
- Inventory taken every week (IKEA) or 2x a year (Costco) by pairs of people manually counting items. **Benefit of drones**: Huge potential savings (not paying 100s of workers overtime to work overnight)
- **Potential problems for drones**
  - Barcodes not visible, multiple barcodes per item, or handwritten barcodes
  - Shelves may have uneven heights
  - Different items on a single pallet
- **Common issue encountered by retail stores**: Customers move and misplace items, making stock counts/locations inaccurate
- **Pain point**: Inventory counts in the system are not always up to date, especially during store hours, when customers can move items. Faster fix is needed for when customer requests a missing item.
- **Insight**: “Retail” stores/warehouses are less structured and prone to error due to customers as compared to “storage” warehouses. Each type of warehouse has its unique needs.

Benchmarking

Inventory Stock Taking

- Counting of on-hand inventory often by hand
- Mostly periodic as required for auditing or verification
- Warehouses: forklifts, barcode scanners
- Goal: **moving from a periodic inventory model to a continuous inventory model**

Relevant Systems

- **InventAIRy** and **DroneScan**: automated mapping of warehouse environment and inventory identification via barcodes
- RFID reading drones for steel yards
- **Kiva Systems (Amazon Robotics)**
- Others

Software Market

- Warehouse Management Systems (WMS) market breaks down into four types of vendors
  - Application megasuite
  - Supply chain management suite
  - Specialists
  - Independent components
- **SAP Extended Warehouse Management**
  - Inventory tracking and management module

Liaison Lunch

Overview of SAP

- Customers include Coca Cola, Nestle, Ikea, etc.

Settings for inventory management

- Storage warehouses
- Retail
- Ports

Logistics

- Philip & Karsten will help look for customers so we have playground to test our drone
- Buy first drone ourselves

Resources

- Aaron Williams, lead expert developer at the d. shop
- Karthik, computer vision & ML expert
- SAP Innovation Center

Trajectory of project

- Drone path planning and development
- Analysis of footage gathered by drone (computer vision)
- Inventory management system

Drone Research

- Narrowed down to Parrot, DJI, 3DR due to SDK requirement
- 3DR outside of budget constraints, nearing 2000 dollars

Parrot

- Pros
  - Resistant to crashes
  - Cheapest
  - SAP has used Parrots before (and has some we could use?)
- Cons
  - Low picture Quality
  - Low range (100m)
  - Can’t navigate obstructed area

DJI

- Pros
  - 3.2 mile range
  - HD camera
  - Supports payload
- Cons
  - More expensive, $1,200ish
  - Danger in close quarters
  - Payload appx 200g

Next Steps

- Trajectory of project consists of 3 main areas of development
    - Drone path planning and development (may have to modify base hardware system and integrate open source flight control systems)
    - Analysis of footage gathered by drone (computer vision)
    - Inventory management system
- Visit storage warehouse
    - Goal is to determine our target environment
    - This will partially depend on Philip and Karsten’s contacts
- Purchase a drone
    - Phantom, price range ~$800

Questions

- Is there a hardware lab/electronics tools we can have access to in the loft? Or, a EE lab?
- As we look to brainstorm, at what level should we approach the problem space? Should we ideate exclusively under the constraints of drones in the warehouse setting?
- We are currently approaching the project with the goal of providing a proof of concept. For the VC pitch, should we present business value under the assumption that the drone solution is viable/feasible?
- If we don’t hear back from liaisons, do you have ideas on storage warehouses that we may be able to visit?

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