Real World Applications of RFID

Mr. Mike Rogers
Bryan Senior High School
Omaha, NE
RFID Overview

- **RFID**=
  - Radio
  - Frequency
  - Identification

- RFID is based on wireless communication over the air that reads or writes information from a tag.
RFID Overview Continued...

http://www.youtube.com/watch?v=hPqUUR5OFJg&feature=related
Components of an RFID Deployment

- Transponder (tag) – active, passive frequency, form factor
- Encoder – “printers”
- Interrogator – Transceiver or reader ($1,000)
- Middleware
RFID Definitions

Famous Contributors

RFID is based on a chain of scientific discoveries from some of our most important intellectual pioneers such as:

1846
Michael Faraday: identified that both light and radio waves are part of electromagnetic energy.

1864
James Maxwell: in 1864 propounded his theory that electric and magnetic energy travel in transverse waves at the speed of light.

1887
Heinrich Hertz: proved Maxwell's theory and showed that radio waves may be reflected, refracted, and polarized like light.

1895
Guglielmo Marconi: demonstrated wireless transmission of radio waves.

Public Domain and Patents

Military and Government

For Profit Applications

RFID Timeline

Source: RFID Handbook + Land and Catlin’s “Shrouds of Time – The History of RFID”
Shoqlifter or not?

http://www.youtube.com/watch?v=eob532iEpqk&feature=related
Future Supermarket?

• When you go to the grocery store, how do you pay for your items?

• Is this process easy or time-consuming?

• What is the name of this item which cashiers use to check-out a product?

• How does this item work?
RFID vs the Barcode

• Barcode revolutionized Supply Chain Management

• RFID offers the benefits as the Bar Code – but also a whole lot more
• **Barcode**
  
  – **Strengths**
  • Mature technology
  • Established standards
  • Low implementation cost
  • Human readability
  
  – **Weaknesses**
  • Requires clean line of sight
  • Orientation sensitive
  • Sensitive to printing and abrasion
  • Static data content
Bar Code vs RFID

• RFID
  – **Strengths**
    • Line of sight NOT required
    • Passive data collection
    • Not sensitive to environment
    • Dynamic data content
    • Data Capacity
  – **Weaknesses**
    • Emerging technology
    • Lack of standards
    • Cost moderate to high today
Real World Examples of RFID

- Shop Lifting Systems
- Animal Tagging
- Toll Roads
- ID’s and Passports
- Keyless Entry
- Marathon Tracking
- Manufacturing
- Freight Transportation
- Distribution Center
- Retail Stores
- Medical Equipment
- Military/DOD

The key word today in industry is VISIBILITY
Visibility

• Information has Replaced Inventory

  – Technology
    • Internet
    • Supply Chain Software
      – And now RFID

  – Knowledge of what is in the pipeline allows the supply chain to hold less inventory
• What do we know about Inventory?

– It is Expensive
  – Inventory as a percent of total assets
    • Sarah Lee – 1998 – 25%  2007 – 9%
    • Wal-Mart – 1998 – 36%  2008 – 22%

– It is necessary
  • Stockouts cost money
    – P&G in 2003 – average out-of-stock was 10%
    » Cut that to 5% in 2005
RFID – Why Now?

• Mandates:
  – Wal-Mart
  – Target
  – DoD
  – Albertsons

• EPC compliant hardware is emerging

• EPC standards ratified in 12/04
  – Gen-2 tags
Why the Mandates?

• Wal-Mart -- $3.5 billion in lost sales

• Need product on the shelf.
RFID Technology

• Tags – Most important element

• Different types of tags
  – Active vs Passive
  – Low Frequency
  – High Frequency
  – Ultra High Frequency
RFID Tags

• **Passive Tag**
  – Energy from the reader “wakes up” the tag and powers its operation.
  – The tag then reflects a signal that can be decoded from the reader

• **Active Tag**
  – Transmit a signal using its own power source (battery) without initiation
# RFID Frequency

<table>
<thead>
<tr>
<th>Low Frequency (LF)</th>
<th>High Frequency (HF)</th>
<th>Very High Frequency</th>
<th>Ultra High Frequency (UHF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 kHz 125 kHz 134.2 kHz 300 kHz</td>
<td>3 MHz 13.56 MHz 30 MHz</td>
<td>31 MHz 300 MHz</td>
<td>300 MHz 433 MHz 2.45 GHz 3 GHz</td>
</tr>
</tbody>
</table>

RFID Tags
Low Frequency

- Typical Range – 10 feet
- Tag – 3-6 inches
- 50 tags can be read at once
- Cost $3-$10
- Not Wal-Mart compatible
- Used for animal tracking, ID badges
- Not EPC compatible
RFID Tags
High Frequency

• Typical Range – 10 feet
• Tag – 3-6 inches
• 50 tags can be read at once
• Cost $0.50-$5
• Not Wal-Mart compatible
• Used for Industrial, Scientific and Medical – Smart Card Security
• EPC compatible
RFID Tags
Ultra High Frequency

Typical Range – 40 feet
200-1000 tags can be read at once
Cost $0.20- Target is $.08
Wal-Mart compatible
Used for Retail and Supply Chain Management
EPC compatible
UPC vs. EPC

Universal Product Code
or
Electronic Product Code
Threats to RFID

- Tag Cost
- Cost of Implementation
- Lack of Standards
- RF transmission distance
- Tag/Reader sensitivity
- Privacy Concerns
- Security

http://www.youtube.com/watch?v=PoZ8B1qFWh8
RFID Assignment

• Research real-world applications of RFID on the internet
• Pick one application and create a two-minute presentation with a partner discussing this item
• You will be graded on this presentation with the RFID Grade Rubric