

INPHASE

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2014



"Hello World"



Houston, Do you copy??



Martin Cooper





Foreword

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Scientific Progress through the history of man is seen as an “overnight leap”. The way technology and its applications in everyday life have transformed bit by bit have been neglected by the layman, something she takes for granted. Every progress comprises infinite small parts. Contributed by curious experimenters and subsequently sharpened by similar such people. Whether it is the Electromagnetic Theory proposed by James Maxwell, or the ground breaking paper by Claude Shannon, which lay the foundations of Information Theory. Whether it was the discovery of Integrated Circuit by Jack Kilby, or a seemingly simple Bachelor Thesis Project of an Engineering Student. An Android application which runs an intricate Image Processing algorithm or a C code aiding in Computer Vision application.

The cover image is one such example. Communication has come a long way since the dawn of human kind. Telephone’s invention and then subsequent developments led to the mobile phone in the second half of the twentieth century. Speed of communication increased leading from simple voice communication to text communication through cell phones and then to video communication.

This edition of InPhase is devoted to some of these pursuits. Inside the present edition reader would find articles on some of the elegant steps made by students towards development of devices which contribute towards the area of Electronics and Electrical Engineering. Some interesting pieces on Science and its Applications in everyday life are also given. Along with that are included academic and non-academic experiences of our alumni pursuing higher studies at the esteemed University of Toronto and a classmate’s internship experience at KAIST. The magazine is also devoted to a handful of puzzles intended to boggle the mind and a couple of beautiful pieces of creativity by one of our teachers.

We would like to thank all the authors for their contribution and hope you would cherish reading the magazine. Do remember to give us a feedback, as it would help in fine tuning our efforts with the expectations of our department.

Amodh Kant Saxena
Editor-In-Chief
InPhase

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The page numbers have been encrypted in a certain way. Can you identify the type of encryption used?



Internship Experience at KAIST, South Korea

-Pranav Sodhani

Because life gives you a plenty of reasons to smile!

Dreams do come true. You just need to keep the patience for the right time to come. Summer Internship at KAIST is probably the best thing that has ever happened to me.

It was the commencement of the third semester and I had started exploring different research fields so as to find where exactly my interests lie. I was impressed by an online course on Image processing and made up my mind to work on a project in this field in the next summers. Exploring the ongoing research activities of the high-tech labs of foreign universities was indeed amazing. Initial efforts of mailing the Profs went in vain. It was in early January when I got approved for an internship at Smart Sensor Architecture Lab, KAIST, South Korea. KAIST is ranked 25th in engineering and technology and 56th among the top global universities. I was over the moon to imagine spending my summers in the splendid research climate of South Korea when there would be height of summers in India. However, at the same time, there was news of a probable war with North Korea. But come hell or high waters, how could I miss such an opportunity which comes once in a lifetime to a few in thousands? God's grace, situation didn't worsen and there was harmony between the nations again.

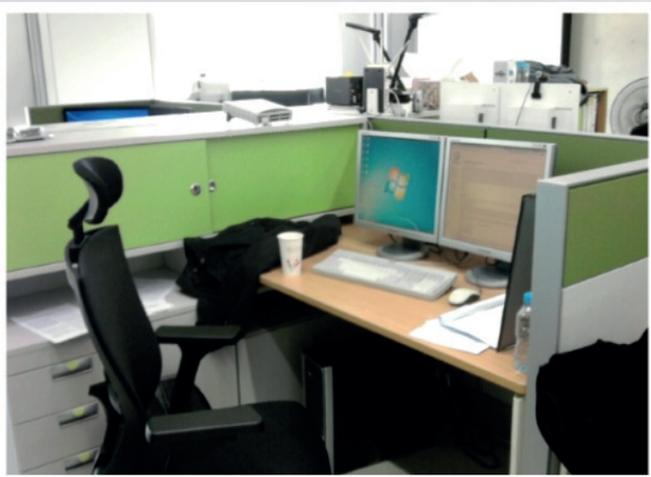
Then it began with the passport renewal, receiving the invitation letter from KAIST, NOC from the institution, booking air-tickets and lastly getting the VISA stamped. I boarded the flight from Kolkata which was destined to Incheon, South Korea via two stops at Kunming and Qingdao (both at China). The journey was too long (around 16 hours) and highly unpleasant, all credits to

the China Eastern airlines. What can be more disastrous to have seafood served in the vegetarian meal! I had to starve the entire day, but the feeling that I would be landing in an exotic land very soon filled me with ecstasy. Incheon Airport is one of the largest and the busiest airports in the world. For seven years in a row (2005–2012), it was rated the best airport worldwide by Airports Council International. A luxurious limousine bus took us to Daejeon where a cab finally brought us to the dormitory after many rounds of address misunderstanding. I was already enthralled to see the GPS functioning in taxis, drivers with those big smart phones, fast roads and the unpolluted city. The dormitory was a well furnished, deluxe place with a common kitchen included. I lived in a double occupancy room with an en suite.

The weekends passed in exploring the dormitory and the picturesque campus. I just loved the civil engineering design over there, with all sorts of bizarre yet awesome structures mounted; the sports complex, in particular, looked palatial.

Words fall short to describe my professor, a true gentleman. He is courteous and at the same time stern regarding work. We discussed on the project plans to be formulated along with a few PhD students at the lab. He kept ensuring my comfy stay and was curious to know more about India, about IITs and about IITians.

Koreans, in general, are very welcoming people, although language is a barrier for communication. 23 months of conscription inculcates immense discipline in them and that is the chief reason of such orderly formulation of the entire country. An old lady gifted us an umbrella while she saw us getting drenched in the rain. The lady at the pizza centre often gave us watermelon slices



My workplace at SSAL, KAIST! ©

for free as we had become regular customers there. Being a vegetarian, cooking in the dorm was inevitable. For several weeks, it was limited snacks for lunch and Maggi for dinner (I had brought 3 dozen Maggi packets with me)! Breakfast was pathetically missed. I realized cooking isn't an easy task, you never know the right amount of water, the amount of salt and the time required and GUESSES SIMPLY DON'T WORK! Days passed in a jiffy while my work on the project progressed. My professor kept motivating me that the project was

something which would prove to be highly beneficial and that the theme was really new. He took us for dinner to a Korean restaurant where we were served Bibimbaap, a Korean dish served as a bowl of warm white rice topped with seasoned vegetables. There were also a couple of Indians and Pakistanis there, pursuing their Masters and PhDs who helped us throughout our stay. We travelled to Seoul, the largest metropolis of South Korea and visited the Daecheon beach during the weekends. Travelling in KTX that moves at a speed of 300 kmph, the subway, the Seoul Tower, starfish, everything was just a gratifying experience. As compared to India, South Korea is quite



expensive, but when it's a paid academic intern, does one really care? I remember purchasing potatoes at INR 200 per kg!

As I approached the end of the internship, I started working in the graveyard shift to make sure I complete the project well in time.



The final presentation was well perceived by my Professor and he suggested me to continue working on the project to make sure that we get a research paper out of it.

It was an everything-to-gain experience except the 10 kilos that I had lost. Within two months, I had gained a global research experience, made a number of friends across different territories of the world, got to know about the rich Korean culture and much more. Although thousands of miles away from home, I never felt homesick, thanks to the wonderful ambience of the country. I was in fact glad when my flight got postponed by a day.

I would like to express gratitude to everyone who supported me throughout, right from the initial phases of securing this internship, helping me in my project and for all the mental support during my stay there. KAIST is really one of the best places to be at for sophomore internships.

Summer Project IIT-B

-Salil Mamodiya

BOTMASTERS!

Yes we called ourselves by the same. The four members were Ajay Kaaran Gupta, Harish Bohara, Abhishek Sen and Salil Mamodiya [myself].

The project was under ITSP 2013, a programme of IIT Bombay. Of the three projects whose abstracts we sent, MULTIERAIN WIRELESS BOT was selected for us to lay our hands on. The duration of the project was of 40 odd days. Although our project was related to both electronics and robotics, it also required a lot of mechanical work. Working on a wireless module was knowledge-enhancing experience. Not to forget the WEL lab (in EE department) of IIT Bombay where we did the testing of wireless module with the help of the instruments in the lab.

We were given two mentors, one from Electronics Club and one from Aerodynamic Club. Searching for components and designing the shape of the robot were the tasks we accomplished in the first week itself. Then we ran our heads into a very big problem. Call it bad timing or test of our patience; the Lamington Road market of electronics goods was closed due to a newly proposed tax by the name of LBT. The consequence- we were not in a position to purchase any components in first two weeks. So we planned to revisit our ideas and choices regarding the same.

To make the robot move on all terrain we came up with the idea of using track-belt wheel cause of its better mobility over rough terrain. The larger surface area of the tracks distributes the weight of the vehicle better than steel or rubber tires on an equivalent

vehicle. It decreases its ground pressure and allows vastly superior traction that result in a much better ability to push or pull large loads where wheeled vehicles dig in. The motor which we used was a johnson motor which has high torque. The purpose of using high torque motor was to enable it to move on all terrain.

Our project also included 'moving on water part' which made us choose the components that were waterproof. Considering the region where we were working, it was very difficult for us to find a water propeller for our robotics project. Hence, we failed to find our desired shape of propeller. The propeller which we got was a tilted propeller whose motor part was inside the bot and shaft part was coming from the backside of the bot. The advantage of this propeller was that we could prevent contact of the motor part from water along with the added blessing of the plastic covered shaft which ensured that only the metal inside the plastic part could rotate. And the hole through which the shaft was coming was covered with the epoxy available in the market as bondite. The same mechanism was performed with wheel part of the robot.

By the end of the third week we were done with all the physical parts of the robot. Wheels and propellers were eventually added to the bot. Now came the intimidating part - the way to go wireless!

Here arrived the electronics part of our project. Radio frequency is the most preferred way to go wireless in a robotics project. For short range wireless control applications, an RF transmitter-Receiver module of frequency 315 MHz or 433 MHz is most suitable.

There are two ways of transmitting data normally through RF module.

1. Parallel
2. Series

When we want to transmit data in parallel, we need parallel numbers of links for wireless or numbers of wires for wired communication depending upon how many bits we want to transmit at a time. For example 8 bits, 16 bits, 32 bits.

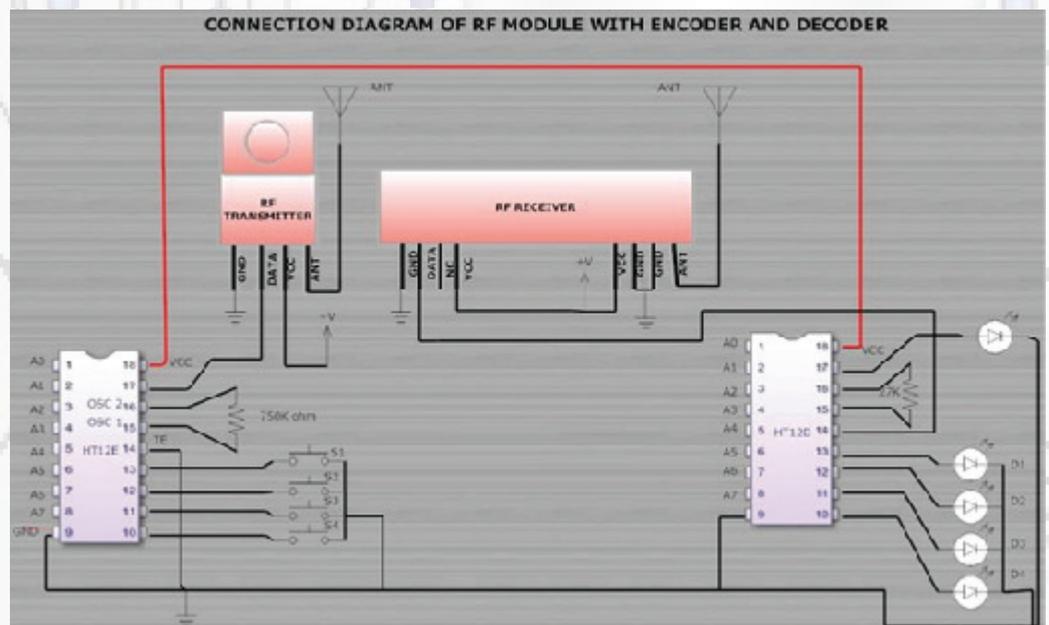
But in series transmission, only one channel is required for wireless transmission or one wire for wire communication. In serial transmission, one by one bit is transmitted through channel or wire.

Our complete RF module included RF transmitter, RF receiver, HT12 Encoder and HT12 Decoder. These Encoder and Decoder have 8 address line and 4 data line.

When we are using only one transmitter and receiver, there is no need to connect address line but when using more transmitter and receiver then to receive any signal the corresponding transmitter and receiver should have same address line. Since we were using only one RF transmitter and receiver so we didn't need to connect address line.

We were providing parallel data through D0, D1, D2, D3. Then the data is converted into series from parallel data. These series data is given to the Encoder with the help of the antenna. Then again converted into parallel data. These four data lines of the decoder were connected to the analog pin of the Arduino. Since we have four data lines so we can transmit 4 bit data and have 16 combination of the signal.

The problem first we faced was that our antenna was not working. It was not transmitting any radio signal. The problem was not in our circuit. The problem was the wire which we had used in the antenna pin. In connecting antenna with antenna pin we first used the normal bread board wire which losses all the radio signal. So it was transmitting less amount of radio signal. Then we used Coaxial cable, the wire which is also used in home dish connection. This cable has inner conductor surrounded by a tabular insulating layer, surrounded by a tabular conducting shield so it does not allow any signal loss. After using it our circuit was working fine and transmitting all the data correctly. First we tested it on the breadboard then applied it on the PCB.



The four bit instruction were given to the Arduino like normal move, acceleration, propellers: on and off, turning. After 30 days of hard work the project was completed.

The link of our wikipedia page:

http://stab-iitb.org/wiki/ORE01_Multi-terrain_vehicle#Abstract

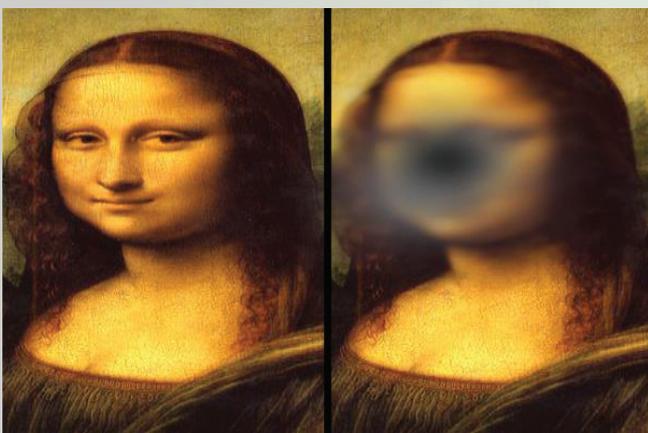
The link of our project video :

<http://www.youtube.com/watch?v=f7JnYp2-9KE&feature=youtu.be>

Diy Engineering the Eye

-Harsha Vardhan Pokolla

Diy- Engineering the Eye is one of the Design Innovation Workshop Series conducted by MIT Media Labs in collaboration with LV Prasad Eye Institute and Perkin School of Blind. The main objective of the workshop was to develop fully functional prototypes which address both preventing blindness and enabling people with existing vision loss to lead fuller, more productive lives.



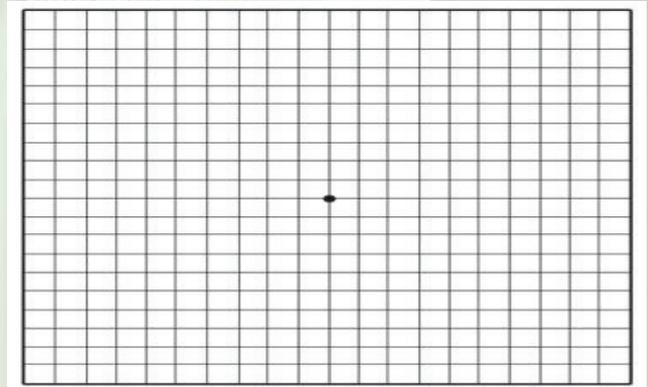
Amsler Grid Test

Age-related macular degeneration (AMD) is a medical condition which usually affects older adults and results in a loss of vision in the center of visual field (macula) because of damage to the retina. Approximately 25 million people are suffering with AMD world-wide.

A diagnostic tool that aids in the detection of AMD is the AMSLER GRID, which is grid of horizontal and vertical lines. Usually in this test, the person looks with each eye separately at the small dot in the center of the grid. Patients with macular disease may see wavy lines, or some lines may be missing.

In this workshop, AmslerGridTest, an android app which simulates the said test was developed. This app is user-friendly enabling to take the test at any place to monitor changes in your vision. Users are guided to mark the distorted areas (wavy/blur portions) of the grid, if any appears. Then app judges the presence of AMD and helps to deliver reports to practitioners. It is available in GooglePlay store at

<https://play.google.com/store/apps/details?id=com.ex.amslergridtest&hl=en>



Features:

- * Interactive: Allows you to interactively draw distorted areas of the grid.
- * Audio: Guided through a set of audio instructions for low visioned.
- * Store: Stores the results on the device and keeps record of them.
- * Email: Functionality to email the reports is provided.

Computational Aesthetics

-Venkat Arun

Is it possible for a computer to model a human concept as abstract as aesthetics, when even the human experts do not have a definite definition of the term? Can it differentiate between a beautiful song and noise, between a well taken photo and an amateur snapshot, an ordinary argument and the rare mathematical gem, an ordinary rhyme and a poetic masterpiece? Moreover, can it actually produce something that is aesthetically pleasing? Will there ever be a computer artist? Well, the answer may be a yes, and this article explores some of the exciting developments in the field, focusing on the visual medium. One line of research investigates aesthetics from a colour balance viewpoint. One familiar example of this system is the automatic colour correction feature in tools such as Photoshop. Two broad classes of such systems are the grey world model and white stretch algorithm. The grey world model assumes that the average of all the pixel values ought to be grey while the white point method identifies the 'whitest' pixels in an image and forces them to absolute white. Others use more sophisticated algorithms to decide when to remove the tint and the algorithm that is most suitable. (eg. [1]).

For, artificially generated images, fractal dimension of the image [5] is found to be a useful metric [3]. Regarding paintings, it has been found that aesthetically pleasing paintings have colour distributions that represent bell curves [2]. These are found to be easier on the eyes. For photographs however, we need a different metric, as bell curves don't work. Images that are complex, yet easy to process are found to be very pleasing to the eye. An empirical method to compute this ratio is based on the JPEG compression algorithm is given in [3].

Colour histograms can also be used to describe aesthetic quality in a more general setting. An algorithm for automatic harmonization of colours in an image is given in [4]. It differs from colour balancing in the fact that it aims for colour harmonization, not for picture realism. It has been demonstrated that it is possible to give reliable aesthetic scores to images that reflect human ratings [6]. This can be done by considering a large database of human scored images and applying a machine

learning algorithm to some features extracted from the image. These features are based on what ideas we already have from photographic experts. Some examples of such features can include colourfulness, hue, whether it follows the rule of thirds, how unique it is etc.

We have now seen that it is possible for computers to have a notion of aesthetics. But can it actually produce aesthetically pleasing content? Can it replace humans to create dynamic content on the fly? Content that is forever changing yet always aesthetic? Well, that may be possible. Let us consider each problem one by one.

A problem that is commonly encountered is the placement of text on images. The text should have the proper colour to enhance visibility while maintaining colour harmony. It should also be placed in a relatively uninteresting part of the image and should be placed unobtrusively.

Regarding the unobtrusiveness of images, empirical studies indicate that placing texts on the angle bisectors of the corner angles is a good idea (Fig 1)

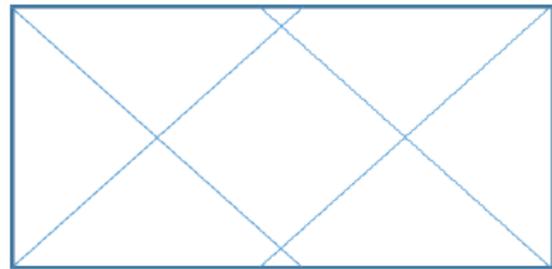


Figure 1 : Text looks good when placed on one of the bisecting diagonals

[7]. Now, we need to find areas of the image that do not contain too much detail. For this we need to find something known as a salience map (Fig. 2), which shows where a human would direct most of his/her attention. A summary of a number of methods is given in [8]. A particularly simple method is to subtract each pixel from the mean of its surroundings at different scales and find a simple average [9]. This mean of surroundings can be efficiently calculated using integral images. In figure three, the brighter an area, the more interesting (or salient) it is. Thus we need to place text on the darker regions to obtain good text placement. Additionally faces can be detected and avoided while placing text.

Let us now address the topic of actually generating art automatically. Genetic algorithms are generally used for this purpose. To do so, we need functions that generate images and a way to represent them concisely. Initially, we generate some random functions, then we compute the aesthetic value of each of the images generated and choose the fittest functions to 'reproduce'. That is, the 'offspring' of the reproducing functions resemble their 'parents'. This process is repeated until images of good aesthetic scores are obtained. Some examples of 'generative' art are given below (Fig 3).

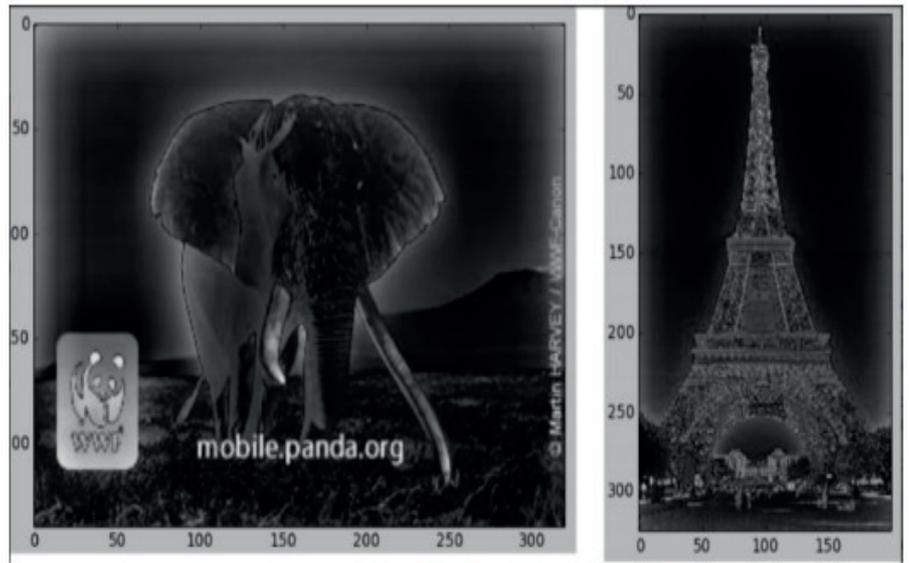


Figure:2 Saliency map for two images. Found by subtracting each pixel from the mean of its surroundings

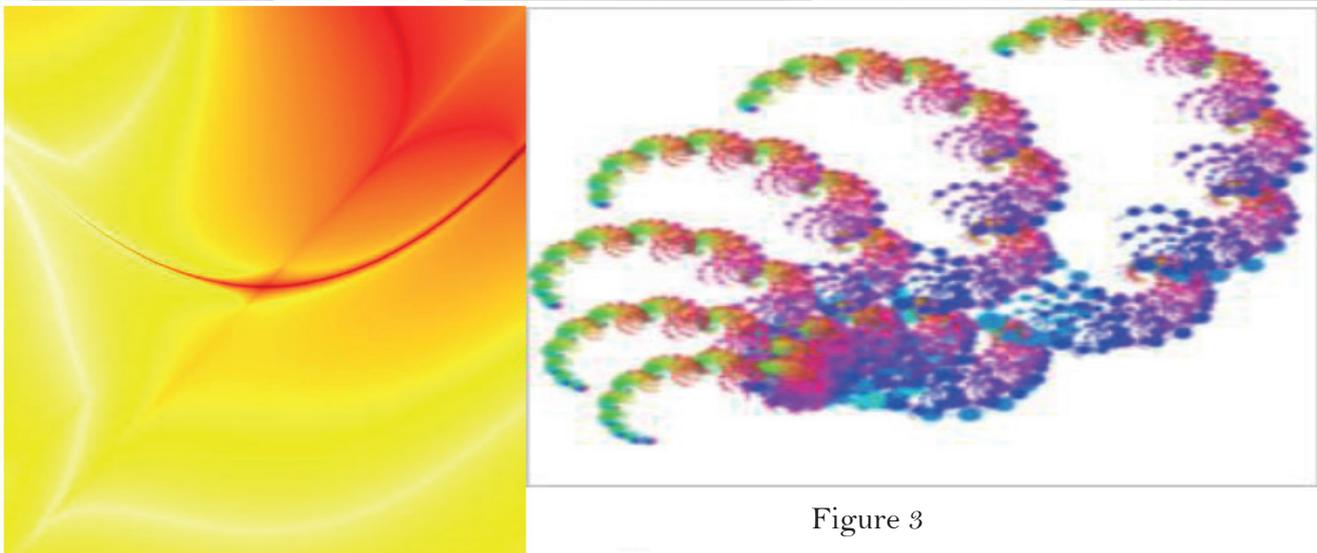


Figure 3

Example of the evolutionary art, generated by AEVA

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Carbon Monoxide Detection: **Canaries** or **Carbon Nanotubes** ?

-Gaurav Saxena

Keywords: Gas detection, Sensors, MEMS, Humans and animals safety

The concern for the harmful gases such as carbon monoxide, carbon dioxide, propane, ammonia, etc is not new. The requirement of gas detection also rose as humans started working in areas where probability of such gas is high. One example of such working area is a coal mine. In coal mines, carbon monoxide, nitrogen, carbon dioxide, methane and hydrogen sulphide gases are normally present. Not only some of these gases are highly flammable, but also highly-toxic even at a low concentration. The added hazards comes from the mixture of such gases. For example, mixture of carbon dioxide and nitrogen makes the atmosphere oxygen deficient, which can cause suffocation. Carbon dioxide, carbon monoxide and nitrogen forms a combination for mine explosion. In early days various methods had been tried out for their detection.

In one of the methods, before the start of first shift, a brave miner, after wearing a wet blanket and equipped with a long wick with one end lit on fire, will first scan the mine for the pockets of methane gas. When the miner hit such a pocket, it would ignite. For small size pockets, the safety of wet blanket can keep the brave miner safe. However, an encounter with a large methane pocket often leads to causality. But in those days, the management wouldn't mind to lose one man than the entire group, so that the work will continue.

The next gas detection method, "The canary in the coalmine," became a popular phrase, often to refer a certain social situation. In this method, according to the legend the miners would bring a caged canary into new coal seams. Canaries are especially sensitive to methane and carbon monoxide gas. The poor canaries could be replaced by other animals but adding more to the misery is their ability to react instinctively, even to small concentration of gas. The detection principle was pretty straight forward. As long as the bird kept singing, the miners knew their air supply was safe. If the canary starts to rock the cage, the signal was to evacuate the mine and a dead canary signaled an immediate evacuation.

When the canaries are in short supply, the groundbreaking human invention i.e fire comes in handy. A miner will hold a flame-light with a flame-arrestor shell. The detection principle was, if the flame starts to extinguish beyond a level, miners have hit an oxygen deficient environment. Or if the flame rises beyond a point they have encountered a flammable environment. The method got popular and some people even started to detect the type of gases by the change in flame colors.

We have come a long way from those days, and now we have gas sensors for detecting gases in parts per billion range. Researchers worldwide are developing sensors using carbon nanotubes. And the size of these nanotubes is one hundred thousandth the size of a human hair. For gas detection, sensor simply measures the change in current upon its exposure to gas. The current modulation is observed because of the adsorption of gas molecules onto the wire surface, which in-turn alters the wire's conductivity. For sensing applications, the amount of change in current leads to the identification of gas concentration.

Though the same detection applies to other sensing materials also (such as, metal oxide semiconductors), the real power of carbon nanotube sensor comes from their very small size, because of which not only the gas sensors can be miniaturized but also the increased surface to volume ratio increases their sensitivity, leading to gas detection in ppb range. However, the commercialization is limited because of carbon nanotubes deposition cost.



Image:1- A canary in coal mine

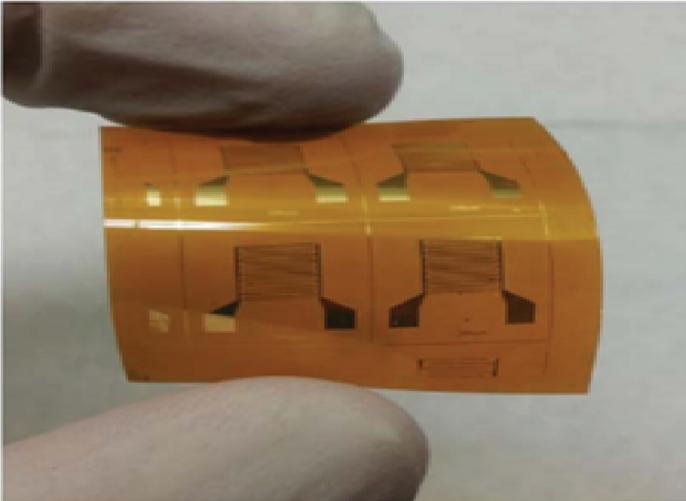


Image:2- TU Munich's CNT sensors fabricated onto a flexible polyimide substrate.

At Technical University of Munich, a group of researchers lead by Dr. Paolo Lugli, has employed a low cost deposition technique called spray deposition method to reduce the cost of deposition (from <http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=06144569>). Though, the spray deposition method is not new in itself, however, in a step towards the low cost fabrication of CNT-based gas sensors, the group deserves credits for exploring its potential, and calibrating the method. Image 3 shows the response of their fabricated sensor (Image 2) as a change in resistance, when tested with different concentrations of carbon monoxide gas. In the response curve, starting at $t=0$, the constant initial resistance is called "baseline resistance". The sudden drop in resistance at around $t=500$ sec is due to the external thermal energy which is applied till around $t=700$ sec. External thermal energy helps in the desorption of any residual or unwanted gas molecules on the CNT surface. After the thermal source is removed, the sensor is allowed to reach its baseline resistance (which is till $t=$ first dotted line).

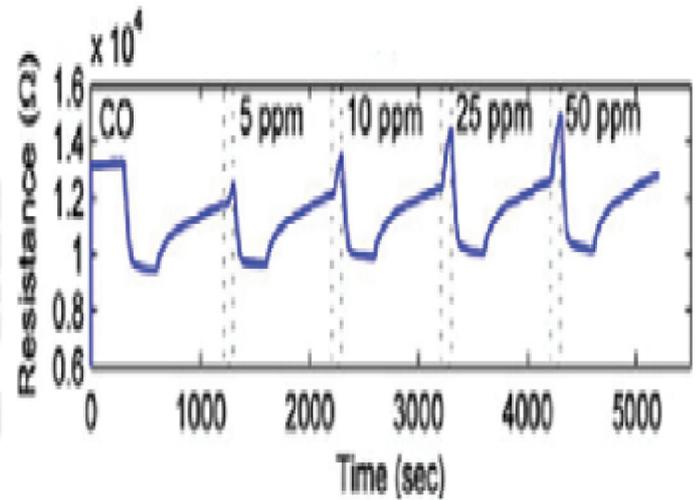


Image:3- Plot of the measured sensor resistance over time. Each graph is divided into four segments, based on four exposure/recovery cycles at different test gas concentrations

Thereafter, the sensor is exposed to 5ppm of carbon monoxide. Since, carbon monoxide is an oxidizing gas, it increases the CNT's resistance which can be observed as the spike in the response curve. At the end of exposure ($t=$ second dotted line), thermal pulse is applied again to "refresh the surface", for testing the sensor with other concentrations. (From:<http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=06403915>)

Even though the results are encouraging and the fabricated sensors shows an excellent change in responses depending on the gas concentration. (from <http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=06527935>)

Budding researchers can still dive into this exciting field as CNT sensor requires more research efforts before they can actually hit the market.

Point-Of-Care Colorimetric Detection

Using A Smartphone

-Kumar Abhishek

In recent years, paper microfluidic assays are gaining popularity as a simple and fast way of disease screening and health monitoring in resource limited environments. Although the colorimetric results of these tests are visible to the naked eye, the accuracy of the results relies upon the precise quantification of the concentration of the analyte. This requires the use of complicated or not-so-easy-to-come-by hardware such as digital color analyzers, scanners or custom portable readers.

Although the colorimetric results of these assays can be viewed by naked eye, it is difficult to precisely quantify the analyte amount.

Promising colorimetric detection results have been demonstrated using video cameras, digital color analyzers, scanners or custom portable readers. A key drawback of all these methods is the need for specialized instrumentation and for image analysis with a computer. A smartphone (or a tablet) offers an attractive alternative for imaging, analysis, and communication of results in the field. With 6 billion subscriptions worldwide, it is needless to say that they are quite ubiquitous. Semi-quantitative home kits can help patients and doctors diagnose such issues without undergoing laboratory tests, although with a reduced accuracy. Recently, there has been growing interest in using low cost imaging devices like mobile phones to quantify such tests at home.

A number of Indian companies have already ventured into this field. IIM Calcutta Alumnus Myshkin Ingawale's Biosense Technologies has launched a iOS urine testing app called uChek. Available in India and the United States, the



company claims that uChek can be used to test for 25 different medical conditions including diabetes, kidney, liver and bladder problems, pre-eclampsia and hypertension, and urinary tract infections. Users can install the app on their iPhone and read the urine dipsticks with the urine sample using a peripheral called 'Cuboid' and color mat.

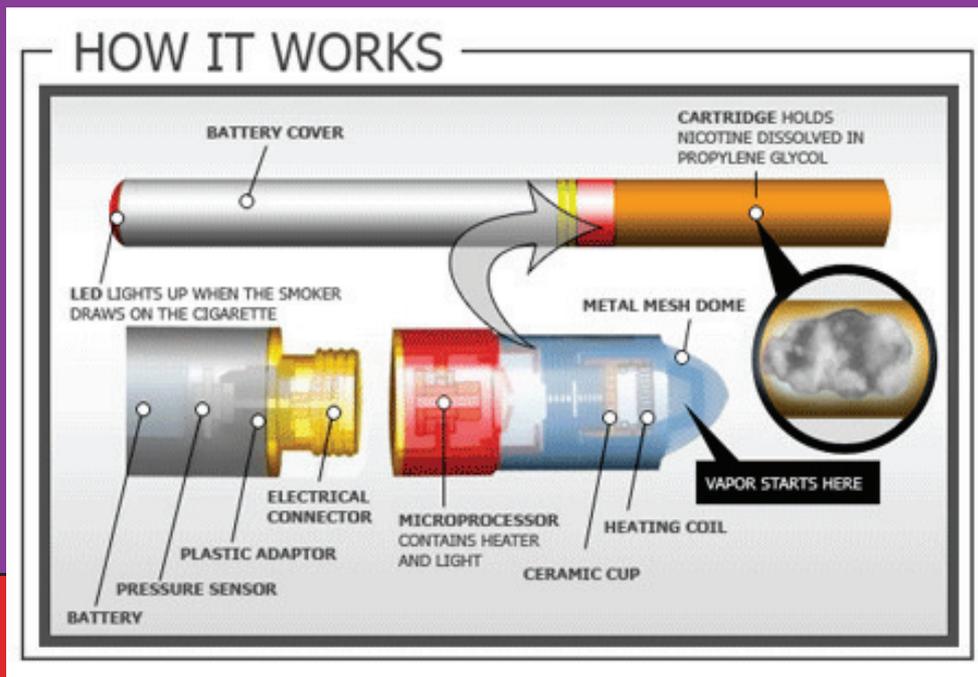
The company says that urine dip sticks begins reacting within 60-120 seconds of dipping them in an urine sample. IIT Madras Alumnus Dhananjaya Dendukuri's Achira Labs is venturing into the field of Fabric Chips and Microfluidic Chips. They are working on developing textile weaving as a platform to manufacture sensors. The importance of using fabric based chips in India is the low cost of their production. Silk weaving is an important industry in India, and the use of silk to manufacture biological assays is not only economical, it also does away with the environmental concerns associated with the use of plastics and/or its derivatives.

ELECTRONIC CIGARETTE

-Surya Teja

We all know that cigarettes are harmful to health. Excess usage can also lead to Cancer: mainly due the combustion of

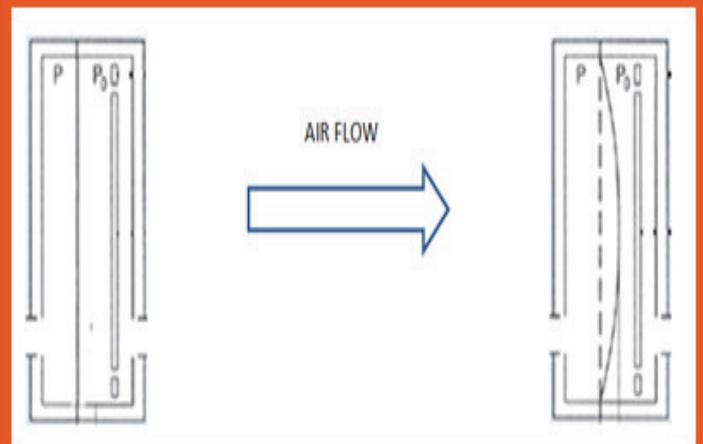
carcinogenic chemicals present in tobacco. Hence, search for alternative sources of nicotine consumption-the main cigarette component without any other harmful components present, has begun. After some rigorous research a solution was put forward by the Chinese namely "The Electronic cigarette"- Using effectively and innovatively the knowledge of electronics for nicotine consumption. It sounds surprising but a simple airflow sensor principle is used for detecting suction pressure which we largely encounter on a daily basis and one of the most widely used electronic component-a Condenser Microphone used widely in mobile phones.



Pressure difference between the two cavities as depicted above is utilized for deformation of a diaphragm, a simple but effective principle for sensing air flow. The signal from this is then conditioned by application of Power Electronics which deals with high power transf-

er devices to heat up a coil which is nothing but an ordinary nichrome wire (resistance) for vapour formation. This vapour is a simulated version of the cigarette smoke but a less harmful alternative.

Sometimes the most innovative solutions to any painstaking problem will just lie around you.



ALUMNI STORY

-Peter Sam

I would firstly like to thank the InPhase team for providing me with the opportunity to share my experiences in graduate school in Canada with the current IITG junta. I have always wanted to come back or communicate with the current students in the campus and I feel hence that this article is more like a letter than an article. I graduated from IITG in 2012 with B.Tech in ECE and currently am pursuing my Masters in Applied Science in Electrical and Computer Engineering at the University of Toronto in Toronto, Canada. I used to live in Kameng, and stayed in the B4 lobby for the entire four years of my stay in IITG and what an amazing four years they were! I'm sure the current students love the natural beauty and calmness of the campus, but it is only after you leave the place for good that you actually realize what treasure you had to explore in the time you spent there.

Coming to graduate school in University of Toronto – a student from IIT notices differences in the academic life immediately when she transitions to graduate school. Specifically at U of T, the uniqueness is exaggerated in that the system has subtle differences with the graduate school system in the US. For starts, you start with a supervisor and her research group instead of choosing one after/during the courses in your first year. This has both pros and cons – in that you're able to start working on your research and thesis far earlier than your friends in American grad schools, but also that you're sort of 'locked' into a particular research group and changing groups later depending on your current group is not a trivial process. However, the greatest pro, which far outweighs everything else in most cases, is that the MASc programme is completely funded – you receive enough funding to pay your tuition and live in Toronto depending on your lifestyle preferences. The differences I mentioned in the beginning are mainly to do with your practical experience in academic life – with courses and interactions with your peers. I found graduate level courses, in most cases, to be extremely challenging and thorough compared to the toughest courses we did in IITG –at the same time enjoyable and enriching. With peers, your interaction decreases both quantitatively and qualitatively in grad school as all grad students pick and choose their courses and projects depending on their research group. This doesn't allow for the consistency of company that leads to interactions at the undergraduate level and hence, one often seems to 'plough a lonely furrow' in graduate school. However, that is a part of the independence that comes with graduate studies and makes you learn much more than you did with a peer group in the process of working with new problems.

A bit about my research – I am currently working on design of a biometric system using ECG signals for identification of human beings. This work has been researched by the BioSecurity Lab in U of T for almost a decade now and I am working on a new system which will allow for the use of ECG biometric technology in smart wearable security systems. More specifically, using Machine Learning and Signal Processing methods, I am working on ways to overcome problems introduced in ECG biometrics when heart-beat changes in response to physiological changes. Coming to the other important aspect – non-academic life in Toronto, I would summarize my experiences in the past seventeen months as 'wonderfully insightful'. Toronto is one of the most multicultural cities on the face of the planet and the diversity and openness of the people here never made me feel I was the odd one. I have visited other cities in Canada and US such as NYC, Boston, Washington and Ottawa. However, I can say that I love Toronto the most because of the variety of experiences one can have in this city. For example, the city has pockets of neighbourhoods which have distinct flavours from different parts of the world. This leads to interesting experiences like walking down a street when in just over a mile you can experience architecture, food, smells, sounds and music from four different cultures, all spaced distinctly on the same street in a beautiful way. Hence, when you live in Toronto, you live in a microcosm of Planet Earth and that makes for an amazing time just living in the city and understanding its character and nature.

While signing off, I would like to say this – for those of you who do end up travelling outside of India or even in India, to places which you've never been to before – make sure you don't spend all your time in the new place missing its cultural and demographical taste. You can do this only by spending time interacting with people from the city/town you find yourself in – and only in the stories they tell and experiences they recount will you find the real taste of the city. Otherwise, you will only taste and see the ingredients separately – missing tasting the dish!

All the best for your future and as Miracle Max says in the epic movie The Princess Bride, (watch it to get the context!)

“Bye-Bye boys! Have fun storming the castle”

Drop

One drop trickles to join another,
Many such strands coalesce to form micro-canals,
Many such micro-canals merge to form a stream,
Many such streams flow into a river,
Many such rivers finally join the vast expansive ocean.

Creativity begins with a pure **THOUGHT**,
A thought, devoid of conditioning,
A thought, that brings happiness unbound,
A thought, that separates us from the plane of knowledge,
A thought, radiant, fresh and free,
A thought, most of all, filled with love.

Latch on to this thought,
This is your child,
Hug it, hold it and nurture it,
Shape it, water it and build on it,
But most of all remember to love it.

Years from now, this thought,
Will become, a sub-conscious living legend,
A part of your soul,
A pillar of support,
A true reflection of your principles,
Your very principles,
Which have stood by you in the toughest of moments.

From a pure drop to a fortress,
From a strand to an ocean of knowledge,
You are everywhere, across time and space,
Monumental in character,
Supreme in intellect,
Multidimensional in vision,
Most of all full of love and simple at heart.
What can the Gods take back from you?

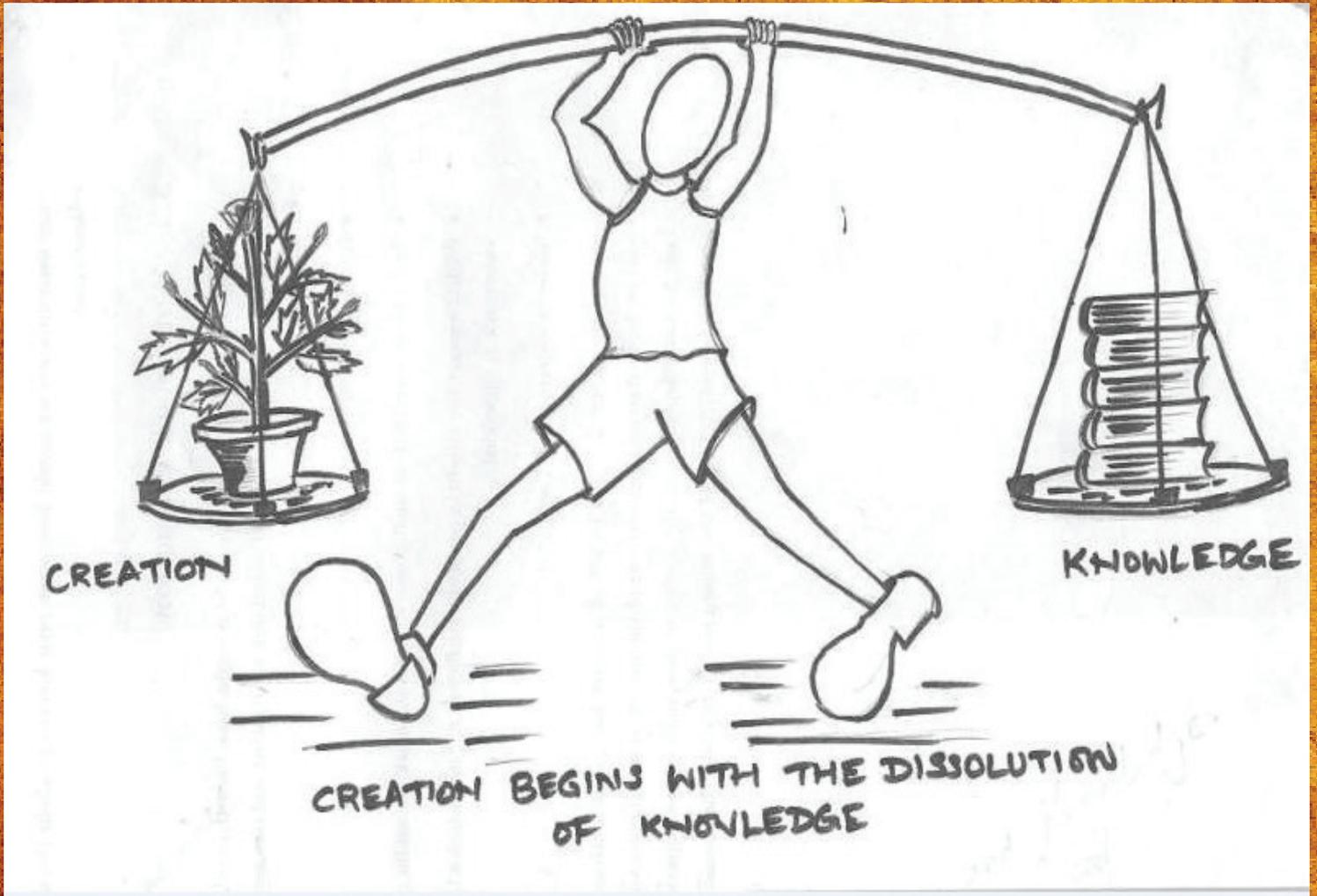
- Dr. Kannan Karthik (Jan 25, 2014)

CARTOONS



Ideas do not fall from the sky:

Ideas are often mistaken to be random strands of thought. We are all thinkers. When we sip a cup of coffee, we think. When we drool over a set of equations, we are thinking. When we are listening to a lecture in class, we are thinking. We even think, when we sleep. Every research problem small or large, triggers a chain of thoughts, which becomes a subconscious flow. The rational mind is grinding away behind the curtains, piecing together disparate fragments of information till all these fragments finally coalesce and crystallize into a beautiful solution to a complex problem. At that point when the convergence is complete the mind becomes free, the problem has been completely assimilated. When we suddenly wake up with a solution, it is not because of a random strand, it is due to the complete process of rational grinding which has finally converged to a singular thought: which serves as the UNLOCKING KEY to the complex problem.



Creation vs Knowledge:

It is not possible for a creator to extend a majestic design, unless the creator has fully assimilated it and has let go of it. It is in the light of this detachment that the creator liberates himself from the design. In other words creation is not possible without knowledge. But to resume the process of creation and to extend the design, the mind has to be empty, which is not possible without complete assimilation and detachment.

-Dr. Kannan Karthik

Just the Facts



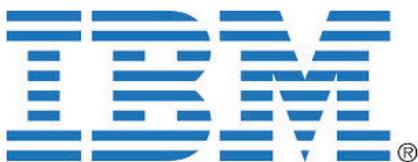
1. Hong Kong is the world's fastest internet place. It has blazing fast internet, an average peak speed of 54.1 megabits per second. At this speed you can download an HD movie in about 4 minutes.

2. Google estimates internet data at about 5 million terabytes. The human brain could hold an estimated 1 to 10 terabytes. Using an estimate of 5 terabytes per brain, it would take a million human brains to store the internet.



3. The time shown on all of the devices in pictures on Apple's website is the same (9:41 a.m. for iOS devices and 10:50 a.m. for Macs). The time is coordinated with when the pictures will be shown during Steve Jobs' keynote address.

4. The first hand-held mobile phone was demonstrated by Dr. Martin Cooper of Motorola in 1973, using a handset weighing around 1 kg.



5. IBM was initially called Computing Tabulating Recording Corporation. In 1924, it officially changed its name to International Business Machines.

6. Nokia is currently the world's largest digital camera manufacturer. The sales of the company's camera-equipped phones have exceeded those of any conventional camera manufacturer.



7. Nokia is very careful about not including the number 4 in any Nokia handset model that is retailing in Asia, as the number is considered to be unlucky by many in this particular region.

~	!	@	#	\$	%	^	&	*	()	{	}	←
1	2	3	4	5	6	7	8	9	0	[]	Backspace	
Tab	"	<	>	P	Y	F	G	C	R	L	?	+	
↑	↑	A	O	E	U	I	D	H	T	N	S	-	Enter
↑	:	Q	J	K	X	B	M	W	V	Z	Shift	↑	Shift
Ctrl	Win Key	Alt								Alt Gr	Win Key	Menu	Ctrl

8. The Dvorak keyboard can be more efficient than Qwerty, 20 times faster in fact.

9. Gates initially wrote company name as Micro-soft, which made sense considering it's a portmanteau of "microcomputer" and "software." Losing the hyphen, "Microsoft" was officially registered as a company in November, 1976. The current Microsoft logo was introduced in 1987, but previous to that was the "blibbet" logo that's pictured.



10. Lee Byung Chull founded Samsung in 1938 as a trading company that dealt in local groceries and had 40 employees. At that point of time it used to produce noodles as well. It was only in the late 1960's that the group ventured into electronics and eventually formed Samsung Electronics.

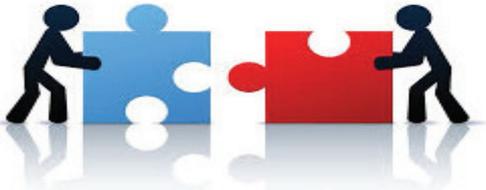
11. Google bought the domain name Gmail.com from the most popular newspaper comic Garfield.com. It was used for sending Email to their Fans.



12. Niue is an island country in the South Pacific Ocean, 2,400 kilometres (1,500 mi) northeast of New Zealand and with an area of 260 square kilometres. In 2003, it became the world's first "Wi-Fi nation", in which free wireless Internet access is provided throughout the country.

13. World's first website can still be found at <http://info.cern.ch/hypertext/WWW/TheProject.html>

Puzzles



5 pirates of different ages have a treasure of 100 gold coins. On their ship, they decide to split the coins using this scheme:

The oldest pirate proposes how to share the coins, and ALL pirates (including the oldest) vote for or against it. If 50% or more of the pirates vote for it, then the coins will be shared that way. Otherwise, the pirate proposing the scheme will be thrown overboard, and the process is repeated with the pirates that remain. As pirates tend to be a bloodthirsty bunch, if a pirate would get the same number of coins if he voted for or against a proposal, he will vote against so that the pirate who proposed the plan will be thrown overboard.

Assuming that all 5 pirates are intelligent, rational, greedy, and do not wish to die, what will happen?



One hundred persons will be lined up single file, facing north. Each person will be assigned either a red hat or a blue hat. No one can see the color of his or her own hat. However, each person is able to see the color of the hat worn by every person in front of him or her. That is, for example, the last person in line can see the color of the hat on 99 persons in front of him or her; and the first person, who is at the front of the line, cannot see the color of any hat.

Beginning with the last person in line, and then moving to the 99th person, the 98th, etc., each will be asked to name the color of his or her own hat. If the color is correctly named, the person lives; if incorrectly named, the person is shot dead on the spot. Everyone in line is able to hear every response as well as hear the gunshot; also, everyone in line is able to remember all that needs to be remembered and is able to compute all that needs to be computed.

Before being lined up, the 100 persons are allowed to discuss strategy, with an eye toward developing a plan that will allow as many of them as possible to name the correct color of his or her own hat (and thus survive). They know all of the preceding information in this problem. Once lined up, each person is allowed only to say "Red" or "Blue" when his or her turn arrives, beginning with the last person in line.

Develop a plan that allows as many people as possible to live.



Three gods A, B, and C are called, in some order, True, False, and Random. True always speaks truly, False always speaks falsely, but whether Random speaks truly or falsely is a completely random matter. Your task is to determine the identities of A, B, and C by asking three yes-no questions; each question must be put to exactly one god. The gods understand English, but will answer all questions in their own language in which the words for 'yes' and 'no' are 'da' and 'ja', in some order. You do not know which word means which.

Generation Concept



1G

2.4_{kbps}

- Basic voice service
- Analog based protocol



2G

64_{kbps}

- Designed for voice.
- Improved coverage and capacity
- First Digital standards(GSM, CDMA)



3G

2000_{kbps}

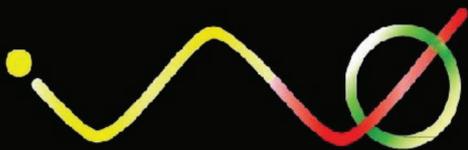
- Designed for voice with some data consideration(multi media, text, Internet)
- First Mobile Broadband



4G

100,000_{kbps}

- Designed primarily for data
- IP-based protocol (IPE)
- True mobile broadband



Inphase Magazine
By Cepstrum Student Society
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Indian Institute of Technology Guwahati



AWAITING YOUR FEEDBACK!