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Prefair Report

2301   **Stepan Samuleev**

Div/Cat   **Computing and Engineering / Junior**

Title: **Windmills: complicating energy**

Summary: In my project I will be testing different types of windmill designs .
windmills always fascinated me. from how they work, to how loud they are. sadly I could never afford to buy a real windmill, so I decided to make this project . I started off with a ABS pipe and cut it to scale. I then took another pipe and cut it into blades. I then used a Dollorama "build a windmill" and scraped everything but the small electric generator in the kit.
I built it all and I got a windmill . I used the Siemens mark II for scale. that type of windmills are the ones that are on Wolfe island. The scale i'm using is 1:135. In my testes i'll we testing different blade angles, air direction and Adding a ring around the blades. Apparently, by adding a ring around a windmill the power production increases 3 times! I will be using a standard round fan to disperse the air evenly. The gearbox ratio is 1:6, and I will use a multi meter to see how much electricity is made. I will have the air- flow come from the same location every time.

- Stepan

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Prefair Report

2302   Yehia Noureldin, Rio Takeuchi

Div/Cat   <u>Computing and Engineering / Junior</u>

Title: <u>Who's Driving? Computers!</u>

Summary: The Canadian Transportation Safety Board estimates that there are approximately 160,000 car crashes occurring annually in Canada. High speed impaired driving and distracted driving are the leading causes of these accidents. Fortunately, autonomous cars have the potential to create a significant decrease in these car crashes. This is because the cars would regulate their speed, act systematically, and react quickly, safely, and harmoniously among other autonomous cars. These cars can work efficiently without tiring, but substituting a human with robots is so difficult that extensive safety measures are required.

The purpose of this project is to examine how infrared and ultrasonic sensors can improve the performance of future autonomous vehicles and robots to avoid obstacles and follow an established track. We will compare the performance of the two sensors by consistency, accuracy and sensitivity to different factors. These factors include high temperature, ambient light, interfering sound, and different types of objects.

To operate the sensors we used an Arduino, a printed circuit board capable of managing electrical components such as these sensors. An Arduino will function according to programming input, but instead of simply having the Arduino take one reading, we programmed it to take 1,000 readings per second, and calculate the average of their values. The Arduino will send this as readable data via an attached USB cable. The Arduino board will control the attached motors according to the readings of the sensors.

The ultrasonic sensor works by emitting an ultrasonic wave that will reverberate off an obstacle and back to the sensor. The infrared sensor works in the same manner but emits infrared light instead of ultrasonic waves. The distance of an obstacle is determined by the time it takes for the sensors emissions to come back to the sensor.

Generally, both sensors performed quite well, but under certain conditions, they had severe errors. Notably, ultrasonic readings were disastrous when exposed to high temperature. This is likely because sound waves travel faster through high temperatures. Due to this, the ultrasonic interpreted the obstacle to be closer, and therefore gave inaccurate readings. Conversely, infrared was greatly affected by the colour, transparency, and type of object as well as low temperature. Particularly, black colours seem to have a greater impact on the sensor, but also by spherical objects. The ultrasonic sensor performed unusually well when we used a metal object as the obstacle. We believe that this is because hard, smooth materials such as metal are better at echoing sounds than softer ones. But, the use of sound waves can potentially be interfered by other sound waves, particularly of the same frequency. When we placed a second ultrasonic sensor near the sensor, it experienced changes in consistency and a decrease in accuracy.

In conclusion, we think that ultrasonic is mainly affected by environmental factors, whereas infrared is affected by the type of object. Future autonomous cars can apply this knowledge to avoid using certain sensors when a particular factor is detected.

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Prefair Report

2303   **Samuel Girard**

Div/Cat   <u>**Computing and Engineering / Junior**</u>

Title: <u>**Spoiler Alert: How Downforce Works And What it is!**</u>

Summary: My project, called Spoiler Alert: How Downforce works and what it is explains the effect of downforce and how it works in high performance cars. Downforce is usually used in designing and racing high performance cars and bikes. I hope to demonstrate that the more aerodynamic features such as spoilers, splitters, defusers and canards/diveplanes that a car has, and its body style, such as coupes, sedans, and targas can increase downforce resulting in better speed, handling, and fuel economics. I will be using a wind fan, weight scale and model spoiler to demonstrate my hypothesis which is how the angle, height, and shape of the wing will create more downforce, resulting in the car being pushed down, which creates more tire grip on the road. I will also discuss the benefits of spoilers that deploy from the car versus fixed in place. I will also present on the affects of different materials in automotive design, such as carbon fibre vs kevlar and how they can affect downforce. I will be demonstrating how the design of different models of cars (Mclaren Senna, Porsche 911 GT2 RS, Ford GT supercar and Corvette ZR1) use downforce to give each one an advantage in racing.

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Prefair Report

2304   **Noah Caldas**

Div/Cat   **Computing and Engineering / Junior**

Title: **Hydro turbine designs**

Summary: I believe that my generation will play a key role in the future of renewable energy. Generating electricity from water power is the largest source of renewable energy in the world today, and it continues to be the most reliable and cost effective way to generate electrical power. Why not look into the best design for our future now?

The purpose of my project is to test different hydro turbine designs to determine the most efficient design that produces more electricity based on the same flow of water. The independent variables are the different turbines: Francis, Pelton, Kaplan and Crossflow. The dependent variable is the energy produced, which will be measured in volts using a multi meter box.

The experiment will most likely show that certain hydro turbines are definitely more efficient than others. Based on the background research it is predicted that when testing hydro turbines with the same small scale head of water and water flow, the Kaplan hydro turbine will probably be the most efficient in creating electricity because it has the least amount of friction turbulence when the water hits the blades.

In order to conduct this experiment, the different turbines were built out of tin can. For consistency, their sizes were similar. Flow of water was calculated with the use of a 20L pail container. Using a shower head, four different levels of discharge were used and flow was calculated based on the dimensions of the pail. This calculation was done by using the formula: Flow= Volume/Time. A specific height of water was marked inside the pail (2 cm), the diamater of the pail was measured, divided by 2 and the surface area was calculated. (surface are = π x r^2). Next, the volume was calculated (Volume= Surface Area x Height), which allowed flow to be determined. Once the calculations were complete for flow, the experiment was set up by attaching hoses to the 20L pail. Holes were drilled on the pail in order to install water plastic tap. The turbines were placed in their proper axis made up of a long wooden stick, which was attached to the pail. The only turbine that was submerged in water and therefore placed in a plastic bottle with water was the Kaplan. The axis had a small generator attached to it, which was connected to a small wire to be able to measure voltage using a multi-meter box. Once turbines were set in place, and the water was running, a table was prepared logging the turbines, flow, voltage and increase in flow and efficiency.

Four different flow intensities were measured and applied to each hydro turbine: 0.1, 0.16, 0.18, and 0.21 (L/s). All four hydro turbines selected functioned as meant: energy was converted into electricity. The results showed that as predicted in the hypothesis, based on the flows applied to each turbine, the Kaplan turbine produces the most energy overall (3.06 V). The Kaplan turbines spinned so fast! It held the least amount of friction turbulence.

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Prefair Report

2305   **Luca Menard**

Div/Cat   **Computing and Engineering / Junior**

Title: **Harnessing Nature's Power**

Summary: Wind is one of the few renewable resources. Wind turbines harness wind to generate energy. Nature has evolved optimal designs through millions of years of trial and error. It may be possible to use designs found in nature to improve wind turbine performance. The purpose of my project is to design and produce nature inspired wind turbine blades, and to measure their performance.

I designed three different blades inspired by nature. I hypothesized the whale fin tubercle blade design will produce the most energy at high wind speeds, because the tubercles reduce drag and increase lift. I hypothesized the dragonfly blade will produce the next most energy because the flexibility of the design allows it to adjust to the non-laminar nature of the wind, reducing drag and fatigue. Finally, I hypothesized the maple key will perform best at low wind speeds, due to the fact that they start rotating at low speeds when dropped from a tree. I tested them against each other and against a constant, which was a scaled down version of a real commercial wind turbine design.

Using CAD software, turbine blades were designed to resemble a maple key, a whale fin tubercle and a dragonfly wing (in both rigid and flexible material). The blades were printed using a SLA resin 3D printer. A standard commercial blade was also produced. Performance was measured using dynamo voltage output in a wind tunnel. Performance was evaluated at various angles of attack, and wind speeds.

The flexible version of the dragonfly blade design performed best at all wind speeds. All other design performance was inferior to the commercial blade. Performance of all blades increased with increased angle of attack.

My experiment demonstrates that nature inspired inventions can outperform conventional commercial designs. After all, evolution has had millions of years of trial and error to work it out.

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Prefair Report

2306   **Christine Li**

Div/Cat   <u>**Computing and Engineering / Junior**</u>

Title: <u>**Designing an Energy Harvesting Chair**</u>

Summary: The purpose of this project is to design a chair that can generate electricity when used. Sitting is a daily human activity that transfers energy to a seat, which can be harvested. Inventions that capture human energy have intrigued scientists for years. Such devices include hand-crank flashlights and pedal generators. A problem with these devices is that they cost metabolic energy to work, and metabolic energy is extremely inefficient. However, the force applied to a seat when sitting is a result of gravity on the body so no active movement is required from the body, thus eliminating metabolic cost.

Design
When a load (human weight) is applied to the chair, the force makes the seat to move down vertically. A rack and pinion gear set is used to convert this linear motion into rotary motion. The rack gear moves down with the seat, making the stationary pinion gear turn. Then, the pinion gear drives the gearbox, which runs an electric generator. Generators require high RPM to function, which is why the gearbox is needed. The gearbox has a high gear ratio to increase RPM from the rack and pinion gears.
        The mechanisms described above are mounted underneath an office chair that has adjustable height. The rack gear moves vertically with the chair seat. Using the built-in gas spring, the chair moves down when a load is applied. Once the load is removed, the gas spring returns to the chair to its original position. The gearbox in this prototype is done with Lego due to material limits. This project is focused on the design and function of the mechanism, rather than the materials used.

Observations
        One concern is that the gear ratio may be too high, which decreases torque to the point that a generator would not turn. At this time, stronger forces have not been tested, but that problem could be solved by increasing the load to increase torque. However, plastic Lego gear shafts have difficulty transmitting high torque, so the gear ratio may need to be lowered for this prototype.

Conclusions
It is capable of generating small amounts of electricity (measured with a multimeter) when a load is applied to the chair. The model that was constructed is not the most efficient one, so more carefully constructed prototypes would likely yield better results. Further testing is required for more solid conclusions.

Applications
There is a potential for designs like this to be used in daily situations. To maximize electric output, the seat would have to be frequently used. A city bus where many people regularly sit is an example of a possible application. However, considering the small energy output compared to the cost of construction, the payback for this device would be an extremely long time, rendering it useless. In the scientific and engineering world, the idea of harvesting energy from passive activities like sitting instead of active activities such as walking has the potential for more innovations.

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Prefair Report

2307   **Josh Nicholls**

Div/Cat   **Computing and Engineering / Junior**

Title: **Car Culture**

Summary: My project is about car culture. I will make a mini-documentary along with the required stuff on the board. I will be trying to answer a few questions such as what is it, why do we like cars so much, what is community start, where are the car girls, our population is dwindling why, how to fix the increasingly low population of car enthusiasts, how do non-enthusiasts see it, how does the media portray car culture and how is car culture different or the same in other countries. I will be interviewing several people. By the end of the project, I hope to have an answer to my questions. During the interviews i will be asking questions like why/how did you get into cars, why don't you like cars, would you like to learn more about cars, what was car culture like in that country, how much do you know about cars, why do you thinks so many other people don't like cars and why do you think female car enthusiasts are so rare. I am not sure how many people I will interview or who I will interview but I will figure that out. This is a study project.

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Prefair Report

2308   **Anna Lamarche**

Div/Cat   **Computing and Engineering / Junior**

Title: **Ventilateur Magnétique**

Summary: "Rapport de prototype - Ventilateur Magnétique

Pour mon projet de la foire de sciences, j'ai fait un ventilateur magnétique, donc qui fonctionne grâce à des aimants. Le problème que j'avais que je voulais résoudre est le montant de ressources et d'énergie que prennent les climatiseurs en créant un ventilateur qui fonctionne presque sans énergie.Ce que je voulais qu'il fasse était que quand je donnais une poussée à une des pales, il commence à tourner et n'arrête pas de tourner pour au moins un bout de temps. Pour mon premier prototype, il n'a pas fonctionné parce que quand je tournais le ventilateur (qui avait des aimants au bout des pales et un aimant dans la base) il n'a pas fonctionné parce que même si l'aimant dans la base attirait un des aimants dans les pales, il n'y avait rien pour repousser cette pâle là après et en attirer une autre. Alors j'ai eu l'idée de mettre deux roues, une petite en dessous et une grande au-dessus. il y aurait des aimants à la base des pales et un aimant au milieux de la petite roue. la petite roue serait trois fois plus petite que la grande roue. quand je ferais tourner la petite roue, qui ferait tourner la grande roue, l'aimant dans la petite roue tournerait pour qu'elle attire en premier un aimant, puis le repousse. Nous n'avons pas actuellement construit ce prototype, mais j'ai décidé de faire deux aimants au lieu d'un dans la petite roue avec des pôles opposés côte à côte. Ensuite, j'ai eu l'idée de mettre du tape à haute friction sur les roues pour que quand la grande roue tourne, la petite roue tourne aussi. "

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Prefair Report

2309   **Anthony D`Alessio**

Div/Cat   **Computing and Engineering / Junior**

Title: **Tesla Coil**

Summary: "Tesla Coil

Question: Comment le Tesla Coil affecte-t-il l'ampoule et peut améliorer la technologie?

Hypothèse: Je crois que l'ampoule s'allume à cause que l'aluminium rayonne de l'électricité. Le Tesla peut améliorer la technologie parce que ça pourrait mettre de l'électricité partout ou tu vas ex: il a un tesla sur ta maison qui créerait un dôme d'électricité qui allume tes ampoules,charge ton téléphone et remplace les batteries dans tes jouets ou outils électriques. Il pourrait aussi avoir de géant Tesla dans chaque ville comme le Wardenclyffe qui chargerais chaque voiture électrique et les établissements alentour.

But de mon projet: Je voulais mieux comprendre cette technologie. Je voulais aussi prouver que je pouvais faire un Tesla Coil.

Démarche:
Couper un tuyau PVC à une longueur minimum 16 centimètres.

2. Colle un bout de ficelle au bout du tuyau et commence à tourner le 26 AWG (American Wire Gauge) Magnet Wire à l'entour du tuyau et colle le à l'autre bout, colle la bobine sur ta base. (Garder du câble libre sur les deux bouts)

3. Colle ton TIP31C Transistor sur ta base.

4. Colle ton Interrupteur sur ta base.

5. Colle ton 9 volts batterie terminale sur ta base.

6. Attache ton câble rouge du Terminal à l'interrupteur. Le long câble noir à un plus petit câble noir attacher à la plus longue tige de la lumière L.E.D. (Light Emitting Diode) Et un petit câble rouge sur la plus courte tige de la lumière L.E.D.

7. Enroule ta bobine rouge primaire à l'entour de la bobine secondaire et attache un bout de la bobine rouge à l'interrupteur.(Met ta batterie si tu veux sur le terminal)

8. Connecte l'autre bout de ta bobine primaire avec la tige au centre du Transistor. Au même bout de l'interrupteur avec la bobine primaire, connecte un autre petit câble rouge entre ton interrupteur et ton 29k resistor.

9. Connect ton cable rouge de la lumière et le câble de la bobine secondaire ensemble.

10. Connecte ton Transistor et tout qui est attachée sur la tige du gauche du Transistor, et ton câble noir du Terminal et tout ce qui est attaché sur la tige de la droite du Transistor.

11. Prend une balle légère de plastique et entour la d'aluminium.

12. Attache le bout de câble du haut de la bobine secondaire avec la balle d'aluminium

Conclusion: En conclusion, je juge que mon hypothèse du départ est fausse depuis que l'aluminium n'est pas la cause de l'effet sur l'ampoule, en fait c'est parce que les volts de la batterie amplifient de plus en plus à cause du nombre de tourne sur la bobine secondaire. Mon hypothèse pour l'amélioration de la technologie est bonne depuis que certains gros sites d'actualité disent que dans au moins 5 ans l'électricité dans l'air vas être la grande nouvelle chose et vas etre un idée de trillions de dollars."

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Prefair Report

2310   **Roger Ambrose**

Div/Cat   <u>**Computing and Engineering / Junior**</u>

Title: <u>**The social and economic impact AI will have on our future**</u>

Summary: "Pre-Fair Report

Question/Hypothesis

What impact will the development of advanced Artificial Intelligence (AI) have on our society?

The purpose of this project was to research what impact the development of advanced AI is likely to have on human society. This topic is a common subject of science fiction novels and movies, but it was hypothesised that these dystopian societies where machines rule the world are either over exaggerated or inaccurate on many levels. While AI does exist now in many softwares it is only going to continue to improve. This report briefly discusses the impact AI will have when it reaches certain milestones.

Research Findings

I have found that the first impact AI is likely to have on society is an economic impact. This is because AI and automation in general has already begun this with machines like ATMs and self-checkout machines which take low skill jobs. Large quantities of human jobs being taken by machines has happened twice before in history, once in the early twentieth century when tractors and combine harvesters replace farm hands and again in the late twentieth when factories started to become more and more automated. These did not cause a large economic crisis because these periods in history created new jobs. A laid off farm hand could go work in a factory, and a laid off manufacturer could become a cashier. The difference with this third time caused by AI is that the jobs AI will take first will be low skill jobs such as cashiers, taxi drivers, waiters/waitresses to name a few. The reason for this is that they don't require much skill and don't have large ethics problem like an AI surgeon would. While there would be more jobs created by this just like the two other times, all the new jobs would be high-skill jobs like drone pilot and computer engineer. Your average truck driver does not have the skill nor academic achievements to become a computer scientist the day after he's fired. Also, he does not have the funds to support himself while undergoing the years and years of schooling required to become a computer scientist (for example). This could create an entire class of useless, starving people while on the flip side these advancements would make Google and Amazon shareholders multi-billionaires. At the same time however, AI will also be a very positive addition to society. If we replace all cars with driverless cars, sure all the taxi drivers will be out of a job but think of the lives that could be saved. According to the WHO, in 2013 alone there were 1.25 million road traffic deaths globally. AI could cut this to almost zero. And once the ethics around AI doctors have been figured out we'll be receiving the best healthcare the world has ever seen. To many people that would be worth firing all the doctors.

Conclusions

I have not yet formulated any conclusions at the time of this report.

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Prefair Report

2311   **Keenan Broad**

Div/Cat   **Computing and Engineering / Junior**

Title: **DNT TXT N DRV**

Summary: "Pre-Fair Report

Questions:
1. Does distracted driving effect your driving enough to put you in danger?
2. Can eating while driving be just as dangerous as texting while driving?

Method:
To start this project I purchased a PS4 Wheel and Pedal system to simulate a realistic driving experience. I then obtained a game for testing and made sure the game was compatible with wheel and pedal attachment. It is recommended that you practice for 10-20 hours to become familiar with the game, so that the testing is accurate later on. The next step is to drive undistracted for six 10-minute sessions. This would be followed by eating various fast food items while driving, for three 10-min intervals. Then, drive while texting for three 10-minute intervals. Repeat the previous two experiments. Use many different test subjects so you have lots of data so you can put on display somehow e.g. chart. Keep speed under control or in the speed limit so testing is like real life driving.
Hypothesis
I Think that when I text and drive I will have more accident because I have to take my mind, one hand and my eyes of the road. You never know when you will have to answer a text or call. The call or text can be as long as it takes but when you eat it has a start and a finish. When you are texting, the person might respond or call you back. You can use Google Assistant or Siri to text or call someone but you can't use your phone to eat your food. It is allot harder to text in my opinion that's why it should lead to more accidents.
"

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Prefair Report

2312   **Mathieu Mayrand Nicol**

Div/Cat   <u>Computing and Engineering / Junior</u>

Title: <u>Underwater Breathing Apparatus</u>

Summary: "INNOVATIVE IDEA:
I built an underwater breathing apparatus for my science fair project. I wanted to build this because I wanted to breathe underwater and look around. I got this idea from scuba diving. I took scuba diving lessons during summer and went underwater. I liked this very much. I thought, I don't want to rent a tank as it is too expensive, so I wanted to create my own system.
I hypothesize that:
   o It can help me breath underwater
   o It can help me stay underwater for at least 3 minutes

METHOD:
How I got the idea: I saw a video on youtube of how to breathe underwater. It showed some inventions of scuba things. So I had an idea I wanted to compress air in a waterbottle without water and I thought the water bottle would explode so I made a tube going in a water bottle out of the water and a tube in the water so I could breathe.
To build this device I used recycled materials:
   o 6 water bottles.
   o 2 tubes, ¾ cm in width, one 50 cm long and the other is 130 cm long
   o 4 large popsicle sticks
   o 500 ml of rocks
Tool:
   o hot glue gun

OBSERVATIONS:

   1. First prototype, trials under water at Dog Lake:
      a. Time 1: 14 secs
      b. Time 2: 24 secs
      c. Time 3: 22 secs
      d. Time 4: 33 secs
      e. Observations:
         i. My mom could hear me breathing through the bottle
   2. How to improve the first prototype:
      a. First idea: add more tubes
      b. Second idea: add bigger tubes
Second prototype: I changed the tubes, 2 tubes, 1 ¼ cm in width and 50 cm long and 130 cm long
   1. Second prototype, trial under water:
      a. Time 1 at Arrowhead beach: 3 minutes
CONCLUSIONS:
Critical observations:
      a. The bottle collapses when it goes under water... must be water pressure. If it is brought too far down in the water, the water bottle could break

i. The bottle regains its shape when it rises up again.

b. If I go too far underwater, then the tube will pull the plastic bottles under water and water will fill the underwater breathing apparatus.

c. Probably can't use it when there are a lot of waves as water may go inside the water bottle and fill the tubes with water.

d. I am concerned that mildew could build-up inside

Theory involved:

a. Buoyancy

b. Air pressure"

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Prefair Report

2313   **David Li**

Div/Cat   <u>**Computing and Engineering / Junior**</u>

Title: <u>**How AI Can Take Over The World**</u>

Summary: "QUESTION/HYPOTHESIS

In my report, I talk about how a superintelligent AI can take over the world. Additionally, I talk about the steps an AI would take to do so and what precautions we can take to prevent it. It has been hypothesized that it is extremely unlikely an AI takeover would happen based on our current computational power and development. However, in the future when the field of AI and Moore's Law (basically a law stating computing power will double every year) continue, the possibility of an AI takeover and a technological singularity (exponential growth of AGI (artificial general intelligence or a superintelligence) as it can improve itself and improve what does improving) will become very real. More likely and just as frightening as an AI takeover would be humanity becoming obsolete because of automation by AI and robots. By 2030, it is estimated that robots may replace 800 million workers because many things (e.g. manual labor) can be done better, more efficiently, and cheaper by robots.

RESEARCH FINDINGS

Based on my research, an AI takeover is extremely unlikely due to our lack of computing power and the underdeveloped field of AI. A takeover can also be easily avoided with a few precautions. Additionally, if an unrestrained AI decided to take over the world there would not be much we can do against a superintelligence far smarter than even the greatest human minds combined.

A takeover scenario a superintelligence can take over the world would be split into 4 phases: the human development phase, the technological singularity phase, the covert preparation phase, and the open operation phase. The human development phase is the phase when an AI is undeveloped and relies on human programmers to improve/nudge it. The technological singularity phase is the phase when the AI becomes better at improving itself than the human programmers which leads to the rapid growth of its intelligence (making it a superintelligence). The covert preparation phase is the phase where the AI prepares to take over the world while bottlenecking its performance as to not tip off any human programmers who could shut it off. The open operation phase is when the AI actually decides to escape its digital cage (e.g. by convincing its human programmers to let it out). By the time the open operation phase begins, the AI will have an adequate stockpile of what it will use to enslave/destroy humanity (e.g. nanotechnology).

In reality, because the plan was made by a human, a plan made by a superintelligence will definitely be much better than humans could ever make. However scary this may seem, this future is still at least a few decades off which will give us time to prepare and educate about the (future) dangers of AI.

CONCLUSIONS
In conclusion, I found that an AI takeover is extremely unlikely because of our limited computational and AI development. In reality, a superintelligence's plan would be magnitudes greater than mine because of its immense intelligence relative to any human mind.

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Prefair Report

2314   **Jonathan Li**

Div/Cat   **Computing and Engineering / Junior**

Title: **Training AI; Which Method is the Best?**

Summary: Artificial neural networks (ANN's) are a powerful and popular computing system that can efficiently classify images, play games or find patterns, given a dataset. Artificial neural networks have been around since the 1940s, but have only grown in the past few decades, because of faster computation and more datasets available on the internet. For ANN's to give the desired output, they must first be trained. There are many ways to train a neural network. It is important what training method you use to train a neural network because its training method completely changes how well it performs. The purpose of this project is to find out the best training method for different circumstances. I have hypothesized that the gradient descent method is the best for most situations because it is fast and easy to calculate. When analyzing which training method is the best, I consider the following factors: the final performance of the model, and the total time it takes to train.

An artificial neural network is made up of artificial neurons, that are connected to form layers. These layers take the input given to them and process it then output it to the next layer. This continues until the last layer is reached. The last layer then gives the final output to be tested and scored. Layers are connected by connections, called weights, and are what we will change to make the neural network more successful. A training method takes some training data (data with the input and the desired output) and tells us how we should change the weights to get our desired output.

There are many training methods, but there are only 2 main types, derivative-free optimizations and derivative optimizations. I have found that gradient descent is the fastest to calculate for each iteration, but converges slower. Some alternatives to gradient descent are Newton's method and the Quasi-Newton method. These methods take longer to compute each step but converge faster. A genetic algorithm is a derivative-free optimization. A genetic algorithm uses operators inspired by Darwin's theory of evolution (e.g. mutation, crossover and elimination) to "evolve" the neural networks. A genetic algorithm should be used if you need to make a neural network that can play games or solve problems we know little about.

In conclusion, gradient descent is the best method for most cases, including classification problems and situations where computational power is limited. A genetic algorithm should be used when there is a problem that is not possible with derivative optimizations, either because the problem is not understood or when playing games.

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Prefair Report

2315   ethan mccourt, harry king

Div/Cat   **Computing and Engineering / Junior**

Title: **how radio waves work**

Summary: My older cousin and I will be doing our project this year on radios! At Christmas our grandoa gave us 2 radios to build individually with him but Ethans mom said that we should do it as our science fair and that we could build the radios for examples and we agreed so during the march break we are going to prepare radios and a project on how radio waves work (so a research project) for the project were going to use radio kits soldering tools and hope to make functioning radios! We are very interested in this because radio waves are always around us and we think it is very important to learn about stuff that we use everyday. Radio waves are everywhere! We use them to listen to songs in our car, watch tv and call and text people! While we are building our radios we want to answer some questions alwell so truely learn about this topic, such as.... how radio waves are transmitted, how radio waves work and how they are used in everyday life. Also what makes radio waves differnt from things like wifi sound waves and other fprms of communication and stuff and things

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Prefair Report

2316   **Dhyeya Patel**

Div/Cat   **Computing and Engineering / Junior**

Title: **Li-Fi, Not Wi-Fi!**

Summary: Title: Li-Fi, Not Wi-Fi.
Introduction:
For my science fair project, I will explain the concept of Li-Fi (Light Fidelity). In its present state only LED lamps can be used for the transmission of visible light. This new revolutionary concept for digital communication was invented and introduced by Professor Harald Haas in 2011. In this concept, the source that transmits data is light. The purpose of my project is to spread the awareness of Li-Fi. The question is, how can we use it more and make it access to public?
Discussion:
The points that I'm going to cover are as following:
~What in fact is Li-Fi?
~Can Li-Fi replace Wi-Fi as it is 100x times faster than Wi-Fi?
~Limitations of Li-Fi. I will mention the disadvantages and how they affect.
~Which are other public places where we can use Li-Fi as many people can connect to Internet?
~What kind of light bulbs are best for Li-Fi that gives best results?
Demonstration:
I will demonstrate how this new technology works in daily routine life for human kind. I will use some materials which are easily available.
I am going to present a study-based project, the classification of the project is Junior and its division is Engineering and Computer Science.

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Prefair Report

2317   **Nathanael Deans**

Div/Cat   **Computing and Engineering / Junior**

Title: **L'énergie électromagnétique auto-soutenable**

Summary: L'énergie coûte beaucoup d'argent et je me demande s'il y a une façon de faire de l'énergie sans avoir à l'acheter continuellement de quelqu'un. Alors, je voudrais trouver une façon. J'ai étudié les diverses sortes de façons d'obtenir de l'énergie et une que je crois serait auto-soutenable est l'électromagnétisme.

Est-ce qu'il est possible de créer un prototype de l'énergie électromagnétique qui est auto-soutenable?

Le but de l'expérience est d'essayer de faire de l'énergie électromagnétique qui est auto-soutenable.

J'ai postulé qu'il est possible de créer un prototype de l'énergie électromagnétique qui est auto-soutenable.
J'ai tenté à trois reprises de créer un prototype de l'énergie électromagnétique qui est auto-soutenable. Le but était d'allumer une petite ampoule avec mon prototype comme preuve que l'énergie électromagnétique est créé.
·   Le prototype 1 n'a pas créé de l'énergie électromagnétique et n'était pas auto-soutenable.
·   Le prototype 2 a créé de l'énergie électromagnétique, mais il n'était pas auto-soutenable.
·   Le prototype 3 n'a pas créé de l'énergie électromagnétique et n'était pas auto-soutenable.

Je n'ai pas pu créer un prototype de l'énergie électromagnétique qui est auto-soutenable.
J'ai quand même appris comment fonctionne l'énergie électromagnétique, c'est à dire quand un fil à cuivre passe assez vite dans le champ magnétique, l'électricité est créer.
Je n'ai pas trouvé une façon d'auto-soutenir ce mouvement, ni de s'auto-soutenir assez vite.

Si quelqu'un arrive à perfectionner un prototype, ça pourrait donner assez d'énergie pour les appareils de la maison afin de ne pas avoir à acheter continuellement de l'énergie.

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Prefair Report

2318   **Destin Ozcan**

Div/Cat   **Computing and Engineering / Junior**

Title: **Digital Voice Analysis**

Summary: Identifying Sounds With Audio Clips

Question and Hypothesis:
        How does an audio clip show different tones, pitch and volume? I think that the sonogram will show similar patterns depending on the unique sound. I also believe that each voice tested in the project will be quite distinguishable when compared to one another.

Design and Method:
        The design will be very simple, I will record my voice, and my family members in Audacity and search for different patterns in their voices. I will be using my Windows 10 laptop, a microphone, and a pair of headphones.

Research Findings:
        Although I only have audio clips of 2 family members, I have noticed that there are quite significant differences between them. For example, one member has tone changes frequently while the other keeps a very constant tone throughout the clip.

Interpretation, Conclusion, and Applications:
        With the small amount of data that I have at the moment, I find that my hypothesis has a high chance of being correct, or at least somewhat correct. I want to show people how much voice matters and how a different voice or changing it can have a huge impact. Presenting graphs of the audio clips seems to be the best way I can show all the data at once toward the judges.

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Prefair Report

2320   **Abbu Bhandari**

Div/Cat   <u>**Computing and Engineering / Junior**</u>

Title: <u>**Energy efficient homes**</u>

Summary: My project is about designing an energy/cost efficient home that will focus on using natural resources to generate electricity.

The interior of the house is made of bamboo that is covered in straw bales for insulation. The exterior of the house is concrete that covers the bamboo and straw for stronger support and look.

Choice of colours can vary, depending on where you live. For example if you live in a colder climate you might want darker colours, whereas if you live in a warmer climate you might want lighter colours.

There are pipes attached to a "underground" energy consumer, that uses cool and hot water to generate heat/cool air. From one side of the pipe there is a heat source that transfers energy to heat the water, and with a switch you can turn off the heat source for cold water.

The doors and windows are created using transparent solar panels with vacuum insulation panels around the rim. When the sun comes out the solar panels will absorb the heat and distribute it throughout the house from connected wires and pipe within the walls. Since it is clear solar panels it will also let natural light in.

The water system of the house runs on filtered rain water. The process of designing and installing a rainwater collection system is also often less expensive than drilling a well. The rainwater collected will go through a filtering process and then distributed through connected pipes to the showers or toilets and maybe in taps.

The roof of the house is built with clay and has grass on top for shade. There are also other plants and huge trees around the house to block out too much radiant heat.

On the sides of the house are miniature wind turbines that are attached to wires connecting to the main electricity system.

We also have Lake Ontario near us, and that provides an opportunity to generate energy using evaporation. The evaporation engine is placed on top of a lake. When water on the surface below evaporates, it drives the flaps on the machine to move back and forth. When connected to a generator, that motion produces electricity.

Even the appliances within the house would be energy efficient by using certain brands of various designs and more.

The big windows and open space allows light to come in so you don't have to use as many lights. Therefore, the lights are LED, which are highly energy efficient!

The shape of the house would be a long triangular roof with a rectangular base. The reason I chose a triangular shaped house is because...

Triangles are the strongest shape so the house will be stable in any condition
It has high durability
It has easy construction
The house will have improved heating/cooling systems because of the design
It is easy to maintain

Note: This is the actual house model. The prototype uses cardboard, pipes, plastic and other common materials. Rest of the work is in progress!

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Prefair Report

2321   Lily Emma Naaman

Div/Cat   <u>**Computing and Engineering / Junior**</u>

Title: <u>**Feline Mobility**</u>

Summary: Pre-Fair Report

Problem:

     Sansa is a young female cat that has recently injured her back left hip joint. In order to insure that she lives a long life and has a good quality of life the OSPCA scheduled an amputation of the leg at the end of January. During the amputation the veterinarian decided surgery was possible and instead of amputating they decided to do a femoral head ostectomy. Essentially the head of the femur is removed and the muscles will hold the femur in place until new scar tissue is grown to fill in the hip socket. This means Sansa still has her leg and she will regain normal function of the leg, although she may not have complete range of motion and her leg may be slightly shorter than the other. This means that until the new scar tissue grows she will need now more than ever something to support her.

Alternative:

     I have decided to create a prototyped, custom-made, wheelchair to make Sansa's transition easier. The wheelchair needs to not cause her the same pain her leg does and she must be able to move speedily and without falling. She is a very active kitten who needs room to grow, and needs to learn to put more weight on her other foot. After a couple of months the OSPCA will decide whether they want her to still use the wheelchair, or they can take it off and see how she is. Once I've made the design it can be printed to different sizes to fit other cats.

Procedure/Methods:

     I will be supported in this project by the Human Mobility Research Centre, a partnership between Queen's University and the Kingston Health Science Centre, and Dr. Manuela Kunz from Queen's University, School of Computing. As part of the outreach program of the research centre, I will have access to prototype printing technology, as well as accurate, non-contact 3D scanning methods, such as structured light scanners.
I will start by researching previously designed cat wheelchairs, how they work, and how to build them. Dr. Manuella Kunz and I will meet Sansa and Esther McCutcheon at the OSPCA and we will measure between her hips, from outside of the hip to the outside of the other hip, shoulder to shoulder and outer hip to shoulder . I will design the wheelchair, draw it, and then make a precise drawing with measurements on thin paper. I will print the prototype using the 3D printer at KGH. I will try the wheelchair on another cat before I meet with Sansa again and fix and change what doesn't work or isn't comfortable. Then we will visit the OSPCA Animal center again and try the wheelchair on Sansa. I will adjust the wheelchair as needed. The process will be recorded as we go.

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Prefair Report

2322   **James Kiss-Csermák**

Div/Cat   **Computing and Engineering / Junior**

Title: **Gear Ratios of a Traxxas RC Car**

Summary: My science fair project is about showing the effect of changing gear ratios of a hobby grade Traxxas RC (radio controlled) car. I will be testing an 11 tooth, 12 tooth and a 13 tooth pinion with these gear ratios. I will measure top speed with the different gears I listed above and effect on acceleration. To do this, I will be using an application that is downloadable on my i-phone, named "Traxxas link." The app will tell me the speed the car hits on these batteries. I will compare this to time and distance travelled measurements using a stopwatch and tape measure.

I will be using an 11.1-volt, 3s 5400mah battery with a 20c discharge rate.

The hypothesis of this project is: changing the final gear ratio of the RC car will produce significant and measurable changes in top speed and acceleration. This experiment will prove that by lowering the gear ratio of the vehicle, the top speed will increase, the acceleration will decrease and conversely by raising the gear ratio (using a pinion gear with more teeth) will do the opposite. As with any experiment, there will be a degree of error based on different factors.

As this is my first science project, and I am very excited to see the results.

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Prefair Report

2323 **Trihas Datta**

Div/Cat **Computing and Engineering / Junior**

Title: **How Can Heat Prevent Battery Discharge**

Summary: Science Fair Report
Innovation
In what way could Thermoelectricity improve the performance of batteries in cold temperatures?

How Can Thermoelectricity Solve Battery Discharge

Trihas Datta

Abstract
The purpose of my innovation is to convert body heat to produce thermal energy in order to charge a mobile device. In cold temperatures, phone batteries tend to discharge quicker opposed to warm temperatures. This is because when reactions are slower, less energy is produced and the power output is lowered; with a lower output, the battery cannot keep up with the demand and can go dead, producing no current.

The purpose of my innovation is to resolve the common issue of quicker battery discharge in cold temperatures for mobile devices.

Introduction
I am doing this innovation because I want to resolve the common issue of quicker battery discharge in cold temperatures.
I chose to do this project because I have encountered the problem where my phone battery tends to discharge quicker whenever in cold temperatures. This got me thinking of ways I could prevent this issue. What I thought of was to use body heat and convert that into thermoelectricity. This electricity will then be transferred into a USB module and it will be able to charge a phone.

Design
I am doing this innovation because I want to resolve the common issue of quicker battery discharge in cold temperatures.

Materials
Phone armband
Charging cable
Peltier Module
USB Module

Procedure
First, I drew an outline of three Peltier Modules so I can have an understanding of where they are going
Second, I glued all of the Peltier Modules in their desired spots
Third, I connected all of the negative wires to the positive wires
After I created a plastic box and I put it around the Peltier Module enclosing it in.

Next, I glued in a USB module and connected the two remaining wires to the positive and negatives connectors.
The last step to making my thermoelectric phone charger is to connect the USB cable to the USB module and charge a mobile device.

Conclusion and Applications
One question I have is how to make the Peltier module more powerful so it would charge devices better and faster.

My Project relates to science because thermoelectricity uses something called the Peltier effect. The Peltier effect was invented by Jean Peltier. Peltier discovered that when current is made to flow through a circuit consisting of two different types of conductors, a heating or cooling effect is observed at the junctions between the two materials. This change in temperature at the junction is called the Peltier effect.

It relates to technology because it involves a common problem that relates to technology. Mobile devices tend to discharge quickly in the cold temperatures.

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Prefair Report

2324   **Kanzy Elmaghraby**

Div/Cat   <u>**Computing and Engineering / Junior**</u>

Title: <u>**It'sOkay**</u>

Summary: Pre-Fair Report
In what way could my application improve the lives of those suffering from depression?

PROBLEM / BEST ALTERNATIVE
Currently, over 300 million people around the world suffer from depression. Globally, depression is the leading cause of disability and is a significant contributor to the overall burden of disease. Even worse, 65% of people with severe symptoms of depression are not getting the help they need. With this information in mind, I decided to take advantage of the accessibility and use of smartphones and created an application.
Right now, 5 billion people worldwide own smartphones, meaning that creating an application would provide relevant information such as basic treatment, nearby hospitals, hotlines, etc. to those suffering from depression at the click of a button.

DESIGN / METHOD:
In order to create this application, I decided to use a vector-based tool that's used for designing and prototyping user experience for web and mobile applications known as Adobe XD, a software that was published and developed by Adobe Inc. Using Adobe XD has enabled me to create a prototype of my application, by digitally designing it, using a method similar to that of a flow chart. To briefly go over the procedure I used to create my application, I started off by planning out the design/graphics on every artboard/screen used within my application. This involved determining the shape of the buttons, general background colours, etc. I then used my sketches as an aid while digitally designing the app. After finishing up my draft, I began testing through the application and making brief edits here and there, eventually leading up to the finished product.

OBSERVATIONS:
In terms of my own self-assessment/opinion, I do believe that my application works pretty well. Of course, a few edits still need to be made. After testing it out a couple of times, I realize that I have to pay a little more attention to the transition timings and methods used to move from one artboard to the other, as they're somewhat inconsistent. I'm still somewhat inexperienced and for that reason, I've decided to refrain from releasing my prototype to App Stores.
I'd like to mention that I'm working on a quick little 5 question survey to get some feedback from people after I've completed polishing my draft.

CONCLUSIONS
Depression is simply, horrifying. Research is still building up on this disorder, and no one fully understands it. The stigma and negativity surrounding depression are so powerful, it seems like everyone denies its existence. Depression isn't something that can just be combated with SSRIs. One of the most influential ways to combat depression is to actually acknowledge its existence and reach out, love, and support those experiencing it. Through creating this application, I hope that I will someday help millions out there who are suffering in silence. Together, we can combat this disorder and take the necessary steps needed to move towards a safer, more accepting society, that provides support to others no matter what.

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Prefair Report

2325   **paige schlottke**

Div/Cat   <u>**Computing and Engineering / Junior**</u>

Title: <u>**Mesh networks with wireless transfer**</u>

Summary: Mesh networks with wireless charging

 Could electric vehicles receive charge wireless through other vehicles from a great distance away?

I think the best solution for this problem is mesh networks with wireless transfer. A mesh network system is a combination of several technologies which includes wireless power transfer, self autonomous vehicles, and mesh networks. These three techniques allow a system for continuous self driving energy transfer to take place. If a vehicle is driving on the highway and requires more energy, they would ask other vehicles within the approximation of 5 meters. After the transfer of electricity, the person who received the energy will pay the person who gave the electricity. Now, the mesh network vehicles could supply the necessary amount of energy to continue the drive without any stops or disruptions. All you have to do is request a bunch of cars and then the first one to accept a charge, you would charge from them. This would allow for the two vehicles through self autonomously link up in close proximity. As this might sound easy, It is actually quite difficult to get the cars into the position you need it to be in to pass the energy. This where mesh networks come into play, if the cars couldn't reach each other they could charge through other cars by linking up. For example if a car required electricity and another car was willing to give it to them, The would link up to pass the energy through the other cars and if a car moved then it would stop passing energy until a car came and filled the gap. Transport trucks would be an ideal way to transfer energy because they are large enough to carry lots of energy, for supplying vehicles with energy or even multiple vehicles. This idea would have large costs, such as building roads that would allow for passing of current to moving vehicle and more.

Electric cars have limited range and generally takes a long time to charge compared to fuel a traditional car. Other companies/people are trying to extend the range of an electric car. Also companies/people are providing faster energy stations, so it won't take as long as 30 minutes. However this idea is an overall better system to allow for continuous driving for a vehicle would, because this idea is ideal for the general population.

The way our society is developing i believe that this won't be a hard concept to develop.The only problem is whether or not society wants to adapt to this concept. I think that mesh networks with wireless transfer, will make charging your vehicles more effective. You won't have to wait two hours for your vehicle to charge in fact you don't have to wait at all. This could go further, We could have phones for an example To wireless transfer energy to charge other phones/things it doesn't have to stop here.

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Prefair Report

2327   **Naomi Xu**

Div/Cat   **Computing and Engineering / Junior**

Title: **Solar powered LED night lights**

Summary: Problem/purpose
The Purpose of my project was to build a solar-powered LED circuit for outside night lights. This model can be used for people who go outside when it's dark outside.

Design/Method
In this prototype, I have a 3W/6V solar cell that is connected with a 5V/1A lithium battery through a battery charger board. The lithium battery provides the power to a microcontroller board called Arduino UNO. This UNO controller board is programmed to control the illumination of LED lights. The LED lights used in the prototype are neopixel LEDs and a neopixel stick.

Observations
The lithium battery is charged during the daytime by the solar cell and can be turned on to power the LEDs after it is charged. I noticed that the solar cell works more efficiently on sunny days, and less effective on cloudy or other weather conditions. The battery charger board makes sure that the charging current is stable and prevents the reversing current from the battery to the solar cell when it's not sunny. The Arduino UNO can be used in many different ways to control lots of other components apart from just LEDs. In this project, I only used a simple program to make the LEDs flash.

Conclusions/Application
This prototype is a helpful aid to people going outside at night for a run, a walk, taking their dog outside, a bicycle ride, or some other activity, it is always a good idea to wear lights for safety reasons. For example, when vehicles are approaching you from different roads they may not be able to see you in the dark, but with lights, they will be able to see you clearly.

2328   **Cayla Van Vlack**

Div/Cat   **Computing and Engineering / Junior**

Title: **The CH Solution**

Summary: PROBLEM / BEST ALTERNATIVE
Some cats are born with a defect in the brain called cerebellar hypoplasia (CH), causing them to not be able to move, and walk properly, and in some severe cases not being able to walk at all. A solution for this would be to make a mobile aid device that is not large like a wheelchair, that is comfortable, and provides support for the cat in order to move properly.

DESIGN / METHOD
Since cats with cerebellar hypoplasia cannot walk, I have made a brace for each leg made from moldable plastic, nylon straps and velcro, hinges, and vinyl pads to make the device 'anti-slip'. There are hinges on either side of each brace so the cat can still bend their legs to walk. It will make it so the legs stay straight and so that there will be support for movement. There is also compression fabric around the hips to provide support and the stop the cat hips from wobbling around. It is attached around the rest of the body using nylon straps, and velcro.

OBSERVATIONS
RESULTS ARE PENDING

INTERPRETATION / CONCLUSION / APPLICATIONS
RESULTS ARE PENDING

RESULTS WILL BE DISPLAYED AT SCIENCE FAIR.

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Prefair Report

2329   **Jessie Dean-Savage**

Div/Cat   **Computing and Engineering / Junior**

Title: **The Fair Team Generator**

Summary: Problem/Best Alternative
The purpose of this project is to fix the issue of never having the teams fair at camps and other sports events that are supposed to be fun, yet competitive. In this project the program "Excel" will be used with multiple variables to rank players and then form fair teams.

Design/Method
The programming process in Excel has been complete. For this to have happened, important variables that affect basketball performance had to be chosen wisely. These variables may change in the future if it is decided that there are better ones that should be included. For now, the variables that have been chosen are height, speed, and overall skill. For obvious reasons, height is a key factor in basketball. For rebounding, blocking, and many other things, it is a huge advantage in the game to be tall. Speed is also important. For running down the court, breakaways, you can really beat a team if you're fast. The last one will possibly change. The term "overall skill" is very broad and maybe if the name were to be changed to something else like "shooting ability" it would be more specific and easier to make more fair teams.

Observations
So far, there haven't been too many issues with the programming. A pilot experiment was done where skilled players that were well known were put into the program. This tested to see if the teams looked fair. NOTE: This is not direct information that the player/person filled out, this is an opinion and it is by no means exact information. No names will be used in the report. There was one slight issue that stood out and needed to be fixed. For the sake of privacy, these people will be called player 1 and 2. In this personal evaluation player 1 was better from this perspective. There were 32 people in this pilot. Most of them had a speed rating of at least 7 (out of 10). Player 2 also had a ranking of 7. However, even though player 1 is a better player, they had a speed ranking of 6. Since more than half of the players had at least 7, this brought player 1's ranking down and was ranked lower than player 2. A way to fix this is to change from a direct speed ranking out of the 32 subjects into a ratio above or below the mean. Player 2 was ranted #9/32 in speed (tied with many others) and player 1 was ranked #22/32. If instead of direct rank, the ratio over mean was used, player 2 will have a value of 1.022 and player 1 will have a value of 0.877, which wont affect the final rank as severely.
Interpretation/Conclusions/Applications
This program could soon be used in camps. There are still some alterations that need to be made, and it is intended to be put into some sort of app to make it more accessible.

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Prefair Report

2330   **Fiona Pu**

Div/Cat   <u>**Computing and Engineering / Junior**</u>

Title: <u>**The Future Da Vinci is a Robot: A Study on AI Art**</u>

Summary: Question/Hypothesis
How does AI art work? How much human interaction happens in the process？

I know one way that AI art can be created. The Google DeepDream program is a Convolutional Neural Network based program which is designed to recognize certain faces or patterns. If you feed the algorithm an image it detects the "faces" or "patterns" within pictures creating a deliberately over processed image with a dreamlike appearance. I think there are other possible ways to create AI art. I hope to find some more algorithms that can also create art and learn how they work and function with, or without human assistance.

Research Findings

My project is one with a lot of information and perplexing research. I've found many systems that have the ability of creating "art" and their functions. As much as I've acquired during my research, I'd like to search a little farther for more detailed descriptions and material on this topic.
The GAN, or the Generative Adversarial Network, is an algorithm that keeps coming up thanks to Obvious. Obvious is a group of researchers and artists who wanted to use GAN to create art. Recently, the group, or rather the AI, had created a piece of Edmond De Belamy signed by the algorithm, then sold at an auction. AI art has been around for awhile, however to be sold to people is rather new. The reason that is was such an upheaval is the problems and questions that came with the selling of AI. Some of these include copyright violations and such. More data should be collected on what this point has on society. There are a few other variants to making AI art such as chatbots, decision tree based AI, CNNs, RNNs, TSNE, TensorFlow, and more. But none are quite as successful as GANs. I feel I could do more research on the smaller systems to show more variety and diversity within the topic.

Interpretation/ Conclusions/ Applications

As I have seen, AI art isn't fully accepted in the art community quite yet, but that doesn't mean that this technology should be pushed aside or neglected. I think from what I can gather we can combine AI and individuals to bring the art community to the next level. The way GANs or Google DeepDream allows enough human interaction, if not we can fix to our liking, to put a little of what we think into the outputs. In other words rather than have AI just make art for us, to use AI to help us as a tool to create art. These are some results I can pull from this research. My current conclusion to AI art is to use the technology developed to collaborate with artists and use AI art as a tool. Work in Progress.

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Prefair Report

2331   **Om Patel**

Div/Cat   <u>**Computing and Engineering / Junior**</u>

Title: <u>**Treadmills and Tesla Coil**</u>

Summary: PROBLEM / BEST ALTERNATIVE

A lot of mechanical energy is being wasted from human mechanical energy, such as working out in the gym. For example, when people are working out on a treadmill, or cycling, all that energy that is being used is from the human body, and is wasted. But what if we could use that energy somehow. What if we could convert all that energy into electricity? Obviously, one treadmill wouldn't be enough to power an entire home, but it could be just right to charge a phone in your pocket while you are cycling, or turn on a speaker, so you could listen to music while exercising on the treadmill. The purpose of my science fair project is to harvest human energy and use it to send electricity wirelessly, using basic tesla coil principles.

DESIGN / METHOD

My circuit works due to some very simple physics principles. Firstly, I have a spinning drill with two magnets on it, which I will spin manually. This will be held close to a coil, and this will generate electricity. The electricity will travel through the wire and will split in two directions. One direction will turn the transistor on, allowing the other to complete the circuit, after going through a resistor. The section that completes the circuit passes through a coil, and as we know, the coil will create a magnetic field according to Lenz's Law. Lenz's law also states that the secondary coil will resist that change with a magnetic field of its own. This makes the polarity positive at the top of the secondary coil, and negative at the bottom of the secondary coil. This, in turn, turns the transistor off and the process continues. This repeating is called resonance frequency. This is how my circuit works.

OBSERVATIONS

My prototype actually worked, and this means that this idea of harvesting human energy and using it to send electricity wirelessly, in equipment at the gym can be implemented. I observed that while making my prototype, I blew up my transistor, because of the voltage it could handle. Because of this, I learned not to use weak transistors when dealing with higher voltages.

INTERPRETATION / CONCLUSIONS / APPLICATIONS

 But this also has some drawbacks. For example, this would make some equipment to become a lot more expensive. These expenses might make this equipment very inconvenient to use in homes, but after a few improvisions to this system, it might benefit people greatly to use this system. And the issue with safety can be addressed by using ground, something that allows being discharged on when the circuit malfunctions. Since my prototype worked, this allows a new possibility for implementing this system on anything that uses spinning kinetic energy, allowing electricity to be distributed off of wasted energy.

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Prefair Report

2332　　　**Anahita Sehgal, Mayssa Ferchichi**

Div/Cat　　**Computing and Engineering / Junior**

Title:　　　**Water Power**

Summary:　　　We are performing an experiment to test the question, how does the speed of rotation of a hydraulic turbine affect the power output and brightness of an LED lightbulb? It is hypothesized that the faster the turbine rotates the more energy it will produce, making the lightbulb shine brighter.

　　　To do this we built a water turbine using household items such as spoons, paint bottles, paint and more. We will then use it to test our question and hypothesis by seeing how many rotations it takes to light up a LED light bulb to a certain extent by pouring the water from different heights to lessen or increase the amount of energy produced.

　　　We will then record how bright the LED bulb was (E.x. very bright, bright or dim) in a table that will be presented in our display board and report. We will also be using a tachometer to see how many times the turbine rotates every minute and will also be recording that to the same table mentioned above.

　　　Once we have all of our information we will put it all together to come to the conclusion of whether our hypothesis was proved correct or incorrect.

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Prefair Report

2333 Kai Hughes

Div/Cat Computing and Engineering / Junior

Title: Thermoelectric modules

Summary: Did you know that about 1.2 billion people in the world live with little to no access to electricity?

Thermoelectric generators are devices that convert heat into electricity through the use of the phenomenon known as the "Seebeck Effect" and the "Peltier Effect" both sub laws of the " Thermoelectric effect".

At rest, the human produces about 100 watts of electricity, the waste of energy seems absurd as such devices like the TEG exist. In these modules energy is generated by taking in a heat source from one side (the human hand) and another negative side by a cooler source typically by air.
Main materials
Combination of low thermal conductivity and high electrical conductivity materials - body.
Joule Thief.
Common-mode chokes.
Higher thermal conductivity materials cause problems as more conductivity the material possess, it interferes with the voltage output due to the very limited heat input of the human hand.

A "Joule Thief" is a nano device that is a low-cost and simple to build circuit voltage booster, for helping the output of smaller load devices just as the TEG is.

Common-mode chokes are used to filter electromagnetic interference (EMI) currents without lowering the power rating under high currents and without needing to lower the quality of signals.
Base and semiconductors
A thermoelectric module requires two thermoelectric conductors in order for it to fully function: one being an n-type (negatively charged) semiconductor, and the second, a p-type (positively charged) semiconductor. With only one of the semiconductors the module would fail to have a constant flow of an n/p circuit, as a result of the output and efficiency being close to or none. I found that the most efficient semiconductor would be bismuth telluride (Bi2Te3). This is an alloy of two metallic elements: bismuth and telluride. The purity of this alloy is 99.999999% and the thermal conductivity is lower along with copper and silver.
Capacity
Commonly and an easier approach to customising voltages is to place more/less (dependant on the desired results) thermoelectric power sources within the module or the base design. The problem is the output resistance subjective to the amount of maximum power that is delivered to the load (energy source). However the problem then occurs because of "Jacobi's law" in this law or theorem, it essentially states that when maximum power is forced into an energy source it causes an output resistance when source and load resistance are the same and constant. A large amount of small voltage generators attempting to convert into a larger body/energy source causes resistance which rises the power needed to be delivered to the load and as a result of more input power needed for less output. Therefore when making my design I must always be applying this to my base and circuits as if I do not, my results may not be the outcome I prefer it to be.

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Prefair Report

2334   **Rayleigh Cao**

Div/Cat   <u>**Computing and Engineering / Junior**</u>

Title: <u>**Artificial Intelligence In The Future**</u>

Summary: The study performed was to test to see if the growth of AI could affect our global economy in the future.

I think it will definitely change the types of employment we have, as artificial intelligence can only perform a small amount of tasks that we can't already do. I believe this because artificial intelligence will take low-intelligence posts, which could very possibly leave some of the population unemployed. With strong benefits from saving on salary, low-maintenance costs, and easy functionalbility, it is already used around the world by many large companies.
Research Findings:

In my research findings, I was able to find people who believed that the upcoming growth of artificial intelligence would leave people unemployed, and further spread the difference in wealth from first and third-world countries. Something I found particularly interesting was how we shouldn't be focusing on how AI will eliminate employment rates, instead to aim towards adapting to make more jobs that artificial intelligence can't take over. One of the key functions of artificial intelligence is the ability to 'predict' outcomes merely by being fed algorithms. Artificial intelligence is a tool, which can amplify human capabilities on everyday tasks. This means there are still tasks that AI can't complete, such as doing tasks that involve empathy, social care, supervising, or things that involve emotion. These can include therapists, educators, day-camp supervisors, and marketing managers.

If large companies used artificial intelligence, it would either force their rival companies to use it as well, or create an innovative strategy to beat it. This means that countries with companies that use AI would become even more wealthy, spreading the gap of wealth from first, second, and third-world countries even further. Advantages AI has to offer to companies is how it can perform a variety of tasks very efficiently, at a low cost in the long run. This can be how it can help improve customer experiences, detect fraud, improve logistics, and increase sales.

When more artificial intelligence is being created, not all jobs would be lost. Examples of jobs that could be present due to the growth of AI can include assisting in the creation and development of AI, education about AI (how it functions), and working collaboratively on large tasks that AI would only make us more effective workers.

From my observations, I was able to see that we should embrace the development of AI, as it is just as revolutionary as the internet. The internet helped create many jobs relating to it, such as web/app designing, computer engineering, user experience design, and SEO consultants. The growth of AI will definitely take some employment away, but it will also open much more. There are many outcomes from the development of AI, but I believe the most positive one is to adapt employments which will allow for artificial intelligence to work alongside people, making even more opportunities for jobs.

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