



Calibrating and Positioning RFID Sensors in Smart Environment

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Outline

- Introduction
- Calibration of sensor detector
- Positioning RFIDs
- Smart environment and applications of RFIDs
- Conclusion

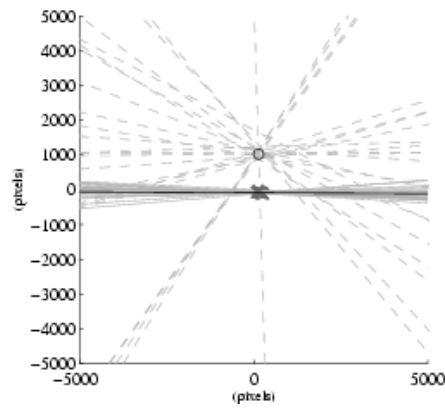
Two major issues which restrict RFID applications

- Accuracy of detection
 - 65% false positive
 - Solution: increase power and reduce wave length
- Positioning sensors
 - Power and wave length not helpful
 - Restrict applications very significantly,
 - eg, automatic check-out in supermarket

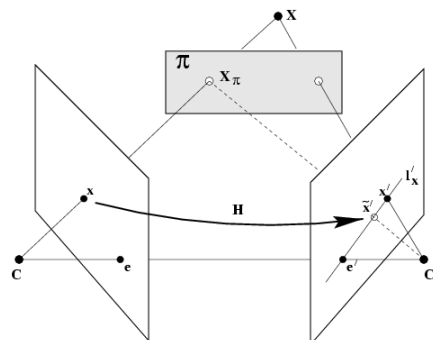
Six coded RFIDs to identify the position



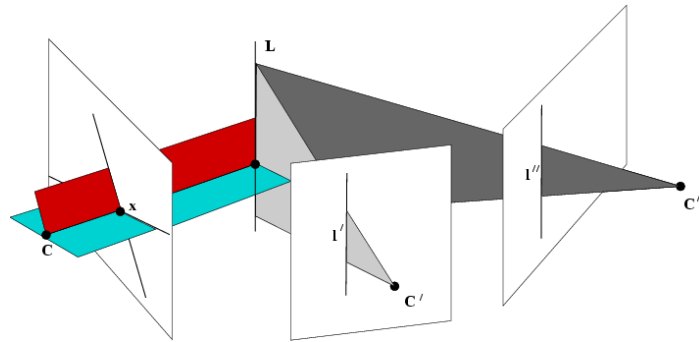
Intrinsic parameter estimation using planar property



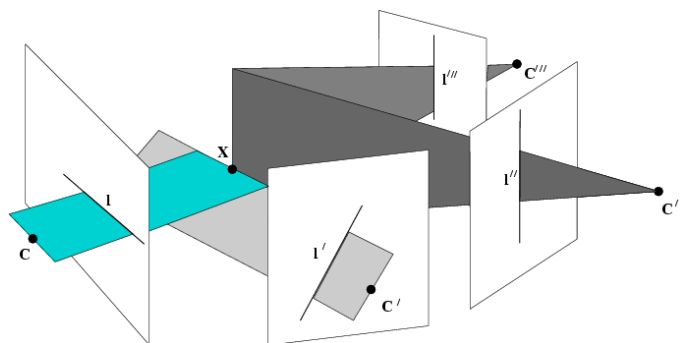
Epipolar geometry for detecting position



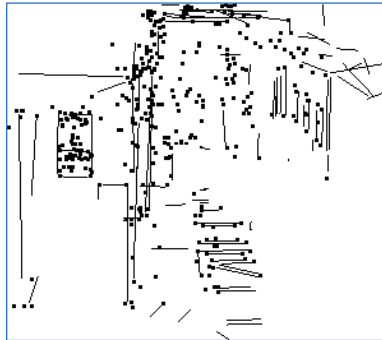
Multi-view positioning



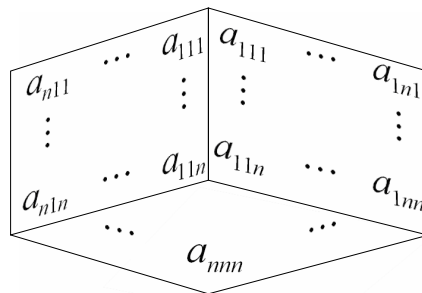
Multi-view positioning with error tolerance



Tracking with positioning



Clustering using high-dimensional matrixes



$$\begin{bmatrix} a_{111} & a_{121} & \dots & a_{1n1} \\ a_{211} & a_{221} & \dots & a_{2n1} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n11} & a_{n21} & \dots & a_{nn1} \end{bmatrix} \parallel \begin{bmatrix} a_{112} & a_{122} & \dots & a_{1n2} \\ a_{212} & a_{222} & \dots & a_{2n2} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n12} & a_{n22} & \dots & a_{nn2} \end{bmatrix} \dots \dots \begin{bmatrix} a_{12n} & a_{12n} & \dots & a_{1nn} \\ a_{21n} & a_{22n} & \dots & a_{2nn} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1n} & a_{n2n} & \dots & a_{nnn} \end{bmatrix}$$

Smart fridge using RFID tags



Smart fridge recommends recipes

FridgePanel

Store List Unexpired list Back

Code_ID	Name	Expire_Date
0930706090011	Raw Beef	20070609
0930706090031	Butter, No Salt	20070609
0930706090041	Cheese, macaroni	20070609
0930706090021	Beef Steak	20070609
0930706090141	Beer	20070609
0930706090101	Chicken, breast	20070609
0930706090051	Egg	20070609
0930706090111	Turkey	20070609
0930706090171	Chicken broth	20070609

FridgePanel

Recipes Dairy & Egg Products Please select Disease Back

Egg Salad

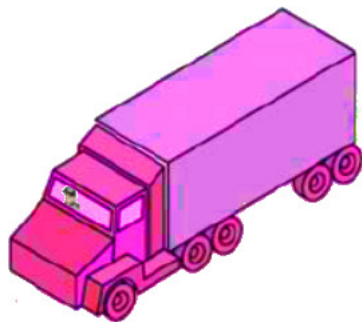
1. Run cold water over boiled eggs to prevent darkening. 2. Cool & peel. 3. Chop eggs finely. Add chopped onion to eggs. 4. Add salt, pepper, mustard, & miracle whip. 5. Mix well & refrigerate for at least 1 hour before serving.

Demo Previous Check Calorie Next

Smart fridge provides demo and visualization



Logistics control for DataMax



- Log tracking
- Driver safety control
- Mileage control
- Reward calculation
- Freight tracking

Conclusion

- Positioning RFID sensors is an important issue
- Positioning is possible through calibration
- We have developed a new calibration scheme
- Sensor network is a powerful solution for many applications

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Thank you and Questions