AccuTag by PRECISION WIRELESS

WIRELESS DIGITAL E-INK PRICE TAG SYSTEM

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THINKING OF THE WORLD

Overview

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Background

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There are many flaws in utilization of paper price tags:

- Updating traditional paper price tags is time consuming and labour intensive.
- The tags are most likely not recycled
- Updating the prices on the daily basis is not possible nor efficient.

Project Motivation

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- To develop a pricing system that is more efficient and reliable.
- To increase the feasibility of frequent price updates.
- To make the process more eco-friendly and power efficient compare to existing solutions
- To Enable price updates from the headquarters using a synchronized database system
- To make the system easy to use and implement so it can be integrated in any store in the matter of days.
- Making the display more flexible and user friendly depending on various applications.

Proposed Product

Wireless electronic price tag; AccuTag System:

Display Unit:

- E-paper Display (Pervasive Display)
- Atmel single-chip transceiver solution for use as a MCU and RF transmission unit.

Transmitter Unit:

- Transmitter prototype
- Synchronized database

Hardware Design

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High Level Block Diagram

Price Tag
- Receives signals
- Updates E-Ink display
- ~~Sends ACK~~

Central Transmitter Unit
- Broadcasts prices to tags
- ~~Awaits ACK responses~~

Host Computer
- Checks for price changes
- Controls transmitter according to our protocol

Price Catalog/Database
- MS SQL database
- No custom written software

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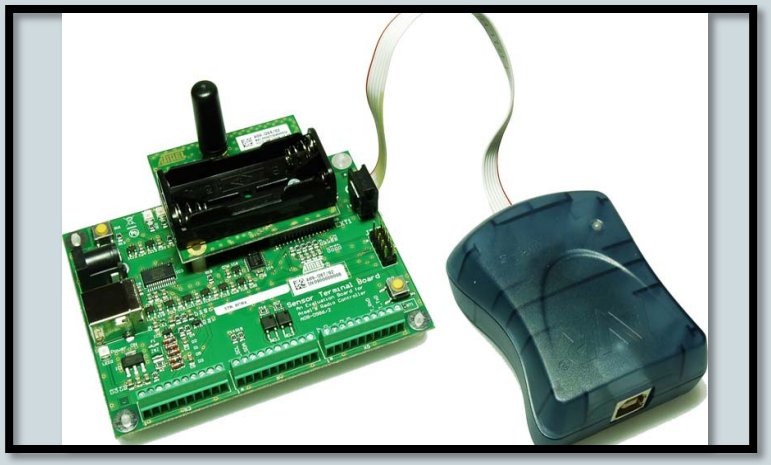

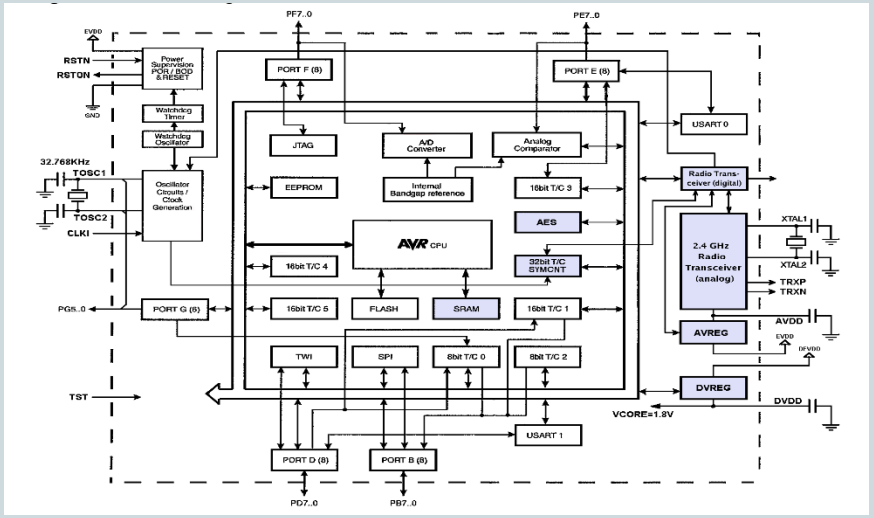

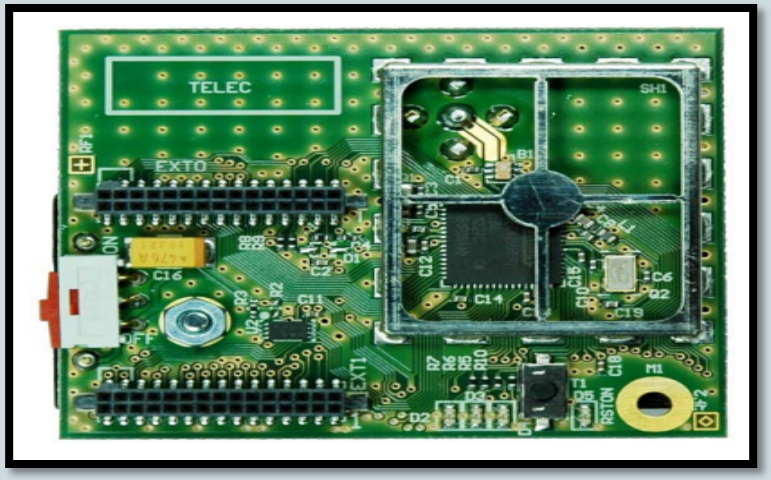

Schedule

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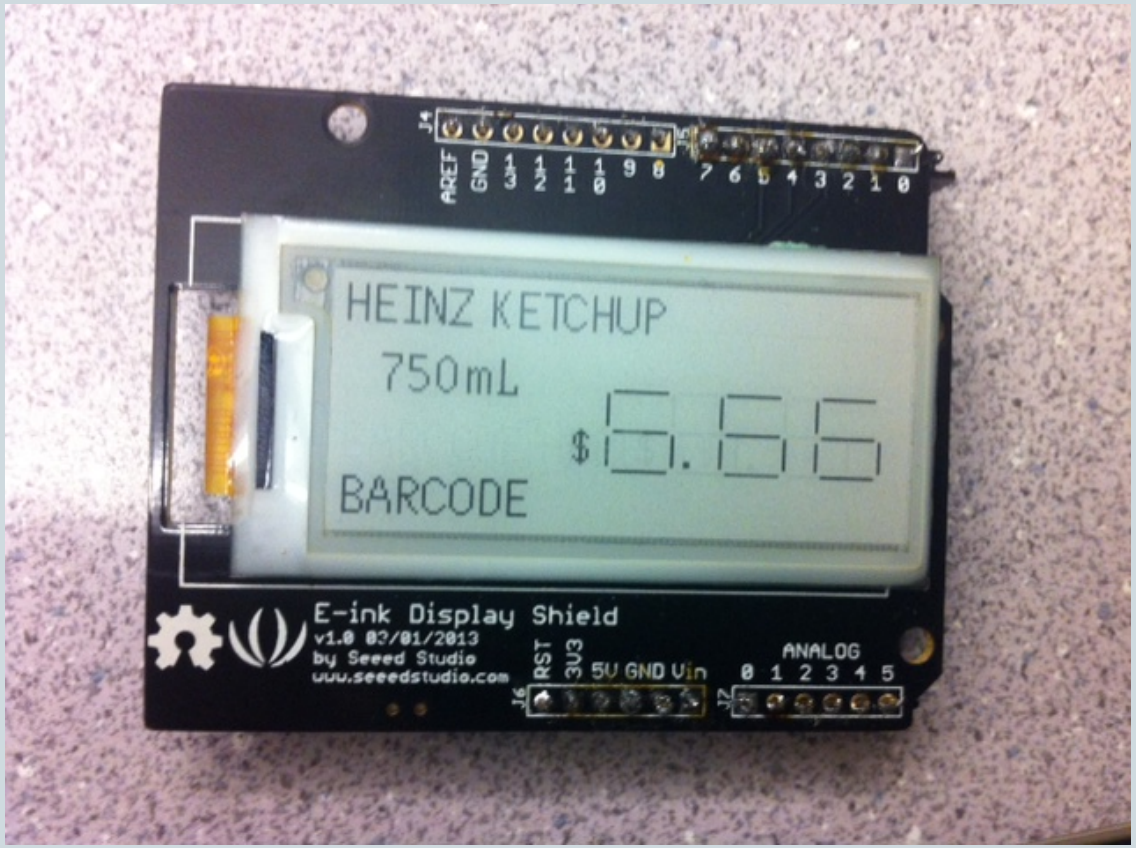
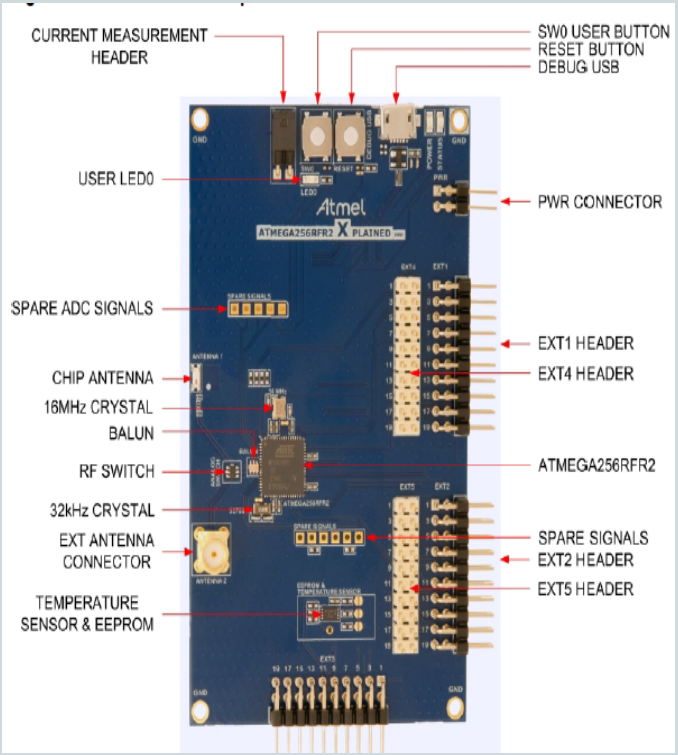
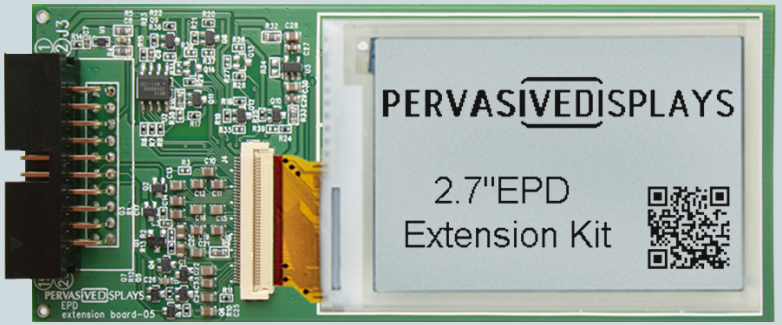
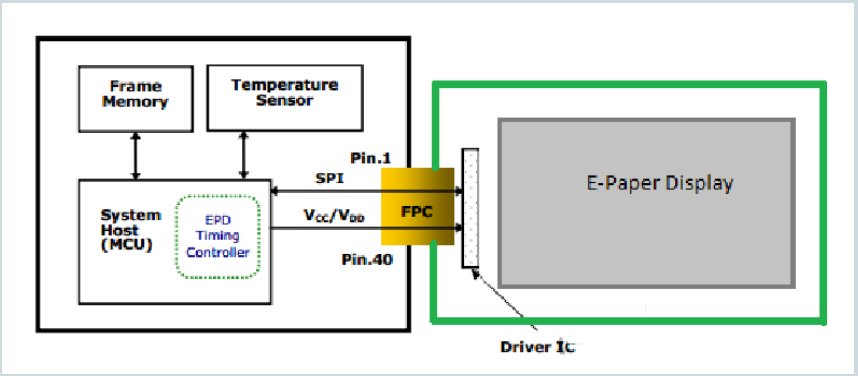


E-Ink Integration







- Electrophoretic Display
  - Unlike conventional back lit displays; e-paper reflects light.
  - Mimics the behaviour of conventional paper theoretically making it more comfortable to watch and giving a surface wider viewing angle.
  - In addition, text and images will remain on the e-paper without power supply.
  - Environmentally the solution is better as paper tags are substituted.

RF Communication

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- Data Transmission
  - Packet format
  - Composing packets
- Data Reception
  - Parsing packets
  - Sending data to EPD
- Database
  - Set up of catalogue on SQL Server
  - Table schema
- Host software
  - Monitoring database
  - Sending messages to transmitter

Packet Format

Name	Size (Bytes)	Offset	Description	Example
Packet Type	1	0	Indicates whether this signal is to update a price or retrieve a price.	"U" – update ~~"R" – retrieve~~
Tag ID	~~2~~ 1	1	Identifier of the price tag.	0x0019
Item Name	16	3	Name of the product.	"Welch's Gummies"
Price Digits	5	19	Single byte digits of item price. Decimal point is placed before last 2 digits.	0x0000010709 (1.79)
~~**Item Info**~~	32	24	Misc. information related to the item.	"2 For 1 Sale"

Final Hardware Design

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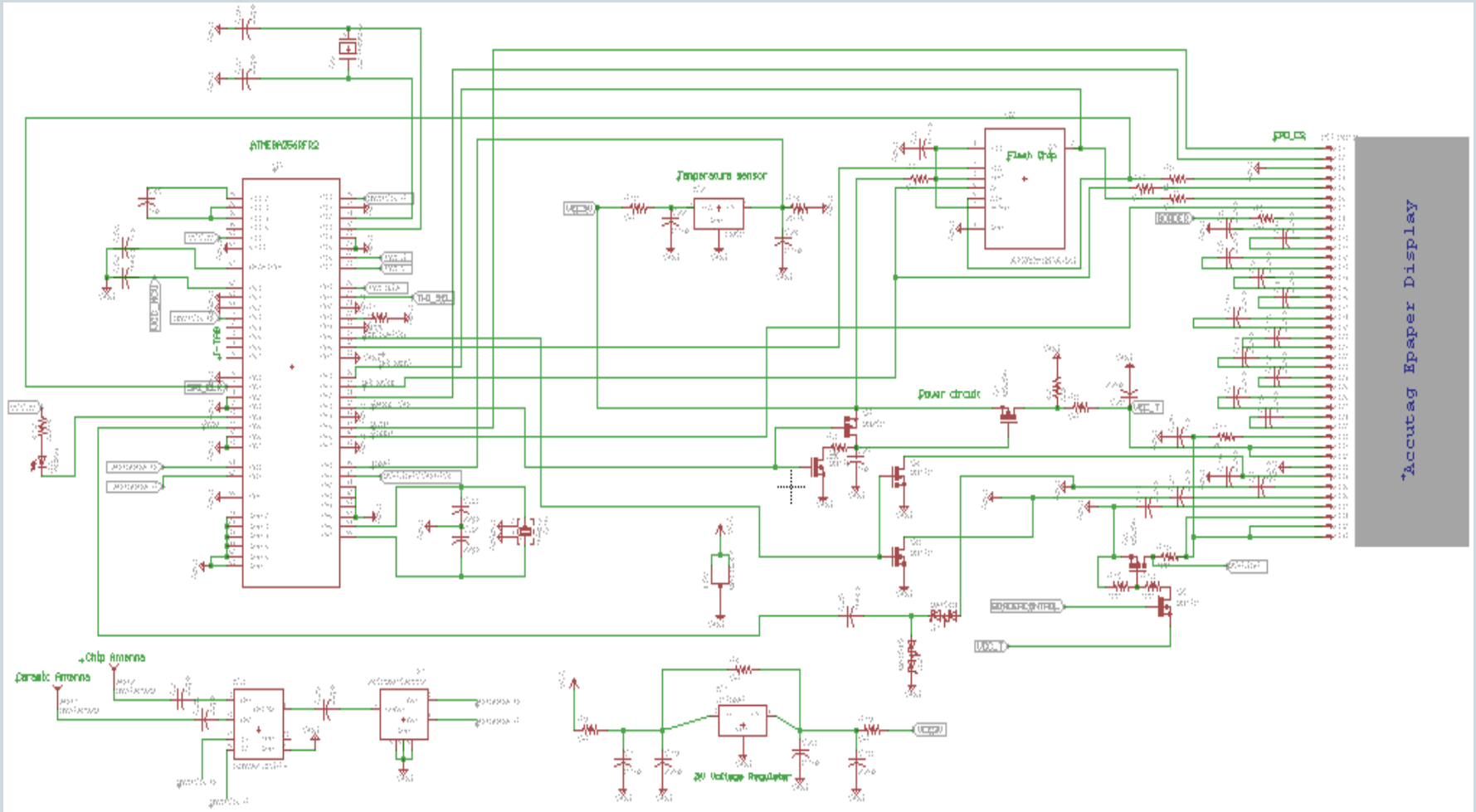
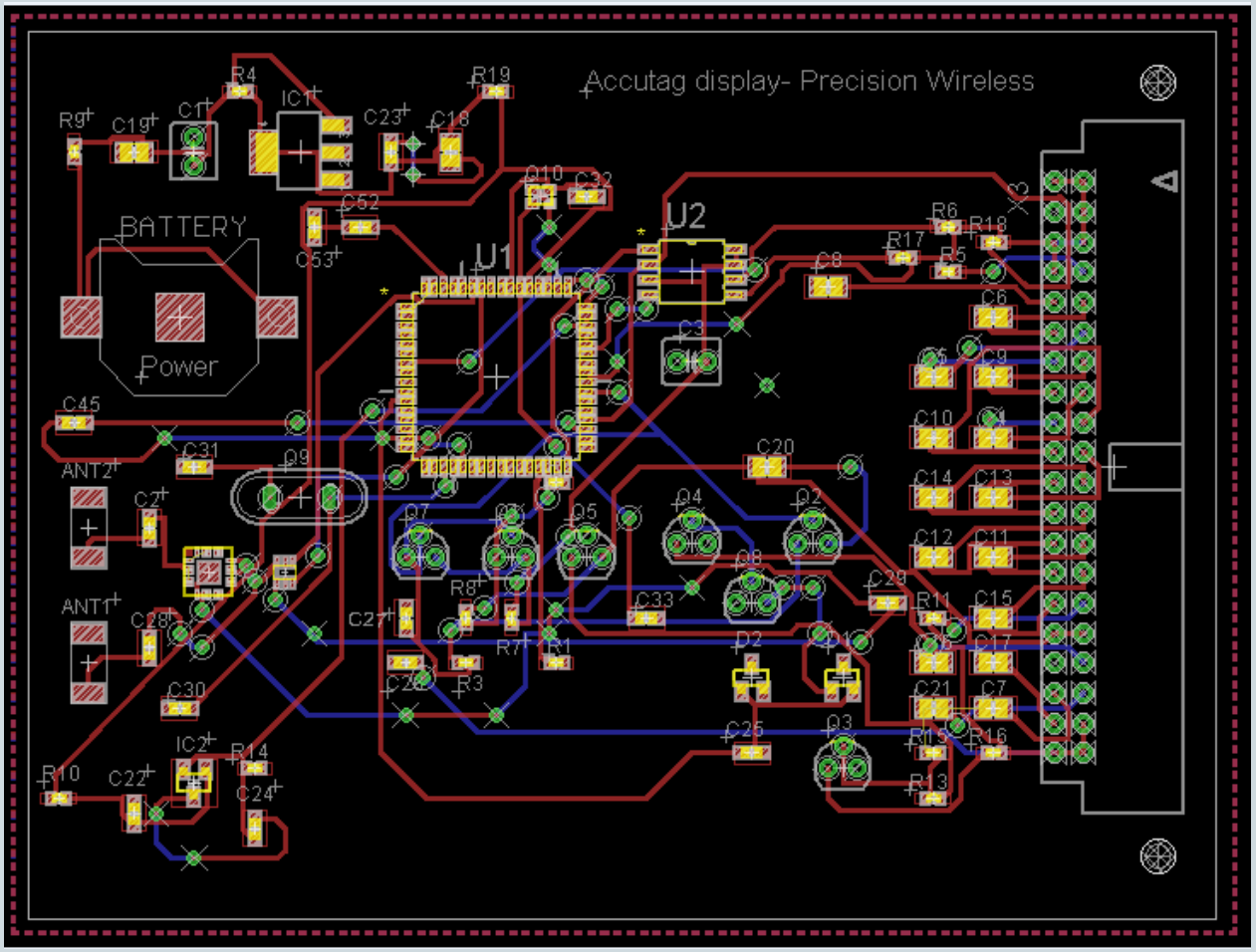
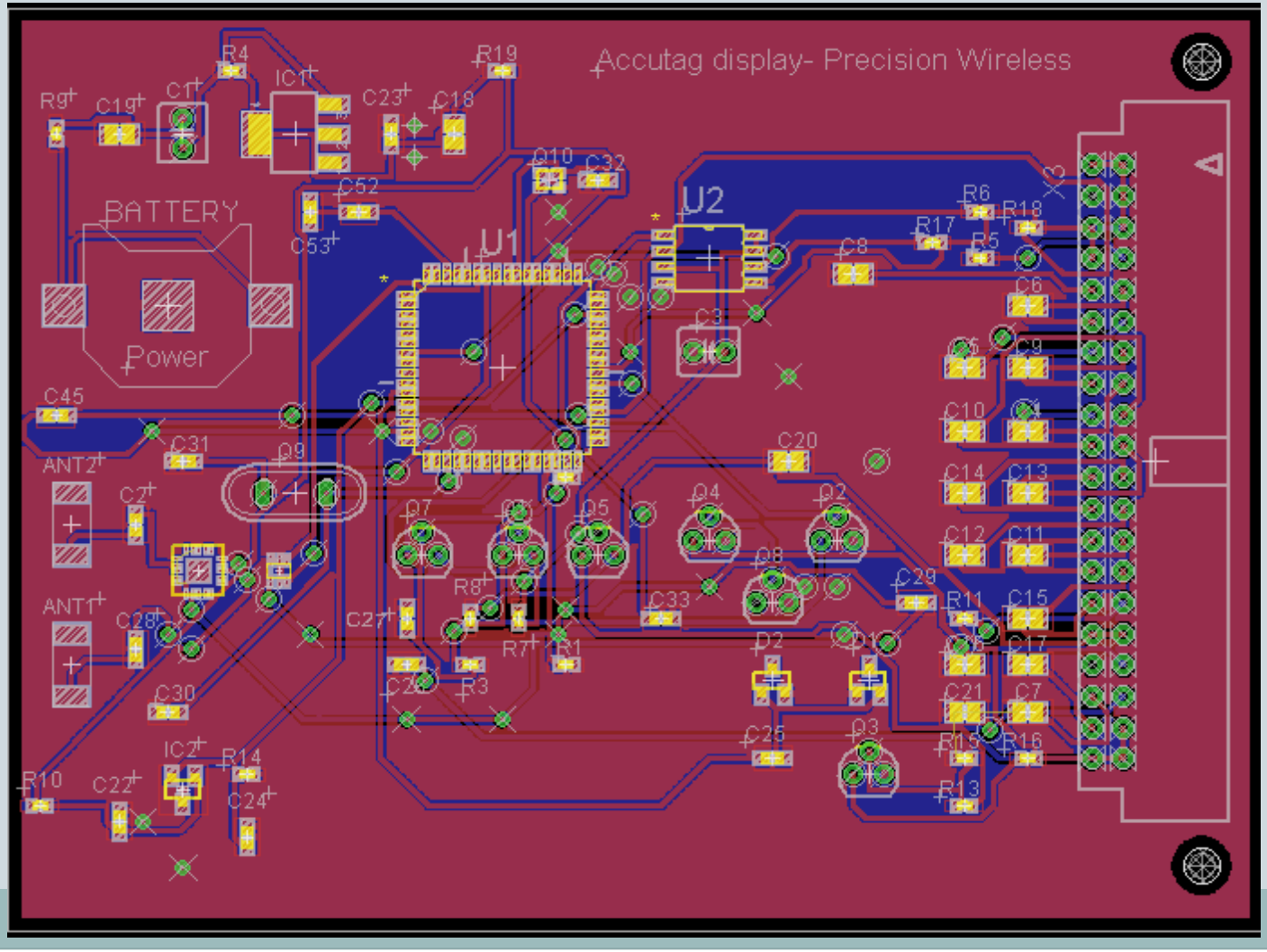


PCB Layout


Accutag display- Precision Wireless
BATTERY
Power
U1
U2
IC1
IC2
ANT1
ANT2

PCB Layout w/ Layers



Budget Breakdown

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Projected Costs		Actual Costs	
Dot Matrix Displays	$40	ATMEGA256RFR2-XPRO Eval kit (Rx side)	$51
E-ink display	$120	ATM256RFR2-EK Eval kit (Tx side)	$361
Tx/Rx Evaluation kit (with mcu$_s$)	$450	Seeedstudio -Eink display	$74
Circuit Components	$50	Pervasive EPD display 2.7''	$58
Miscellaneous	$150	Miscellaneous (Batteries, Headers, Regulators)	$48
Total projected costs	**= $810**	**Total Costs = $592**	
		Total Funding from ESSEF = $600	
		Remaining surplus = $8	

Market

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Estimates of the Annual Menu Costs Per Store for Each Chain (in 1991–92 dollars)

Menu cost component	Chain A	Chain B	Chain C	Chain D	Average of chains A–D	Chain E (item pricing law)
Labor cost of price changes	61,414	53,149	40,027	53,748	52,084 (49.2%)	52,944
Labor cost of sign changes[a]	16,411	22,183	22,183	27,955	22,183 (20.9%)	22,183
Costs of printing and delivering price tags	4,110	10,018	3,048	6,879	6,014 (5.7%)	7,644
Mistake costs[b]	19,135	20,593	20,692	20,140	20,140 (19.0%)	20,799
In-store supervision costs[c]	4,241	6,692	5,466	5,466	5,466 (5.2%)	5,466
Total annual menu cost per store	**105,311**	**112,635**	**91,416**	**114,188**	**105,887 (100%)**	**109,036**

One Time Costs	
Components	Price (CAN)
E-INK Display	$3.83
Cost of LCD Controller	$3.00
Atmega 256RFR2	$7.00
Assembly/Marketing	
Marketing	$2.00
Fabrication & Assembly	$10.00
Cost of Each Tag	$25.83
Cost of 1,000 Tags	***$25,830***
Initial Capital	$1000
Yearly Costs	
Labor Costs Software Maintenance (IT Service)	$10,920
Battery Replacement (per 5 years) (Duracell 395/399 & 5V Watch Battery per price tag)	$1000
Miscellaneous (per 5 years)	$3000

Total Initial Cost for Buying 1000 AccuTags
$37,350

Future Improvements

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- ACK Handling
- Variable Packet Size
- Item Info
- Barcodes
- Move to 802.11.n Technology
- Expand bitmap library

Questions