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

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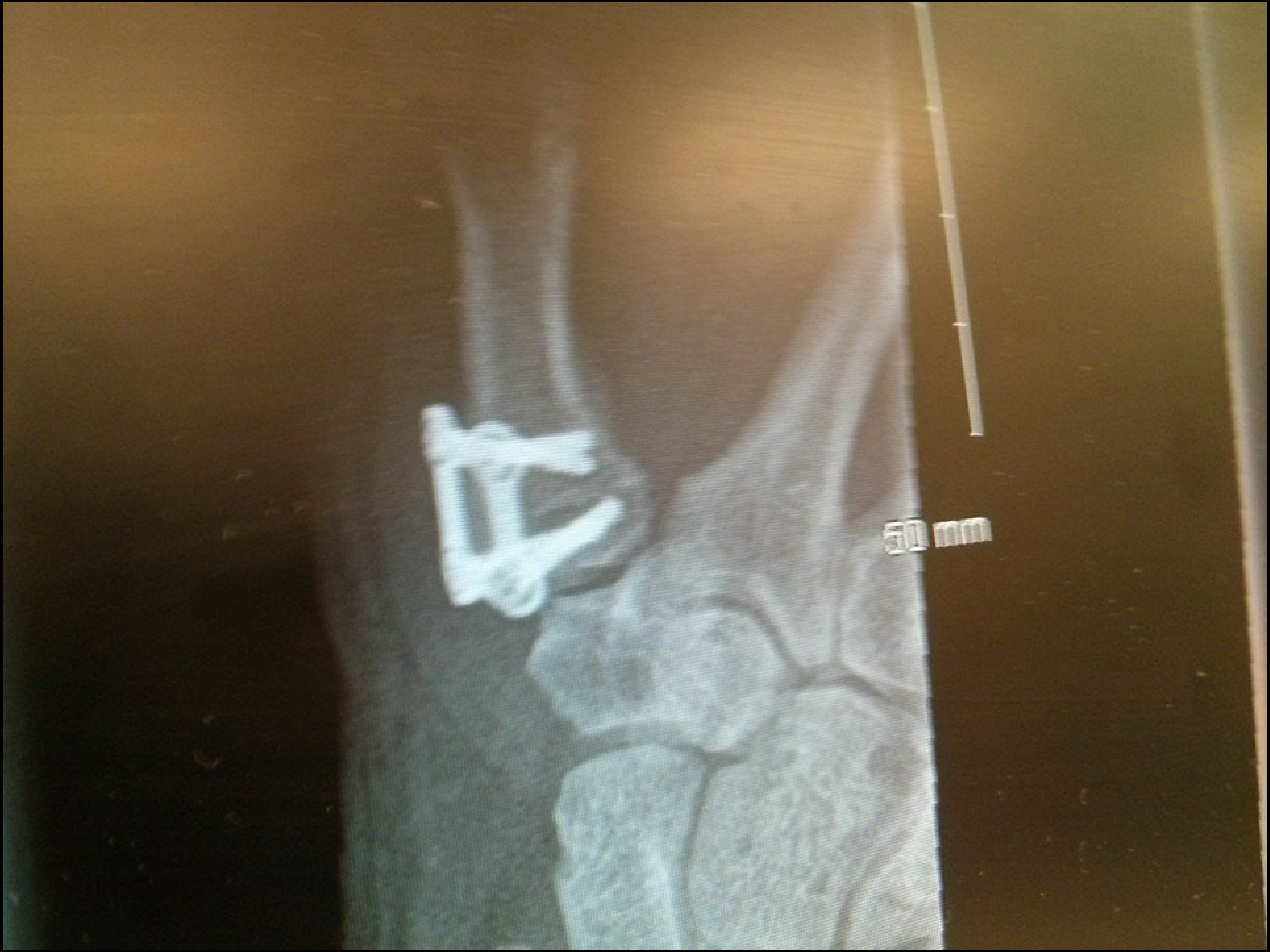
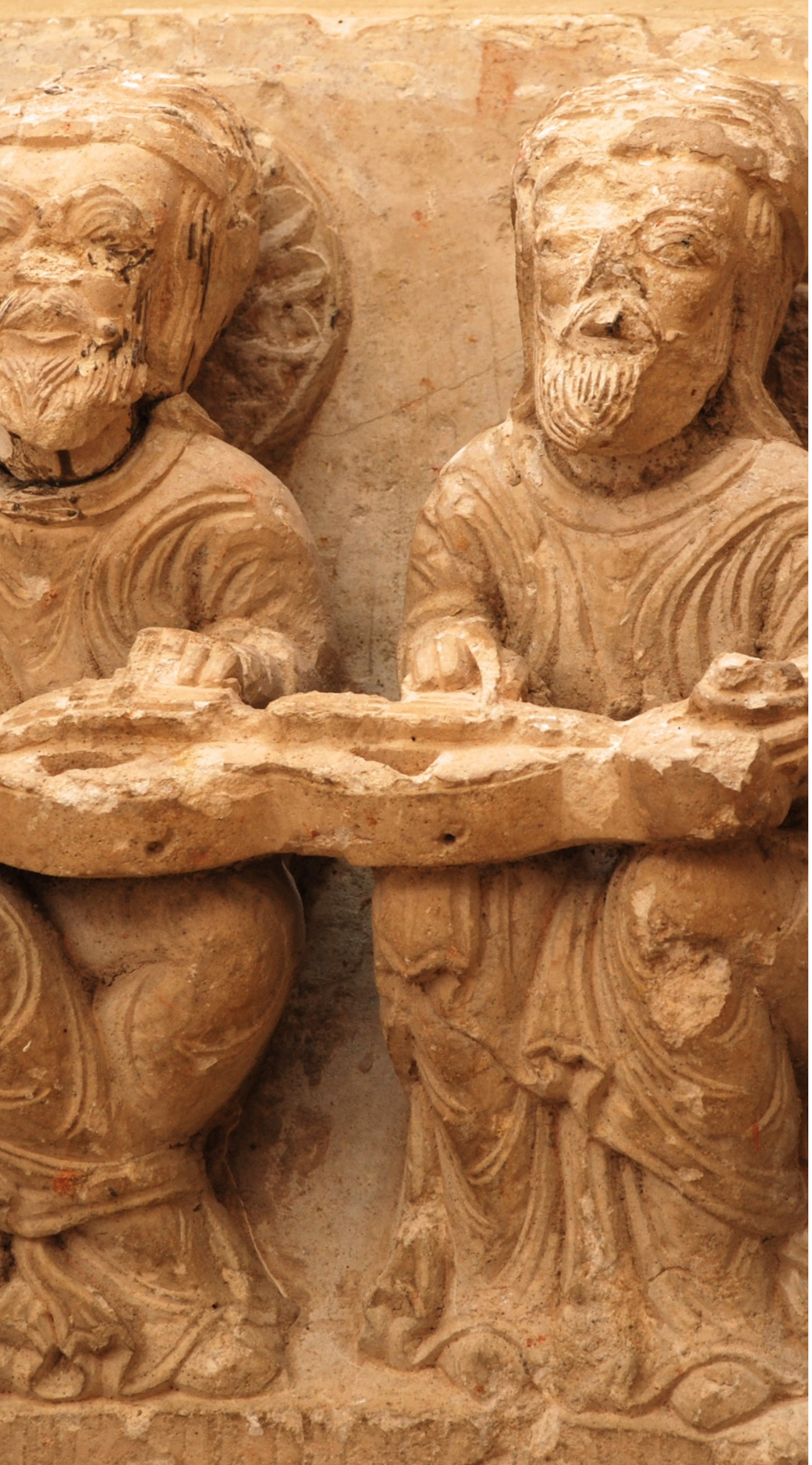
ELCE Dublin 2015

My hobbies are not exactly compatible.


50 mm

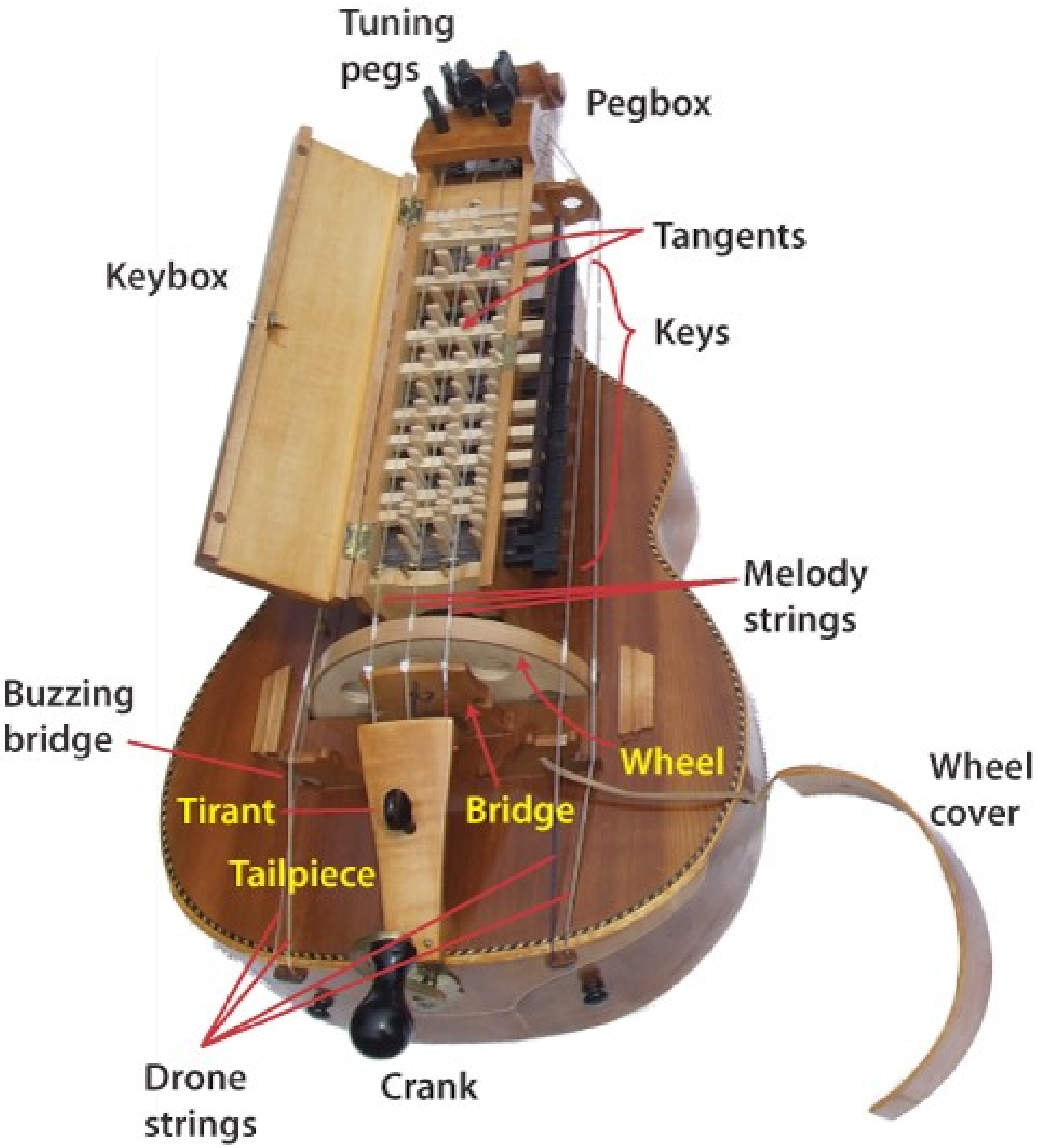
The Hurdy Gurdy



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


Tuning pegs
Pegbox
Tangents
Keybox
Keys
Melody strings
Buzzing bridge
Wheel
Wheel cover
Tirant
Bridge
Tailpiece
Drone strings
Crank

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!

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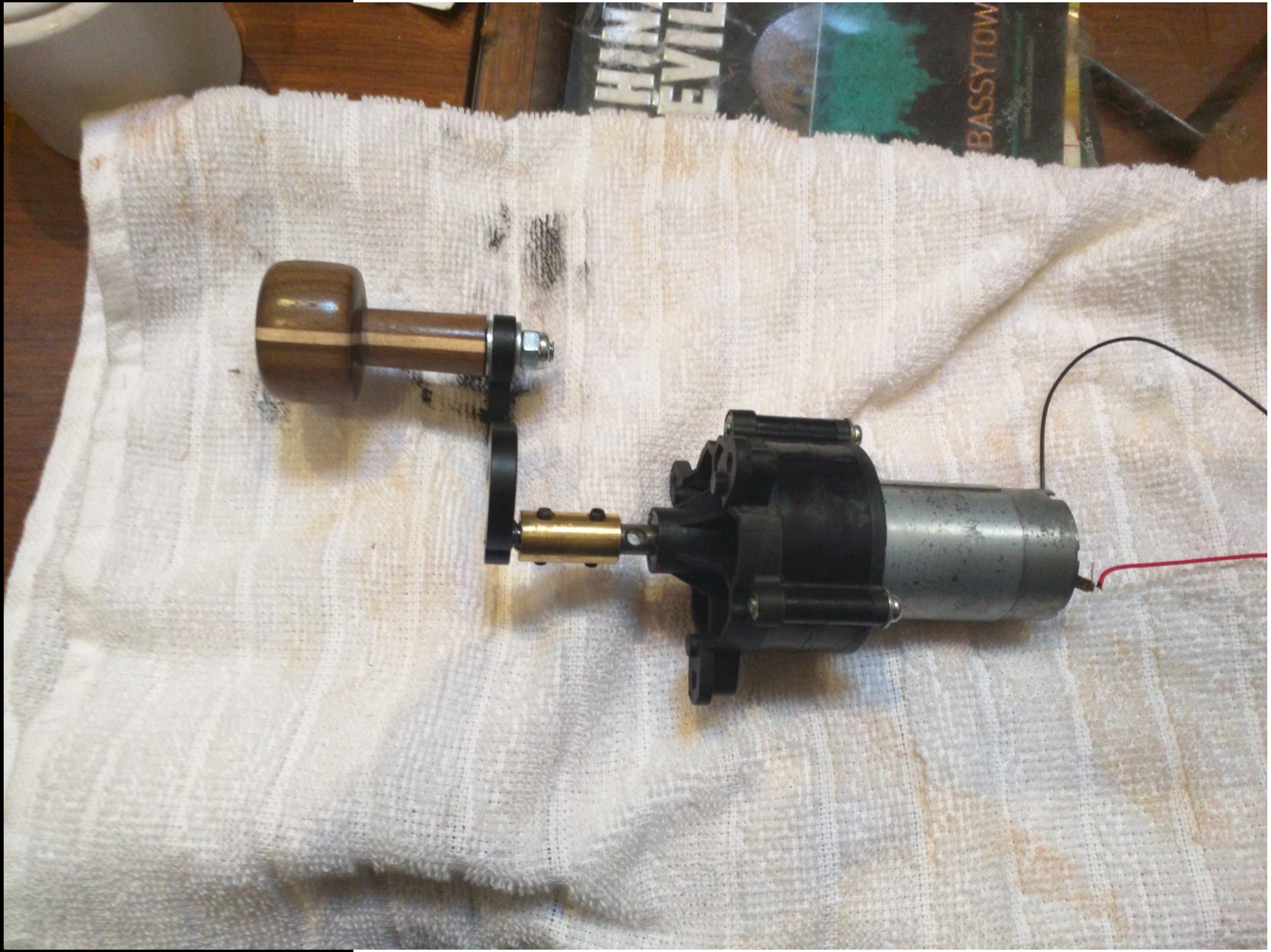
Hurdy gurdy design consideration number 1

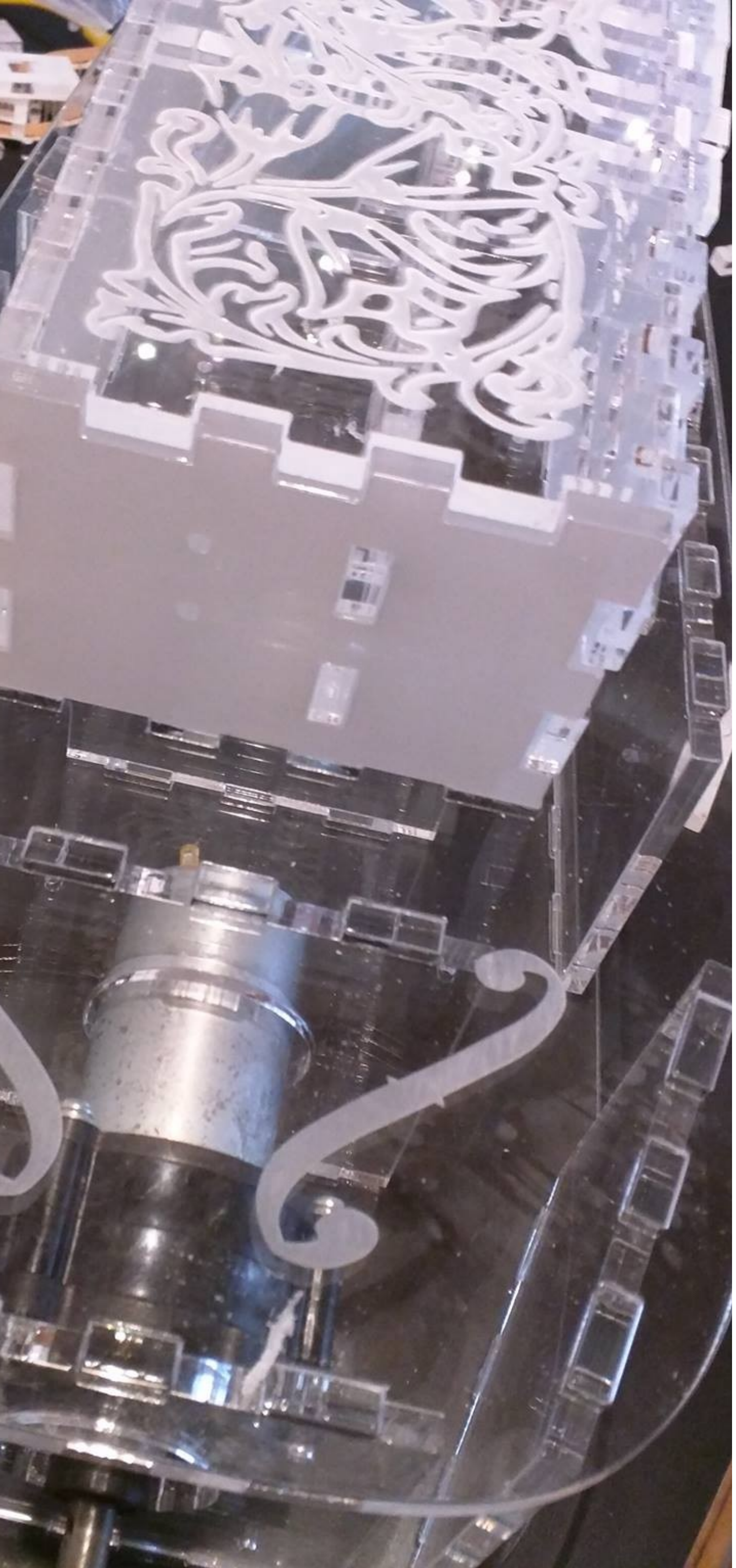
I am cheap.

24 EU on Alibaba!



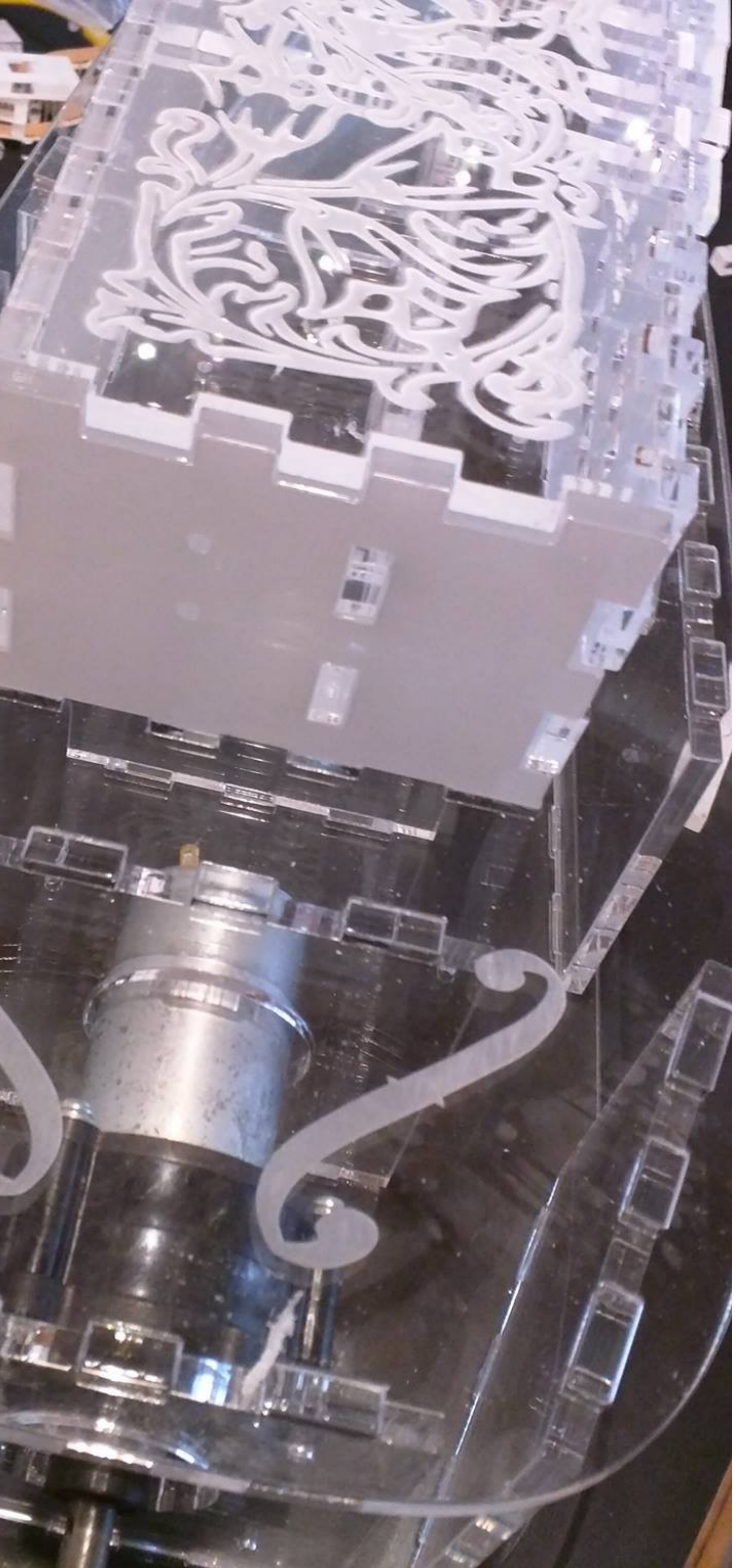
Why a motor and not a rotary encoder?

- 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.



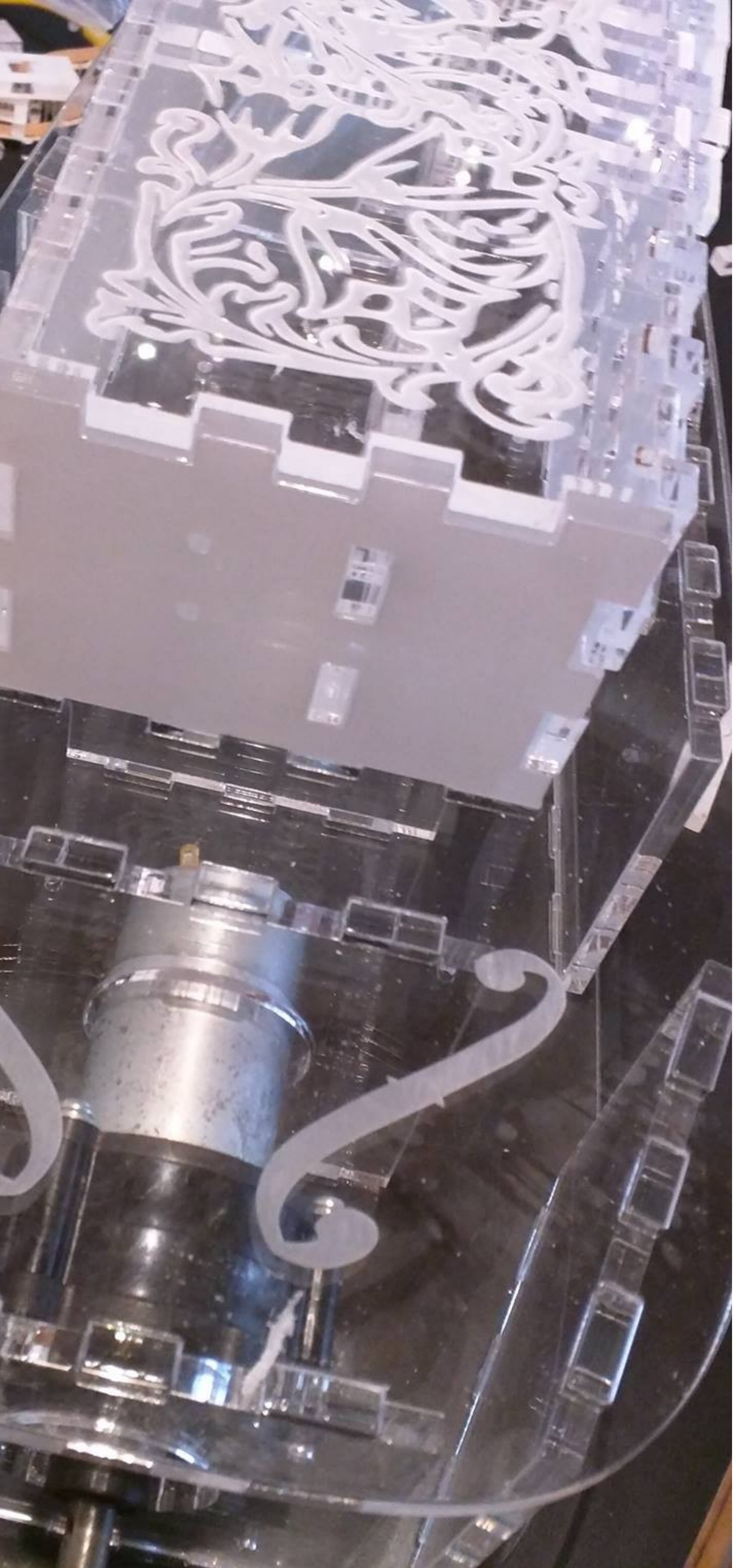
Body

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



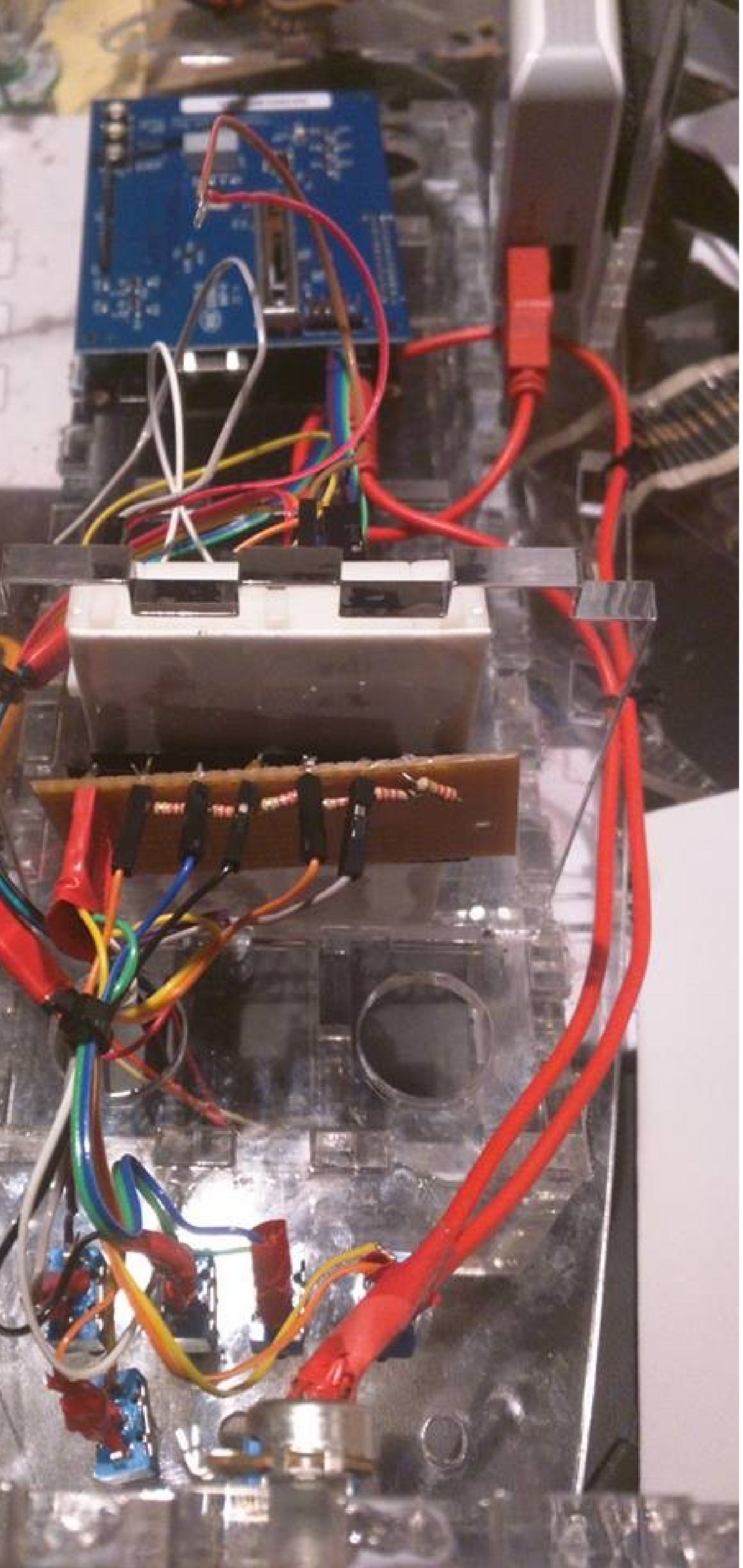
Keys

- 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

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

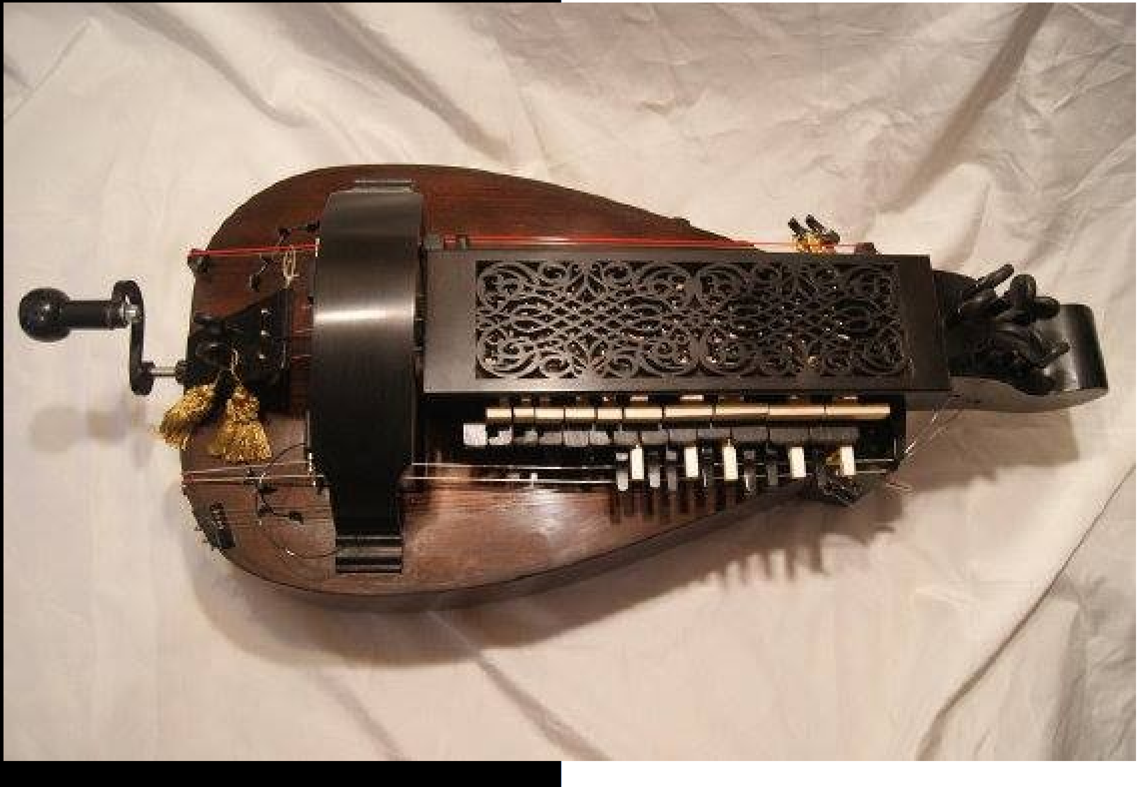
meta-hurdy

- 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?