Watson Capstone Project
Interface for IBM 1403-N1 Printer

WCP22
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Supported by The Center for Technology & Innovation (CT&I)

Sponsored by IEEE Binghamton Chapter, Chair: William Tracz

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Presentation Outline

- Project Goal
- History of the IBM1403-N1 Printer
- Functionality of the IBM1403-N1 Printer
- Design Solutions, Hardware and Software
- Project Schedule, Budget, and Future Plans
- Conclusion

Project Goal

- Interface a modern PC and the IBM 1403-N1 printer located at CT&I
  - Print multiple lines of meaningful text from the PC
  - Design for Expandability

IBM 1403-N1 Printer

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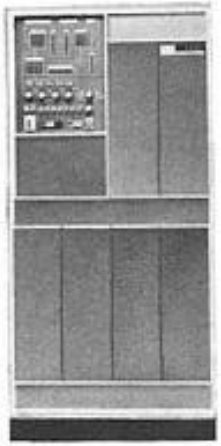
IBM 1403-N1 Printer History

- The IBM 1403-N1 printer was part of a successful line of affordable computing during the 1960s
  - Worked specifically with the IBM 1401 Processor

IBM 1402 Card Read-Punch

IBM 1401 Processing Unit

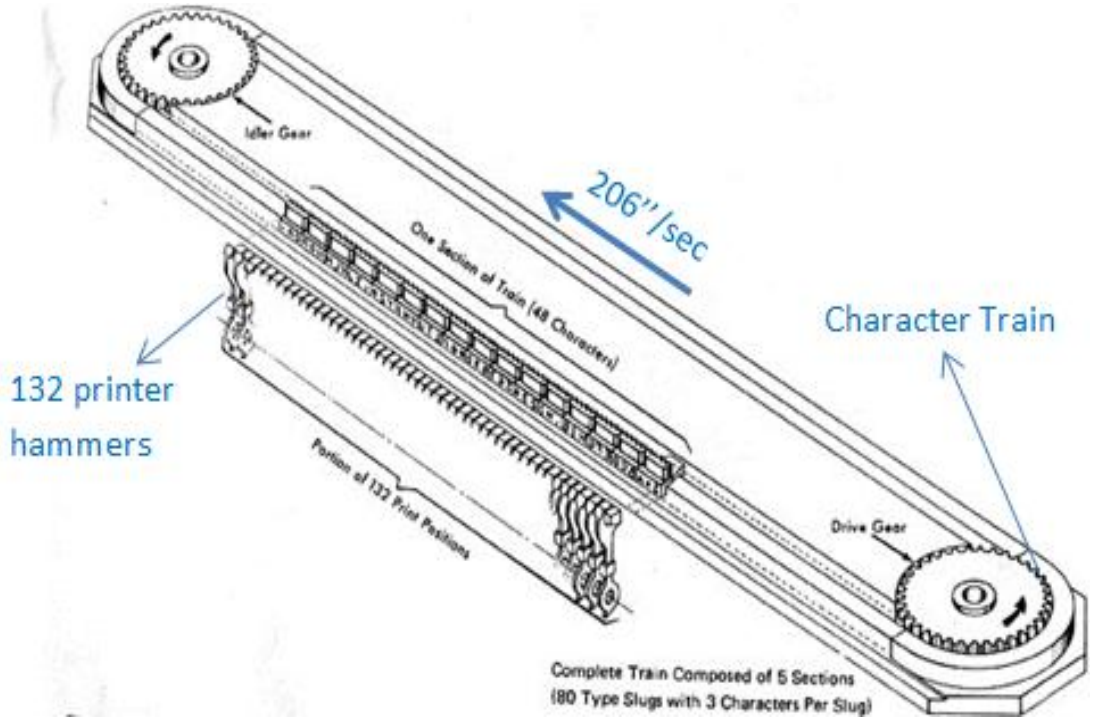


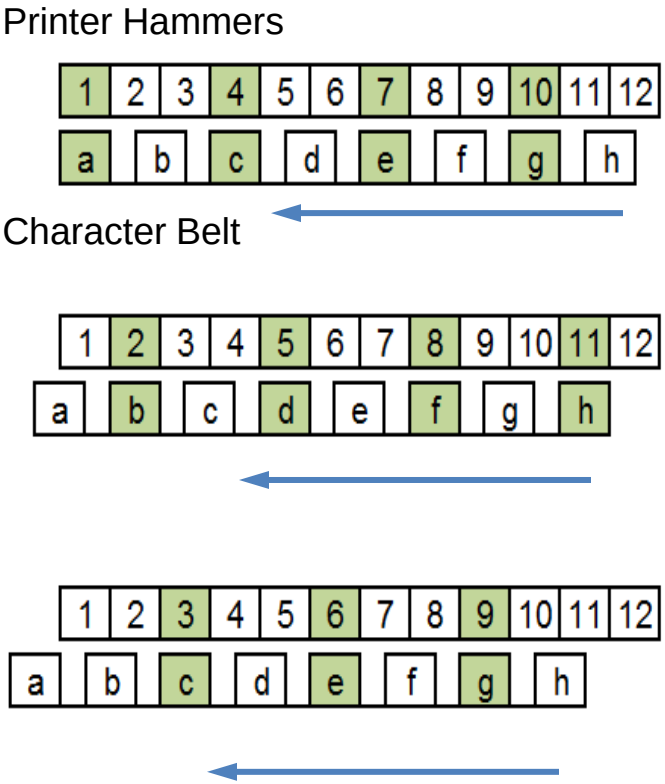
IBM 1403-N1 Printer

1

IBM 1403-N1 Printer Functionality

- The printer utilizes a character belt and printer hammers





IBM 1403-N1 Carriage Functionality

- Carriage moves the paper up, enters on your PC.
- 1403-N1 utilizes mechanical hydraulic units for carriage control.
- Four units control space start, space stop, skip start and skip stop magnets.
- Gears in hydraulic units sends out signals as spacing being carried out.
- Skipping is just spacing multiple lines.

IBM 1403-N1 Driver Cards

- The printer uses driver cards to control the printer hammers and carriage
  - Utilizes Standard Modular System (SMS) technology
  - Hardware currently unavailable

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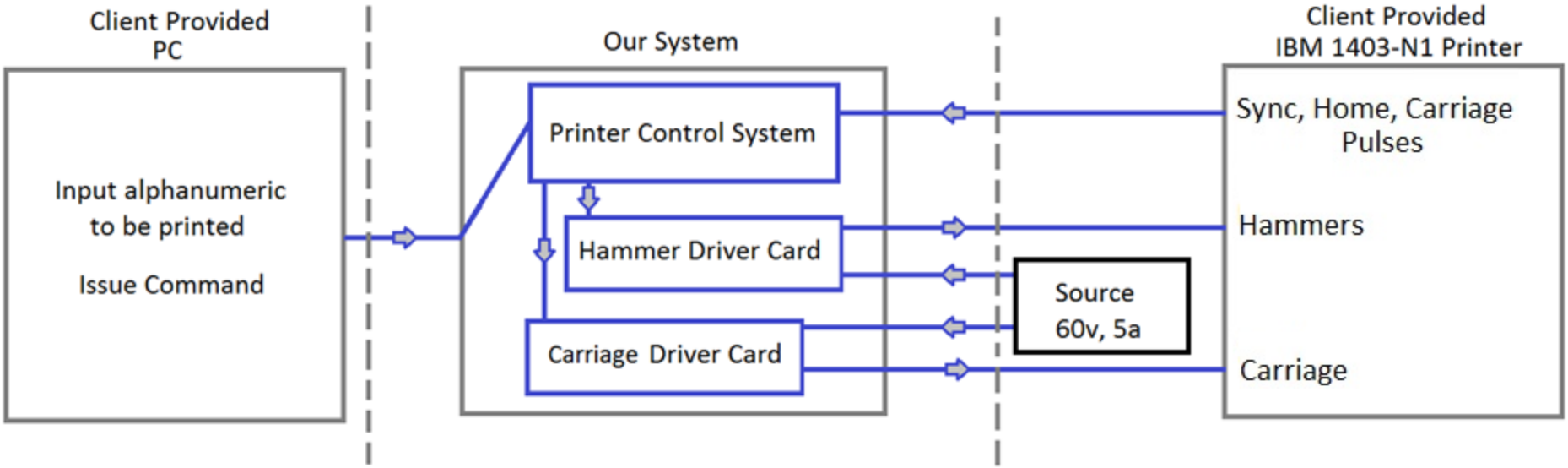
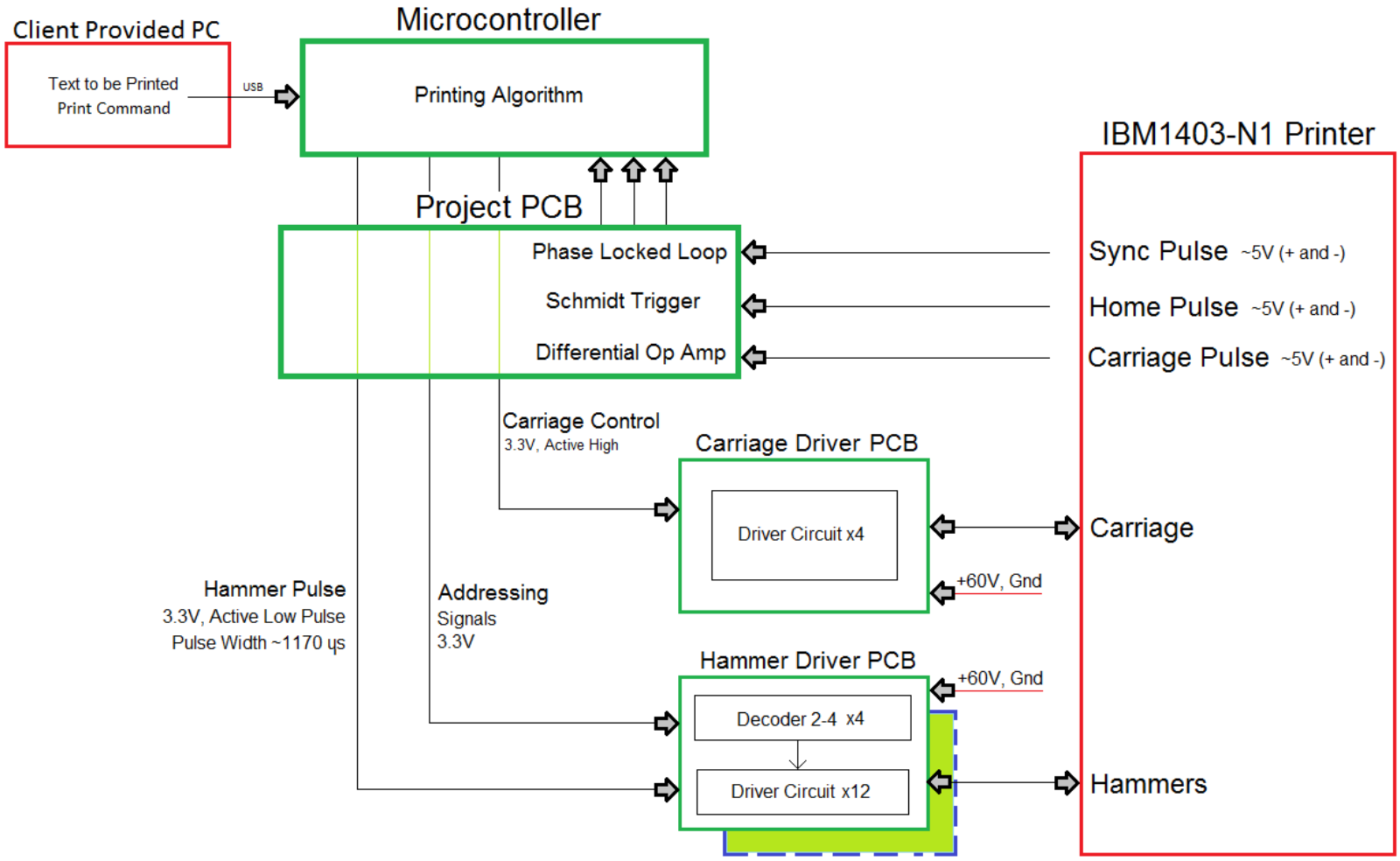
Contextual Flow Chart



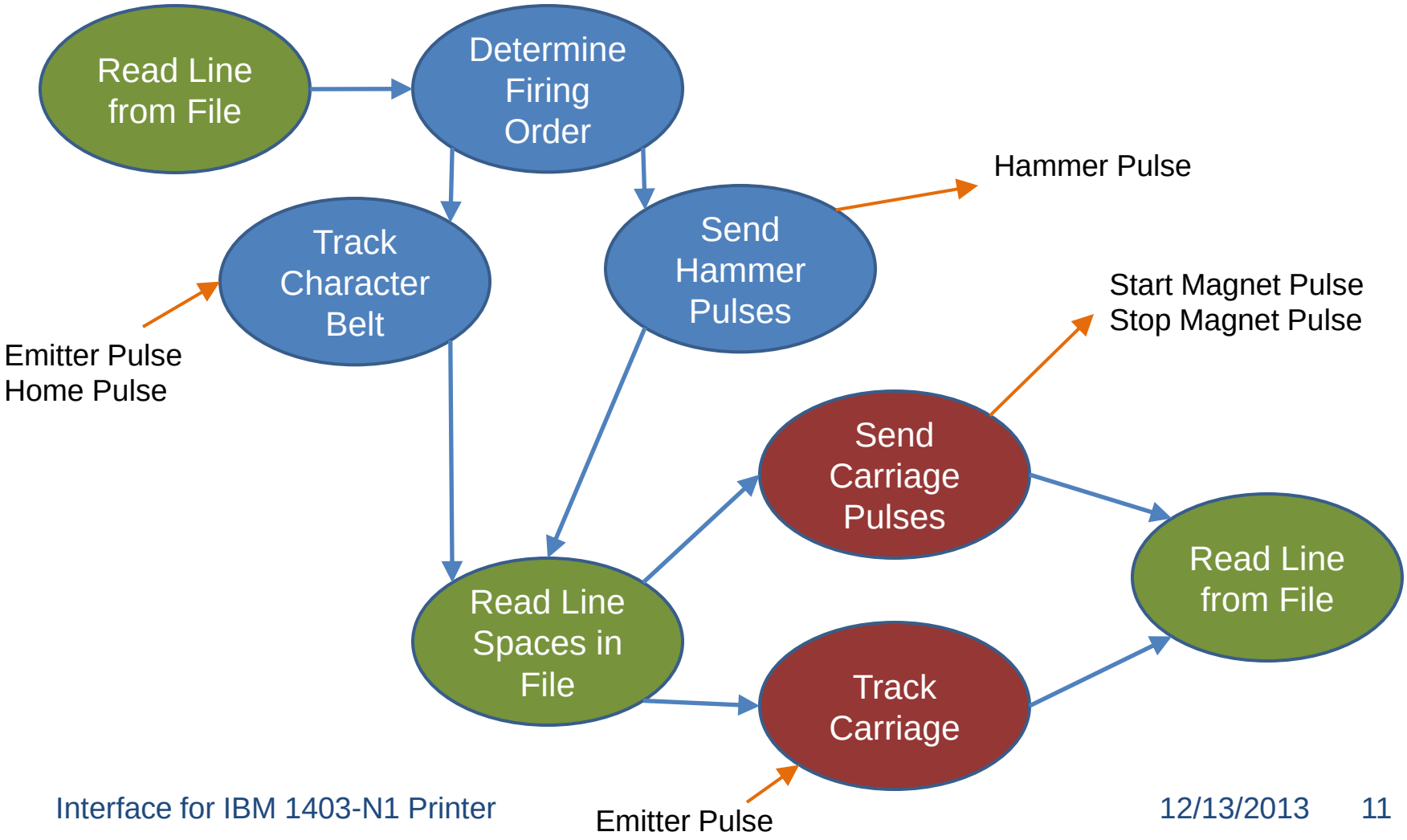
System Block Diagram



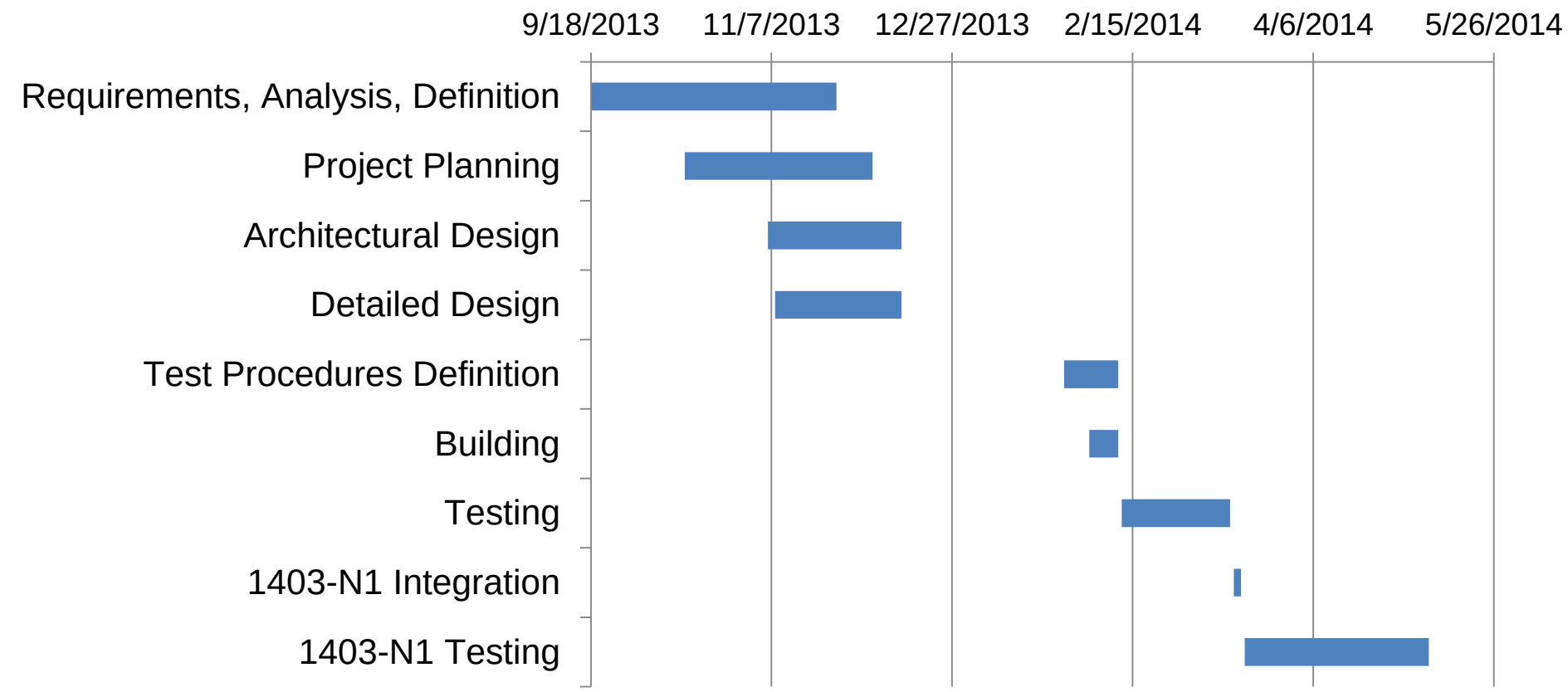
System Microcontroller Trade Study

		Arduino Due			chipKIT Pro MX4		
Criterion	Weight	Value	Score	Result	Value	Score	Result
# of I/O Pins	.2	54	2	0.4	74	5	1
Pin Voltage	.1	3.3V	4	0.4	3.3V	4	0.4
I/O Total Current	0.05	130 mA	4	0.2	200 mA	5	0.25
Input Voltage	0.05	7-12V	5	0.25	3.6-12V	5	0.25
Clock Speed	0.2	84 MHz	5	1	80 MHz	5	1
Flash Memory	0.2	512 kB	5	1	512 kB	5	1
SRAM	0.05	96 kB	5	0.25	32 kB	3	0.15
EEPROM	0.05	N/A	0	0	N/A	0	0
Cost	0.1	$58	3	0.3	$80	2	0.2
Sum	1			**3.8**			**4.25**

Printing Algorithm



Schedule


9/18/2013
11/7/2013
12/27/2013
2/15/2014
4/6/2014
5/26/2014
Requirements, Analysis, Definition
Project Planning
Architectural Design
Detailed Design
Test Procedures Definition
Building
Testing
1403-N1 Integration
1403-N1 Testing

Team Budget

Item	Original Estimate	Expended	Estimate-to-Completion	Estimate-at-Completion
Electrical Components	75	0	175	175
Printed Circuit Boards	75	0	175	175
Microcontroller	50	0	80	80
Expandable Memory	30	0	30	30
Cables	20	0	20	20
				Total: $480
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Future Plans

- Ordering, Population, Unit Testing, and Integration of Printed Circuit Boards
- Testing of Algorithm and Integration of microcontroller
- Integration and Testing of Printer Interface Project and IBM1403-N1 Printer
- Completing Documentation for Use, Maintenance, and Expansion
- Optional incorporation of additional print functions (bold text, block letters)

Conclusion

Photo Credit - Center for Technology & Innovation, 2013

Special Thanks To…

IEEE Binghamton

The Center For Technology & Innovation

Professor Jack Maynard

Image References

1. http://www-03.ibm.com/ibm/history/ibm100/images/icp/R709458M58603Y15/us__en_us__ibm100__1401__minimal_system__620x350.jpg
2. http://www.beagle-ears.com/lars/engineer/comphist/c20-1684/fig011.jpg
3. http://ibm-1401.info/1403Font-.jpg
4. http://ibm-1401.info/SMS-AEN-.jpg
5. http://content.answcdn.com/main/content/img/CDE/BANDPRNT.GIF

- Team Photo: Center for Technology & Innovation, 2013
- Special Thanks Graphic: “Hammer Driver PCB Layout,” by Yuchao Wang