AUTOMATED LAUNDRY PROCESSING SYSTEM

ALPS

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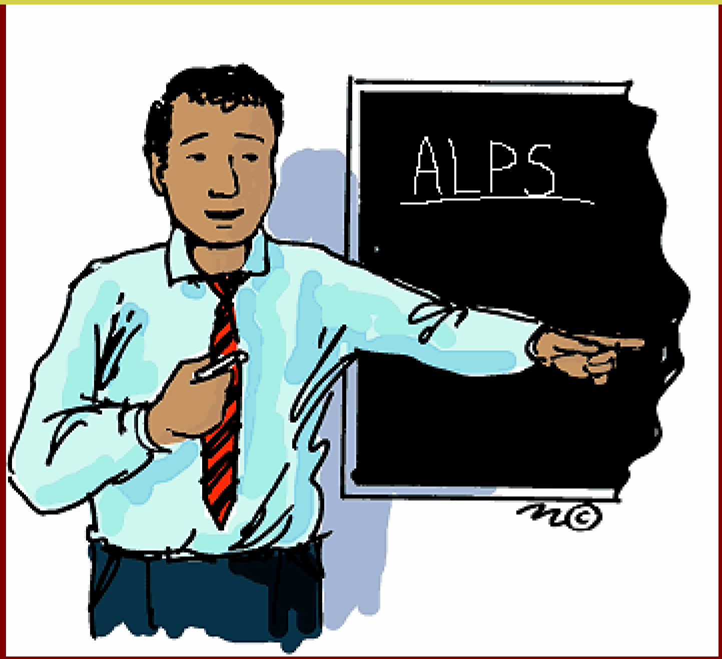
AUTOMATED LAUNDRY PROCESSING SYSTEM
ALPS

Sulaimin Barrett

- Introduction
- Tradeoff
- Conclusion



Presentation Outline

- Scope of Work
- Project Objective/Major Goals of *ALPS*
- System Overview
- Goals, Scenarios, Use Cases
- System Structure and Design
- Requirements
- Verification and Validation
- Tradeoff Analysis
- Conclusion

Scope of Work

Today's mom and pop dry cleaning business rely heavily on manual labor, especially the manual tagging, cataloging and searching of hundreds of customers' clothing. In a nutshell, a typical cleaner's business process consists of tagging the clothes, cleaning the clothes, cataloging and grouping the clean clothes based on the tags assigned to the clothes and to the customer, and searching for customers' clothes. Every step of the process involves manual cataloging and tracking of customer's clothes. These manual processes work well but are prone to errors and are taxing to dry cleaning staff. Computers have been introduced to the dry cleaning business to reduce errors, but there still exists a heavy reliance on manual labor in the cataloging and searching of clothes. As any manual process, human errors still exist in the process even with use of computers.

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We are proposing an automated system that will:

- Eliminate manual cataloging of clothes
- Eliminate manual searching for customer’s clothes
- Eliminate such error as misplaced/miscataloged clothes
- Reporting of any missing or late clothes
- Must be safe for end users
- Have manual backup if the system fails

All through the use of Smart Tag!

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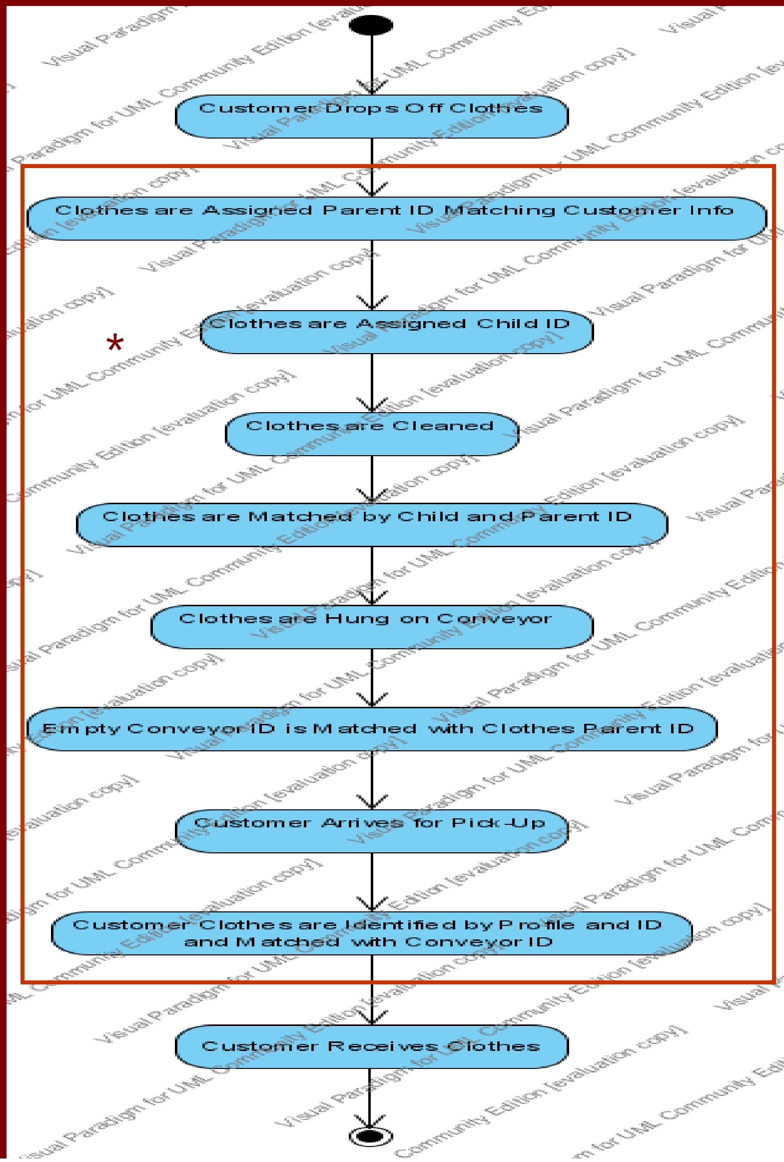

The overview of Automated Laundry Processing System (ALPS) consistes of the same standard process of picking up, dropping off and cleaning clothes without the use of paper receipts. The normal procedure of dropping off and picking up clothes remains the same but once the customer leaves ALPS take over to automate the logging process. As the customer drops off his or her clothes for cleaning, instead of a paper ticket given out the clothes are scanned and input into the system matching the customer's personal information. The customer is assigned a unique ID given by ALPS for pick up of clothes. ALPS uses Smart Tags and a sophisticated ID system to track clothes from drop off through laundering to pick up. It uses these Smart Tags to allow hands free control of the clothes conveyor allowing quick and easy pcik up of clothes by the customer.

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Customer Pick Up

Empty Conveyor

Clothes Cataloging With Scanner

Clerk User Screen

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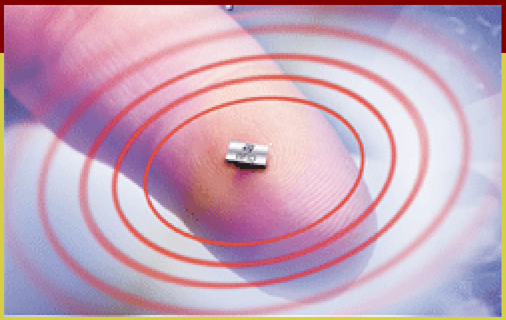
RF Chips



Clothes Cataloging With Scanner

RFID Buttons

Operator/User Characteristics

Typical operators or users of the system are expected to have at least rudimentary education consisting of at least middle school education.
The operators are required to read and understand written English language be proficient in usage of modern personal computers and its operations.

Definitions

Laundry Transaction: atomic action that starts with customer dropping off articles of clothes to be cleaned and ends with customer picking up the cleaned clothes.
Transaction id/Parent id: an identifier associated with Laundry Transaction
Child id: an identifier attached to each article of clothes in a laundry transaction
Tagging: an act of attaching a unique child id to an article of clothing
Tag: marker that can be identified with scanner
Abnormal child id: all ids that does not belong to the laundry transaction id

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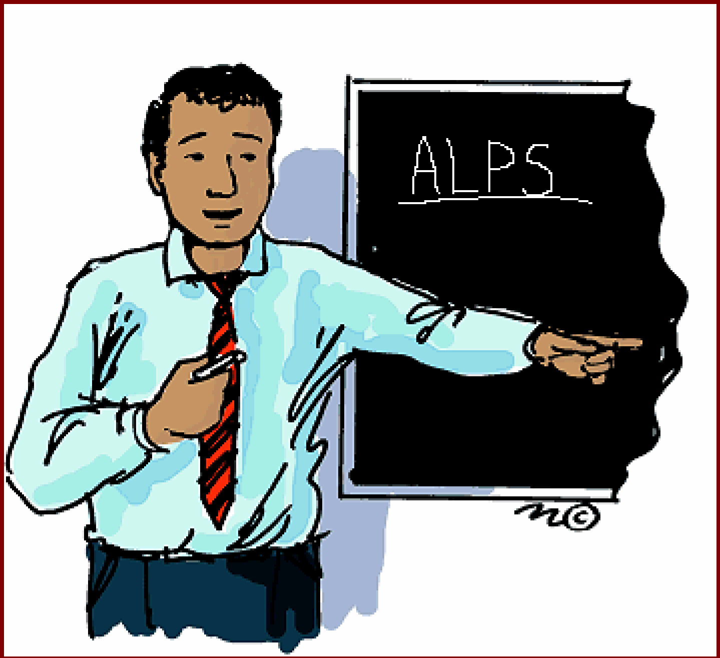
- System Overview
- Major System Use Cases



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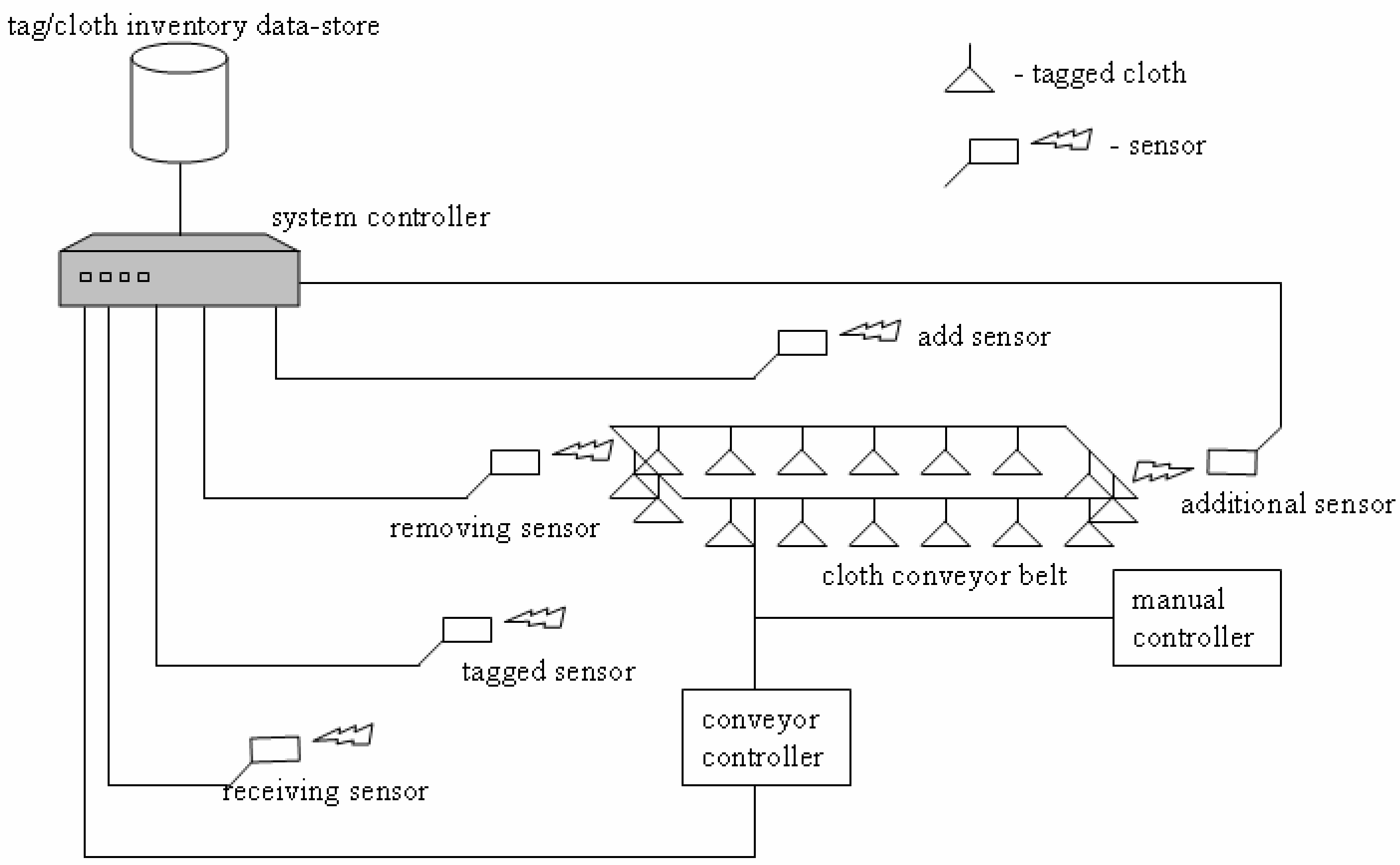

System View

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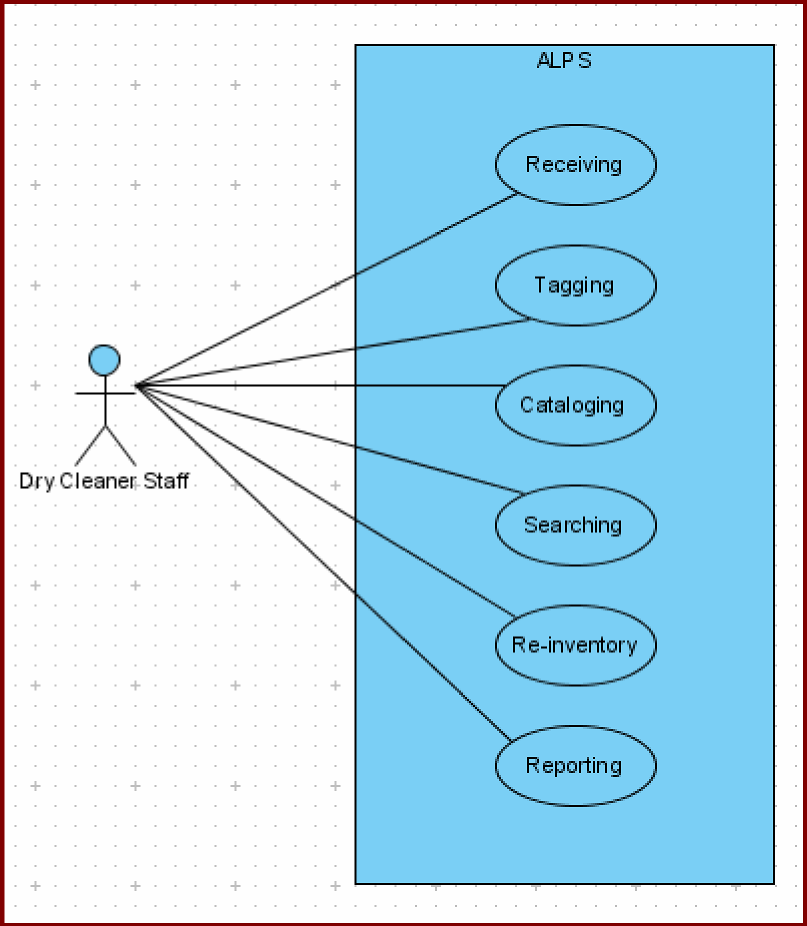
System Use Cases



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Name:	**Receiving Scan**
Description:	Customer brings in clothes to get them dry-cleaned. The employee takes the clothes and hands a receipt to the customer.
Actors:	Employee
Trigger:	Customer bring clothes to get cleaned
Precondition:	None
Post-condition:	System has the printed receipt in the system's data store.
Normal Flow:	1. Employee prints a receipt and scans the receipt 2. System stores the scanned receipt's id 3. Receipt is handed to customer 4. Employee bags the clothes and the receipt
Alternate Flow:	None
Notes:	

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Name:	**Tagged Scan**
Description:	After the clothes are received, employee tags the bagged clothes. The tags are scanned into the system along with the parent tag, which is the receipt. The parent tag and the child tags on the clothes are linked.
Actors:	Employee
Trigger:	Bagged clothe arrives to tagging station
Precondition:	Parent receipt is created and scanned into the system
Post-condition:	Parent tag and child tags are in the system with established relationship between the parent and child tags.
Normal Flow:	1. Bagged clothes are tagged. 2. Parent tag is scanned 3. Parent tag is retrieved from the system and displayed 4. Tags attached to the clothes are scanned and these tags are defined as child tags 5. Child tags are associated with the parent tag
Alternate Flow:	3.1 Parent tag is not found in the system 3.2 Scan the parent tag in the bag and save it 4. Flow of normal flow is followed from here on at step 4 of normal flow
Notes:	

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Name:	**Cataloging Cleaned Clothes**
Description:	After the cleaned clothes are returned from the cleaning facility or after cleaned on site, the clean clothes are hanged on the conveyor belt and cataloged into the system.
Actors:	Employee
Trigger:	Cleaned cloth arrives and needs to be cataloged. Cleaned clothes are grouped as a bundle with their parent tag/receipt attached to the bundle
Precondition:	System has parent and child tag and its relationship stored in the data-store.
Post-condition:	System stores the location where the cleaned clothes/parent tag is hanged.
Normal Flow:	1. Employee rotates the conveyor belt until open slot is found 2. Employee hangs the clothes on the open slot 3. System scans the hanged clothes' parent tag 4. System marks the location where of open slot and associates with the scanned parent tag
Alternate Flow:	None
Notes:	None

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Name:	**Searching and removing Customer Clothes**
Description:	Customer comes in to pick up their cleaned clothes and system finds the clothes and rotates the conveyor belt and stop the conveyor belt where the cloths hangs
Actors:	Employee
Trigger:	Customer comes in the pick their cloth.
Precondition:	System has the location of the clothes stored in the system's data-store
Post-condition:	System marks the parent tag as being picked up and no longer in the system.
Normal Flow:	1. Employee scans the customer's receipt 2. System retrieves the scanned receipt's tag and location where the clothes are. 3. System rotates the conveyor belt and stop on the location where the clothes are hanging 4. Employee unhooks the clothes from the conveyor belt and hands the clothes to customer 5. System marks the parent tag as being picked up
Alternate Flow:	1. Employee enters customer's account number 2. System retrieves all the parent tags under the account number 3. System finds first parent tag and rotates the conveyor belt 4. System stops conveyor belt at the location where the clothes are hanging 5. Employee unhooks the clothes 6. System marks the unhooked clothes' parent tag as being picked up. 7. Employee presses "Next" button 8. Go to step 3 until all the clothes are marked as picked up
Notes:	

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Name:	**Re-inventorying**
Description:	At set time or when employee request re-inventory, system associates all the parent tags in the system with location of the slot where the clothes are hanging
Actors:	Employee or pre-determined time
Trigger:	Pre-determined time arrives or employee requests re-inventory
Precondition:	System is in working order
Post-condition:	All the clothes/parent tags in the conveyor belt are scanned and its location is logged.
Normal Flow:	1. System rotates the conveyor belt 2. Scans all the parent tags and associated slot number 3. Saves the tag and slot number in the system 4. System stops the conveyor belt until all the slots are accounted for
Alternate Flow:	None
Notes:	

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Name:	**Reporting**
Description:	System scans the data-store and report any missing clothes or overdue clothes
Actors:	Employee
Trigger:	Makes request for Report
Precondition:	System is in working order
Post-condition:	Report is displayed
Normal Flow:	1. Employee request a missing/overdue report 2. System scans the data-store for missing clothes 3. System scans the data-store for overdue clothes 4. System display missing clothes and overdue clothes with associated customer info
Alternate Flow:	None
Notes:	

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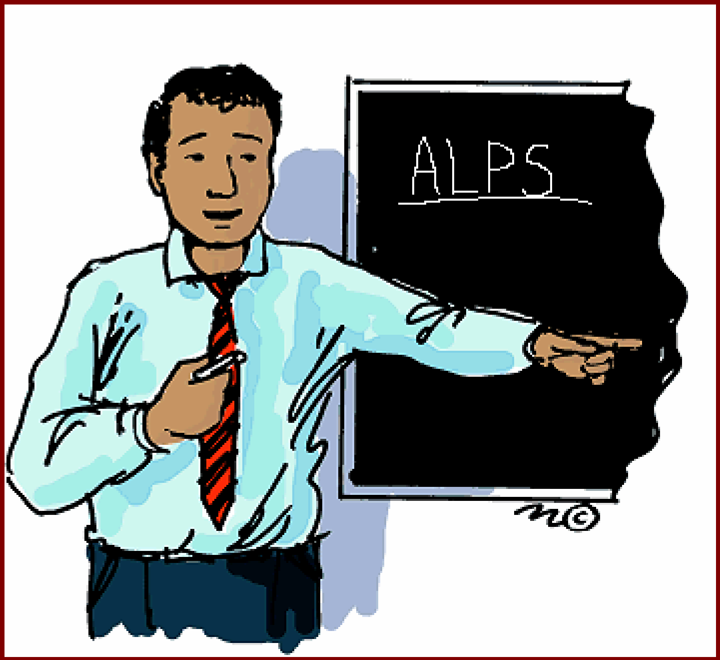
- System Design
- Verification & Validation
- Tradeoff Study



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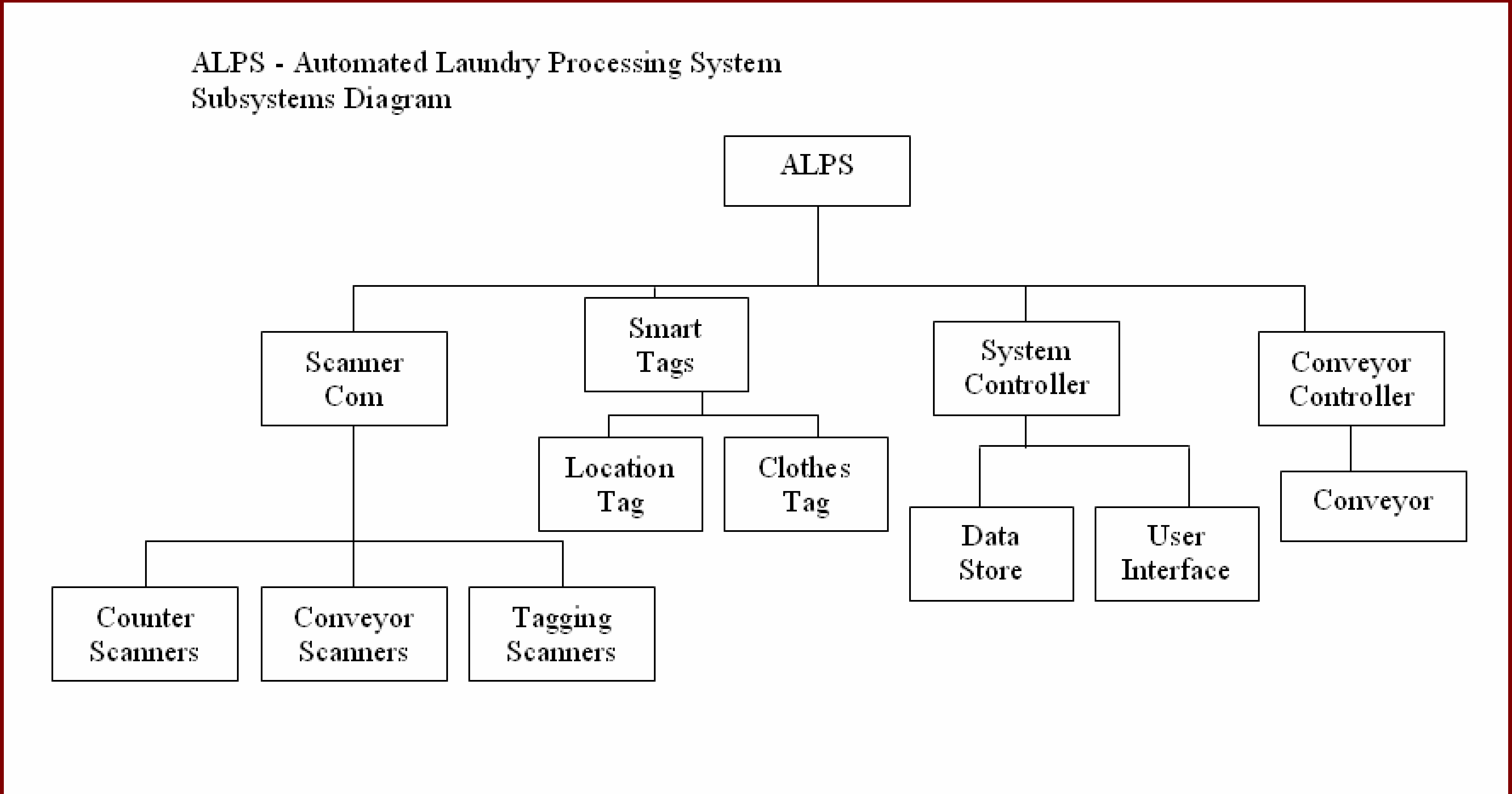
Logical System Structure/Design



REQUIREMENTS TRACEABILITY MATRIX

Requrements	Goals	Scenarios	Verification
1.1 Tags shall be capable of wireless, mid-range (at least __ meters) radio- frequency communications.			
1.1.1 The tag shall communicate with manual tag programmers (Employees).	1, 2	1.1/1.4	V_1.0
1.1.2 The Tag shall communicate with Sensors mounted in a laundry.			
1.1.2.1 Particular number of sensors should be installed in a laundry according to the laundry's area and size.	1	2.4/3.1/3.2/ 4.3/5.1/5.3	V_1.1.4 & V_1.1.5
1.1.2.2 Each Sensor shall be capable of sending and receiving radio frequency (RF) signals in a hemispherical pattern to communicate at a sepecific range.	3, 4, 6	5.1/5.3	V_1.6

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Verification ID	Verification Requirement	Level
V_1.0	Using a fully assembled Smart Tag, Sensor/Scanner, and desktop computer running conveyer belt controlling and logistics tracking software, perform the following functions: 1. Enter Smart Tag I.D. number, type of ID, Customer account number, and time/date information into database. Send data to Tag, verify that tag responds with acknowledgment of received data. Response must occur in 2 sec. or less. 2. Use logistics software to read tag data, data queried from tag must appear on computer screen within 2 seconds. Verify that data retrieved from tag matches the original data sent.	System

Tradeoff Analysis

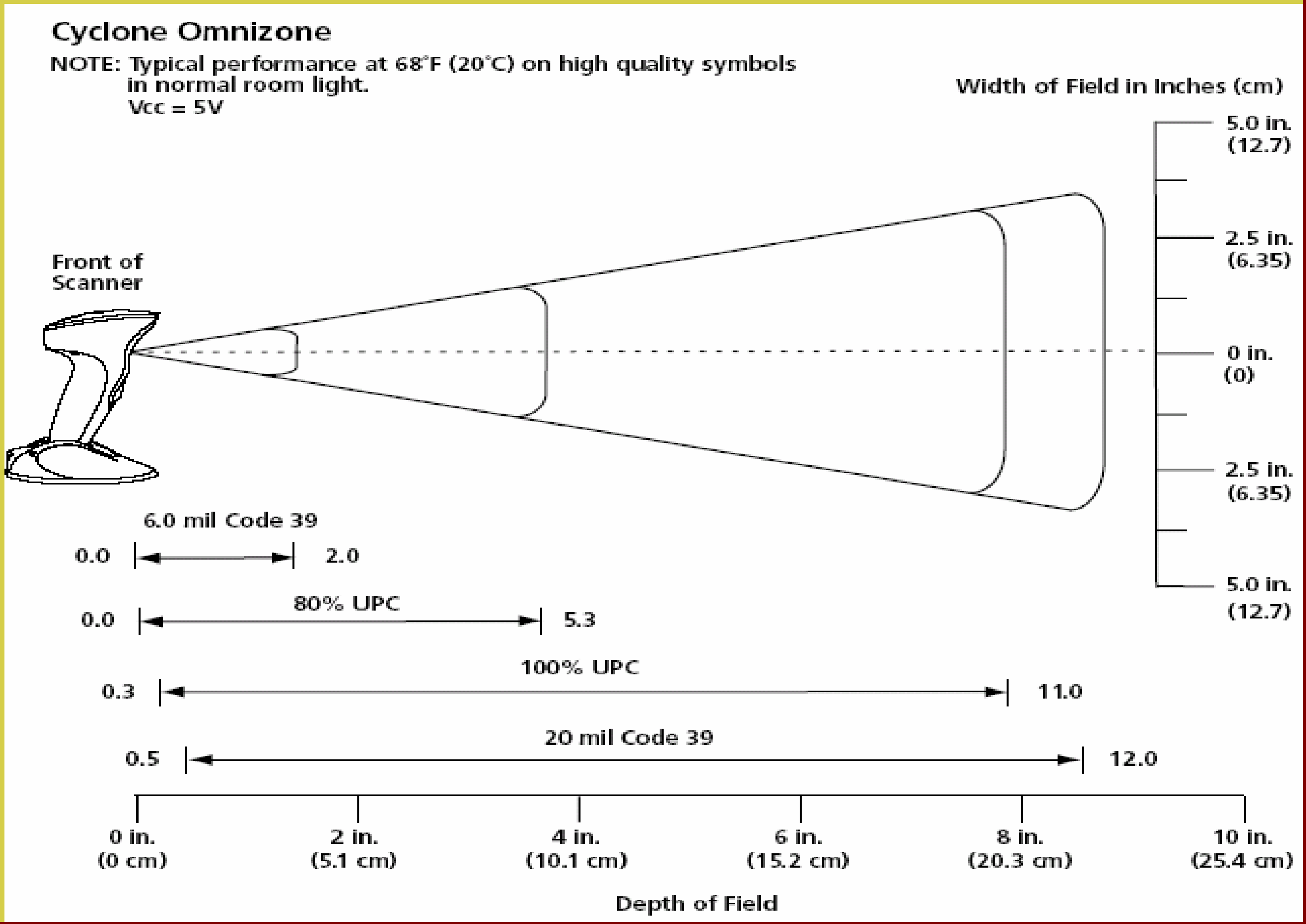
- Cost Saved
    - $20K/yr (labor)
    - $5K/yr (compensation)
- Cost Taken
    - Scanner (which & how many)
    - Tag
    - Controller / Printer

Cyclone M2000 Scanner - $499 (C1)

M2004-I400-0600ZN

Standard Applications, Synapse Adapter Cable-6 foot, Straight Cable-25-32463-20,

Single Line: 590 x 22 frames/sec.



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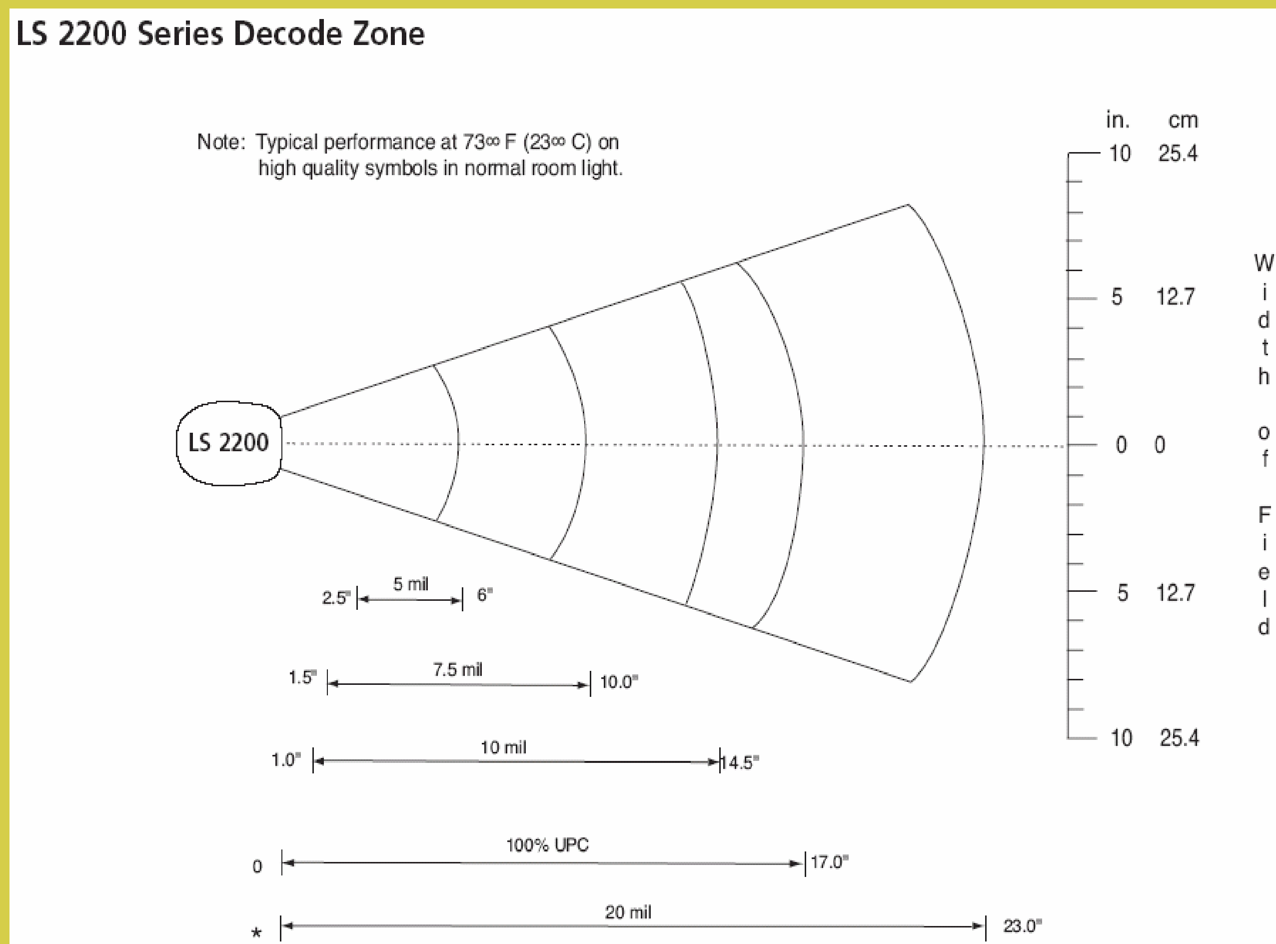
LS 2200 Series Scanner - $204 (C2)

LS2208-1AZK0100S

Multiple Interface Scanner: Includes 25-62417-20 Keyboard Wedge PS/2 6 Foot Straight Cable, 20-61019-01 Intellistand,

Scan Rate: 100 scans per second typical

Scan Angle: 23 degrees nominal



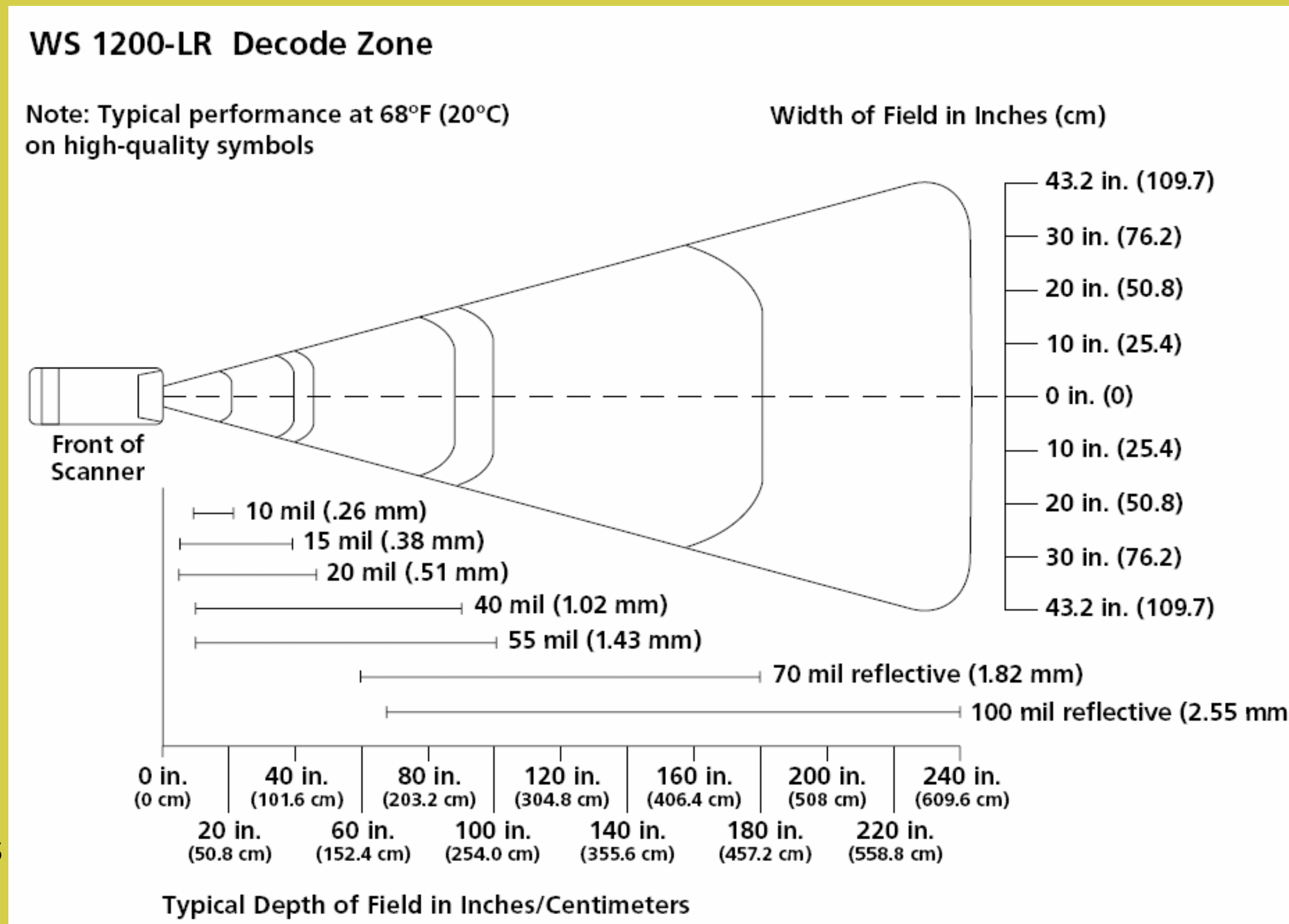
WS 1200-LR Scanner - $999 (C3)

WS1200-LR00

Long Range Scanner: with Plastic Cap, Trigger, Cable and Glove

Scan Rate: 35+5 scans per second

Scan Angle: 33 degrees nominal



Problem Notation

- C1 = cost of M2000 Scanner
- X1 = number of M2000 needed
- C2 = cost of LS 2200 Scanner
- X2 = number of LS2200 needed
- C3 = cost of WS 1200-LR Scanner
- X3 = number of WS 1200LR needed
- C4 = potential cost saving
- FC = fixed cost of Tag and Controller

Problem Formulation

Max: C4 – (C1*X1 + C2*X2 + C3*X3 + FC)

Subject to:

- C4 – Cost Taken > 0;
- (X1, X2, X3)

  (2, 8, 3);

  (3, 4, 2);

  (3, 2, 2);

GARMENT LENGTH	Up to 60" bag
SHAPES VARIATIONS	Straight, inline, L, & WIDE U

Tradeoff Analysis

Wired versus Wireless

Wired

- Cable lengths are typically fixed for a specific location
- Cost for running cables
- Electrician
- Loose cables most common source of failure

Factors Considered
Installation
Total Cost
Reliability
Performance

Wireless

- Very minimal construction
- Data/Signal loss
- Small Wiring Cost
- Environmental issues

Links for further reading

http://news.com.com/2100-1029-995744.html

http://specialevents.com/newsletter/GBS_Linens_uses_RFID_system_to_track_inventory_20060502/index.html

Any Burning Questions