How to build a robot

When projects go terribly wrong

In the beginning

- Had been coasting for years with “fronds”
  - Programmable blinkylights
- Got bored of hauling batteries around
- So...

Build a robot!

- Of course
- “lurch”, a two-wheeled self-balancer
- It started off well...
  - Got some motors, encoders, accelerometer
  - Lots of left over microcontrollers
  - Plausible-looking design on paper

- Clearly at this point, before I had a wheel turning, I needed to look at navigation and AI
- Boring:
  - Ultrasonic
  - Line following
  - Contact switches

Not boring AI

- Vision!
  - How hard could it be?
- Lots of useful info from a camera
- CPU power is cheap
- Cool if it works
- Start to hack...

Hacking away

- While hacking, Rachel comes back from lecture about Chinese astronomy
- Looks at test program:
  - “hey, those look like constellations”
- Yeah, they do
  - and this year's BM theme is “Vault of heaven”
- Tweak, tweak, hack, hack...
- And then

And then...

- Fail to organize projector, generator, etc
- Never gets exhibited
- “Sure this version is cool, but the next version...”

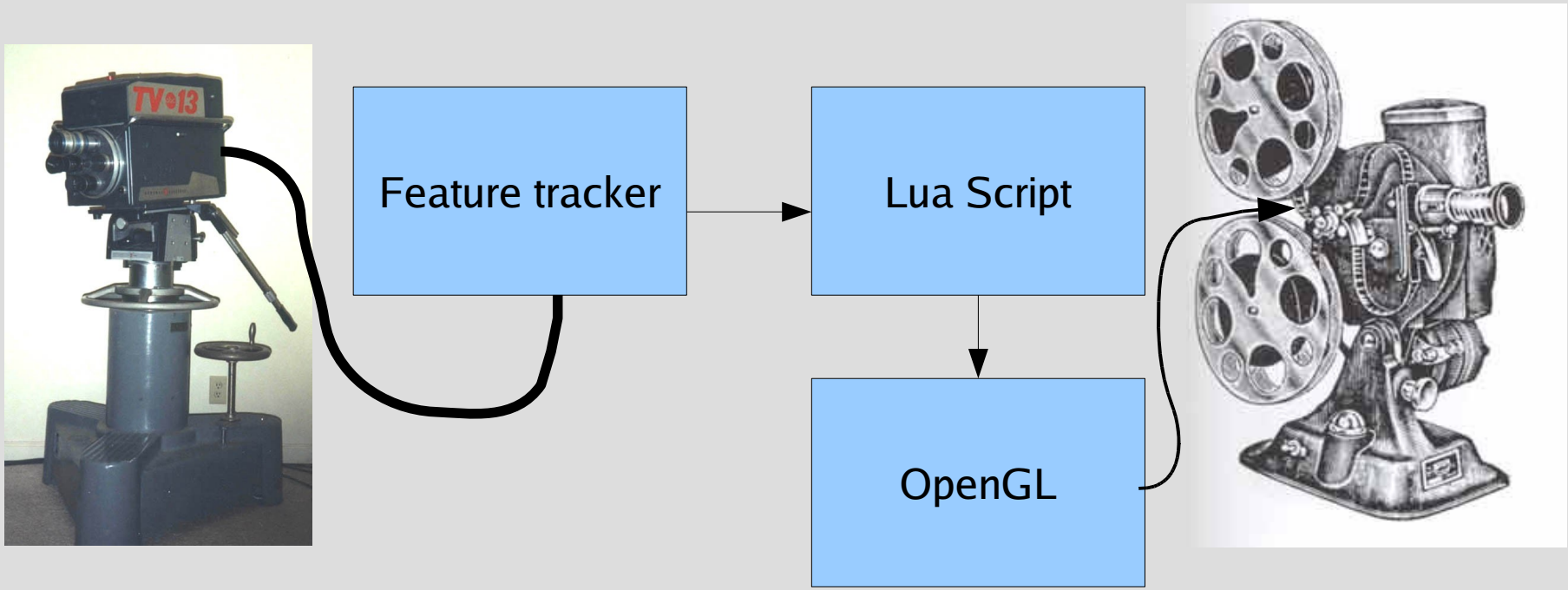
Time passes

Oh by the way...

- “I entered Constellation for Maker Faire”
- Better make it work then

OK, so what is it?

- Cute real-time effects from a webcam



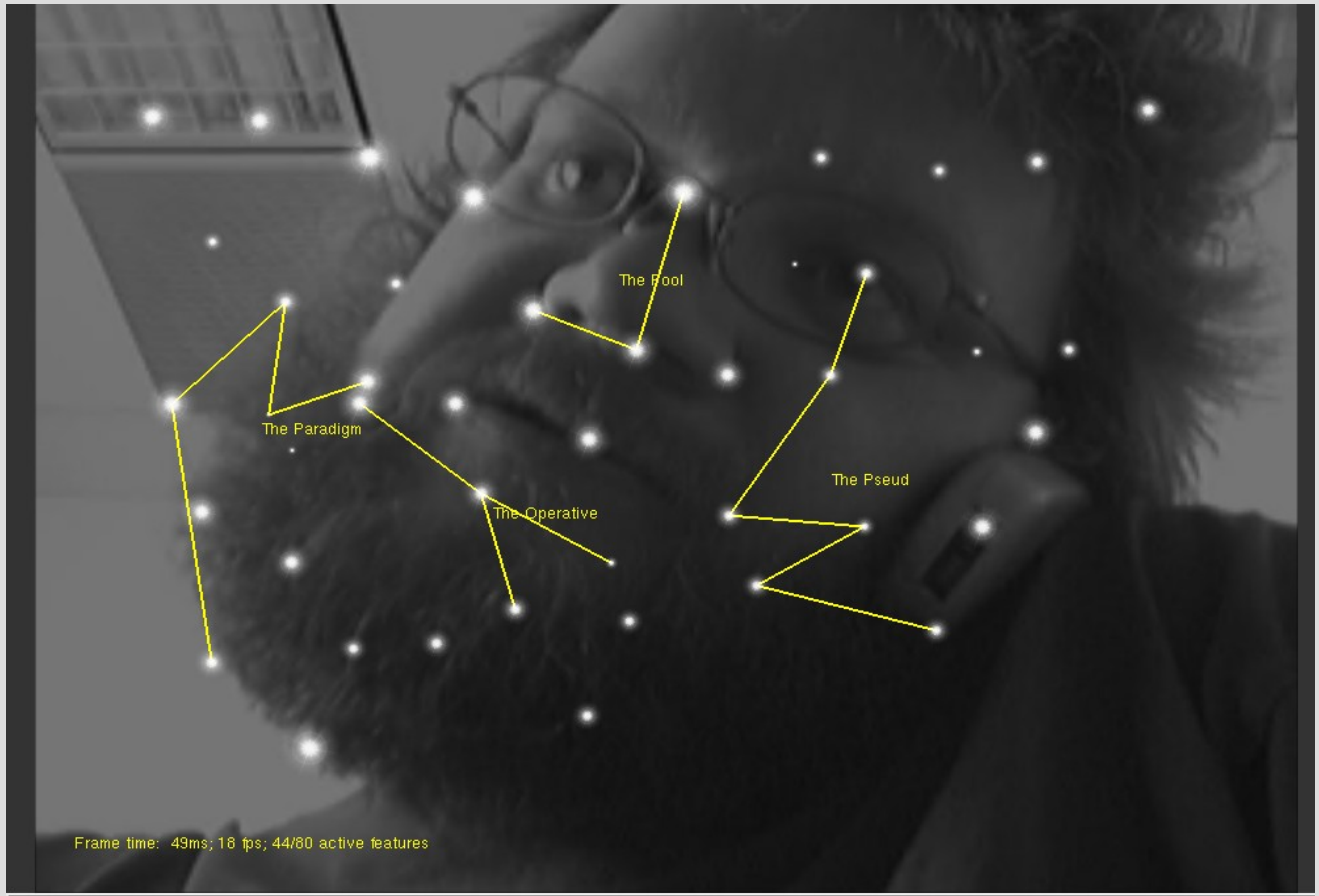
Feature Tracker

- Tracks N (50-200) features per frame
- Looks for new interesting features
- “Interesting” means:
  - well defined in 2 dimensions
  - High contrast
- Tracks feature for as long as it can
- Loses feature if it
  - goes away
  - changes shape


Constellation

Scripting

- First version hard-coded C++
- Cute, but inflexible



C++ = annoying

- Needed something better
- Too many “it would be neat if” ideas which were too fiddley to implement
- Solution: scripting language

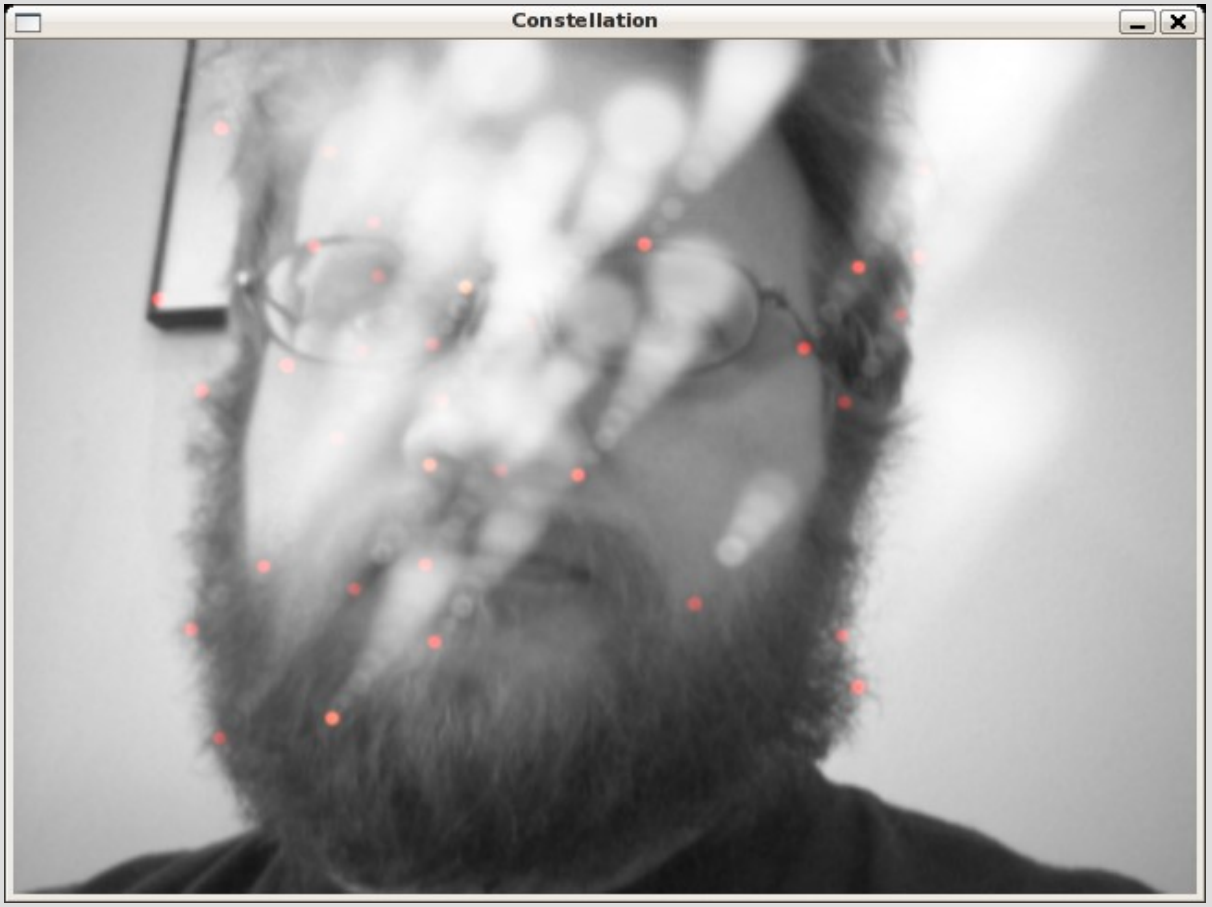
Lua Scripting

- Intended to be easy & accessible
- After all, programming is just typing
- Allows lots of experiments in a short time
- Useful script in about 30 lines:

```
require('bokstd')

t=tracker.new(100,120)

star = gfx.texture('blob.png')

-- Function to construct a new tracked feature point
function trackpoint(x, y, w)
   pt = { x=x, y=y }        -- updated by tracker

   -- drawing function
```

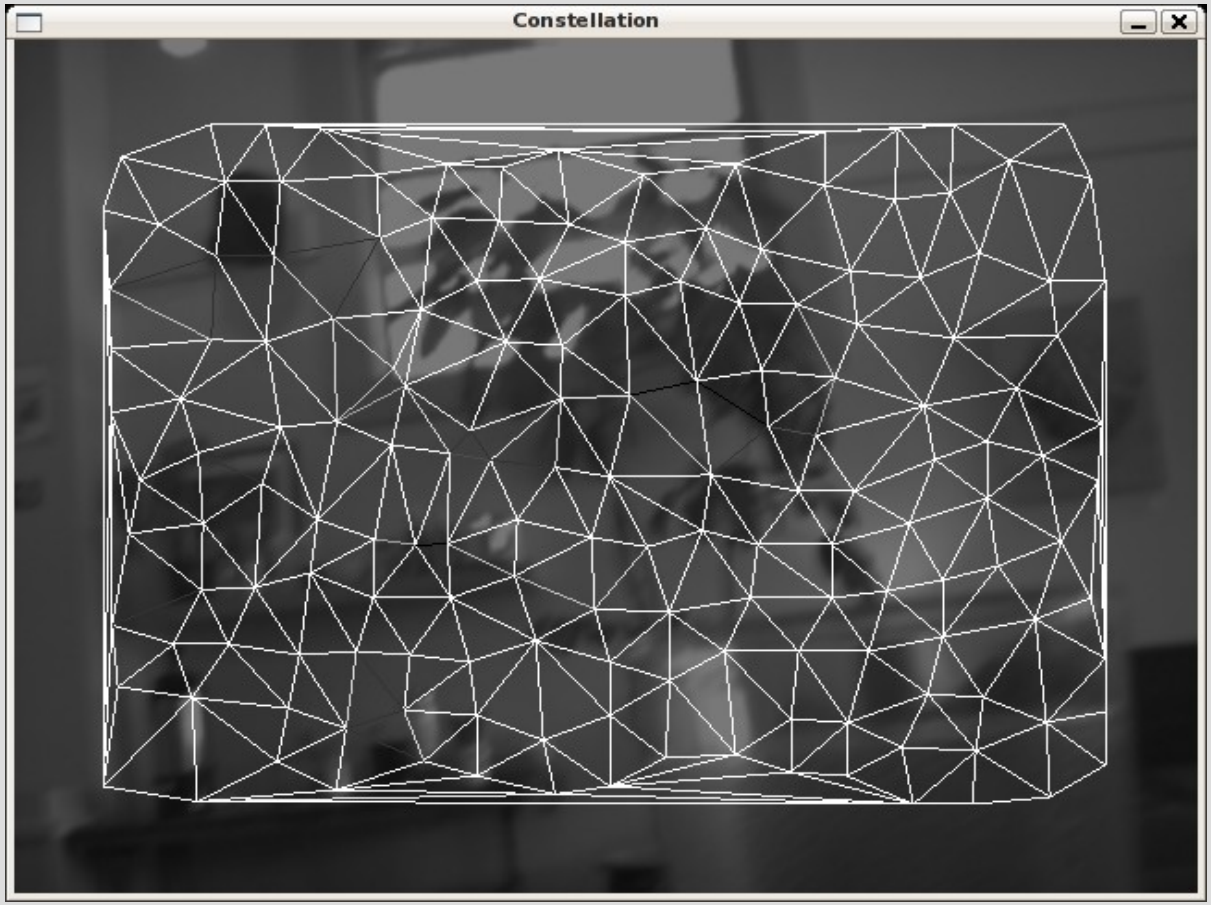
Fun things

- Do you smoke?



Mesh

- Things get interesting when you connect points



Constellatoins

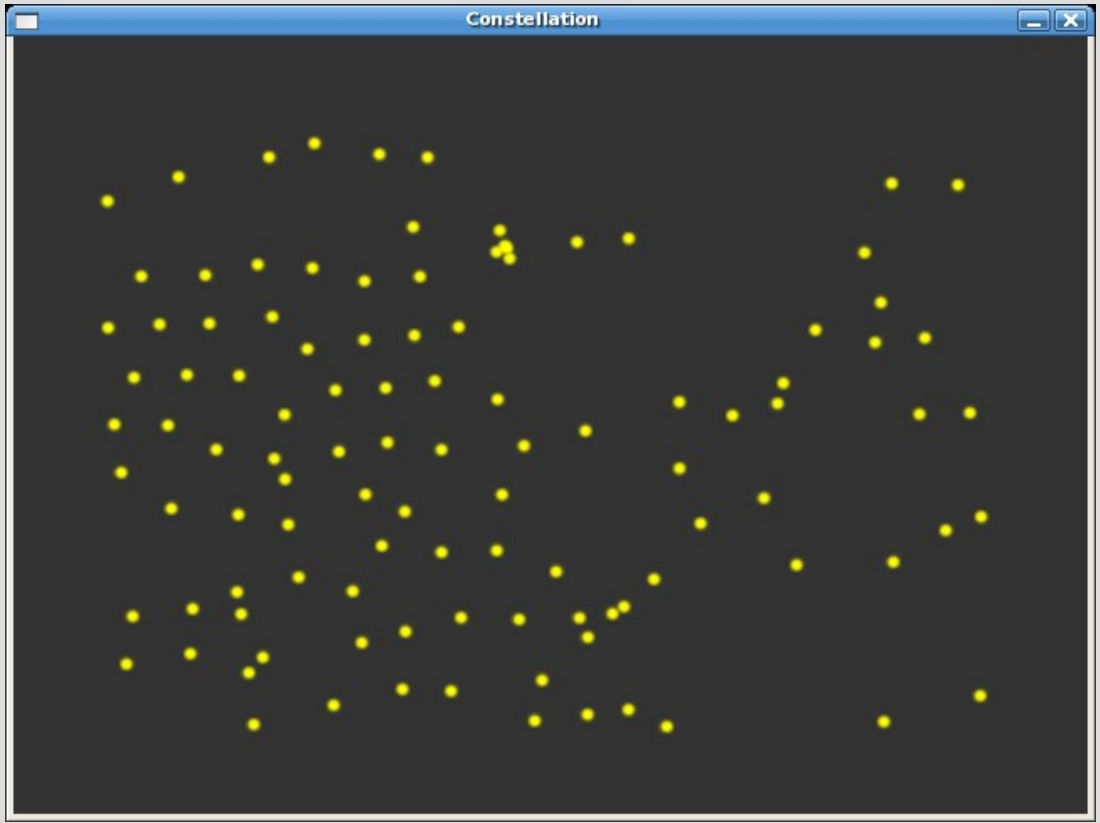
- Mesh basis of constellations
- When a star is
  - Old enough
  - Big enough
- Becomes basis of constellation
- Join adjacent stars on the mesh
- Lines don't cross initially
  - But might if the stars move

Explosions!

- When the feature behind a star gets lost
- Star goes into nova (of course)
- Lets people create and destroy large numbers of stars
  - They seem to enjoy it

Something cute

- Your eyes/brain can pick out features with just the points
  - But only if they move



If your brain can do that...

- There are only ~100 points there
- That's not much information
- So if your brain can get stuff from that
  - Shouldn't be too hard for a computer...
- Hmm...

Future stuff

- Release source
- More powerful trackers
- Actual machine vision
  - Maybe even build robot

Contact

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