

Target SmartCart MVP

Leading the Future of In-store Analytics

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Stanford – Target Product Management Partnership, 2018



Team Members



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Mentors and Corporate Partners



Fred Gibbons
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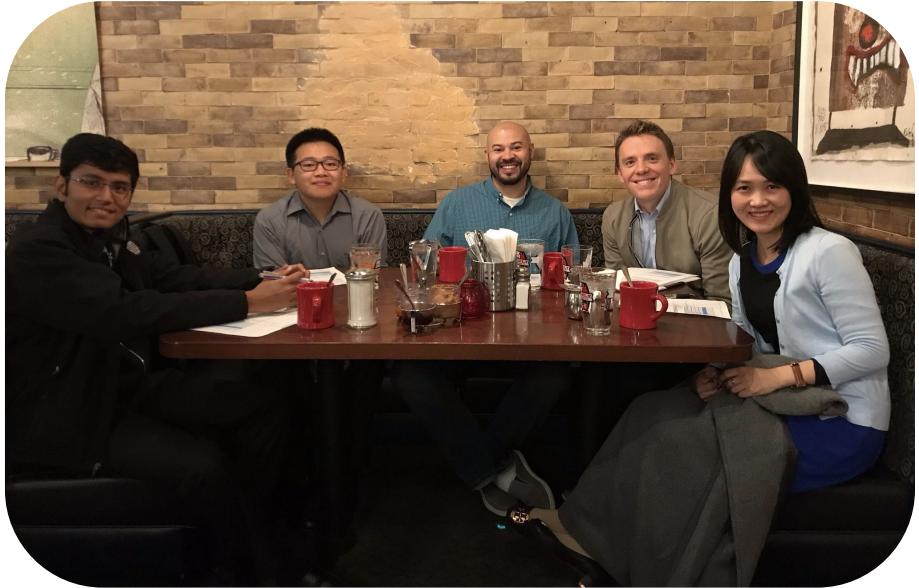


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Corporate Partner
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Manager

Corporate Visits



Minneapolis, MN
Oct. 12-14, 2018

Stanford University

Part I

MARKET RESEARCH



Market Research

Target Corporation

- Marketing Directors
- GXC Principal Engineer
- Teams in Media Strategy, Account Management, etc.

Computational

- TMN
- EDABI/HPC
- Cartwheel
- External Analytics Providers

Vendors

- Pepsi
- Clorox
- Unilever
- SC Johnson

Target Stores

- Store managers (2)
- Employees (7)
- In-store shoppers (23)

Customer Job to be Done

Value Proposition

- In-store customer insights
- Currently 7% of CPG's marketing budget spent on analytics
- Expect to grow to 11%

Online Analytics

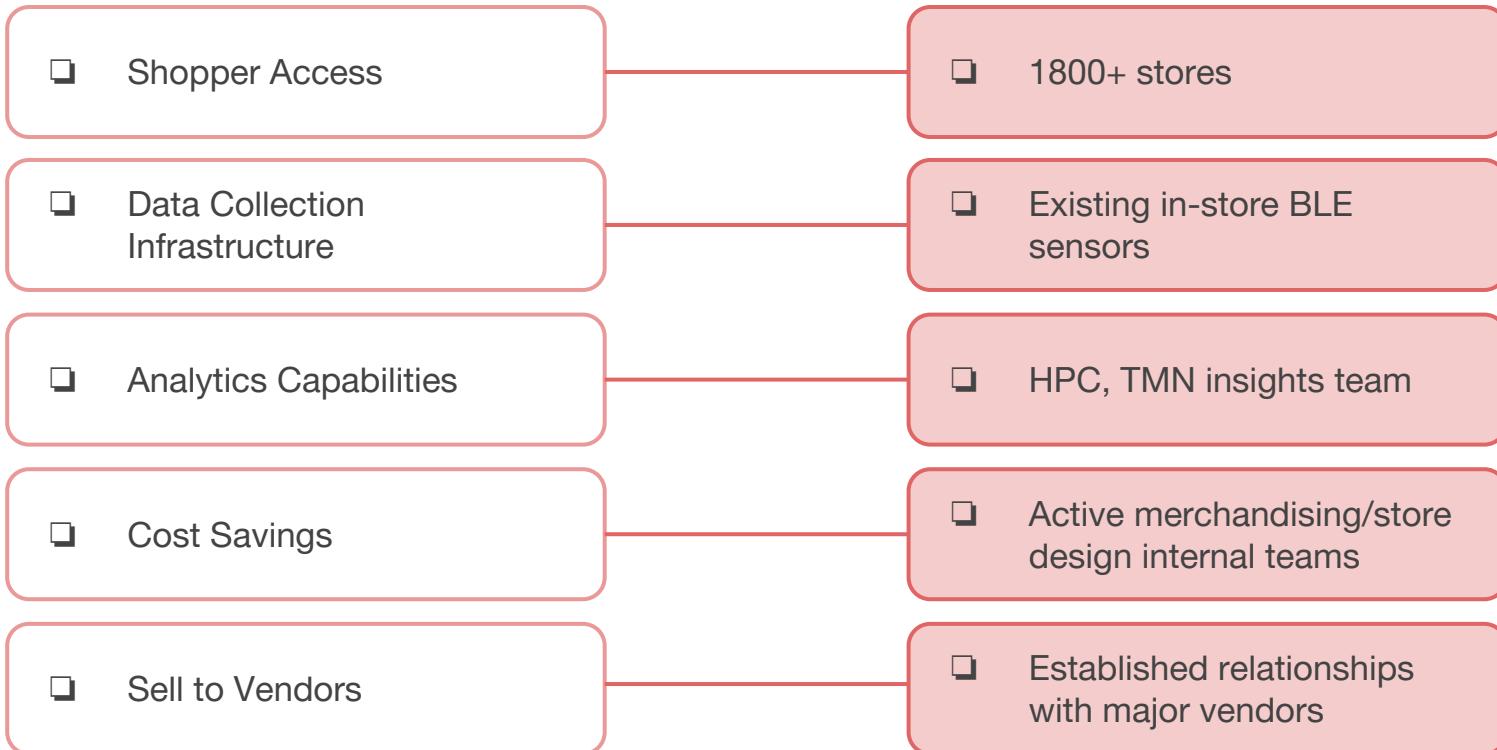
Product Capabilities

- 97% sales in-store, still dominant
- Only POS data in store available**
- 15% of app use -> 75% cart use
- Demands little computation power
- Link activity in-store to online

In-store Analytics



Target's Unique Position



PRODUCT OVERVIEW

Part II



Motivating our Product Vision

Blending the best of our digital and physical shopping experiences.

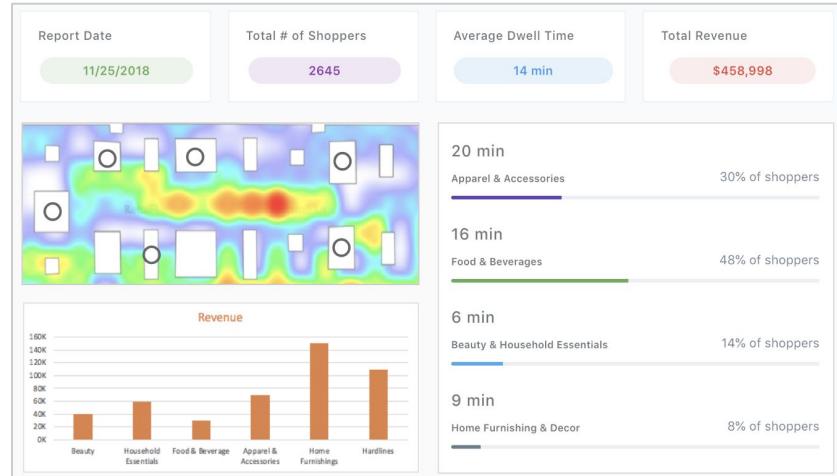
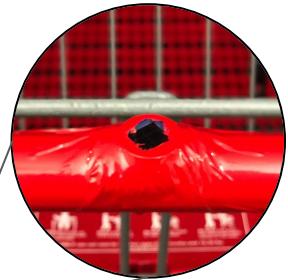
We are currently making, and expect to continue to make, significant investments in technology and selective acquisitions to improve guest experiences across sales channels and improve our supply chain and inventory management systems.

*Our ability to create a personalized guest experience through the **collection and use of accurate and relevant guest data is important to our ability to differentiate from other retailers.***

We rely extensively on our computer systems to manage and account for inventory, process guest transactions, communicate with our vendors and other third parties ... and summarize and analyze results.

- Target 2017 Annual Report

The Target SmartCart



BLE-trackable shopping carts,
tied to POS

In-store metric dashboard

Product Description



- ❑ Track shopping cart path through store using BLE-enabled carts and link data to online guest ID at POS



- ❑ Dwell time, shopping paths, heatmaps, engagement within aisles, sales lift



- ❑ For vendors: new in-store metrics, ability to attribute incremental sales increases from campaigns
- ❑ For internal Target teams: new insights into store design and product merchandising
- ❑ For Target stores: new individualized data regarding shopper behavior, with zero adoption costs to shoppers

Field Research

People Followed	23
Average Duration	27 minutes
Percentage with carts	~70%
Time spent without cart	~30%
Distance away from cart	2-3 meters



Competition around In-Store Analytics



- Experimented with smart carts ('17 patent)
- Eden: Computer vision produce freshness tracking
- Scan & Go - still had to wait in line (Dropped)



- Scan, Bag, & Go: full launch by 2019
- Personalized product recommendations
- 2200 smart shelf trial

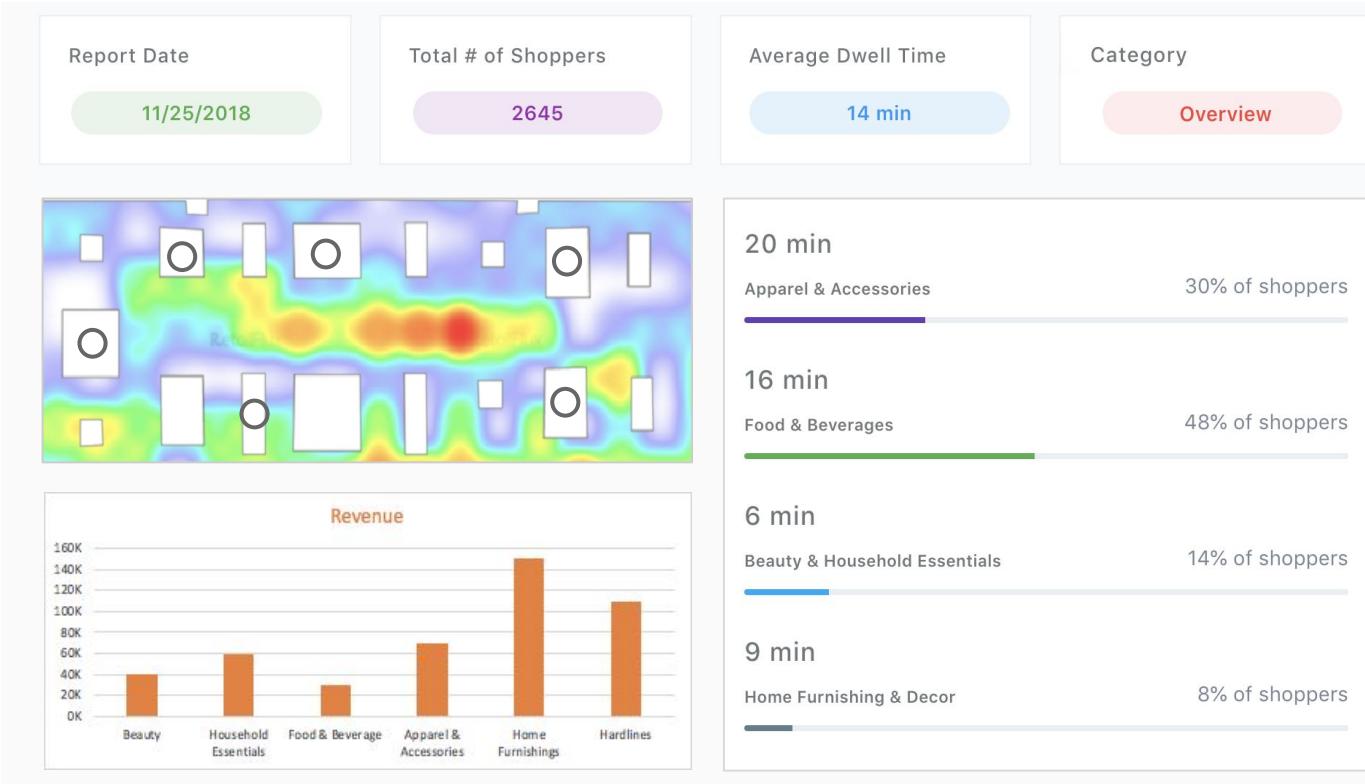


- Amazon Go, launched in 5 stores
- Cashierless checkout
- Mobile app, in-store cameras, weight sensors

Part III

USER INTERFACE & EXPERIENCE

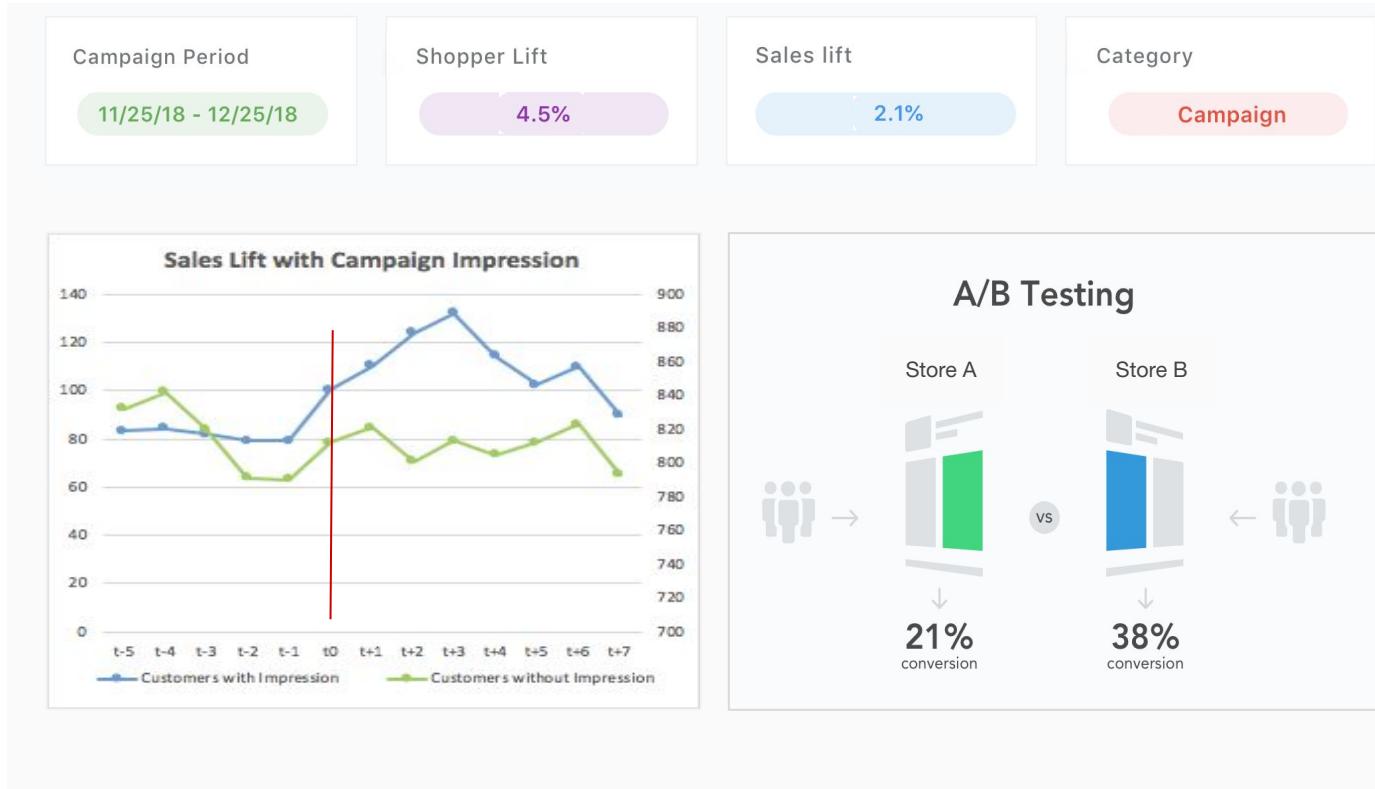
Dashboard Overview



Dashboard by Category



Dashboard Campaign View



User Group 1: Vendors

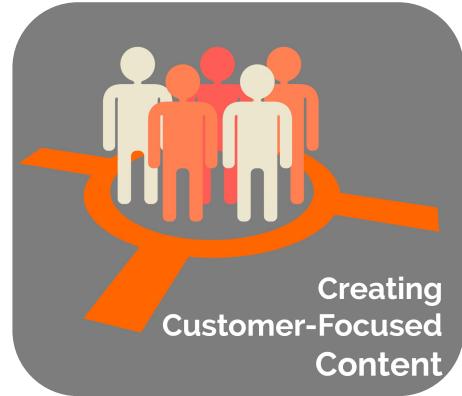
Vendors	% In-store sales	User Stories	Vendor Estimated Value Added to Marketing Budget
	97%	<input type="checkbox"/> Customer engagements with end-caps, signage, and other merchandising vehicles	10%
	98.5%	<input type="checkbox"/> Target's beauty concierge program: do people go to the product in aisle after consultation?	25%
	95%	<input type="checkbox"/> End-cap vs. in-line activity <input type="checkbox"/> Shopping path in-store	10%
	99%	<input type="checkbox"/> Customer conversion/responsiveness in campaign	-

User Group 2: In-Store Marketing

Data-driven store design



Focused advertising efforts

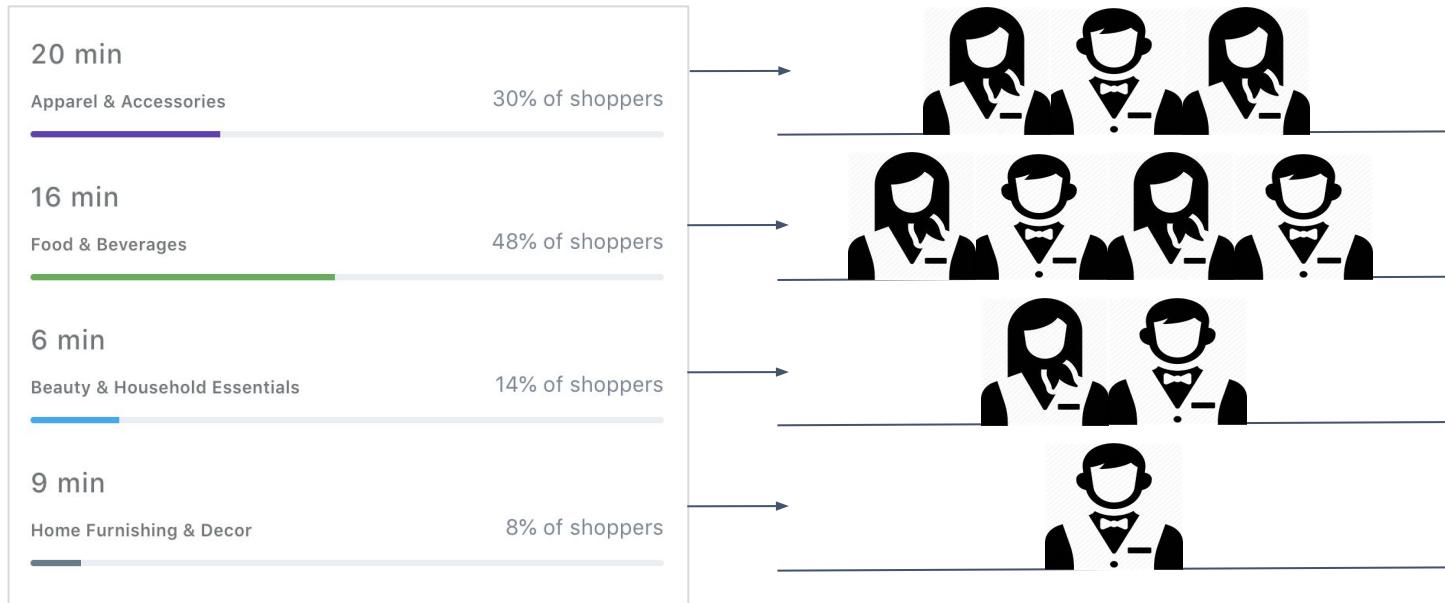


- Better understanding how shoppers interact with aisles in store
- Ability to do A/B testing for store design
- Focus in-store marketing efforts on aisles heavily visited
- Overall cost savings for ISM
- “[Your] MVP could unlock a ton of insights for guest behavior and ultimately business results”
 - Allison, Director of Marketing

User Group 3: Store Managers

"This will be really useful for **allocating staffing resources** in-store."

- Chelsea, Target Store @ East Palo Alto



TECHNICAL PRODUCT DETAILS

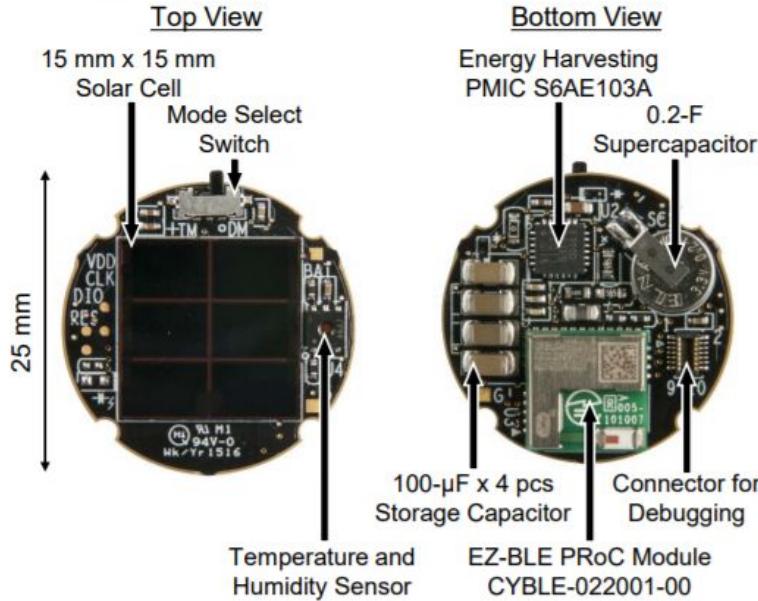
Part IV

Target SmartCart: How does it work?



- Low-profile BLE beacon on every cart
- Signal sent to receivers in already installed BLE lights every 5 seconds
- Back-calculate from signal strength, location of cart, +/- 1m
- At POS, tie location of cart/time with credit card swiped
- Long battery life (30hr), self-recharging solar cell
- No adoption cost to customer

Technical design of the Cypress BLE sensor



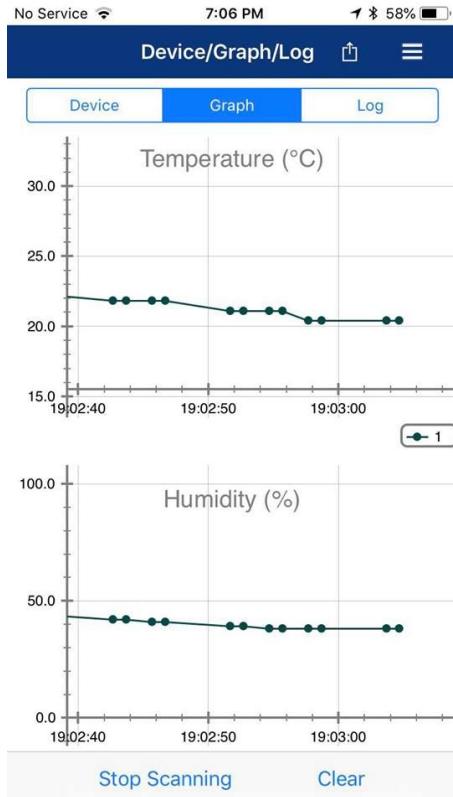
Solar BLE Sensor

- Low-profile design: 25 x 5.5 mm
- Precise: Can triangulate to obtain location within +/- 1m
- Long battery life: Up to 30-hours operation without ambient light via the fully charged supercapacitor (0.2 F)
- Self-recharging: Mounted Energy Harvesting through solar cell
- Operates at low light (100 lux minimum, normal store 500-750 lux)

Raw data collection example



Data collected from beacon at Target store



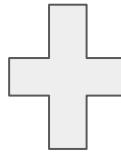
- Can poll beacon every 1-10 second (programmable)
- Get signal strength per beacon with ID at each light
- 100 bits of data per instance per beacon



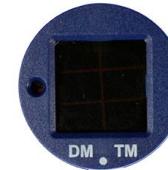
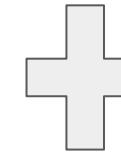
Our Prototype of a SmartCart Add-On



Vinyl



Foam



BLE beacon

How we prototyped:

- Method: Place beacon in pre-cut foam, wrap vinyl over cart handlebar
- Install time: 15 minutes

Our Vision for a Production Solution

Product Overview: A bolt-on handlebar cover with embedded BLE beacon



Product Requirements

- Must be low-profile
- Must be tamper-proof
- Must be easy to replace if it breaks
- Must be universal to all carts

Estimated Production Cost

- ~\$20 in production, including plastic, bolts, and BLE beacon
- Order volume of 200,000+

Technology integration, issues and risks

Technology



- Works with existing BLE setup in store
- At POS, tie cart's location/timestamp and path data with customer purchases and online guest ID

Issues and Risks

- Modification of each cart
- Tying POS with cart position (ecosystem)
- Up to 1m accuracy
- Legally tying to individuals
- People leaving carts around 30%

Potential solutions

- Plastic-replaceable carts already
- Terms and conditions at POS

DEVELOPMENT, COSTS & REVENUE

Part V

How we launch Target SmartCart

Product Development Team: Team, Size, Skills

- ❑ **6 engineers, 2 store managers, 6 months**

Overview of Technology to be Used

- ❑ BLE beacons and overhead Bluetooth receivers (already in-store)

Development Methodology

- ❑ Buy assembled handlebar cover including BLE chip, enclosure, security bolts

Development Time Estimates

- ❑ 6 months for handlebar development and production, data pipeline setup

Development Cost Estimates

- ❑ **Cost: approximately \$400,000**



SmartCart operations cost for all stores

Install Costs <ul style="list-style-type: none"><input type="checkbox"/> Average install time on 15 min / cart, after gathering carts<input type="checkbox"/> Three technicians to install overnight	\$1,387,500
Operational Costs / Year <ul style="list-style-type: none"><input type="checkbox"/> Two new data scientists devoted to data stream (\$200,000)<input type="checkbox"/> Data storage, transmission, processing costs. Real-time computation not needed - can be done backend at night or low-demand times.	\$201,737



Summary of Costs: Nationwide total costs (1850 stores)

Engineering development cost: \$400,000

Installation cost: \$1,387,500

Hardware cost per store (assume 100 carts per store): \$2000

Hardware cost for all stores: \$3.7 million

Total one time cost to roll out to all stores:

COGS: \$5.7 million

Operations cost: \$201,737/year

Revenue and cost savings

Revenue generation through TMN

- Subscription: can charge 10-20% extra for metrics (obtained from vendors)
- \$7.5 - 40 M value added through sales to 150+ vendors
- More vendor interest: increase volume of vendors

Cost savings for In-store Marketing

- Better data based decision for store layouts
- Better understanding of customer path
- In-store marketing targeting frequently visited aisles

Resource allocation for store managers

- Store managers can allocate staff better based on where more customers are

Support

Physical support In-store

- Property managers for device installation, and engineers for maintenance
- Regular maintenance not required - potentially cleaning of panel

Data collection and processing

- HPC and EDABI team for data collection
- Big Red for data storage
- Maintaining dashboards

Insight generation

- TMN for analytics





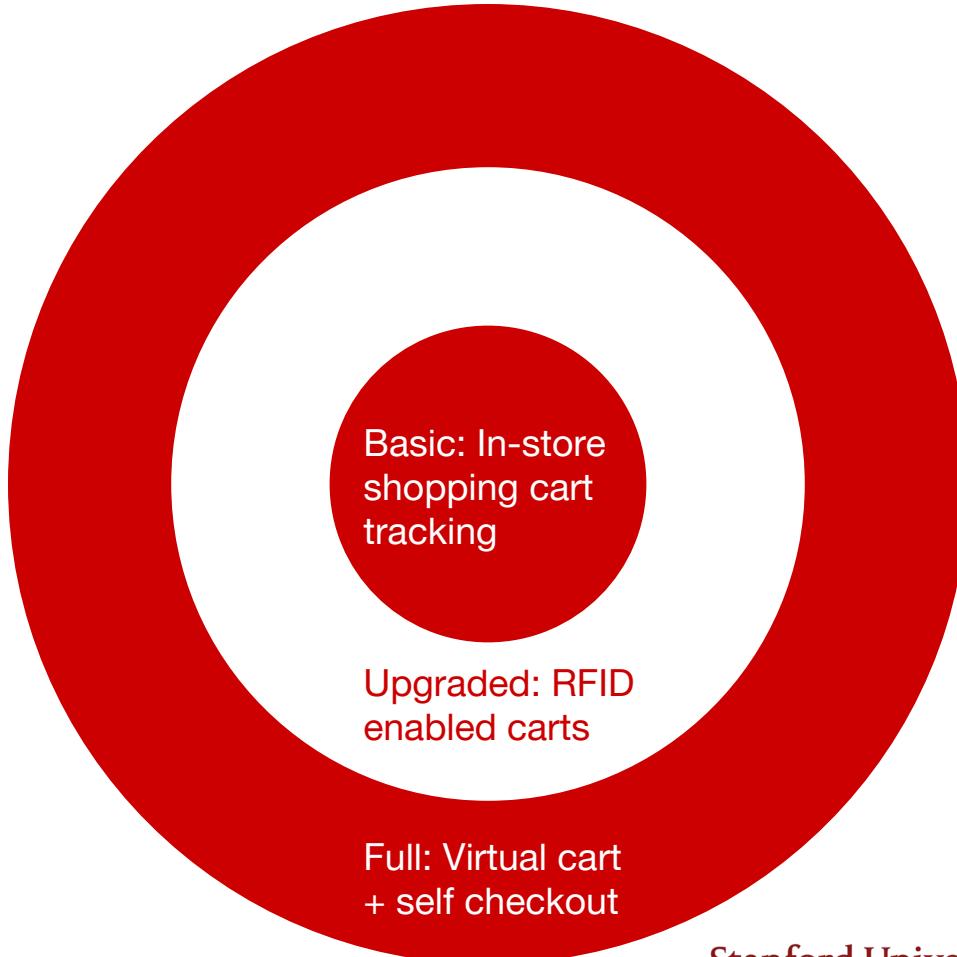
Business model summary

- ❑ **Value proposition:** In-store retail metrics are an unmet need. Vendors want in-store KPI besides POS. Multiple teams can leverage this data.
- ❑ **Solution:** SmartCart, BLE enabled carts to track movement and tied to POS.
- ❑ **Partners involved:** HPC, TMN, ISM, Guest Experience Center.
- ❑ **Cost estimate:** \$5.7 million to set up, \$201,737/year to operate.
- ❑ **Revenue & cost savings impact:** \$7.5 - 40 M revenue to TMN, significant cost savings to ISM and store managers.

“Our ability to create a personalized guest experience through the collection and use of accurate and relevant guest data is important to our ability to differentiate from other retailers”.

- Target 2017 Annual Report

Next Steps





Thank you!
Questions?



Acknowledgements

Carson Bailey, SCJ

Allison

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Emily Pearl, Target

Kara Pierce, Target

Mahesh Puduppadi, Target

Caitlin Hall, Target



Sample customer path

- Baby clothing 3 min
- Left 2m from cart, baby wipes 1 min
- Walk 1 min
- Left 1m from cart, Baby seats 50s
- Walk 2 min
- Christmas stocking endcap 40s
- Walk 1 min
- Decorative accents endcap 30s
- Turned into candle section
- Pillows 40 s
- Walk 3 min
- Clothing 4 minutes

MVP Doc Breakdown

- 1. Product code name**
- 2. MVP Summary statement (Joseph)**
- 3. Prototype (Guillermo/Anand)**
- 4. User Experience (UX) (Javen/Joseph)**
- 5. Technical feasibility (Anand)**
- 6. Product Development (Guillermo)**
- 8. Next Steps (Anand)**

MVP Final Corporate Partner presentation			
Criteria	Ratings	Pts	
MVP Summary statement a. Product vision b. Strategic fit with corporate partner c. POA summary		1.0 pts	
Prototype Mock-ups i. 3D models ii. Wireframes iii. Drawings iv. Pictures v. PPTs		4.0 pts	
User Experience (UX) a. User stories b. Prototype user stories		4.0 pts	
MVP Description a. Product Design Principals (ex. "iPods must be able to hold 1000 songs, be easy to use, have digital rights management) b. Features (Prioritized) c. Visual Representation		4.0 pts	
Business Model		3.0 pts	
Technical feasibility a. Technology solution overview b. Risks c. Dependencies d. Long term trends		1.0 pts	
Product Development a. Team i. Size ii. Skills b. Overview of technology to be used c. Development methodology d. Development time estimates e. Development cost estimates		2.0 pts	
Overall Integration of POA and compelling case for proceeding to MVP		1.0 pts	
Total Points: 20.0			

Upgraded Package: RFID enabled carts



- ❑ Incentivize Target app usage in-store and track hands-on product engagement through e-cart in-app
-



- ❑ Cart abandonment
 - ❑ new purchases based on in-app shopping lists
 - ❑ all existing online/app data
-



- ❑ For vendors: Targeted ads + Cart abandonment KPI
- ❑ For shoppers: partial e-cart, product information and coupons, targeted ads based on past purchases, location of products
- ❑ Adoption cost to shoppers: one-time app installation



Cost of operations

Physical device costs:

Market price - \$20 per beacon (in bulk, will be cheaper)

Computational costs:

Sending it to HPC at night - assumed: \$10 per store per day.

- Mostly electricity cost
- Real time computation not needed - can be done backend at night

Installation costs:

3 contract engineers, 1 day, per store

\$720 per store

Upgraded Package: technology, issues and risks

Technology



- Connect to app by scanning QR code on cart. Product added to cart will be display on app

Issues and Risks

- RFID tags needed to be added
- Lag in updating app
- Need app to be used

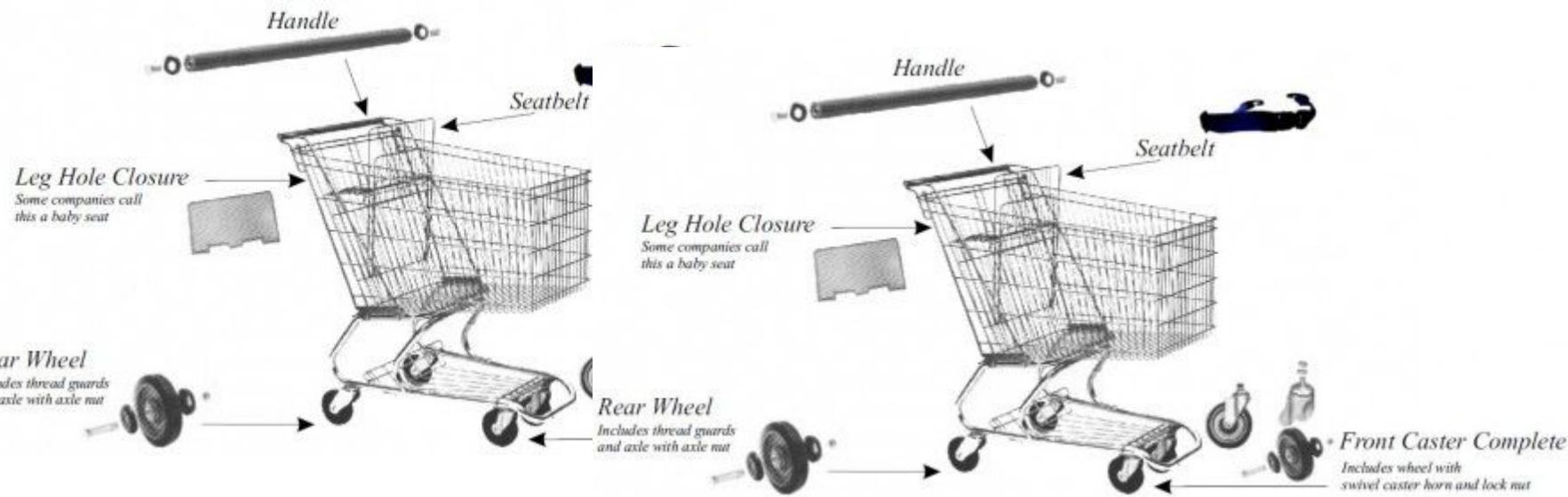
Estimated costs

- \$45-\$60 per cart
- 3 cents for every tag

Potential solutions

- Creating a platform where self check out may become possible

The product: A bolt-on handlebar cover



EasyCheck Out: SmartCart Plus



- Updated virtual cart while shopping in-store with fast payment and purchase confirmation
 - Walk out store with cart and payment billed to app directly - no queues.
-



- For vendors: real-time POS sales data
- For shoppers: Tracking items in virtual cart while shopping, faster and more convenient check-out, more employee availability
- Adoption cost to shoppers: existing e-payment method



SmartCart Plus: technology, issues and risks

Technology



- ❑ At exit, all items scanned again and charged to customer directly

Issues and Risks

- ❑ Theft and cheating
- ❑ Failure to recognize RFID tags
- ❑ Re-working ecosystem

Estimated costs

- ❑ \$45-\$60 per cart
- ❑ 5 cents per tag
- ❑ \$2000 secondary RFID scanner

Side benefit

- ❑ Accurate track of inventory real time



Review of technology for in-store tracking

Technology	Advantage	Disadvantage
Camera	Accurate position, demographic data, emotions, product handling, already installed	Covers limited area, stitching journey is hard,
Wifi router	Track location, already exists - no added cost	Need to log into wifi (Android pings can be found without logging in), poor accuracy
RFID reader in cart	Accurately record product added/removed to cart, can link to app (offline-online)	Need installation and hardware across all stores
Mobile App in store	Position + online-offline data tracking	Need users to actually download and use app

Bluetooth Low Energy (BLE) Beacon

BLE112-A-V1

blue giga
A Silicon Labs Company



[Enlarge](#)

Images are for reference only
See Product Specifications

[Share](#)

Mouser #: 603-BLE112-A

Mfr. #: BLE112-A-V1

Mfr.: [Silicon Labs / Bluegiga](#)

Customer #:

Description: Bluetooth Modules (802.15.1) Class2 BLE Module 4.0 SINGLEMODE W/ANT

Datasheet: [BLE112-A-V1 Datasheet](#)

ECAD Model: [PCB Symbol & Footprint](#)

Download the free [Library Loader](#) to convert this file for your ECAD Tool.

More Information: [Learn more about Silicon Labs / Bluegiga BLE112-A-V1](#)

[Compare Product](#)

[Add To Project](#) | [Add Notes](#)

In Stock: 20,624

Stock: 20,624 Can Ship Immediately

On Order: 0

Factory Lead-Time: 3 Weeks

Minimum: 1 Multiples: 1

Enter Quantity:

[Buy](#)

Pricing (USD)

Qty.	Unit Price	Ext. Price
1	\$11.89	\$11.89
25	\$10.85	\$271.25
100	\$9.82	\$982.00
500	\$7.24	\$3,620.00

Full Reel (Order in multiples of 1000)

1,000	\$6.46	\$6,460.00
-------	--------	------------

**\$7.00 MouseReel™ fee will be added and calculated in your shopping cart. All MouseReel™ orders are non-cancellable and non-returnable.

Total Cost Breakdown

<u>Cost Category</u>	<u>Value</u>
Engineering Development <ul style="list-style-type: none">- Design and development of device- Integration with data pipeline- Roll-out: 6 engineers, 2 store managers, 6 months	\$400,000
Hardware Costs <ul style="list-style-type: none">- \$20 device cost (cheaper at scale)	\$3,700,000
Install Costs <ul style="list-style-type: none">- Average install time of 15 min / cart, after gathering carts	\$1,387,500
Operation Costs / Year <ul style="list-style-type: none">- Two new data scientists devoted to data stream (\$200,000)- Data storage, transmission, processing costs. Real time computation not needed - can be done backend at night	\$201,737

Development costs

Target At Software Engineer Salaries



- 6 engineers, 2 store managers, 6 months

\$30,000+\$45,000

~\$400,000

Target Target Mobile Store Manager Hourly Pay

Salaries Updated Sep 3, 2015

United States

Any Experience

Base Pay
\$12 - \$15



Additional Pay
\$48 - \$3K

In-store installation costs



Contract Quality Engineer - Hourly

Zimmer Biomet

3 salaries

\$33/hr

\$23

\$33

\$30/hr for 3 engineers for 1 day



Operational Costs - Categories

Data Generated per sensor: 12.5 bytes/sample, at 720 samples per hour, for 100 carts per store at 1850 stores, operating 60+24 hours a week for 360/365 days a year. We get ~6680 gb/yr.

- Data transmission cost: \$0.06/gb, \$401 additional per year
- Data computation cost: \$0.10/hr for 32Gb memory on 16 virtual cores. We take as a conservative estimate the number \$0.10/gb as if it were a per-gb cost. \$668/yr
- Data storage cost: \$0.10/gb, \$668 / yr
- Data analysis costs: two new data scientists devoted to new in-store cart location data stream: \$200,000 / yr

Assume: All 100 carts per store used at all times during store hours.

See next slide for cost assumptions.

Operational Costs - Cost Assumptions

Compute cost

Region:	US East (Ohio) ▾				
	vCPU	ECU	Memory (GiB)	Instance Storage (GB)	Linux/UNIX Usage
General Purpose - Current Generation					
a1.medium	1	NA	2 GiB	EBS Only	\$0.0255 per Hour
a1.large	2	NA	4 GiB	EBS Only	\$0.051 per Hour
a1.xlarge	4	NA	8 GiB	EBS Only	\$0.102 per Hour

Data transmission cost

From a consumer perspective, Google Drive costs \$30/yr for 200 GB, equating to \$0.15/gb/yr. We estimate lower costs for a business solution implemented at scale.

Data storage cost

From a consumer perspective, Google Drive costs \$30/yr for 200 GB, equating to \$0.15/gb/yr. We estimate lower costs for a business solution implemented at scale.

Dashboard (Overview)



Light level: units in lux

Normal Office Work, PC Work, Study Library, Groceries, Show Rooms, Laboratories	500
supermarkets, Mechanical Workshops, Office Landscapes	750