Speaker Timing System for the Western Protective Relay Conference

ECE 480 Senior Design Review
April 27, 2006

Team Time’s UP!
Frank Gonzales
Tim Montoya
Jesse Rebeck
Hugh Roberts

Instructor: Brian Johnson
Client: Dave Angell
Sponsor: WSU Center for Distance and Professional Education
Presentation Outline

- Background
- Needs Analysis
- Specifications
- Project Outcomes / Deliverables
- Design Options
  - Wireless Alternatives
  - Programming Interface Alternatives
  - Time of Day Clock Alternatives
- Budget
- Work Schedule
- Summary
Background

The Western Protective Relay Conference in Spokane Washington is in need of a speaker timing system.
Needs Analysis

- Three Categories:
  - 1) Functionality
  - 2) Communications
  - 3) Physical
Needs Analysis

Functionality

- System suited for dual conference sessions.
- Presentation length and warning times programmable at master station.

- Presentation time and indicator lights on the remote station visible to speaker.
- Usable for any conference (alternate locations).
- Stand alone units
Needs Analysis
Communications

- Wireless communication between master and slave stations
- Synchronized time-of-day clocks on master stations for moderators.
Needs Analysis

Physical

- Economical
- Long product life
- Durable and rugged
- Compact, lightweight, and portable size
- Powered by 120 volts, AC
Target Specifications

- Product life $\geq$ 20 years
- Durability - can withstand 4 ft drop
- Wireless Communication range $\geq$ 50 ft
- Master clock synchronized to GPS or WWVB
- Remote station base area $\leq$ 48 $\text{in}^2$ (12 X 4 inches)

- Master station base area $\leq$ 96 $\text{in}^2$ (12 X 8 inches)
- Master/ slave weight $\leq$ 5 lb
- Acceptable power supply - standard 120 VAC power outlet
- Countdown Timer accuracy $\geq$ 1ms
- Time to program $\leq$ 1 minute
Project Outcomes / Deliverables

- Two portable speaker timing system units, each consisting of a programmable master station and remote station.
- Instruction Manual.
- Technical documentation.
System Components

- Wireless Transmitter/Receiver
- Interface to program the system
- Time of day clock
- Microcontroller to control the countdown timer
- LCD and 7-segment display
- LED lights (Red, Yellow, Green)
- Power Supply System
- Housing unit to enclose circuitry
Wireless Design Alternatives

- Embedded Bluetooth Serial Module
  - Estimated Cost: 4 x $55

- XBee ZigBee RF Module
  - Estimated Cost: 4 x $19

- XCite RF Module
  - Estimated Cost 4 x $40
Programming Interface Alternative 1

Master

Slave

Programing Screen/Countdown Timer

Time of day GPS clock

Countdown Timer

00:35:13

Test/Reset

Start/Send
Programming Interface Alternative 2

- Presentation Length: 00:00:00
- Warning Time 1: 00:05:00
- Warning Time 2: 00:01:00
- Countdown Timer: 00:60:00
- Current Time (Atomic Clock): 10:00 AM
- Start/Stop/Reset

- Red
- Yellow
- Green
Time of Day Clock Alternative 2

Integrating clock into circuit board.

- **Pros**
  - Encased in station

- **Cons**
  - Expensive
  - Antenna will protrude from housing unit.
Time of Day Clock Alternative 1

Prepackaged Commercial Clock

- **Pros**
  - Inexpensive

- **Cons**
  - Requires power regulation
  - Must be housed in moderator station
Budget

See Handout
Work Schedule

See Handout
Summary

- 900 MHz Wireless link
- Programming Interface - 10 digit keypad
- Clock with WWVB
- Master and Slave with Rabbit Microcontroller
- Speaker Timing System will be done by October.