Inphase

11th Edition

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Cepstrum

Dept. of EEE
IIT Guwahati

Hello Android
Cognitive Radio
Decoding OMRs
Stealth Technology
Internship Experience

We are proud to present the 11th edition of InPhase - Enlighten Yourself, following the protocol for presenting knowledge as: 'Put it before them briefly so they will read it, clearly so they will appreciate it, picturesquely so they will remember it and, above all, accurately so they will be guided by its light'. The cover page depicts the theme 'Enlighten yourself with InPhase' whereas the back page urges all the readers to always remain 'in phase with InPhase.'

One never notices what has been done; one can only see what remains to be done. So we present the articles from both sides, but more emphasize is given to upcoming technologies. We introduce cognitive radios and smart grid briefly just like seeds of ideas and leave it up to you to flourish them further. New coming technologies like driverless car, stealth technology in aircrafts are also presented. Unfamiliar devices like magnetic amplifiers are brought to you by this InPhase.

Be less curious about people and more curious about ideas. And so it's time to say 'Hello Android'. Give it a try. You will learn how to develop an android application. This issue also features an article about morphological image segmentation, an algorithm to evaluate OMR answer sheets.

Once a newspaper touches a story, the facts are lost forever, even to the protagonists. So only after presenting lots of facts and ideas we bring to you the live stories and fun part. You might want to go through an internship experience, caricature, picture of pass out alumni's batch etc. I hope you will find articles interesting and useful.

We must all understand that how easily the good initiatives die down if they do not get continuous support and encouragement. InPhase is still in its infancy and it needs the support of everyone to grow further and strong! Only with your continued input and feedback can InPhase stay alive. So this is a request from me to all our readers. Let the hundred articles be written, let the hundred dreams come alive!

I would like to thank entire InPhase team for their collaborative efforts. I also like to thank all authors of articles and many more people who worked solely for the name of Cepstrum and InPhase.

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(Final year BTech)

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/* Decoding OMRs -A Novel Way*/

Sitting with some PDF's related to open computer vision and working with images, I dunno when and how I was caught into a nap dreaming something out of the box and now I have spent over a month realizing and improving it. Wondering what the dream was…

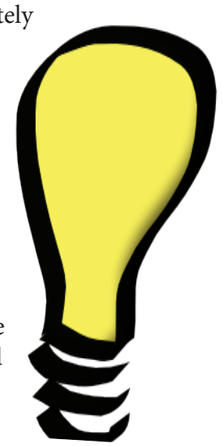
Before the nap, it was binary images hovering in my minds. Binary images are the digital black and white images in which each pixel is either completely black or white. In opencv pixel information is stored completely in the form of bits where 0 represents black and 1 represents white. Opencv has a good library with millions of functions and mimics C++ programming a lot in the domain of images. Just an instance of it is a function cvOr which performs OR operation on each pixel of the two images just like any digital circuit and the result can be easily stored.Tired and exhausted, I yawned and went into the world of dreams. And then the days of JEE and writing exams on OMR based bubble filling sheets dawned to me. And then I leaped out of my dream for I had struck an idea.

I thought ,why not make a program in C++ that can check the scanned bubble-filled OMR sheets. After all, the ADF printing machines which check 30-50 such sheets per minute cost no less than a minimum of Rs.5000. The cost of better ones go more than Rs.80000. Though affordable when a lot of such sheets need to be checked but what if the scale of database is small and you wanna be out of the burden of checking. That's what was the idea driving me hard at it and here's how it works.

The simple OR operation between the corresponding pixels of the two images are:
0 + 0 = 0
0 + 1 = 1
1 + 0 = 1
1 + 1 = 1

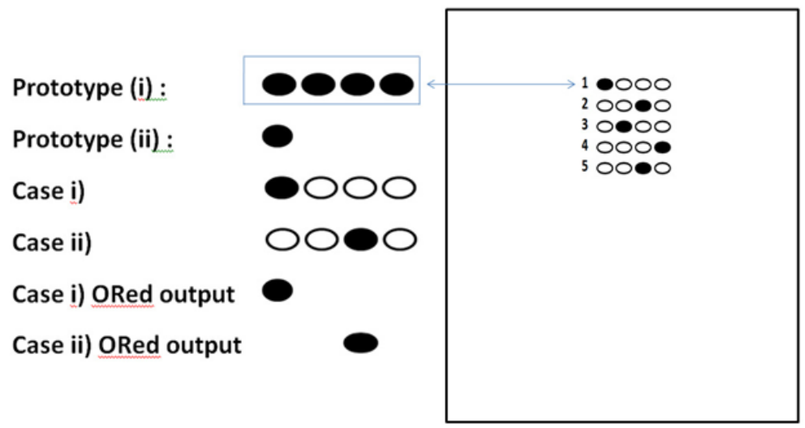
Just suppose the answer to question is option (a) and lets take two cases: i)when the student answers (a) and ii) when the student any option other than (a) say (c).

In order to evaluate, we generate prototype(i) and prototype(ii) as shown above. Prototype (a) contains a dark region corresponding all the options while there is dark region corresponding to position (a) and remaining all positions of the image is completely white in prototype(ii) thereby making all other pixel elements 1 other than the dark region where pixel stores 0.



Evaluation is done in two stages:

i)Single Keying: Here we OR between the prototype(i) and the answer sheet to be evaluated and count the dark regions in the ORed output.



/*Decoding OMRs -A Novel Way*/

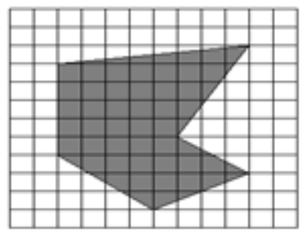
ii)Correct Keying : Here we count the total number of dark regions in the ORed output of prototype(ii)and the answer sheet.

In our case only one option (a) is correct. If the number of dark regions in the stage (i) is greater than 1, it clearly implies that the clever examinee has filled in more than 1 bubble and hence is awarded zero. In case the stage (i) yields 1 we proceed to stage (ii). Incase the outcome in the stage(ii) is 1, the answer is correct .

The method described above is used if only a single option is correct. Stage (i) and (ii) become of much more critical importance incase more than one option is correct.The method discussed is a big departure from the currently used softwares based on reflection in which the fact that darker regions reflect less light is exploited. The portions of the answer sheet from which less light is reflected is compared to corresponding regions of the answer key and accordingly the results are evaluated.

Pixels, Binary Images & OpenCV

A Binary Image



Binary Image with Pixels

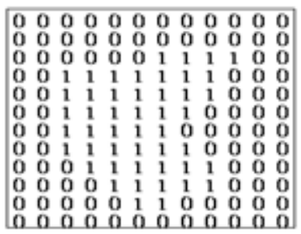


Image information about each pixel

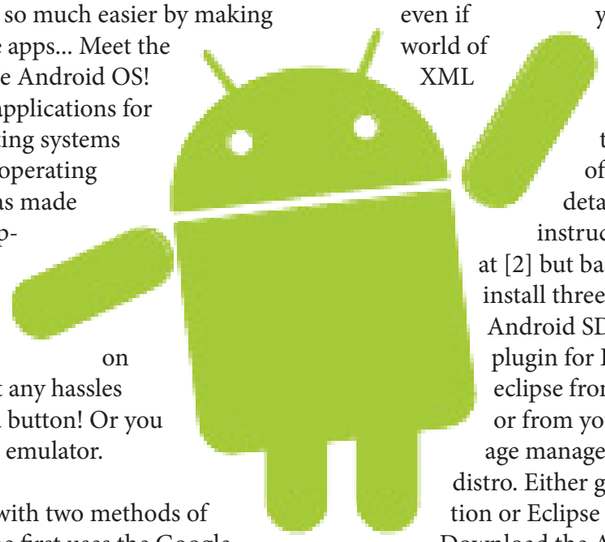
Pixel is the smallest rectangular area under the grid. It is smallest unit of a digital image that can be accessed or processed. (replace 1's by 0's and viceversa for the rightmost image).

Binary images are the digital black and white images in which each pixel is either completely black or white. In OpenCV(an open source computer vision library developed originally by Intel), pixel information is stored completely in the form of bits where 0 represents black and 1 represents white. OpenCV has a good library with millions of functions and mimics C++ programming a lot in the domain of image processing. Just an instance of it is a function cvOr which performs OR operation on each pixel of the two images just like any digital circuit and the result can be easily stored in the form of a new image. /

Kailash Atal
3rd year ECE

Hello ~~World~~ Android

Two volumes ago, we introduced you to Ubuntu's then latest release, the Karmic Koala. Now we bring you the power of the same Linux kernel to the palm of your hands, or rather Google did! Introducing the Android OS! I'd be surprised if you already haven't met! The Android OS, as you know, is Google's take on Linux for the mobile platform. Android has been taking the mobile market by storm but that's not the crux of this article... Not even close... In this article, we introduce you to a different side of the Android OS, a side seen till now only by those who make our lives so much easier by making the most innovative apps... Meet the developer side of the Android OS! Unlike developing applications for a majority of operating systems (including desktop operating systems), Google has made android app development unthinkably easy! The best part is that you can test your apps directly on your phone without any hassles with just a click of a button! Or you can test them on an emulator.



We will be dealing with two methods of developing apps. The first uses the Google App Inventor and the second uses the Eclipse IDE and the Android SDK. App Inventor is a product of Google Labs and is compatible with Windows, MacOS and Linux. It can be found at [1]. I kid you not when I say Google App Inventor involves absolutely no coding! You just need a Java enabled browser and you need to install a single application which is available on the site itself. Once you've done that, the app development is self-explanatory! All the widgets (Including buttons, input text boxes, stopwatch!) and sensor readings (G-Sensor, accelerometer, ambient light sensor, compass) you'll ever need are found as blocks. You just need to drag them on-screen and add an event listener (Which is another block) which waits for some user action and responds to them. The actions can be edited in the form of a flow diagram. So once you make the app that you've always been dreaming of (Okay, so maybe I'm exaggerating a bit), you click the button "Send to Phone" and voilà! Your very own app on your very own phone! I told you it was easy!

The second approach requires a basic understanding of Java which isn't very hard to gain even if you're new to the world of coding! It also uses XML which can also be easily learned through the use of examples. The detailed installation instructions can be found at [2] but basically, you need to install three things, Eclipse, the Android SDK and the ADT plugin for Eclipse. You can get eclipse from [3] (Windows) or from your default package manager on any Linux distro. Either get the classic edition or Eclipse for Java developers. Download the Android SDK [2] and install the following through it: Android SDK Tool, Android SDK Platform-Tools and the SDK Platform for the version of Android you wish to develop for. You may have some problems here because of the proxy authentication. You can use Gproxy or a similar solution to bypass that as these will allow the use of an unauthenticated proxy. The simplest solution is to take the SDK files from someone who has already set up the SDK. If you have a wireless internet connection, this wouldn't be a problem either.

Hello ~~World~~ Android

Now we come down to the crux of the matter! How to put those brilliant minds that think in OOP to work! Don't worry even if it doesn't, think in OOP that is!

Android app development on Eclipse involves two stages, the UI (User Interface) and the back-end The UI is made using XML or if you're feeling lucky, you can make it through Java. But XML just gives you the advantage of being able to see your output as you make it. This itself can done in one of two ways. There is a blocks editor in which you drag objects on the screen, not very much unlike the App Inventor. The editor provides you with a very large set of widgets you can choose from. Once you add a widget, you can edit its properties through a simple right click or you can just switch to the XML code and modify the tags manually. All the XML properties of each object are named by their function and with Eclipse auto-complete (Ctrl - Space), it is very easy to pick up. There are different types of layouts such as the relative layout, the grid layout, the list layout and the linear layout. You can see detailed tutorials about them at [4]. Once you're done making the UI, it's time to write some coffee!

Android applications are made up a set of classes known as activities. Each activity can be thought of as a separate screen with a separate XML for the UI. When the application is started, the main activity is opened. This activity can open other activities. The activities form a stack with the latest called activity at the top. When that activity finishes, the earlier activity comes to the forefront and so on until the home screen is reached. Activities are made by inheriting the activity class and overriding the built-in functions. The activity lifecycle can be found at [5]. There is a specific function which is executed when an activity is started, finished, paused or resumed.

Once your activity is made, the linking of XML elements (Such as buttons and text boxes) with event listeners in Java is done through the use of id's assigned to the XML elements. The event listeners themselves wait for some action to be performed on the widgets and respond to them accordingly.

You can also use file management, built-in libraries, OpenGL and vectors graphics to improve your application. Google has provided a great deal of libraries and API's that you can make use of for many different things. There are libraries for sounds, 2D graphics, OpenGL for 3D graphics, JavaCV [6] for Computer Vision on Android and much more. There are even API's that allow you to make use of the default camera application to take pictures, the default gallery to open an image file, Google Maps, the SMS and phone applications, the sensor read, the bar code reader and so much more. The world of Android is very vast but there are so many resources out there that is very easy to get started. Most of the resources and tutorials that you would need to get started are already present at the Android Developer site at [4]. They even provide basic tutorials that get you up and running! Feel free to get in touch with us if you need some help.

Now that you know how to develop Android apps, all you need is a smart idea...

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Ajaykumar Kannan
3rd year ECE

Driver-less car technology
What drives the future!

Driver-less car technology
What drives the future!

Dreams of the past, are ideas of the present and realities of the future, they say. There were days, when motion seemed impossible, without the aid of beasts to bear the burden of your luxury. Then came the aid of the motor, to relieve those naive animals, to give us what we now consider granted. Now cut to the future, when technology completely wipes out the necessity of human intervention to drive him! What is written below is a glimpse into that world, where one travels without driving, and one goes places, without moving an inch! A driverless car is a vehicle equipped with an autopilot system, which is capable of driving from one point to another without any input from human operator.

In order to drive a car, a system would need

1. Sensors
2. Navigation
3. Motion Planning
4. Actuation

1) Sensors: Sensors are there in the car to sense the speed of the car, the objects around, road signs, object's motion, can so calculate relative speeds and predict collision. By using radar sensors on the front of the car Adaptive Cruise Control can tell when an object is in front of it, if the object is moving, how fast it is moving etc. Advanced Parking Guidance System uses sensors all around the car to guide it into a parallel parking space.

2) Navigation: The system which has ability to plot a route from where the vehicle is to where the user wants to be is called Navigation System. Have you heard about a frog that can drive your car for you? FROG (Free Ranging on Grid) technology is used in Automated Guided Vehicle Systems, which are, well, driverless cars. The vehicles which use FROG consist of computer that contains the map of the area in which the vehicle operates. The vehicle starts from a known location and uses the map to determine the route to its destination. It counts wheel revolutions to figure out how far it has travelled. The problem with FROG technology is that is can be used in only a limited area.

3) Motion Planning : The motion planning subsystem guides the car in its second-to-second movement so that it can abide by traffic rules and avoid collisions. This is current research problem.

4) Actuation : These systems modify the driver's instructions so as to execute them in a more effective way, for example the most widely deployed system of this type is ABS. Anti-lock braking system (ABS) often coupled with Electronic brake force distribution (EBD), which prevents the brakes from locking and losing traction while braking. Traction control system (TCS) actuates brakes or reduces throttle to restore traction if driven wheels begin to spin. Four wheel drive (AWD) with a centre differential. Distributing power to all four wheels lessens the chances of wheel spin. It also suffers less from oversteer and understeer.

There are many driverless car competitions, but the biggest of all is DARPA GRAND CHALLENGE which is funded by Defence Advanced Research Projects Agency, the most prominent research organization of the United States Department of Defence. A race in which an autonomous car must navigate city streets, obey traffic laws, avoid obstructions, and, crucially, drive well among other cars in traffic. Till now 3 challenges had been held in which two teams were chasing each other for the top position, one team is from Stanford University and the other from Carnegie Mellon University. Stanford's autonomous car named JUNIOR has a total of eight LIDAR systems that emit beams of light and detect reflections to determine the distance of other objects. One system is mounted on the front of Junior's roof and has a range of about 100 meters. Another LIDAR system points at the ground and constantly keeps track of the road and reflective lane markers. A third system constantly takes a 360-degree image of its surroundings. All this data is process by two Intel quad-core machines running at 2.3 gigahertz, and the pertinent information is relayed to the driving systems, which guide the car.

Junior is also equipped with a precise location system that include GPS and other sensors that measure the revolution of the wheels and the direction the car is moving in. Together, these sensors allow Junior to pinpoint its location to within 30 centimetres.

This intelligence comes in the form of about 500 different probabilistic algorithms that process all the environmental information collected by the sensors and makes the decision that is most likely to be the best. These decisions are made in less than 300 milliseconds, which is sufficient for slowing down or changing lanes.

Hardware: Rack mount servers with two Intel quad-core processors process sensor data up to 20 times a second and run Junior's artificial intelligence software.

Software : Junior's intelligence comes from a suite of integrated, custom-coded modules, including a planner (making decisions, choosing paths), a mapper (transforming sensor data into environment models), a localizer (refining GPS position and road map structure from lane markings), and a controller (turning decisions into driving).

The body:
Model: 2006 Volkswagen Passat wagon
Engine: 4-cylinder turbo diesel injection
Transmission: Six-speed direct-shift gearbox
Engine cubic capacity: 1968cc
Fuel Consumption: City: 25.5 mpg (9.2l/100km), Highway: 42.7 mpg (5.5l/100km), Combined: 34.6 mpg (6.8l/100km)
Power: 140 hp (103kW) at 4000rpm
Torque: 236 lb ft (320Nm) at 1800-2500 rpm
Top speed: 126miles/h (203km/h), Acceleration: 0-100km/h: 10.1sec
Engine provides power through a high-current prototype alternator and a battery-backed, electronically controlled power system.
Before coming to road, this technology has to face lots of challenge. If scientists are to be believed, you will have to wait till 2018 to let such a machine drive you.

-Amiya Tiwari
3rd year EEE

HISTORY OF COGNITIVE RADIO AND BASIC ISSUES IN SPECTRUM SENSING

Try to recall the meaning of the words "Cognitive" and "Radio". Well, let me refresh the meanings once for you- the word "Cognitive" is used to describe a process which requires thinking while "Radio" refers to transmission and reception of radio waves. So what meaning do you make out of the term "Cognitive Radio"?

Cognitive radio is a wireless communication technology that took birth from the soaring need of efficient spectrum utilisation.

Before going into the detail of what exactly does it mean let us look ata brief scenario of the situation that lead to its birth. In recent years man has been using the radio spectrum in many facets of his life. From the Bluetooth in your mobiles to satellite communication- everything is radio wave communication. With the ever increasing demand for applications using radio spectrum, man started to feel that the radio spectrum available to him was insufficient.

In November 2002, FCC (Federal Communication Commission) published a report [1] that aimed at improving the spectrum utilisation in United States. This report said that most of the spectrum congestion problems were a result of prevalence of overly crowded spectrum and under-utilized or idle spectra rather than actual physical scarcity of radio spectrum. This means that out of all the spectra available to man- 1) some of it is heavily occupied 2) some of it is largely under-occupied and 3) rest is partially occupied.

"If you look at the entire RF frequency up to 100GHz, and take a snapshot at any given time, you'll see that only 5-10% of it is being used. So there is 90GHz bandwidth available."
-Ed Thomas, Former chief engineer at the FCC

This realization created a breakthrough for research in this field. Soon, it was found that if unlicensed users are allowed to access the licensed bands, the spectrum could be utilised efficiently. And the technology that would allow this is today called cognitive radio (CR). CR is a term for radios that are aware of their surroundings and can change their transmission parameters like transmission power, transmit frequency, etc. according to the environment. Thus, it derives the name "Cognitive". CR basically allows the unlicensed users access to spectrally under-utilized licensed bands. Now this may spark many questions in your mind as to – "how is this possible to implement?", "would it not harm primary user transmission?" etc. Now there are several transmission strategies of to ensure that there is no harm to the primary users. [3] describes these transmission strategies as:

1. Interweave
It says that an unlicensed user (also called secondary user because it gets a secondary importance as compared to the licensed while analyzing a CR system) should transmit only when the licensed user (also called primary user) is not transmitting.
2. Underlay
It says thata secondary user can transmit even though primary user is transmitting but it has to transmit under a power constraint. The transmit power of the secondary user should be such that the primary users are unaffected by the presence of secondary transmission.
3. Overlay
It says that the secondary user can transmit at full power even though primary user is transmitting. But it will use some part of this power to relay the information carried by primary users.

The key principles on which the CR concept works are –
1. Spectrum sensing
The cognitive users need to sense the presence and absence of primary users to decide their own transmit power.

HISTORY OF COGNITIVE RADIO AND BASIC ISSUES IN SPECTRUM SENSING

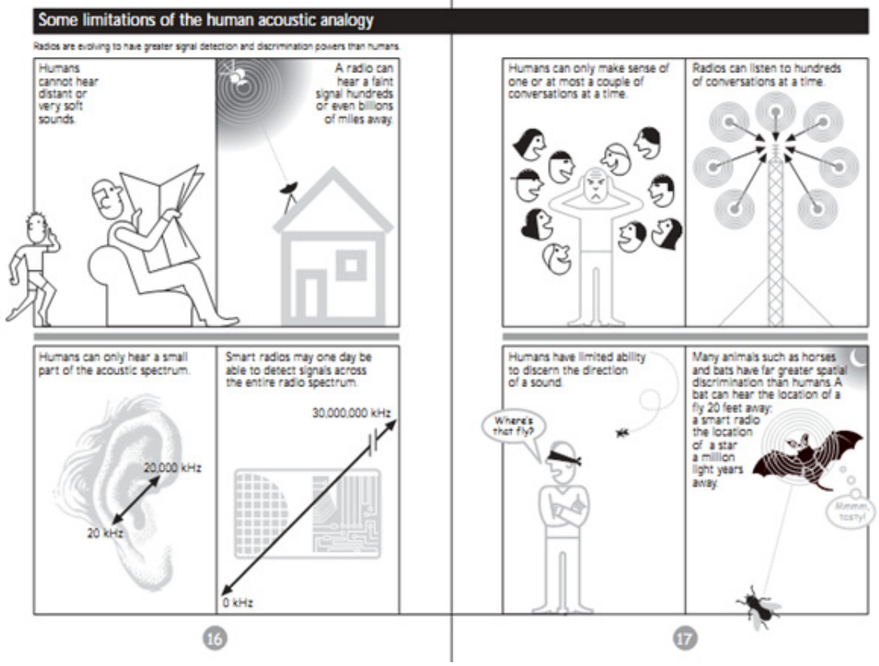

Figure 1: (Source: The Cartoon Guide to Federal Spectrum Policy by Homes and Snider)

2. Spectrum sharing
The licensed band is shared by the secondary users among themselves too. The decision as to which secondary user will transmit at a given time slot is given by a scheduler present at secondary base station.

Spectrum Sensing Issue:

Though the concept of cognitive radio may seem simple but applying it is tricky! The key feature of a cognitive radio system is that secondary users should correctly sense the presence or absence of primary transmission. But it is possible in actual practice that the missed detection and false alarm imperfections lead to a more involved analysis of a CR system.
1. Missed Detection:
As the name suggests, missed detection implies that the secondary user senses the primary to be off even though it is on. Thus, the secondary transmits at full power without any interference power constraint. This leads to increased interference at primary receiver.
2. False alarm:
False alarm implies that the secondary user senses the primary to be on though it is off. This causes the secondary users to unnecessarily transmit under an interference power constraint. Though false alarm does not affect the primary user in any way, it leads to a reduced secondary system performance.

Efficient spectrum sensing is one the major difficulty in implementing cognitive radio. We will briefly have a look at the some of the popular spectrum sensing techniques used [4], [5].

1. Matched Filter Detection (Most optimal):
An optimal way for any signal detection is matched filter since it maximizes signal to noise ratio. However this technique requires demodulation of a primary user signal.
Advantages: Most optimal scheme for spectrum sensing.

*Drawback:*This scheme will require a dedicated receiver for each secondary user. Also it assumes apriory knowledge of primary signal is available at receiving end.Carrier and timing synchronization is another major issue. But this issue can be resolved as most primary users have pilots, preambles, synchronization words, or spreading codes that can be used for coherent detection. Example: CDMA systems have spreading codes for pilot and synchronization channels.

2. Energy Detection (Sub optimal):
The decision of presence or absence of primary user transmission is made based on the received signal power. Let "γ" be the threshold energy.

If P_received<γ, there is no primary user transmission.
Else P_received>γ, there is primary user transmission.

The main challenge in designing this type of receiver is deciding an optimum threshold energy "γ" . [6] deals with finding this optimal threshold energy when energy detection is coupled with cooperative sensing.

Here y(t) is the received signal(contains signal + noise). Output θ is the final decision made. For detailed formulation of this technique refer [4].
Advantage: Easy to implement (low complexity), no need to haveapriori knowledge of primary signal and gives fairly accurate results.
Drawback: Noise variationscan lead to incorrect decisions being made. The only criterion for decision is the net received power and there is no discrimination that the receiver makes between noise and signal.

3. Cyclostationarityfeature detection:
Modulated signals generally have a built in periodicity embedded in them. This justifies the received signal (with noise+interference embedded) to be assumed as a cyclostationary-process. This property, of incoming message signal, is used to detect presence or absence of primary transmission.
For incoming signal x(t), following figure shows a typical cyclostationarity detector

Here the features detected are number of signals, their modulation types, symbol rates and presence of interferers.

Co-operative spectrum sensing:

The above mentioned spectrum sensing techniques coupled with cooperative sensing has gained lot of importance of late. [6] validates the importance of cooperative spectrum sensing. In cooperative spectrum sensing, all the cognitive users make a common decision about presence or absence of primary transmission. All the cognitive users individually apply any of the above mentioned spectrum sensing techniques and convey their

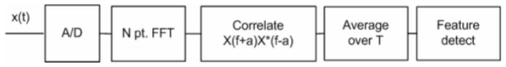

Figure 2: Schematic representation of Energy Detector, adapted from [4]

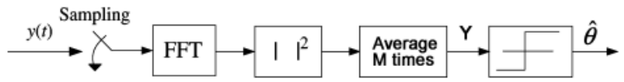

Figure 3: Schematic representation of cyclostationarity feature detector, adapted from [5]

HISTORY OF COGNITIVE RADIO AND BASIC ISSUES IN SPECTRUM SENSING

result (primary on/off) to the base station.If number of users agreeing upon a decision is greater than or equal to a threshold k, then this decision is levied upon all the secondary users as a global rule.
Assume that there are N secondary users present in a cognitive radio system. Let P_f be the false alarm probability of each secondary user, without using cooperative spectrum sensing (Note: Each secondary user need not have same false alarm probability, but we assume these to be same for simplicity). Thus, the effective false alarm probability after cooperative spectrum sensing is given as where k is the minimum number of secondary users which should agree upon a common decision, for this decision to be implemented to all other users as well.Equation (1) shows thatP_(f,net)≤P_f.

$$P_{f,net} = \sum_{j=k}^{N} P_f^{\,j} \left(1 - P_f\right)^{N-j} \quad -(1)$$

Similar expression for effective missed detection probability can be obtained and it can be shown-that the spectrum sensing efficiency is improved by using cooperative sensing.

This completes a brief introduction to cognitive radio and the basic spectrum sensing issues involved in its implementation.

Try searching "Cognitive Radio" on IEEE Xplore and you will find more than 7000 papers published since the new millennium began! Indeed, cognitive radio is one of the fastest growing research fields in wireless communication!
I hope that this introduction encourages you to want to know more about it! You will get the real essence of this upcoming technology once you start reading more on it! Who knows, you could be the next person to provide a revolutionary breakthrough in the ongoing research in this field...

-MandarKulkarni
3rd year ECE

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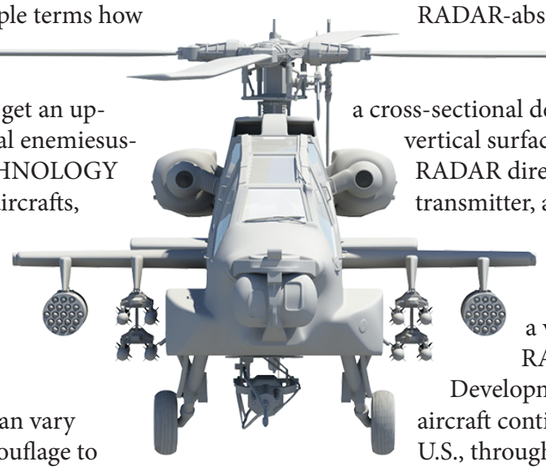
STEALTH TECHNOLOGY IN AIRCRAFTS

Getting Away the 007 Style (FGFA)

Did you ever had this wish of getting inside some high security facility and getting away undetected and unscathed. Well this article isn't going to fulfill your above wish, but it will explain in some simple terms how armed forces and scientists all over the world are trying get an upper hand on potential enemiesusing STEALTH TECHNOLOGY which provides for aircrafts, choppers getting away undetected in enemy territory.



Stealth technology can vary from the use of camouflage to the use of detection and interception technologies used with soldiers, aircrafts, ships, submarines, and missiles, to make them less visible (ideally invisible) to radar, infrared, sonar and other detection methods of the enemy forces. Most stealth technologies are directed at suppressing RADAR returns from aircraft, but stealth technology minimizes other "observables" as well, including energy emissions that of any kind that might be observed by an opponent by infrared detection techniques. Stealth technology is deployed today on several types of aircraft and a few surface ships.

HISTORY

Near world war I the only concern was visibility and transparent materials and light colours were used to reduce visibility by Germans first and Soviets later. During World War II, Germany coated the snorkels of its submarines with RADAR-absorbent paint to make them less visible to RADARs carried by Allied antisubmarine aircraft. In 1945 the U.S. developed a RADAR-absorbent paint containing iron, making an airplane less RADAR-reflective, but was heavy and made aircrafts difficult to fly. In the mid-1960s, the U.S. built a high-altitude reconnaissance aircraft, the Lockheed SR-71 Blackbird that was extremely RADAR-stealthy for its day. The SR-71 had special RADAR-absorbing structures along the edges of wings and tailfins, a cross-sectional design featuring few vertical surfaces that could reflect RADAR directly back toward a transmitter, and a coating termed "iron ball" that could be electronically manipulated to produce a variable, confusing RADAR reflection.

Development of modern stealth aircraft continued, primarily in the U.S., throughout the 1960s and 1970s, and several stealth prototypes were flown in the early 1970s. Efforts to keep this research secret were successful; not until a press conference was held on August, 22, 1980, when the US accepted the stealth research.

TYPES OF RESEARCH

The types of stealth that a maximally stealthy aircraft (or other vehicle) seeks to achieve can be categorized as visual, infrared, acoustic, and RADAR.

STEALTH TECHNOLOGY IN AIRCRAFTS

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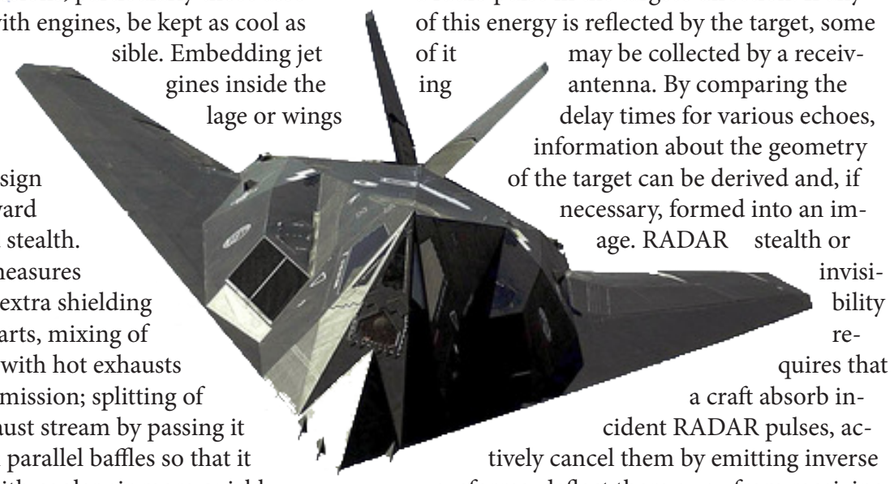
VISUAL STEALTH: Low visibility is achieved by coloring the aircraft so that it tends to blend in with its environment. For instance, reconnaissance planes designed to operate at very high altitudes, where the sky is black, are painted black. (Black is also a low visibility color at night, at any altitude.) Conventional daytime fighter aircraft are painted a shade of blue known as "air-superiority blue-gray," to blend in with the sky. Stealth aircraft are flown at night for maximum visual stealth, and so are painted black or dark gray. Chameleon or "smart skin" technology that would enable an aircraft to change its appearance to mimic its background is being researched. Furthermore, glint (bright reflections from cockpit glass or other smooth surfaces) must be minimized for visual stealth; this is accomplished using special coatings.

INFRARED STEALTH: Heat-seeking missiles and other weapons zero in on the infrared glow of hot aircraft parts. Infrared stealth, therefore, requires that aircraft parts and emissions, particularly those associated with engines, be kept as cool as possible. Embedding jet engines inside the fuselage or wings is one basic design step toward infrared stealth. Other measures include extra shielding of hot parts, mixing of cool air with hot exhausts before emission; splitting of the exhaust stream by passing it through parallel baffles so that it mixes with cooler air more quickly; directing of hot exhausts upward, away from ground observers; and the application of special coatings to hot spots to absorb and diffuse heat over larger areas. Active countermeasures against infrared detection and tracking can be combined with passive stealth measures; these include infrared jamming (i.e., mounting of flickering infrared radiators near engine exhausts to confuse the tracking circuits of heat-seeking missiles) and the launching of infrared decoy flares.



ACOUSTIC STEALTH: Although sound moves too slowly to be an effective locating signal for antiaircraft weapons, for low-altitude reconnaissance aircraft, such as Lockheed's QT-2 and YO-3A it is still best to be inaudible to ground observers. Aircraft of this type are ultra-light, run on small internal combustion engines quieted by silencer-suppressor mufflers, and are driven by large, often wooden propellers. The U.S. F-117 stealth fighter, which is designed to fly at high speed at very low altitudes, also incorporates acoustic-stealth measures, including sound-absorbent linings inside its engine intake and exhaust cowlings.

RADAR STEALTH: RADAR first transmits a radio pulse in the target's direction. If any of this energy is reflected by the target, some of it may be collected by a receiving antenna. By comparing the delay times for various echoes, information about the geometry of the target can be derived and, if necessary, formed into an image. RADAR stealth or invisibility requires that a craft absorb incident RADAR pulses, actively cancel them by emitting inverse waveforms, deflect them away from receiving antennas, or all of the above. Absorption and deflection, treated below, are the most important prerequisites of RADAR stealth.

ABSORPTION: Metallic surfaces reflect RADAR; therefore, stealth aircraft parts must either be coated with RADAR-absorbent plastics, carbon-based materials, ceramics, and blends of these materials or made out of them to begin with. Combining such materials with RADAR-absorbing surface geometry enhances stealth. The F-117 stealth aircraft is built mostly out of a RADAR-absorbent material termed Fibaloy, which consists of glass fibers embedded in plastic, and of carbon fibers, which are used mostly for hot spots like leading wing-edges and panels covering the jet engines. Thanks to the use of such materials, the airframe of the F-117 is only about 10% metal. Interestinglythe B-2 stealth bomber and the F-117 reflect about as much RADAR as a hummingbird. Placement of metal screens over the intake vents of jet engines. These screens—used, for example, on the F-117 stealth fighter—absorb RADAR waves exactly like the metal screens embedded in the doors of microwave ovens. Another technique namely the cloaking of aircraft in ionized gas (plasma) can also be used. Plasma absorbs radio waves, so it is theoretically possible to diminish the RADAR reflectivity of an otherwise non-stealthy aircraft by a factor of 100 or more by generating plasma at the nose and leading edges of an aircraft and allowing it flow backward over the fuselage and wings. A disadvantage of the plasma technique is that it would probably make the aircraft glow in the visible part of the spectrum.

DEFLECTION: Deflection means reflecting RADAR pulses in any direction other than the one they came from. This in turn requires that stealth aircraft lack flat, vertical surfaces that could act as simple RADAR mirrors. RADAR can also be strongly reflected wherever three planar surfaces meet at a corner. Stealth aircrafts tend to be highly angled and streamlined. The B-2 bomber, for example, is shaped like a boomerang.
Stealth aircraft need not only to be invisible to RADARbut an aircraft needs conventional RADAR to track incoming missiles and hostile aircraft which is self-contradictory. Solutions include having moveable RADAR-absorbent covers over RADAR antennas that slip aside only when the RADAR must be used. The disadvantage of sliding mechanical covers is that they may malfunction, and must remain open for periods of time that are long by electronic standards. A better solutionis the plasma stealth antenna composed of composed of parallel tubes made of glass, plastic, or ceramic that are filled with gas. When each tube is energized, the gas in it becomes ionized, and can conduct current just like a metal wire. A number of such energized tubes in a flat, parallel array, wired for individual control can be used to send and receive RADAR signals across a wide range of angles without being physically rotated. When the tubes are not energized, they are transparent to RADAR. This makes the aircraft a radar reflector only for a brief period of time when tubes are energized

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COUNTER STEALTH MEASURES

No matter how cool the exhaust vents of an aircraft are kept, the same amount of heat is always liberated by burning a given amount of fuel, and this heat must be left behind the aircraft as a trail of warm air. Infrared-detecting devices might be devised that could image this heat trail as it formed, tracking a stealth aircraft. Every jet aircraft leaves swirls of air—vortices—in its path. Doppler RADAR, which can image wind velocities, might pinpoint such disturbances if it could be made sufficiently high-resolution. Further measures can be the detection of aircraft-caused disturbances in the Earth's magnetic field, networks of lowfrequency radio links to detect stealth aircraft by interruptions in transmission, the use of specially shaped RADAR pulses that resist absorption, and netted RADAR i.e. use of more than one receiver, and possibly more than one transmitter, in a network. Receivers located off the line of pulse transmission might be able to detected deflected echoes.

FUTURE OF STEALTH TECHNOLOGY

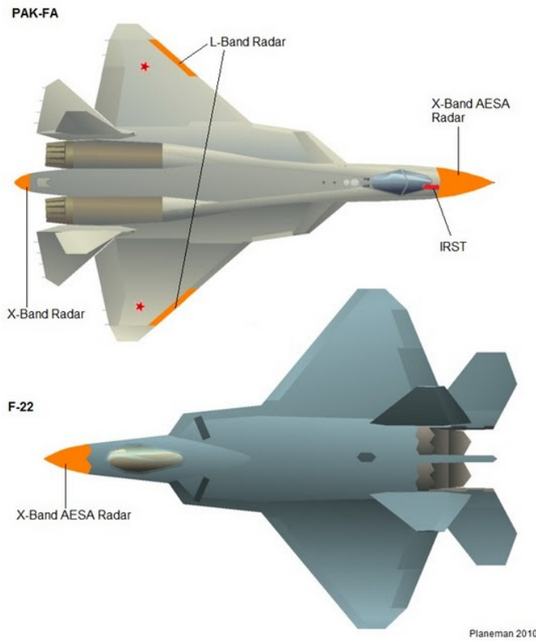
Stealth technology is clearly the future of air combat. In the future, as air defense systems grow more accurate and deadly, stealth technology can be a factor for future warfare. In the future, stealth technology will not only be incorporated as important part in fighters and bombers but also in ships, helicopters, tanks and transport planes.

STEALTH AIRCRAFTS:

In service
- B-2 Spirit – Northrop Grumman
- F-22 Raptor – Lockheed Martin / Boeing

Formerly in service
- F-117 Nighthawk– Lockheed Martin

Under development
- F-35 Lightning II– Lockheed Martin / BAE Systems / Northrop Grumman
- PAK FA – Sukhoi
- FGFA – Sukhoi / HAL
- Chengdu J-20 – Chengdu Aircraft Corporation
- AMCA – ADA / HAL



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1) http://www.totalairdominance.50megs.com/articles/stealth.htm
2) http://www.ausairpower.net/TE-Stealth.html
3) http://science.howstuffworks.com/question69.htm
4) http://en.wikipedia.org/wiki/Stealth_technology
5) http://www.faqs.org/espionage/Sp-Te/Stealth-Technology.html

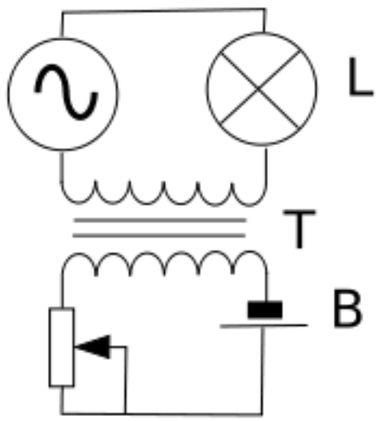
- Rumit Singh
3rd Year EEE

N Magnetic Amplifier

Introduction

The "magnetic amplifier" or more commonly the "mag-amp" is an electromagnetic device used to amplify electric signals. It is the predecessor to the modern day transistor-based amplifiers and the successor to the much older vacuum tube-amplifiers which were large in size and required high current for functioning. It was first developed in Germany during World War II. Though it is difficult to find a device which uses magnetic amplifiers in our daily lives, it is still used in certain safety critical, high reliability demanding applications.

Working Principle



At first glance, one might peg it for a kind of transformer but its working principle is quite different from the intuitive as Einstein once said "Intuition can be a bad guide" pans out to be quite true in this case. The Mag-amp works on the principle of magnetic saturation of the core. Normal transformers use softly saturating core materials whose B-H curve taper slowly but Mag-amps use core materials with rather rectangular B-H curve characteristics.

A typical Mag-amp consists of two similar transformer magnetic cores, each having a control winding and an AC winding. Control windings of the two cores are series-connected while AC windings can be either series or parallel-connected giving rise to different types of Mag-amps.The amount of control current fed into the control winding sets the point in the AC winding waveform at which either core will saturate. In saturation, the AC winding on the saturated core will go from a high impedance state ("off") into a very low impedance state ("on") - that is, the control current controls at which voltage the mag amp switches "on".A relatively small DC current on the control winding is able to control or switch large AC currents on the AC windings. This results in current amplification.

History and Applications

Primitive Mag-amps were used by the American and the German Navy, the Americans used it merely to rotate equipment while the Germans developed and integrated it into their weaponry as gun-stabilizers and for controlling long-range rockets like the German V-2.

Though significant development of Mag-amps took place between the 40s and the 60s, its initial uses in the field of radio communications and voice modulation could be traced back to the 20s, they were used to control large and high powered alternators for communications.

Before the advent of digital electronics, Mag-amps were used in avionics to control various functions, the most important among them being engine air intake and the auto pilot mechanism.

The 1950s was a time when transistors were both expensive and unreliable, so mag-amps were studied as potential switching elements in computers. They were of great use in the ALU since the mag-amps could combine several inputs.

The Mag-amp technology is largely replaced today by the transistor, yet Mag-amps continue to find use in applications such as Motor-starter, Automatic Battery-change mechanism, regulators, instrumental amplifiers, modulators, inverters, phase-shift oscillators, fuel pump reactor drives, mine and submarine detectors etc.

Pros

- No Wear-out mechanism hence a long operation period
- Extremely high tolerance to mechanical shocks making it ideal for heavy-duty machinery
- High efficiency (upto 90%)
- Durability
- Completely static device, so no jamming of moving parts and associated shortcomings

Cons

- No Wear-out mechanism hence a long operation period
- Extremely high tolerance to mechanical shocks making it ideal for heavy-duty machinery
- High efficiency (upto 90%)
- Durability
- Completely static device, so no jamming of moving parts and associated shortcomings

Conclusion

Mag-amps were a great technological triumph during the early 20th century; they were all the rage in defence and communication systems at that time due to their extremely high efficiency and durability.

But later on with the advent of pMOS and cMOS technologies in transistors, transistors underwent a revolution and eclipsed the Mag-amps, however, even today they are used in Mine-detecting systems, phase-shift oscillators and other systems where high reliability is required. But nevertheless the Mag-amps are a lost technology as of today.

-Sai Krishna Pallekonda
2nd year ECE

Magnetic Amplifier S

SMART GRID

In the present era of science and technology, mankind is becoming more and more dependent on machines. Industrial development and population growth has boosted up the demand of energy. Although the production of energy is increasing day-by-day but it is still a way behind the current demand of energy, which has resulted in its high pricings and blackouts.

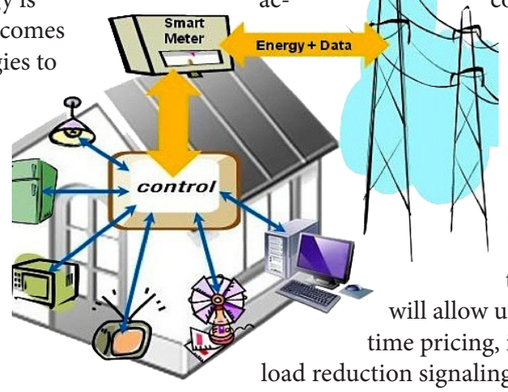
One remedy for this problem is the replacement of earlier used dumb grids by Smart grids. A Smart grid can be understood as more of a process rather than an infrastructure, which involves the use of digital technology, in delivering electricity from supplier to consumer, while increasing reliability and robustness, decreasing cost and saving energy.

Some more functional aspects of a smart grid are:-
1. informed participation of users.
2. on-demand response.
3. Self-healing.
4. Distributed generation.
5. Efficient and smart utilization of renewable sources to produce energy.
6. Home automation which involves the use of smart meter and smart appliances.
7. Improving power quality.

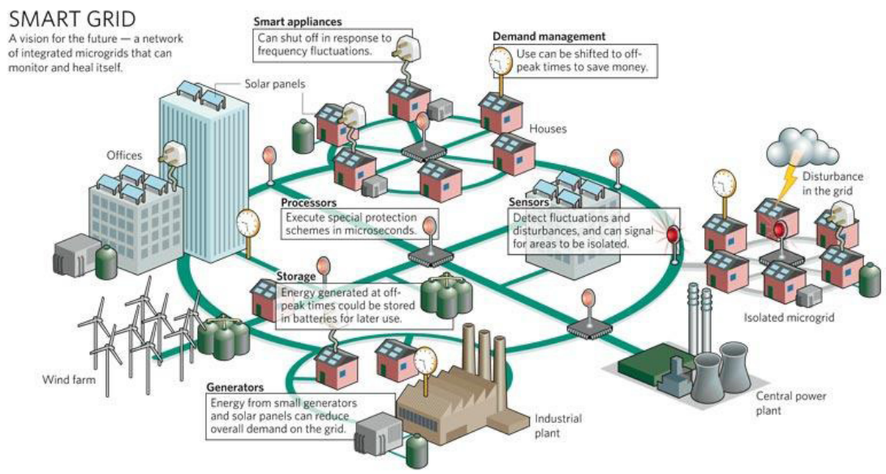
Especially in the case of developing countries like India, where resource to population ratio is low and demand of energy is increasing day-by-day, it becomes a necessity to findtechnologies to efficiently use the available resources. Some major reasons for the need of smart grids In India are:-
1. Large generation and load gap.
2. Poor distribution network.
3. High transmission and distribution losses.
4. Inefficient infrastructure.
5. Low metering efficiency and billing.
6. Power theft is a major concern.

According to the report of innovation observatory, Indiaranks 3rd for smart grid investments following U.S. and china. While India is all set-up to employ smart grids in country, these Smart grids are supposed to take care of above mentioned problems.

First of all, at the generation level, we will try to generate power distributively rather than centrally, so that failure of one generation point can be compensated by others and hence preventing blackouts.This can be accomplished by developing technologies to use renewable sources more efficiently and at cheaper rates, thus promoting customers to install these devices, so that their dependency on the main grid will eventuallydecrease.
In the transmission phase the emphasis will be to reduce the transmission losses which are very high, varying from 30-45% in India. Use of HVDC (high voltage direct current) transmission over conventional A.C. transmission for long distances, can reduce the losses up to 3% per 1000 km.For long-distance transmission, HVDC systems may be less expensive and suffer lower electrical losses.



Smart grid in essence is an effort to change consumer behavior in accordance to their incorporation with the grid. The informed participation of customers is promoted by the use of “net metering or smart meters”. These devices will allow users to exploit real time pricing, incentive based load reduction signaling & emergency based load reduction signaling. These efforts are supposed to reduce the electricity bills by protecting users from cross-subsidization. For example the electricity used at peak load time is more valuable than that used at off-peak hours. Using a communication line the real time prices will be displayed on the meters, Smart meters will not only keep track of “how much energy is consumed” but also at “what time of day and season it is consumed”. And bills will be made accordingly.so being aware of the prices the users can shift some unnecessary load like laundry, electric water-heater, fridging or cooking to off peak hours when the prices will be low, which will not only reduce the overload on grid but will also help consumers to save money. Grid will also be able to make a request to users to shut down the unnecessary load during peak hours, or can automatically shut it down during emergency period



“On-demand supply” is also a major feature of smart grid; which will enable grid to estimate the load at real time.so that it can alter the supply accordingly.

In case of breakdown, the grid will have the ability to self-heal. The sensors embedded in the network will allow it to automatically avoid or mitigate power outage and service disruption. The networks canbe designed in such a way that failure of one part does not affect the supply to end user.

In case of emergency shutdown of load by grid, the home automation system will be activated;this will monitor the distribution of that limited supply in the house. A home automation system integrates electrical devices in a house with each other. For example, centralized control of lighting, HVAC and other systems to provide comfort, save money and energy.These networks can be connected to a local PC or may be controlled remotely through internet; this control will make smart decisions (e.g. washing clothes automatically using solar energy).

Finally the appliances used in home and industries will also be smart and grid capable, which will use minimum amount of energy and will have the ability to hibernate when not in use. Smart grid is indeed a new and fast growing idea and many countries are rushing to implement it. Karnataka is the first state to employ smart grids in India. But there are some major problems to be faced in the installation of the technology on such a large scale. But more than choice Smart Grid has become the necessity for us.

-Himanshu Saini
3rd year EEE

Internship Experience at KAIST

Almost all of us look forward to our second year internship (formally called sophomore research internship :P) from the moment we hear it from our seniors during freshmen days(probably Cepstrum lectures). So what comes to your mind first when I say a paid foreign intern!!! (foreign holidays, clubs, nightlife, lots of fun what else) .A foreign intern offers a lots more than this. Not only it is an opportunity to enjoy and visit places but a rare opportunity to work with the best researchers, professionals, academicians in the world .If you are looking for a masters degree after B.Tech a foreign academic intern is a stepping stone for it (of course not mandatory) .I know it is sometimes boring but kindly bare with me as I tell you my experiences of sophomore research intern. After some 20-30 days of continues tiring & frustrating job of 'apping' finally I managed to get an acceptance from Korean Advanced Institute of Science & Technology (KAIST) situated in Daejeon ,Republic of Korea. I had applied from System Simulation Lab (or our dept. computer centre whatever you call it) and surprisingly within say 15 minutes (or even less:-O) I received the confirmation from the professor at KAIST. I was on cloud seven as I was the first student (to the best of my knowledge) from our batch to have got an acceptance of foreign intern: D

The luckiest thing was that I managed to get a project in the area of my interest which is one of the most difficult tasks seeing the limited opportunities available abroad at least during sophomore years. Moreover since it would have been my first foreign trip I was all the more
excited (Although I have never loved travelling :P)

I remember my first day at my lab when I was introduced to my professor who at the very first impression looked serious and threatening(at least this is what I could decipher from his picture on lab's webpage :P) but to my surprise upon introduction found him cool & calm, & friendly ,in short a true gentleman .My guide deserves a special mention, an IEEE fellow, 30 years of diverse experience working in Samsung, Bell Laboratories, MIT & KAIST having hundreds of papers & patents. Well that seems more than a motivation cum encouragement to prepare yourself work harder to achieve the level of expectation (at least for me).

Initial 3 days were off peacefully due to some kind of national holiday in Korea giving me ample time to get familiarized with the local markets, bus routes etc. Thanks to a lot of Indians, Pakistanis (there are more Pakistanis than Indians) who helped me find Indian shops, restaurants etc. which helped me get a pulse of the city. The university was situated around 5 Kms from my Dormitory and the regular campus shuttle buses helped me reach our lab situated in the nanofab building in KAIST campus. My guide occasionally visited my desk to check the progress of my work and discuss about our future course of action. Most interesting part was that he always seemed curious to know about India (all what he had heard of was IIT, Mahatma Gandhi & Sanskrit language lol: P) and was fascinated by Indian tradition and culture. Being an true academician he was most interested to know about the IIT system(what so special about that :/),attitude of IITan's and their dreams and aspirations.I showed him some snaps of IITG after seeing which he expressed his deep desire to visit India in future. The only problems at KAIST campus was finding some good vegetarian food (vegetarians suffer everywhere abroad) and finding Koreans who were fluent with English:P(this was really frustrating). The only option was to cook my own food which was the most boring but inevitable job (I wish I had learnt cooking before :P).One strange thing I found that although most Koreans could not converse well in English than how could they manage to write the Technical

Internship Experience at KAIST

IEEE papers so well.:/ Upon deep thinking I could figure out that It wasn't their inability to speak English well but they could not decode English spoken at lightning speed: D (Do we Indian's speak that fast?). At times it was so irritating to speak English as slowly as we used to speak when we were a nursery kid .

Well leaving aside the fun part of my intern, let's get back to business .Let me tell you about my project details (may seem boring but bear with me).I was given the flexibility of formulating my own research statement/ proposal (that's why I call myself lucky, very few get such freedom \m/) based on the past

work done by our lab. Our lab basically had 2 divisions, 3-D Integrated Circuits group & Smart Camera System group. Based on my prior knowledge & interest I expressed my will to work with Smart Camera System's group followed by which I was given a few research papers(lots of then rather)to layout the foundations of my research proposal. It took me around 10 days to read the papers and formulate a rough project draft. I decided to work on "Energy minimization of mobile wireless Camera System Using Adaptive modulation Schemes"(leave it after all what's there in the name).The proposal seemed quite challenging to my guide(probably he had low expectations from undergraduates with whom he had worked before) and he said "Abhinav I never expected such orginality and enthusiasm from intern students and that too undergraduates, I am sure you would contribute significantly to our research, Best of Luck " He then asked me to design a mathematical framework for the idea to be implemented and give a presentation to him within a week's time. Highly motivated by his positive remarks I started working towards the presentation, within a week's time I was all ready with the mathematical framework which had to be validated through a series of simulation tests. Although my presentation was fine & was applauded yet somehow my professor felt a bit unsatisfied at some parts and suggested modifications (after all in research it is all about experience).After doing the suggested modifications & a few days of hardship I could complete the initial validation process of my model which marked a successful beginning of my project. After seeing the validation my guide felt happy and suggested me to start writing a draft for the paper side by side(I had earlier expressed my deep desire to publish in the first meeting with prof.).For a few weeks I along with a Phd candidate was busying conducting and analyzing video recordings(not like a film shooting :P) at different locations in KAIST

Internship Experience at KAIST

campus which was supposed to be experimental setting to validate my developed model practically. This was really the most fun part of my work ;).

Although thousands of kilometers away from home I never felt lonely or homesick, thanks to the friendly atmosphere at the dormitory. I shared a common kitchen with other students belonging to China, Korea(of course),Pakistan, Kazakhstan etc .In the meanwhile on weekends I visited many cities including Seoul(the most sophisticated city I have ever seen),Bussan(beach city \m/).Al-

though Seoul gave me a flavor of high tech city , nightlife, pretty ladies, Busan was the place I enjoyed the most probably because I had never visited a beach before & and that too so crystal clear as if the water had been purified by aqua guard(lol)

Besides the very frequent escapades to these magical cities my work was coming along very systematically :D. I managed to write an IEEE symposium paper based on my research and it was well drafted according to my professor(\m/) It gave me immense pleasure to see that my guide was very satisfied and impressed with my research work for the past 2 months. Completing the project well within the deadline and submitting an IEEE symposium paper in a top level conference(which is recently accepted) was perhaps the most satisfying and beautiful feeling of my entire internship experience @ KAIST. Getting such positive remarks on my research work gave me sense of pride for re-imposing the lofty standards & benchmarks created by IITians in the past which helped to establish IIT's as premiere institutes across the globe .After a very warm farewell party at an Indian restaurant (Indy as far as I remember) the next day I left Daejeon for my flight back to India ('Swadesh'->No words to describe that feeling) which was scheduled from Seoul International Airport to New Delhi. Indeed the summer of 2011 was the most beautiful of all summers providing me a great academic and cultural experience.

A few concluding remarks I would like to give to my juniors who would also pursue such internships in future:-

- Always remember the primary objective of an internship is to learn, increase your domain of thought & not mere enjoyment. (You have ample opportunities for that too!!!)
- The reputation of your country & institute is at stake so work hard enough to fulfill the expectations of your host.
- Try to get a technical paper (preferably in IEEE transactions) out of your work. It helps a lot while applying for higher studies)
- Interact with as many researchers as possible to know the state of the art developments in their respective areas.

-Abhinav Agarwal

The author is a Junior Undergraduate student in the Department of Electronics & Communication Engineering IIT Guwahati & is also the Associate General Secretary of Cepstrum(2011-2012).The completed his Sophomore Research Internship at Korean Advanced Institute of Science & Technology(KAIST) in the area of Energy Minimization of Mobile Wireless Camera System.

SEGMENTATION OF MOUSE TIBIAE (BASED ON MORPHOLOGY)

Segmentation of cortical and trabecular bone compartments is the first step in the structural analysis of bone and is critical for accurate quantification of architectural parameters; for example, bone volume ratio would be over-estimated by the inclusion of dense cortical shell in the analysis. The current segmentation gold standard is a semi-automated slice-by-slice hand contouring approach. In this article an approach to achieve automatic segmentation is proposed. This article requires a basic know-how of few biological terms, but the idea behind including this in InPhase is to give the reader a brief look into the world of morphological image segmentation, which has not been introduced in any InPhase edition, earlier.

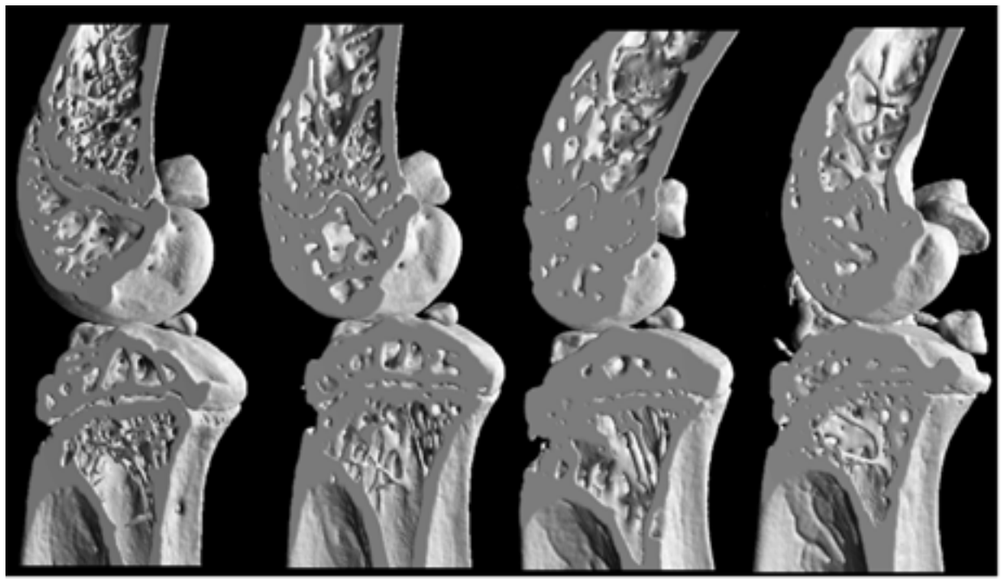


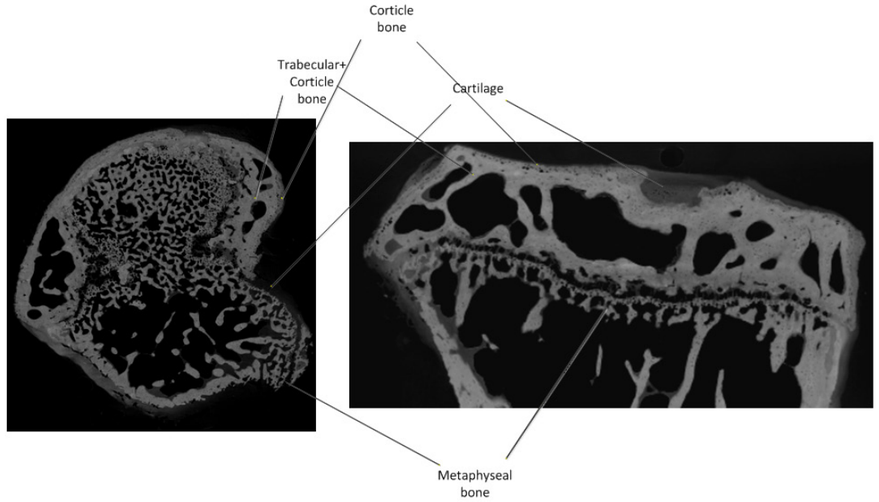
Figure 1: Variation of mouse tibiae structure with age.

Bone structure changes with age and disease (such as osteoarthritis). Different components of bone change differently with time. Image segmentation algorithm is therefore an extremely important procedure in study of bones as it extracts out the region of interest (ROI).

Existing techniques: Segmentation of mouse tibiae is a well-studied problem and several approaches have been suggested. Prior based image segmentation using active contour model is one of the most popular approach and is studied in detail in Kapur et. al. [1]. Such approach models image as a differential equation and forms an atlas on basis of it. One other popular approach is to use morphology for separating out these regions [2, 3]. Other approach involves watershed algorithm, modified canny edge detector and using information theory

SEGMENTATION OF MOUSE TIBIAE (BASED ON MORPHOLOGY)

Figure 2: Mouse tibiae sample.
(a) Front view (b) side view.



Segmentation using morphology: Imaging of bone is done by CT scan and that of cartilage is done by MRI. The first step involves is to register the cartilage and bone images (B-spline algorithm is used for registration). The segmentation starts by removing cartilage which is done by a simple application of threshold.Metaphyseal bone needs to be separated which is done by component labeling of binary image obtained with suitable threshold. Separating trabecular and corticle bone is a difficult task as any the intensity profile is continuous and rough so simple application of threshold is not enough. The problem was already solved and is dealt in detail in [3].It can be observed that corticle bone have two different regions marked by different intensity and texture. To separate them an algorithm is devised and following steps are used.

Pearson's cross correlation is often used in comparing medical image segmentation and in this case it demonstrates moderate correlation which is statistically significant.

The extraction of a region of interest which is significantly similar to that of a manual segmentation is one step towards proving the robustness of the extraction algorithm. In a nex

t step, the comparison of morphometric measures will be undertaken. Analysis of the lacunae and canal morphometry should be shown to be reproducible and robust, and secondly provide a quantitative measure of differences in cortical morphometry between aged and diseased samples.

References:

1. Kapur,T. et al. Image analysis,9 :293-304,1998
2. Kohler, T. et al. Bone, 41:659–67, 2007.
3. Buie, H.R. et al. TransOrthopRes Soc, 32: 1371, 2007.

(Figure 3 and 4 on next page)

SEGMENTATION OF MOUSE TIBIAE (BASED ON MORPHOLOGY)

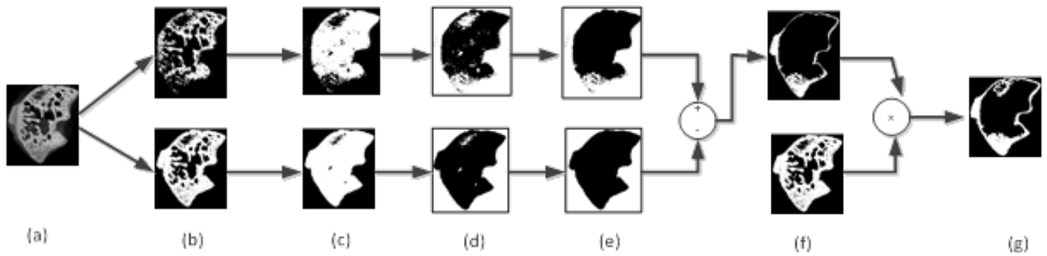


Figure 3: (a) Input image of mouse tibia. (b) Binary images from two different thresholds; 37.5%(top) and 21.25%(bottom). (c)-(e)Void filling using inversion (d), and component labelling (e).(f) Top: Region of interest obtained by subtraction of high threshold mask from low threshold mask. Bottom: low threshold binary image. (g) Solid mask obtained by multiplication of mask with low threshold image and dilation.

The expected and obtained results are compared below:

Figure 4: (a) 2D cross section of a typical input image. Extracted region of interest: (b) automatic segmentation and (c) manual segmentation.

-Harshit Bangar
4th Year EEE

Class of 2011

Dear X,
It was indeed a pleasure to know that you and 25 of your friends from your department are interested in doing an internship in my lab with my research group which has but five people.
Your email in particular was exceedingly fascinating.
Allow me to make a few remarks about the contents of your email and your Curriculum Vitae.

1) I found it highly commendable that you have and I quote-‘ Read all of my papers and my books’ which is in itself an achievement considering that I have published over 300 papers and have authored more than 10 books. Good Job!!

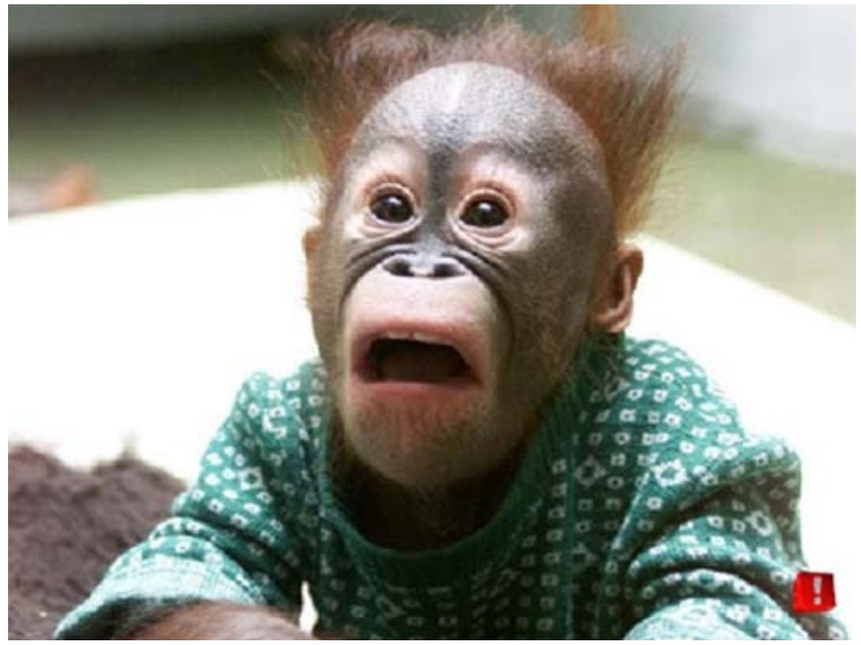
2) You must indeed be a proficient researcher as you claim to ‘be fully capable of using an Oscilloscope of Yokogawa make’ as mentioned under the ‘Technical Skills’ section in your CV.

3) One of the ‘challenging’ projects you have undertaken included one on making a 16 bit counter. This may well indeed entitle you to a position at a university far better than the one I work at. I recommend you go ahead and apply at MIT.

4) Yes, even though ‘winning a singing competition in 7th grade’ is something that must have earned you numerous admirers, I doubt it if it ever counts for a lot when you apply for a research internship.

5) I see that you have played instrumental roles in the organising of almost each of your college’s fests. It confounds me how a student can manage to be so versatile. It must take a lot for a student to juggle all of this with undertaking projects like ‘making counters’, and
‘remembering all the resistance colour codes.’

I found the emails and the attached Curriculum Vitae of a number of your friends who have been kind enough to drop me mails, also very interesting.
I am sure that you shall one day make some other Professor at some other university very happy with your work.
It pains me to tell you this but I cannot offer you an interim position in my laboratory, as you seem to be too over-qualified for such an assignment.
Thanking you.
Yours sincerely,
Professor _____
Department of Electrical and Computer Engineering
University of _____

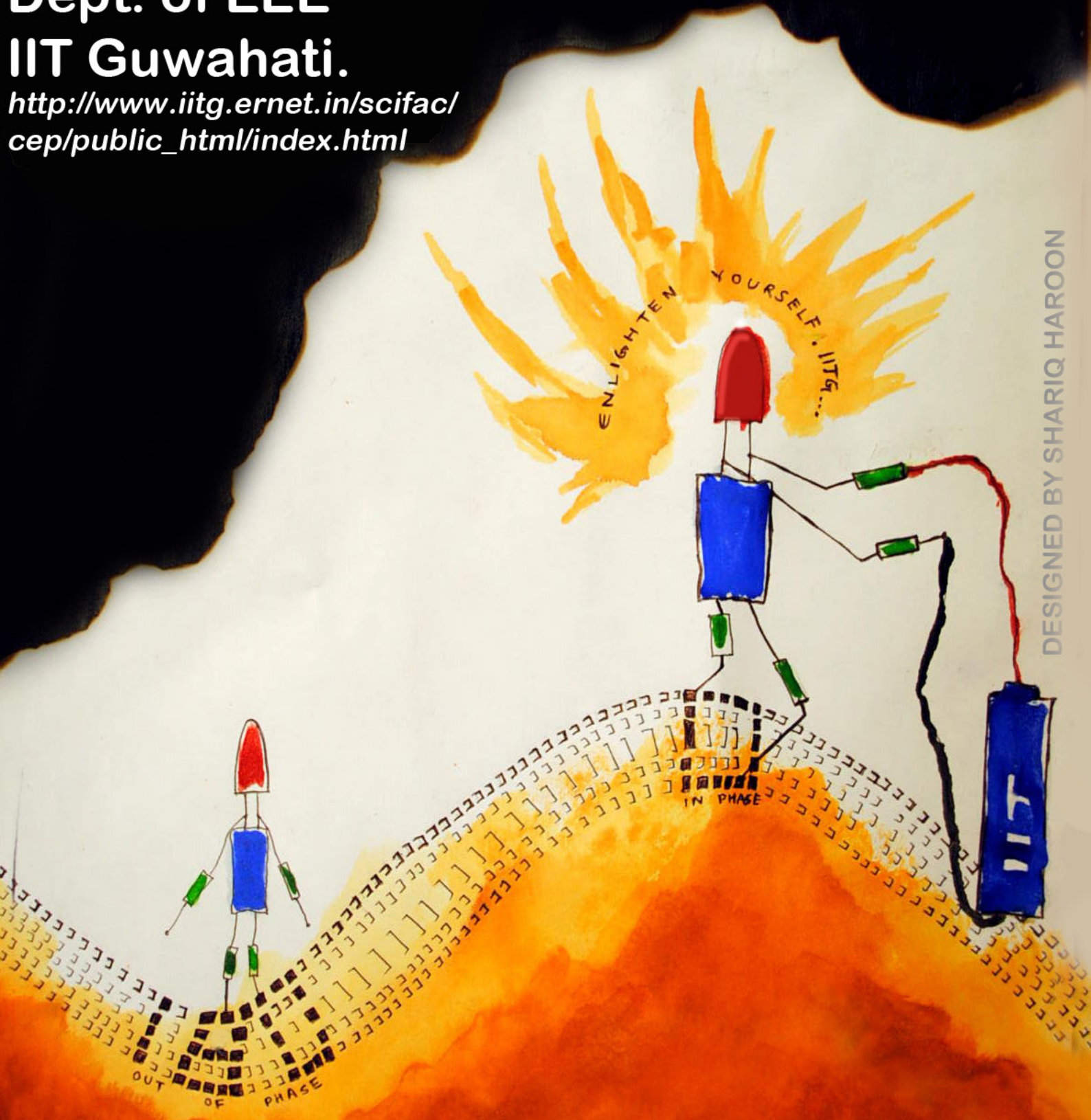


-Srijan Maulick
3rd year ECE

" " in phase with InPhase

Cepstrum
Dept. of EEE
IIT Guwahati.

http://www.iitg.ernet.in/scifac/cep/public_html/index.html



DESIGNED BY SHARIQ HAROON

AWAITING YOUR FEEDBACK

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