An APRS Tracker

with a real screen

Goals

- A real screen!
  - Color display
  - Multiple font sizes
  - Lots of data in view
- Beacon smartly
- Cool Telemetry
- Do some interesting things

Where to find a screen?

- Gut an existing device?
  - Repurposing a GPS didn't seem feasible
  - Can't have something called 'chumby' in a Jeep
  - Wasn't willing to commit an android device
- Cheap composite LCDs available on eBay
  - Intended for backup cameras
  - Composite video is bad for text, but....
  - They're cheap
- HDMI monitors will be an option at some point

Horsepower Required

- Real graphics without a lot of work
  - Means using existing tools
  - Existing tools means it can't be an arduino
- Considered SDL
  - Even text seemed like more work than I wanted
  - Would have been simpler and more portable
- Settled on GTK
  - Because I'm lazy
  - Because you get free anti-aliasing

Beagle Board xM

- 1GHz OMAP processor
- 512MB RAM
- 4x USB, Ethernet, Serial
- HDMI and composite/S-Video out
- Audio
- Micro-SD card
- Runs Linux!
- ~$100 not including the enclosure

The Whole Package

- Ubuntu 10.04 on a 2G Micro-SD card
- 2x USB-to-serial adapters for GPS and Radio
- Uses my existing TM-D700 in KISS mode
- GPS from a Garmin GPS-18
- Composite video out to the LCD display
- Custom-written APRS tracker and display software

The Software

- Separate Tracker and Display binaries
  - Provides isolation from X and GTK
  - Could run headless
- Written in C using libfap and GTK
  - Small and efficient
  - Runs equally well on a desktop for development

ui

Last station

W7JKH-9 23.3mi E via N7QNM

12 MPH NE @ 177 FT

Off duty

Station list

1:VSAM	14mi E	5:KF7CLD B	8mi S
2:WA7FW-A	21mi S	6:MSVL	33mi N
3:NG7N-1	25 sec	7:AC7HH-4	40mi E
4:KF7CLD C	8mi S	8:VBALDI	35mi SE

My Info

47.61000N 122.33300W 16:00:00 Locked: 0 sats

Stationary, Alt 404 ft

KK7DS-0 Never ATREST

Nearest WX

NG7N-1 (25 sec ago)

36F Rain 0.01h0.34d 97%

tU2k !

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Tracker Behavior

- Beacons smartly
- Uses a .ini file on the SD card for parameters
- Transmits regular packets when stationary
- Sends Mic-E packets when moving
- Can round-robin the status/comment field among multiple configured strings
- Sends PHG beacons
- Sends weather beacons when stopped
- Will digipeat for TEMP1-1

Display Behavior

- Keeps the last nine received beacons in view
- Most recent beacon at the top, with color icon
- Calculates distance and direction in real time
- Persists the most recent and closest weather beacon at the bottom
- Calculates digipeater penetration and displays a signal meter like a cellphone
- Flashes green, red, or amber panels when packets are received, transmitted, or digi'd

Telemetry

- A small arduino pro collects temperature and voltage
- Feeds it over the serial port to the tracker
- Really would like more data, like current draw, dome light/headlight status, etc

What's missing?

- Messaging
- Mapping
- Querying
- More of an interface for changing settings on the device

The End

Challenges

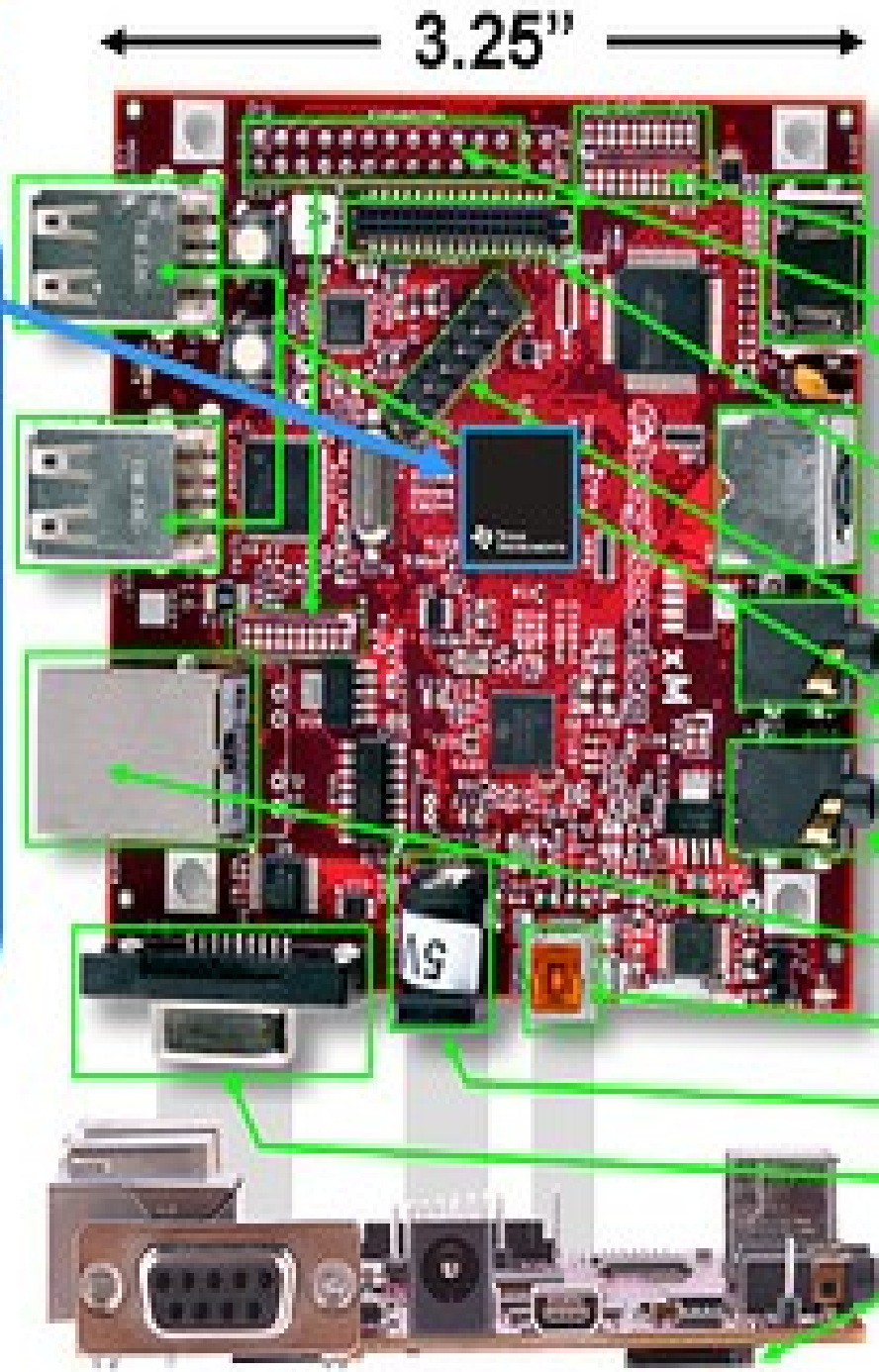
- Jeeps are RF-noisy
  - Disrupts some USB devices
  - Makes composite video very hard
- My first LCD died (but it was cheap!)
- Many LCDs do overscan
- Lots of moving parts (USB adapters)
- Hard to mount cleanly
- The Beagle Board's serial port is used for the bootloader, can't be used for GPS or radio

Challenges

- Battery life
  - The Beagle Board is rated at 2W
  - Takes some juice to run the GPS, serial adapters, and the radio
  - Need to back off on the stationary beacons
  - Really need a low voltage cutoff!
- Control
  - Ended up with a cheap presentation remote
  - Provides a little on-screen control

Laptop-like performance

- Super-scaler ARM® Cortex™-A8
- More than 2,000 Dhrystone MIPS
- Up to 20 Million polygons per sec graphics
- HD video capable C64x+™ DSP core
- 512 MB LPDDR RAM



Typical PC peripherals via high-speed USB

- LCD Expansion
- I²C, I²S, SPI, MMC/SD Expansion
- DVI-D
- Camera Header
- S-Video
- JTAG
- USB Hosts
- Stereo Out
- Stereo In
- 10/100 Ethernet
- USB 2.0 HS OTG*
- Alternate Power
- RS-232 Serial*
- Micro-SD Slot*

* Supports booting from this peripheral