Projects Portfolio

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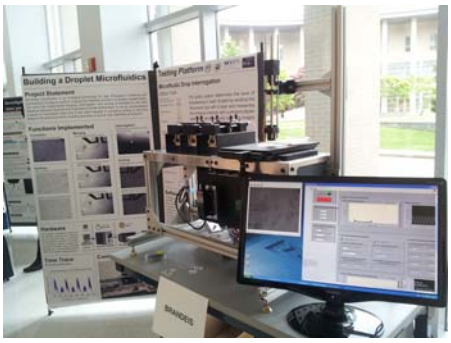
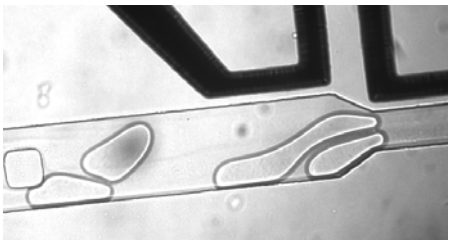
A sampling of my most recent/favorite endeavors. Let me know what you think!





Production Microfluidics Interrogation Device

Capstone, Team of 4

Brief:Designed, and developed a modular, robust platform for interrogating, sorting, and merging microfluidic (5uL) droplets at high-throughput rates- to be used in protein crystallization research at Brandeis University.

Project Details:

- Ability to process micro-scale (5uL) droplets at rates of 1,000-5,000/second
- Class II laser and specialty photon-counter sensors to identify contents of uL-scale droplets
- Lightning-fast software & electronics written on an FPGA, operating real-time at 20kHz
- Platform designed with low-cost, modularity, and reproducability in mind
- Extensive documentation, parts sheets and code commenting, to enable future work

What I did:

- Led system design and integration
- Acted as project-manager, team-leader, and liason to sponsor
- Wrote the UI, architecture, algorithms, and embedded FPGA code to perform the software functions

ReVerb Solar-Powered Speaker

Work (Noribachi Inc.), Individual

Brief: Designed the interaction and refined the electrical system for ReVerb, a $2,500 POS free-standing solar-powered speaker

Project Details:

- Can play for 4-6 hours on one charge (no sun), continuously if appropriate solar power
- Touch-button interface and control
- Seamless switch in charging/playing between solar power and AC-power
- Any-device play, iPod-charge functionality

What I did:

- Designed and integrated the electrical system; included power-MOSFET switching, analog logic,
- Selected, implemented, and characterized a solar-panel --> Li-Ion charging circuit
- Identified use cases, potential pain points, and extreme cases of used, to incorporate in design
- Worked with manufacturer in China to design custom plastic-embedded solar panels
- Built external structure, so could be used as 'looks-like,' 'works-like' sales and marketing tool

Appropriate Technology Research & Development

Self-Initiated, Team

Brief: Developed a locally-manufacturable and affordable groundnut (peanut) sheller and pioeneered a small-scale technique for making charcoal from maize cobs (waste biomass).

Project Details (Groundnut Sheller):

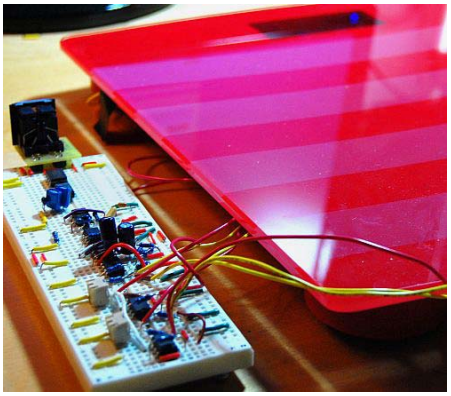
- Made entirely from local materials (concrete, metal, etc.) and local manufacturing techniques (welding, basic screwing, etc.)
- Costs under $15 USD (comprable to $50/$550 existing technology)
- Easily understood and operated by any person or child
- Low nut breakage percentage (1 broken for every 10-11 whole)

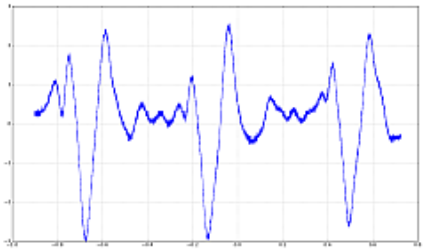
Project Details (Charcoal):

- Easily performed on a small-scale and incorporated into daily life
- Uses either pre-existing or 'waste' resources (cooking fires, a tin can, and biomass)

What I did:

- Performed an analysis of the local needs, materials and challenges, researched potential existing solutions, and defined opportunity areas and project scope
- Developed the technologies (mechanical design, parametric testing, performance testing, iteration, etc.)
- Worked to introduce projects into the community and the daily lives of community members
- Created and disseminated documentation on how to replicate either of these projects





Heartbeat Detection w/ a Digital Bathroom Scale

Class, Individual

Brief: Built a ballistocardiogram that can accurately detect the heartbeat of a person standing on it - by hacking an off-the-shelf bathroom scale & implementing precision electronics.

Project Details:

- Gives a fairly accurate BCG reading, comparable to that of a $1000 EKG machine
- Sensitive enough to detect the QRS & TUP heartbeat complexes
- Doesn't require intrusive wires to use
- Works for people of any weight range
- Has applications in consumer and medical settings

What I did:

- Designed the core high precision circuitry that makes the project work
  - Signal amplification
  - Power supply filtering
  - Signal cleaning/filtering
- Interfaced circuitry with strain gauges
- Debugging, prototyping