MICHIGAN STATE UNIVERSITY

Project Plan

Reducing Shoplifting Using Machine Learning

The Capstone Experience

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From Students…
…to Professionals

Functional Specifications

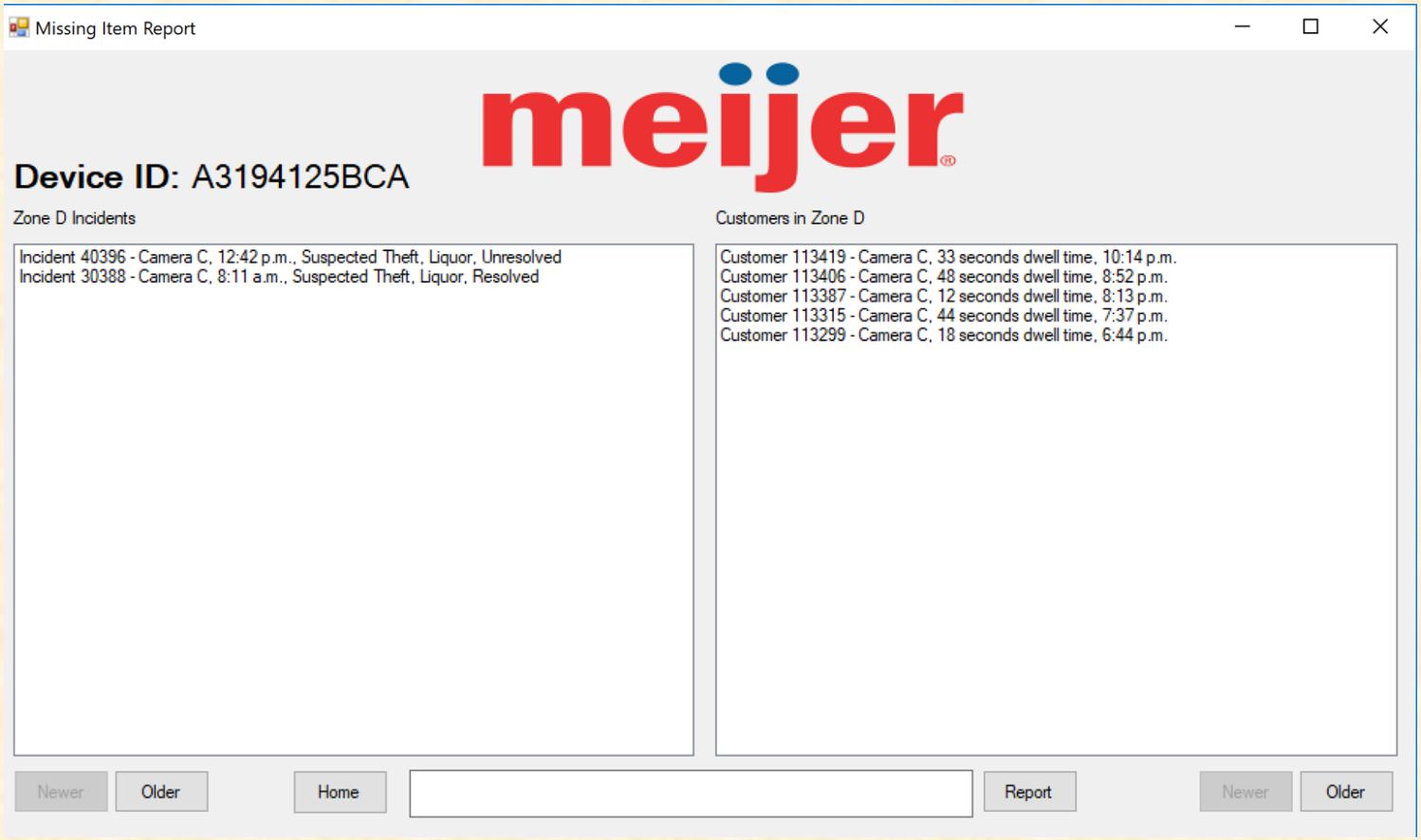
- Monitors shopper's devices for shoplifting patterns.
- Translates information from Mist sensors to security cameras.
- Submits alerts to staff members, through email, and app notifications.
- Allows staff to report missing goods and find a likely time it was stolen.

Design Specifications

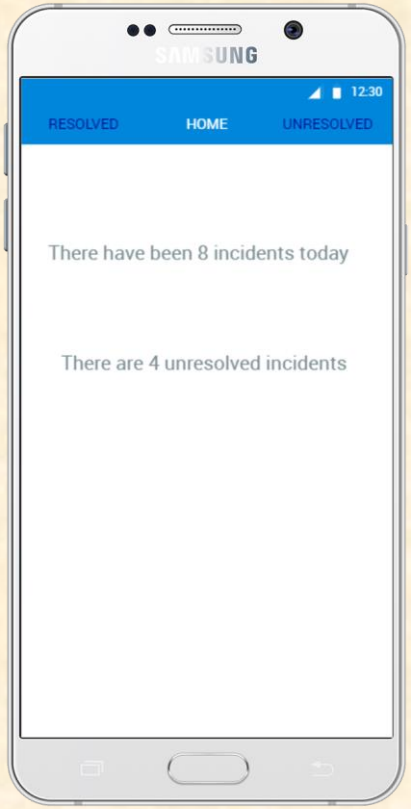
- The Asset Protection team wants a desktop app that combines Mist data and security cameras in a single window.
- The design must simplify the translation between Mist and security footage, as well as allow reports.
- An app for floor workers receives notifications, and aids in resolving shoplifting incidents.

Screen Mockup: Desktop App

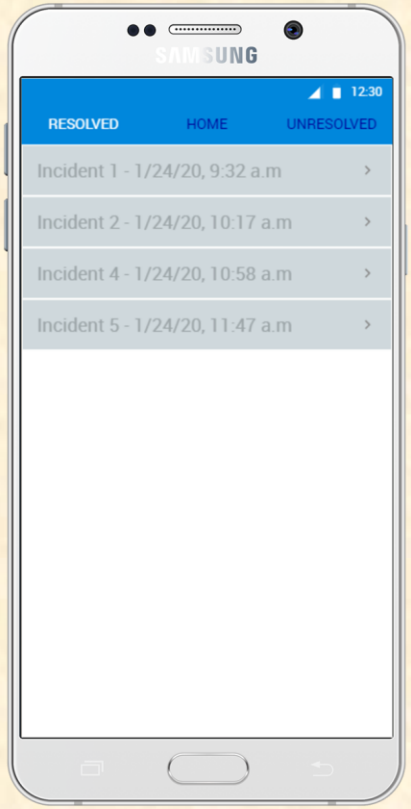
Screen Mockup: Missing Item Report

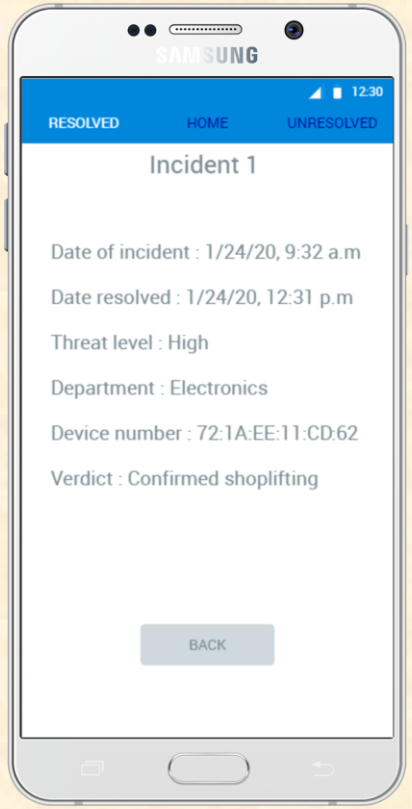


Screen Mockup: Home Page

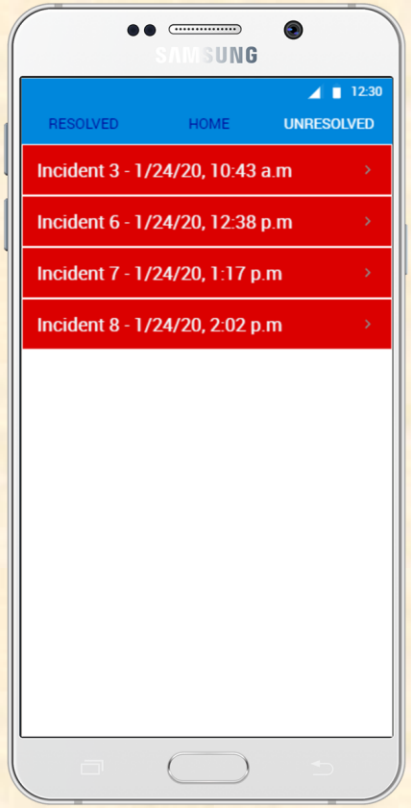


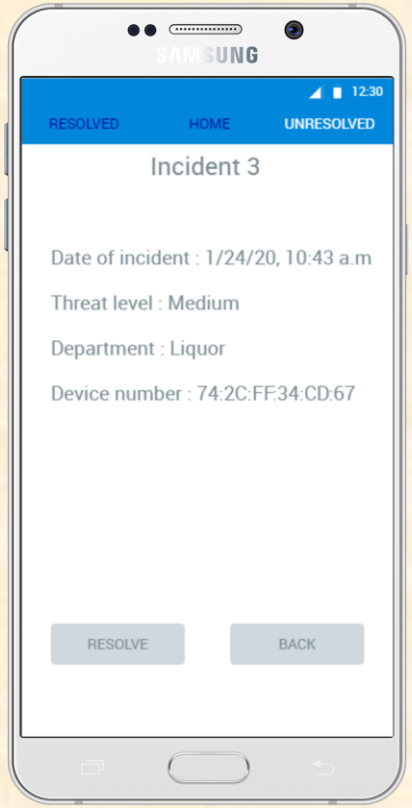
Screen Mockup: Resolved Pages

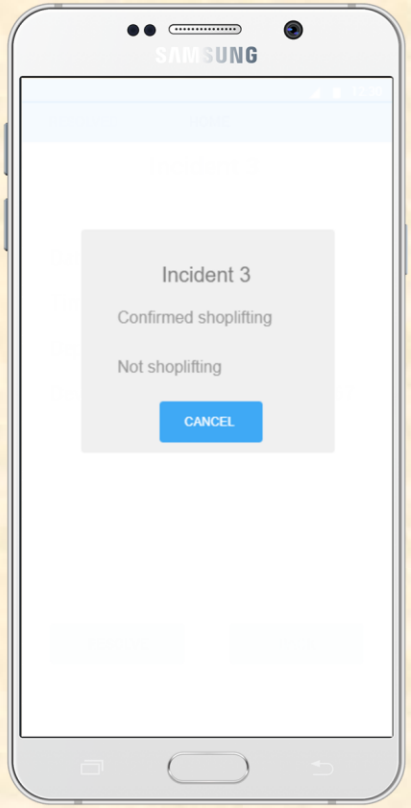




Screen Mockup: Unresolved Pages



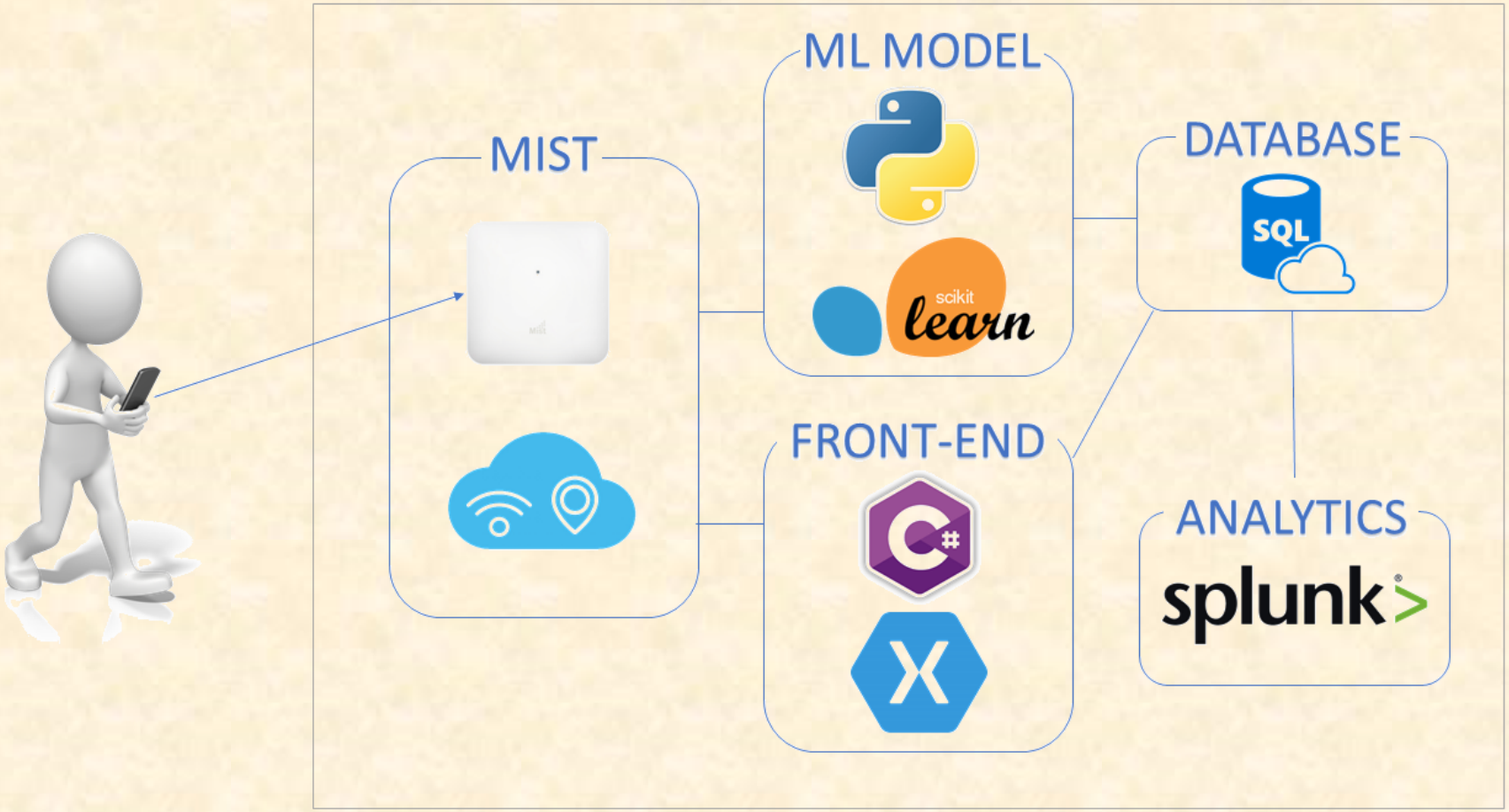




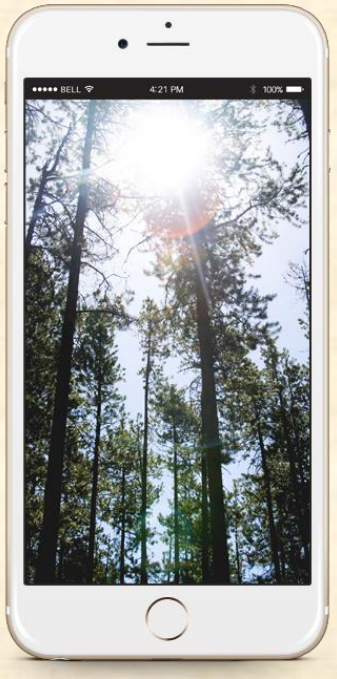
Technical Specifications

- Mist
- Machine Learning Model
- Front-End
- Database
- Analytics

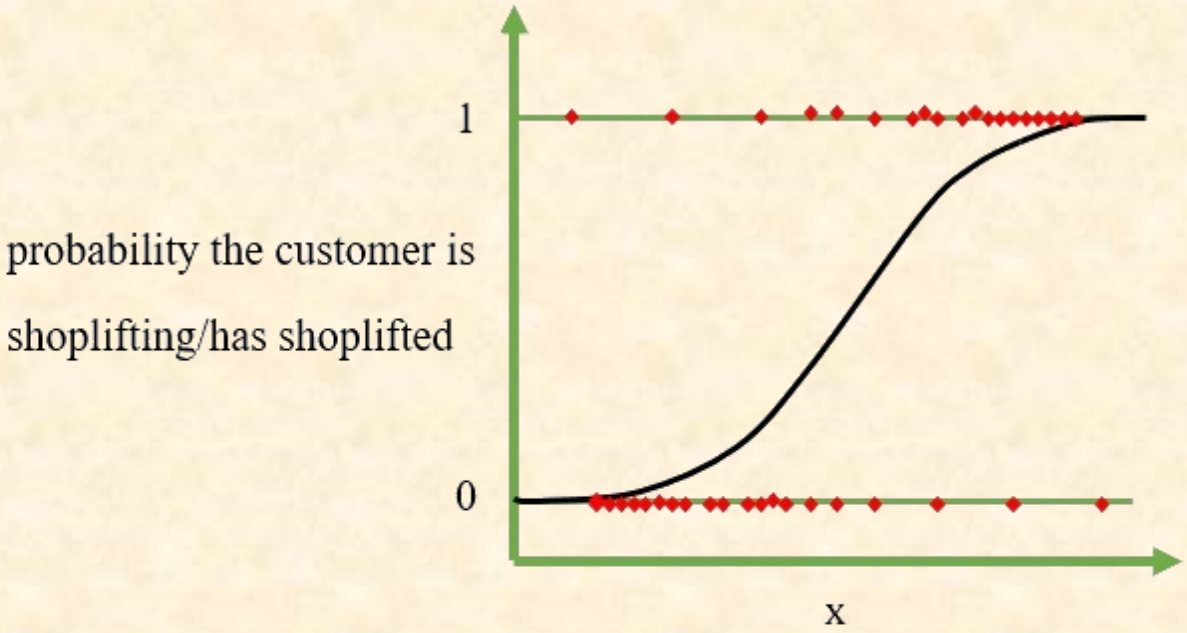
System Architecture



Suspicious Activity



ML Model



$$x = w_1(\text{dwell time in high value area}) + w_2(\text{dwell time in quiet area}) + w_3(\text{total time of trip})$$

System Components

- Hardware Platforms
  - Mist AP41 Access Points.
  - Meijer Asset Protection Team Desktop PC.
  - iOS devices for upper management, Android devices for floor workers.
- Software Platforms / Technologies
  - Xamarin
  - Mist API/Machine Learning
  - Azure SQL Database
  - C#/.net Framework
  - Splunk

Risks

- Sensor imprecision
  - Without the installation of the Mist SDK, sensors are only precise within 10-20 meters.
  - We've organized the store into zones and we are basing our solution on finding dwell times.
- Can we detect phones that are not discoverable?
  - Previous projects that used Mist access points required the phone to return a signal to clearly identify the location.
  - Met with James to discuss other options if we weren't able to detect phones that were not discoverable.

Risks

- Gathering and Classifying Data
  - A large part of this project revolves around creating a pattern, and detecting anomalies. We don't have any real data to train our model, and we are afraid that we won't get enough data collected before the due date.
  - We can generate "fake data" to test our machine learning algorithms, but this cannot be used to train the model itself. For this, we need to continue to work with Team Meijer to acquire and categorize real in-store shopper data.
- Combining Machine Learning with Splunk
  - After we discover these outlier patterns, we need to use Splunk to create some charts that indicate how often this anomaly indicates a shoplifter.
  - We plan to go to a Splunk presentation to further understand the utility of Splunk.