ENGINEERING IN PRACTICE

FIRST LEGO LEAGUE

by Shasta Subramanian

When I was younger, if someone asked what I wanted to be when I grew up, I always said, "an engineer." I was always looking for something to build or take apart, from toys to watches, and put back together in new ways. When I was seven, my family and I toured the Intel chip factory, where I learned about the function and structure of individual chips. I was intrigued by the fact that such a small chip—around the size of a penny—could allow a computer to perform hundreds of thousands of functions.

Eventually, my fascination with building led me to participate in competitions, including Odyssey of the Mind and Robofest. But *FIRST* LEGO League (FLL) was always my favorite because of the variety of challenges and levels of complexity it entailed. I participated in FLL in grades four through eight—every year I was eligible.

Exploring Problems and Solutions

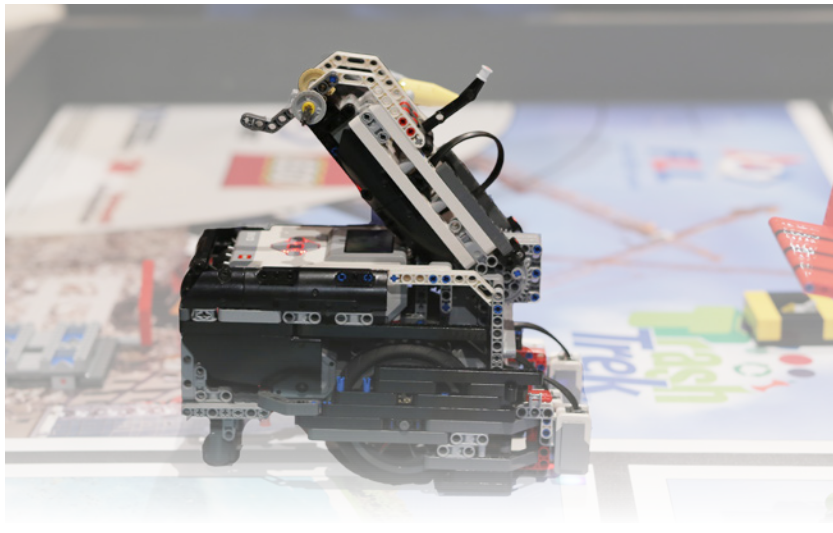
FIRST LEGO League consists of three main components. In the Project portion, teams of students choose and solve a real-world problem. In the Robot Game, they use LEGO MINDSTORMS to build and program an autonomous robot to carry out a set of missions during regional tournaments. The competition's theme changes every year, but FLL's Core Values, which emphasize teamwork and a spirit of learning and friendly competition, remain consistent. Judging is based on teams' adherence to these values, as well as on the project and the robot's design and performance. A variety of awards are presented, with the Champion's Award going to the team that performs best across all three categories. Teams with the highest overall scores advance to the state competition.

The first time I competed, my team had eight members, and our coaches were our parents. Unfortunately, as novices, we didn't realize that having so many team members would actually make teamwork more challenging. For example, our goal was to meet two times a week at one of our homes, but it was hard to find times when everyone could attend. When we did, we often had conflicting ideas about everything from robot design and programming methods to which attachments our robot would need to complete the required tasks during competition. That year's theme, Senior Solutions, focused on helping seniors stay independent, engaged, and connected. To simulate strength exercises, the robot had to lift weights. To mimic gardening, it placed "plants" in target locations, and it turned off burners on a "stove."

For our project, we created a prototype necklace that vibrated, lit up, and made sounds to help remind seniors to take their medicine. Despite our earlier disagreements, we placed third out of around 25 teams for robot performance. The experience helped us prepare for future competitions, and—thanks to some high school students at the host school who let us play with their advanced robots—we were able to explore more sophisticated models. Most of all, it was fun.

Meeting New Challenges

Going forward, we limited our team to three or four members. For the next year's theme, Nature's Fury, everyone helped build the robot and the attachments it needed to complete tasks, which



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included erecting an evacuation sign, simulating a base isolation test on a building, and distributing bottled water. Individuals were also assigned specific roles. My job involved programming the robot and determining its ideal starting spot and angle. My teammates organized the attachments that needed to be switched out on the robot.

A great deal of consideration went into determining the ideal attachment for each task. If the robot had to transport a ring from one location to another (for the theme of Senior Solutions, the ring represented medicines for seniors), it might use a specialized hook that allowed it to carry the ring without dropping it. To reach a great height, the robot might use a lift that could double its reach. Choosing the right attachment became a lesson in teamwork: When we had conflicting ideas, we agreed to test each attachment and use the one that worked best.

While each competition presented unique challenges, an ongoing problem involved the robots' alignment. In order to maneuver around the game board to complete the required tasks, the robot had to be positioned very precisely. But because these robots aren't particularly precise, we had to repeatedly realign our robot during practice and competition runs. This cost us valuable points. We eventually solved the problem by creating a jig, a tool that held the robot in the correct position.

World-Class Learning

To assess a team's adherence to the Core Values, the judges present a theme-based problem and observe as the team works to solve it. They consider the level of cooperation, whether everyone contributes ideas, and how much the team relies on assistance from their coach. For the Nature's Fury theme, we had to act out a natural disaster and come up with a creative solution. One of my teammates was a tornado that spun around and displaced people (us) and objects in its path. After the tornado had destroyed our "town," we helped each other up and rebuilt by resetting all the objects in the area. We then acted out the installation of an innovative water filter that would supply clean water to the area. We made it to the state competition that year, as well as the next two years.

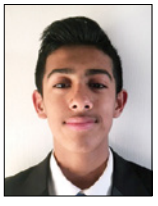
The most memorable competition, however, took place when I was in seventh grade. It was the last year I would be working with my team members, who, as eighth-graders, were aging out of the competition. For the project on the theme of World-Class Learning, we were tasked with helping to improve education on a worldwide scale. Following some research, we came up with the idea of an educational website that addresses the fact that not all people learn the same way. Most people learn by watching, listening, reading, writing, moving, or some combination thereof. We worked on

Shasta (far left) and teammates during the 2013 Nature's Fury challenge

a mock design for the website, which demonstrated ways educators could apply these various learning styles to help students learn effectively. For example, math lessons for visual learners featured images and diagrams, while those for kinesthetic learners demonstrated hands-on activities.

In the end, we created an actual website, which we presented to the judges. At the regional competition, my team received the award for best robot and best project, as well as the Champion's Award. At the state level, we won the Judges Award, which is given to teams whose unique efforts, performance, or dynamics merit recognition.

Participating in *FIRST* LEGO League showed me that adversity and failure really are the best teachers, that teamwork requires compromise, and that learning is an ongoing process. It also showed me that I can combine my interest in robotics with helping my community, and it solidified my desire to become an engineer. ■



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Learn more about *FIRST* LEGO League at firstlegoleague.org.