Thomas Needham

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Education

Massachusetts Institute of Technology — **Cambridge, MA**
Candidate for S.B. in Mechanical Engineering — June 2017
Applicable courses: Circuits & Electronics, Product Design & Manufacturing, Mechanics of Materials, Data Science, Thermodynamics, Numerical Computation, Power Electronics (mechatronics focused), Python

Work & Experience

TSTech Americas — **Columbus, OH**
Test Automation Intern — May 2016 – August 2016

- Review test methods in preparation for ISO compliance audits
- Develop novel, low-cost systems to replace lifecycle test machines of automotive power seat functions
- Design, source, assemble, and verify electronics to run the test systems
- Write code for system fault tolerance and self-checking, as tests would run for months
- Establish documentation of assembly, usage, and debugging for others to reference

MIT CSAIL — **Cambridge, MA**
Prototyping and Mechanical UROP — December 2014 – Present

- Develop more appealing enclosure shapes, better production methods
- Design, 3D print, assemble, and test motorized system for mounting and rotating antennas precisely with feedback for experiments on alignment of 24GHz equipment
- Laser cut and thermoform enclosures for antenna arrays and RF equipment

Pi Charging, Inc. — **Cambridge, MA**
Enclosure and Test Consultant — J une 2015 – August 2015

- Advised on thermal management of power electronics, industry standard connectors, materials, processes, and components for scaling up production of test units
- Designed, cut, machined, and calibrated RF coils inside metal-free portable test unit
- Optimized coil layout and design within unit; tested for peak coupling between MHz coils

Skills

Rapid prototyping; CAD (EAGLE, SolidWorks, MasterCam); Arduino, MATLAB, and Python; CAN Bus; CNC and manual machining; Soldering (incl. SMD); Project budgeting and ordering (BOMs); Industry-standard supplier familiarity (McMaster, Grainger, Digi-Key, Mouser, Online Metals) ; ISO compliance documentation

Selected Projects

Car Modifications: Starting summer of 2016 I've been designing and installing several systems for a friend's car. The central controller is a Raspberry Pi 3 connected to a touchscreen on the dash, with several microcontroller subsystems attached to it to run data gathering, front LEDs, interior LEDs, a modified sound system, and some automation within the car. All the circuits were custom SMD PCBs, the switch panel and LCD enclosure were machined by hand, and the pedal covers will be replaced by waterjet-cut carbon fiber panels with cast silicone grips. The subwoofer boxes and electronics mounts are also custom.

Contract Work: Besides personal projects, I help research groups at MIT with mechanical problems. Half the reason I enjoy it is the constant variety of problems to solve; linear positioning systems for radio antennas, remote radial positioning systems, designing thermoformed plastic enclosures for mass production (my current task), waterproof boxes to be mounted on light poles, and testing coils for novel wireless charging.

Room Lighting: I have designed and installed nine radio-controlled units with two 10w LEDs each (6000k and 3000k to reduce eye strain, blue light at night) to supplement insufficient single-light dormitory scheme. Each node contains a dozen sensors and metrics being reported back to the base station. Each has its own fail-safes and runs off a common 14VDC bus installed on and around my bespoke loft. The nodes operate on PCBs designed in EAGLE with SMD components, thermistors, error code LEDs, fans, a microcontroller, radio, and fit into machined mounts for connection to the power bus.

Automation: I conceived, designed, and led a team in the creation of a small, self-contained oven/conveyor/refrigerator/computer to store, dispense, cook, and present foods on demand. The unit and all of its components were made by our team just for this project: the fridge was foam insulated and cooled by Peltier plates with water cooling on the heat rejection side; the dispensers were 3x3 stacks of electromagnetic levers that could be swapped out; the conveyor ran on a lead screw and operated in both the fridge and running oven; the computer accounted for cooking times, kept inventory, and monitored the system; the oven was double-insulated aluminum with Teflon interconnects and bearings, and was heated by Nichrome resistance wire. Upon completion, the entire system was no larger than the average microwave and baked its first item just before school started Senior year of high school.