RepRap & repsnapper ...

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Replicating Rapid Prototyper

- It prints itself
  - how do you print the first one?
  - Hand-tools + wood + gears + [ extruder ]
  - Reasonably accurate: sub-mm precision
- It has software to control it
  - Software written by mechanical engineers
  - Serial protocol: no flow control & buffer mgmt
  - C++ / curious Arduino based control software
rep-strap

- Based on Mendel
- Un-documented
- Steppers provide the precision
- Z axis: vertical driven by studding
rep-strap

- Based on Mendel
- Un-documented
- Steppers provide the precision
- X axis carriage extrudes plastic
- Y axis moves build platform
- Both belt driven
Gears are hard:

Borrowed the wife's chopping block for some hard nylon.
Coat hanger
Notice the string problem:

Pin wheel
z axis

Beer Bottle opener.
Next print: a real Mendel

- Very complicated
- Tons of fixings
- Lots of little ABS bits to print out
- Hideous warping problems from repstrap ...
Next print: a real Mendel

- Electronics trivial in comparison.
- Geared extruder a necessitity for printing PLA
- Import misc. Prusa features to fix:
Print quality considerably better:

- Now printing in PLA: a tough bio-plastic from corn-starch
- Reliability much improved with Mendel.
Print(ing)

Prusa Mendel:

- Prusa: recommended
  Mendel to build:
- Far fewer components
  - 3 bearings vs. 50+
  - Printable on one
    mendel bed.
- Easier to assemble
- Etc.
Electronics ...

• Initially quite complicated:

Main controller

Extruder controller

4 Stepper Drivers
Now a simple Arduino + shield
RAMPS 'Shield' board plugs in on top: ~complete

Standard Arduino board underneath
The Software ...

- All existing control software is Java
  - evilly unpleasant, terrible native platform integration, performance also poor
  - (but the problems are hard)
- Rendering to GCode Java or Python – also slow.
- RepSnapper: the solution
  - Native C++, Gtk-- (ported from FLTK)
  - Almost entirely re-written by yours truly.
Load and render STL files ....
Slicing the 3D shapes to 2D slices, then shrinking / growing by nozzle width.
Rendering generated Gcode & comms to drive printer.
Software love required ...

- dynamic detection / hot-plug of USB printers
- accelerated slicing / shrinking / fill
  - algorithms really lame, input files dirty too.
  - improved filling algorithms, multi-dimension modelling etc.
- standard for multi-object / multi-material
  - .zip file with XML meta-data + STLs ?
- good multi-extruder / multi-material support
- only characteristic settings + calibration flow
- Binary Controller code tweak-ability + up-load
Finally ... Rhys Jones' metals ...

- Electrical machine / PCBs need metal
- Custom low temp. Tin, Bismuth, Indium alloy

Unfortunately dissolves metal nozzle at well below its melting point.

Ergo: requires an anodised nozzle to fix:

- The future from here ...
- Credits: all @ Bath, Prague & wider community

http://www.reprap.org/