Eine Kliene Eingebettete Musik
*(A little embedded music)*
*Replicating 12th Century Musical Instruments Using Embedded Linux*

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My hobbies are not exactly compatible.
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The Hurdy Gurdy
What is a Hurdy Gurdy?

Basically, a keyed viol type instrument, that uses a rosined crank wheel to “bow” one or more strings.
How it works
How it sounds
Physical/Electrical Design
• Crank
  • Problems with using a rotary encoder
  • What I went with and why.
• Body
  • Acrylic Laser Cut
  • 6mm/.25 in
• Keys
  • Lots of bad ideas here!
  • buttons!
  • slide pots!
• Crank
  • Problems with using a rotary encoder
  • What I went with and why.
• Body
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  • slide pots!
Hurdy gurdy design consideration number 1
I am cheap.
24 EU on Alibaba!
Why a motor and not a rotary encoder?

- Able to have a feel of strings/resistance
- Ability to change sense of resistance
- Power the device
- 0-42VDC voltage divided down to ~3.0VDC
- Hurdy crank has a 8mmish Shaft.
Body

- Designed in Inkscape
- Laser cut by SNOW Laser Studio Dublin
- Rush job ~400EU
- Certainly cheaper in hacker spaces
- 6mm/.25in
Keys

• Spent a lot of time thinking about this.
• Lots of REALLY BAD WAYS to do it!
• Lots of REALLY expensive ways to do it
Keys
- SoftPots!
- The GOOD!
  - Cheap! (see design consideration 1!)
  - Easy to wire up!
  - Uses one analog input!
- The BAD!
  - Loss of string bending
  - Laser bendt key shafts
The embedded board
• Minnow Turbot + Calamari board.
• Issues with Ika board support.
  • i2c non-determinent bus.
  • Ungh.
  • This is being fixed!
• Calamari has a linear pot.... soooo... lazy crank mode!
OS/Software Design
hurdy-image-rt-dev
• based off of core-image-sato dev
• pygame, numpy, scikits-samplerate
• pyhurdy.py
pyhurdy.py
- drone strings are pygame.mixer.Sound objects
- melody string is based off a single wav file
- resampled on startup based off of self.tuning
  - this takes time
  - different sample rates are really fast
  - and sound horrible
- while True: loop
  - reads voltage of crank
    - adjusts volume of drone strings and melody string
  - reads resistance of pots
    - if I'm lazy and don't want to crank, there is the onboard calamari pot
TODO

- selectable strings
  - ika to calamari killed my digital i/o
  - my lousy hand is lousy at soldering
- buzzing bridge
  - voltage gate of crank
  - play buzzing sound
- selectable tuning
  - resample a0-g4 on startup
  - on switch, switch all strings to new tuning
- tuning indicator
  - I'm absolutely tone deaf.
- charge system
  - crank spits out 0-42VDC. would be nice to charge the battery
- faking string bending
meta-hurdy
• hurdy-image-rt-dev
• the layer was relatively easy to do....
• pulling my hair out over SDL->SDL-mixer->pygame issues
• crying over the scikits samplerate build issues
  • probably PEBCAK with PYTHONPATH issues
• fix needing X11/HDMI
  • go with a soundcard and directfb
• Layer took about a 3 days to get *mostly* working.
• Still compiled on target to avoid SDL issue
What was learned
Embedded Engineers take *almost* as much time as Luthiers
In fairness, I only spent about 3 weeks total on this. My luthier spent 5 months.
Dependency/compile issues

- Upstream your patches
- Open Bugs
- Open your layers
I *kinda* neglected to learn how to play the hurdy gurdy
Demo
Who brought the ear plugs?