# THE LOOSE GEARS

## Storming Robots LLC
### Engineering and Computational Thinking Kids!

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# Teams Ranked High at International Competition

By: Nikhil Shah

During the summer of 2013, many teams from Storming Robots represented the United States at the international RoboCup Junior competition in Eindhoven, Netherlands. After succeeding at regional tournaments in multiple categories, such as RoboSoccer, Rescue, and Dance, teams from the center were allowed to compete in this international tournament, with representatives from countries all around the world. In the end, the teams from Storming Robots performed very well, with teams such as the Visionaries winning second place for having the best technical programming in the dance

*Robocup Junior Logo. Photo Credit: http://rcj.robocup.org/*

# Team Quark Charm Advanced to MIT/NASA ZeroRobotics ISS-Final

By: Tanya Glushkova

One Storming Robots High School team once again won the 3D Elimination Round and advanced to the ISS-Final ZeroRobotics Programming Competition. The tournament was created by NASA in collaboration with the Massachusetts Institute of Technology. The Branchburg team is called The Quark Charm, and currently has ten members. The competition is based around mini-satellites called SPHERES, which fly around in the International Space Station. Teams program these SPHERES to compete in several challenges. They get to control the speed, direction, and rotation of the robots, but they must also ensure that

*ZeroRobotics Logo. Photo Credit: http://www.zeroboticsr.org/*

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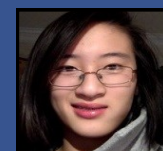
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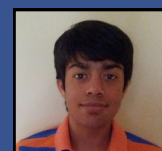
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## Calling for Columnists and Writers

*The pen is mightier than the sword* !

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## Attention!

- Send us shout-outs, accomplishments, and articles!
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- Write an article about your interests, such as science, technology, your favorite school events, or anything else.
- Email office@stormingrobots.com to submit something, or to request more details about what is accepted by the paper.

## Storming Robots LLC
### Engineering and Computational Thinking For Kids!

# My Experience at Robocup Junior 2013: Eindhoven

By: Bhavik Shah

The Robocup Junior 2013 competition was one of the most enlightening and amazing experiences that I have been able to commit myself to throughout all of my time (6 years) at Storming Robots. This has added unspeakable amount of knowledge on my belt In additional to the various things I have learned about robotics during the years of being in Roboclub at SR. This includes from simple mechanical concept, various types of sensors interface,  to some really cool computer science data structure, algorithms, etc. Then, for the competition, I finally extended to have an opportunity in getting in electronic and do some cross-platform programming and electronic hookup (between NXT and Arduino).

Throughout the duration of the competition, I learned very valuable sets of skills that are useful in virtually any work environment. One of these skills is working as part of a team to effectively complete tasks based on a schedule, in which the tasks can be divided up. Also, I believe that the entire process was able to help me develop into an independent thinker.


The RoboCup Junior arena.

My team consisted of three people: William Cui, Ashley Yang, and me. We participated specifically in the Rescue A - Primary division of Robocup Junior. This specific challenge had many particular parts, but in its essence, the challenge was divided up into three separate rooms and a ramp.

The rooms were divided into two separate floors; the first floor contained two rooms while the second contained the last one. Within the first two rooms, the purpose of the robot was to follow a line while avoiding obstacles and turning right at intersections of lines. At the entrance to the final room, the robot had to first stop at a silver tape marking. Inside the room, the judges placed a single silver can in a

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random position.  At this point in the field, the robot's task was to pick up the can and bring it to the designated drop-off zone in a corner of the room.


Bhavik at Eindhoven, Netherlands

The regional competition for Robocup Junior was held at the Liberty Science Center in Jersey City, NJ. The robot we took to compete with was programmed using RobotC, a IDE (Integrated Development Environment) developed by Carnegie Mellon University.  We used an NXT controller and two motors for basic movement, with sticky wheels to increase friction and ease the robot's ascent up the ramp. We also had a servo motor to power a claw, but it was plugged into a sensor port instead of a motor port. We also used a multitude of sensors. On the front of our robot, we used a light array to follow the line, a LEGO light sensor to recognize the silver tape, and an Electro-Optical Proximity Detector, or EOPD sensor, to recognize obstacles in front of the robot.

On the sides of the robot, there were two mid-range distance sensors from Sharp in order to help it detect the can and navigate around an obstacle once it detects it. In the center of the robot, elevated slightly, there was one compass sensor and one accelerometer. We attached the compass sensor to align with the silver tape, and we attached the accelerometer to speed up the power on ramp. Due to our robot having more than four sensors, on port 1 we had to use a HiTechnic multiplexer, which allowed us to put more than one LEGO or HiTechnic sensor on a port. We also used a port splitter in port four which allowed us to

use multiple I2C sensors on one port.

During regionals, each team got three time slots (one on each field) to attempt to achieve the highest score possible. Only the highest score of each team was considered in the final ranking process. In the end, our team, The Horatii, got third place. Only the first and second place teams are permitted to go to the international competition. However, our team merged with the first place team, Seedz, which ultimately allowed us to go.

The team Seedz that we merged with consisted of Sean Doran, Yuwen Zhang, and Neelay Trivedi, which raised our team's number to six people. The first problem we had to overcome as a new team, with limited time before the international competition, was which robot to use. In the end, we decided to utilize the frame of their chassis, as their treads made it ideal to navigate up the ramp. However, we decided to use our sensors as they provided a much wider array of options. In terms of hardware adjusting, we removed the accelerometer, and added another bottom facing light sensor to aid in detecting silver.  We also edited many portions of our code. We made a more sophisticated gap navigation code, created an obstacle avoidance program that adjusts the sharpness of the turn based on how far the robot is from the object, and a

Students from Storming Robots at Eindhoven, Netherlands.

scanning program that could be adjusted based on the location of the door to detect the can more efficiently. With these tools and adjustments, we went to Eindhoven, Netherlands to compete in the international competition.

Eindhoven is a city in the Dutch speaking country of the Netherlands. However, our team was able to communicate with residents of the city, as most of them spoke English. All of the announcements in the competition were said in English as well as Dutch. There were hundreds of people representing around 40 countries that participated in the

three main categories (rescue, soccer, and dance). When we arrived at internationals there were two main options for living: the hotels located around the city, and the tents on the competition premises. The tents were located in the building attached to the arena where the competition was held, and provided cots and communal showers for all of the residents. All of the members on my team chose to reside in hotels.

The competition itself was divided up into five days, plus a symposium for robotics related lectures afterwards. On the first day, each team gave a technical presentation that provided an overview of the software and hardware of the robot, and answered questions from a judge. The next three days were almost exactly the same as the day in regionals, with three runs a day. However, because there were three days, the total amount of runs accumulated to nine. All of these runs would be added into a team's final score, except for the lowest one, which was omitted. On these days, my team would work almost twelve hours a day fine-tuning our algorithms and sensor calibrations. Some problems we encountered involved getting our new obstacle avoidance algorithm to scale properly in regards to the robot's distance away from the obstacle. Another problem was found in our line tracing algorithm,

which was that our robot would turn left at intersections. Our robot should have been turning right at intersections, as it utilized a right-bias algorithm so every time the robot hit an intersection it would automatically turn right without checking any other sides to confirm if it was an intersection rather than a regular right turn. We found the problem which was the values spiking, and in order to fix this we took a series of values at a time and had the robot average them before making any decisions.
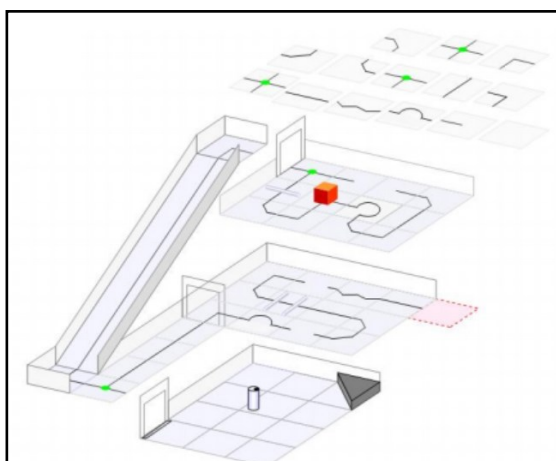

Rescue A Layout Sample

On the third day of competitions, the "superteam" challenge was revealed. A "superteam" is when, in each division,

each team is randomly paired up with another team to try to complete a challenge that involves two robots. However, the catch is that nobody knows what the challenge is until the day before they have to complete it.

In our division, the challenge was for the first robot to count the amount of intersections on the first floor, then communicate to the second robot (which would be stationary on the ramp the entire time) the number of intersections. Using this data, the second robot would have to pick the correctly numbered pathway, which had a silver can that needed to be pushed to a drop zone.

We encountered problems during this challenge as well. One of these problems was specifically recognizing the intersections. Our robot lacked a color sensor which we could have used to recognize the green spots that marked intersections on the field. The reason for this was that our robot was utilizing right bias, which disregards actually recognizing intersections, and instead just turns right whenever possible. We overcame this problem by using a light sensor, and counted intersections by utilizing the minor fluctuations within the light values. However, this solution was not always 100% accurate.

Another prevalent problem was how to communicate with the other team's robot with alliance team for the SuperTeam Competition. Our solution involved hitting a touch sensor on their robot a number of times that corresponded with the amount of intersections. We were unable to establish a Bluetooth communication as their robot had insufficient hardware to be compatible with Bluetooth. We were assigned to the team that represented Mexico. Overall, our team, Seedz, scored 18th in the world, and tied for 4th in Superteams.

On the final day, an optional symposium was held for lectures based on applied math and robotics. These lectures consisted of various mathematical algorithms and how to apply them, along with ideas for new artificial intelligence algorithms for the robots. Many of these lectures were tailored specifically for the adult soccer league. In the end, even though we didn't win, Robocup Junior 2013 was an amazing experience that expanded my horizons regarding robotics.

The Robocup Junior website says that the "Robocup Rescue competition provides benchmarks for robot rescue strategies. Robotic systems are integrated into an autonomous robot system or a simulated robot.

# Interview With Jonathon Van Blarcum

Interviewer: Nikhil Shah

Interviewee: Jonathon Van Blarcum

Jonathon has been a member of Storming Robots for many years. He has recently graduated to college in Fall of 2013. Below is a list of questions he answered, followed by an e-mail exchange between Ms. Elizabeth, the owner of the Storming Robots facility and and Jonathon's mother.

**Can you tell me about yourself?**

Most of my time is divided between school, soccer, and robotics. I enjoy the competitive aspects and athletic challenge of soccer as well as the mentally taxing challenges provided in robotics and academia. I will be attending Worcester Polytechnic Institute (WPI) this fall to study Mechanical Engineering. I love Chinese food and short walks on the beach.

**How did Storming Robots help you develop over the years**



Morgan at 5th grade. That was one year after he has joined Storming Robots.

Storming Robots has fostered my interest in engineering and mathematics, providing focus for my academic pursuits. In competitions I learned how to cooperate with a team and develop a final product. I have no doubt such skills will be invaluable in the real world.

**Did Storming Robots influence you choice in engineering?**

I came to Storming Robots in 4th grade because I expressed an interest in engineering. Some 14 years later Storming Robots has confirmed that I do indeed enjoy the engineering process and have at least some aptitude for it. Without Storming Robots I doubt that I would have developed the passion for engineering that now fuels my work in school.

**Why did you want to select mechanical engineering and environmental engineering?**

I have chosen to pursue Mechanical and Environmental engineering in college. I chose mechanical because I enjoy designing and building. I recognize that a well designed product can change how people live. I am planning to focus in environmental engineering because gas is expensive and eventually our dependence on it just won't end well. I would like to do my part in helping to provide alternatives to fossil fuels and develop technology that uses energy more responsibly.

**Comment from Morgan's mother**

"...I wish to express my whole-hearted thanks for creating such an important and special business. Your program was so special to Morgan - given his interest in engineering, and lack of opportunities within the public schools - your program has been an integral piece of his education - since 4th grade! Through Storming Robots he was able to take his theoretical understanding of math and apply them to a practical application. Plus having the opportunity to teach gave him the skills needed to work besides RPI college students one summer though he was still in High School. I have no doubt that these experiences truly helped him stand out when applying for colleges and helped secure substantial amount of scholarship... So my hats off to you! My son's success is a direct reflection of the value Storming Robots brings to out community. "



Morgan shows his funny side at summer classes in 2010

**Comment from Elizabeth Mabrey**

"Most of us in SR know him by the name Morgan. I can go on for pages to describe what a fine young man Morgan is. Morgan is a very well-rounded, and talented individual. He has always been our go-to-guy whenever anyone has any building issues, or running our strategic ideas on robotics projects.  He clearly proved himself as   an out-of-the-box thinker and showed his leadership potential in very early age. He has started his mentorship and instructor role at SR ever since his 8th grade. It is a privilege for SR to have Morgan in our roboclub alumni list. Among many farewell good wishes, I joked, "Morgan, make sure you come back to say hi when you get famous one day!"



Morgan was mentoring a RCJ team in 2011.

# Preparing for RoboCup Junior 2014

By: Tanya Glushkova

Storming Robots is busy once again preparing for RoboCup Junior 2014. There are three divisions in RCJ: Rescue A, Rescue B, and Soccer. Each team must choose to compete in one of these areas and must make a robot to perform the assigned task.

Rescue A and B involve navigating several rooms and finding key objects, while Soccer consists of  a typical soccer game with robots.  The Storming Robots soccer team, Luke Dai and Vadym Glushkov, will be competing for the third year in a row. Last year, they were tremendously successful, making it all the way to the quarterfinals at the World event at the Netherlands.

Although they have just participated for two years, the team has gained valuable insight into continuing to further  improve upon the algorithms in both hardware and software development .  They are preparing to make this their best year so far with the ultimate goal of making it to the finals.

How exactly do they plan to approach the challenge?  "We are still in the process of finding the best design for our robot. However, we have found some great hardware to make our robot as strong as it can be," says team member Vadym Glushkov. For example, the team will acquire brushless motors, which are special because the rotation speed can be varied by the amount of volts applied to it and the torque of the motors is based on the current going through them. These motors will give the team a much better handle on their robot's motion and will allow them to control the robot much more precisely.

Another crucial part of the robot's design is the sensors. "One mistake we hope to avoid this year is unstable plates. Last year the top plate of our robot, which contained several sensors, began to wobble. It caused inaccurate readings from those sensors, which 1 is smaller than last year. "Hopefully with the new hardware that we're getting we'll be able to win first place," says Vadym.

The team has certainly been working hard with the help of their mentors and parents. This year's competition will be tough, but the soccer team is ready to face the challenge.

# Learning Paths: "Road Maps" for Students

**- By Kelly Kraemer** *(the administrative assistant)*

In the past, we have always made verbal suggestion to parents about students' progression to the next level. In 2014, due to our rapidly increased students volume, we created a road map which serves as a compass for every Roboclub student to have an idea what classes you have to look forward to in the future. The left map below is for students in fourth to eighth grade. The right map below is for students in eighth to twelfth grade. By looking at these road maps, you can see how you will progress through different difficulty levels and topics during your time at Storming Robots.
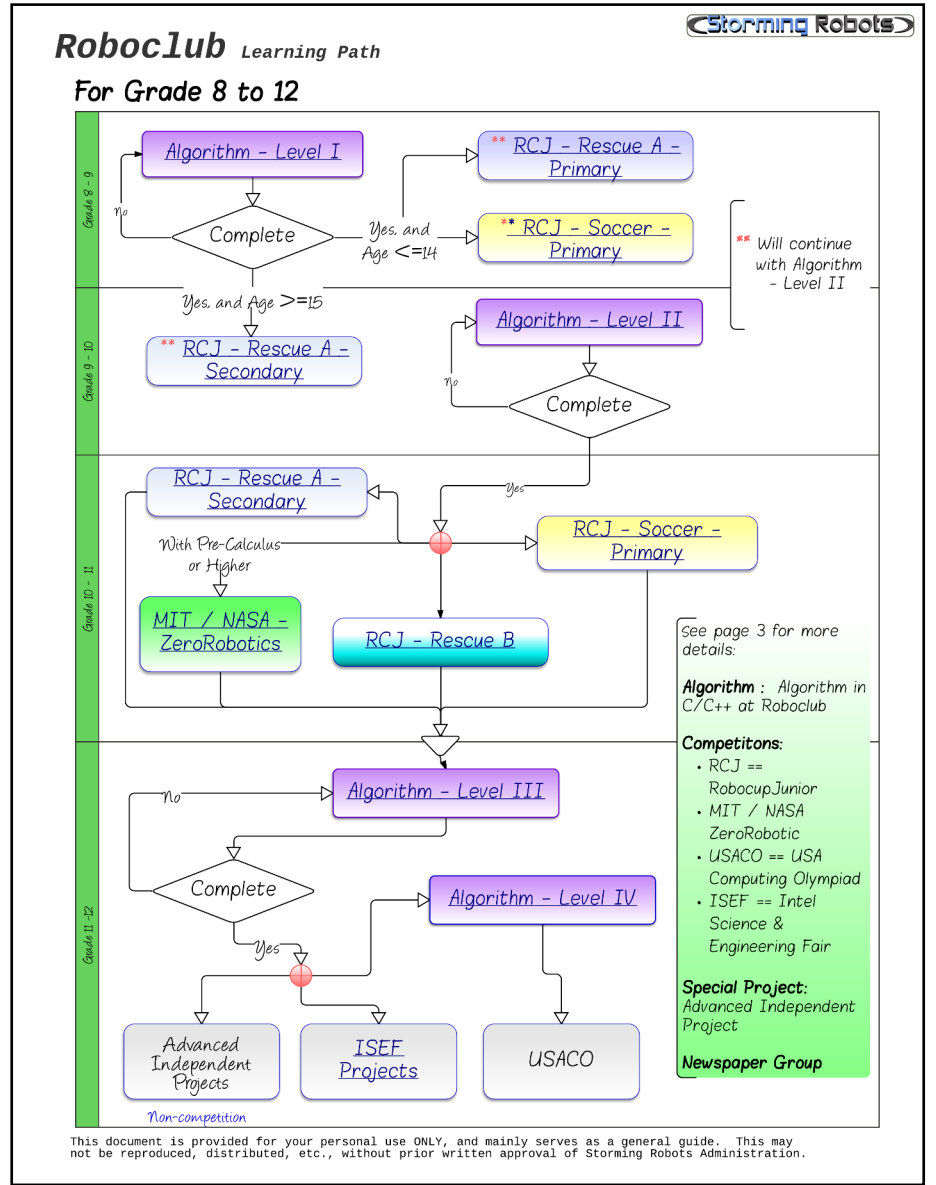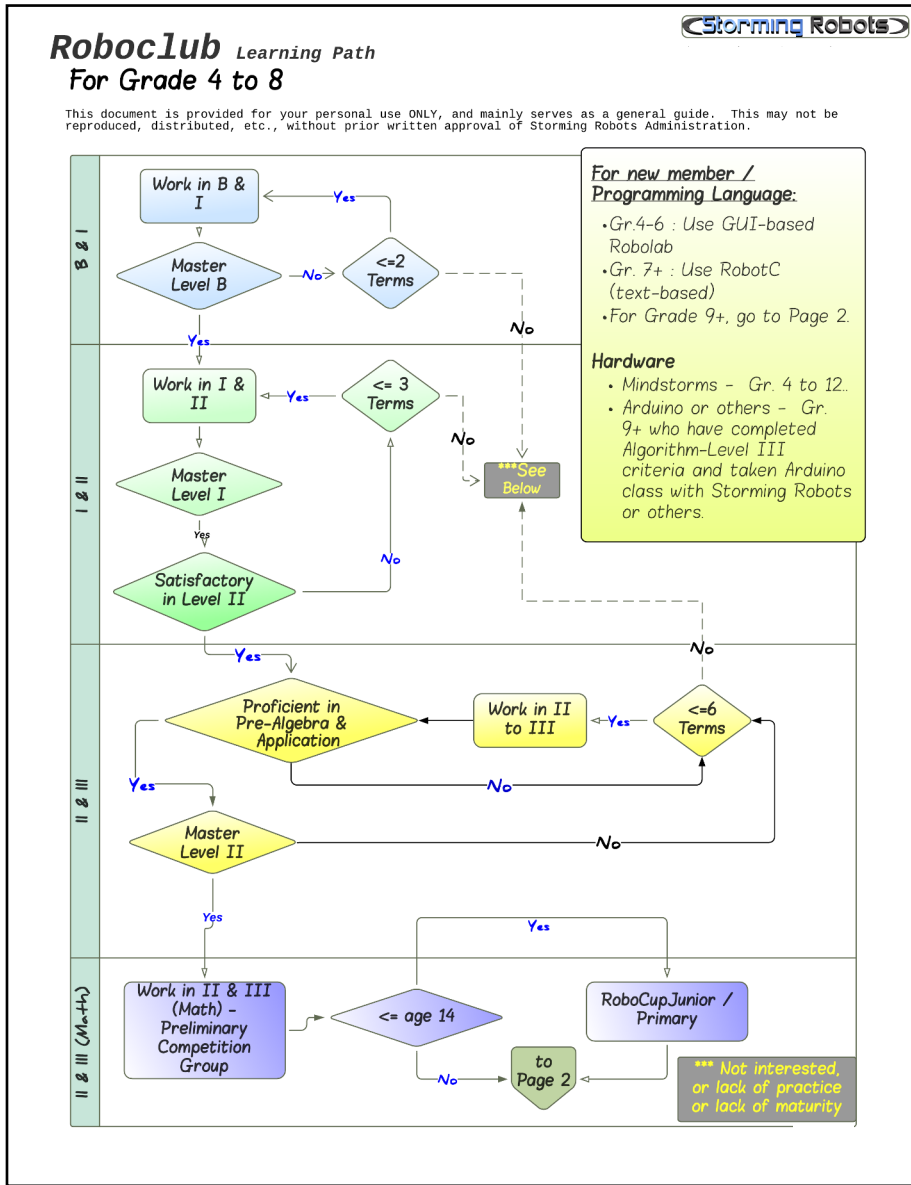




## What's New in 2014 for Roboclub?

### Mentorship Program

Starting this year, the most outstanding members of Roboclub will have the chance to become mentors for other members. Students selected to be mentors will be those who demonstrate maturity and self-discipline, and who have been actively involved in intensive robotics competitive events in the past.

Selected students will be mentors for classes, competitive teams, and will help coordinate competitive events. Mentors should be enthusiastic about robotics and about seeing their fellow Roboclub members succeed at competitions. They will have the opportunity to be actively involved in creating visions and plans for classes, articulating them, and exercising their commitment to completion.

Mentees will learn from and be advised by mentors who have a successful history at Storming Robots and in competition.

Mentors will gain a sense of leadership, as well as dedication, integrity, assertiveness, magnanimity, and humility. In this way, both mentors and mentees will benefit from this new program.

## Instructors and Students to Receive Certification Through RobotC/Carnegie Mellon Robotics Academy

Starting this year, some of the advanced Gr. 7+ instructors will receive "Mindstorms Programming Instructor Certification" from the RobotC/Carnegie Mellon Robotics Academy.

Coming in Fall/2014 — selective students in the Multi-Agent Robotics Group will receive badges for passing an internal exam at Storming Robots. The badge will also be recognized by the RobotC/Carnegie Mellon Robotics Academy.

## Looking Ahead to the Summer

Are you ready for summer classes at Storming Robots? Registration will begin by the end of January, so take a look at the tentative summer schedule, pick a class or two, and get prepared to sign up. More information about classes and the final summer schedule will be available this month at the Storming Robots website, summer.stormingrobots. com. Registration for summer sessions must be done online through the Storming Robots website.

|  |  | Grades | Class ( Tentative Only ) |
|---|---|---|---|
| 23-Jun | 27-Jun | 4-8 | Robotics Technology Projects |
|  |  | 3-4 | Super Mechanical Thinking Creator |
|  |  | 3-4 | Amusement Park I |
| 30-Jun | 4-Jul | Center Closed | |
| 7-Jul | 11-Jul | 6-10 | Programming with Algebra &Robotics |
|  |  | 5-8 | Robotics Nano Missions! |
| 14-Jul | 18-Jul | 4-6 | Robotics Fun with Mathematics |
|  |  | 4-6 | Robo500 Grand Challenge & Drag Racing |
| 21-Jul | 25-Jul | 7-11 | Robot-to-Robot Automation in Remote Con- |
|  |  | 4-6 | Remote Control Racing Bot! |
| 28-Jul | 1-Aug | 8-11 | Physics with Robotics |
|  |  | 8-11 | Robotics with Electronics - Hybrid |
|  |  | 4-8 | Robotics Engineering Projects |
| 4-Aug | 8-Aug | 8-11 | Robotics with Electronics - Arduino |
|  |  | 4-8 | Robotics Zoo |
| 11-Aug | 15-Aug | 4-8 | Robotics Think Quest |
|  |  | 4-8 | Robotics VEX IQ Challenge |
| 18-Aug | 22-Aug | 6-10 | Programming with Algebra &Robotics |
|  |  | 8-11 | Robo500 Grand Challenge & Drag Racing |
| 25-Aug | 29-Aug | 7-9 | RobocupJunior Rescue Projects Training |
|  |  | 4-6 | Remote Control Racing Bot! |

**Note: Most sessions will have pre-requisites, especially those are for Gr. 7+.**

## Storming Robots Ranked High at International Competition

competition. They were also part of a larger team, known as a "superteam," that became the World Champion in the RoboDance category. The RoboDance competition calls for a team to design and program a robot to dance along with background music.


Colleen and Brenna with their awards: 1st Place RoboDance SuperTeam World Championship Award and 2nd Place of RoboDance Technical Award.

Additionally, Team ShimoZumo won the Best Technical Presentation award.


Team ShimoZumo in action!

They were competing in the RoboRescue A category, in which they had to identify a fake victim in a multi-platform obstacle course.

Seedz, another team from Storming Robots, came in 15th out of the 31 teams competing in the tournament. The Dimensions also performed well and made it into the Quarter-Final round of the RoboSoccer competition in the Secondary age group. They programmed two robots

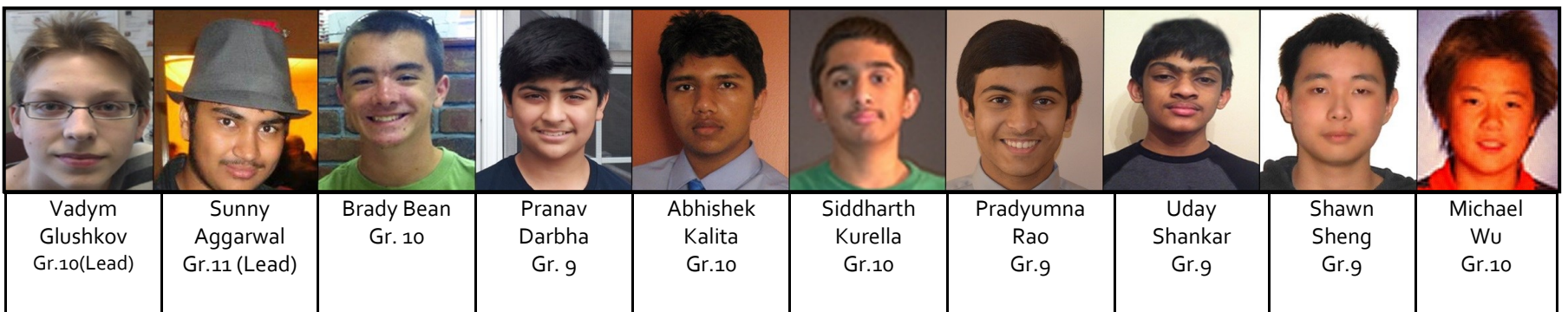to play a game of soccer against another 2-robot soccer team.

Finally, the SR-chitects reached 13th place among the 29 teams competing in the RoboRescue B competition, in which teams program a robot to find a victim emitting heat. All of the teams worked very hard to qualify for and compete in the international tournament.


Rescue B Super Team—Storming Robots' SRchitects

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## Team Quark Charm Advanced to ZeroRobotics ISS-Finals



| Vadym Glushkov Gr.10(Lead) | Sunny Aggarwal Gr.11 (Lead) | Brady Bean Gr. 10 | Pranav Darbha Gr. 9 | Abhishek Kalita Gr.10 | Siddharth Kurella Gr.10 | Pradyumna Rao Gr.9 | Uday Shankar Gr.9 | Shawn Sheng Gr.9 | Michael Wu Gr.10 |

they conserve fuel, and stay within the time and code size limit. The finalists get to have their program run by an astronaut aboard ISS.

Teams use the Zero Robotics website to generate and run code in an environment that simulates space environment. Teams must find a way to complete multiple challenges, including picking up and getting rid of space debris, and protecting their home base from the asteroid heading their way. Teams can accomplish their tasks in multiple ways such as lassoing or using gravity. In order for a team to become a finalist on the ISS, they must pass a number of preliminary rounds. So far the Storming Robots team has passed both the 2D and 3D qualifiers. Quark Team won the 3D round with flying color.

It then formed an alliance with two other participating teams: the "Radjanauts"

from Texas and "At Least We Tried" from California. The three teams worked together to create the finished program by the end of November. Team leader Vadym Glushkov says that collaborating with other


Zero Robotics satellite.
Photo credit: http://usstem.org/programs.html

productive teams has helped out the effort to create more creative strategies to complete the mission. Overall, all team members have put in a tremendous amount of effort, both at Storming Robots and at home, to finish the challenge.

Final code submission was taken placed on December 22nd of 2013. Then, their code will be loaded into the satellites, SPHERE, and compete a live championship aboard the International Space Station (ISS). An astronaut will conduct the championship competition live in the space station.

Sunny, the co-captain, initiated the design of the team logo. Since there is no known shape of a Charm particle, he decided to use a heart shaped charm. Team thought it was a cool idea. The final Team Quark Charm's logo indeed looks charming.

Elizabeth, the mentor, helped to improve the image by adding in the 3D cosmic effects to symbolize speed and cosmic collision. Grid lines give a sense of time-warping.

You may wonder how on earth the word named "Charm" become part of the team name. For those who are curious, here it is.


Team Quark Charm's Logo

Quark is a sub-atomic particle. It has 6 types—Top, Down, Up, Bottom, Strange, and Charm. Charm is the most massive one. In addition, it can only be produced in high energy collisions, such as cosmic rays and in particle accelerators. That was why Charm was chosen.

Adding onto the excitement, the team was invited to talk at an internet radio talk show—Good Morning—Hunterdon Chamber Internet Radio on December 31st. Only eight out of the total ten members were able to make it to the show.


8 Team members met at the Hunterdon Chamber Internet Radio Station


Talk Show Host speaking to the team.

The Zero Robotics High School Tournament is the world's first robotics competition in Space! How cool is that to run your software up in the ISS real time! The robots are SPHERES satellites inside the International Space Station. They are truly engaged in systems engineering which requires them to tackle a complex technical problem systematically.

The competition closely resembles the way software written for spacecraft. Their code will control the satellite positioning in 3D space. This requires application of Calculus, motions/ physics, linear algebra, and explore motion feedback control systems. Truly give them a head start to competitive college environment too.

On the coming January 17th, the agenda they have at the ISS-Final competition date is not short from being intense. It starts from 7:30 am with speeches from event organizer and special guests. The Final will start "live" on ISS around 9am. After lunch time, they will conduct interview. They even will get a chance to view Gavin Hood, Matt Butler present "The Making of Ender's Game, which shows how they simulate Zero-G Battles. Ceremony will finally take place at around 6pm.

Go Team — Blast off to space on January 17th.

# Robotics News...

## Maker Faire 2013


MakerFaire Logo.

Photo credit: http://www.makerfaire.com

By: Tanya Glushkova

On the weekend of September 21st and 22nd classes were canceled at Storming Robots because, for the first time, Storming Robots was represented at the World Maker Faire in New York. The Maker Faire is an annual, weekend-long event that was started in 2006 in the Bay Area. The success of the Maker Faire on the West Coast prompted the organization of a Maker Faire in New York. The Maker Faire is an opportunity for makers, who include technology enthusiasts, engineers, teachers, students, hobbyists and anyone who has something to show the world, to showcase their inventions, businesses, and interests. Anyone interested in seeing fascinating technology, or catching up on the latest gadgets is welcome to experience the Maker Faire. This year RoboCup Junior and Storming Robots organized a booth at the Maker Faire.

Storming Robots students who participated in RCJ showcased their robots and other projects at the fair. Michael Xie, the team lead of SR-chitects, gave a presentation about his Rescue B robot. Bhavik Shah and Salil Pathare, two long time SR roboclub members, collaborated to create a remote control car using both Arduino and NXT parts. Ashley Yang, another long time roboclub members, brought some of her best Lego creations including a working Lego guitar and trumpet, and also a Rescue A robot. The soccer team, Vadym Glushkov and Luke Dai, brought their soccer bots as well. All the students got a chance to present their projects to many interested adults and students.

The Maker Faire had hundreds of booths that gave kids and adults the opportunity to see the newest technology, and talk to some of the most interesting people. Some of the more prominent technology represented at the fair included Arduino, robots of all types, and 3D printers. There were also authors, jewelry makers, and photographers selling their art. There were plenty of activities set up for younger kids, including several science experiment stations. There was plenty to do and see at each booth. The Maker Faire is an amazing experience for people of all ages and offers everything from coloring pictures and making necklaces, to watching a working 3D printer and interacting with robots.

## Maximizing Memory in a Prime Number Generator

By: Bhavik Shah

In my time at Algorithm C classes at Storming Robots, I wrote a prime number generator that utilizes every bit of data being. A prime allocated. A prime number, most of us know, is a number that is divisible only by itself and one.

The algorithm I used for determining the amount of prime numbers involves first creating an array of bytes that will represent each number up to the limit determined by the user of the program. The size of the array is set by dynamically allocating a memory space based on the input. Then, I proceed to use the algorithm called the Sieve of Eratosthenes.

First of all, let's talk about the basic flow of the program as following;

```
For  x from 3 to maximum value
{
   If (x is a composite number)
     Go back to the beginning of
     the loop
   Else
     Mark every multiple of x up
     to the max as composite
}
The numbers remaining are prime.
```

Create a counting variable with the initial value of 2.  (I disregard 0 and 1).  In this program, the counter is called "x".  Every number between 2 and the maximum input value provided by the user is defaulted to be prime, then the program eliminates the numbers that are composite.  The following diagram illustrates the algorithm.



An image of prime and composite numbers.
Photocredit: http://www.jonesnc.net/Page/2128

Although this method is very efficient, memory management needs some level of care.   Even when I use one byte to represent number, it is wasteful. One byte actually takes up 8 bits. Although it is set to either 1 or 0 (one bit usage), it uses up the whole byte (8 bits) to simply  represent a single number. This wastes seven bits for every number I need to assess!  So, I was determined to use up every single bit (literally)  of  the data space I have allocated.

Assessing bits and assigning bits individually is where things get tricky.

In order to utilize every bit, I will have to create a conversion by the bits order.  In order to set the bit, I have to use bit-wise operation, such as bit-xor, bit-shifting, complement and two's compliment.

The first trick is to set all bits to 1. The easiest thing to do is to set the entire byte to –1.  Why?  It is because of the 2's compliment structure.  Here is how:

```
        To do:    X = -1
1) Set to          0000 0001
2) Take 2's compliment:
2.a)compliment     1111 1110
2.b) + 1           1111 1111
```

As you see, all bits are set to 1. That means number 1 thru 8 are defaulted to be prime.  Same trick also applies to the next byte 9 thru 16, then byte 17 thru 24 etc.

After that, I will simply apply Sieve Eratosthenes Algorithm to find out the prime vs composite numbers (bits).

To do this, I will have to apply another binary trick to convert all the subsequent bits to the corresponding based-10 numbers. To do that, I simply use bit-Xor (exclusive  OR) and bit-shift method to a target bit to 0 as composite.

The following illustrates how to use bit-

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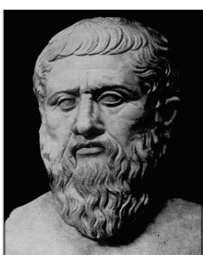
▲ *Continue from Above*

shift and bit-Xor for the operations:

```
X = 1101 0110   | i.e. number
                | 2,3,5,7, 8 are left
                | as prime
To Set number 8 to  be composite,
you need to do:
  A) 1<<7 ==  1000 0000
  B) Bit-Xor with X
     = 0101 0110
This bit is set to zero. That means
number 8 is composite. Only number
2,3,5,7 are left as prime.
```

Using these simple bits operations, I am able to set a target bit that I need to in my prime number generator, while still making sure any other bit in the data bits remains the same.  The main idea is that when a bit is set to  zero, it means composite. When it remains to be 1, it means prime.

Utilizing this method, I can use 8 times more than without these binary tricks.  This proves to be a very efficient in terms of memory management. With 64-bit machine, I can go up to almost  150 Quintillion (i.e $10^{18}$).  Based on the Great Internet Mersenne Prime Search (GIMPS), the record is currently held with 17,425,170 digits.



Eratosthenes, inventor of the Sieve of Eratosthenes algorithm.
Photo Credit: http://www.windows2universe.org/

## Nobel Prizes in Chemistry and Physics for 2013

By: Nikhil Shah

The Nobel Prize is one of the most respected awards in many fields, including the sciences.  The prizes for physics and chemistry have been awarded for this year. According to Nobelprize.org, the prize in physics was awarded to Peter Higgs and François Englert.  The press release detailing their award describes how they had correctly created a theory explaining how all subatomic particles contain mass.  This was then confirmed by physicists in 2013 in the Large Hadron Collider.   The entire model of modern physics depends on this theory developed almost 50 years ago.

However, the Nobel Prize awarded in chemistry was also very significant. Computers and programming are very prevalent in the modern world.  They affect not only daily life and culture, but also research and professional fields. However, when Nobelprize.org posted a press release awarding their annual prize in chemistry, they described a common predicament in chemistry.  When modeling chemical reactions, problems arise when creating simulations.   Either the computationally taxing quantum mechanics are used, or the less accurate classical mechanics are used.  However, with developments from Martin Karplus, Michael Levitt and Arieh Warshel, this problem is being addressed.  They were able to blend the different models of physics and make it easier to model chemical reactions.

Both of these prestigious awards were awarded to scientists from different countries.  Truly, scientific progress has become an international endeavor and is optimized with teamwork.  These strides made in both physics and chemistry will allow scientists to better understand the world that we live in.



A Nobel Prize medal.
Photo credit: http://en.wikipedia.org/wiki/File:Nobel_Prize.png

# Mars

By: Aneesh Durai
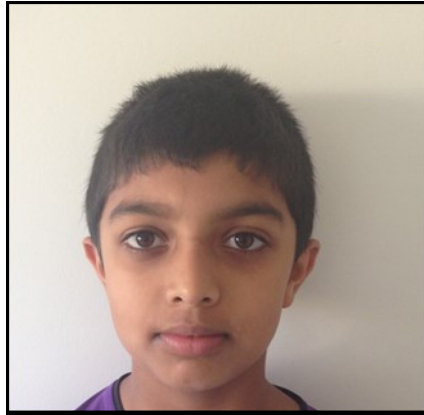
Aneesh Durai

Mars is called "The Red Planet" because it appears like a red star in the sky. The red appearance of the planet comes from the rust in the rocks. Mars orbits around the sun at an average distance of 228 million km, with an average distance of 114 million km between Earth and Mars.

Mars is the fourth planet from the sun. Since it is 114 million km away, human visitors would find it really cold. Humans on Mars could have other problems. The air is 100 times thinner on Mars than it is on earth. It's completely made of carbon dioxide, which plants need more than humans. Visiting humans would need to wear oxygen masks and special suits. They could also have a sealed home on Mars where they would not need to wear oxygen masks and special suits.

Mars has many large impact craters south of the equator. Craters have been made by meteorites (objects that pass through the atmosphere and fall to the surface of a planet or moon), but this happened a billion years ago. The largest crater on mars is about 1800 km across. That is huge enough to swallow half of Europe.

Valleys have formed by cracking in the planet's surface, when the crust stretches and pulls apart. Valleys on Mars are so wide that if two people were on opposite ends of one, they wouldn't be able to see each other.

Mars has the largest volcano in the solar system. It's called "Olympus Mons," three times higher than Mount Everest. However, none of the volcanoes on Mars are active at the present time.

Two actual radio-controlled robots named Spirit and Opportunity are exploring Mars. The rovers (the process of preparing a strand) are sending information back to earth and giving it to scientists that have never studied that information in such detail before.

Spirit and Opportunity have found some interesting information about the rocks, dirt, and landscape on Mars. They had to do many things on Mars to collect the information. For instance, Opportunity dug a trench with its front wheel and that showed that the soil composition changes with depth.

Spirit was on the other side of the planet. Spirit found the top layer of soil to be stickier than he thought it would be.
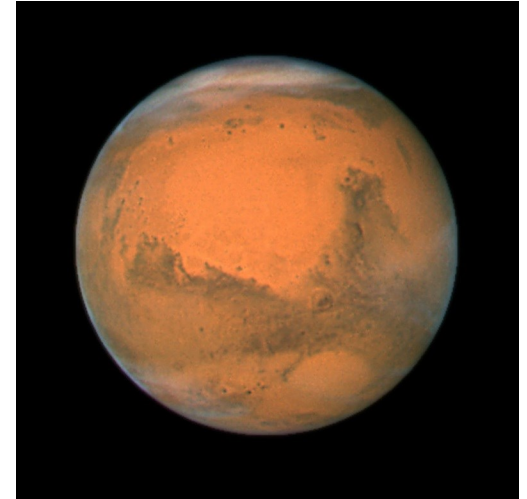
Gravity is different on Mars than it is on Earth. A person's muscles and bones would break down on Mars due to this difference. A person weighing 100 pounds on Earth would weigh about 38 pounds on Mars.

Did you know that a mission, including travel time, to Mars takes 2 and half years? No one has lasted that long in outer space.

Wooster had planned a mission in 2006 to send 15 mice into outer space for five weeks to find out how mammals might fare on Mars. Each of the mice had its own cage. The Spacecraft had span enough for the mice to experience the gravitational pull found on Mars.

Today, mice and robots are still exploring Mars and getting to stroll across the dusty surface of the Red Planet.
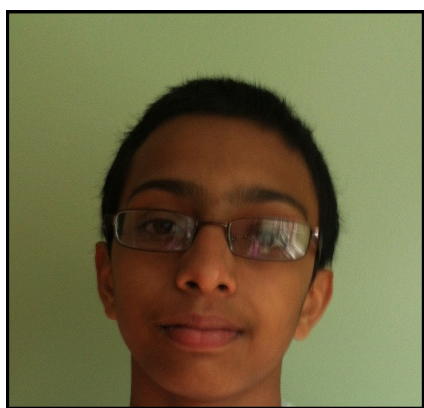
Mars
Photo Credit: http://www.npr.org/blogsthetwoway/2013/05/02/180532424/send-your-haiku-to-mars-nasa-seeks-poets

# Is Intergalactic Travel Possible?

By: Prayaag Rao

Prayaag Rao

With current technology, intergalactic travel is not possible. There are several huge problems that we need to face. The enormous distances that separate galaxies would make it near impossible to allow a spacecraft to go from one galaxy to another. Even with the fastest of human made objects, at its max speed cruising at and near 3% of the speed of light, traveling to the nearest galaxy would take billions of years. Frankly, the human race does not have that kind of time to spare. Furthermore, according to the current theory of the speed of light, the limit of the speed of light will stop us from going at speeds that would allow us to reach other galaxies within a reasonable time limit. Also, communication would be a major problem. Radio signals would take hundreds of billions of years to get to other galaxies. Lastly, the navigation would be a problem because we do not fully understand how galaxies move.

There still lies some hope for the optimist. There are stars which have escaped the Milky Way and other galaxies so that means humans might be able to go "island hopping" from star to star. Though it may be extremely difficult, we could build a spacecraft that could spend thousands of years, with hundreds of generations of humans, on one trip. Time dilation could also be a huge benefactor in these kinds of trips. Even though millions of years might pass on Earth, traveling at near the speed of light would make the trip much shorter for the occupants. Finally, the Alcubierre Drive is a concept that would allow spacecraft to go over the speed of light. The space itself might not need to surpass the speed of light, but the space around it would. This concept is highly hypothetical, but could be possible. To culminate, the possibility of intergalactic travel is highly unpredictable, and it is impossible to answer that question in current times.

I used this source in writing this article, http://en.wikipedia.org/wiki/Intergalactic travel. Date of Visitation: 8/20/13.

# The Road to Storming

By: Samvit Deshmukh

There is not much I remember about being three years old other than lots and lots of Lego related objects- Lego blocks, Lego clothing, a trip to Legoland, etc. However, once I was in grade school, I stumbled upon a very unusual type of Lego: Bionicle.  Here was a set of humanoid, customizable figurines, with an actual storyline behind them! The sets were usually just armor and pieces of that specific character, but I built a whole new person with armor from different sets. I would save up my allowance to get the sets I liked. I would also relentlessly browse through Lego magazines and websites for Bionicles I wanted, and I would either get them for my birthday, or save up my allowance for them. One time, I paid ten dollars for a set all in coins! And through all of this, I continued looking through magazines. It was there that I discovered NXT.



Lego Bionicle

Image Credit: http://www.wallsave.com/wallpaper/1600x1200/bionicle-1161985.html

I have to admit, I was excited! Now, not only could I customize them, I could get them to move! Unfortunately, I could never find the sets in stock at any Lego stores near me, so I just kept on looking for them, and when Bionicle was discontinued, I began looking for NXT kits full time. I was never able to find them, but I did find a good alternative: the Storming Robots class, which my parents discovered online. If I couldn't find the kits, I thought working with them would be the second best thing. I was very excited because working with Legos has always been one of my favorite pastimes. The class has always been enjoyable, and the teachers teach in a way that is not at all hard to understand. As an added bonus, the curriculum teaches programming, a skill I have wanted to learn ever since I discovered that robots needed programs. All in all, I love programming and I look forward to going to Storming Robots this year!



The Storming Robots logo

# FIFA 14

By: Jay Joshi

FIFA 14, the much anticipated game of this fall, was released on September 24, 2013. The publishers of this beautiful game are the influential EA Sports.

FIFA 14 has a lot of upgrades from FIFA 13, which solve previous problems, some of which were the extremely annoying to deal with:

Glitches: Every game has glitches, but FIFA 13 was full of them. The glitches were quite frustrating and they would occur randomly and could completely range from a small glitch to ruining a game. Glitches include:

- Invisible soccer balls.
- Invisible players.

Wrong numbers on the referee's substitution board.

The lightest contact would send players spinning and sprawling across the ground.

Online game crashes: Nothing is more infuriating than playing a game online, winning by a huge margin and randomly getting disconnected. Which basically destroys your online record, and might even get you banned.

Annoying commentators: The commentators were quite harsh on the players and would criticize even the smallest mistake.

The improvements enhance the overall game play experience, along with the usual graphical upgrades. The upgrades will be quite beneficial:

Ignite Engine, a realistic AI system that will make the soccer player "smart" with better game reading abilities. It would basically stop all the problems in FIFA 13, which were mentioned above (in theory, at least).

"Human Intelligence" will cause the players to act in a more understandable way; more runs into space, more intelligent dribbles, more thru-balls, better overhead passes.

"Real Ball Physics" will determine the trajectory of the ball in game, allowing players to use the ball just as they would in real life.

The game sold about 4.5 million copies alone in the first five days. That was nothing compared to Grand Theft Auto V, which sold about 80 million copies in its first day. Still, soccer fans and video game enthusiasts will greatly enjoy the game.

FIFA 14 was much anticipated by millions of soccer fans across the world, and with EA Sports releasing tantalizing screenshots of the game, many couldn't wait to get their hands on it.

The game is sold by most game distributors, such as GameStop and Best Buy (in the USA) and Vogue Distribution (in the UK). The release dates:

- September 24, 2013 - USA
- September 26, 2013 - Rest of the world



FIFA 14

Photo Credit: http://www.gamerheadlines.com/fifa-14-leading-game-charts-breaking-sales-record-gta-5/

## Sensor Obituaries…

This new section details fictional obituaries for sensors or electronics that were somehow destroyed in Storming Robots. They create stories that allude to the mistakes that they themselves, or that a student made while using the sensor.

The following obituary describes electronic devices that were destroyed by roboclub students at Storming Robots.  Most likely high voltage source was the cause of death.

---

### Steve the Ping Sensor

By: Ashley Yang

Steve the ping sensor was a great father.  Everyday he would take his kids, Matt (16), Mauro (14), Josephine (10), and Janet (8) out to spot white walls in a huge maze.  Unfortunately Steve, at age 37, was killed in a freak 9V storm.  When the Salian clouds set forth a pure shocking
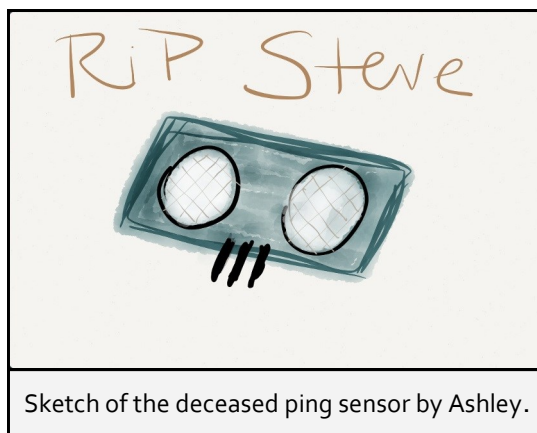


Sketch of the deceased ping sensor by Ashley.

nine volt surge, Steve jumped in front of the family and took one for the team.  He was fried like a tempura shrimp, and his identification badge was shriveled.  There was smoke rising from the scene of the tragic accident.   The ambulance wasn't able to arrive in time.   Steve will be remembered as a great, wonderful, and heroic father.  R.I.P. old man.

### RGB the LED

By: Bhavik Shah

**R**oy **G**. **B**arrington, before his untimely death, was regarded as one of the greatest racers. His place of death was on the Arduino Circuit, one of the most famed tracks in all of "Stormingrobotsland". However, the Arduino Circuit is also the



The deceased RGB LED

most hazardous of them, as it has the lowest survival rate. However, a crash in his last race had damaged his occipital lobe and caused him to become colorblind.

As a result, he had thought the red tape leading to a shortcut on the circuit was actually green. Consequently, he had not realized he had to accelerate in order to make a very long jump. Moreover, he neglected to install the necessary speed resistors on his car as he thought it would've slowed him down. As a result, he couldn't hit his brakes before the jump. Therefore, he fell into the fire pit below, where he burnt to death. He will be remembered as a brave and courageous LED.

---

# Robotics  Puzzle…



**Across**

1- "Robot" comes from the Czech word robota, meaning _____

4- _____ sensors measure the angular rate change.

5- In 2005, Professor James Tour from the Rice University designed a nanobot run by a single-molecule car using _____ as wheels.

9- An _____ is a mechanism that puts something into automatic actions.

11- In 1981, there was the first case of robot homicide, when a robotic arm crushed a factory worker to his demise. In which country did it happen?

14- Robots may use _____ sensors to calculate the distance travelled.

15- You use _____ sensor to detect UV light.

16- The world's smallest robot is a nanowalker made with _____ Acid.

17- A soccer ball is about 10 septillion times bigger than a buckyball, which are molecules that have 60 carbon atoms. How many digits does one septillion contain?

18- What is the name of the world's first humanoid robot, which could walk and talk.

19- "Dead _____" is a process of estimating a robot's current position based upon a previously determined position.
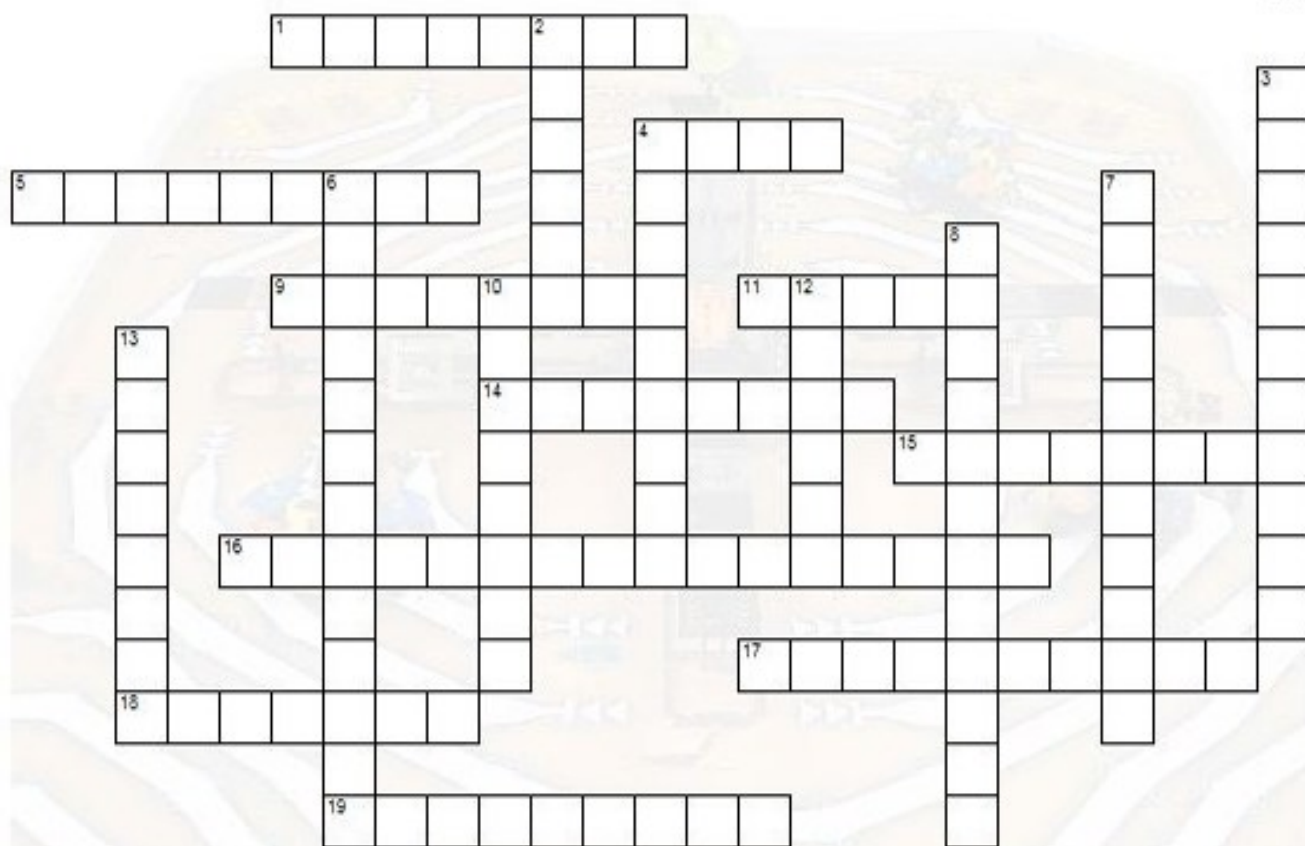
**Down**

2- Robots eat sewage!? Yes, researchers at the Bristol Robotics Lab developed robot to use Microbial Fuel Cell technology to create energy! What is the name of this robot?

3- Scientists attach these nano particles to cancer cells to emit light like IR or UV .

4- Usually, you calculate the distance traveled for the robot based on the size of its tire, encoder reading, and _____.

6- _____ is a device that used in Wii Controller to allow motion sensing control.

7- What science fiction writer wrote the three laws of robotics?

8- Robots with two independent motors most likely do not run straight, because of the _____ output.

10- _____ nanorobots can identify their host (human) by chemical signature, much like a bloodhound or mosquito following a human.

12- Atomic Force Microscope invented by two physicists Gerd Binning and Heinrich Rohrer in the early 1980s at the  IBM Research Zuich.  It is an instrument for imaging surfaces at the _____ level.

13- Roboticist Mark Rosheim produced miniature bot named "Anthrobots" for NASA to _____ Mars.

# On the Lighter Side

## Puzzle - Simple Key words about Gears...
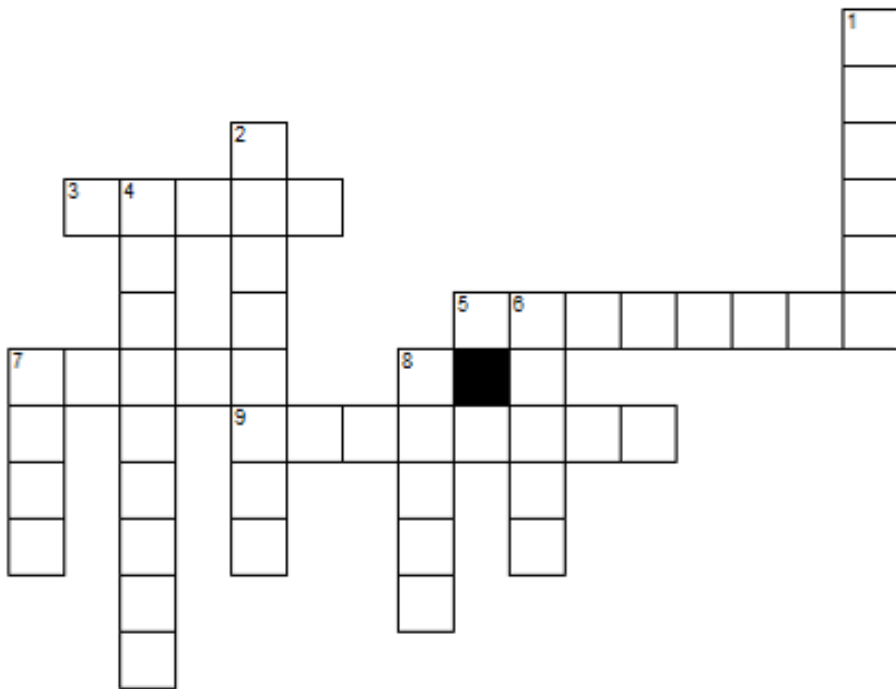


**Across**

3. The name for a gear that is meshed between a driver and a follower gear.

5. When gears have higher turning force, it means it is _____.

7. You use gears to increase or decrease the _____ of rotation.

9. When you put two gears together, they turn _____ direction.

**Down**

1. When gears have higher turning speed, it means it is _____.

2. A smaller gear "drives" a bigger "gear". This will make it _____.

4. You use gears to change the _____ of rotation.

6. When you put three gears together, the first gear turns the same direction as the _____ gear.

7. When two gear wheels are mounted on the same axle, they turn at _____ speed.

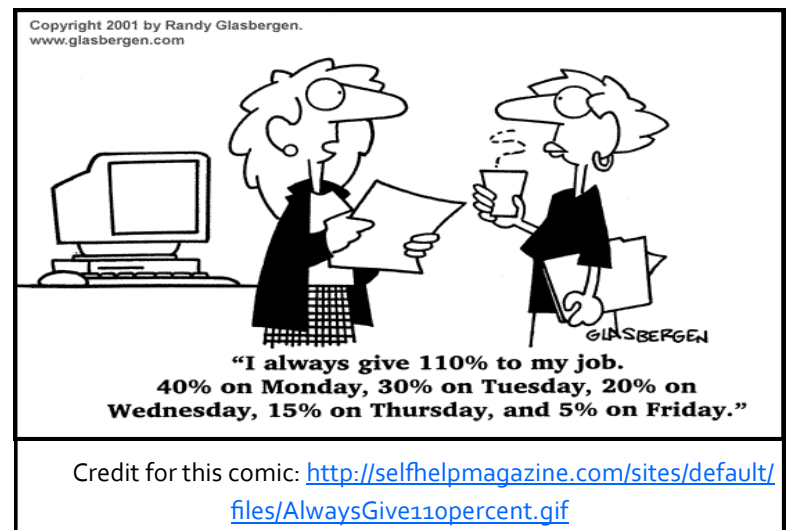8. You usually lose in turning _____ when you gain in turning speed.

*Words Bank:* Speed idler geardown same stronger faster force third direction third opposite

## Comics...



Credit for this comic: http://xkcd.com/1296/



"I always give 110% to my job. 40% on Monday, 30% on Tuesday, 20% on Wednesday, 15% on Thursday, and 5% on Friday."

Credit for this comic: http://selfhelpmagazine.com/sites/default/files/AlwaysGive110percent.gif

## Happening...

| Roboclub : | http://roboclub.stormingrobots.com |
|---|---|
| Summer Program: | http://summer.stormingrobots.com<br>Schedule will be announced no later than January 31st, 2014.<br>Highlights:<br>◊ Weeks of various Robotics Projects for Gr. 4 to 8<br>◊ Two to three weeks on Ardunio and NXT cross-platform<br>◊ One week focus on RobocupJunior Projects<br>◊ One to two weeks of Physics with Robotic. |
| Twitter: | http://www.twitter.com/stormingrobots |
| Winter Event: | ISS-Final by MIT/NASA ZeroRobotics—January 17th of 2014.<br>10 of our high school students will be at the competition held at MIT. |
| Feb 15: | Renewal for 2014 Spring Term Roboclub starts. |
| Mar 5: | New students registration for 2014 Spring Term Roboclub starts. |
| Mar 16: | Last Day of 2014 Winter Term of Roboclub (may change in order to make up for any possible snow days) |
| Mar 26: | 2014 Spring Term starts. |
| Apr 21-27: | Spring Break. Center Closed. |
| Mid-April: | RobocupJunior Tournament. (Exact Date Pending) |
| May 1: | Articles for Issue VII is due. |
| May 30: | Articles due for the 2014 Newspaper issue VII. |
| June 23: | Summer Workshops starts (Tentatively) |

| | |
|---|---|
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