

Storming Robots Teams Fill the Leaderboard Again at the AI-oriented Robotics Tournament



The Dimensions preparing for competition. From left to right: Vadym Glushkov, Luke Dai.

The Eighth US RobocupJunior, an artificial intelligence oriented robotics competition, was held at the Liberty Science Center on April 14th of 2013. There were 44 teams with 169 participants from CA, NC, NJ, NY, PA. Storming Robots teams again filled the leaderboard in most of the Leagues.

The competition consists of three different events: Rescue A, Rescue B and Soccer. Students are placed in Primary or Secondary subdivision based on age of team members.



Team Seedz at the regional competition. From left to right: Sean Doran, Yuwen Zhang, Neelay Trivedi

The Rescue A and B missions are both meant to simulate a disaster scenario where it is too dangerous for humans to intervene, and they must rely on robots to save the victims trapped inside.

In the Rescue A challenge the teams must program their robots to navigate around a course, which has a total of three separate rooms, connected by a ramp. There is a black line provided for the robots to follow. In the first two rooms the robots must cross a number of challenges including speed bumps, obstacles, and gaps in the black line. In the third room, the robot must locate a silver soda can, and move it to the designated corner of the room.

In the Rescue B challenge teams must search the three rooms in search of victims, which are depicted by heat elements. Also in Rescue B there is more than one victim, which can be found anywhere in the labyrinth. As an added challenge there are no black lines for the robot to follow.

The Soccer challenge allows students to play a real game of soccer using robots. Each team is allowed two players. The robots must locate an infrared-light-emitting ball in the field, and attempt to shoot it into the other team's goal.

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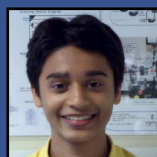
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What I have learned working between NXT/Mindstorms and Arduino...

By : Salil Pathare

Advisor: Elizabeth Mabrey



Disclaimer: This article reflects only facts to my best knowledge from my own experience, experience from other students from Storming Robots, internet research, and data received from experienced individuals. Nothing on this document shall be construed as official views from the manufacturers. Storming Robots shall not be liable for any errors or omissions contained in this document.

In the past four to five years, it seemed to be the most user friendly robotics kit out there

for young robotics hobbyist like us was LEGO Mindstorms. This year we have found many new alternatives that can replace the NXT during our competition season. The first one that came to our attention was the Arduino. I was excited to learn more. Elizabeth, the director of Storming Robots, suggested me to write up my thought about my experience. I, of course, was delighted to do so because I am more an electronic gadget person.

I want to emphasize that this article is not meant to provide in-depth analysis between the NXT/Mindstorms and Arduino platform. I just want to share my experience on the two platforms, and hope to be informative to stimulate others' thought when it comes to exploring Arduino vs NXT/Mindstorms.

We have been pondering between Arduino and NXT/Mindstorms for a while. We have always thought Arduino platform must be a much more advanced platform than NXT/Mindstorms. I used to think moving onto Arduino must be the way to go in order to do anything more sophisticated than NXT/Mindstorms. After diving into our latest






competition robot with Arduino, and gaining some insight with the founder (or the chief Instructor) at Storming Robots, the choice is not so black and white.

I think you will find this article informative, as it may clear up the immediate presumption about NXT being only a toy-grade platform, and having to move to another "metal" like platform like Arduino in order to do some real robotics projects.

First of all, comparing Arduino and NXT/Mindstorms is rather like comparing apple to orange. You need to read this article from the perspective of a person who tries to decide between the two most popular robotics educational platforms available to pre-college kids. I listed the main hardware differences which I think most robotics enthusiasts like us first want to know before investing on time and money on them.

The following lists some major features from the platforms that I have come across : EV3™/Mindstorms from LEGO®, NXT™/Mindstorms

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Some major characteristics on main controller and its popular Programming Software							
This table below only reflects some of the main characteristics among the controllers (or you may call it the brains), not including additional part such as motors, sensors, etc.							
Processing power		 Mindstorms—EV3	 Mindstorms—NXT		 Arduino—Due	 Arduino—Mega	 Arduino—UNO
	Processor	32 bit ARM9	32 bit ARM7 as the main processor	8-bit ATmega48 as co-processor	32 bit ARM Cortex-M3	8 bit ATmega2560	8 bit ATmega328
	Clock Speed (MHz)	300	48	8	84	16	16
	SRAM(KB)	6400	256	0.5	96	8	2
Expand-ability	I/O Pins	5 input ports	4 input ports		54 digital (12 PWM)	54 digital (14 PWM)	14 digital (14 PWM)
		4 output ports	3 output ports				
	Analog Input Pins	N/A	N/A		12	16	6
	Analog Output Pins	N/A	N/A		2	N/A	N/A
Storage	EEPROM (KB)	N/A	N/A		N/A	4	1
	Flash Memory (KB)	16,000 (i.e. 16MB)	256		512	128	64
	Additional storage	mini SDHC card	None		N/A	N/A	N/A
Network & others	Bluetooth	Improved Bluetooth stack to communicate with Android-OS and iOS	Older version of Bluetooth stack. Compatible with Android OS, but not iOS		N/A	N/A	N/A
	Speaker	Yes	Yes		N/A	N/A	N/A
Software	Compiler/programming language	NXC , RobotC, NI LABVIEW	NXC , LeJOS, Robolab, NI LABVIEW	RobotC, ADA, NXTG,	Arduino IDE –C, Special library for java APIs	Arduino IDE - C, Special library for java APIs	Arduino IDE - C, Special library for java APIs
	Debugger	Yes	Yes. A well-written UI debugger		N/A	N/A	N/A
	File management	Yes	Yes		N/A	N/A	N/A
	Operating System	Linux	Proprietary Embedded System		Open-Source Embedded System	Open-Source Embedded System	Open-Source Embedded System

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from LEGO®, Dué, Mega, and Uno from Arduino®,

Let's examine why the criteria above is important.

Processing power

NXT's processing speed is ~20 IPC (instructions per cycle), or 1 instruction per ~100 μs. Arduino/Mega's processing speed is about ~7 IPC, or 1 instruction per ~300 μs.

NXT's processor speed is 3X Arduino's Mega's. Now, RobotC compiled code is in "bytecode" , while the Arduino's Sketch .hex binary code. Bytecode runs slower than compiled code because of the 'interpretive overhead" involved during run-time. This is because the interpreter must perform further analyze each code in the program before executing the desired action; whereas the compiled code just performs the action within a pre-determined context created during the compilation time. However, even that, with

3X faster processor speed, NXT/RobotC will still out-perform Arduino's binary code,in terms of runtime performance.

Memory

However, when it comes to the memory, 8K in Arduino's Mega simply cannot beat the 256K in NXT. For example, for our Maze projects which use recursion Depth First Search Algorithms. The program's recursive stack size increases, i.e. the maze size increases. Part of

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	Definition	What is better	Impact to robot
EEPROM	Electrically erasable programmable read-only memory – is user-modifiable read-only memory (ROM) that can be erased and re-programmed (written to) repeatedly.	Higher amount of EEPROM allows for larger code saved without power.	Allow to store a larger operating software built into the firmware, even when your robot loses its power source. For example, your robot loses power for a while, the firmware remains intact.
Flash Memory	Memory for storing user data, such as user programs even without power supply to it. This is a specific type of EEPROM.	Higher amount of Flash memory allows robots to store larger volume of data which you wish to remain on the system even when there is no power to it.	Very much like EEPROM, except Flash is usually for storing users' programming data. Therefore, you can save more of your favorite programs.
Clock Speed	The frequency the CPU is running at, and the speed at which instructions are called.	The clock rate is better at a higher rate. The faster the clock, the more instructions the CPU can execute per second.	Speedier processing power. Although it is subject to the limitation on the speed of other electronic devices, such as sensors.
RAM	Random Access Memory is a type of semiconductor memory reliably to store each bit of data when power exists.	Greater amounts of static RAM will allow your program to use more memory during run-time.	Allow more programming flexibility during run time. For example, your software requires more memory when running such as recursive Maze solver algorithms.
I/O Pins	Input/Output pins are pins on the chip that can send out a ON or OFF signal from one of their ports. It can also be used to receive signals from sensors.	The more I/O pins you have, the greater the amount of sensors that you can use.	The number of I/O pins can limit the amount of sensors and motors you can use on your robot. With a limited number of pins it will limit the amount of feedback the robot will receive.

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After that said, you can always add an external flash memory shield to increase storage space. That goes back to expandability. Unlike NXT, there is no easy way to add an external storage space. The new EV3, coming in the Fall of 2013, comes with a micro SD-Card reader, which can handle up to 32 GB data.

Network

NXT comes with Bluetooth capability, so it is definitely a handy tool to have for multi-agent implementation. For Arduino platform, you will have to purchase an external network device.

Size Factor

Size can also be a determining factor. Think about the NXT controller's size: 48cm x 9.3cm x 50.5cm (i.e. 18.9in x 3.7in x 14.9in) vs Arduino's processor size, 10.8cm x 1.5 cm x 5.3cm. (i.e. 4.25in x 0.6in x 2in)

However you will need to let the Arduino sit on at least a breadboard and hook up all the necessary sensors to accomplish what a single NXT controller can do. The footprint of the system put together with Arduino is still most likely still smaller than the NXT controller itself.

Software - Ease of Development Environment

One of the most popular Arduino IDE,

Sketch, lacks many key features that allows a coder to be more efficient and save time. One of the main features we would love to have is a debugger, the closest thing we what to a debugger in the Arduino ide is the Serial communication commands. It is a hassle to figure out the issues in a sketch when the best you have is "Serial.Println();". Now in Mindstorms, development offers a user-friendly debugger to use at runtime.

For our Rescue B project contains complex logic and algorithm which requires much run time debugging, I would rather use NXT's RobotC.

Data collection capability

The NXT comes preloaded with data collection software that can easily be viewed on the computer. No extra hardware such as SD cards are needed. This becomes very beneficial for many robotics applications. When we use Arduino the situation is different. There is no way to collect data without buying additional shields that will cost us around \$30. Going the route for Arduino will take more time than using NXT. Besides, NXT's RobotC comes with a simple file management tool which makes it easy to do data collection.

Compatibility of 3rd party hardware

3rd party hardware plays a big role in various projects. Both the NXT and Arduino are

the core tasks is to keep partial stack memory persistent (i.e. save it onto the disk.) Naturally, it is doable with NXT platform. With Arduino, you will have to purchase an external storage, such as a SD card device.

Expandability

Mega has a total of 54 digital I/O (input/output) pins This allows the user to add far many more sensors than they could have with the default Mindstorms Kit, even with upcoming EV3 version. When it comes to do any other cool non-robotics electronic project, you cannot beat using the Arduino platform because of its expandability. You can virtually do any electronic project your imagination takes you with Arduino platform.

Having said that, it does not mean that you cannot add on the limited 3 motors and 4 sensors capability on Mindstorms either. There are two major vendors for expanding NXTs limited ports restraint, HiTechnic and Mindsensors. They provide 3rd parties sensors as well as sensors and motors multiplexer. For example, theoretically, you may have up to 16 sensors hooked up to a NXT; 4 sensors connected to a sensor mux, and each sensor mux expands to 4 sensors. Now, I am not saying it is a good idea, as power consumption will come to a big question. In addition, they all are quite costly, usually \$50+ per device.

With Mindsensor's motor mux, again theoretically, you may daisy chain it to get many motors connected. Well, not sure how well this works though because they all work off from a single motor controller inside the NXT brick. There were teams reporting that they have experienced lagging performance from the motors which happened to be connected to the motor mux. Besides, it will get so bulky that it makes it very undesirable to use for small sized robots projects.

Storage

For NXT, it has enough persistent memory for you to save more files such as some fun sound or icon files. More importantly, you can save data files, such as sensors data for more complex analysis. Arduino simply does not offer that ability.

capable of interfacing with 3rd party sensors and tools. However, Arduino allows for a much easier integration. In addition, the number of 3rd party devices compatible with Arduino are virtually limitless. With the NXT, although RobotC is packaged with galore of driver code written for some 3rd party devices. However, they are mostly limited to a couple of outlets, Mindsensors and HiTechnics.

So, for high expandability and higher compatibility without concerning the cost, time, etc., I would definitely prefer Arduino definitely over NXT.

Cost and Time Constraint Consideration

People have a misconception that it must be cheaper to use Arduino. It really depends on the project. In order to put this in a more easily appropriate context, I am listing 3 scenarios - one project with simple usage of sensors, one with more complex requirement in algorithm and usage of sensors, and one non-robotics electronic project. Now, the following scenarios are not meant to give you detailed bill of materials, nor buying guide. It is only meant to provide a more laymen and pragmatic way to show the differences.

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Scenario 1: Robot with simple sumo capability

(e.g. Pushing another approximately 1kg robot out the ring):

- Built with Tank configuration
- Ability to know it is the edge of the ring to stay inside
- Equip with two 2A DC motors with stalled torque strong enough to push 1kg object on a smooth surface.

(Disclaimer: Again, all the dollars figure in this article reflects from our experience only. There are tons of variation in devices you can get from many outlets. You should check on the prize yourself for verification.)

Scenario 1 shows it is more economical to do it with Arduino platform for reaching similar results. Besides, with Sumo robotics activity, software development is very simple. Therefore, you will not need to be concerned in software debugging aspect. The most bulk of work is in mechanical, and a bit on electronic when it comes to manipulate a high torque motor. Thus, the only up cost can be very steep is on high torque motors and motor controllers which can support the high level of amperage. This will go true no matter whether you use Mindstorms or Arduino platform.

Scenario 2: Robot with line recognition, wall tracing and physical impact sensing capability:

- Equip with simple 1-1 gear system 2-wheels drive with 2 motors
- Able to know how far the robot has traveled
- Able to perform wall following with 2 ping sensors
- Recognize table edge with a light sensor so that it does not fall over
- Recognize physical impact with push button / touch sensor.
- Allow LCD display debugging information
- Allow data collection for performing more reliable analysis on sensors/ motors feedback
- Have an end effector like a claw to grab an object.

The cost shown for the Arduino platform is only close to minimal. From my experience, the cost can easily add up considering the fact that you will have to spend a lot of time to shop for the right parts and ensure compatibility. Unless you are already an electronic know-how, you may find yourself spending tremendous amount of time and money on a robotics project with Arduino. In addition, you may burn a fill pieces here and there, as I have done a few!

Scenario 3: A GPS- based treasure lock box:

- Equip with a simple servo or DC motor with encoder
- Simple locking mechanism
- GPS receiver

Scenario 3 shows more economical to do this in Arduino for reaching similar results.

Scenario 1: Robot with simple sumo capability					
	EV3	NXT	Due	Mega	Uno
Controller / Brain	\$350	\$280	\$50	\$30	\$20
2 DC Motors	Included	Included	\$40	\$40	\$40
Motor controller	Included	Included	\$20+	\$20+	\$20+
LCD	Included	Included	None	None	none
Buttons control	Included	Included	None	None	none
1 light sensor	Included	Included	\$5+	\$5+	\$5+
1 touch sensor	Included	Included	\$5+	\$5+	\$5+
Chassis /wheels, building materials	Included	Included	\$30+	\$30+	\$30+
Protective case	Included	Included	None.. can be any amount	None.. can be any amount	None.. can be any amount
Minimum total:	\$350	\$280	\$150+	\$130+	\$120+

Scenario 2: Robot with line recognition, wall tracing and impact sensing capability:					
	EV3	NXT	Due	Mega	Uno
Controller / Brain	\$350	\$280	\$50	\$30+	\$20+
Motors with encoder for wheels	Included	Included	\$60+	\$60+	\$60+
Motor with encoder for claw	Included	Included	\$30+	\$30+	\$30+
Motor controller	Included	Included	+1 4-channel controller - \$40	+1 4-controller - \$40	+1 4-controller - \$40
LCD	Included	Included	\$30+	\$30+	\$30+
Buttons control	Included	Included	None	None	none
1 light sensor	Included	Included	\$5+	\$5+	\$5+
Chassis /wheels, building materials	Included	Included	\$50+	\$50+	\$50+
Protective case	Included	Included	None.. can be any amount	None.. can be any amount	None.. can be any amount
Memory for data collection	Included	Included	\$30+	\$30+	\$30+
Minimum total:	\$350	\$280	\$420+	\$410+	\$400+

Scenario 3: A GPS- based treasure lock box					
	EV3	NXT	Due	Mega	Uno
Controller / Brain	\$350	\$280	\$50	\$30	\$20
Servo or DC motor	Included	Included	\$30+	\$30+	\$30+
LCD	Included	Included	\$30+	\$30+	\$20+
Buttons control	Included	Included	\$10+	\$10+	\$10+
GPS receiver	\$50+	\$50+	\$70+	\$50+	\$50+
Box	\$10+	\$10+	\$10+	\$10+	\$10+
Minimum total:	\$410+	\$340+	\$200+	\$160+	\$140+

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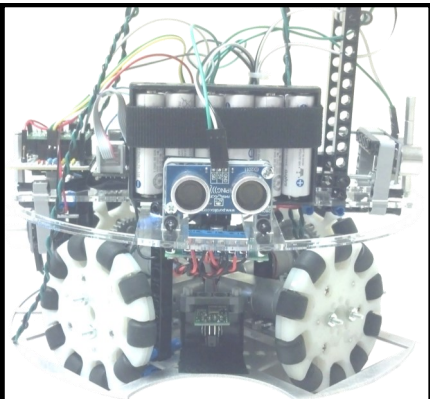
My Final Thought

When it comes to allow a large variety of electronic projects, just the expandability and size factors along make Arduino a far more desirable platform. The Arduino comes in many flavors and are also much more open to the user. You are open to choose whatever your project calls for.

One student at SR created a GPS treasure box project using an Arduino Uno as the controller, and a simple servo motor, and a GPS receiver. She learned the electronic aspect of it, which she would not have easily got from using NXT/Mindstorms platform.



GPS box with Arduino Platform. The cost of this platform is around \$140.



A close up image of our Soccer Bot—complete Arduino platform. Our Dimension team designed the complete chassis from scratch. The cost of materials alone costs approximately \$1000.

Our peer team, Dimensions - the RoboSoccer Team (who won the world title 3rd Place in 2012 World RobocupJunior Championship in Mexico City), has decided to use complete Arduino platform because of weight and size restriction, various sensors, as well as the necessity to use more powerful motors.

For a person like me who loves electronic and mechanical projects, I tend to look for a very expandable and flexible hardware; so I would go for the Arduino. But then, if I need a more hassle free solution, I would pick the Mindstorms kits.

Now this does not mean that Mindstorms is inferior to Arduino platform. If I want processing power, doing multi-tasking, complex algorithm which makes a good debugging indispensable, as well as expandability, I will go for a hybrid platform.

Take my team SR-chitects as an example. Despite of my love of using Arduino, we have decided to go for a hybrid – using Mindstorms as the master controller with Arduino-Nano as its I2C device. It was used as a secondary controller to interface with non-NXT distance sensors. This will take advantage of the processing power of Mindstorms, and it's quite good debugging environment, and the expandability of Arduino.

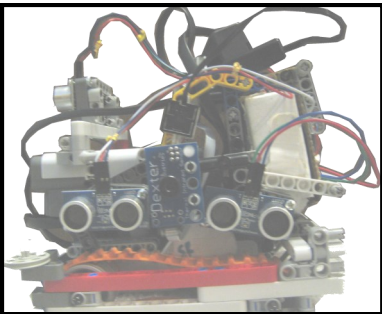
My competitive team SR-chitects will use this platform at the upcoming RobocupJunior Rescue B / Maze World Tournament. I build a prototype box to house the Arduino, breadboard, as well as all the connectors.

This solution gains us both processing power and expandability.

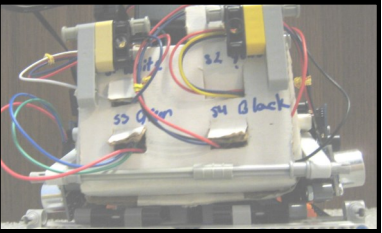
Now, our robot can easily perform multitasking, data collection, and debugging. All of which are extremely important to our project .

This hybrid system on the right contains a home-made self-contained Arduino adaptor box out of a cardboard box. Yes, a cardboard box! Who said it needs to costs a lot of money!

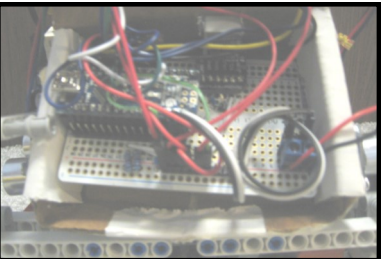
This box can easily be removed from this NXT and



NXT-Arduino Hybrid with NXT as the main processor with an Arduino Nano as secondary processor.



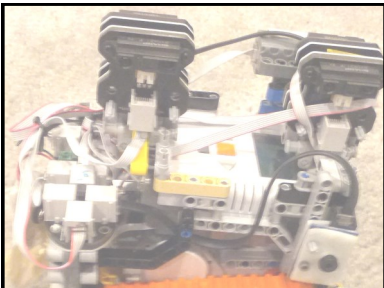
4-pin w/ Arduino-Nano adaptor prototype box



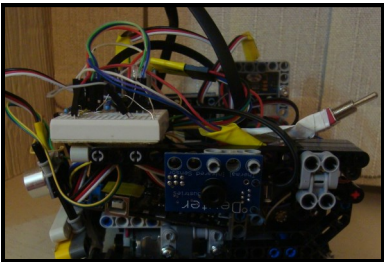
Arduino Nano inside the prototype adaptor box.

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Our RescueB Maze Bot capable of doing multitasking, data collection, have much higher processing power than its counter part below



Our alternative Rescue B with Arduino. Much higher expandability than the counterpart above.

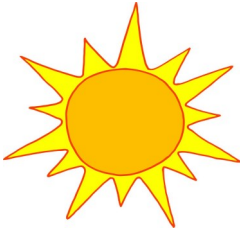
connected to another NXT without doing extra work for the interface. NXT-Arduino Hybrid with NXT as the main processor with an Arduino as secondary processor for additional sensors or motors seems to be a good solution for gaining both processing power and expandability.

All in all, an individual who is looking into a specific platform should pick the hardware that would be best suited for their projects. I hope my experience and the specific categories listed above will help you in making an educated decision.

Poem...

Weather

By: Umar Ahmed
Badami



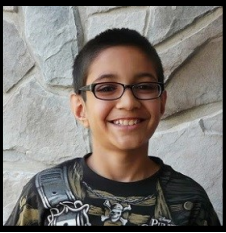
Weather can walk like a gentle breeze,
Weather can run like the howling wind.
Weather can be sad like the clouds weeping,
Weather can be angry like a lightning bolt.
Weather can be scary like a hurricane.

Weather can be happy by making waves.
Weather can be surprising by making it hot
in February.
Weather is like us.

Misc ...

My Favorite PS3 Game

By: Shiven Tyagi



Have you ever enjoyed a game so much that it was as if you were actually in it? For me, it happens almost every single time I play *Call of Duty: Black Ops II*. This happens to me especially when I play the *zombies* mode of the game. One of the maps you can choose to survive against zombies on is called Die Rise.

In Die Rise you are stuck on a huge row of buildings of which some are upside down and totally destroyed. Die Rise just happens to be my

favorite map because of its huge buildings with over seventy-five floors total and secondly because it is the newest map. But, relax I got about ten other things added to the game along with Die Rise apart of the DLC Revolution map pack. Anyway, what happens is that you start with 500 points to try to survive zombies and earn points and but other supplies to survive with the points you earn and it gets harder and harder every round you get past.

Once, I got to round 27 which is very hard to survive on, and very high., I got a game over. I got mad but I had to get over it. When the other map packs for *Black Ops II* come out, I will probably be ready with my season pass so I can get it automatically. The season pass basically gets every map pack quicker and you don't need to install them, they just download and install into the game automatically.

Geocache Box

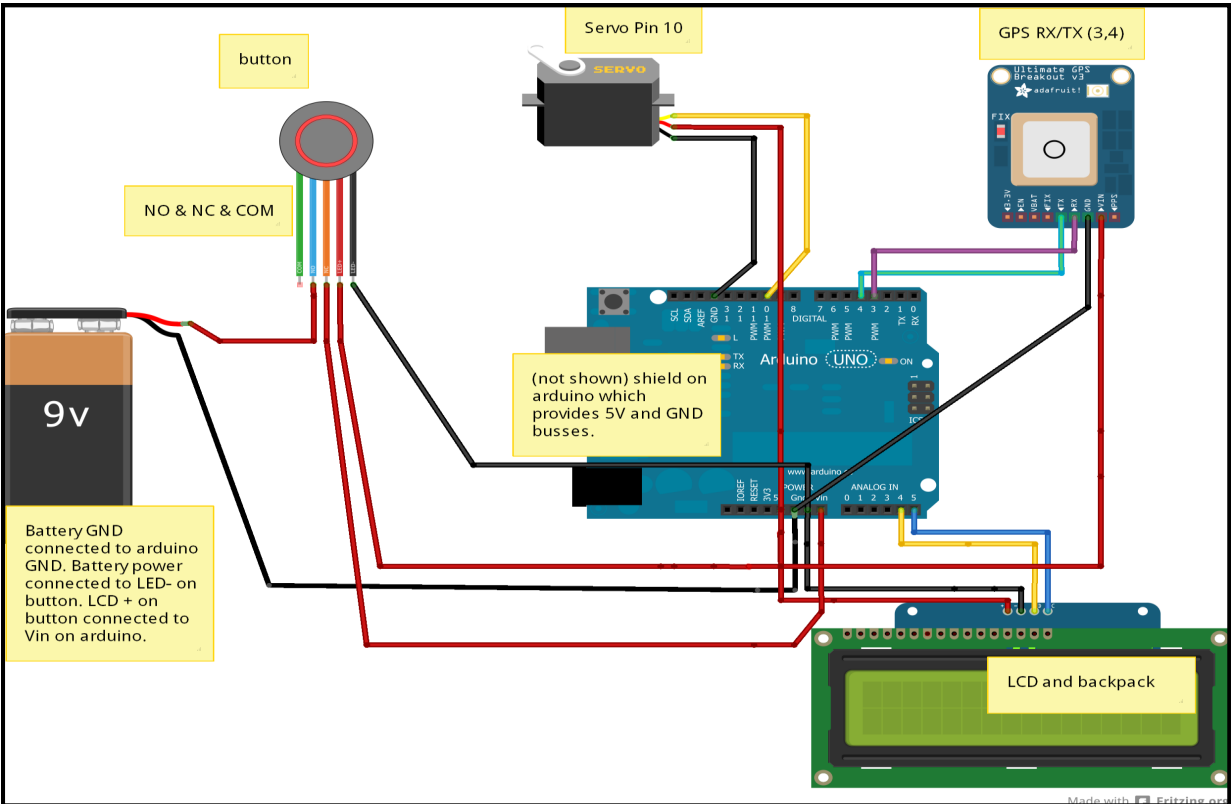
By:Tanya Glushkova

This semester I created my very own geocache box. This project is a great way to get acquainted with the Arduino platform, and learn the crucial basics necessary to work with the Arduino.

For those unfamiliar with the concept, the idea behind a geocache box is that the box is programmed to open only at a certain location. The user would have to stand still in a certain location, and turn on the box. After getting a sufficient GPS signal, the LCD would tell the user how far away (in meters) he/she is from the specified location. The user must then travel to a different point and repeat the process. Eventually, when the user is within a certain radius of the specified location, the box will open.

The wiring inside the box looks a little messy, however the diagram at the right shows the components of the box and how they were connected to the Arduino Uno. Here are some of the ones worth mentioning:

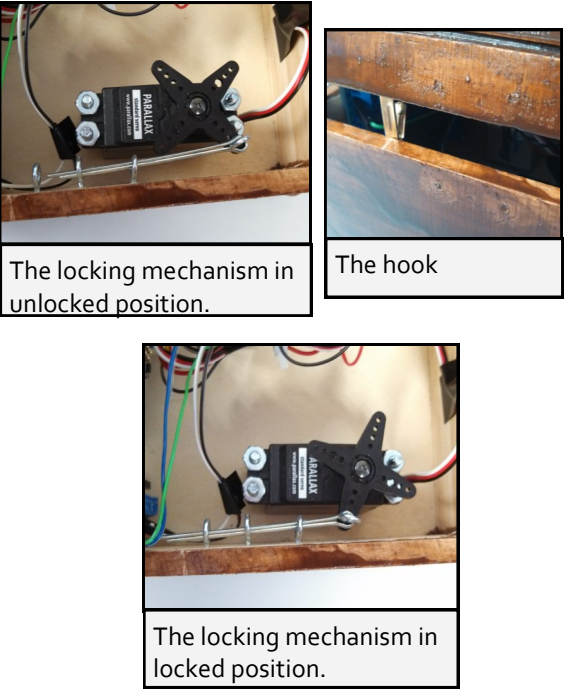
- The button: powers the entire circuit.
- The battery: one end is wired to ground on the Uno, the other to the button, which then connects to the special Vin (“voltage in”)



- The GPS receiver, which is probably the most important part of the project, as the Uno was programmed to obtain Longitude and Latitude from this device and relay the location to the user.
- The LCD, which is where distances are displayed for the user.
- The servo, which is the locking mechanism behind the box. When the servo motor turns, the metal rod attached to it slides into the hook and locked the lid. When user arrives the correct destination, the servo was programmed to unlock automatically.

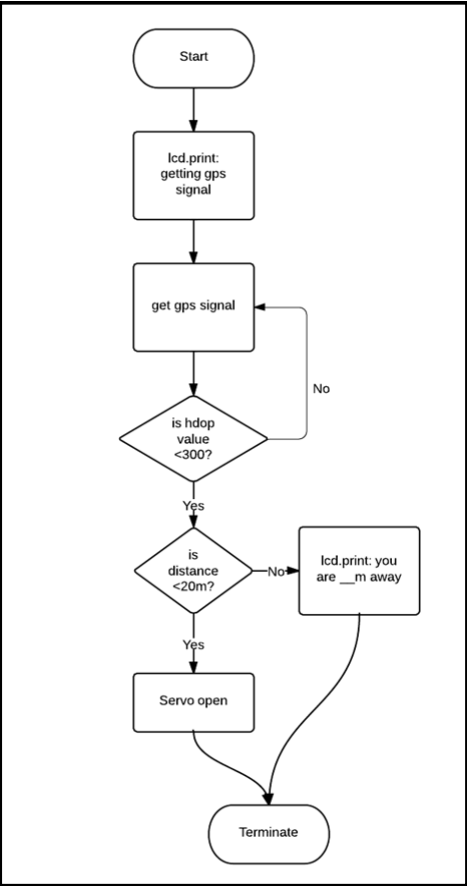
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To write the program I used the Arduino software. The program could be written entirely in setup(). A flowchart for this program is shown below.

An important aspect of this program was the parsing of the feedback given by the GPS. Any GPS is actually capable of sending back several statements or “sentences” to the user, which consist of many numbers and letters. For example the sentence that I was most concerned with the GPGGA which gave me , among other information, the longitude and latitude , the number of satellites being used,

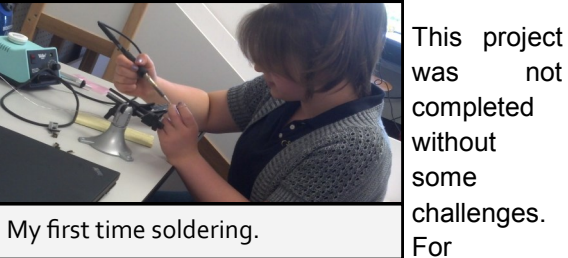


and the HDOP value. HDOP stands for “horizontal dilution of position”. A complicated algorithm is used to calculate this value, but essentially it is a measure of how accurate the signal I am receiving is. I needed this in order to ensure that the distances that the user would be seeing displayed on the LCD were in fact correct.

Now the trouble with getting this information is that the GPS sends back a slew of many sentences (not just GPGGA) which contain multiple elements within them. Searching for the one HDOP value that I need among all this information is difficult. Luckily, a function called TinyGPS exists. It parses the GPS data for me and makes it easy to find the value I need.

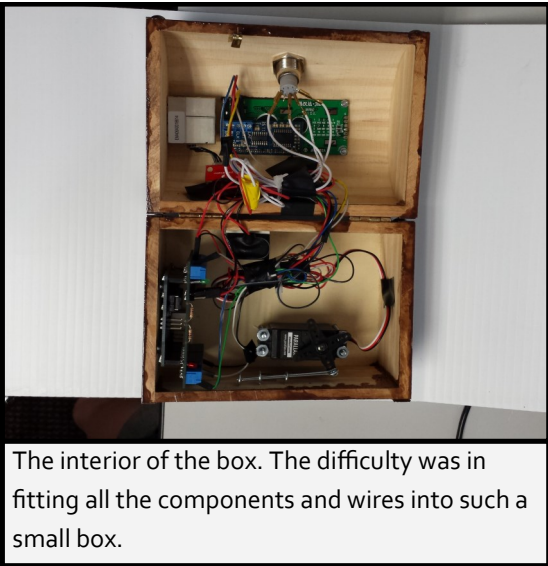
Before getting any of this information I had chosen a location using Google Maps that was

nearby the Storming Robots center. I got the coordinates for this location also from Google and allowed a 20m radius. The TinyGPS function also gives me a value for a distance from my current location to one that I specified through the coordinates. It was this distance that is displayed to the user. When this distance value is less than 20 meters, then the servo will turn and unlock the box. I wrote “lock” and “unlock” functions for the servo, and simply called them at the necessary points in the code.

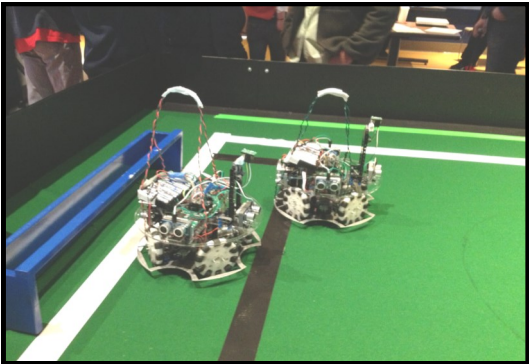


instance, we short circuited the LCD after soldering some wires together, and had to debug the issue, eventually replacing the LCD. After rounds of testing, the box was finally working properly.

This project is an amazing way to get acquainted with the Arduino. I learned about so many different aspects of building and programming and it was a lot of fun!



◀ Continued from Page 1



RoboSoccer Bot — Arduino Platform

Hats off to all our teams who have demonstrated impressive dedication and perseverance in doing their best in challenging themselves. What set our teams apart from many others was that throughout the six hour competition process, they were completely on their own. They had to make strategic and technical decision to continuously improve themselves. Storming Robots is extremely proud to have claimed some of the top honors at the competition including:

- Soccer Primary 1st place: the Dimensions
- Rescue B Secondary 1st place: SR-Chitects
- Rescue B Secondary 3rd place: RoboSapiens

- Rescue A primary 1st place: Seedz
- Rescue A primary 2nd place: Shimizumo and Chitty Chitty Bot Bot tied (ShimiZumo wins by the consistency)
- Rescue A primary 3rd place: Horatii

All teams which won first place will be invited to compete at the 2013 World Competition held in the city of Eindhoven in the Netherlands between June 24th and July 1st, 2013. At the World Tournament, they will have the opportunity to interface with hundreds of research scientists and engineers from around the world, and watch their amazing robotics apparatuses in action.



Members of Horatii prepping for competition. From left to right: William Cui, Bhavik Shah. Not pictured: Ashley Yang

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Many thanks to the parents for their support and all the late night chauffeuring of their children to the center for practice.

A listing of all the Storming Robots teams and members can be found below .

3-Amigos/ RescueA—Primary	Alexander Lisenko Aaron Fan Aditya Jain
Chitty Chitty BotBot / RescueA—Primary	Vishnu Pathmanaban and Hugh Zhang
Dimensions/ Soccer—Secondary	Luke Dai, and Vadym Glushkov
Horatii / RescueA—Primary	Ashley Yang, Bhavik Shah and William Cui
Methodology Madness / RescueA—Primary	Daniel Carroll, Andrew Krapivin, Luke Bernick, Ryan Betz
MooTurtles / RescueA—Primary	Brandon Tang, Jesse Cross, Tanav Suman
Robosapiens / Rescue B—Secondary	Siddharth Kurella and Abhishek Kalita
Seedz / RescueA—Primary	Sean Doran, Neelay Trivedi and Yuwen Zhang
ShimoZumo / RescueA-Primary	Joseph Chen and Wilson Liou
SR-chitects / Rescue B – Secondary	Michael Xie, Andre Gou, Andrew Amerman and Salil Patharetook
TechKnolwedgers / RescueA-Primary	Prateek Humane, Nikolaj Folmer, Rishab Bhatt
The Baryons Team / RescueB—Secondary	Brady Bean, Steven Lee
The Red Steaming Robots Dragons / RescueA—Primary	John Kapustka, Shanmukha Akkapeddi, Vishwa Arasappan
Visionaries / RoboDance—Primary	Brenna Herryty and Colleen McConnell
#Yolo / RescueA—Primary	Alexander Staff, Steven Chen, Tian Jin

Interview with RCJ
Contestant: Vadym Glushkov
representing The Dimensions

By: Tanya Glushkova

Q: How have you been preparing for the international competition?

A: At regionals we had a slight malfunction with the motors on our robot,. We modified our robot to be stronger and more durable. We also edited our code to match the necessary requirements for the competition and to make our old one better.

Q: How much work would you say went into the project all together?

A: We have been working for the lasst nine months to create an awesome robot. For last year's competition we used a strictly NXT platform. This year our goal was to use the Arduino platform. This gives our robot an edge, but also required a lot more time. We work every week for at least seven hours. As the competition date approaches we have been putting in ten hours a week.

Q: What is your favorite part of working on this project?

A: The learning experience. I have learned so much about programming and building during this project. It was difficult at times, but I am so glad that we never gave up. I enjoyed working on this project and finally seeing the project at work. I am very excited for the competition.

Cool Science...

SpaceX Launches and
Receives Rockets

By: Nikhil Shah

Space travel has been an important part of scientific achievement in recent decades. NASA, the government agency that is in charge of space exploration has accomplished tasks since its creation, including playing a pivotal role in the International Space Station. Recently, due to funding issues, NASA has decided not to use its own rockets to send supplies to the International Space Station.

According to The Guardian, in lieu of this it decided to pay SpaceX, a private company, \$1.6 billion to resupply the station twelve times., on March 26, 2013, The Dragon capsule that sent supplies to the station returned back on Earth. The capsule arrived safely and reached the station located 250 miles from the ground.

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The Guardian reported that the capsule brought back over 2,668 pounds of old equipment from the station. The capsule brought down samples and data from experiments conducted in the station.

The Guardian also reported that there are other groups that send supplies to the station, SpaceX's capsule is the only one that can send the supplies back down to Earth's surface.



The launch
Source: forbes.com

SpaceX has other ambitions than sending capsules to the International Space Station. Forbes has reported that SpaceX ran a test flight of its Grasshopper rocket on March 11, 2013. The Rocket was designed to travel vertically and land back on ground. It was used as a reusable rocket. This means that instead of the engine burning up or being unusable, the rocket can be launched multiple times. The rocket rose 24 stories in this test flight, which was double the height it received in previous ones.

The History of Inoculation and Vaccination

By Umar Ahmed Badami



Have you ever wondered what's inside your vaccine? And what is "inoculation"? In this essay, you will get answers to all your questions about inoculation and vaccination.

Part I: History of Inoculation

If you are thinking that inoculation is the same as vaccination, you're wrong. In the 8th century, a physician named Madhav Malik wrote a book of diseases called the Nidana, which mentioned a disease called smallpox. In the 9th century, Arab physician Al Razi became the first physician to distinguish smallpox from measles. He wrote "The Book on Smallpox and Measles", which told in detail about these diseases. Smallpox was a dangerous disease, because it was highly contagious, and you could die from it. Using Al Razi's book, research on smallpox cures started in China during the time of the Song Dynasty in the 10th century and went on until the Ming Dynasty in the 14th century. This flow of information during these centuries was enabled by trade routes, especially the Silk Road. In China, research specifically on inoculation methods was done. Smallpox would be taken from the nose of a person who was infected with it, using a cotton plug. The Chinese physicians would put it up a healthy person's nose. That didn't always work, because the smallpox was a live virus and the healthy person could get infected. There was a slim chance of not getting infected. The Chinese improved this procedure in the Qing Dynasty in the 17th century. Then, Turkey took up the research. The Turks used smallpox

pus, with the live virus inside, and injected that into a healthy person. How did they do this? They made special instruments to inject the smallpox pus, like small knives with delicate tips to make an incision in the skin to let the smallpox inside. This led to the future invention of syringes.

In 1718, Lady Mary Montagu, whose husband was Britain's ambassador, went to Turkey to live. She saw Turkish people inoculating themselves with smallpox so that they could be safe from it. Montagu got herself as well as her children inoculated, because there was no inoculation in the West at that time. When she went back home to England, her family was protected from smallpox, but people around her in England were facing a smallpox plague and they were dying. She made a speech in which she told people in the English Parliament about what she saw in Turkey about inoculation and how the Turks saved their people from smallpox. People didn't listen to her because she was a woman and these were Turkish customs, not English. Lady Montagu kept on trying to convince people. We know this because of her writings and letters which still survive today.

Part II: History of Vaccination

Edward Jenner discovered vaccination. He was born on 18th May, 1749. He was an English doctor, father of immunology, and a pioneer in medical science. In his early days as a country doctor, he used to visit patients on his rounds. Some of his patients had smallpox. He began to hear rumors that dairymaids were not getting smallpox. He was interested in this phenomenon. After a lot of research, at age 47, Jenner carried out his most famous experiment on James Phipps, a gardener who was a boy of eight. He had heard of Lady Montagu's trip to Turkey and the inoculation methods there. He decided to improvise on their methods. Jenner took cowpox pus from a dairymaid's sore and put it in James' arm. He got a bit sick with cowpox but soon recovered. Then, Jenner gave James the live smallpox

virus. Amazingly, James didn't get sick at all! Jenner's method of inoculation was different from that of the Turks. He used another illness to cure a disease. Jenner called this method "vaccination". "Vaccina" means cow pox in Latin, and "vaccination" means "cowpox against itself".

Why did James Phipps not get sick? This was because his immune system (the thing that protects you from germs) learned how to fight the cowpox, and that is how it fought the smallpox. Jenner then gave the results to the Royal Society in England, which said that there was not enough proof for Jenner's method to be accepted.

The clergy, which is the Church, said that Jenner should not put cowpox into healthy people, or they would get sick. This did not trouble Jenner. He continued his work and ignored what the clergy said. To get more proof so that his theory could get accepted, Jenner did the same vaccination procedure on other kids, including his 11 month old son. Finally, the results were published, and vaccination was accepted by the West.

Part III: New World Vaccination

Today, at the doctor's office, you can get vaccinations for diseases that are going around or that you need to be protected from. Nowadays, they use syringes instead of olden-day knives and other old tools. We should be glad that many diseases that happened in the past are not in the world today. If we stop vaccinating, the diseases that were in times gone by might come back. So, whenever you get your vaccine, remember the pain and suffering others went through!



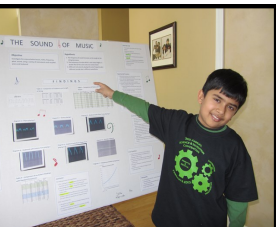
A syringe used for administering vaccinations
Source: horsenation.com

The Sound of Music: A Science Fair Project

By: Shikhar Ahuj

There was an Invention Convention Science Fair in my school in which I participated. I did a project on the science behind music.

I have two guitars, a keyboard and a few other instruments that I used in my project. During my research I came across several hypotheses. To understand them you must acknowledge that music is created from vibrations.



Shikhar proudly displaying his science fair project.

My first hypothesis explains how the frequency of sound increases as the length of the string decreases. The frequency is the number of vibrations in a period of time measured in a unit called hertz. (hz.) This test would have to be preformed on a guitar.

My second hypothesis was that the frequency of a note which is one octave higher (pitch), is double that of the same note one octave lower. The third hypothesis was that



Source: sweetclipart.com

instruments playing the same note (frequency) will have a different sound quality due to the different waveforms produced. A waveform is the shape of the wave from one point in the cycle to another.

I enjoyed sharing my science project on music. I collected readings from the guitars, keyboard, and piano and with the help of software apps on the Ipad, I was able to prove all three of my hypotheses right. I presented my project in school and enjoyed sharing it with my fellow classmates and teachers.

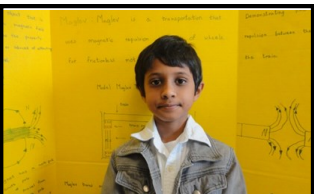


Source: drawing-step.com

Maglev Train

By: Srujan Damaraju

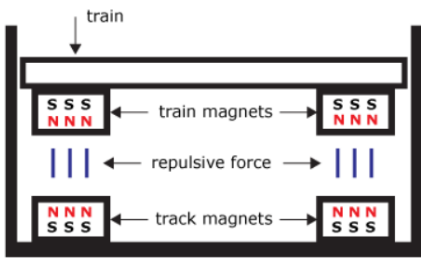
This is a Maglev train model built and demonstrated by Srujan Damaraju in science fair at Maurice Hawk School, Princeton.



Srujan and his project

Maglev is a transportation that uses magnetic repulsion instead of wheels, for frictionless motion. These trains are extremely fast and smooth because of

no friction and also environmentally friendly.



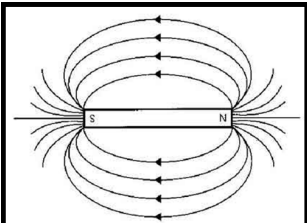
Construction:

The construction is based on a series of magnets placed across tracks and elevated train. The repulsion between like poles elevates the train in air without friction.

Facts about Magnetism:

A magnet is an object that is surrounded by a magnetic field and that has the property either natural or induced of attracting iron or steel.

- 1. Every magnet has a north pole and south pole.
- 2. Magnetic fields travel from north to south pole.
- 3. Opposite poles of magnets attract each other and like poles repel.



A magnet's field lines

Existence of Higgs Boson Confirmed

By: Tanya Glushkova

A particle that scientists believed to be the Higgs Boson was discovered a little while ago, but just recently it was confirmed that the particle was in fact the Higgs Boson that scientists have been looking for ever since Peter Higgs theorized of its existence in 1964. The discovery is a strong contender for the Noble Prize, but more importantly it explains the origins of everything on Earth.

So what is the Higgs Boson? It's a tiny piece of matter that is responsible for the mass of everything on Earth. Remember the universe has more than one type of particle. More specifically sub-atomic particles exist. This is just a fancy way of saying that they are really tiny. However even though they are extremely small, there are still sub-atomic particles that are bigger than others. Scientists have

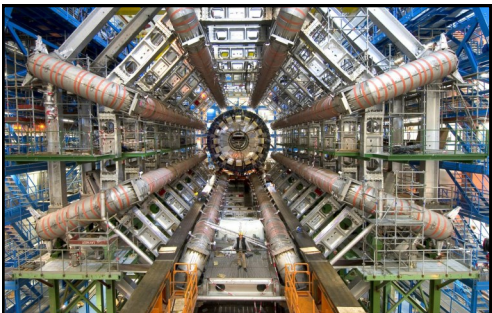
wondered what is it exactly that determines how massive a particle is. What makes some of the particles have more mass than others? The answer is the Higgs Boson.

You've probably heard of the gravitational field, and you know that it is everywhere around us. The Higgs Boson works in the same way. It also has a field, called the Higgs field that is all around us. When sub-atomic particles pass through this field they acquire mass. Big particles, when they pass through the field are slowed down greatly, and therefore have a big mass. The smallest of particles are barely effected by the field because they are so small, and therefore have very little mass.

So then what is the Higgs Boson? It is simply the particle that makes the Higgs field. A good analogy is water. All water is made of tiny molecules of H₂O, just like the Higgs field is made of a lot of Higgs Bosons.

To confirm that the particle exists, scientists at CERN laboratories used the Large

Hadron Collider which cost \$10 billion and runs in a 17-mile underground tunnel on the Swiss-French border. This machine is actually capable of simulating the energy levels of the Earth seconds after the Big Bang. What the machine does is basically make a bunch of particles collide together at very high speeds. As a result of these collisions, scientists were able to isolate the Higgs Boson.



The large hadron collider at CERN used to create the Higgs Boson.
Source: Huffington Post

How the Sundew Can Help Heal Human Wounds

By: Tanya Glushkova



The sundew flower.
Source: photography.nationalgeographic.com/

The Sundew flower is named for its hair-like extensions that contain what looks like a drop of morning dew at the tip. This dew-looking substance is actually adhesive, or sticky, and is meant to attract bugs to the plant. Once the bug lands of this drop of dew, it finds itself stuck on the sticky surface. As it struggles to free itself, the carnivorous plant eats it. Recently, Mingjun Zhang from the University of Tennessee began investigating the adhesive properties of the Sundew, and uncovered revolutionary information that will help to progress emerging fields in science like tissue engineering.

What is tissue engineering and how does it work?

Tissues are part of the human body and they are made up of many cells. In the human body, there are many distinct tissues which contain their own types of cells. For example, muscle tissue is made of muscle cells, just like nerve tissue is made up of nerve cells. When the tissue is damaged severely it becomes very difficult and sometimes impossible for the body to repair it on its own. That is where tissue engineering comes in. Doctors are able to inject healthy cells into the heavily damaged area in hopes that these new cells will integrate into the tissue. If successful, the new cells should repair the injured tissue and restore its function. However, it's not quite that easy.

In order to inject the cells the doctors need a "scaffold" to place them on. This material will

act as support for the new cells inside the body. It will give them a surface to stick to and divide which will help them repair the tissue. Today these "scaffolds" are being made from all sorts of biodegradable material like sponges, meshes, gels and films.

Significance of the Sundew

Scientists are constantly on the lookout for material that may be used as the platform cells. Zhang made the unlikely connection between the flower and the platform. He hypothesized that the tip of the flower ("the dew drop") could be used as a platform for cells. It was sticky and flexible, and allowed cells to attach to the surface and multiply. This discovery could be a breakthrough in the field of tissue engineering.

Tissue engineering is used for medical purposes to treat severe wounds. Sometimes when human tissue becomes injured it can heal on its own, but other times the wound is so severe that doctors must help it heal. Scientists now are experimenting with the implications of the sundew, and they are hopeful that one day this plant can be a simple, accessible alternative for doctors.

DARPA Researches Robot Hands

By: Nikhil Shah

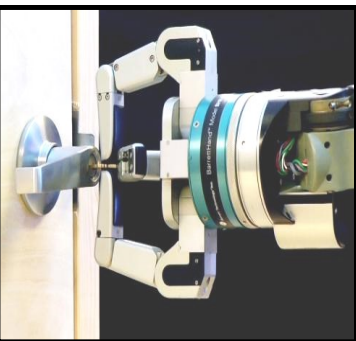


Source: Wikipedia.org

In 1958 the United States formed the Defense Advanced Research Projects Agency, known as DARPA. The goal of this organization was to increase the technological

capabilities of the United States military. Recently, DARPA has taken a leap in robotics technology. DARPA has created robotic hands with dexterity that approaches that of humans, according to the New York Times.

The Verge reported that the robotic hands tested by DARPA have the ability to take a tire off of a car. The New York Times stated that one of the purposes of the program was to make the robots work as prosthetic devices. Current models of these robots have not proliferated because of their high price tag, at about \$10,000 per hand. Additionally, the hands have only been tested and operated in highly specific scenarios.



A robotic hand opening a door with a key.
Source: <http://phys.org>

price has gone down significantly and DARPA thinks that the hands can be produced at under \$3,000 per hand. The government and DARPA have goals for this robotic hand project other than for use as prosthetics. The Verge reported that the future goal is for the robotic hands to locate improvised explosive devices using their sense of touch. Another project funded by DARPA produced robotic fingers that could identify textures more accurately than a human being could.

According to the Times, DARPA hopes the robot could one day open a zippered bag and detect individual objects. Manipulating the devices once identified and grasped is much more challenging. More research needs to be done in this field of research in the 18 months that this project will still be funded. DARPA has also financed other groups to work on projects involving robotic hands. The Times wrote that DARPA funded Johns Hopkins University to connect the robot arms to the brain so that the arms can be controlled by humans. Moreover, DARPA is spending money to finance other institutions that would work on making the robotic hands more inexpensive to produce.

Driverless Car

By: Prateek Huamne

Cars are part of our every day life. Since people drive so much, accidents occur. In the U.S about 115 people die each day in a car accident. Soon that number will decrease tremendously, when driverless cars release to the public.

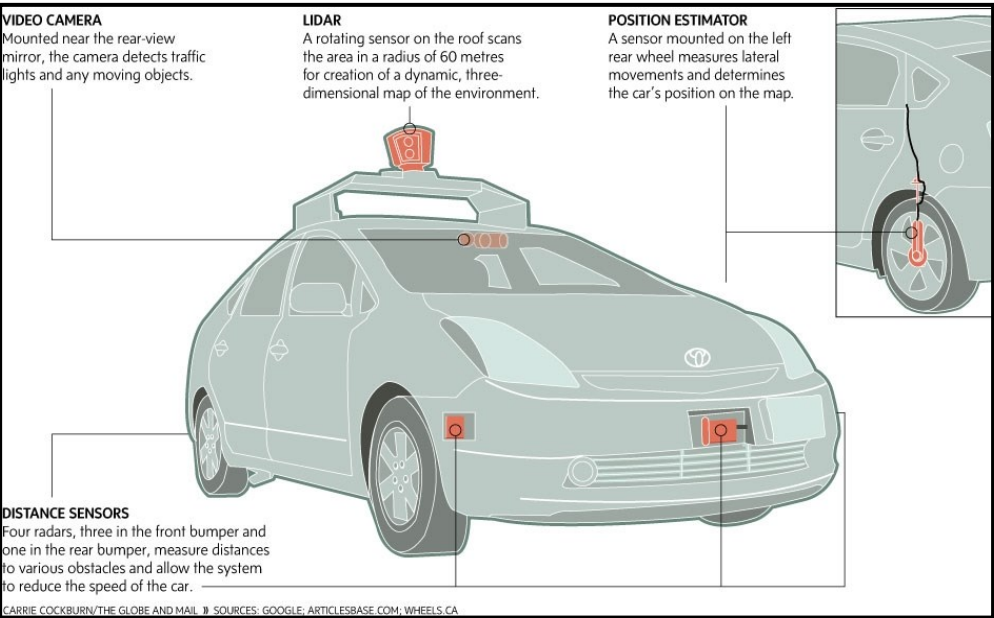
Per Google, a group of people are in the process of putting driverless cars into use. The car that they made uses many different technologies to navigate itself through an every day rout.

A scanner on the top rotates at a fast speed while it uses sixty four lasers to measure the time it takes for a laser to hit and object and bounce back again. By using this information it can tell how far away an object is to avoid hitting it.

The car also uses an encoder to measure the acceleration and rotation of the wheel and it associates that information with its location on the gps to find the cars exact location.

The way the car knows if another car is close is by using the cars distance sensors. When a car or pedestrian is near, the driverless car can sense it and it will yield allowing it to pass.

One other tool the car uses is a video camera. With this it can decipher the difference between something like a pole and a human.



Also it can tell what color a traffic light is.

This new technology makes things much safer. The car will be able to se completely around it at all times, never make a mistake, and can not get distracted. While using this car you can save alot of time.

You will no longer have to park, the car will

drop you off and park itself. The car that was built at Google has been tested on all kinds of roads and never faced a problem. It has been working just like all the other cars on the road. Some states made driverless cars legal, but it is still about five years away from public use.

Fiction...

Vamwolf

By: Umar Ahmed Badami

WARNING: This story is a science horror fiction, so it is highly possible you will get nightmares. If you're scared, don't read it!



Source: blog.spot.com

In a dark, lightning-struck, misty, dark atmosphere lay a castle. Black it was, for its name was Bloodshed Castle, Transylvania. It was home to a scientist by the name of Dr. Hadenns. Away from civilization, in a dark, desolate land, did he not feel lonely? Tis the truth, he felt quite at home with the spirits visiting him. His hobby was making potions, and quite a few had made some disastrous events happen.

One night, one April 23rd, 1801, a spirit happened to call on him. It said,"Look at Halley's Comet, and you will become a horrible beast of such horribleness". Now, the scientist didn't happen to know what a comet is. So, he went out of the castle into the dank, misty night, and looked at the castle. Suddenly, a potion inside the castle started to fizz and bubble very fast, and it made a blue ball come out of it. The blue ball then whizzed out if the castle and then encircled the doctor's head. The doctor started to look at the ball, which now had a tail. The ball hypnotized him and told Dr. Hadenns to jump into the Underworldan Trench which was under the castle. Immediately, he went into the castle to get his needed rest. While he was sleeping, his heart started to transform into that of a werewolf.. Hence, his body turned bloodthirsty and he became a vampire-werewolf, otherwise known as a "Vamwolf".

His fur was impenetrable, not even with a bullet. His strength became stronger than the most powerful thing of our reckoning. His blood was boiling. He became fearless, reckless, daring, unruly and inhumane. He became the fastest thing living on the planet. He then got out of bed and started to dig and dig, until he

reached a long, deep, narrow trench. He kept on going inside until he reached a giant castle. A giant skull with horns was the castle's design. Fires were burning inside, making it a very scary sight to see. When he reached the castle, he jumped onto the top of the skull and howled very loudly. Inside the skull were vampires, werewolves and skeletons in jars. The werewolves howled back, and ran to get atop the skull. Vamwolf flicked them off as if they were flies. The ninjas said, "He is the most powerful out of us all. We should pay our respects to him." They all lined up in battle formation; the vampires with axes, the ninjas with scythes, swords, shurikens and nunchucks, while the werewolves used their abilities. "Under our leader, we are unstoppable!" they cried. They marched out and went through a portal. They finally appeared in the year 3000 A.D.

They were in the castle but it was being destroyed by mechanical shovels! The soldiers of evil (vampires, ninjas, werewolves) went outside to destroy the shovels. People started to flee the area. Just then, the wolves started to breathe lava. It started to ooze along the ground until it reached the water. The lava floated on the water and scorched it. Suddenly, the world burned into flames, while the castle was left untouched. Vamwolf had conquered the human race. He howled triumphantly.

We don't know how, but we do know that the core produces heat, which might heat up the ice underground, which then might make a glacier. We don't know if this is true. But XXXIX is made of rocks. It's volume is of 39 galaxies. The planet's colors are green, blue, and red. It has 2,000,000 storms on it. They blow at 290 Mach per second. XXXIX takes 39 decades to orbit the sun. This is the planet of my dreams.

Murder on the Liverpool Express

By: Umar Ahmed Badami

Reader discretion is advised. Some content is violent



Source: blogspot.com

One dark, misty night in 1832, I happened to call on Sherlock Holmes. He said, "Watson, I have a new case upon my hands. Here is the article," and thrust the paper into my hands. It was about a murder of a Dr. Crialm on the Liverpool Express train, which travels to and from Liverpool. On the train, they found a knife that said L.D. on the hilt. The knife was driven into the back of the doctor. Holmes said, "I'll go to investigate the train. Watson, go and find out who was on the train at the time of the murder. I shall meet you in thirty minutes at the station." We agreed on the meeting place. I went through their ticket list and found out that three people were on the train with Dr.Crialm: Lancen Cravens, Gerden Harker, and Harmen Carrs. Holmes found a window broken on the train. He said it seemed unlikely that someone killed Dr.Crialm from the interior of the train.

The murder was at 9:50 P.M. The train was at Liverpool Station when the doctor was murdered. A person called Lancen Doyne was on the boardwalk. He was supposed to board the train at 9:50 P.M. A passenger said that Doyne took out a knife and threw it before bolting into an alley. Holmes and I had enough evidence. We sought out his house number, 231 Baker St. We went with Inspector Lestrade from Scotland Yard. The house was just behind Scotland Yard. We arrested Doyne after a few minutes. Lestrade found that he was guilty of many crimes, including stealing a diamond ring. After all that, the case is now well rested!

Planet XXXIX

By: Umar Ahmed Badami

XXXIX is the number 39 in Roman numerals. It is also the name of a planet as big as the galaxy. This planet is the shape of the letter "D". It has 39 rings that are in the shape of an "O". It is a three-dimensional

planet. It is just like Earth, only bigger, has rings, is in the shape of a "D" and is 3-dimensional. It also has no atmosphere. Monkeys called Loopa-Dupas live on XXXIX. They don't need atmosphere. So the water and food comes from another source: XXXIX's core.



A representation of what Planet XXXIX would look like.

Source: <http://yano.co.uk>

NQueen Problem

By: Elizabeth Mabrey

Have you ever come across this fun chess problem:

On a 8x8 Chess board with given 8 Queens, you are asked to place all eight Queens on the chess board so that none of them is in captureable position. Most people who know a bit about Chess rules understand that Queen captures pieces in the same row or column, and its diagonal line. To find one or two solutions is not hard. However, how about you are asked all such possible locations? Well, it will take us a while to do so by hand. However, it will be very fast if you write a program to do the search.

The general idea is to place a Queen systematically from the first line to the last. As soon as it fails on a certain row, it will backtrack to the previous step, and try the next possible column.

There are solutions existing for placing *N* queens on an *N* × *N* board for all *N* ≥ 4. When it comes to counting the solutions, they may be either combinatorial (we call it distinct) or unique.

Distinct == all solutions even simply by symmetry operations (rotations and reflections) of the board.

Unique == all solutions are different only by rotating and reflecting one solution, this is considered to be an unique solution.

The following shows two samples:

4 x 4 Board

Try 1

1st

2nd

Fail

Try 2

1st

2nd

3rd

Fail

since these positions are invalid, and all columns in row 2 are consumed, need to restart from row 1

Try 3

redo 1st

2nd

3rd

4th

Solution Found

∴ column = 1/2 of 4, stops!

∴ There are distinct solutions.

As you see, they not unique. So, there are 2 "Distinct" solutions.

There is only 1 "Unique" solution in 4x4 board.

5 x 5 Board

Try 1

1st

2nd

3rd

4th

5th

Solution Found

Note: make 90° turns...

Ultimately, four 90° rotational positions.

+ 4 (one reflection from each of these 4 positions)

+ 4 from their reflections.

You get 8 distinct solutions but only one unique from this setup

Try 2

Solution Found.

+ 1 distinct position from its reflection

∴ You get 2 distinct solutions but only one unique from this setup

∴ There are 10 distinct solutions but 2 unique solutions in 5x5 board.

Continued to Below ►

◀ Continued from Above

The idea of the algorithm is : Recursion & Backtracking. Sample recursive algorithm for Nqueen problem is:

- 1.For each row, place at the first 'valid' column
- 2.Continue to the next row if current placement succeeds.
- 3.If no valid column is found on the current row, back to the previous row.
- 4.Repeat 1 to 3 until the last row is reached.

The display on the right demonstrates the pseudo-code for this recursive algorithm.

This is one of the typical puzzle programs given in college Computer Science/Engineering course work — disciplines needed in artificial intelligence realm. This practice covers mathematical algorithm, software structure design, and algorithm design.

Now, just to obtain the correct solutions has still yet reached the main goal of this algorithm. The goal of this is to optimize it in order to gain high performance.

Although it is only introduced in higher college level, two students in our "Algorithm/C" group have already accomplished writing this algorithm. One wrote this without optimization but just using Brute Force Recursion. One of them even continued to work on the optimization in order to submit his solving to the USACO—United States of America Computing Olympiad, a highly regarded computer science competition.

The ones without optimization attempted to

Sample pseudo code for the Nqueen recursive algorithm:

Function determineRow (current row #)

```
for each row
if row > dimension we found a solution!
++ solution count
return; // successful
for each column up to max. dimension
if this is a 'legal' pos ( can be optimized )
move Q to this row and col,
i.e. save the column #in the Queens' roow
recursive call determineRow (row# + 1)
Remove Q from the current row & col
// if it ever gets here, it means failing to find a
// 'legal' pos at the current row
```

generate for 14x14 board: (on a 1.3GHZ desktop). Unfortunately, he waited for more than an hour, it still was running. Then, one student continued to work on the optimization with just Backtracking Recursive algorithm, it sped up graciously and took more than approx. 6 minutes to finish. After that, more optimization was applied, including systemic search and utilizing more compact data structure, it took about 3 seconds to generate 365,596 distinct solutions for 14x14 board. It took about 45 minutes to complete 666,090,624 solutions for 18x18 board.

What is the application of this algorithm?

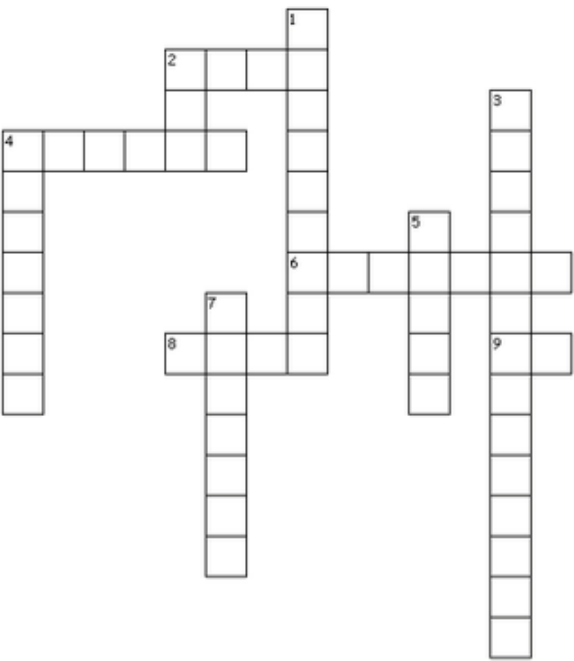
Well, in and of itself, the N queens problem is not important. However, the problem serves an excellent exercise to learn about optimization. The crucial key is "how fast" can

the algorithm generate the correct result. Techniques used to speed this up can be used in many areas in artificial intelligence realm, such as chess-playing program or a path-finding algorithm.



Programming Puzzle

by Nikhil Shah



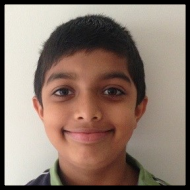
- Across
- 2. This equals to 8 bits.
 - 4. An interactive Development Environment for NXT controller.
 - 6. This is a data type which may contain sizes ranging from 1 byte to 4 bytes.
 - 8. Another word for a program.
 - 9. A key word used in a conditional statement.

- Down
- 1. A programming function calling itself.
 - 2. The smallest data unit size stored in computer
 - 3. The university that produced RoboC
 - 4. If you started at Storming Robots since Elementary school, you probably used this before RobotC.
 - 5. You do this if your program is not functioning as expected.
 - 6. A data type that allows only 2 values.

RoboLab, Byte, RobotC, Integer, Code, Recursive, Bit, Carnegie Mellon, Debug, Boolean, If

Words Bank:

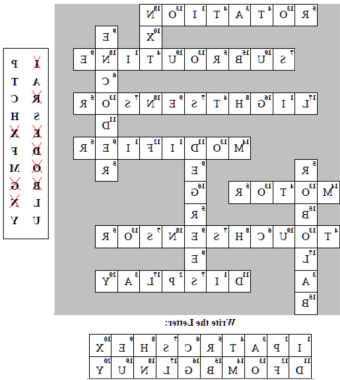
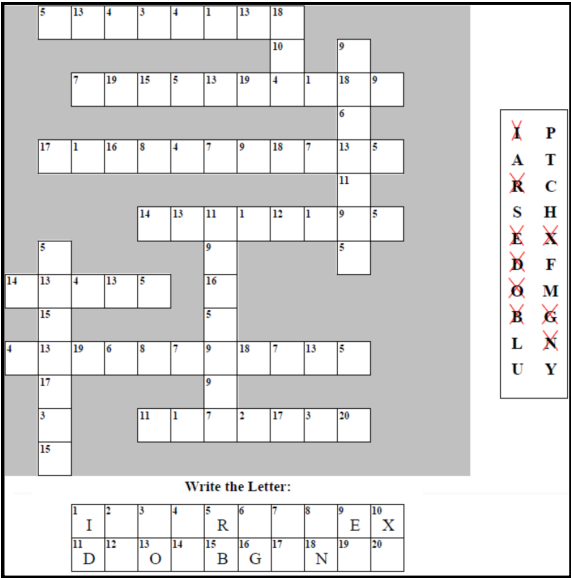
Word Puzzle by Aneesh Durai



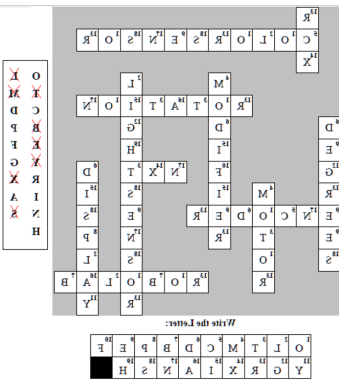
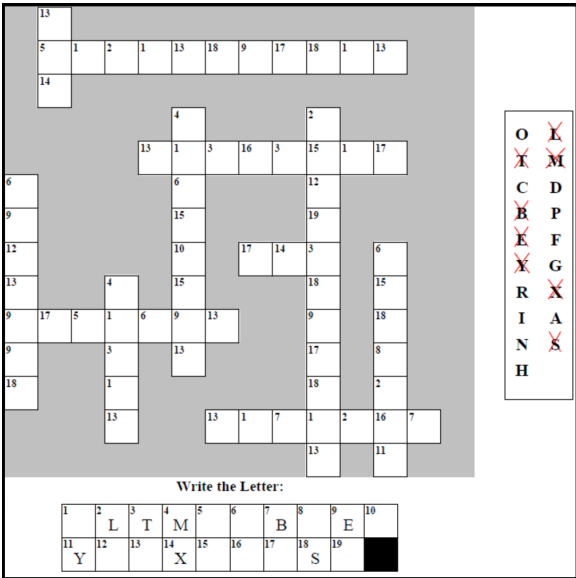
Oh, no! Letters have been changed to numbers. Please change the numbers back to letters.

NOTE: Answers key below. Do not look at the answer key before you solve these puzzles though!

puzzle_1:



puzzle_2:



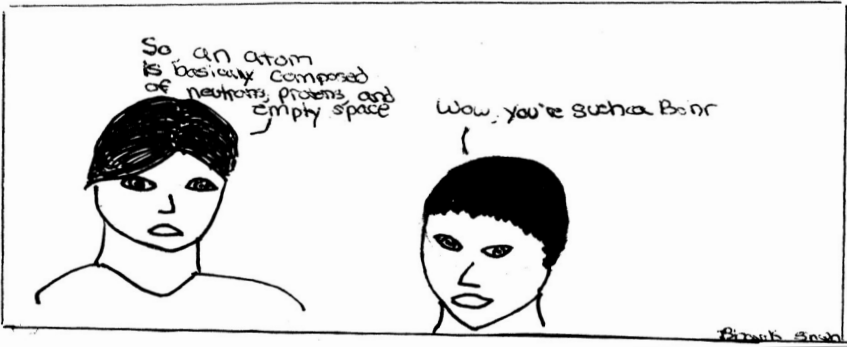
I use eHelpers.com to generate these puzzles. You will find a lot of educational resources on this site.

Happening...

Roboclub Program:	http://roboclub.stormingrobots.com Renewal for returning students starts on June 15th. Registration for new students starts on August 1st. IMPORTANT: No automatic renewal. Confirmation to the administrator's renewal email is required.
Summer Program:	http://summer.stormingrobots.com New: Weekly Analytical Math Camp (American Math Contests 8 Level) Weekly Mechanical Building (focus on functionalities)
Twitter:	http://www.twitter.com/stormingrobots
Fall Event:	2013 MIT/NASA ZeroRobotics. Sept-20 to 22: Special Demonstration at MakerFaire / NY
Nov 8th:	Special Workshop on the NJEA School Day off
Nov 27– Dec 1:	Thanksgiving Holiday. Center Closed.
Nov 1:	Renewal for 2014 Winter Term Roboclub starts.
Dec 1:	New students registration for 2014 Winter Term Roboclub starts.
Dec 10:	Articles due for the 2013 Newspaper issue VI.
Dec 15:	Last Day of 2013 Fall Term of Roboclub
Dec 24-28:	Center closed.
Jan 4:	2013 Winter Term starts. (End on March 17th.)
Feb. 13-17th	Spring Break. Center Closed.
April	RobocupJunior Tournament. Date pending.
April 15th:	Articles due for the 2013 Newspaper issue VII.



Comic by Bhavik Shah



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