Spring 2016 Volume 18

MONKEY BUSINESS

News of the Lynbrook High School Robotics "Funky Monkeys," FIRST® Team 846

Editor-in-Chief
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Contributing Authors
A.Iyer, A.Ng, A.Zhang, J.Jiao, J.Peng, N.Chen, R.Iyer, S.Majumdar

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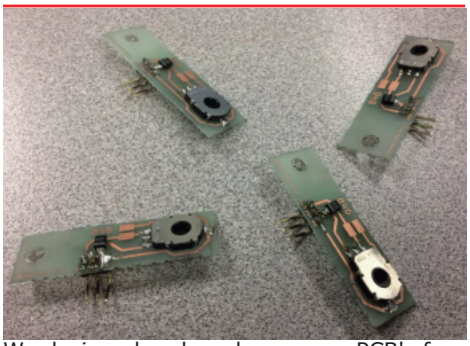
Summer Worksessions (in Room 612)
PTA International Robotics Workshop
Chezy Champs..... Sept 24-25, 2016
CalGames.....Oct 7-8, 2016

DIY Printed Circuit Boards

Learn how we made our own printed circuit boards, and how you can too!

Nathan Chen (*junior*)



We designed and made our own PCB's for our robot's sensors and custom LED lighting.

see **DIY PRINTED CIRCUIT BOARDS**, *Page 3*

The Safety Animation Award

The process of making our award-winning safety animation.

Rahul Iyer (*senior*)

This year, the Funky Monkeys won the UL Safety Animation award for our video "Workin' Safety w/ yo Robot." The video stood out amongst the other entries as the animation was tightly bound to original music and rap lyrics from the team's students. In the past, like most FRC teams, we have created safety animations that include an animated story narrated by a single speaker throughout. Considering this format of a narrated animation to be trite, we decided this year to turn our safety animation into a safety rap. Like previous years, the story, "working safely in the pits" would be conveyed visually through the animation,

see **THE SAFETY ANIMATION AWARD**, *Page 2*

In this year's FIRST robotics game called Stronghold, teams must design their robots to cross multiple obstacles and then score foam boulders into their opponent's towers.

FIRST Community: Sharing Ideas

Just how open are teams to sharing their design ideas?

Andrew Ng (*freshman*), James Jiao (*freshman*), Jing-Chen Peng(*sophomore*)

This year is the team's 15th year competing in FIRST Robotics Competition (FRC), and as a team, we have gained a lot of experience in building a robot. However, we are still amazed every time we attend a regional competition, staring in awe at all the robots from all the top tier teams. While simply seeing the elegance of these top robots is certainly entertaining in its own right, we decided to use the unique setting of the competition to learn from these robots' designs and improve our knowledge bank for future seasons.

A core part of the FIRST community environment is the ability of each team to learn from their peers. We quickly discovered this as we went around between different teams and talked to them about their robot design. Although FIRST Robotics is extremely competitive, all the teams we talked to were surprisingly open about how they approached design and how they tackled problems. People were more than happy to explain the most innovative aspects of their robot.

While talking to teams, we learned

see FIRST **COMMUNITY: SHARING IDEAS**, *Page 2*

Our 2016 Build Season

The challenges other than just completing the robot.

Arthur Zhang (*sophomore*)

The robotics build season has helped me learn more than just engineering. Throughout the build season, I learned to manage my time, make new friends, and also maintain my composure under pressure.

Since I joined robotics, I had to manage the time I took to do homework. During the first week of build season, we were playing around with ideas and concepts. The hours were short and there were plenty of people. However, after the first two weeks things started getting more hectic. To meet deadlines we had to start finishing more subsystem designs at home and extend work session hours. As

see **OUR 2016 BUILD SEASON**, *Page 2*

FIRST Community: Sharing Ideas Continued...

about how many teams used different approaches to tackle the same problems that we experienced. For example, while we relied on a sturdy mechanism and a torque limiter to protect our robot collector arm from damage, Team 192, (from Gunn High School), used PVC arms that broke easily but were easy to replace. In contrast, other teams used thick, metal structures to prevent their robot's arms from breaking. If it weren't for the cooperative spirit of the FIRST community, teams would not be able to learn and improve year to year as well as we do now.

Not only did we gain a tremendous amount of technical advice from other teams, we also contributed to this community of sharing. Teams stopped by and inquired about our design, asking questions about the highlights of our robot, such as counterbalancing. This year, we counterbalanced our robot shooter arm and collector mechanisms, allowing them to be held up with no force from the motors at all. Many teams were extremely impressed and were able to learn a lot from our team.

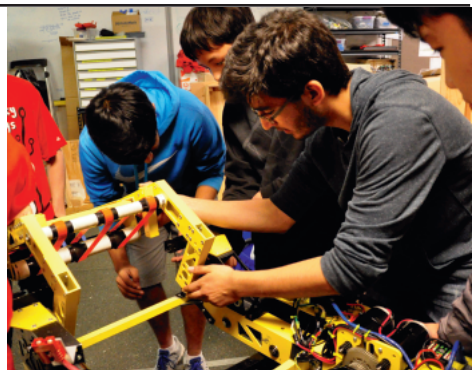
As a team, we have acquired an enormous amount of ideas and techniques with the generous help of all the other FRC teams, and we too contribute to their experience. It is this process of sharing ideas that allows FIRST teams to quickly learn from their peers and improve themselves. Most people only see the intense matches occurring at the center stage, with the audience cheering and robots battling. What people don't see is the FIRST spirit of cooperation down at the pits, with teams helping each other out, lending parts, and sharing ideas. As Founder of FIRST Dean Kamen says, "FIRST is more than robots."

Our 2016 Build Season Continued...

a sophomore with some extra time on my hands, I thought that I could spend a couple extra hours at robotics with time to spare. I was proven wrong when I had to cram all of my study time after getting home at ten at night with only energy drinks to keep me awake. Gradually, I worked out a healthier schedule for balancing my homework with robotics. I spent free time like lunch finishing homework so that I had less homework to do later. In addition, I stopped multitasking and focused on only doing one thing at a time. Sleeping at 2 AM became sleeping at 1 AM, and I began to have more energy for the rest of the day. An essential part of my efficiency was staying on task. By forcing myself into this position, I could not preoccupy myself with distractions.

With the schedule worked out, I had another issue: changing my friend group to fit my interests. Admittedly, I did not balance this part of high school life well. On a good week, I was able to spend one or two hours with friends outside of robotics. Unfortunately, I instead spent my free time prepping for the next round of tests or the flurry of homework assignments. On the bright side, I became friends with many robotics members. Unlike most new acquaintances, we shared a common interest in robotics and always had something to talk about. Everyone spent their free time joking around and getting to know each other better. Even though everyone at robotics had their own friends, everyone's interests' melted together.

Near the end of build season, I learned how to operate more effectively under pressure. Since we started machining our robot late into the season, we had very little margin for error. If something was designed or machined incorrectly, it set back the whole robot. Because of this, I began working more diligently and made sure everything was done right the first time. I double checked each design I made for all of the possible flaws and also thought of more efficient ways to design parts. By improving my methods, I not only increased my productivity in robotics, but also in academics as well. During tests, I wrote out my work concisely so that it was easier to check for errors. This new skill helped me improve my grades despite having less time to study for exams.



Students work hard to finish the robot during the final hours of build season.

The robotics build season taught me how to focus my time, become more sociable, and also become more efficient under stress. Even if I forget the specific details of the robotics season, the build season experience is something that I will not forget.

The Safety Animation Award Continued...

but the narration would be replaced by a rap that told the same story.

Planning and executing the safety rap required our animation group to coordinate with the students working on the music for the rap. The animation team, led by junior Brian Lo, had to wait for the rap's lyrics and story to be finalized so that the students would know what animations to create for which scenes. In this time, Brian took the initiative to teach several underclassmen how to use the animation software, Autodesk Maya. Meanwhile, another team of students, led by Amrita Iyer, wrote the lyrics for the rap. The team of four students browsed numerous rap songs from various artists to get different ideas for the speed and the flow of the rap while Amrita completed the task of fitting the ideas of pit safety to rhyming verse.

Along with the UL Safety Animation Award, our animation was played at every single *FIRST* event this year.

With rap lyrics formed and matched to the beat of a popular work, the team decided to create a unique beat for the rap. I took charge of composing the instrumental track that would serve as the background music for Amrita's track. Using GarageBand, a Mac tool for piecing together instrumental and vocal tracks to form complete soundtracks, I found different drum sets and synthesized percussion instruments to form the beat of the rap, and used a string bass for the underlying "theme" of the piece. Over the course of several weeks, "Workin' Safety w/ yo' Robot" came together beautifully, demonstrating Team 846 students' ability to put together different talents to create a product that impressed members from the FIRST community all over. We hope this year's safety rap serves as an inspiration to transform the annual safety animation contest into an exciting and creative way of spreading awareness about both safety and the fun of being in FIRST Robotics!

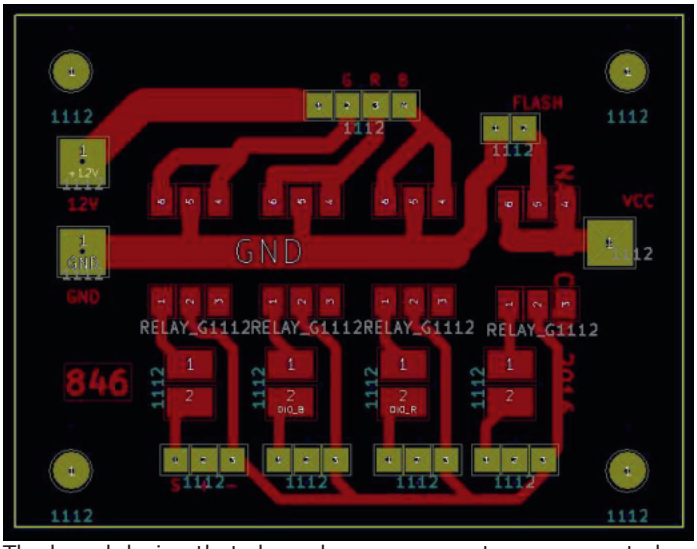
DIY Printed Circuit Boards

All these wires sure do get complicated; wouldn't it be great if we could turn this rat's nest into a clean circuit somehow? Enter the printed circuit board! Now, instead of having wires stick out all over the place, we can "print" copper lines on a flat board to connect our circuit components.

This year, the Funky Monkeys implemented printed circuit boards (PCBs) on our robot, in order to implement a potentiometer sensor for the shooter arm, LEDs for robot signals, and flashlights for aiming the shooter. However, instead of making our boards by sending our designs to a professional manufacturer, we made PCBs ourselves, in-house! The result was a fun, educational DIY experience that you can follow below.

Step 1: Design

It's always a good idea to plan out a project, so our PCBs were designed with KiCAD, a computer program that designs circuit schematics and circuit board layouts.



The board design that shows how components are connected and laid out.

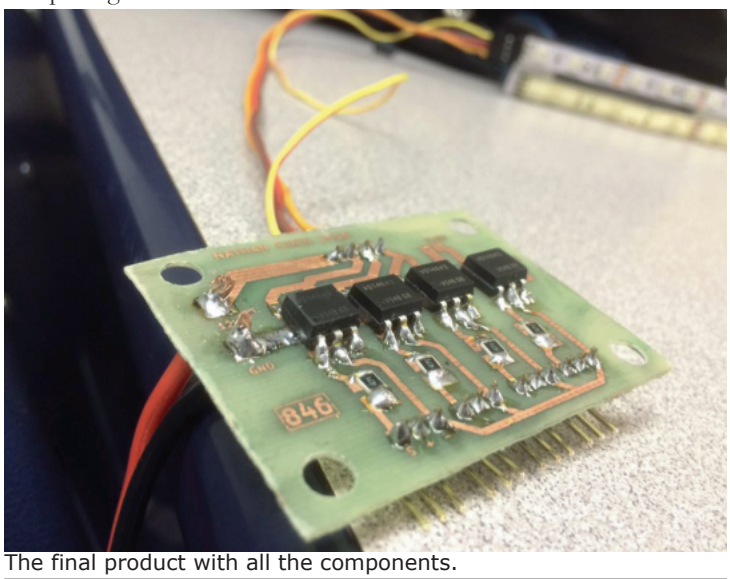
Step 2: Printing and Etching

It actually turns out that we can "draw" the board we want on KiCAD, and then directly print out how we want it to look! All it took was an everyday Laserjet printer to print the layout onto special transfer paper that could transfer ink onto copper. After the copper traces were marked by the transfer paper, we sealed them in with a green laminating foil. Then, we used ferric chloride to dissolve the rest of the copper, leaving only the copper paths that we wanted.

The design has been transferred to the board, then sealed up with green laminating foil.

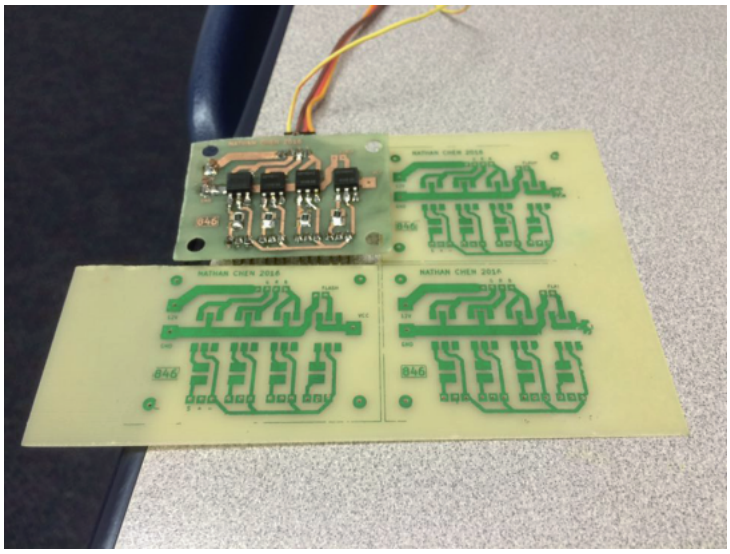
Step 3: Drilling and Soldering

Finally, we drilled necessary holes and soldered on components, completing the circuit boards for use.



The final product with all the components.

Learning the ins and outs of circuit board design and fabrication took hours on hours, but students like myself came out with more refined circuit design skills, a little practice with soldering, and a sense of accomplishment in seeing our work come to life.



Comparison from start to finish.

Senior Goodbyes

Srinjoy Majumdar

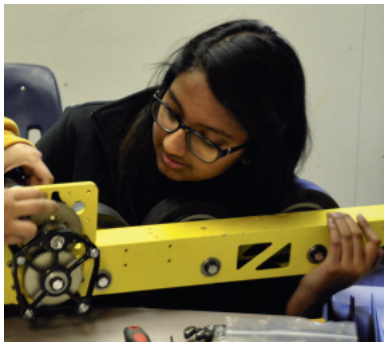
Dear Team,

As I'm about to complete my senior year as a Monkey, I'm amazed by how far the team has come in the last four years. We've been to the World Championships twice, won our first regional, won an offseason competition, and been on countless adventures as a team! However, I'm more impressed by how we've all grown as individuals, and become aspiring engineers heading off to college.

I highly encourage newer members on the team to work with the mentors on our team. They've been the driving factor behind my passion for engineering. As a freshman, I was intimidated by the mentors but at the same time in awe of how much they seemed to know about engineering and how all the robots worked. Mr. G, our head coach, encouraged me to become more active and take risks. One of the first things I worked on as a robotics member was presenting at the Western Region Robotics Forum workshops, an activity I continued to participate in and lead for the next four years. While it was difficult to understand the concepts at first, Mr. G taught me about the technology behind the different systems on our robot and how to present them in a manner that was easy to understand for the audience. In a similar manner, Fernando, one of our Mechanical Design mentors, guided me in designing the stacking gearbox on our 2015 robot. His enthusiasm kept me coming to the workshop everyday. All of the mentors on the team have taught me about a tremendous amount about engineering and driven my interest in robotics

These past four years in Robotics have helped me become a more confident engineer, and I'm forever grateful to all the mentors and students who have helped me. I know that Lynbrook Robotics will continue to grow at a rapid pace over the next few years, and I can't wait to see what the team accomplishes.

-Srinjoy Majumdar
2015-2016 Co-President



Amrita Iyer

Dear Funky Monkeys,

As my time on Team 846 comes to end, I want to thank my fellow members and my wonderful mentors for a fantastic three years. I will always remember working long nights during build season, cheering by your side at competitions, and most importantly, learning and growing into a strong leader under your continuous support and guidance.

This club has been the epitome of a constructive, learning environment filled with excitement, innovation, and pure fun. Over my three years on this team, I have participated in technological challenges, public presentations, business ventures, and have even done my share of artistic and musical work. As an example, just this past season, my brother and I partnered up with the Animation Lead to respectively write original music and rap the lyrics to our team's award-winning 2016 Safety Animation, which I then had the honor of performing live at the Silicon Valley Regional. I cannot imagine another working environment in which I could have had such a wide variety of opportunities.

A note to our newest members: As my own experience with the club might prove, there is never a dull moment on the team, and as long as you remain actively engaged with the process you are bound to find something that speaks to your interests. Although I too came onto the team as a shy and inexperienced sophomore, I knew from the start that I had wanted to work on robot design and hardware, and three years later, I stand as the team's Co-Hardware Lead. Try to not let your lack of experience with robotics itself stand in the way of your core passions, and I can assure you that you will take both technological and personal strides.

Once again, thank you Funky Monkeys for transforming me into a confident leader ready to take on what the world has in store for her! I will never forget my time on this team, the people I have met, the bonds I have forged, the competitions I have participated in, and the lessons I have learned, technological and otherwise. I know you have greatness in store for you, and wish you luck in your upcoming seasons!

-Amrita Iyer
2015-2016 Co-Hardware Lead

Where Can You Find the Class of 2016?