Embedded Systems Workshop - GPS Based Tracking System

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Agenda

- Goals and Challenges
- Hardware Blocks
- Software Blocks
- Measurements
- Demonstration
- Future Enhancements
Goals and Challenges

• Building portable GPS Tracking device
  ▫ Outputs KML (Keyhole Markup Language) files
  ▫ Flash based storage including standard FS
  ▫ Power efficient [and battery powered]
• Challenges
  ▫ Custom board, SD Interface electrical design
  ▫ Driving GPS controller
  ▫ Integrating SPI-MMC and UART-GPS
  ▫ Development and Debugging Environment (IAR, O’scope, JTAG)
Use Case - Application Flow

Power ON
- Storage initialization
  - GPS Cold Start - Waiting for GPS Fix
- Full power consumption
- Led in ON

Recording
- Captures NMEA and translating to KML
  - Saving to SD card in mmddhmm.kml format
- Moderate power consumption
- Led is blinking

Idle Button Pressed
- Unit transits to power saving mode
  - [GPS is off, MSP is in LPM0]
- Low power consumption
- Led is OFF

Idle Button Released
- Unit transits to record mode
  - GPS Warm Start
- Moderate power consumption
- Led is ON
Hardware Blocks

- U-Blox NEO 5Q GPS receiver
- SD Memory card
- MSP430F2618 uController
- UART
- SPI
- On/Off
- 3.6V DC
- GPIO (out)
- LED
- GPIO (in)
- Idle Button
  - Track record
  - Start/Stop
Software Blocks

Application

KML Writer

Tracking Mngr

FS-FAT

NMEA Reader

Power Governor

SPI Driver

UART Driver

GPIO Driver

MMC/SD

GPS

Leds/Buttons
Measurements

- **GPS Fix timing**
  - 1-2 minutes on initial boot
  - Less than 30 seconds for re-fix after return from idle mode

- **Power Consumption:**
  - Idle/Lowpower 4mA
    - GPS is off
    - MSP is in LPM0
  - Recording 110mA
    - GPS is on
    - MSP is on
Demonstration

- Sample NMEA invalid line (no GPS fix)
  - $GPRMC,,V,,,,,,,,,,N*53
- Sample NMEA valid line (GPS fix)
  - $GPRMC,083559.00,A,4717.11437,N,00833.91522,E,0.004,77.52,091202,,A*57
- Parsed Sample
  - Status: GPS_VALID
  - Lat: 4.72852401 E+
  - Long: 8.56525325
  - Time: 8:35:59
  - Date: 9.12.2002
- KML <coordinates> entry
  - 34.82730800000000,32.00327000000000,0
- Sample KML File: 03310947.KML
Sample Track - 03310947.KML
Sample Track - 04020757.KML
Future Enhancements

• Remove power consuming voltage regulator
• Attach an accelerometer and provide even more power saving
• Connect board to network assisted GPS
• Attach Wi-Fi device and transmit GPS samples directly to nearby server