



# MONKEY BUSINESS



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

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## Upcoming Events

### Winter Social

Dec. 16, 2017

### Build Season

Kickoff - Jan. 6, 2018

Stop Build - Feb. 20, 2018

## The Hardest Fun You'll Ever Have!

Find out more about building robots during Build Season!

Rin Ha (*soph.*)

With the start of the second semester, the yearly challenge is released, everyone's favorite time, Build Season, officially begins! From Kickoff Day till Stop Build Day, our team works industriously everyday so that at the end of build season, we can all stand together for a large team photo with our robot sitting proudly in the center.

We gather at one lucky student's house at 7 in the morning for a Kickoff Party to start off the intense season excited, energized, and enthusiastic. At the Kickoff party, people bring chips and doughnuts, and everyone is gathered together around the TV as we watch the live web stream that announces the game for the first time.

Once that the game is revealed, we learn specific rules from a 100 page manual. We meet up again in the afternoon to ensure that everyone knows the rules and start developing our strategy. In the 2017 game, FIRST Steamworks, we learned that the robot could earn points by collecting gears, shooting whiffle balls, and climbing. We discussed which tasks will earn the most points. After much discussion, we finally decided our robot do all three tasks to have a winning robot.

With our strategy decided the hardware team divided themselves into groups, each led by an experienced designer, to oversee a subsystem on the robot. Then, they explore sorts of designs for the subsystem. Once the hardware team decides the idea for their subsystem, they begin designing!

The design process takes up the bulk of

see **THE HARDEST FUN**, Page 2

## Anna Goes Bananas

The making of our marvelous monkey mascot

Anna Shaposhnik (*soph.*)

As a freshmen attending my first regional at Utah, spirit brought me closer to the team. I was excited to wear our team mascot and dance in front of thousands of people. I enjoyed the experience, but I knew I could make it even better since our current monkey costume was uncomfortably hot. It was going to be a challenge creating a new monkey suit for our team, but I was excited take it on immediately.

I stumbled upon a Russian Youtuber, iclowns, with great videos about foam mascot making. I learned that it is like origami: you cut 2D shapes that become 3D when folded and glued together. Following her lead, I made a prototype of a circular head: a sphere of 6 "petals,"

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Anna Shaposhnik (*soph.*) with the mascot she designed with Atul Nair (*jr.*)

making sure to leave space for the head at the bottom and a ventilation hole at the top. My prototype was riddled with mistakes. First, I wrongly cut the foam at an angle, hoping to make it smoother but instead made it more angular. Six petals wasn't smooth enough; eight would be better. Finally, spray glue was just too weak. A combination of Tacky Glue and sewing turned out to be the strongest way to

## Upgrading our Second Robot

The work we put into fielding a second robot

Jing-Chen Peng (*sr.*)

This year for CalGames, we decided to enter two robots into the competition to give our drivers more practice. We used our practice robot drivetrain for our second entry. We resurrected the Banana Breakers, Team 864, the team we created as an April Fool's joke from last year. We decided to transform this robot into a fast, gear placing robot, by removing the entire upper frame to make the robot lighter.

see **SECOND ROBOT**, Page 3

## Strategy: The Key to Our Success

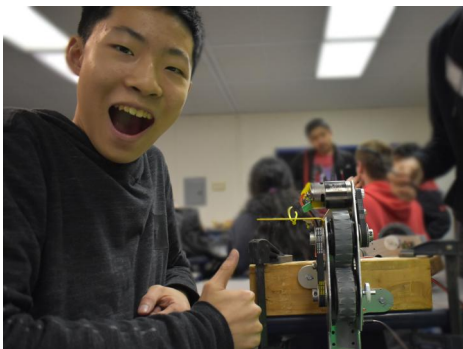
Analyzing teams' performances for the best strategy

Eesha Deepak (*jr.*), Aayush Shah (*jr.*)

An important yet often underrated team role at each FIRST Robotics Competition is that of our scouts. In our most recent competition, the WRRF's CalGames at Evergreen High School, our well-planned and executed scouting operation significantly contributed to our championship. Scouting involves collecting intelligence on the robots of other teams during matches. It is similar to how a

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*The Hardest Fun Continued...*



James Jiao (*jr.*) is ready to test a prototype of the 2017 shooter using 2016's shooter.

the six-week period. During that time, the students work on designs, review them with our mentors, and make improvements. While working on the design, the subsystem leads also communicate with each other to ensure that there are no conflicts and will work together. In our

*As a rookie member,  
working on projects and  
seeing their value  
was really rewarding*

2017 robot, while deciding the drivetrain frame dimensions, it was determined that the frame would be a square so the collectors could extend out, giving flexibility to those systems.

Once the designs are finalized, it's time to machine and assemble our robot! Often, not much time is left for the machining and assembling because of the long design process, and it's done in a blur. During this time, our machine shop has all the machines running, and once the parts are machined, people work together to assemble the subsystems. It was a great chance for me, as a rookie, to help with hardware because I otherwise focused on software.

On the software side of the team, while the hardware team was designing, we worked on improving our framework for writing robot code. Last year, I worked with Shadaj(*sr.*) on projects, like hot configuration reloading. Hot config reloading allows us to test and tune our robot much quicker. As a rookie member, working on projects like these and seeing their value was really rewarding, and encouraged me to keep going to the work

see **THE HARDEST FUN**, Page 3

*Strategy Continued...*



Before alliance selections, Eesha Deepak (*jr.*) and Aayush Shah (*jr.*) discuss strategies for our two competition robots.

basketball scout watches players in high school games to look for the next Michael Jordan. For each match at the competition, we have rotations of six people each tailing the robots on the field. The scouting leads coordinates the scouts and plays the metagame by formulating counter strategies and advanced gameplay. For this year's game, STEAMWORKS, we looked for data such as number of gears scored, rope climbing success, and more. As the matches progressed, we gradually compiled a rich analysis for all the teams. This data shows how consistently the robots perform and

see **STRATEGY**, Page 3

their usual plans for gameplay. By aggregating the data into a spreadsheet, we can see trends per team and take specific notes on the top teams, such as physically drawing out their favorite paths to score, capturing the precise timing of scoring actions, and looking for weaknesses to exploit.

Once alliances are set for the playoffs,

*Our drive captain yelled  
"3 and D" as loud  
as he could, running  
back and forth*

we share the scouting data with our partners to compare our abilities head-to-head with those of the opposing teams. We noticed that 846's alliance was quite proficient at scoring gears and that we had two exceptionally fast robots. Thus, we decided with our alliance partners that our primary strategy was to pursue four rotors (equivalent to scoring 12 gears). Additionally, if we were short on time, the backup plan was to secure three rotors, and

*Monkey Suit Continued...*

connect the foam. As I learned from my mistakes, the final result greatly improved.

Now that I had some idea of how to make it, I had to figure out what to make. I knew it was going to be a monkey, but what should it look like? Initially, I planned to make the monkey resemble our logo, but after I discussed it with the team, I narrowed down to a more realistically styled monkey with a wide smile.

The next hurdle was finding fabric. I



Anna Shaposhnik's (*soph.*) original vision for the new monkey suit.

see **MONKEY SUIT**, Page 3

think the texture of the fabric really makes or breaks a lovable mascot: not too long and shaggy to look unkempt, but not too short to look like a shaved poodle. I blew threw a couple Joan stores before finding "the perfect one." It was a beautiful rich brown, stretchy enough to cover complex shapes and super soft and cuddly. I matched it with a light-brown fleecy fabric.

Now began the process of making the final costume. After making the foam sphere and lining the inside with black fabric, I started sculpting the face. I glued layers of foam together and used scissors to



Anna glues on final parts to the underlying foam structure of the head.

*The Hardest Fun Continued...*

sessions.

Because build season is a short period of time to complete such a huge project, several team members commit innumerable hours for us to have a great robot. On weekdays, we meet from 6pm until 9:30pm, and as we approach Stop Build Day, until 10pm. On weekends, we meet at 1pm and stop working at times dependent on how far we are into build season. It starts off with 1pm - 5pm but by the end of build season, we work until 10pm.

Even though build season is extremely busy and hectic, it's also the most fun time of the year! We form strong bonds after spending so many hours together. We even celebrate our birthdays with each other eating a cake to share with the entire team, although eventually, some of the cake ends up on their faces!

Build season is an intensely fast paced time with many things happening, but at the end, we all gather together as a closer and stronger team. It is an intense period, but still the most exciting time of the year!

*Strategy Continued...*

then play all-out defense by each of the three robots. As the matches progressed, we realised that reaching the level of four rotors placed us into an ideal position to dominate the elimination stages, so we pushed to execute this strategy to perfection. On top of that, to optimize our points for a potential tiebreaker, our alliance decided to have our 846 robot shoot fuel into the boiler in autonomous mode, during which each ball counted for triple the number of points.

There were countless exciting moments throughout the eliminations matches. When one of our alliance partners' robots shut down unexpectedly, our drive team captain yelled, "3 and D" as loud as he could running, back and forth, meaning go for three rotors and then defense. Luckily, our alliance partner's robot came back to life and climbed the airship with seconds to spare! Overall, from the beginning of the scouting process to winning CalGames, our efficient and effective scouting was critical in clinching the victory!

*Monkey Suit Continued...*

sculpt the facial features.

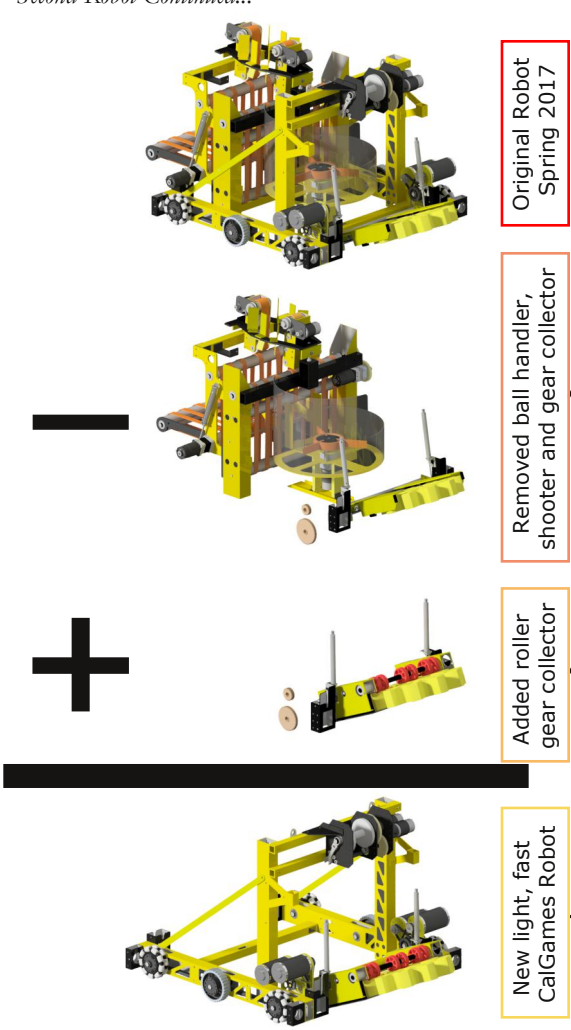
Then I wrapped the fabric around the shapes of the face. I pulled the fabric over one shape at a time and used safety pins to mark where I would sew the fabric together. I hand sewed the fabric around the openings to make it as neat as possible. Finally, I added a zipper and snaps to the side of the head so it could be opened if needed.

For the body, I bought a beautiful red mechanic's jumpsuit. I cut out "846" in white felt and put it on the back of the suit. I brought everything to a team meeting to test it out. It fit great!

The monkey suit officially debuted at CalGames where Atul (junior) danced in and transformed into our mascot. The audience loved it and I was ecstatic!

The journey of making the monkey suit was long but rewarding. I learned a lot, like sewing and managing expenses. A pleasant surprise was finding that the engineering design process applies to costume making as well. You really find it everywhere!

*Second Robot Continued...*



After removing the ball collection, storage, and shooting systems, our robot was a full 50 pounds lighter! Seeing this opportunity, we decided to change the gear ratio for our new robot to raise the top speed. But how much faster? By setting a target distance for our robot to travel, based on this year's game, and solving differential equations using a monstrous excel spreadsheet, we decided on a new gear ratio, improving our top speed by about 15%. (About 500,000 cells of calculations for numerical integration! Praise Excel.)

After all that math, installing the new gears seemed like a breath of fresh air. However, all this added speed wouldn't do us much good if our gear collector couldn't pick up gears efficiently. Our old gear collector worked like your hand might; it could only pick up gears that were fully captured by its fingers. We wanted our collector to be able to suck gears into the machine instantly, like a vacuum. To do this, we turned to a roller based design, using a series of rubber wheels to grab the gear and push it into the collector. Our initial prototypes showed that the design was promising, so we went ahead and designed the roller based collector for our second robot. At this point, there wasn't much time left for CalGames, so we doubled down on our efforts, machining the entire collector in just one weekend!

The week before CalGames, we took our new robot out for a spin, practicing picking up and placing gears with the new collector. The lightened robot flew across the field like our build season robot never could, picking up gears at lightning speed, using its automatic pickup and efficient deployment of gears was almost twice as fast as our old robot. After two weeks of intense preparation, seeing our new robot drive around, with all the systems working as designed, as well as getting picked for an alliance, was the most rewarding feeling! Our accomplishments were visible all throughout the competition, and our team can say that all the hard work we put in before was time well spent!



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# Thanks to the Lynbrook Robotics Team Volunteers

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**Weile Wang**

to Lynbrook Robotics

Dear Lynbrook Robotics Team,

I am writing to express my sincere appreciation to James, Sean, Atul, Aayush, Shaunak, Kunal, Jonah, and possibly a few other Lynbrook students who volunteered in the North California First Lego League (FLL) Scrimmage the past Sunday (Oct. 29, 2017). You enormously helped the participating FLL teams -- many of them are rookie teams -- to better prepare for the coming 2017 FLL season qualifiers. More importantly, your activities helped set up "role models" for the younger kids to develop their interests in robotics as well as community services.

As a part-time FLL coach, this year I helped on two rookie teams and both of them participated in the scrimmage. The kids spent the past several months building, programming, and testing their robots. Everything seemed to work well at home, so they started to ignore my warning about the "consistency". Yet at the scrimmage everything was slightly different, including the competition tables, the field models, the lighting, and so on. All these slight differences added up and our robot failed completely! It was a just-in-time lesson for the kids: now they went back to square one and started to check everything from the beginning. This was not just our experience -- there were about 16 teams at the scrimmage and I saw similar surprised expressions on all the kids and even some of the coaches! It must be a good experience for all of us.

During the scrimmage I noticed that it was mostly run by high school students -- that is, by you. Some of you were referees or announcer/commentator. Some of you scheduled the games and recorded the scores, and furthermore, some of you walked around to help the teams improve their robots/strategies. The schedule was so tight (roughly every 10 minutes a game from around 11:30am to 3:00pm) that you had to take turns to have a slice pizza for lunch! I managed to talk to some of you briefly and learned that most of you are juniors (and Sean is even a senior). As a Bay Area high school parent myself, I totally understand how busy you all are. Given that SAT is coming this week, you still decided to spare the valuable hours with us to help the younger kids. I was really touched!

Lastly, as a professional research scientist, it is my passion for science and technology that led me to coach kids in robotics in my spare time. Many of my colleagues volunteer their time, too. I was so glad to see the same passion in young minds like you. Also, you certainly helped inspire the younger kids at the scrimmage (and previous events, I believe), as they often look up to you (not us adults) as their role models. This adds one more reason that I should also express my appreciation to you -- for you add fresh strength in building a better community! Thank you!

Sincerely,

Weile Wang, Ph.D.  
Research Scientist,  
CSUMB/NASA Ames Research Center



James Jiao (*jr.*) discusses different strategies with an FLL team.



An FLL team asks Kunal Sheth (*soph.*) and James Jiao (*jr.*) for advice on debugging their code.