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IEEE SPARK
University of Illinois at
Urbana Champaign
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For example, during the 2010 Superbowl, Twitter users tweeted an average of 1,000 times per second - an, as of then, unanticipated rate which caused the servers to crash. As a result, much of the infrastructure has had to be changed or redesigned over Twitter's lifetime. In another instance, user Lacey Duvalle had amassed a large number (roughly 100,000) of follow requests on her private account. Upon clicking accept all, Lacey also managed to take down a few servers. To avoid these problems in the future,

Twitter does a substantial amount of monitoring of their current services and extensive testing of new components pre-release. In fact, when it comes to code Chan claims that if you can't monitor or test it, then you're probably doing it wrong. In essence, Chan emphasized that when moving a product from being used by several people to several million people there are often new bugs that arise from users using said product in unheard of ways.

Startup Panel

Amit Kulkarni - Do.com



Dave Paola - Bloc



Cory Levy - One



Dan Manges - Braintree



The members of the panel talked about both the numerous benefits and difficulties involved with starting your own company.

Why a startup?

In short, there's nothing better than being your own boss. At a startup you have a substantial amount of independence that can be harder to find when working for a larger firm. You get to mind your own business and how you spend your time is up to you. There is less red-tape to cut through and it can often be easier to put your ideas into motion.

As a result, you also have the opportunity to make a big impact through your own personal contributions. Ultimately though, it is an individual choice. Everybody on the panel agreed on the importance of enjoying your work because quite frankly it will comprise the majority of most people's lives. If being an independent entrepreneur is what excites you, then the reward of having a fulfilling job will outweigh the difficulties of working for a small firm.

What's challenging?

There are numerous challenges that can arise from working with a small team of individuals. The most obvious is of course the lack of backing. It can often be difficult to compete with larger firms in the same industry that simply have more resources and manpower with which they can put out products faster. Amit Kulkarni of Do.com spoke about how his team unfortunately

launched their social task application at the same time that Google launched Google Tasks. While Google Tasks comprises a small part of Google's large repertoire of products, the Do app represented the entirety of Do's business. Another difficulty is maintaining proper communication between all members of the team. While working with brilliant people is necessary, it can also be difficult to reconcile different opinions to finalize the design of a product.

What's important?

All members of the panel concluded that it is important to always be anticipating future challenges. Things always take longer than expected and as such one should always be raising capital even if it's not immediately necessary. Similarly, it is important to maintain a healthy balance between the technology side and the business side of a startup. While producing an intelligent

product is important, so is being able to bring that product to market. However, what will definitely make or break a startup is the people involved. It is important to surround yourself with intelligent people and then to always maintain that network. The startup community, both entrepreneurs and investors, is truly smaller than one might expect and it is often the case that these connections are just as important as having a good idea.

"Want to be more involved with IEEE-UIUC? Have your own "tail" to tell? Write for Spark magazine! From beginner projects to advanced research, Spark is dedicated to sharing YOUR story. Contact us at ieee.spark@gmail.com or go online to ieee.illinois.edu for more information about the IEEE student branch. Visit us any time in Everitt Labortory Room 245!"





reflections

projections 2012

valuable about being in one place for a very long while. Learning and growing as a person is about having these networks of people that you can connect with. Now as a faculty it is fun that I know everybody, I know lots of people, I have lots of resources and as a student I definitely didn't have that. So that's one thing I try to help my students get because it's EXTREMELY important to your success.



Can you give some advice to freshmen who are struggling picking between Computer Engineering and Electrical Engineering?

Try them out. This is an engineering methodology; just go do something, figure out and adjust later. The really powerful and great thing about courses like ECE 290 and programming courses, particularly in today's technological world, is that almost all electrical systems require some level of computation. To be in signal processing, communications, power, transmission lines you need to have some background on how computers work, how they process information and the likes as these are critical for you to be able to work on a team. Take your first two years trying to figure out which courses

you like more but take them all seriously because even if you go into EE, at some point you'll use something you learned from 290, almost guaranteed. Everything has computers in it now. It's just the world we're getting into and you can't find out what you're passionate about until you've tried something. A lot of times people wonder if they would like something they pick but you can't know what excites you until you try it and you can always change paths too. I didn't know education in my undergrad but now it is my expertise. Don't freak out too much about the decision because you can always switch later. If you talk to a lot of the professors, a lot of them don't have degrees in the department that they are teaching in. There are computer science professors who were mechanical engineering students, industrial engineering people who are now in different departments so you can always switch. A lot of our ECE faculty were Physics students so you can always adjust. Learn to explore and make changes.

Favorite restaurant in Champaign-Urbana?

It's really dependent on my mood. I tend to eat a lot of Cravings. I like Zorbas a lot. Papa Del's is fine. Those are good. My wife and I tend to go to Siam Terrance a lot. That's kind of our go-to restaurant if we are trying to figure out what to eat so I'd say that's our favorite in Champaign Urbana. I like my own cooking actually. Cooking was one thing my mom ensured I learned. I like cooking at home. maybe I'm strange haha!

How about sports?

I used to play in the Ultimate Frisbee Rec League. I don't have time anymore. You run out of time very quickly once you become a Professor but that was my favorite sport!

Eighteen years ago, the student chapter of the Association for Computing Machinery at the University of Illinois (ACM@UIUC) held its first computing conference. 150 students from across the midwest attended the event, which was supported by 14 corporations.

Since its beginning, the conference has continued to grow and branch out in its featured events. This year, the nineteenth Reflections|Projections was a three-day conference, hosting a job fair, startup fair, 25 corporate sponsors, and a cryptography programming competition by PuzzleBang.

Serving over 700 students this year alone, R|P is a large event that aims to provide opportunities and in case you missed it this year, here is a recap of some of its exciting events!

Engineering at Human Scale

Ian Chan
Twitter



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Ian Chan is a front-end engineer at Twitter who studied computer science at the University of Toronto. Since its inception Twitter has experienced rapid growth and a tremendous increase in its number of users. Currently there are about 140 million active users who tweet an average of 400 million tweets a day. As a result, there have been many unexpected challenges that have accompanied building a product capable of handling such large-scale use. In fact, Twitter's goal is to create a product that is "human-scale," as in capable of supporting every single individual on the planet. Ian talked about the importance of writing high-quality code that is both robust and versatile enough to handle many of the unanticipated issues that may arise.





Innovative Education Engineer --Geoffrey Herman

"Don't be afraid of failing, be afraid of succeeding at things that don't matter."

ECE 290 is one of the ECE core curriculum. Fall 2012, as the course director, Prof. Herman made a revolutionary change and named it the Intrinsic Motivation course conversion project. It is about creating choices for students that will enable them to study and solve engineering problems that are personally meaningful to them. Instead of standard midterms, students' grades now depend on three group projects designed by themselves!

I love it here. Initially I didn't like it. At first it was a bit disappointing coming from a big city to a smaller city but Champaign Urbana grows on you. One of the things I really like about it is that you get some of the things you'd normally get from a bigger city here like the Krannert Center or shows in Assembly Hall but without the traffic and the high crime rate associated with big cities. I've learned to really like it and I love the University and I think there's a lot of desire to improve and grow so it has been a good match in terms of my interests and what they would like to have happen here.

Why Electrical Engineering?

My initial majors were actually computer engineering and music because I like computers and music. I was a cello performance major and I have

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Can you tell us about your upbringing and where you grew up?

I was born in the Northern Suburbs of Chicago and lived my entire life there until I came to the University of Illinois. I did my undergraduate and Master's in Electrical Engineering here at the University of Illinois with a focus in signal processing, music, speech recognition, music synthesis and the likes. For my PhD, my focus shifted to education, research and engineering education in an attempt to learn how to better teach engineering and figure out the common problems students have both in learning and in transitioning from school to the work place.

How does it feel having stayed here for such a long time?

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played cello for twenty something years. Then, I began to realize I'm more interested in how we hear music and how we process it. Hence, I switched to signal processing. I took audio engineering classes like ECE 402 and 403 and went on to do automatic music transcription, where you hear a song and it writes out the notes to be played. For my Master's thesis, I worked specifically on transcribing music when multiple instruments are being played at the same time. I liked building things and I liked to play music so I put those two things together.

You consider yourself to be an education engineer. When and how did you find yourself in this field?

Good question! My mom said I grew up teaching. She said one of the ways I played with my siblings was that I'd try teaching them things. I'd try to teach my brother and sister fractions for example so I've always enjoyed teaching. I considered switching out of electrical engineering to physics education my junior or senior year of college but there were too many credit hours to do the change so I ended up sticking with electrical engineering. Then I started teaching; I taught ECE 110, ECE 385, ECE 290 and some other courses and found I enjoyed those. I also started realizing that lots of students are struggling with what's going on in the course. You could explain something to a student and 5 seconds later he or she would ask you the same question. I started realizing there are so many things we could be doing better. I ended up thinking back to my own education where there were things I knew were valuable but were extraordinarily difficult. As a student I never really got a strong sense of what Engineers do or what my job would look like when I got out to the work place. Seeing some of those problems as a student and then as a teacher coupled with how much

I enjoy teaching, out of the blue, I emailed Professor Michael Loui who is known as a very good teacher. I had a friend who had done research with him on education so I asked him if he had any similar projects. He replied saying he is looking for a Research Assistant for a project to research how students learn digital logic concepts, why it's difficult for students to learn them and I happened to have contacted him at the same time he got funding. So I started working on that for my dissertation and also worked on different projects. I worked with the Center for Teaching Excellence across campus, a couple of other student teaching organizations and things like that. So I kept learning how to teach better, still learning, still a lot to learn, still a lot to get better at and that's the brief story of how it happened.

What's the difference between when you were a student and now that you are teaching?

A lot more time as a student (laughs). As a student I wish I had more mentors probably because I started off with that double major. I didn't start off focusing on my engineering classes until my junior year when I dropped the second major. I didn't really have a strong sense of connectedness and community. For example, if I wanted to get a study group I had to go hunt people down or just try to find someone. So part of my intentions and goals as an instructor is that I want to really help supply that because there's a lot of students. When I look inside a course, I notice that the students don't know many other people. People aren't connecting with each other so there are a lot of people who are just off on their own. Trying to help those students is one thing which I've been looking at because now I've been here for so long I have a really large network and it's helpful to be able to go "oh I need help with this" "Oh I can go talk to this person and this person." So that's one thing which is really

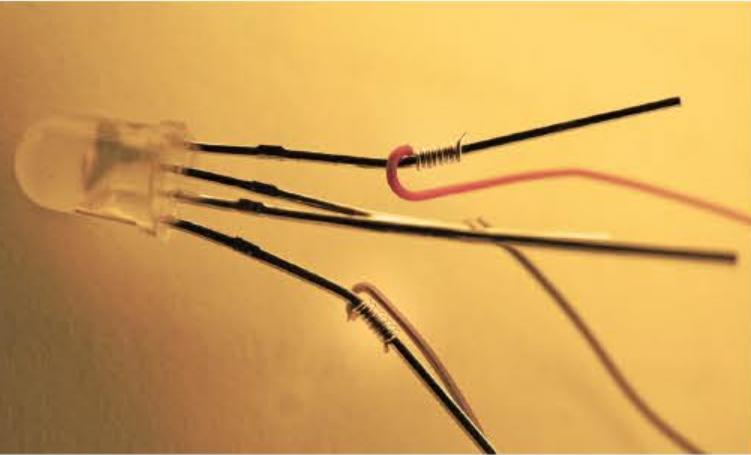
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Gurmehar Lugani



is a junior majoring in Computer Engineering. Most people know him by "Guru." He transferred from Manipal University, India just this year, and within his first semester at UIUC, he eagerly began work on an interesting SEED project: A Pressure Sensitive LED Array. This basically consists of a surface that responds to a change in pressure and physical force with color changing LEDs. Guru first got the idea for this project while looking through a catalog of sensors on SparkFun.com.

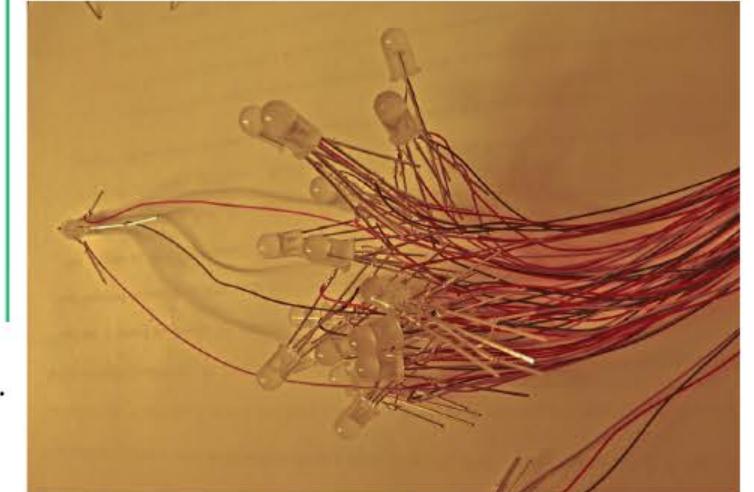
PRESSURE SENSITIVE LED ARRAY



Guru has had some past experience with such projects, since it is one of his hobbies. He enjoys coding and working with microcontrollers. In the past, he has made gizmos such as a programmable LED cube. So he started the project on his own. He worked on it during whatever free time he had. But then he started to run into a few difficulties such as soldering multiple LEDs and fabricating an acrylic box. Guru decided that he needed a bit of guidance to continue his project, so he turned to IEEE for help.

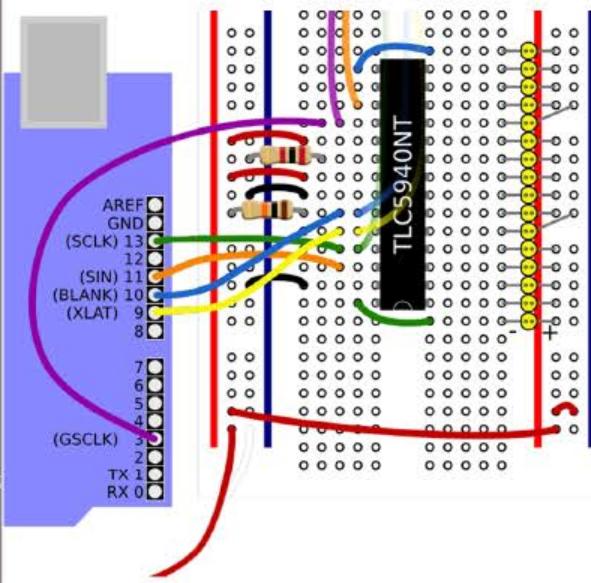
"I came across these nifty little sensors called "force sensors". I ordered a few just to play around with them. I decided I wanted to make something out of them. I discovered that by sandwiching these sensors between two layers of acrylic sheet, lighted with LEDs under them, I could make a surface which can react to pressure variations. After some thought, I decided to apply my idea to a coffee table. The classic, oversized displays with big LEDs just don't fit in with the atmosphere of a relaxing, stylish living room. A coffee table with a pressure sensitive surface solves the problem. It responds to any object placed on it by changing the color of that region. I used a microcontroller to control the LEDs. In addition, to make the appearance of the table more refined, I added a light-diffusing acrylic sheet above the LEDs to give it all a warm glow."

"I heard about the SEED program through IEEE, and it looked like a great opportunity to further my experience with hands on projects. I decided to apply for a grant. I wrote a proposal and presented my idea. IEEE was very helpful in guiding me through the problems I faced. They helped me with the use of labs and machine shop for fabricating various parts of my projects."



Once his project was approved, Guru ordered the parts he needed. Next, he started on the code for the LEDs, and once the parts arrived, he built a basic TLC chip and tried out some LED animations. Finally, after a bit more tinkering and another order of parts, he built the box that houses his pressure sensitive LED array.

"This project has helped me understand the hardware side of computer engineering. I learned how to use various tools like wire twisters and breadboard crimpers. I also learned how to extend I/O ports on a microcontroller and interfacing other ICs with it. I have learned a great deal from participating in the SEED project, and it is a great opportunity for anyone who wants to learn. For the future, I would like to build upon my project by increasing the number of LEDs and hence the pressure sensitive surface area. Also, I have plans to embed games like Snake on it."



Adjacent to the Beckman Institute and across from the Coordinated Science Laboratory on the northern edge of campus, the new ECE building will locate the department and all of its activities in the heart of the University's center for groundbreaking high-tech research.

With the new ECE building the University is determined to achieve LEED platinum certification, and is striving for a net-zero energy design that will enable the building to supply all of its own energy. From a vast array of photovoltaic cells, to a chilled beam system to cool and heat the classroom tower, ECE will accomplish a major campus addition with maximum space and minimal carbon footprint.

In addition, instructional labs will make up 28% of the new space, and classrooms and the auditorium making up an additional 18% of the space.



Department Head: Prof. Cangellaris signing the iron beam
Photo Credit: Thompson-McClellan

Though I'm still working on my project, I have learned a lot about the different steps that go into building, testing, and flying a working quadcopter. Learning how to do all of this requires researching information online and utilizing online communities, such as that of the ArduPilot or OpenPilot microcontroller platforms, as knowledge bases for figuring out various hardware and software issues. A lot of the knowledge about

quadcopters, I simply never knew before, so seeking it out has taken considerable time. There's details about batteries that are as important as motor specifications, as both need to be paired up in order for the quadcopter to even lift off the ground. There are online calculators dedicated to quadcopters where you can input details such as the type of motor, propeller size, etc. and it spits out whether your quadcopter is too heavy or too overpowered. Figuring out all of these problems to produce a working product in the end is, to me, a rewarding process.

Brady Salz



is a sophomore majoring in Electrical Engineering from Reading, MA. He is currently the Workshops Committee Co-director on the IEEE executive board. IEEE workshops work to expose students to new concepts and topics in engineering through hands-on and informative sessions spread throughout the academic year. Brady works to organize these skill-building workshops that everyone can learn from in topics ranging from analog electronics to Arduino.

“My first interaction with true Electrical Engineering outside of the classroom came from a little box with LEDs, a transistor, a 9V battery, and some headphones jacks. With that, an iPod, and a good deal of help from the Internet, I constructed, a neat little circuit with LEDs that bounced around to music. My wiring skills at this point were a joke, so I learned how to solder and made my circuit prettier.



I showed my feat of engineering to a good friend of mine, Matthew Dierker. He found the little guy absolutely fascinating; and I can't blame him! From there came the end all be all question that became the principal theme of our SEED project: if you can turn on one LED in time with the music, what's to stop you from controlling them all?”

That led to us, as well as our friend Alex Smith, to apply for a SEED project. We needed funding to purchase the massive amount of Christmas lights we planned to use to create a nice, happy display for the holidays. We had plenty of friends in IEEE, and it really seemed like the most approachable student organization. Next, all three of us wrote up and submitted a formal proposal for our idea, and heard back with good news rather quickly. Now it came time to design and test.



We tried a lot of things that didn't work out quite as well as expected. For example, we thought it would be fairly simple to reverse engineer the control unit on pre-bought lights. Turned out to be near impossible to just get the control screws out, let alone reverse engineer the PCB and microcontroller instructions. Some other problems arose from our attempts to do our own AC/DC power regulation and rectification; we blew an awful lot of fuses and capacitors that way. Luckily no one was harmed, and in retrospect that's pretty impressive.

Ultimately we used a microcontroller and a suite of solid-state relays to operate our lights to music. When we finally got everything to work, we were ieee.illinois.edu



more than overjoyed. We also received some serious help along the way. Many people all over the department pitched in to lend us a hand. The current IEEE President Joseph Shim, several members of the IEEE Power Electronics Society (PELS), and a few power professors were all more than willing to help. It was very encouraging to see everyone show a lot of enthusiasm for our project.

At last, it came time to present our project. We had a lot of friends come and help us set up in front of Everitt 151 for the Engineering Open House (EOH). It was pretty hectic putting it all together last minute. It took us one crazy all-nighter to get it done, but it was finished. It was an awesome exhibit that I feel a lot of people truly loved and enjoyed, which is the best feeling one can ask for. Unfortunately, our goal was to create a fantastic outside show, but it fell apart due to a lack of time. That may have been a letdown, but only temporarily. For the future, we're hoping to return to the Engineering Open House with a vengeance. We want to come back and utterly blow everyone away with more lights, more LEDs, more lasers, more everything! We've got a much larger team this year, and we're ready for Round Two, or as we like to call it: Bigger, Better, Brighter!

Oliver Cai



is a Junior in Electrical Engineering from Orange, Connecticut. He is the current Technical Vice President for IEEE, overseeing the technical activities of IEEE's competitions, workshops, and projects, giving students opportunities to expand their hands-on skills. Oliver seeks to expand his own hands-on skills by tackling an innovative and intricate SEED project:

Bill of materials

Part Description	Link	Quantity	Unit Price	Total Price	Additions
Spectrum DX7 2.4GHz Transmitter		1	\$160.00	\$160.00	
OrangeRx R710 7Ch Receiver	http://ww	1	\$20.98	\$20.98	
KDA A20-L motor accessory pack	http://ww	4	\$3.63	\$14.52	
HK-500GT Tail Boom	http://ww	8	\$2.20	\$17.60	4 extra
PolyMax 3.5mm Gold Connectors 10 PAIRS (20PC)	http://ww	2	\$1.59	\$3.18	
Turnigy Pure-Silicone Wire 16AWG (1mtr) BLACK	http://ww	10	\$1.29	\$12.90	
Turnigy Heat Shrink Tube 25mm Transparent (1mtr)	http://ww	1	\$0.75	\$0.75	
Rhino 2620mAh 3S 11.1v Low-Discharge Transmitter LiPo Pack	http://ww	1	\$14.95	\$14.95	
Nylon T-Connectors 10 Pairs (20pc)	http://ww	1	\$3.08	\$3.08	
ArduPilot Mega 2.0 Kit, Not Assembled	https://st	1	\$199.99	\$199.99	assemble
Quadcopter Power Distribution Board	http://sto	1	\$15.00	\$15.00	
Servo Extension Cable 15cm Female-Female	https://st	7	\$1.75	\$12.25	
Deans Ultra Plug Connector, FEMALE	http://sto	3	\$1.00	\$3.00	replace all battery connectors Deans connectors get the ESCs
Deans Ultra Plug Connector, MALE	https://st	4	\$1.00	\$4.00	
AGL Hobbies UAP1-Sport Quadcopter Frame DYS 30A ESC	http://wox	1	\$70.00	\$70.00	
Gemfan Carbon Reinforced 11x4.7 CW/CCW Pair	http://ww	4	\$17.50	\$70.00	
2x Alu Metal Tail Boom For Align T-rex 500	http://ww	2	\$5.50	\$11.00	alternative is OOS
		4	\$13.40		
Total				\$633.20	

I learned about SEED my freshman year, since I became involved with IEEE as its IT Director during my second semester. Since I was active with the student branch so early on, I got accustomed to what resources we had but never took full advantage of them. I used the IEEE lab for my ENG 198 course, where I made a remote controlled blimp for my final project and worked on a couple of IEEE-held workshops.

“ My current SEED project is a quadcopter that will eventually lead into an aerial photography platform. For those who have never heard of quadcopters before, they are basically a type of aircraft that’s controlled by four spinning propellers, usually each propeller placed at the end of an ‘X’ shaped frame. By mounting a camera on the quadcopter, you now have the ability to shoot not only useful but pretty awesome footage from the air. Since there’s a lot of work needed to be done in both the quadcopter design and the camera mount aspects, I decided to divide the project into two parts. The first priority is getting the quadcopter portion working, which has been challenging in itself. Once that is done, I will look into camera mount designs. ”

I also learned about a lot about past projects that have gone through our student branch, such as Andy Gong’s robot controller and now grad student Andres Guzman’s wireless glove controlled mountainboard. However, the idea of starting a SEED project of my own didn’t hit me until the summer after sophomore year when I really wanted to work on something challenging and rewarding.

Since I am still involved with the executive board as Technical Vice President, I should mention that we are always encouraging people who want to turn their ideas into reality to submit them to us as a SEED proposal (which is done through our Wiki). All of the proposals get reviewed through our Technical Director of Projects, Matt Robillard, to make sure that what you’re working on is relatively original and feasible. I also work closely with our IT Director, Daeyun Shin, to bring to our website our Wiki, which is designed to be a central technical resource for all project and workshop related knowledge.

There are very few places where students can get funded for a project they want to do outside of school, and working on such projects gives you the chance to use those skills you can’t get within class (except in courses like senior design or ECE 395). Since I have yet to take either of these courses, SEED is the perfect opportunity for me to work on a hands-on project.

Why did you choose to build a quadcopter?

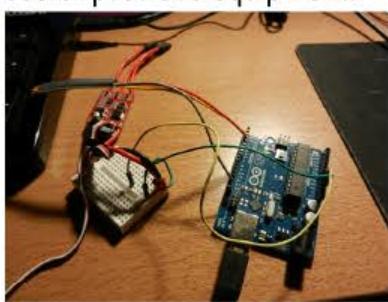
I chose to build a quadcopter since I have been building and flying model airplanes as a hobby for quite some time, so naturally I have a fascination for flying things. This project combines my interest with ECE as well, since there’s a pretty extensive amount of hardware and software required to make a quadcopter actually fly. So why a quadcopter and not something like an airplane? The reason why quadcopters are becoming increasingly popular is due to the simplistic nature of the design. The frame is incredibly easy to construct, making it robust enough to stand crashes and allows for repairability. Breaking something like a wing or a fuselage on an airplane takes time to fix whereas fixing a quadcopter frame is a matter of replacing an arm or other component. The only moving components are the four motors, so mechanically it is also very simple.

Quadcopters are also easier to control than normal RC planes. Since quadcopters are programmed to self-stabilize, there’s no need to worry about it constantly moving forward. The small size allows greater maneuverability both indoors and outdoors, allowing a bunch of different applications.

Interestingly, this isn’t our student branch’s first quadcopter. Last year, our president, Joseph Shim, started a quadcopter after the Jerry Sanders Design Competition revised its rules to allow flying robots.

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I witnessed a lot of his progress in getting the quadcopter to hovering state, but some last minute equipment failures caused the frame to be scrapped. In building an improved quadcopter, I will be reusing the motors and propellers from the previous project, which will make good use of previous equipment.



Did you run into any difficulties?

Probably one of the most common things people overlook when working with anything hobby related is safety. Safety should always remain your number one priority. For example, when testing any of the quadcopter functionality indoors, always, and always, make sure the propellers are detached from the motor shaft. On one occasion, I forgot to unscrew the propellers when hooking up some of the electronics while the battery was connected. This was inside of my apartment, and suddenly every propeller spins at full speed. At this point, the quadcopter is literally a flying lawn mower ready to slice anything in its path. What happened occurred so fast that there was no reaction time for me to do anything. Within a second, the quadcopter hit the floor, shattering the propeller and sending shards of plastic flying everywhere. Fortunately, I was holding the RC transmitter in my hand, which deflected the propeller slices. One such incident is more than enough to teach me the proper procedure of testing a quadcopter indoors. While there were a few other issues I ran into while working on the project, having the motors live with the propellers was probably the most memorable.

THE COMPETITION

The Formula Hybrid International Competition is a multi-disciplinary design challenge that invites undergraduate and graduate students to design and build an open wheel hybrid or electric race car.



The competition consists of three days of dynamic and static events. The dynamic events include acceleration, autocross, and endurance tests and the static events involve inspections, presentations, and engineering design. The objective is to encourage innovation in efficiency and performance of vehicle power trains by infusing hybrid technology into the realm of high performance racing.

The Formula Hybrid International Competition is held once a year in early May at the New Hampshire Motor Speedway. This competition is organized by Dartmouth and is sponsored by SAE International, IEEE, Ford, GM, Toyota, Chrysler, ANSYS, and SolidWorks among others. It continues to gain popularity with both added participants and sponsors each season.

While challenging students to apply cutting edge technology to performance racing, Formula Hybrid readies the next generation of engineers for a sustainable world.



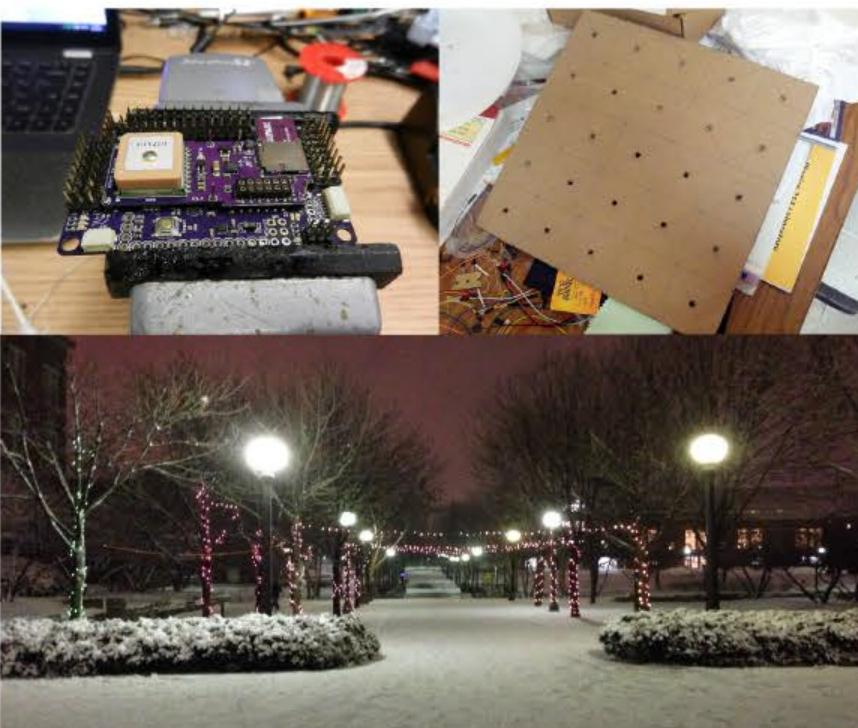
seed

"SEED projects are really great," says Matt Robillard, the SEED Director at the IEEE branch at UIUC, "It puts undergraduates on the path to success by giving them structure and support on their projects." He goes on to explain how students often take initiatives, but don't finish what they start. The goal of SEED is for the student to learn, but at the same time, setup of the program ensures completion through its design and requirements. Once a SEED project is completed, it is showcased at future IEEE events and meetings.

SEED is a worthwhile learning experience that allows students to take time to explore their interests outside of coursework. It improves the student's understanding of electronics and technology, and furthermore it allows the student to form valuable connections with teachers and graduate level researchers. It is an excellent opportunity for anybody who is curious, motivated, and eager to learn.

SEED is an IEEE sponsored organization that helps give students the resources to undertake their own small-scale engineering projects. For a project to be considered, students must submit a technical proposal that consists of the project design, specifications, and goals. If approved, the IEEE branch at UIUC will not only fund the student's project but also connect him with the graduate students and faculty who will serve as mentors.

As an additional requirement for the duration of the project, students must post updates of their progress on the SEED's Wiki page. These posts are an excellent way for the student to give back to the community because they truly expand the online knowledge base. Students around the world will be able to take advantage of what UIUC students learned through their SEED projects, and apply it to their ideas.





COMPUTERIZED SYSTEMS

- Control Systems
- Data Acquisition
- Power Management
- 3-D Modeling
- Simulations
- Website Design and Management



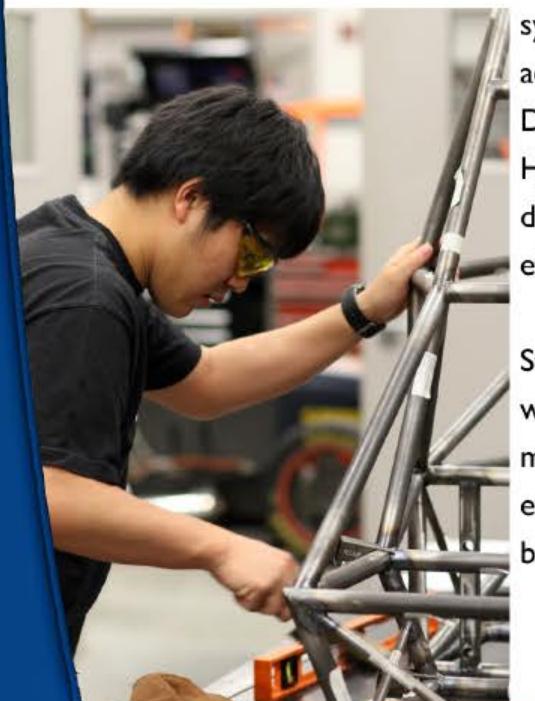
MANUFACTURING

- CAM
- CNC Milling
- Water Jetting
- Lathing
- Welding



HUMAN FACTORS

- Ergonomics
- Workplace safety
- Teamwork
- Public speaking
- Leadership
- Conflict Resolution



Students of different subsystems work together on certain projects making for a truly interdisciplinary experience. Good examples would be motor control and batteries.



The large scope of the project requires an experienced and diverse team of students that can meet real world challenges.

The team is composed of undergraduate and graduate students from a wide range of engineering and non-engineering disciplines.

Illini Formula Electric team members have included mechanical, electrical, computer, industrial, civil, general, nuclear, biochemistry and aerospace engineering students. Non-engineering members have included chemistry, physics, art & design, advertising, and business. Most students participate as a purely extra-curricular activity. In addition, students have the opportunity to gain college credit for participation.

THE ECE SCOPE

The team requires intensive work in the ECE scope due to high requirements for the electrical system by the competition rules. ECE students from freshmen to graduate students take different levels of tasks. Since the team started, the team has embedded many brilliant ideas in ECE

system design. The most significant achievement was the General Motor Design Award in the 2011 Formula Hybrid Competition for the excellent design in terms of safety and efficiency of battery packs.

For batteries, students need to pick out the right type of batteries to maximize the performance of the vehicle and satisfy competition rules. At the same time, the power electronics team needs to know the right current and voltage that can be pulled out of the battery for motor performance. The control and instrumentation team should work with the battery team on the battery management system, which is required by rule that each cell's temperature, voltage, and current should be monitored for safety issues. The high voltage team should design safety circuits such as contactors and ground fault detectors for batteries.

THE STUDENTS

Currently the team divides the electrical subsystems as follows:

Power Electronics – rectifiers, DC-DC converters, DC-AC motor drives
Electric Machinery – motors including primary induction motor and PM generator

Accumulators (Batteries) – power storage systems and power management

Control Systems – software development and driver-computer optimization

Instrumentation – monitor pressure, temperature, velocity, torque, etc and driver panel

High Voltage – high voltage fault detection, high voltage safety and compliance.



To implement correct motor control, the power electronics and electrical machinery teams need to test motor characteristics, setup simulation, and learn how to use the motor controller provided by the sponsor; the control system team needs to implement the right control algorithm on the micro controller and learn to work with the standard vehicle control system -- CAN (control area network).



MECHANICAL SYSTEMS

- Suspension
- Steering
- Braking
- Chassis
- Body and Aero
- Drivetrain



ELECTRICAL SYSTEMS

- Power Electronics
- Electric Machinery
- Accumulators
- Controls
- Instrumentation
- High Voltage



TEAM MANAGEMENT

- Project Management
- Team Organization and Communication
- Data management
- Marketing
- Fundraising
- Fiscal Responsibility

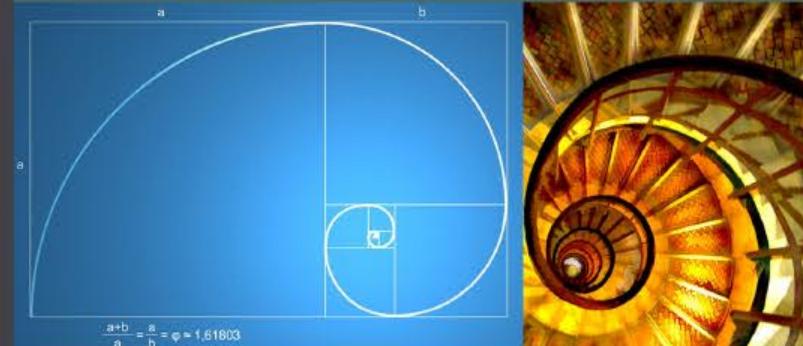
Cover: Golden Spiral

income wherever they can. Having a cheap and reliable source of water also would allow for increased economic development within the village itself. Many commercial operations such as pig farms, palm oil processing, and Laundromats can be built. In fact, a tanker stand for selling water to tanker trucks has already been built in order to help generate revenue for the WPMC. These commercial operations could significantly improve the economic status and lives of many people in the village. The system would also benefit the partners as well. Not only would they help a few thousand people get access to clean drinking water, but they would also gain technical knowledge from EWB-UIUC and get a chance to design additions and make improvements to the system themselves. This would significantly improve their education and understanding of engineering systems and management. If the model works, the partners could use a similar approach to establish similar systems in other regions in Nigeria.

The next few months are critical in determining whether the system will work as it is currently structured. However, the EWB-UIUC Nigeria Water Project team is the most hopeful it has ever been over its long 7-year history that the people in Adu Achi will soon have a clean and reliable source of water and will continue to have it for many years to come.



In geometry, a golden spiral is a logarithmic spiral whose growth factor is φ , the golden ratio. That is, a golden spiral gets wider (or further from its origin) by a factor of φ for every quarter turn it makes.



Approximate logarithmic spirals can occur in nature. In truth, spiral galaxies and nautilus shells (and many mollusk shells) exhibit logarithmic spiral growth, but at a variety of angles usually distinctly different from that of the golden spiral. This pattern allows the organism to grow without changing shape. Approximate logarithmic spirals are common features in nature; golden spirals are one special case of these.



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SOCIETY SPOTLIGHT

ILLINI FORMULA ELECTRIC

The Illini Formula Electric Team at the University of Illinois at Urbana-Champaign strives to provide a multidisciplinary environment for students to cooperatively develop innovative formula hybrid racing solutions.

Illini Formula Electric is a student managed and operated collaborative project. Students are responsible for everything from recruitment and fundraising to component design and manufacturing. University of Illinois faculty and staff restrict themselves to teaching engineering theory and providing general guidance.

Students conceptualize, design, simulate, manufacture, integrate, and test with minimal faculty guidance. The hands-off approach promotes leadership skills including project planning, time management, communication, and personal responsibility, amongst others.

Illini Formula Electric was founded as Illini Formula Hybrid by students in 2009 and has since grown to approximately 100 members annually with about fifteen percent attaining either independent study or senior design credit by demonstrating exceptional leadership and completing special projects.

Students get access to use various facilities in College of Engineering for the projects. Since the team started, students have been using the 5-axis CNC mill in Mechanical Engineering Lab for making mold for the nosecone, power electronics lab in Everitt Lab for motor Dyno test, Composite Material Lab in Talbot for making carbon fiber body panels, and the Engineering Student Project Lab for integration and testing.

FOLLOW UP:

installation costs and the lack of attention towards providing clean water. Therefore a different management structure is required in order to ensure the system doesn't fall apart. With EWB projects, a volunteer management committee made up of people from the village is often created to control all aspects of a system including money collection, paying employees, implementation, and repair. Expecting a few volunteers to manage a system effectively, however, can be a very difficult task, even for developed countries like the United States.



In order to prepare the Adu Ach Water Project Management Committee (WPMC) as much as possible, the WPMC was formed early on during the project and was involved in many aspects of system design and implementation. After the majority of the implementation was completed, several different documents were created. These include a Constitution outlining the responsibilities and structure of the WPMC, a Standard Operating Procedure for the WPMC, and manuals for the system's two employees, the operator and the clerk. The operator is responsible for system inspection, maintenance, and repair, and the clerk is responsible for money collection. Both employees were trained by

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EWB-UIUC during the most recent trip in December 2011.

Since the WPMC will be responsible for ensuring the system is financially sustainable and adequate water quality is maintained in the long term, it needs to follow a rigid structure.



However, the structure of the water committee as it is defined in the Constitution and Standard Operating Procedure is not like what many members of the WPMC are used to, and it requires a large amount of work from all of them. Therefore EWB-UIUC pursued partnerships with volunteers in Nigeria, who could more easily assist the water committee and address problems. Over the past several months, two partnerships have been established. One is with a chapter of EWB-Nigeria (located in Nigeria and made up of Nigerian students) and the other is with

professors and students from universities nearby the village. These partners would be able to travel to the village on a regular basis and help ensure the system continues to function as well as help educate the community about preventing secondary contamination, a common problem in systems with public tap-stands.

No matter how much effort EWB-UIUC puts into ensuring the system is sustainable, the system will only run if the members of the WPMC are willing to put forth the effort to provide water for their village and can be trusted with managing a large system without taking advantage of it. They need to feel responsible for keeping the system running. Over recent weeks many repairs have been made and system start-up has begun. During this time it has become clear that some members of the WPMC care greatly about making the system work and the EWB-UIUC project team has been able to trust the

members completely, indicating that volunteer run systems may be able to work well, even in countries like Nigeria that are often labeled as "corrupt".

Over the coming months, system start-up will begin and the operation will be improved with the assistance of the two established partnerships. If the model for sustainability is run as it is envisioned, there would be numerous benefits, some of which were not considered when the project was first started in 2005. First, there would be clean water provided to the entire village of Adu Achi, which would improve health and give many people, especially women and children, more time to spend on education and pursuing better economic and social opportunities. The hours people now spend getting water has prevented many people in the village from putting forth a significant effort towards improving their lives. They have to live day-to-day getting water and earning a small



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Many of us take access to clean and reliable water for granted. We drink it whenever and wherever we want to and have reliable plumbing for showering, flushing the toilet, washing dishes, and even for watering our gardens and lawn. We do this with little concern about the cost of water or its purity. The quality is actively regulated and monitored and the water is efficiently distributed throughout large distribution systems for prices that are relatively insignificant.

Engineers Without Borders: A Sustainable Source of Water for Adu Achi, Nigeria

However, this is not the case for nearly one billion people throughout the world. In many cases there is no government-run distribution system for providing water, so people look for it wherever they can. If money is available the government or a community may build a small well and install hand or electric pumps for people to collect groundwater from public taps, but in many cases even this is not available. In such cases, many people resort to whatever water they can find including nearby surface water and rainwater, which is often not kept clean and results in potentially fatal waterborne illnesses. Others spend several times what many of us would spend on water to transport it several miles using expensive diesel-guzzling tanker trucks. In Nigeria, the most populous country in Africa and 7th most populous country in the world, approximately half of the people lack access to clean water. Rural communities, such as the village of Adu Achi located in the Southeastern part



of the country, are often affected the most. In this region, many of the villages had running distribution systems several decades ago, but they were destroyed during the Nigerian Civil War in the late 1960s. In Adu Achi, people have relied on rainwater and a contaminated stream 3 km away ever since.

Women and children often spend several hours per day getting water from the stream, which can have severe educational, economic, and social impacts in addition to poor health. In 2004, Engineers Without Borders (EWB) USA was approached by the founder of Canadian Samaritans for Africa, Stan Chu Ilo, who asked for help with providing clean water to the village of Adu Achi, where he was raised. The proposal was accepted and EWB at the University of Illinois was challenged with the opportunity to help the village. Since that time, the team has traveled to Adu Achi 5 times. Initial site assessment indicated that the nearby



concentrations of fecal coliform and E. coli, likely contributing to the high prevalence of Typhoid Fever, a waterborne disease. The rainwater collection systems were not much better. Water was often collected in dirty rooftops and stored in large tanks with stagnant water. Clean rainwater collection systems, although available, were prohibitively expensive. However, the deep aquifer below the village was clean and reliable based on other boreholes in the area, so the EWB-UIUC team chose to build a deep well with a gravity-fed water distribution system.



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There were three implementation trips between 2007 and 2009 during which the majority of the system was built. A 500 foot deep borehole, submersible electric pump, two 23,000 gallon tanks, and approximately 1 of the 3 miles of pipeline designed were installed for providing water to the village's 2500 residents. Along the pipeline several water access points including public tap stands and private house connections were built. A diesel generator was also installed for powering the pump due to the unreliable source of energy from the electric grid in the village.



The biggest challenge for the project, however, has been sustainability. There are countless resources available at the University and elsewhere that provide details about proper design of distribution systems, but almost none provide information about how to sustain projects in developing countries, especially in specific ethnic regions. We rely on paid employees and government regulation of our water systems in the United States, but the Nigerian government has been unable to provide a distribution system for the village of Adu Achi since the last one was destroyed, likely due to the lack of funds for the large

He states that in order to have good communication skills, one must communicate professionally, and this goes a long way toward being able to build up your own personal network. More companies are becoming aware of the need for their employees to have this established network, adapting the policy of “it’s about what you know and who you know.”

Lahdiri and the committee offer an IEEE professional network database, where members are provided resources for programs, lectures, and other professional development opportunities as well as a means of communication for members to talk about their professional

Ethics Competition

For those unfamiliar to an ethics competition, participants are presented with an ethical dilemma and have to prepare an argument around that scenario. Points are awarded for depth of argument, addressing all relative questions, and having the position most well-aligned with predefined codes of ethics.



representing its respective school: Bradley, Northwestern, Saint Ambrose, Saint Cloud, Valparaiso, University of Illinois, and University of Wisconsin-Stout.

After hours of deliberation, the teams presented to a panel of hand picked judges, including two professors of engineering and one professor of psychology.

Valparaiso came out on top, with

The prompt for the conference was specific to engineering: A new hire at a company chooses to use parts for an electric appliance she is working on based solely on advice from a senior mechanical engineer. The result is a fire costing thousands of dollars of damage to a consumer's home. By mid afternoon, the case studies were underway, with each team



picture, swipe back and forth through slides of a presentation, and much more while integrating an interface that is intuitive, reliable, professional, and inviting. The enthusiastic attitudes of the engineers spoke volumes of the rewards of a startup, and the apparent successes of their labors made for a perfect finale to the conference.



After the networking dinner, a startup company based in Champaign called Nuvixa (now Personify) presented their innovative new software dedicated to video communications. Sumant Kowshik and Dennis Lin, two principal engineers at the company, gave a first-hand demo of their interactive software, targeted at changing the face of online interaction. Through the use of hand motions and arm gestures, Nuvixa users appear on screen in front of their content, allowing them to create a more personal experience with the audience on the other end. Users can move on-screen content, flip through layers of a

The IEEE Conferences committee led by Ahmed Suhyl (second from the right) planned and hosted the R4LC. Paw-some work team!



Sweet. What is most sweet is when the students come back to you? This is why I'm doing this.

Is ECE still your favorite?

ECESAC sent me invite for an ice cream social and I stopped by. I knew everyone who was there. I felt like I was at home because it was very sweet and nice. They know me and I know them. It was nice. And of course they made me get some ice cream.

How did you decide you wanted to go into engineering?

I was always very curious and I'm very methodical. I would break things into pieces and see how it worked. I was the "guy" at

home, always repairing things and I would drive my father nuts asking questions on how you do things. My first semester I took a programming class and I really liked it. This got me hooked.

What advice would you give to engineering students?

Don't do it because people are telling you to do it; do it because you love it. There's always classes that aren't your cup of tea but if you keep the big picture in mind then things are easier. I always knew I wanted to be involved with students one way or another and going all the way to my PhD, there were some hard

lonely times where you write something and it isn't right but you just have to try your best. In France, they tend to think engineering is a guys' world. Being a woman in engineering is not very accepted especially to the older generation. Some professors didn't understand why a woman would want to do that. I think that once you find something you really like then you just have to give your best and go for it. Music, art, teaching. Follow what makes sense for you. I wouldn't encourage everyone to be an engineer because it's not for everyone. Not everything is going to be easy; you really have to go for it.



Every year, one IEEE student branch per US Region is chosen to host the Student Leadership Conference, and this year, IEEE-UIUC rose to the occasion. Schools from all around the central US gathered at the University of Illinois for a full day of keynote speakers, networking, leadership training, an ethics competition, and a banquet. The conference is a way to recognize the many student minds behind IEEE and showcase the variety of unique efforts contributed by each branch that makes up Region 4.

REGION 4 IEEE

STUDENT LEADERSHIP CONFERENCE

To kick off the conference, Lisa Bagwell, a Specification Engineering Manager at General Electric, spoke about the crucial role engineers play at GE. She went over a number of different technologies that were developed by GE and the global impact they serve to create. She emphasized the importance of Specification Engineers in the organization of the company as a whole and went over their specific roles and responsibilities. Working off GE's motto, "Imagination at Work," she explained what it means to be a part of the engineering community, and the importance of innovation in engineering.

Leadership training overview





Transition from Department to College, Prof. to Dean

-Brunet's Story

Marie-Christine Brunet is the Assistant Dean for Undergraduate Programs at the University of Illinois, but before becoming a dean, she was a professor and the Chief Undergraduate Advisor for ECE. She has received numerous awards including the 2012 College of Engineering Rose Award for Teaching Excellence and talks to us about her transition into her new position.

What are some of your new responsibilities as a dean?

I have the same responsibilities as with the department but it is different at the same time. The advising part is the same. One difference is that I am advising all undergrads from the college of engineering which brings challenges with their curriculum. I also do prospective engineering student meetings. We have an "Ask a Dean" Q&A with prospective students and their parents, and I am in charge of the Thursday evening Q&A. I still do teaching but I no longer teach ECE 110. I teach ENG 101. The class introduces all of the different majors and covers double majors and curriculums in the engineering program at U of I. We have invited speakers and I do two of the lectures and a few

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others throughout the semester. The big change is that I am handling all of the college of engineering scholarships and it's a big responsibility. I work with applications and trying to find a match for the scholarships.

Why have you chosen this path from professor to dean? Have you always intended on being a dean?

No, I never thought about being a dean. When I started here, especially on the advising part, I met deans and was like, "Whoa what a big responsibility they have." This was never something I had planned from the beginning. I grabbed the opportunity to challenge myself. There was something new, the scholarships, and something familiar, the advising.

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I have some great figures to look up to that I have met through the years that we see from time to time. They were good models for advising: tough when they needed to be but fair and compassionate. It's interesting to think I'd be there. There are different problems here than at ECE. One of the things this position allows me to do is to connect with other people in engineering. I am able to network with different deans of all different colleges, and not just stay within ECE.

What kind of services do you offer students now?

We have advising, where you just stop by if you have questions. In the summer I will do summer advising with all the freshmen, not just ECE students. The services are very comparable to ECE except we are the ones deciding whether to give overload or underload or drop required class.

You have been recognized for going above and beyond to help women in engineering. What are some of the things you do



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and why do you do it?

I have had the women's ECE 110 study group since 2005. Attendance has varied but I continued to do this because these students told me how much they appreciated it. I continue to get involved with any women organizations because women are the minority. I like to help women because I'm a woman and it makes sense to help women. I also help with GAMES' [Girls Adventures in Mathematics, Engineering, and Science] ECE summer camp for women, and GLEE [Girls Learning Electrical Engineering]. Every opportunity I have, people can ask me and I will try to do it. For example, just recently, WECE invited me to talk at their general meeting.

How did you feel when you received the Rose Award for Teaching Excellence?

Ohhhh. It was the cherry on the cake. This was because my best satisfaction has always been about individuals. I said, did, and taught something that made sense either in the advising part or the teaching part. It's always about the one thing you do for that person and when that person comes back to you and says this made a difference in my life makes it all worthwhile. Official recognition

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Hi! I'm Sparky the Welsh Corgi, the loyal companion of IEEE-UIUC. Let's em-bark on a journey through exciting engineering events, on campus and beyond!



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University of Illinois at Urbana-Champaign

Spring 2013

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**EWB brings WATER
to Nigeria**

**HYBRID CARS
QUADCOPTERS
AND MORE!**

Student
Seed
Projects

INTERVIEW
Dean Brunet
Prof. Herman

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