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Franklin W. Olin College of Engineering (2013)

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Career

Current

Projects

Aura, a concept vehicle

Leuven, Belgium
Summer Internship, Olin Year 2

I spent the other half of my time in Leuven (away from the CQS Racing Team), working with renowned nanotechnology research institute, *imec,* and my classmate, Mark.

We **design**ed a concept-car from scratch, with the **aim** to create a compelling aesthetic and engineering design.

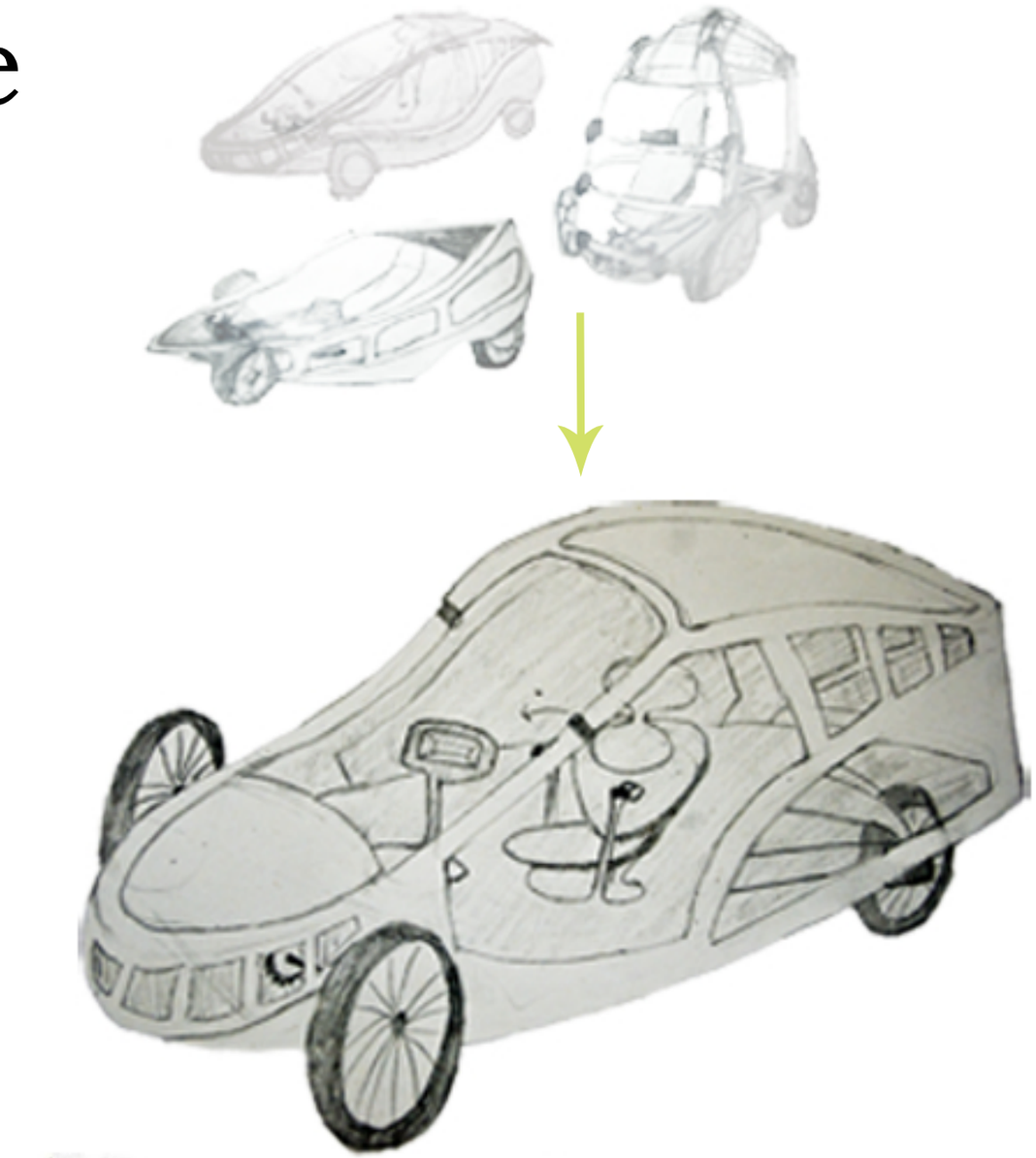
The vehicle targets Europeans that commute in the cities. It is to bridge the gap between the bicycle-commute that is commonplace and the unnecessary car commute that is inefficient. It is a push for renewable energy & *sustainability*.

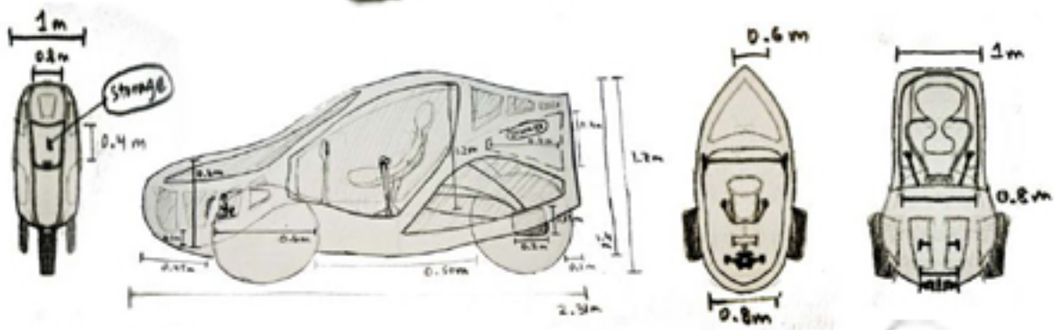
Aura is a 3-wheeled vehicle that aim to preserve the exhilaration of a bicycle ride while integrating the comfort of a car, as desired by our users. It allows the rider to pedal while using electric-motor assistance when required. Aura is different because of its sustainable 'cradle to cradle' manufacturing cycle and nature-friendly transport.

Aura wants to be more than just a vehicle. It is an accessory, a partner in *connectivity with the community* via the smartphone or tablet. The high-tech integration allows for the modern-day user to embrace the power of the social network.

We worked to design the in-hub motor control, its mechanics, and integration with the pedal-power. We laid out the controls system that allows the vehicle to decide when to provide the electric-assist and also integrates the user's needs via the smartphone.

[Manufacturing is set for a June 2012 start.]





CQS GroepT Racing Team

Leuven, Belgium
Summer Internship, Olin Year 2

Introduction: CQS Group T Racing Team consists of ~30 master students from Group T Leuven Engineering College. The goal is to develop a hybrid and electric drivetrain by building two cars: *Pegasus* (biethanol) and *Odyssee* (electric) which take part in the 24h24' for 2CVs at Spa-Francorchamps (Belgian Grand Prix circuit). This year the team is expanding to the Formula Student competition with an electric vehicle. (www.cqsgrouptracingteam.be)

For 2.5 months, I worked in the Electronics department of *Odyssee* for the CQS Racing Team. My main job consisted of 2 tasks. The *first* was to **create** and restore wireless communication between Odyssee and the pitlane when the car is in a race. This enables the team to receive real-time data from the car and optimize their racing strategy. I worked with Xbee modules that can transmit data bytes using the RS232 protocol between the car and the pitlane.

Wireless data was read & saved via LabView, Java, and mySQL. With a fellow CQS teammate, I worked to analyze incoming GPS data. GPS coordinates were plotted real-time on Google Maps. In July when Pegasus participated in a 2CV race at the Circuite de Bresse, we **successfully tested** the wireless communication and GPS sensor! My teammate will continue the work and analyze the incoming data from other sensors as well.

My *second* **aim** was to **re-design** the data-analysis program and user-interface to be modular. Suppose the team wants to add new sensors to the car or make adjustments? How can they more easily do this instead of digging through the software they have and re-program? I developed design document and worked with mySQL, metadata, and Java for this task.

The experience taught me about automobiles and electric motorization. It inspires me to continue in the automotive industry and help those 'going green'.

Identity of the Mind

Personality Psychology Research with Professor Jon Adler
June 2010 - June 2011, Olin Years 1 & 2

Over the past year, I have worked with Professor Jon Alder and classmate Erica Chin to conduct research in Personality Psychology. Jon is a professor and researcher in narrative psychology and he got us interested in how people narrate their own lives and develop their identity along the way.

In Summer 2010, for my first research experience, our **aim** was to understand the way in which people diagnosed with Borderline Personality Disorder make sense of their lives. BPD is a third-rail mental disorder that does not have many therapy options or too many (a little from all other disorder treatements) that it is time-consuming and expensive.
We watched, for the first time ever, video interviews of these people telling their life stories. From that, we identified and coded key thematic characteristics of narrative identity to see how these subjects interpret their lives. Our **findings** are going to be **published** in the *Journal of Personality Disorders* in the coming months.

Other research with Jon as included: studying peoples' reconstructions of experience in psychotherapy. We studied how their narratives change (for good or for bad) over the course of therapy and how this affects the outcome of their experience. And our most recent study has been about how mid-life adults make sense of their body as guided by the ageing process. How do these physical changes alter their personal identity and meaning-making?

My experience with psychology has given me great insight into how people think and make sense of the world around them. As an engineer, having this psychology background is a great asset when designing for users and with users.

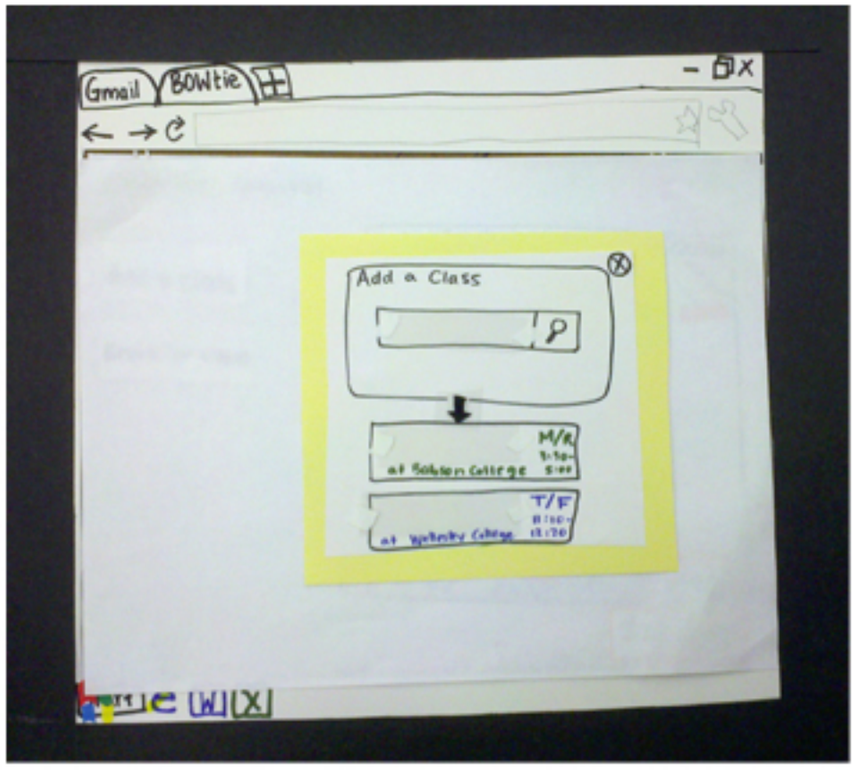
Current Projects (1)

Design & Leadership Experience
Fall 2011, Olin Year 3

1. Human Factors Interface Design

HFID is a class in which we explore the design and development of user interfaces. We take into account the realities of human perception and behavior, the feasibility of computer interaction, and hope to foster synergy between user and computer.

This semester, my team, Ajax, (http://hfid.olin.edu/sa2012/s_engr3220-ajax/team.html) is working to improve the tri-college experience between Babson College, Olin College, and Wellesley College. The students from each school can cross-register to classes at any of the others. Our goal is to make the cross-registration process easy to plan (definitely not the case now) by presenting them with the relevant information in a transparent, effective, and attractive way.



So far in the design process we have had user interviews to get their perspectives on cross-registration, created a paper prototype of our interface and co-designed & have had user tests. For the rest of our semester, we plan to implement our Interface. I am the user-design and interface-design lead for Team Ajax.

Current Projects (2)

Design & Leadership Experience
Fall 2011, Olin Year 3

2. Sustainable Design

Sustainable Design is a class that provides a high-level view of sustainable product design. We learn to use green design principles, conduct life-cycle analysis on an existing product, and strategize to improve the production processes of the product.

Project 1: sStudying an existing product and modifying the material acquisition, manufacturing process, and waste treatment.
My team, Green Wackin', is studying the Weedwacker, a gas-powered gardening tool primarily used by landscaping companies to beautify a mowed lawn at the edges and in small spots.

We have studied users who commonly use the Weedwacker, learned their likes and dislikes with the product, and have done a complete Life Cycle Analysis on a Weedwacker by taking it apart. Now, we are moving into the 'Strategies' phase where we will brainstorm how to make it a tool that doesn't pollute more than 5x's that of a car!

Current Projects (3)

Design & Leadership Experience
Fall 2011, Olin Year 3

3. Society of Women Engineers

SWE has played an important role in my college career. I joined SWE as a first year, unsure of what it was about. However, today I can say that the opportunities have been endless.
The National and Regional Conferences are amazing – great networking opportunities, insightful workshops, Outreach, and a large Career Fair. To be able to meet such inspiring leaders from around the country is a once-in-a-lifetime opportunity for most people; with SWE, it is possible annually. I have been able to visit Orlando, FL, Austin, TX, Troy, NY, and Chicago,IL in this past year for various conferences.

This year I am the Region F (New England Region) Collegiate Representative, working with 25 Section Presidents and 2000+ collegiate female and male engineers along with the SWE National Board. The role has just begun and I am learning so much about SWE Program Management every day. The concerns of people, the operations of their organizations—they are so interesting to watch, it's like an engineering system!

Additionally, I am President of the Olin College SWE Section as well. It is great because it means I am involved in every aspect of my school's activities as well. Even more, it allows me to see the mindset of the Section Presidents who I am corresponding with, enabling me to make better decisions every day to make all of our lives easier.

The leadership training that SWE is providing me is tremendous and I am enjoying every minute of it.

Thank you SWE!

Designing for Tattoo

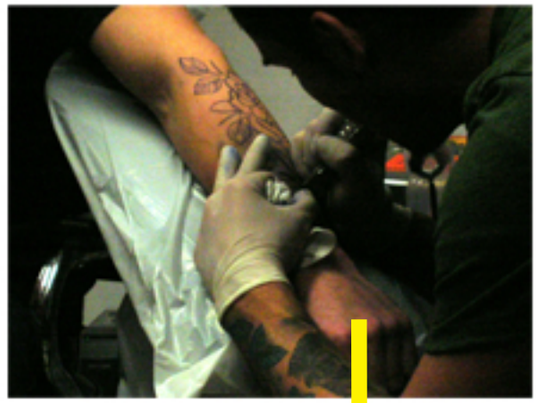
User Design with Boston's Tatttoo Subculture
May 2011, Olin Year 2

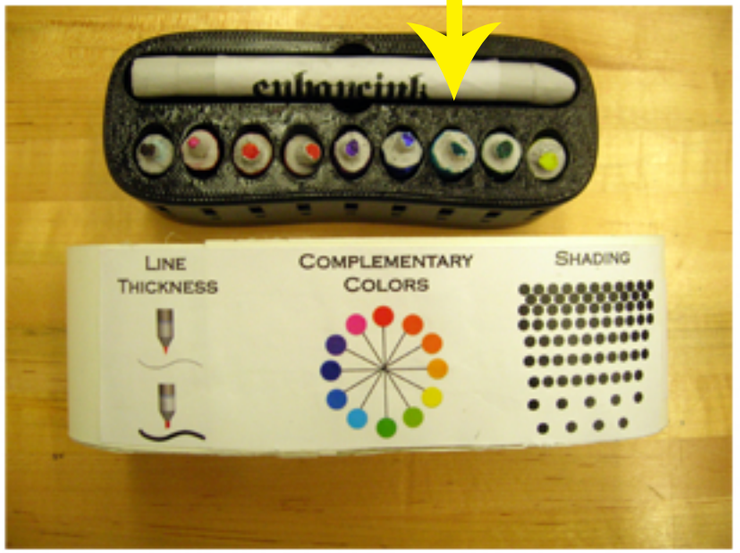
User-Oriented Collaborative Design (UOCD) is the highlight sophomore-level course at Olin. We are set on the task to study a group of people--who are they, what do they want, what are their needs? As engineers, we are taught to build solutions to problems and/or areas of opportunity that are not addressed.
My team chose to study the 'body modification' subculture in Boston. Tattooing became legal in the 21st century in the city, and quickly tattoo parlors have risen in the past decade.

We started by interviewing tattoo artists, tattoo users, people who have friends with tattoos, people who want tattoos, and those who want to get them removed. We talked to users of all tattoo types to learn their ways of life and the people they socialize with and live with. It is to help us step into their shoes and ideate for the subculture.

We created personas and maps of values, areas of opportunity, and brainstormed ideas. Then a few weeks later, we went back to our users and presented our ideas. These users are asked to work with props of our ideas, wear them and see how they feel, and report to us what they think. This co-design helped us see whether our feet fit well into the users' shoes. If they didn't, it was time to go back and re-think our designs.

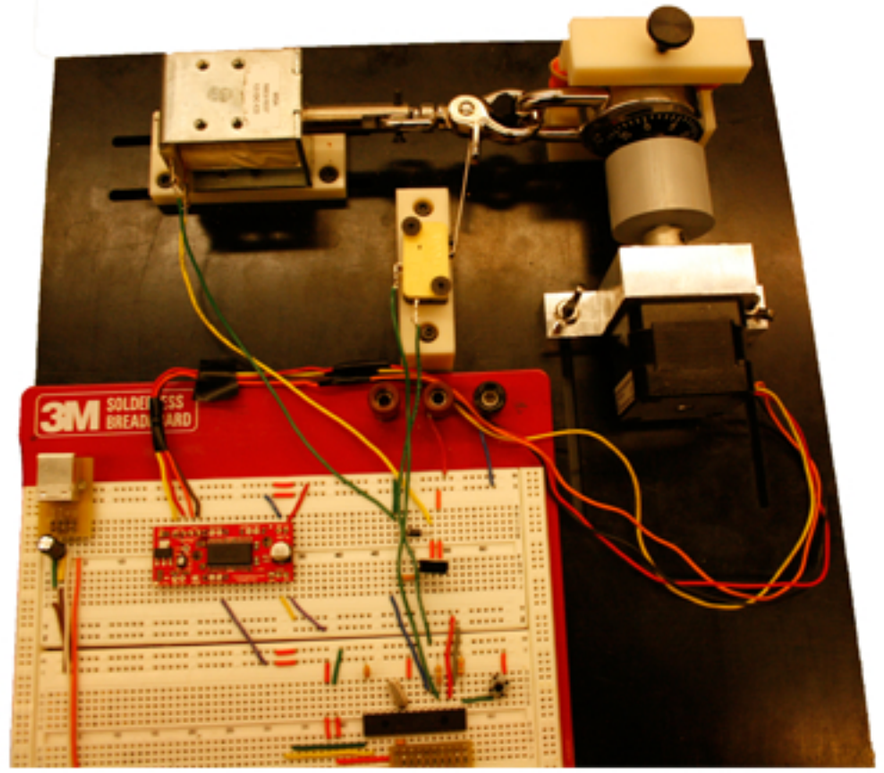
My team concluded the 5-month design project with the product EnhancInk. It is a temporary tattoo pen that draws like a tattoo and allows tattooed people and their dear ones to give tattoos new meaning. Why this? Well, the sense of a tattoo's permanence is very strong among people of the subculture. They have committed to a piece of permanent design on their skin. This pen helps them embrace the permanence by adapting the tattoo(s) to new experiences and stages in life.





The *LockCracker*

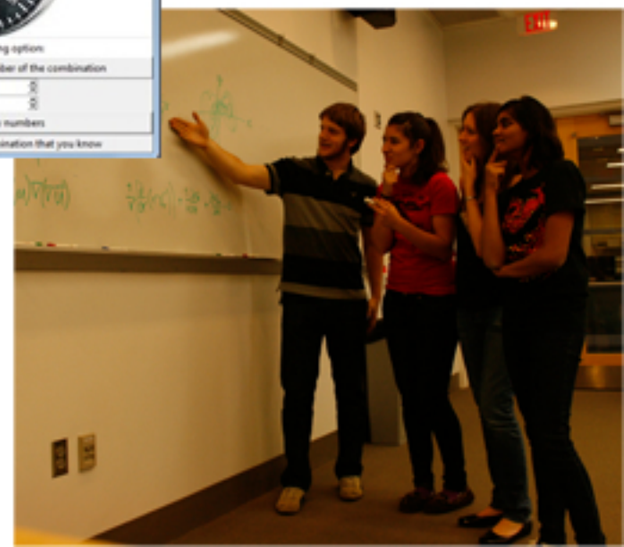
Final Project for Principles of Engineering class
By Team *JARJ*: Jessica, Aiswarya, Rob, Jessica
December 2010, Olin Year 2



Aim: The purpose of this multidisciplinary course was to build a mechatronic system of our choosing. Team JARJ decided on building a lock-cracking device. The Lock-Cracker was set to take a combination lock with an unknown combination and unlock it and display the correct combination to the user via a GUI interface. This flexible electromechanical system should be modifiable to fit any turn-dial lock.

Solution: Team JARJ mechanically turned the dial on the lock and pulled on the latch with every combination that was tried. Jessica & I worked on the electrical and software systems while the rest of the team took upon the mechanical design challenge.

The electrical & software systems were **design**ed as follows: 1. We used a stepper motor with the accuracy needed for the lock's dial to turn to different numbers. 2. We attached a pull-in solenoid to the lock's latch to pull every time a 3-number combination was tried. 3. A limit switch was placed just in front of the latch's connection to the solenoid. When the latch opens and the switch is triggered, the system knows to stop and display the result on the GUI for the user. 4. We used a PIC microcontroller as the brain behind the controls. 5. And, we designed a modular Python back-end to fit to any type of dial that is available in the market.



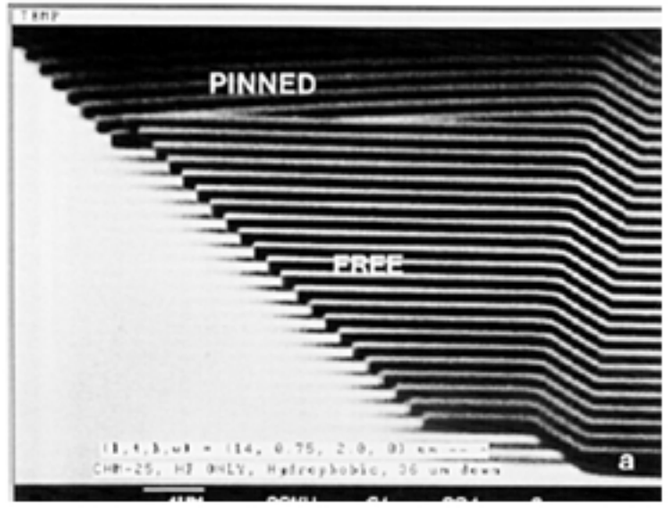
Finally, the user-interface was designed to minimize the time taken by the Lock-Cracker to solve the lock. The user is prompted to enter how many of the numbers they know of the combination and the LockCracker optimizes the procedure accordingly.

Today, the LockCracker has received **publicity** on *Wired.com, Popsci.com, ASME* Magazine, and more. Please visit **www.thelockcracker.com** for more details & for a video of the system-in-action.

Stiction in MEMS RF Switches

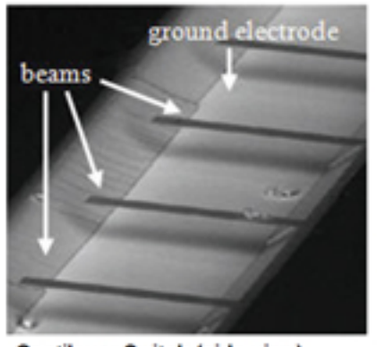
Final Research Paper for MEMS class
December 2010, Olin Year 2

MEMS is a 'special-topics' ECE course at Olin. The multidiscliplinary field is studied in terms of structure **design**s, fabrication techniques, and the future of MEMS devices in the semiconductor industry. It is the class that really got me interested in the semiconductor field, a branch of Electrical Engineering that I want to help bring into renewable energy.

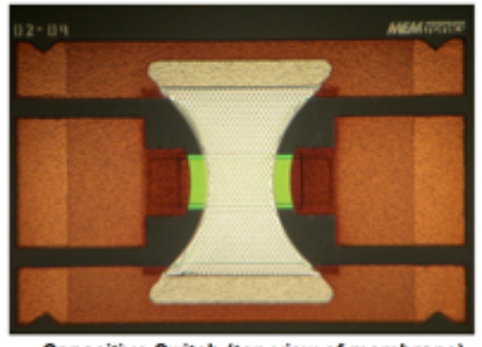


This project is the final research paper in the class, where I studied the phenomena of stiction, the main cause of failure of Microelectromechanical systems. Stiction is the sticking force that comes in between surfaces that touch, and when the attractive surfaces forces between them are too strong, they cannot be separated again. The MEMS device stops operating due to sticking failure.

In this paper, the causes and calculations of the stiction force are discussed. The paper places special focus on the Radio Frequency MEMS switch, used to switch RF signals transmitted across the world. The switch is applied to RF circuits to open and close a contact at very fast rates to stop and send signals in the gigahertz range of frequencies.



Cantilever Switch (side view)


Capacitive Switch (top view of membrane)

The MEMS switch is manufactured as a DC contact switch or a DC shunt capacitive switch. The mechanics behind each switch, the fabrication of each switch, and the force of stiction each can encounter, are the target topics of this paper.

The **aim** is to analyze: what are the novel technologies and methods to reduce or remove stiction? Possible solutions are discussed for their processes, advantages, and disadvantages in switch manufacturing. These include the use of rough surfaces, anti-stiction coatings, partial dielectric charging, and getters or supercritical drying of microstructures on the device. Fully reliable **solutions** to remove stiction are yet to be found in the world of MEMS.

ProjectWizard

Final project for Software Design class
By: Aiswarya, Jessica, Molly, Eric
December 2010, Olin Year 2

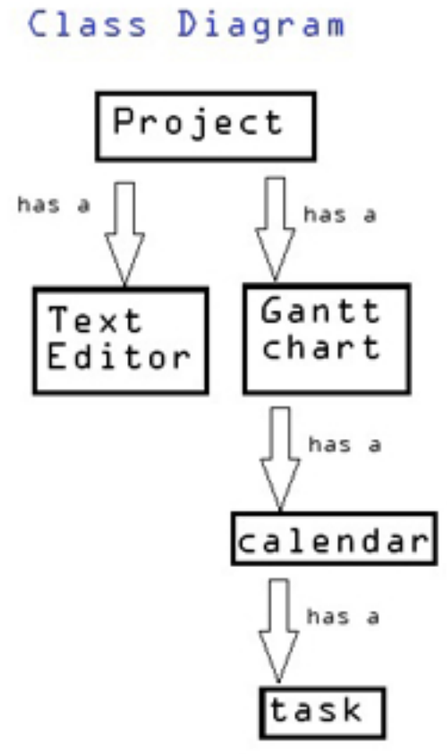
Aim: Aid project-oriented teams in consolidating their work, organization, and thoughts; to be tested via Olin students in project teams.

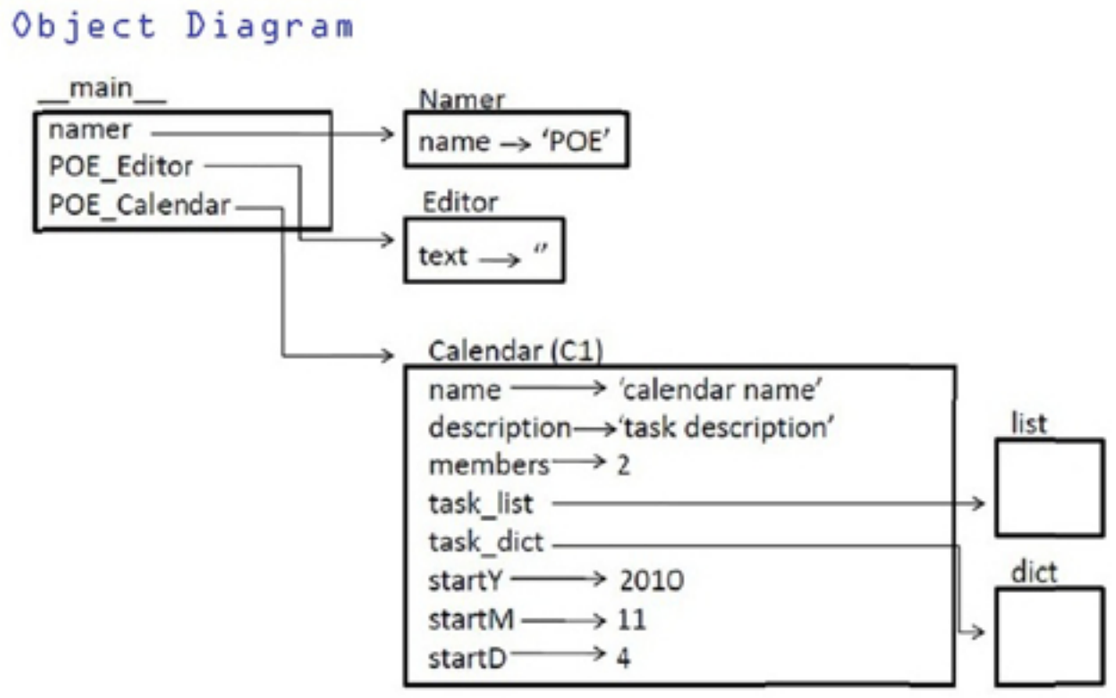
Solution: *ProjectWizard* makes a virtual workspace for every team with a collaborative text editor and a Gantt chart creator. The *ProjectWizard* requires the team to supply a project name and accordingly gives them a text editor to generate ideas and a Gantt chart wizard to create their project schedule.

Design: *ProjectWizard* is hosted on a central server that merges the changes made by every project user.
To make changes, each user has a Python GUI that they use on their local machine to update the Project on the server. The Project and the individual client applications for each team member are linked together by a Python networking tool called Pyro. With Pyro, the team members can open their Project from any computer running *ProjectWizard*, and changes made to the Project get sent to the server.

The local client application and the remote server application communicate back and forth to edit or view the objects living on the server as requested by the user.

Contribution: I worked on the back-end and some of the front-end of the Gantt Chart creator. The user is allowed to schedule tasks in a timeline, and these are graphically displayed on a GUI.





Distance-Sensing Doug

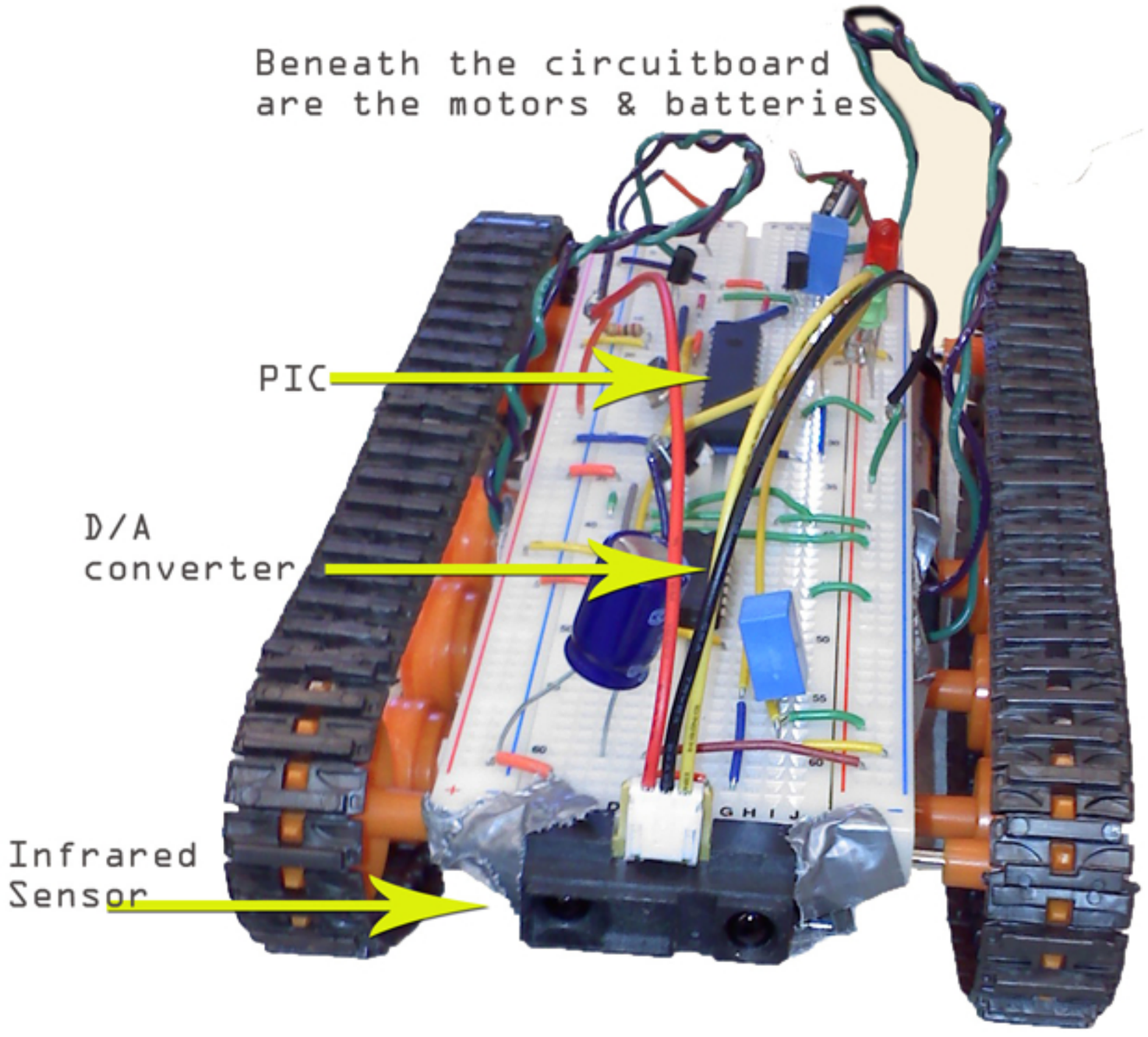
Final Project for Circuiteering Club
December 2009, Olin Year 1

In the Circuiteering club, Molly (fellow freshman) and I learned about microcontrollers, sensors, and basic engineering tools used to build an intelligent creature. We spent 1 month before the bi-annual Expo working on our very first robot.

Aim: a smart creature that can avoid obstacles and move away from them.

Solution: Using an infrared distance sensor mounted to the front of our robot, Doug, and a a PIC microcontroller programmed to sense distances of a few centimeters away. When this distance came between Doug and any obstacle, Dough was commanded to stop, 'turn right by 90 ' and accelerate away from the obstacle.

Design: An assembled mechanical 'machine'.
The distance sensor was mounted to the head of Doug and connected to an input of the PIC. The microcontroller made use of Pulse Width Modulation to control the DC motors in the wheels of Doug via the use of H-bridges in between. The PWM supplied a signal to the H-Bridge-and-motor circuit (via a D/A convertor) so that speed and motor direction could be controlled.

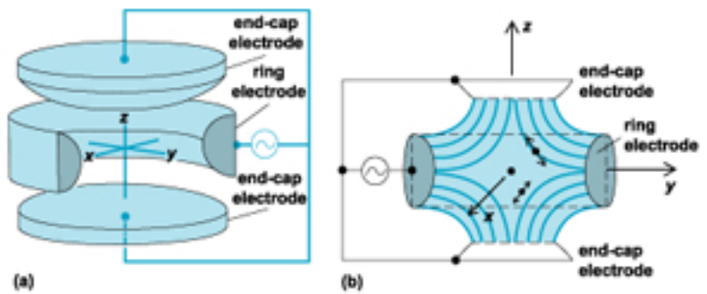


E&M Simulations

Contributors: Samantha Yang, Samantha Becht
December 2009, Olin Year 1

The Characteristics of a Penning Ion Trap

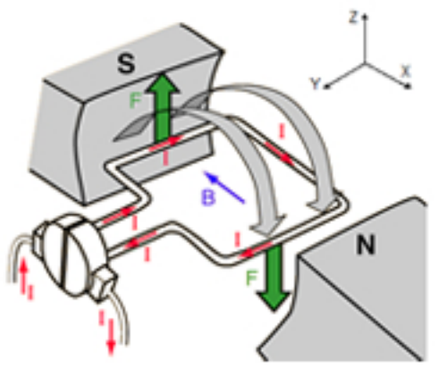
This is a paper written in the E&M: Modeling & Simulation class in freshman year. Yang and I present a simplified model for the **conventional Penning Ion Trap**, used to confine single and multiple ions in a trap. It helps physicists to determine charge-to-mass ratios of atomic particles, characteristics of fundamental constants, and advancements in quantum computation.



Our simplified **design** of the Trap consists of 2 positive point charges and a negatively charged ring centered halfway between the charges. Charged particles are confined within this configuration due to a combination of a static electric and static magnetic field. Our **aim** is to prove that particles do affect the motion of other particles.
The MATLAB simulation **results** support that there must be a maximum number of ions that can be trapped at one time.

The Model of a DC Motor

The **direct current motor** was the first type of motor to be created to convert electrical to rotational mechanical energy in the 1800s. In industry, the torque-speed curve of a DC motor is the most-widely used characteristic of a motor, to pick motors that can operate on the required load without stress.



Becht and I **aim**ed to verify our hypothesized inverse correlation between the load torque and the angular speed of an ideal DC motor. Emphasis was placed on the physics behind the torque-speed relationship.
A mathematical simulation in MATLAB of a direct current motor with various loads ‘placed’ on the motor was used to observe the steady state maximum rotational speed reached over time. The **design** of a motor was simplified to be a metal loop of wire turning in between 2 magnets of opposite polarity.