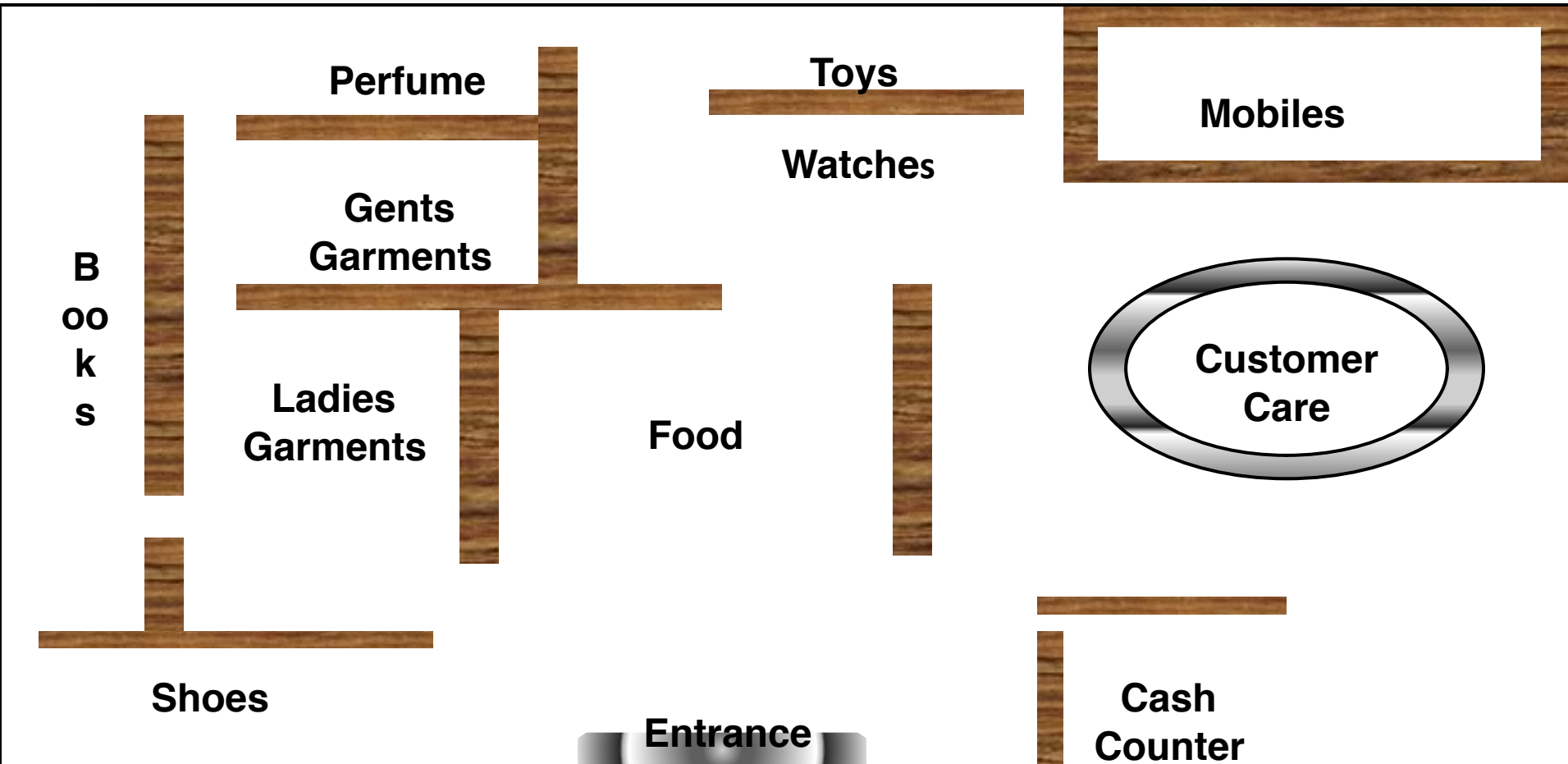


(Stable)Virtual Landmarks: Spatial Dropbox to Enhance Retail Experience

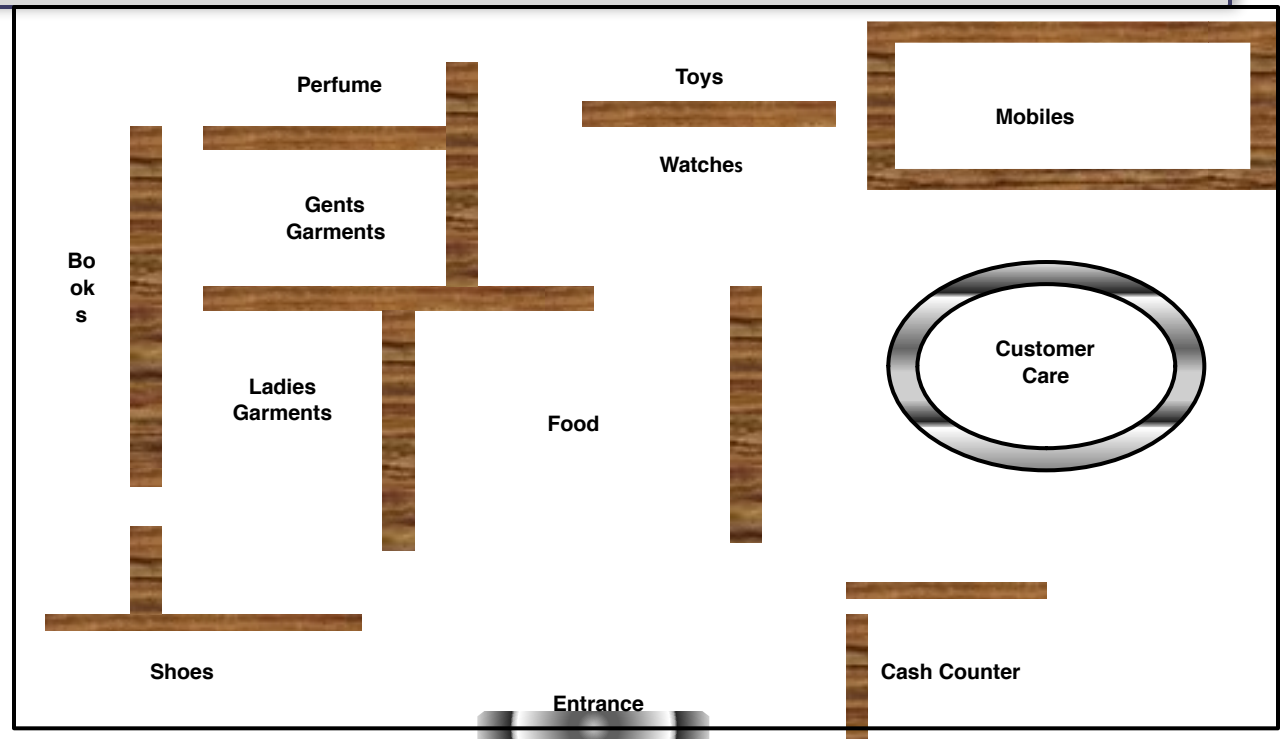
Swadhin Pradhan, Ananth Balashankar,
Niloy Ganguly and Bivas Mitra.

CSE, IIT Kharagpur, India.

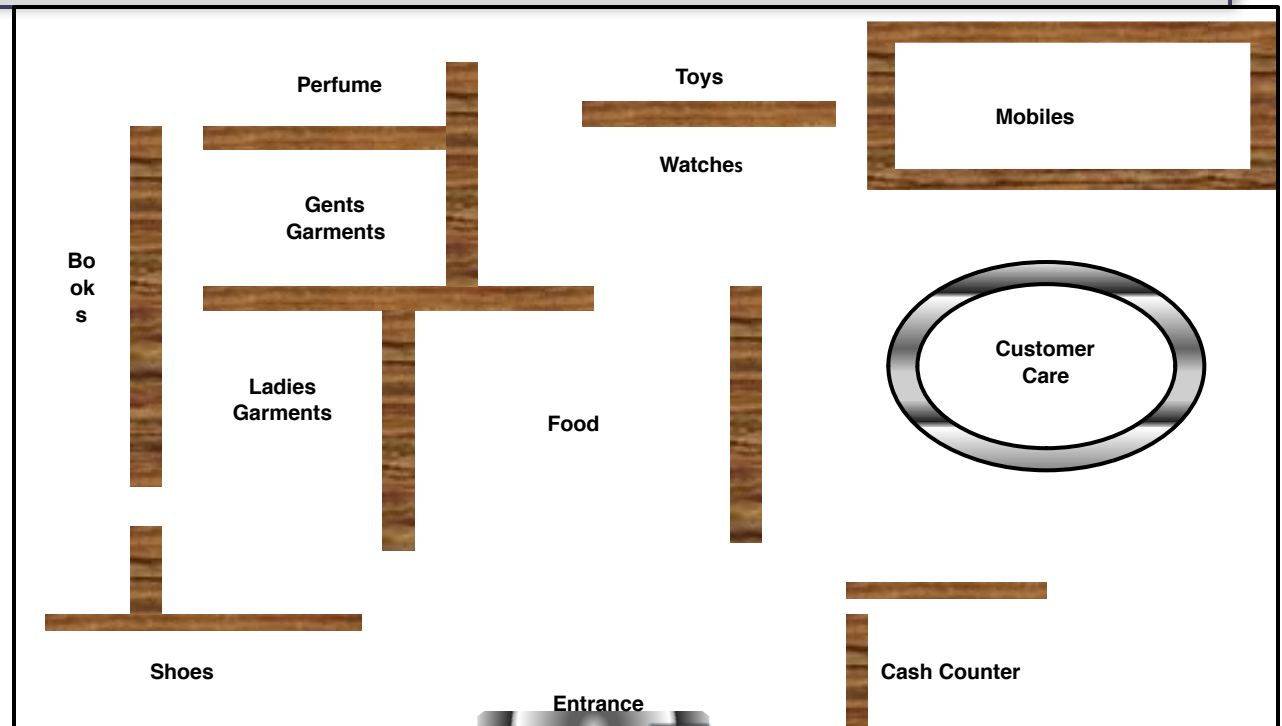
Current Retail Store Scenario



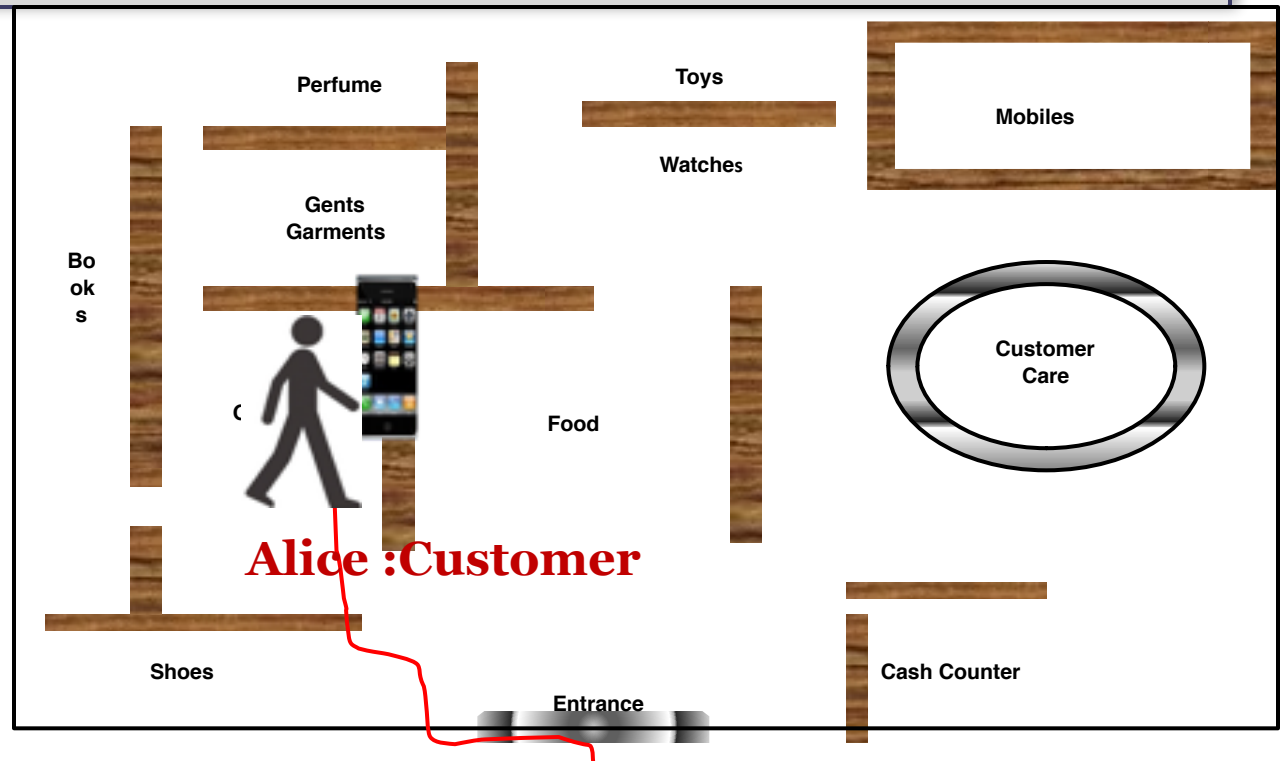
Current Retail Store Scenario



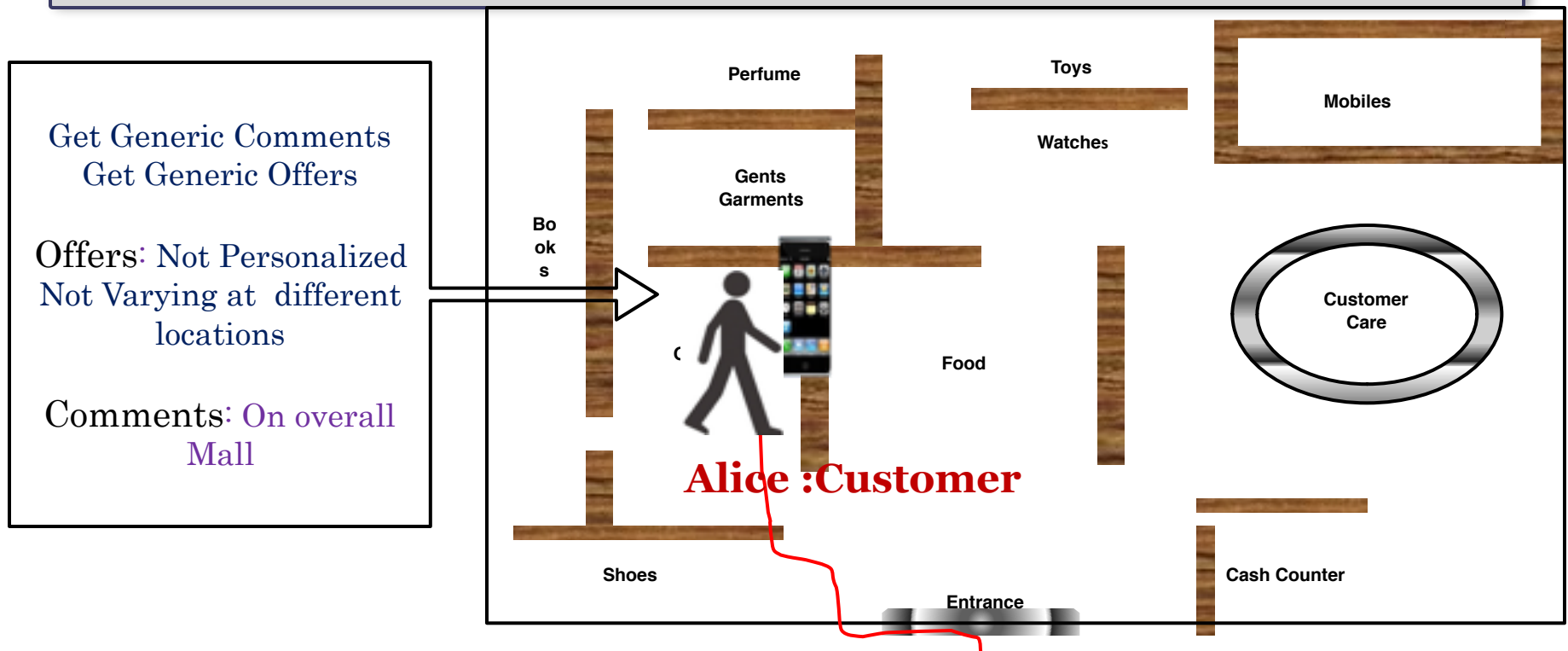
Current Retail Store Scenario



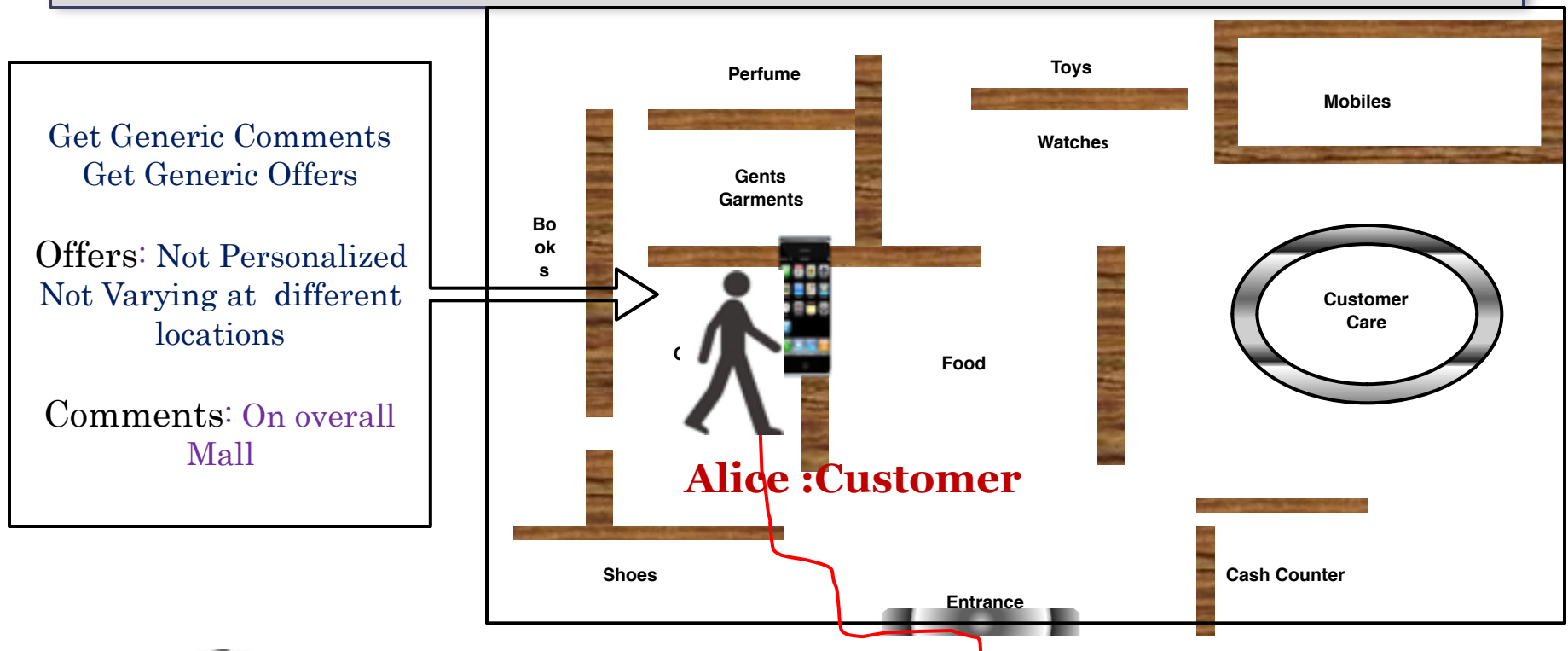
Current Retail Store Scenario



Current Retail Store Scenario

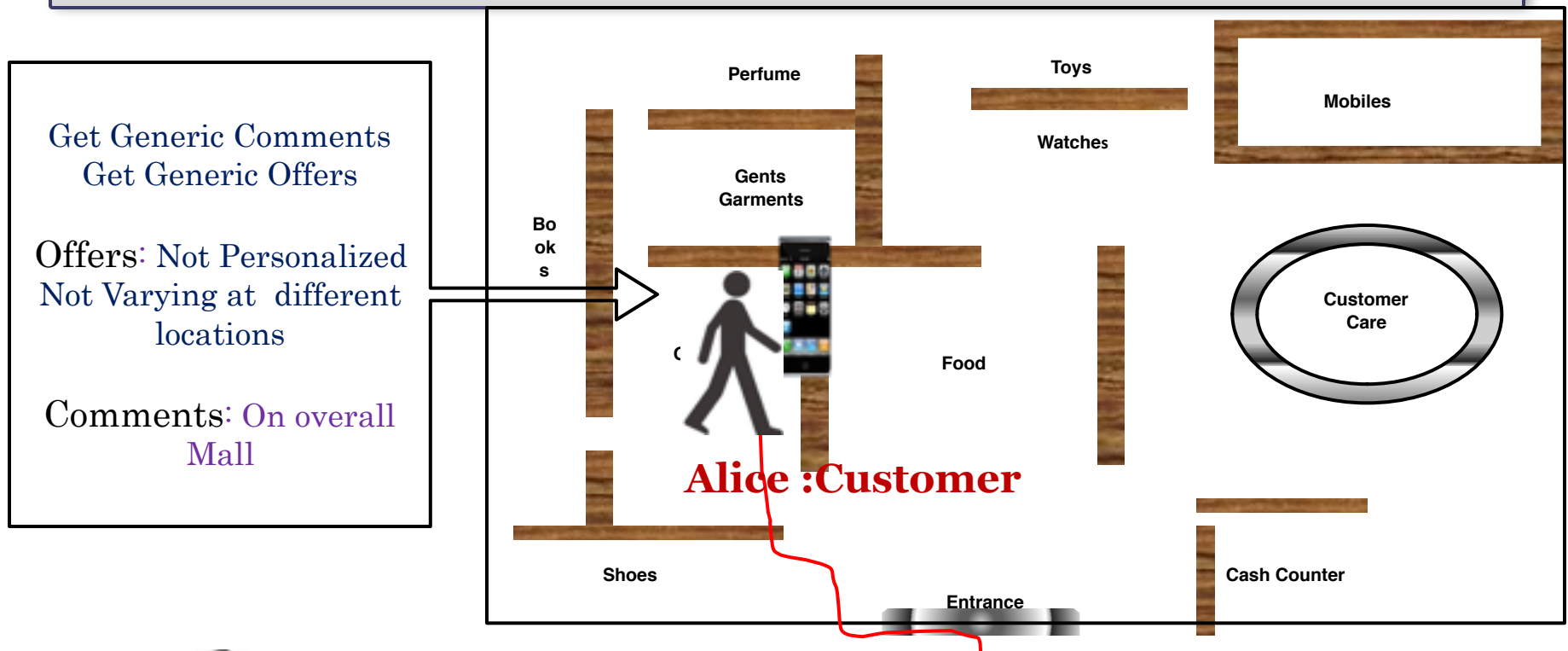


Current Retail Store Scenario



Bob: Mall Admin

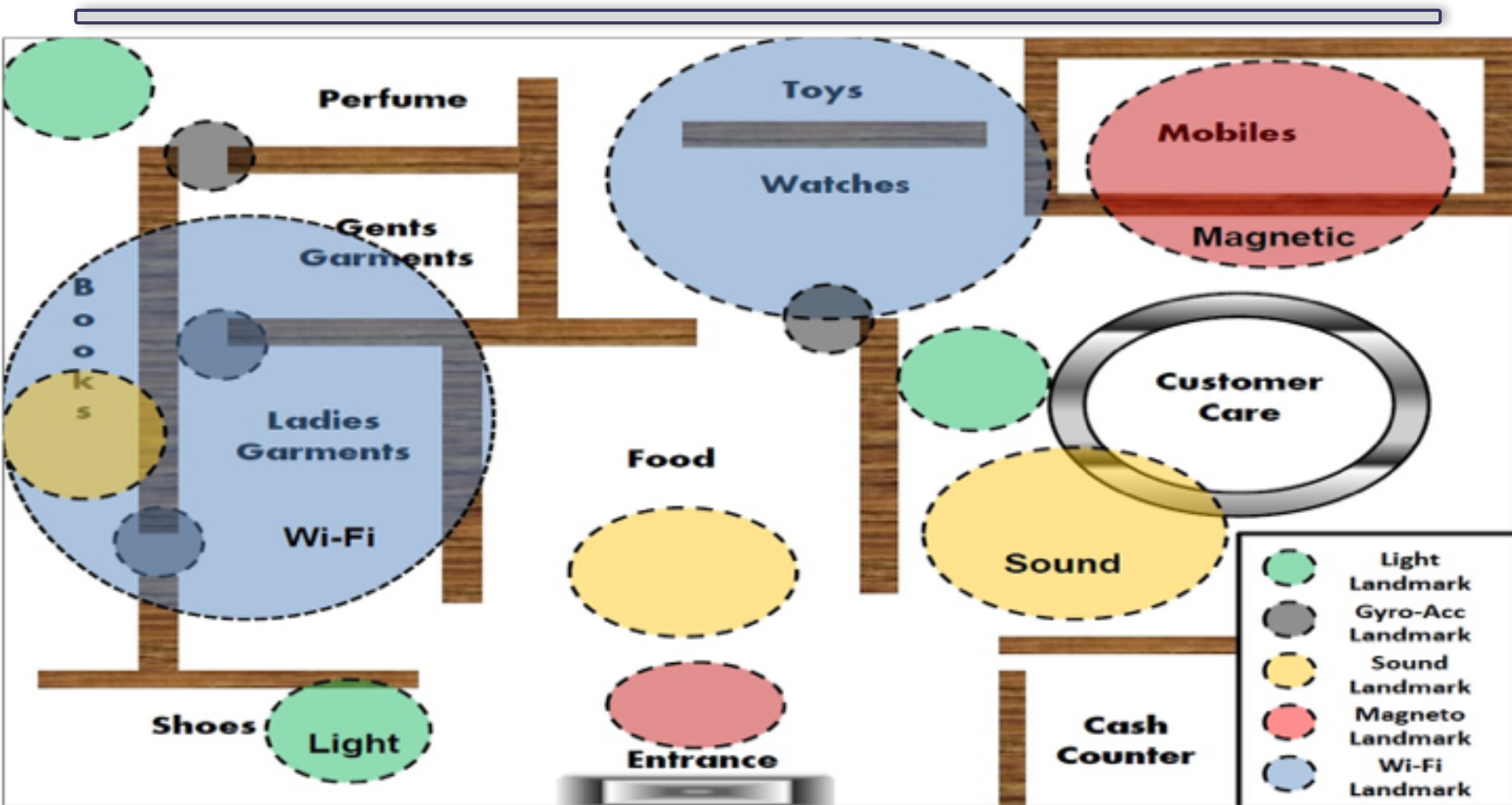
Current Retail Store Scenario



Getting Only Macro Analytics

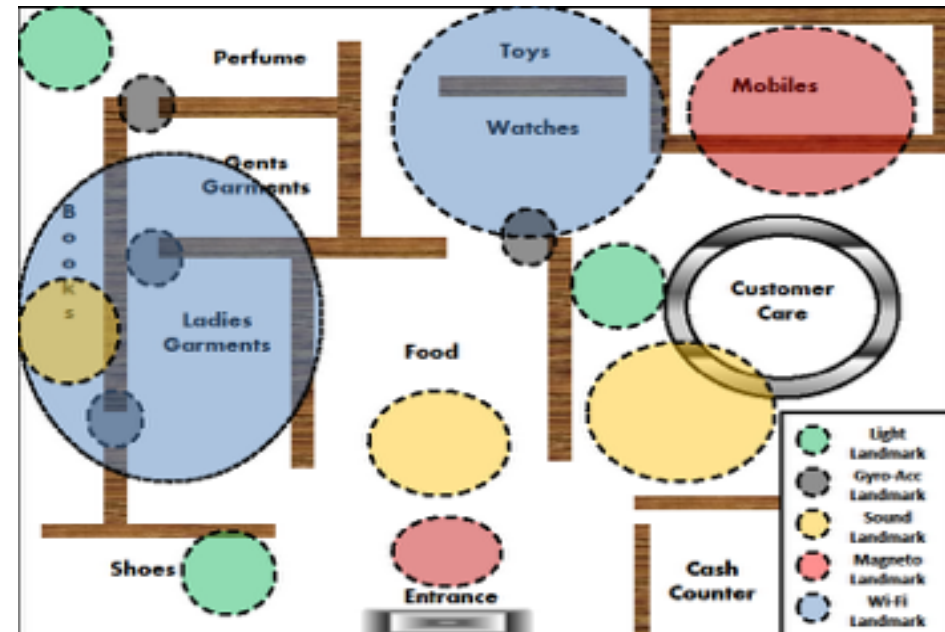
Bob: Mall Admin

Micro Location Annotations via Landmarks

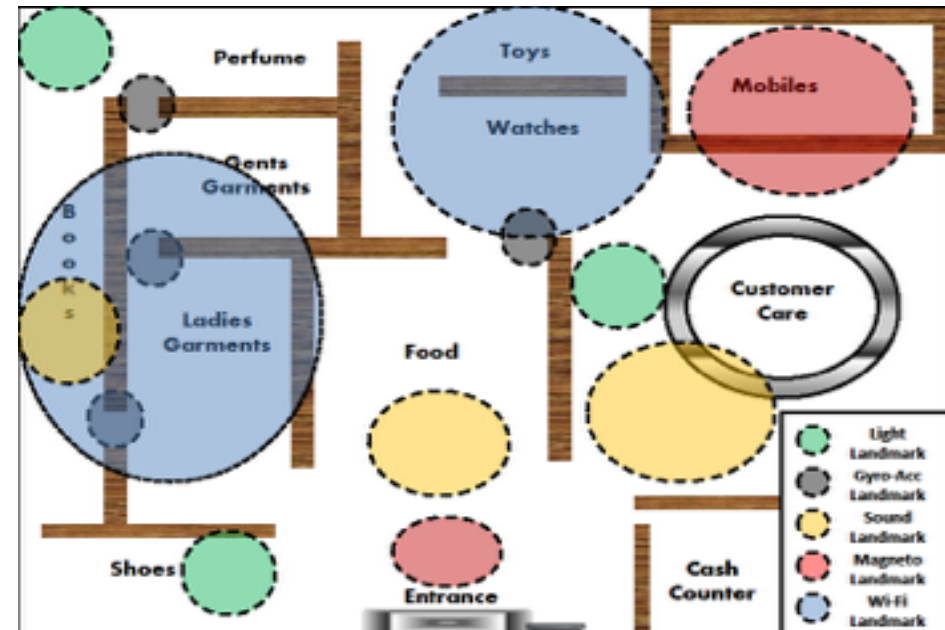


RetailGuide : Retail Analytics App

RetailGuide : Retail Analytics App

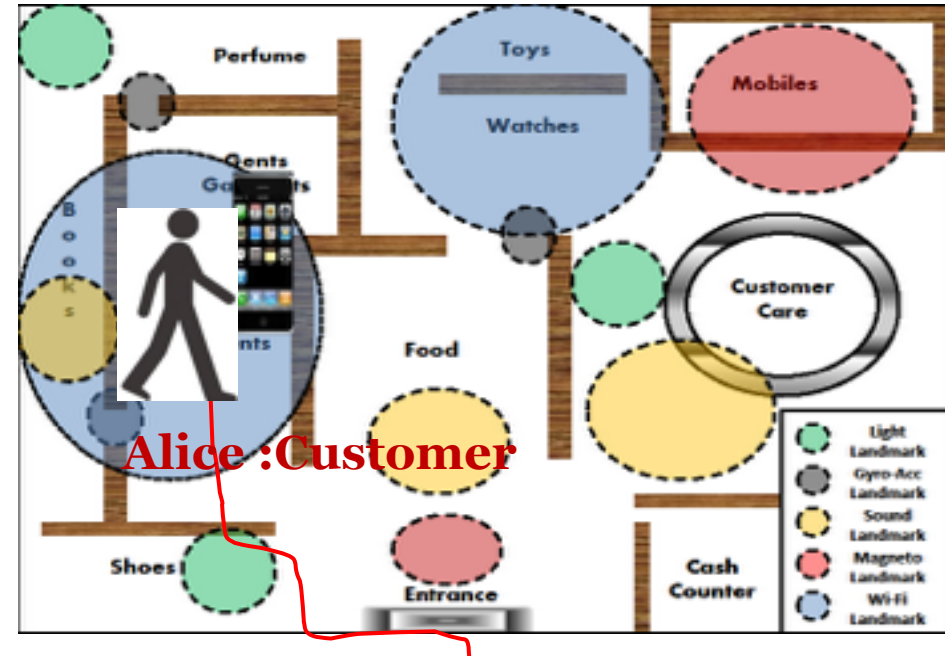


RetailGuide : Retail Analytics App

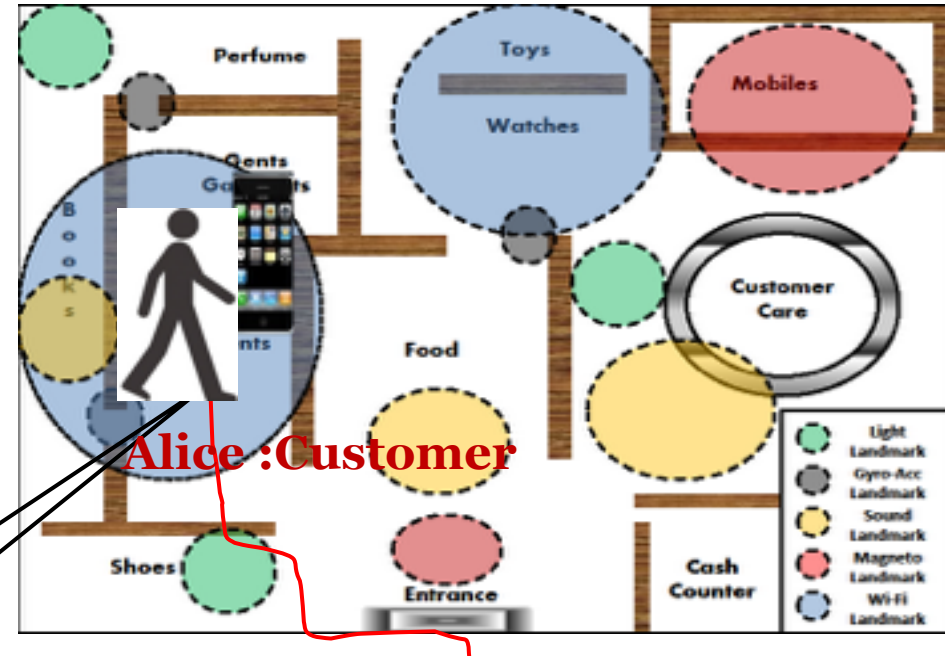


Alice :Customer

RetailGuide : Retail Analytics App



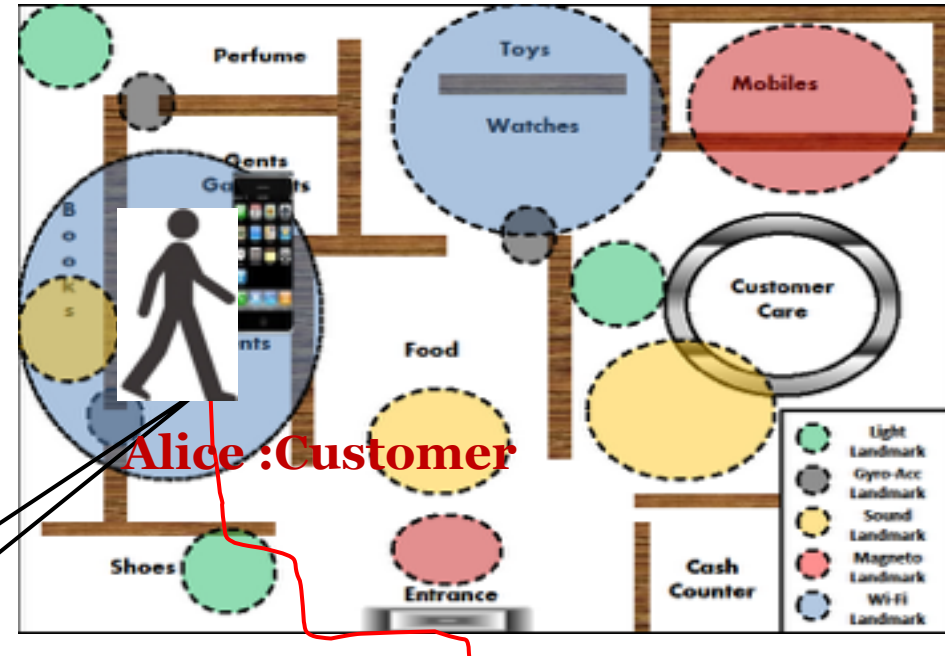
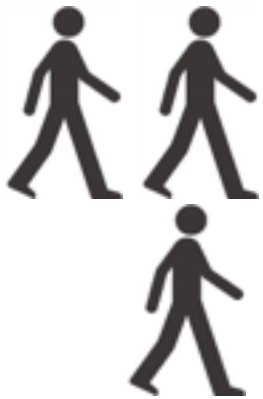
RetailGuide : Retail Analytics App



Would like to see more choices for white dress

Comment

RetailGuide : Retail Analytics App



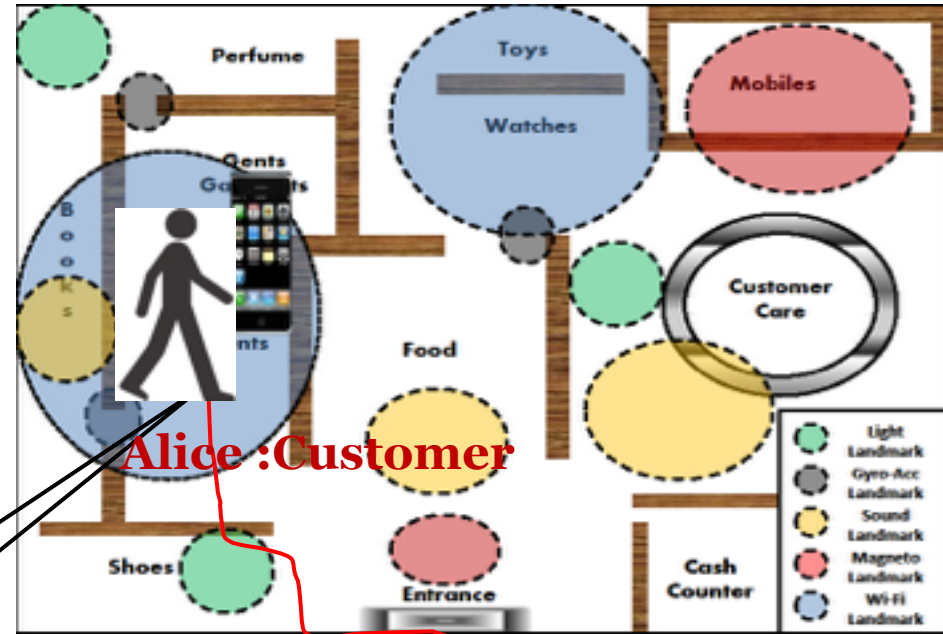
Would like to see more choices for white dress

Comment

RetailGuide : Retail Analytics App



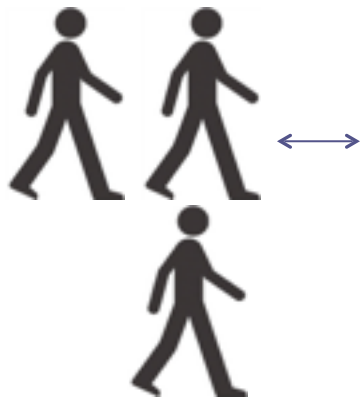
**More
Customers**



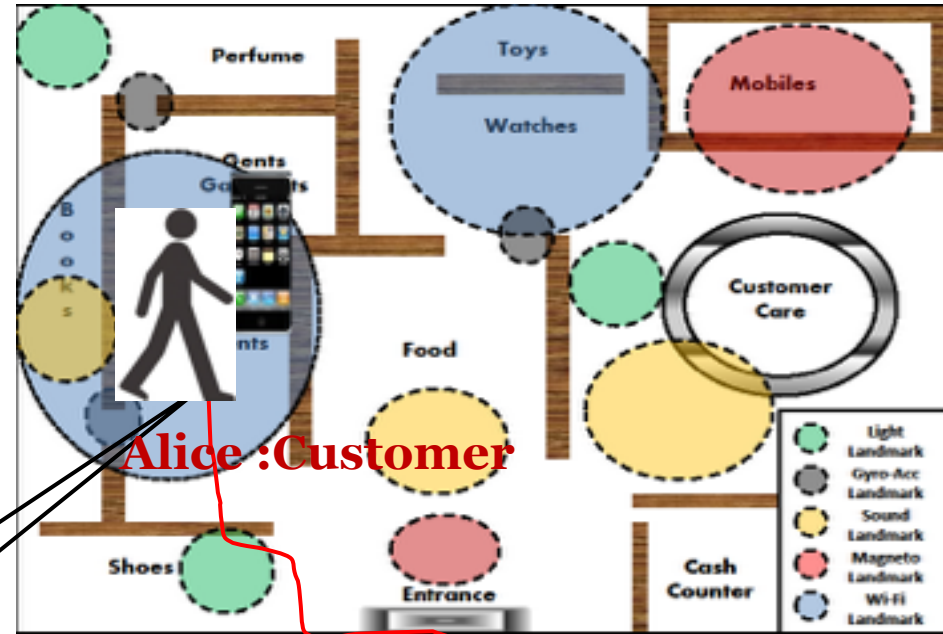
**Would like
to see more
choices for
white dress**

Comment

RetailGuide : Retail Analytics App



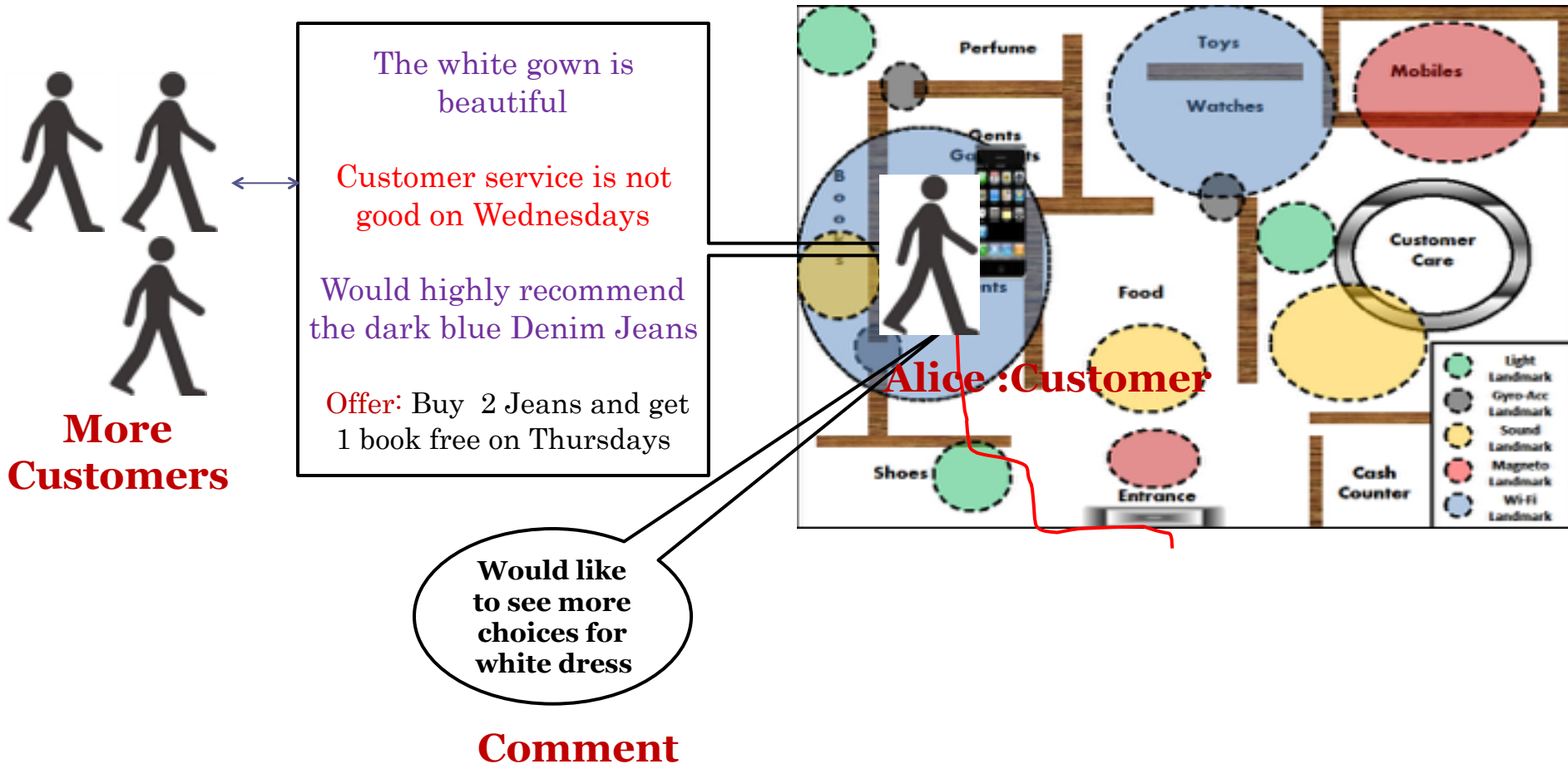
**More
Customers**



Would like
to see more
choices for
white dress

Comment

RetailGuide : Retail Analytics App



RetailGuide : Retail Analytics App

Spatial Dropbox



More Customers

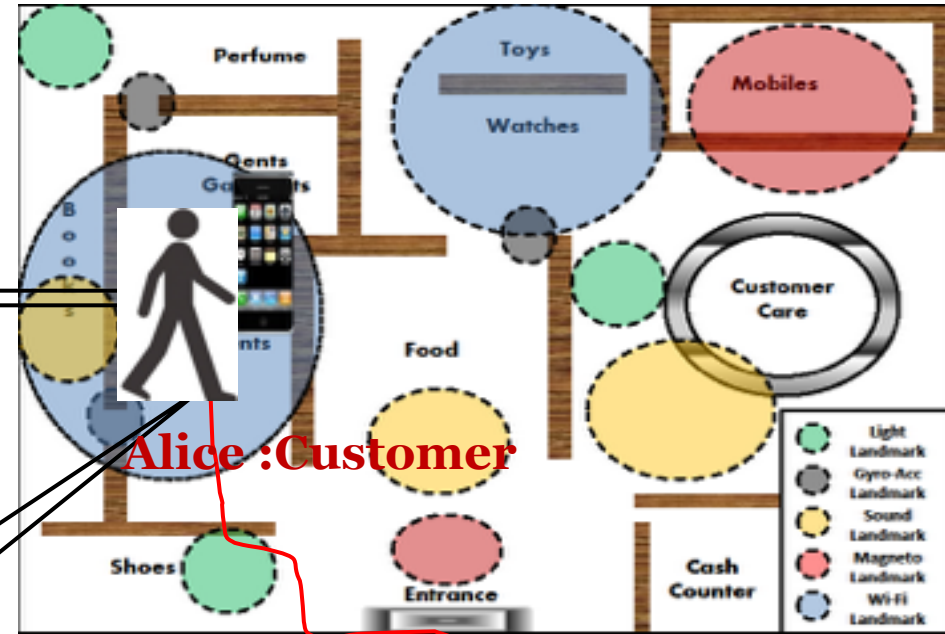


The white gown is beautiful

Customer service is not good on Wednesdays

Would highly recommend the dark blue Denim Jeans

Offer: Buy 2 Jeans and get 1 book free on Thursdays



Alice :Customer

Would like to see more choices for white dress

Comment

RetailGuide : Retail Analytics App

Spatial Dropbox



More Customers

The white gown is beautiful

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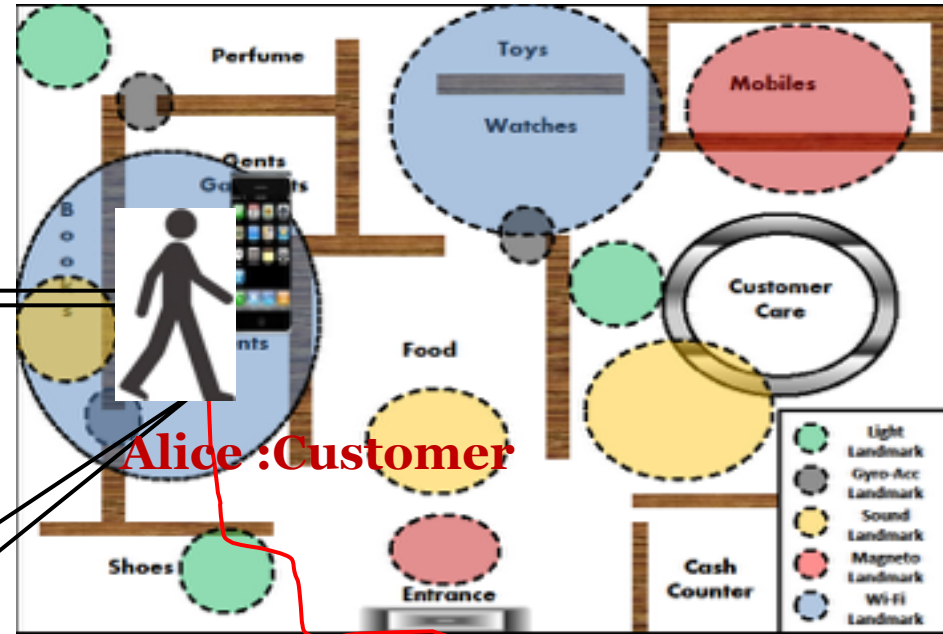
Offer: Buy 2 Jeans and get 1 book free on Thursdays



Bob: Mall Admin

Would like to see more choices for white dress

Comment



Outline

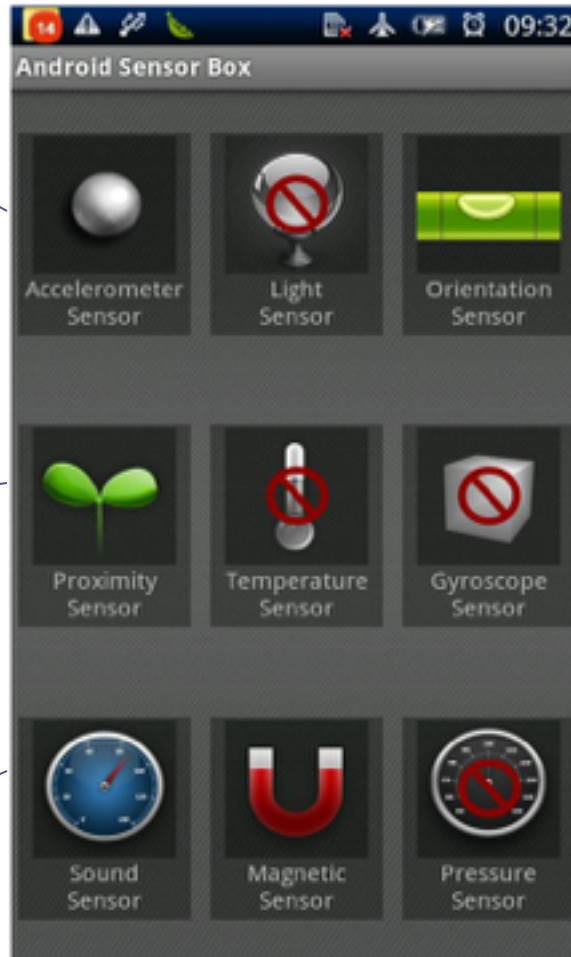
- ❑ What are Virtual Landmarks?
- ❑ Challenges - Stable Landmark Detection.
- ❑ Application Framework using Landmarks.
- ❑ Experiments and Results.
- ❑ Conclusion, Future Works and Beyond.

Landmarks=Mobile Sensors + Location

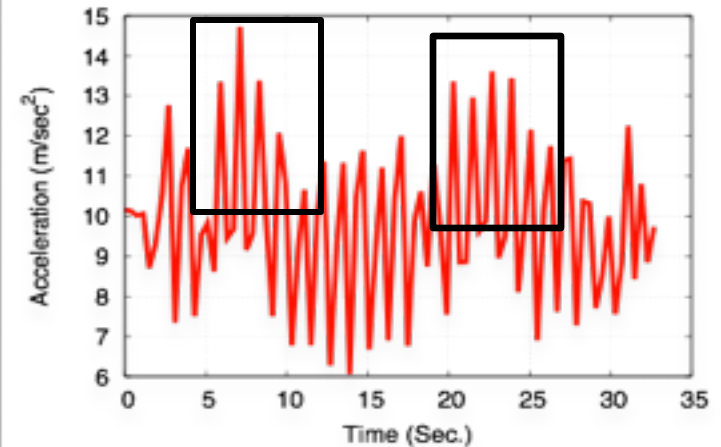
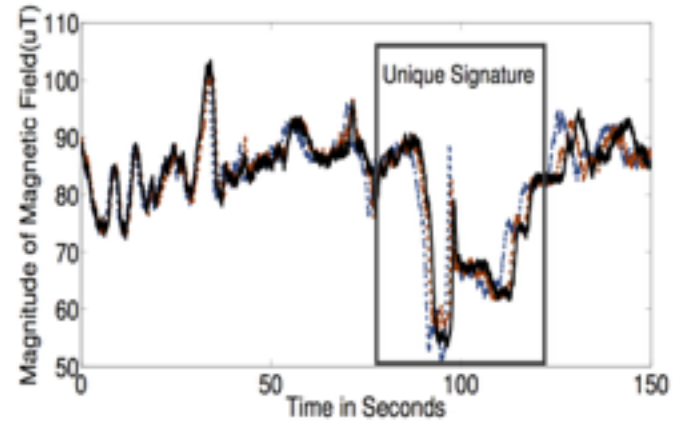
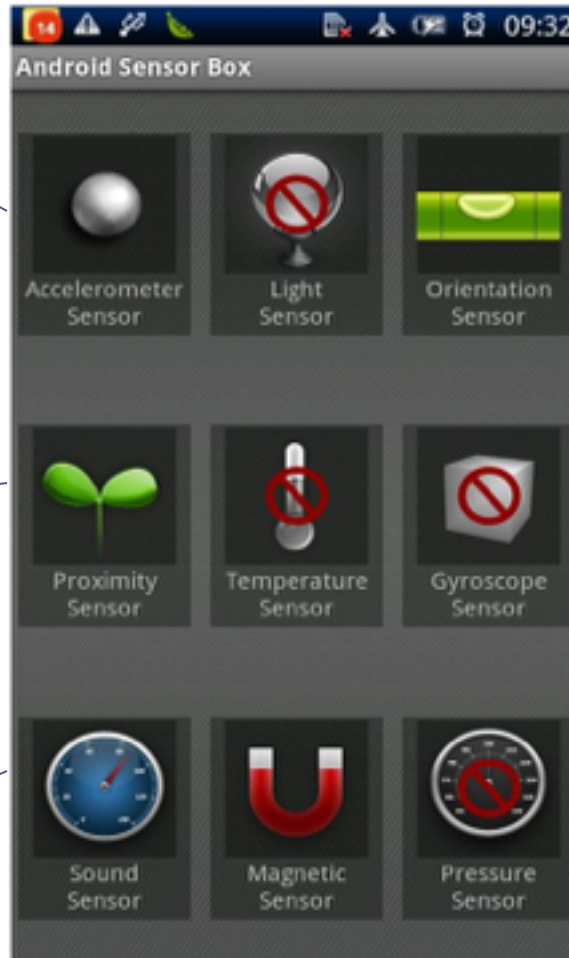
Landmarks=Mobile Sensors + Location



Landmarks=Mobile Sensors + Location



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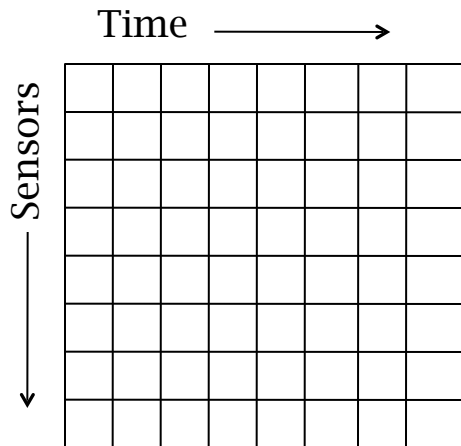


Pruning Virtual Landmarks

Pruning Virtual Landmarks

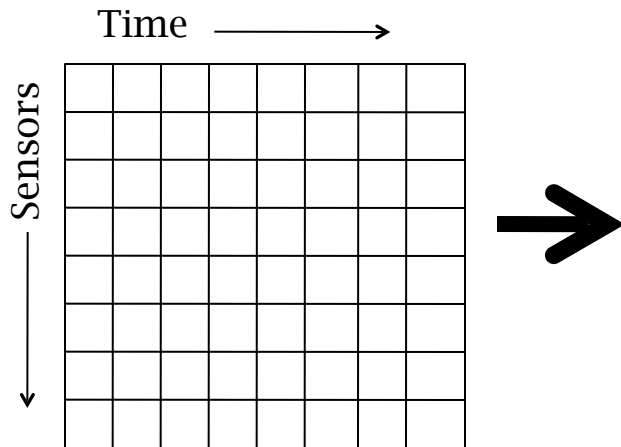
H. Wang et al., “**No need to war-drive: unsupervised indoor localization**,” in Proceedings of **MobiSys '12**, (New York, NY, USA)

Pruning Virtual Landmarks



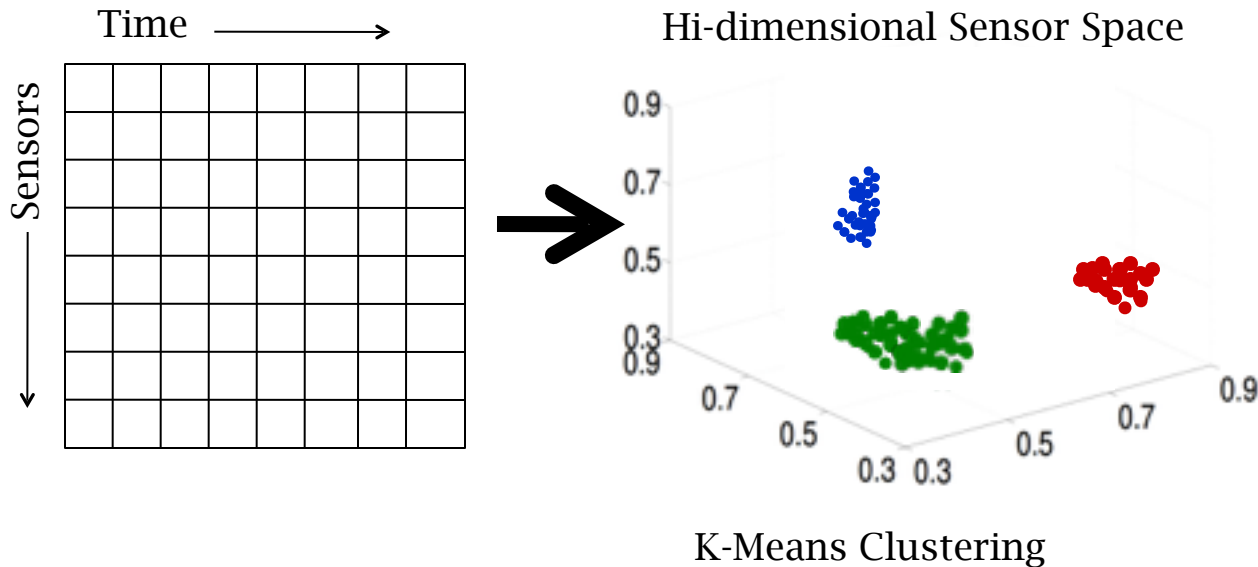
H. Wang et al., “**No need to war-drive: unsupervised indoor localization**,” in Proceedings of **MobiSys '12**, (New York, NY, USA)

Pruning Virtual Landmarks



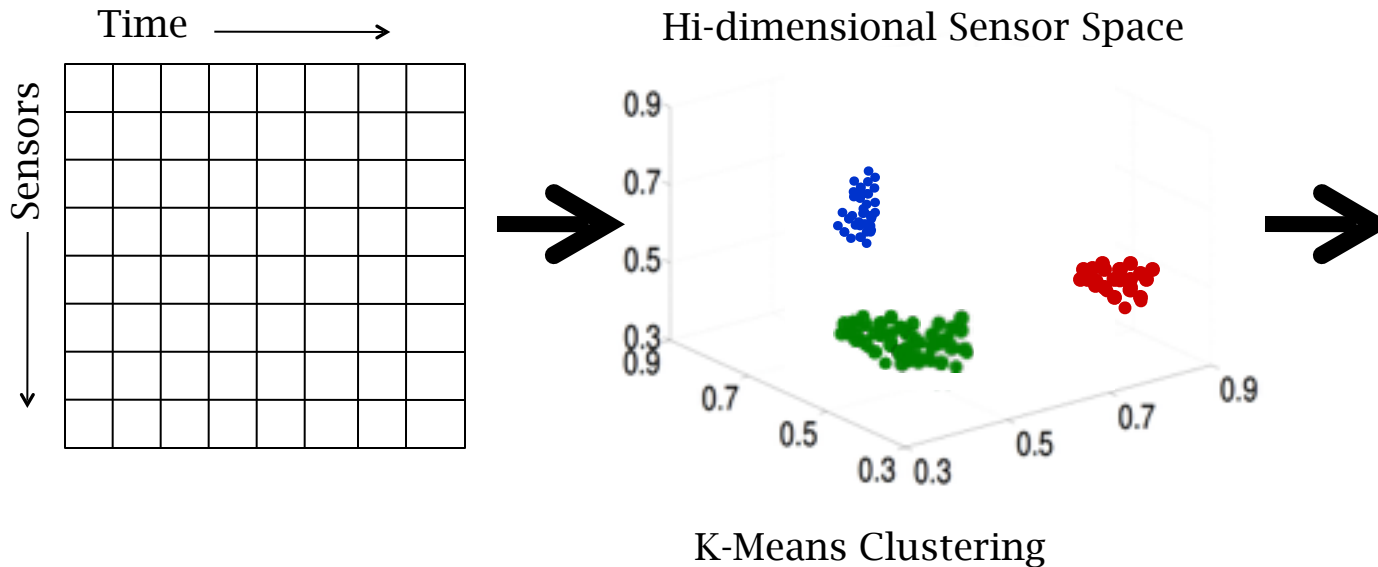
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Pruning Virtual Landmarks



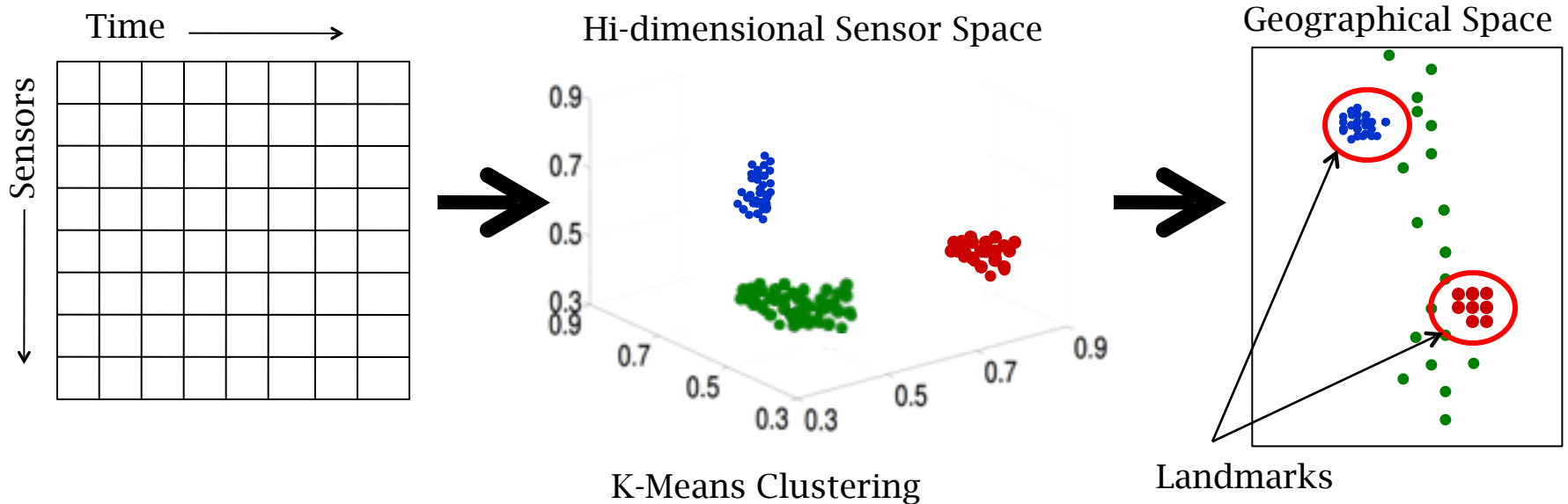
H. Wang et al., “**No need to war-drive: unsupervised indoor localization,**” in Proceedings of **MobiSys '12**, (New York, NY, USA)

Pruning Virtual Landmarks



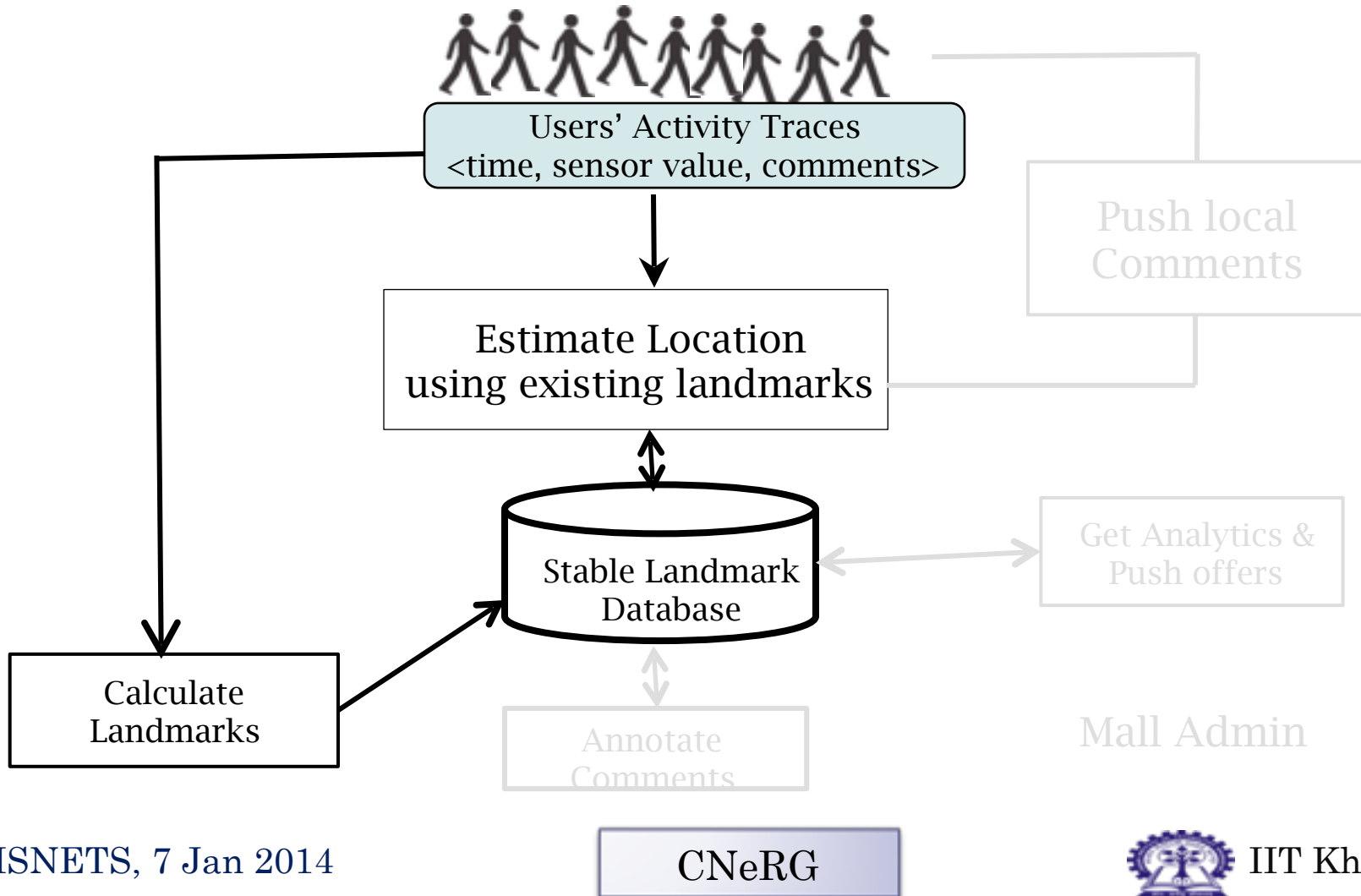
H. Wang et al., “**No need to war-drive: unsupervised indoor localization**,” in Proceedings of **MobiSys '12**, (New York, NY, USA)

Pruning Virtual Landmarks

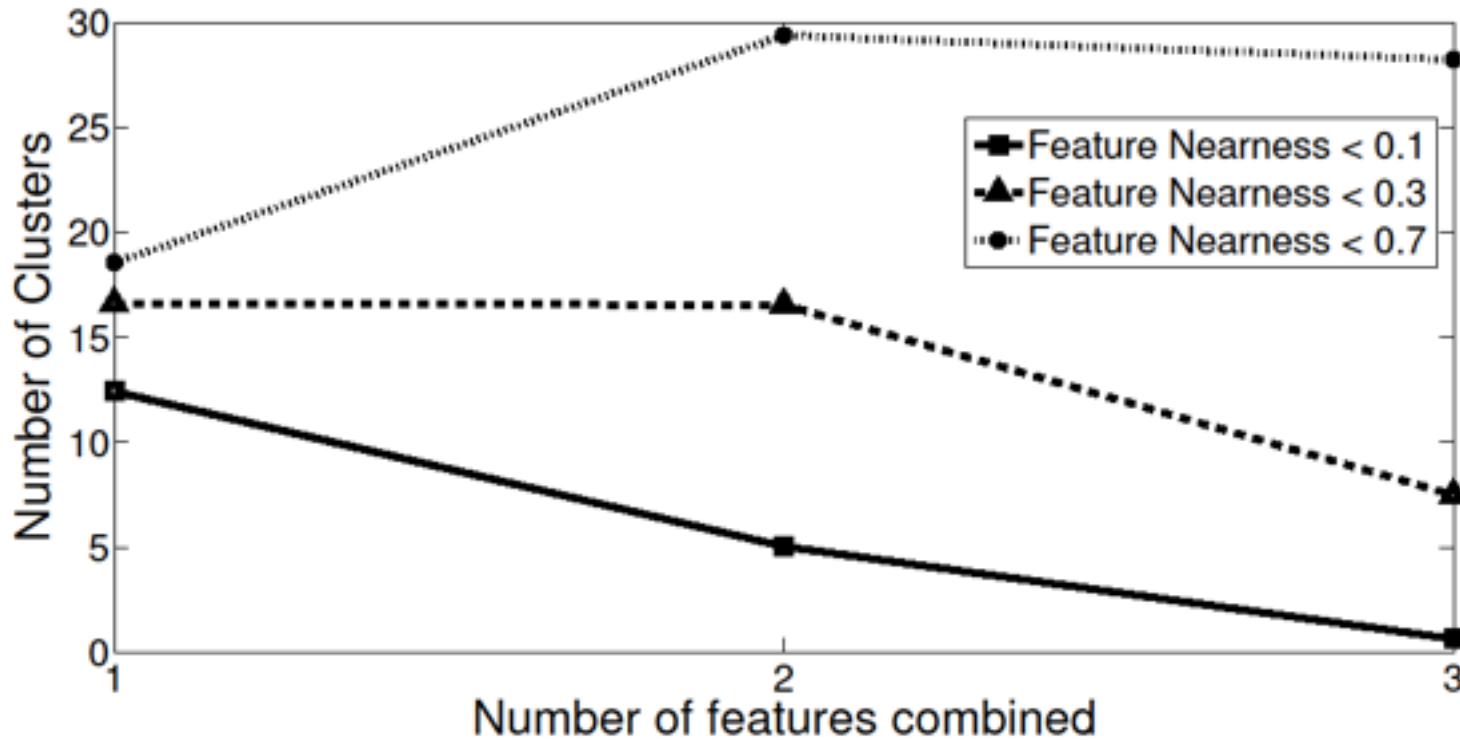


H. Wang et al., “**No need to war-drive: unsupervised indoor localization**,” in Proceedings of **MobiSys '12**, (New York, NY, USA)

Landmark Pruning Architecture

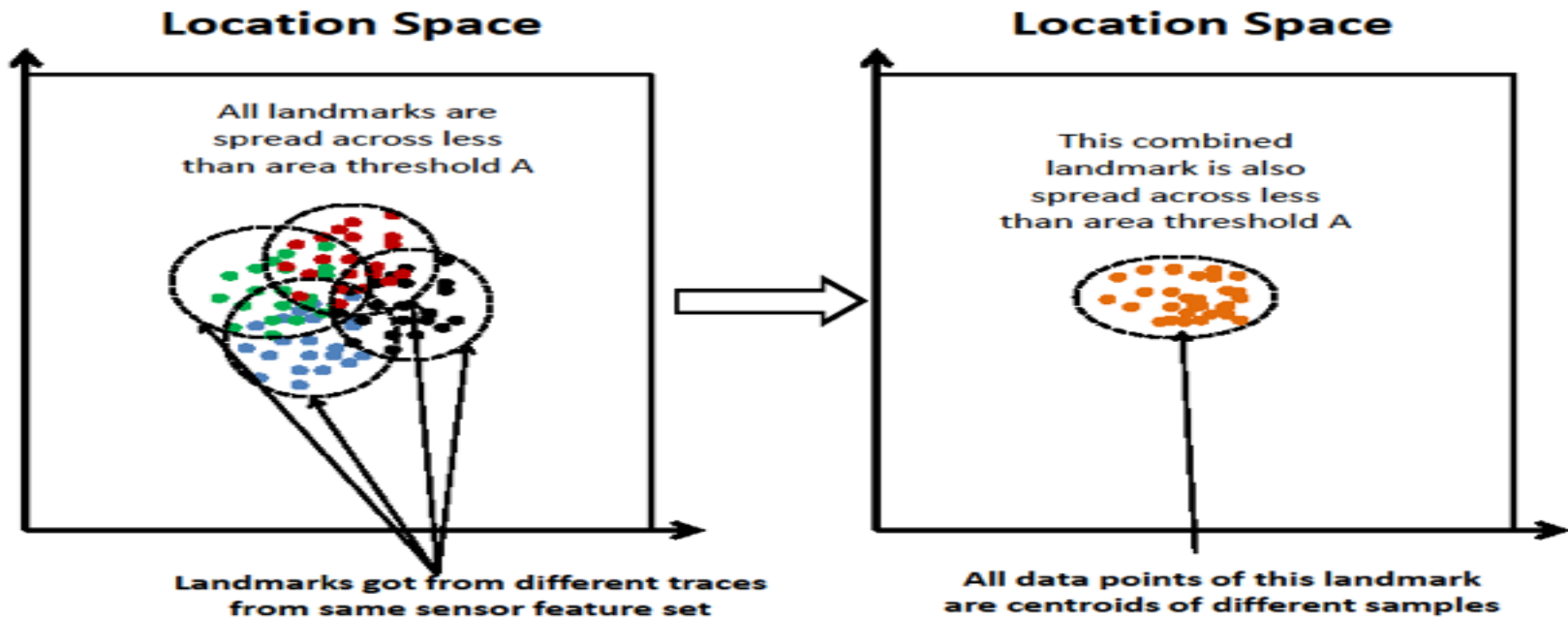


Which Feature Set to Choose?



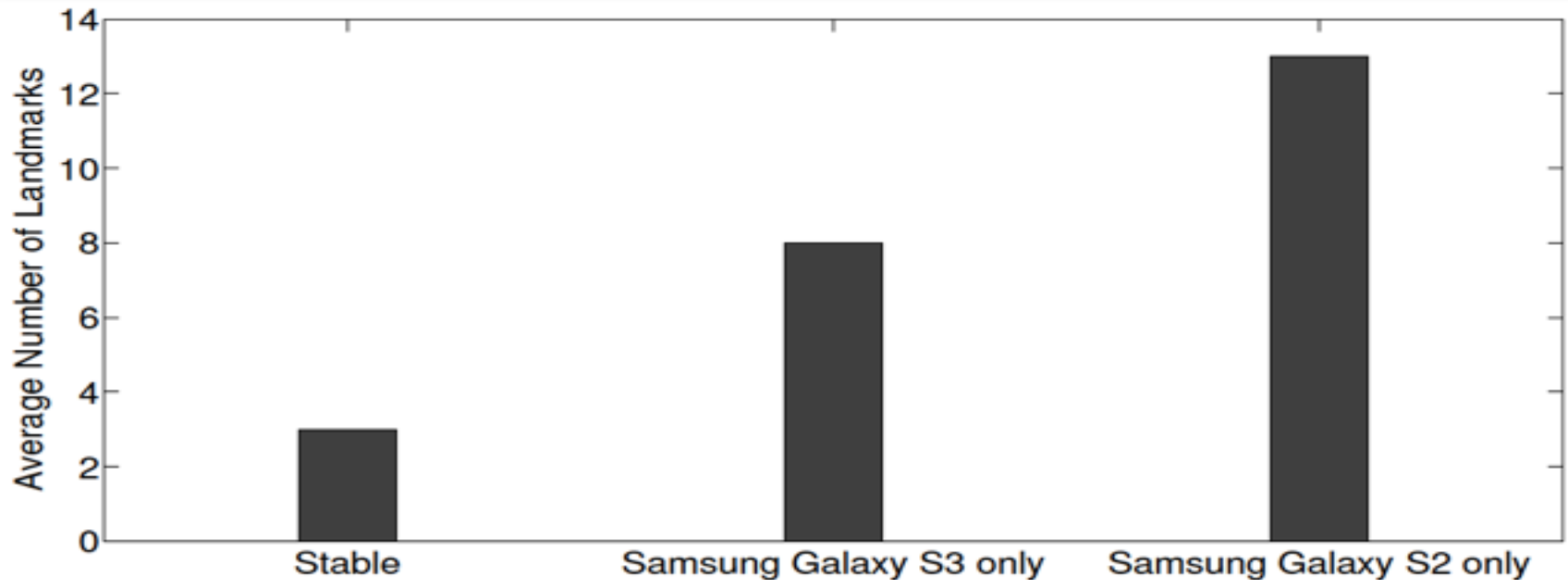
- ❑ Multiple sensor combinations give Landmarks.
- ❑ Three feature combinations are sufficient.

Finding (Stable)Virtual Landmarks



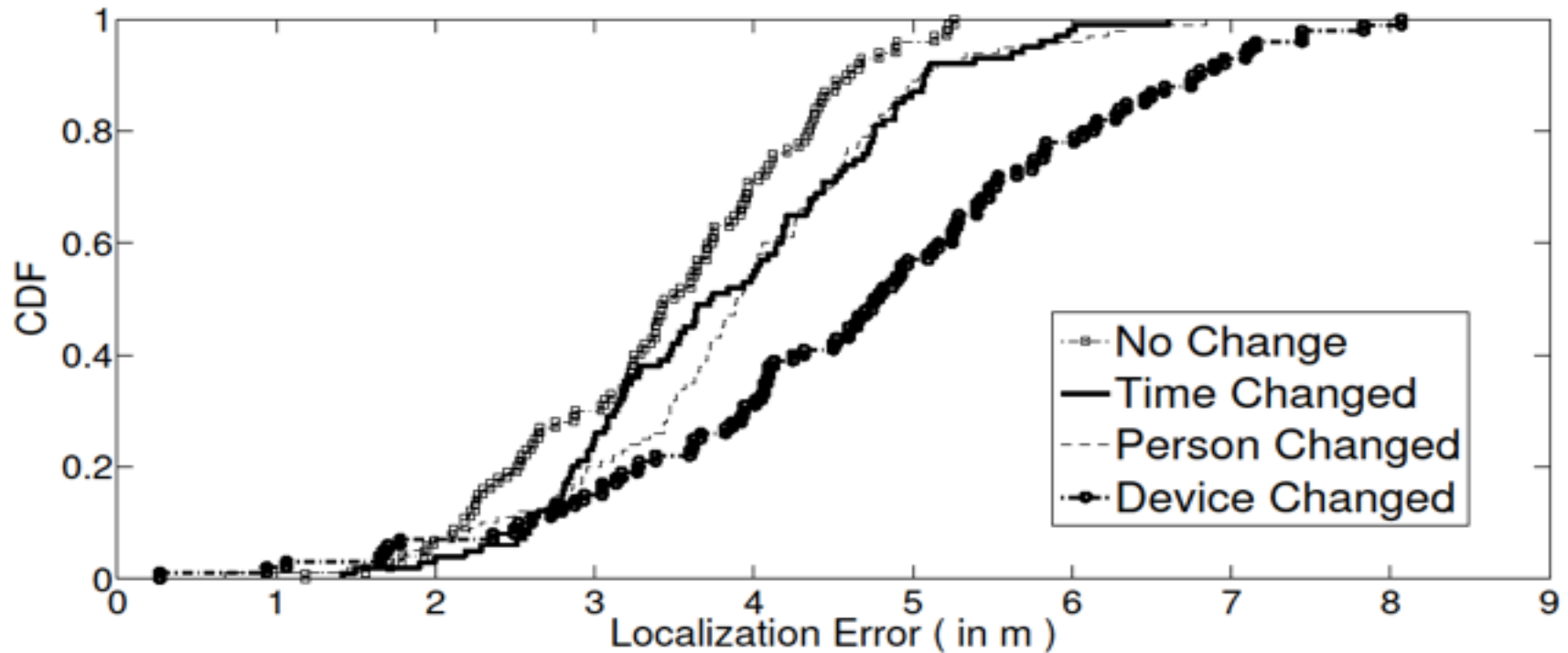
- ❑ Stable Landmarks are essential for *RetailGuide* to work.
- ❑ Converging to a stable landmark from different user traces is non-trivial.

Finding (Stable) Virtual Landmarks



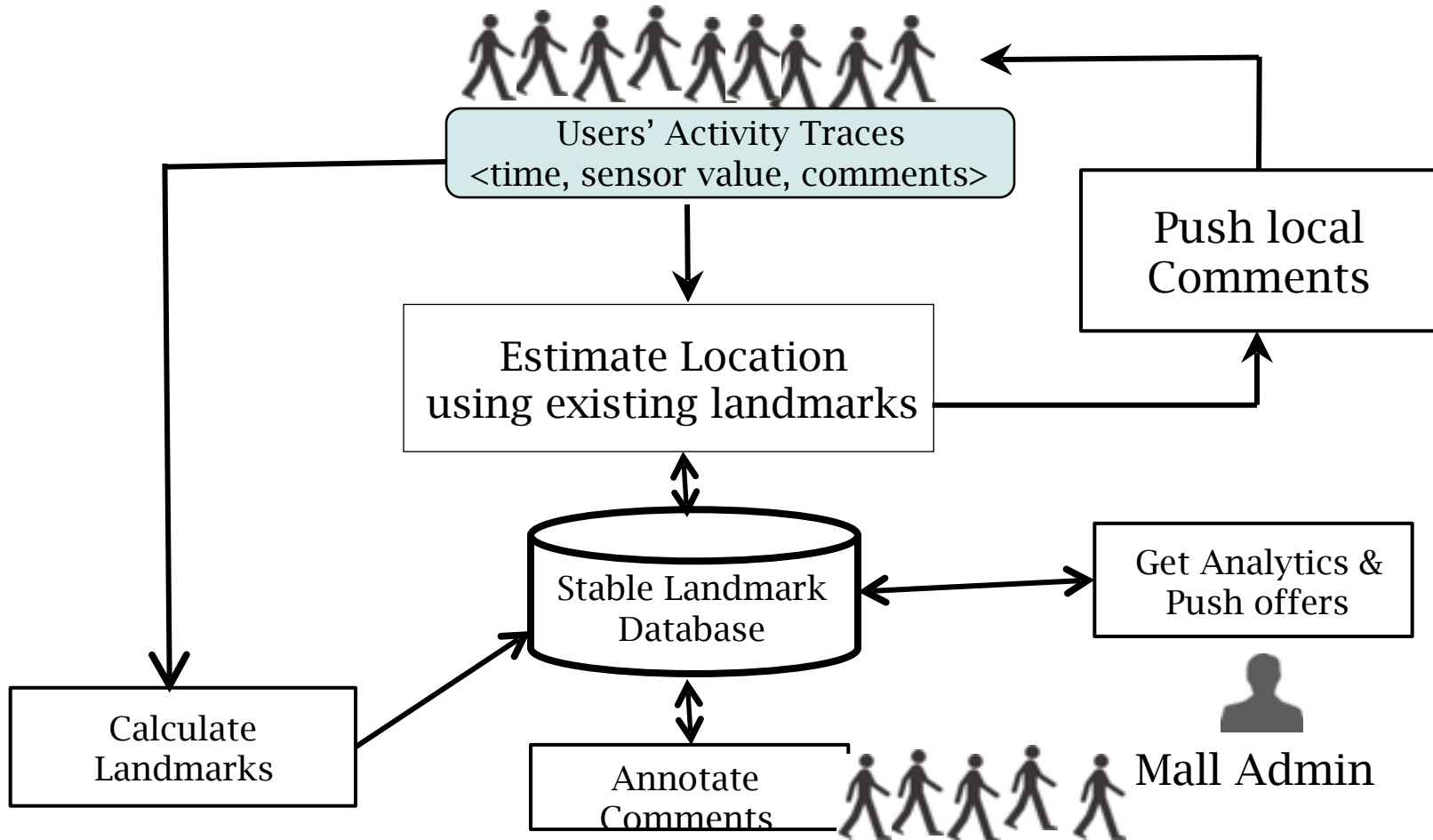
- ❑ Very less stable landmarks.
- ❑ Skew in sensor measurement across devices.
- ❑ **Solution: Maintain different database based on sensor manufacturer.**

Stable Landmarks : Characteristics



□ Impact on Localization: **Device** >> **Time** > **Person**.

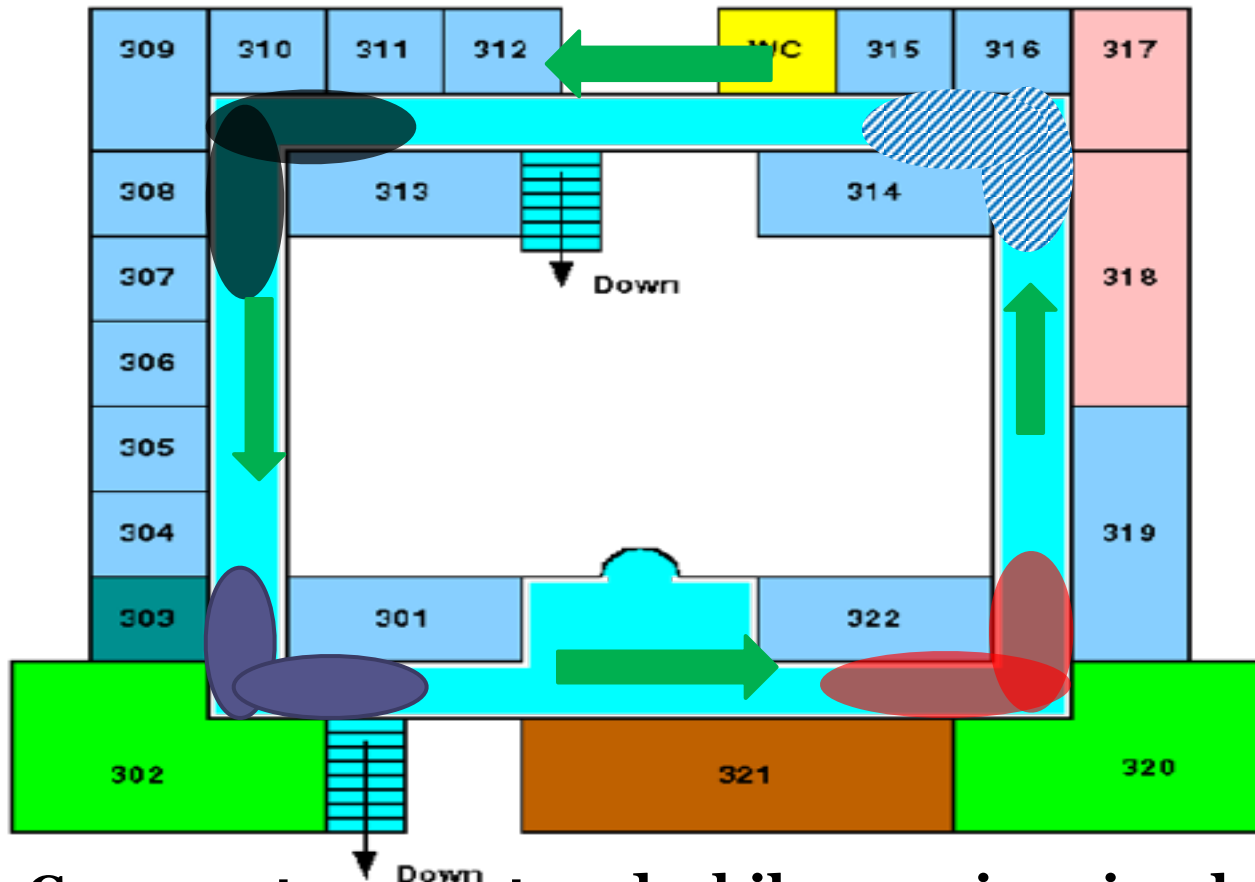
RetailGuide Architecture



Experimental Setup : Pseudo Experiment

- ❑ Simulated mall scenario in the CS Department 2nd floor.
- ❑ 4 users at different time.
- ❑ Smart Phones used – Samsung Galaxy S2 and Samsung S3 with Android 4.2 OS.
- ❑ RetailGuide App used.

Pseudo Retail Scenario



Retail Aisles

-  Soap & Detergents
-  Food
-  Utensils
-  Jeans

Comments are entered while crossing simulated retail aisles

Experimental Settings

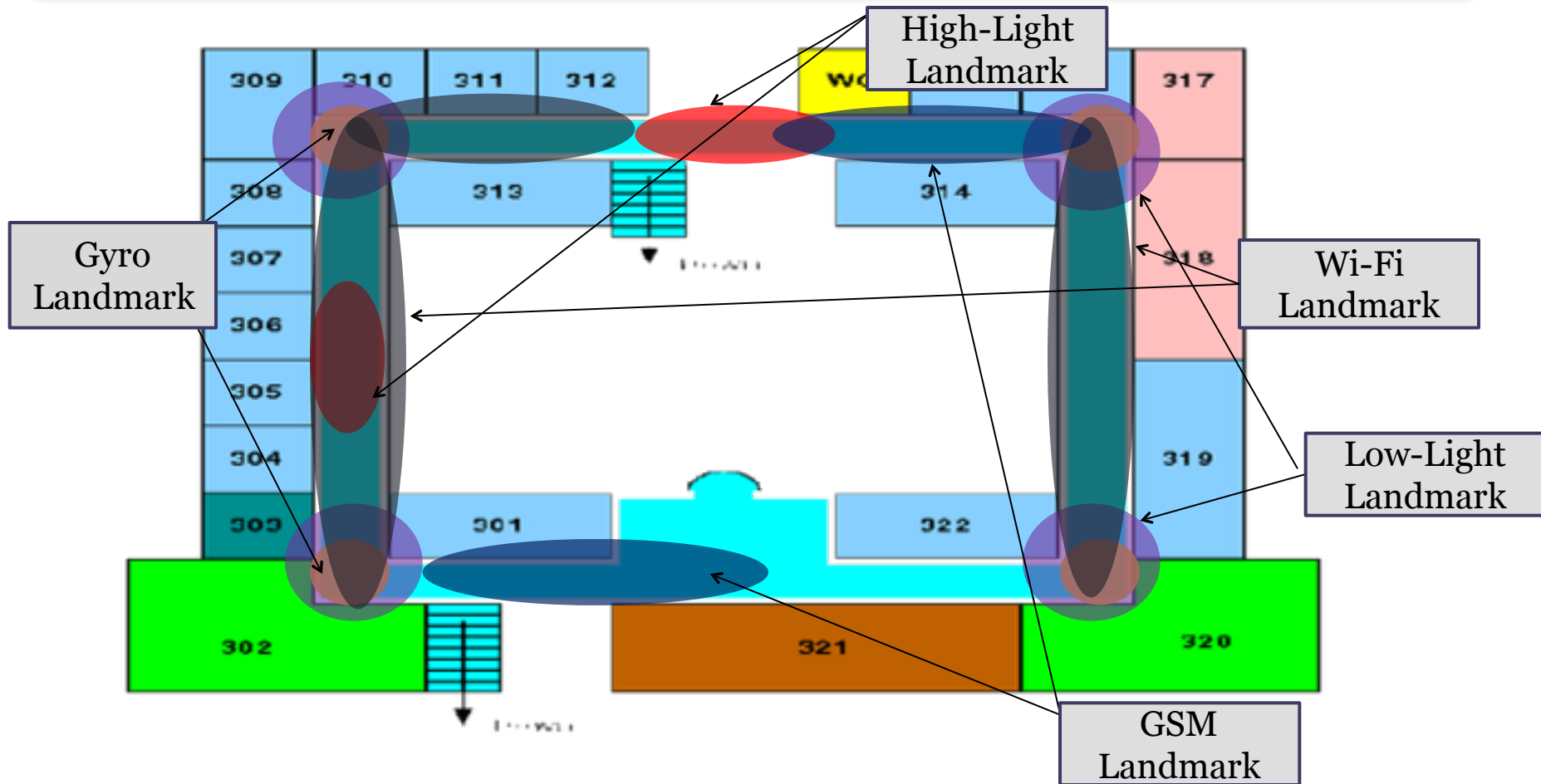
❑ Data Collection – Android App

- Start the app and follow different traces in the corridors.
- Sensor data collected and sent to the server periodically.
- <Timestamp comments> are pushed to the server.

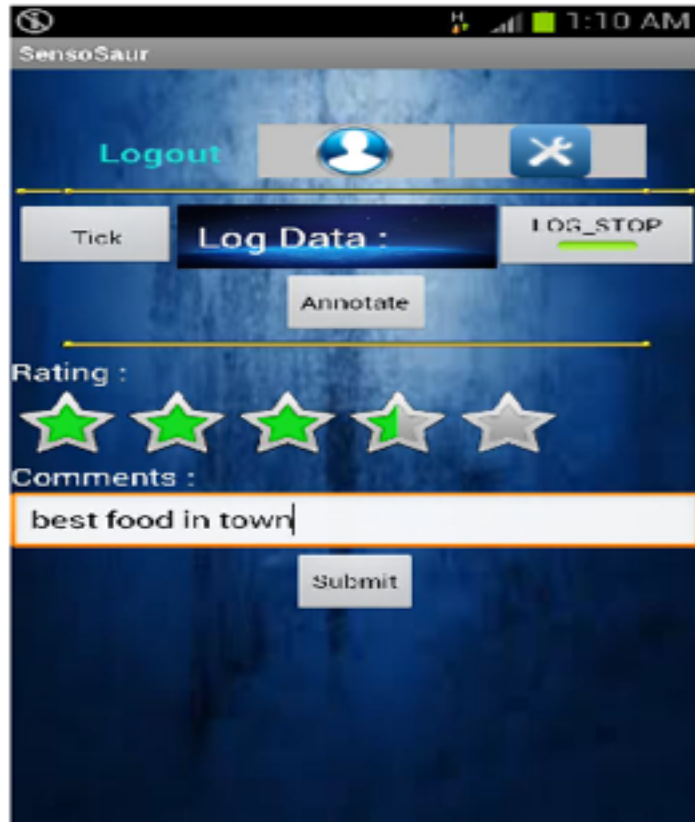
❑ Server Side – Apache server

- Landmarks detected and annotated in Stable Database.
- Push reviews + offers to phone.
- Java Application for Mall Owner to manage the Analytics.

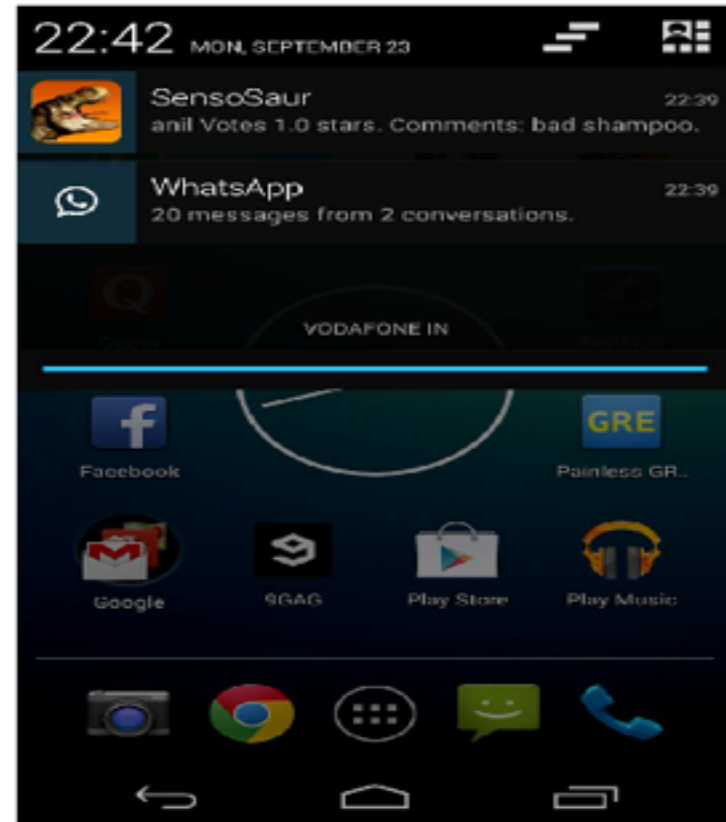
Some Virtual Landmarks



Customer Side Android App

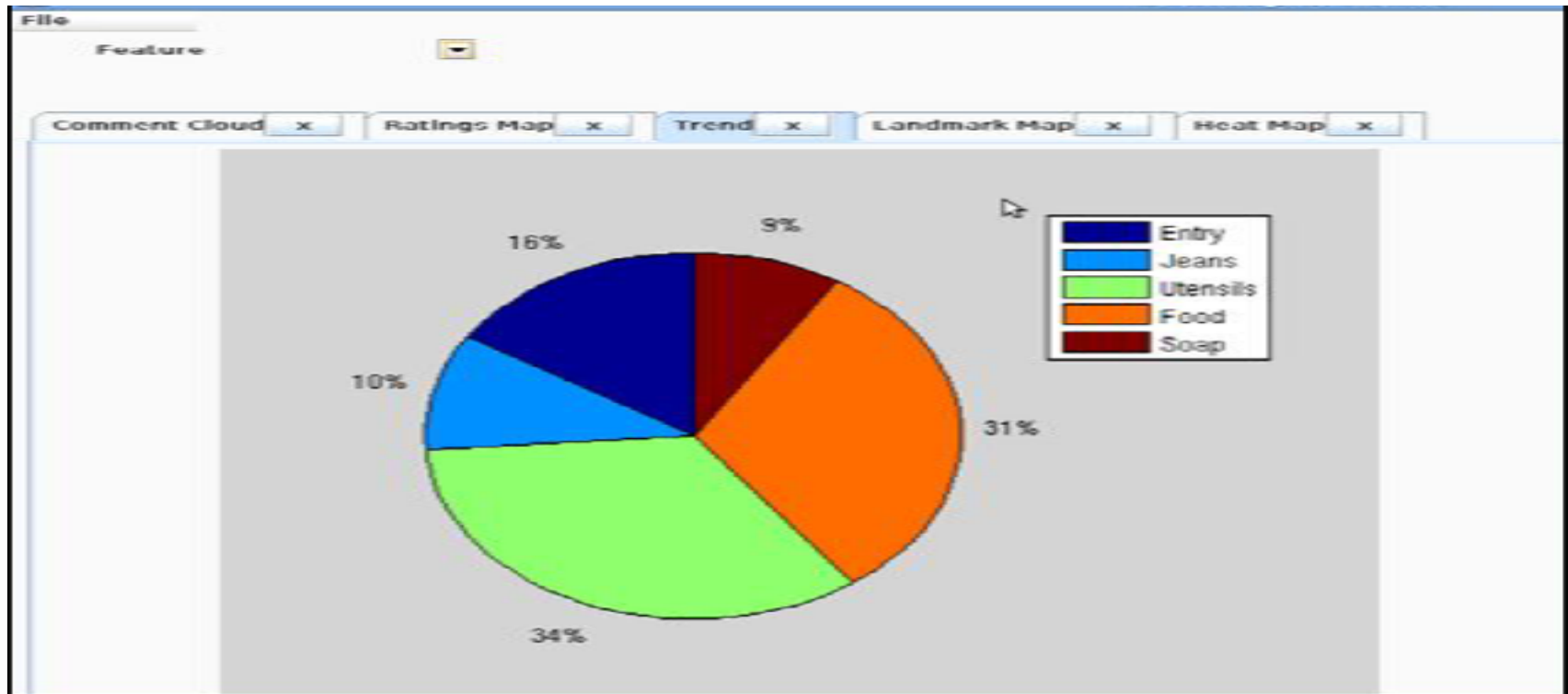


Users' Commenting Interface



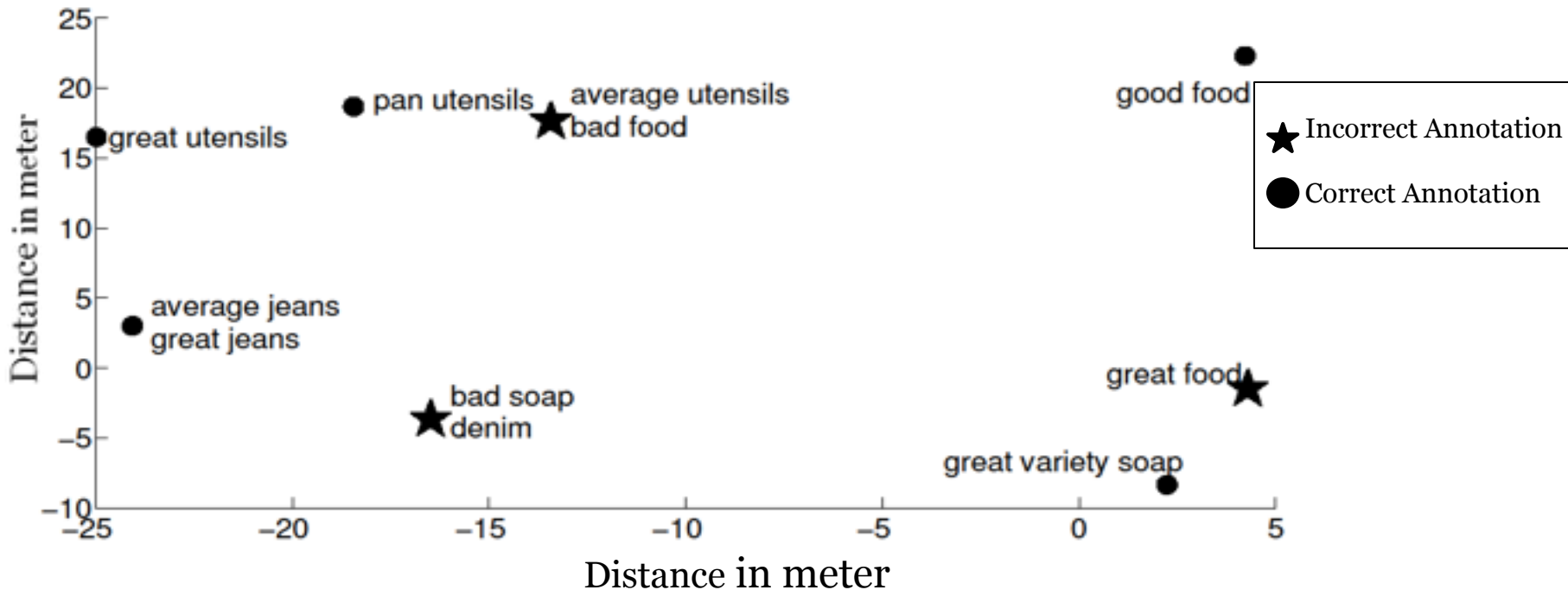
Pushed Notification of Comments

Mall Admin Side Analytics



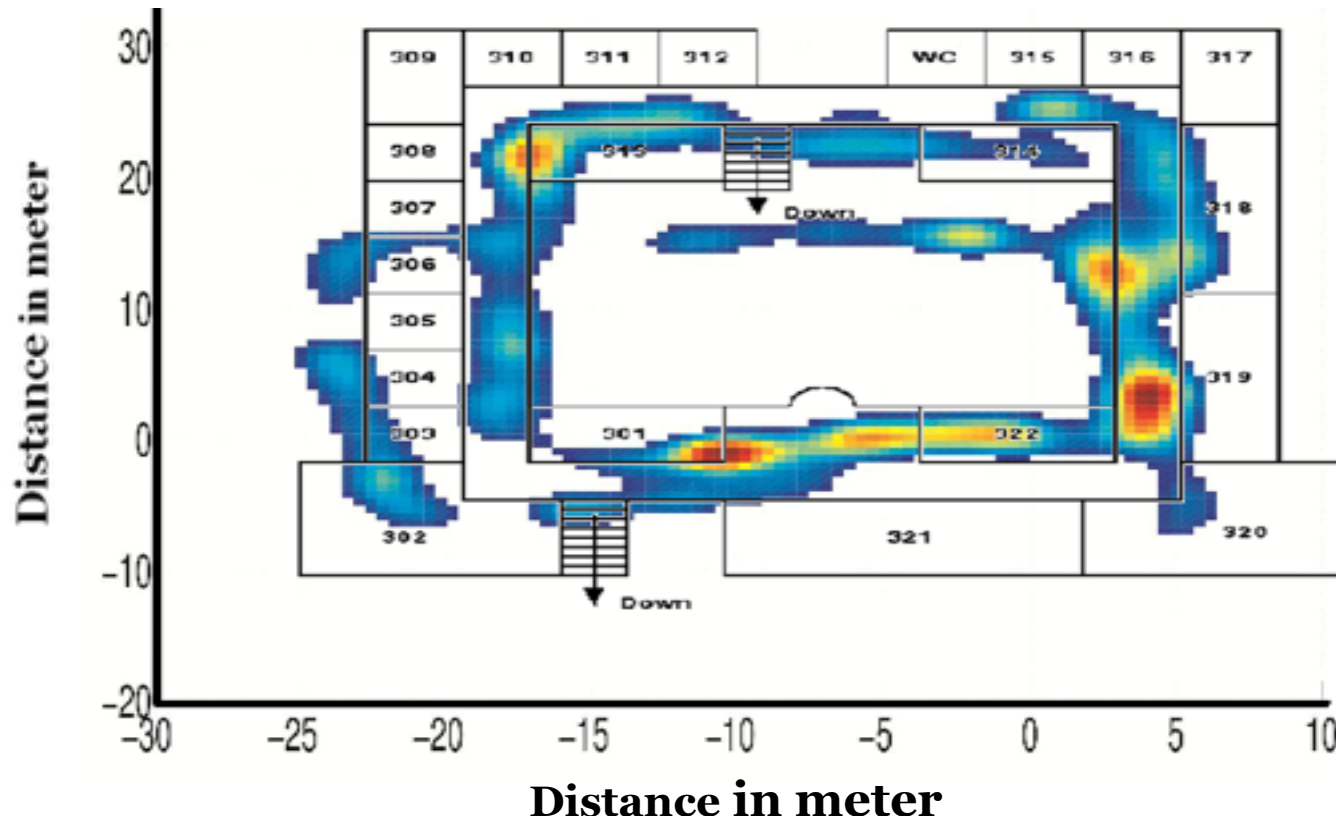
- Can utilize the trend to decide on the offers.
- Browse the data traces to identify patterns of activity.

Using RetailGuide App : Comments



- Comments annotated to nearest Landmark
- **~75% accuracy** in annotation despite localization error

Using RetailGuide App : User HeatMap



Red areas on the map are where users are spending more time

Conclusion

- ❑ Demonstrated the use of Virtual Landmarks in *RetailGuide*.
- ❑ High accuracy of annotation and analytics services.
- ❑ Real-time end-to-end applications relying on Landmarks can be realized.

Future Works

- ❑ Server is online, experiments to be done in a real shopping mall like Big Bazaar.
- ❑ Better interface for android app and better analytics facility for mall owners.
- ❑ Carry out experiments with more varying factors like phone orientation.
- ❑ More experiments on the accuracy and robustness of *RetailGuide*.

Future Beyond RetailGuide



iBeacon



Gimbal



Estimote

❑ Most importantly, Shoppers are ready to share their locations.

Thank You

