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ASIA PACIFIC UNIVERSITY
OF TECHNOLOGY & INNOVATION

SCHOOL OF ENGINEERING

ENGINEERS INSIGHT

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'Engineers Insight' is a quarterly issue by the School of Engineering for the reading pleasure of the staff and students allowing for knowledge sharing and capturing of events for the benefit of engineering education

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HEALTH, SAFETY & ENVIRONMENT (HSE) IN ENGINEERING

Health, Safety and Environment (HSE) are the three most important factors in engineering that can highly contribute towards performances at different situations like the workplace, project sites or in a manufacturing facility/plant. Often, engineers neglect issues pertaining to health & safety and could care less about the environment, eventually landing in trouble with the authorities or causing damages or injuries. So, what is it that drives these three engineering factors? Why are they essential primarily to technical employees?

To start off, the mindset of HSE should be within everyone who is involved in engineering. Ideally you should be thinking about HSE elements in all forms of engineering work, before you design, prior to any installation works or even make it a pre-requisite to any maintenance or repair job. Especially in workplaces such as a manufacturing facility, engineering productivity is of core essence to build on the company's production output. This output highly rests on the performance delivery, which is further supported by good HSE practices. The positive characteristic of HSE is its widespread practice.



**Schneider Electric Switch Outlet
Assembly Line**



**Saison Electric Wire Harnessing
Assembly Line**

Many organizations have incorporated solid HSE policies/procedures and implement them strictly. These organizations have implemented effective safety management systems not just because of concern for their employees, or for legal compliance, but because they understand that superior HSE implementation results leads to;

- improved employee relations and employee trust;
- improved reliability and productivity;
- improved protection from operational interruption;
- increased public trust and improved public image; and,
- increased organizational capability

Injuries, occupational illnesses and incidents causing losses are often symptoms of defects in the workplace systems. Superior performing companies have realized that the underlying defect which has allowed an injury, illness or incident to occur, is probably also affecting the reliability of the operation, productivity, or product quality. Optimized cycle times and attending to customer demand high levels of production reliability.



Heavy Equipment Offloading at A Construction Site – DCP 1, Gardens Project

If you take a project or a construction site as your point of reference, then every employee or any other person authorized to conduct activities in the project or site is responsible to:

- Comply with applicable environmental, health and safety laws and regulations, company HSE policy and accepted safe work practices.
- Observe environmental, health and safety related signs, posters, warning signals and written directions.
- Be familiar with the emergency plan, the emergency assembly area and emergency coordinators for their building, and participate in emergency drills.
- Learn about potential hazards associated with their work and work area; know where information on these hazards is kept for their review; and use this information when needed.
- Use personal protective equipment and engineering controls appropriate to the work.
- Curtail or stop their work if they reasonably believe continuation of the work poses an imminent danger to health or safety, and immediately notify a supervisor or a staff in the chain of authority over the work.
- Report all unsafe conditions as soon as is reasonably possible.
- Warn co-workers about defective equipment and other hazards.
- Participate in HSE training.



Typical Building Site Safety Briefing Conducted by Loyd's Construction



Diesel Engine Overhaul at a Port's Engineering Maintenance Workshop

Reliability engineers often assume that reliability and safety are synonymous, but this assumption is true only in special cases. In general, safety has a broader scope than failures, and failures may not compromise safety. There is obviously an overlap between reliability and safety, but many accidents occur without any component failure. The individual components were operating exactly as specified or intended, that is, without failure. The opposite is also true that components may fail without a resulting accident. Accidents may be caused by equipment operation outside the parameters and time limits upon which the reliability analyses are based. Therefore, a system may have high reliability and still have accidents. Safety is an emergent property that arises at the system level when components are operating together. The events leading to an accident may be a complex combination of equipment failure, faulty maintenance, instrumentation and control problems, human actions, and design errors. Reliability analysis considers only the possibility of accidents related to failures; it does not investigate potential damage that could result from successful operation of the individual components.

HSE should be an engineer's goal. An engineer should recognize that accidents or damages to the environment are uncommon events and are usually preventable. HSE accident prevention is a responsibility all engineers share at every level of their work in the various industries they indulge in. Rightfully all engineers should be trained to identify and correct unsafe conditions on the job in order to provide a non-hazardous work environment for the public as well as themselves. Understanding that HSE is a continuous improvement process helps engineers maintain their HSE goals in their ever-changing work environment. An engineer's HSE goal is achieved when, at the end of the day, all working within the same circle or environment of the engineer arrive SAFELY home to their families.

THINK SAFE, WORK SAFE

By Assoc Prof Ir Dr Vinesh Thiruchelvam

Green Approach Towards Developing

A Sustainable Automobile

Suresh Gobee

In today's world where the fuel price keeps hiking up as the black gold commodity is getting scarcer and the cost of obtaining it is ever rising; a new breed of cars have emerged to replace the conventional gasoline power cars. The new breeds of cars are more fuel efficient, economical and some which does not use the gasoline fuel at all. These new breeds of cars are called "Green Car" and they can be classified into several categories which are Hybrid, Electric and Hydrogen cars. Of these 3 categories the Hybrid and Electric cars are commercially available. Figure 1 shows some of the hybrid and electric car according to their manufacturers.

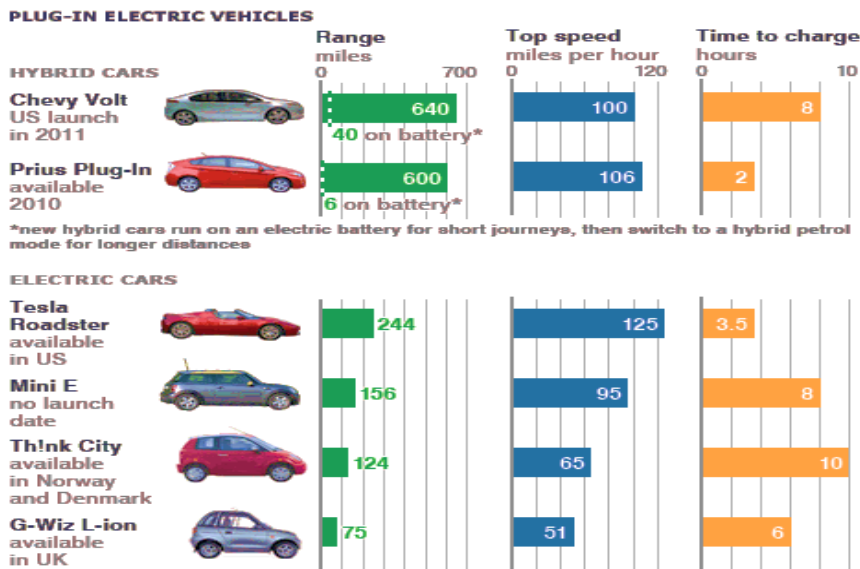


Figure 2: Toyota Prius (www.auto123.com)

Figure 1: Hybrid and Electrical Car (Madslien, 2009)

The most successful categories of the three "Green Car" is the Hybrid car model which is the electric and gasoline model hybrid. One of the most iconic models for Hybrid is the Toyota Prius as shown in Figure 2. The hybrid cars work by using both electric power and normal gasoline engine to power the car. The hybrids cars can work using two different methods which is the parallel system or the series system. In the parallel system the motor and the engine can drive the car at any one time or work together to power the car. While in the series system only the engine runs to turn the motor and the motor powers the car. The main component of a hybrid car is shown in Figure 3.

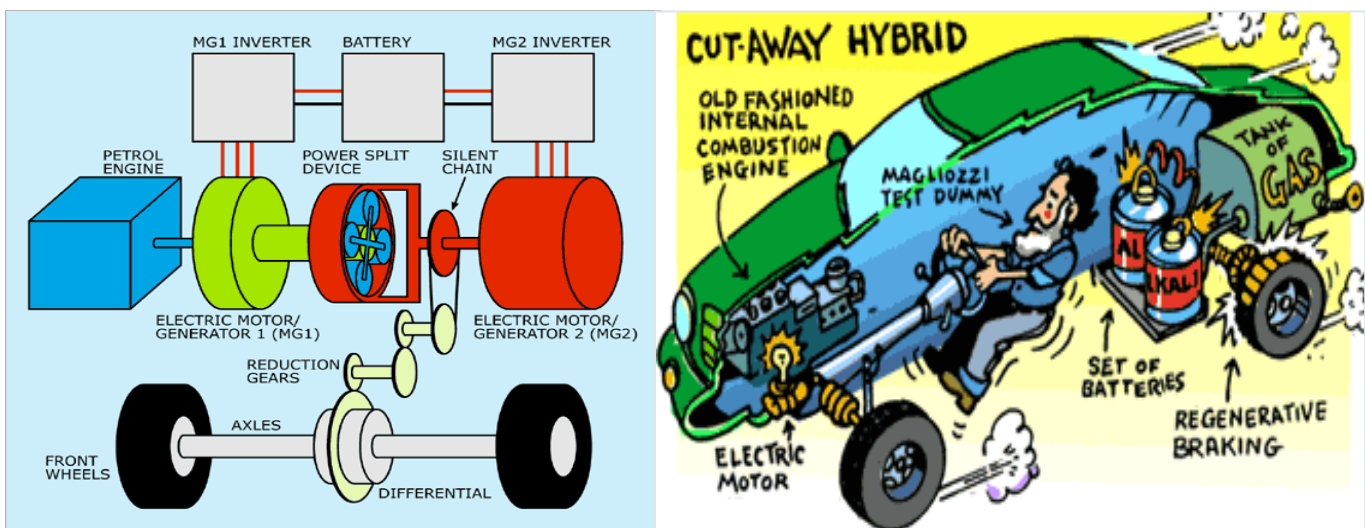


Figure 3: Components in a hybrid car (<http://www.clemson.edu/>, www.circuitstoday.com)

The hybrid car consists of a combustion engine, electric motor which can be powered by the engine or the battery pack, generator to charge the battery and regenerative braking which can recharge the battery pack. Overall the hybrid cars are designed in such a way to reduce fuel consumption by using the electric motor to run on electric mode during low speed below 20 km/h. The other features of a hybrid car that makes it fuel efficient and sustainable is the usage of smaller engine to reduce fuel consumption, having a lighter car body weight, more aerodynamic design and also the engine that will be able to shut-down when the car is idle. This feature will soon become standard in most conventional cars as it will help to reduce emission and produce more sustainable cars.

The second breed of cars which is becoming more common and commercially available nowadays is the electrical car. These cars have zero emission as it's fully driven by electric motor and powered by battery. One of the best electric car voted as the car of the year in 2013 is the Tesla model S as shown in Figure 4. The breakthrough for electric car merged when the battery capacity was increased using Lithium ion battery. A fully charged electric car can travel a distance of 480 km at 80 km/h and this car has a top speed of 200 km/h. Moreover the charging time has been reduced to 30 mins to fully charge the batteries of the electrical cars.



Figure 4: Tesla model S (www.teslamotors.com)

Currently the only drawback of the electric car is the availability of the charging station as there are not many facilities around to cater for the charging, although this can be easily setup through some government involvement. The last and third category is the Hydrogen car or also known as the fuel cell cars. Hydrogen cars produce electricity by using hydrogen fuel cells. Figure 5 shows how the Polymer Exchange Membrane (PEM) fuel cell works in a hydrogen car.

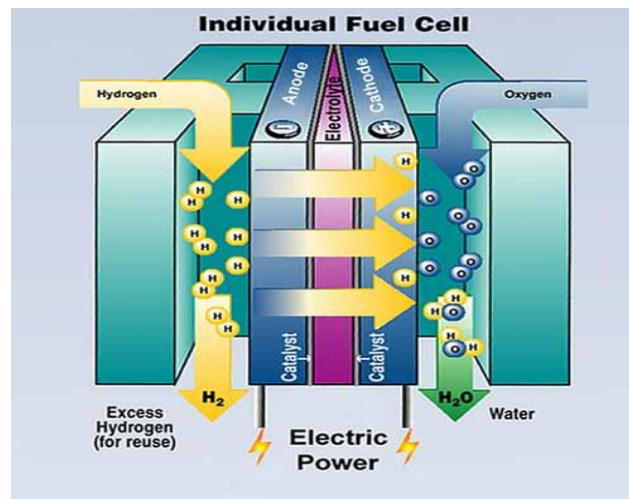


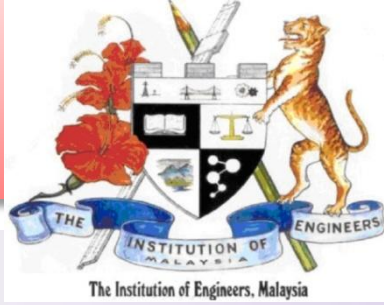
Figure 5: Hydrogen Fuel Cell (www.butane.chem.uiuc.edu)

Hydrogen fuel cell works according to the reverse electrolysis principle. In electrolysis process, current is supplied to water to separate hydrogen and oxygen gas. In fuel cell the electron is separated from the Hydrogen atom to produce electricity. When hydrogen gas is pump to the anode electrode which contains a platinum catalyse, the electron in hydrogen is striped by the platinum and this electron is used to produce electrical current and the H+ ion will combine with O₂ at the cathode electrode to produce water or steam and this is the by-product of the hydrogen car. Although hydrogen fuel cell cars are environmentally friendly with the steam as emission. There are still some major drawbacks to this technology. The questions often being asked is; whether this Hydrogen fuel cell is feasible? Where does the hydrogen come from? The high cost for producing hydrogen and building infrastructure? Is using conventional oil or coal to power the hydrogen production environmentally friendly? And is the hydrogen refuelling station widely available?

Due to the highly questionable technology, high cost and inefficiency of the infrastructure for hydrogen fuel cell the best option currently available for sustainable cars are the hybrid and electrical vehicle (EV).

However there is still a huge improvement needed to make the electrical cars 100% sustainable as currently the electricity for charging the EV comes from oil and coal. This can be achieved by using renewable energy source such as energy from the solar, wind, wave or others. We must admit that, on the bright side of the EV technology is that we will have zero emission and even with the usage of the conventional electrical charging system, these cars are still sustainable and efficient.

As from the above we can see that, all automobile industries are working towards producing greener, environmentally friendly and sustainable cars. The hybrid currently holds the market place for sustainable and efficient cars and with the growing research on improving the EV will create a brighter future for these cars to be more widely available.



Seminars & Workshops

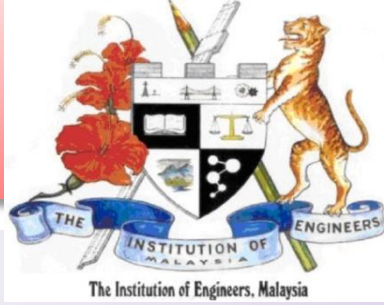
Sustainable Development in Building Engineering



Buildings, infrastructure and the environment are inextricably linked. Energy, materials, water and land are all consumed in the construction and operation of buildings and infrastructure. These built structures in turn become part of our living environment, affecting our living conditions, social well-being and health. It is therefore important to explore environmentally and economically sound design and development techniques in order to design buildings and infrastructure that are sustainable.

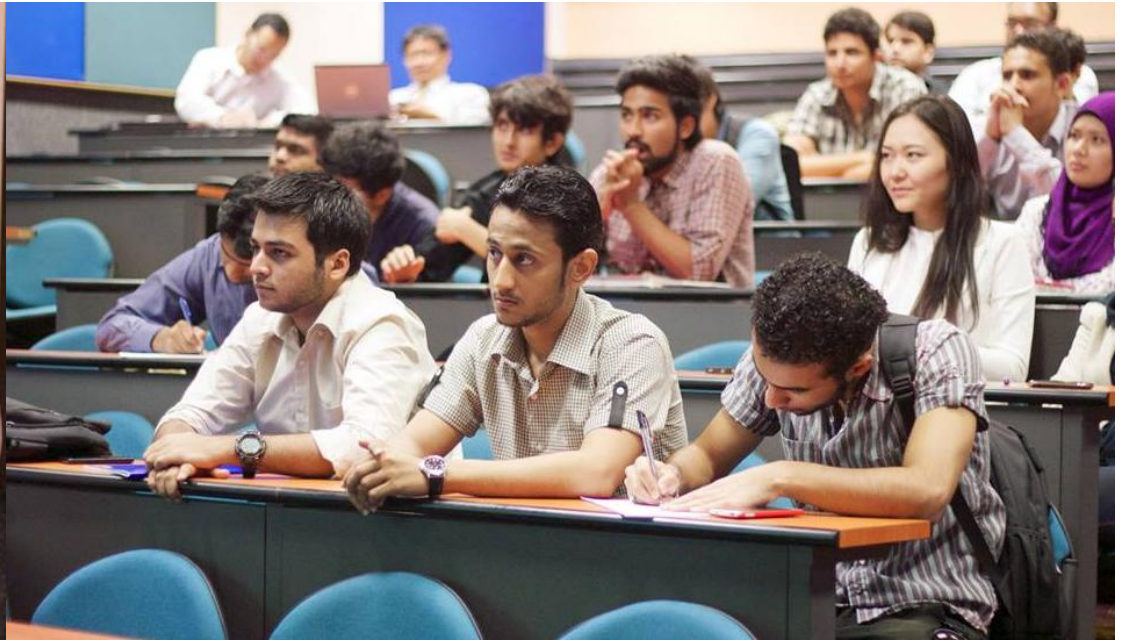
An industrial talk on “Sustainability in Building Engineering” by Mr. Richard J Curran, Technical Director, AECOM, Kuala Lumpur was held on July 11, 2013. The talk was an eye opener on economic effects of the design, construction and operation of the built environment, focusing on the rate of use of resources, the buildings carbon emissions, water consumption, landfill waste and raw materials used for building. The talk was well-received and informative on the role of sustainable growth and development for 40 students and 10 staff who attended the talk.





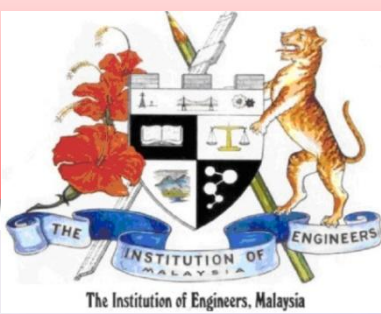
Seminars & Workshops

Engineer to Professional Engineer Status in Malaysia



“Professional Engineer” (PEng) is a term used to describe an engineer who has met the requirements for licensing by the jurisdiction in which he/she will be practicing. It requires a combination of education and practical experience, the successful completion of a series of examinations and fulfilling other requirements of the licensing body. PEng are permitted to independently design, perform necessary engineering calculations, submit plans and, in general, practise the profession of engineering or one of its 25 specialties including material, mechanical, civil, chemical, environmental, electrical, mechatronics engineering, etc. The benefits of being a PEng includes recognition (local & overseas), status, promotion, being a mentor to other engineers, career opportunities, money, entitled to use the designation Ir. (Ingenieur) in front of their name and PEng at the back of their name and is also a route to many more future achievements. The seminar on “Engineer to Professional Engineer Status in Malaysia” by Ir. Dr. Dhakshyani was conducted on September 10, 2013 for 24 students and 10 staff.





Seminars & Workshops

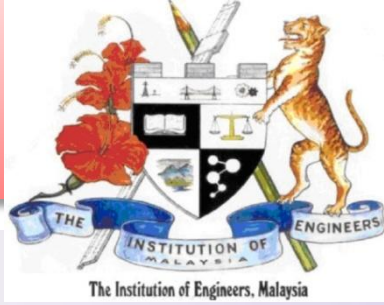
Communication Engineering with Simulation Tools and Experimental Trainers



Communications, unlike networking, requires knowledge from many more disciplines. Furthermore they all require some mathematical background. In communications some blocks operate in the analog domain, whilst others in the digital domain and often blocks are optional or interchangeable. Simulation and modeling tools can help in the communication domains; their use also has well known advantages in the learning process.

The one-day workshop “Communication Engineering with Simulation Tools and Experimental Trainers” by Mr. Shankar Duraikannan, held on October 5, 2013 was demonstrative on the use of the Matlab, Simulink and Multisim in the process of learning communication engineering. The workshop includes a technical description of the main concepts within communications using simulation and modeling tools based on Matlab Simulink, Multisim and the Experimental Trainers. The use of simulation tools in modeling is demonstrated with a simple model of amplitude modulator simulated using all Matlab Simulink and Multisim. The workshop was well-received by 16 students and 2 staff.





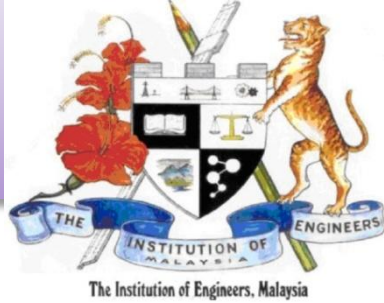
Seminars & Workshops

Occupational Safety and Health



Occupational Safety and Health (OSH) is an area concerned with protecting the safety, health and welfare of people engaged in work or employment. The goals of occupational safety and health programs include to foster a safe and healthy work environment. OSH also protects co-workers, family members, employers, customers, and many others who might be affected by the workplace environment. Occupational safety and health can be important for moral, legal, and financial reasons. The invited talk on “Occupational Safety and Health” by Mr. Aaron Ong, Certified Health and Safety Officer, Envitech Engineering, held on October 8, 2013, was a guide to the participants. The talk opened with an introduction to three major objectives of occupational health and safety, namely (i) the maintenance and promotion of workers’ health and working capacity, the improvement of working environment, (ii) work to become conducive to safety and health and development of work organizations and working cultures in a direction which supports health and safety at work and (iii) in doing so also promotes a positive social climate and smooth operation and may enhance productivity of the undertakings. Furthermore the various categories of hazards were discussed in detail with illustrative case studies and projects carried out by Envitech Engineering. 26 students and 10 staff attended the talk.





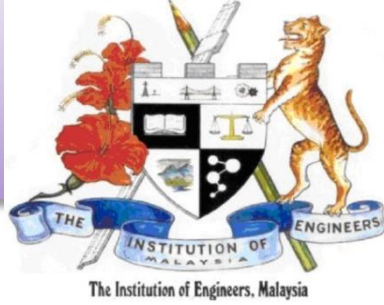
Industrial Visits

LabVIEW Hands On Workshop



LabVIEW is a development environment for problem solving, accelerated productivity, and continual innovation. A graphical programming platform that helps engineers scale from design to test and from small to large systems. It offers unprecedented integration with existing legacy software, IP, and hardware while capitalizing on the latest computing technologies. This introductory hands-on workshop on LabVIEW conducted by National Instruments – Academy and Innovation Nucleus held on July 5, 2013, gave an insight on how LabVIEW works with real-world hands-on exercises. In addition, this also helped the participants to explore several new features of LabVIEW launched in August 2012. The workshop have also given an idea on writing a better code with LabVIEW 2012. 12 staff from School of Engineering attended the workshop. The Guest of Honour for the session was Datuk Idris Jala, Minister in the Prime Minister's Department.





Industrial Visits

National Institute - Academy & Innovation Nucleus



National Instruments transforms the way engineers and scientists around the world design, prototype, and deploy systems for test, control, and embedded design applications. Using NI open graphical programming software and modular hardware, customers at more than 25,000 companies simplify development, increase productivity, and dramatically reduce time to market. From testing next-generation gaming systems to creating breakthrough medical devices NI is into every industry, every application and test. On September 17, 2013, 40 students and 5 staff of SoE visited the facilities of National Institute - Academic Innovation Nucleus. The three-hour visit was beneficial to the students in terms of acquiring knowledge in use of LabVIEW to create simple applications, understand front panels, block diagrams, icons, and connector panes, use of built-in LabVIEW functions for mathematics and signal processing and to create applications that communicate with USB DAQ devices.

Understanding Engineers

A pastor, a doctor and an engineer were waiting one morning for a particularly slow group of golfers. The engineer fumed, "What's with these guys? We must have been waiting for 15 minutes!" The doctor chimed in, "I don't know, but I've never seen such ineptitude!" The pastor said, "Hey, here comes the greens keeper. Let's have a word with him." "Hi, George. Say, what's with that group ahead of us? They're rather slow, aren't they?" The greens keeper replied, "Oh, yes, that's a group of blind firefighters who lost their sight saving our clubhouse from a fire last year, so we always let them play for free anytime."

The group was silent for a moment. The pastor said, "That's so sad. I think I will say a special prayer for them tonight." The doctor said, "Good idea. And I'm going to contact my ophthalmologist buddy and see if there's anything he can do for them."

The engineer said, "Why can't these guys play at night?"

SoE Collaborations

SERI – University Kebangsaan Malaysia

On the 12th of September 2013, the Letter of Intent (LOI) was signed between APU and Solar Energy Research Institute (SERI) of University Kebangsaan Malaysia (UKM). APU were represented by Assoc Prof Ir Dr Vinesh Thiruchelvama and Mr Lim Siong Chung while UKM was represented by SERI Director, Prof. Dato' Dr. Kamaruzzaman Sopian and its leading researcher, Dr Chan Hoy Yen. The LOI allows APU students to work as interns at SERI focusing on renewable energy projects and for the work of between 4-6 months to be taken as a continuity for their Final Year Projects (FYP) in which SERI is happy for the students to complete their FYPs using SERI's laboratory and research facility.



Signing of LOI at Prof Dato Dr Kamaruzzaman's office at SERI



SERI's Advanced Solar Cell Fabrication Laboratory



Trying out the solar cell fit outs on to the main frames at the Fittings Installation - SERI



Visit to SERI-UKM's Green Energy and Innovation Park

SoE Collaborations

SERI – University Kebangsaan Malaysia

SERI is very keen on training APU students for industrial purposes and this provides an excellent opportunity for APU engineering students to not only be exposed to SERI's high tech laboratory and research facilities but to also be supervised by a top researcher in the field of renewable energy which is Dr Chan Hoy Yen. Additionally APU students will work on similar projects as shown below as part of SERI's Green Energy and Innovation Park's expansion.

For further clarification all SoE students may contact, Dr Thang Ka Fei via email - ka.fe@apiit.edu.my



BIPV Roofs



Solar Powered R&R Benches and Irrigation Systems



Energy Efficient Building Models used for Testing



Guard House Operating on Self Generated Power

SoE Conferences

IEEE International Conference on Circuits and Systems - 2013

The IEEE International Conference on Circuits and Systems organized by IEEE Circuits and Systems is the foremost global forum for specialist presentations and interactions in the current and emerging areas of electronic circuits and systems. The conference provides an opportunity to disseminate information about latest technology to users, industries, academics, and students working in the key area of circuits and systems in terms of renowned keynote speeches and technical paper presentations.



2013 IEEE International Conference on Circuits and Systems (ICCAS2013) was held on 18th and 19th September 2013 at Hotel Istana, Kuala Lumpur. APU was part of the conference as a co-organizer with Mr. Lioe De Xing as one of the organizing secretary. A paper from APU titled "Design Optimization for Diminution of 5.75GHz Chebyshev Band Pass Filter" by Mr. Shankar Duraikannan was accepted and presented at the conference. The paper is indexed at IEEE Explore.

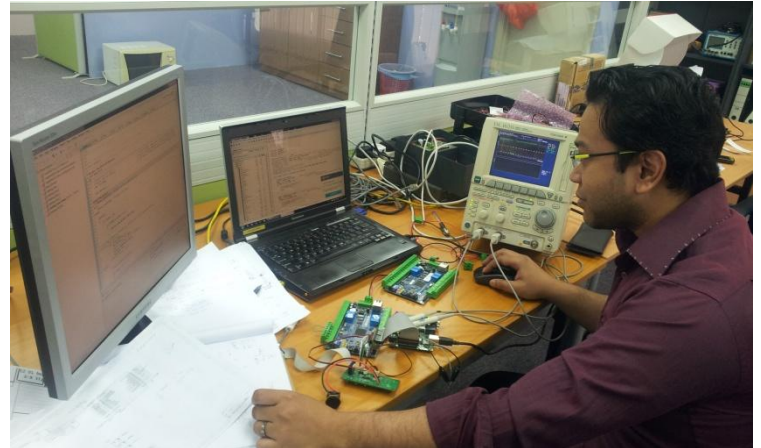


An Internship Story @ EntryPass Corporation

Praneet Choudhury TP021883

July 8th. Anticipation. An hour's journey. I was finally in front of the brown and cream colored enclosure that housed a number of small-to-medium-enterprises, the result of MSC, Malaysia's national ICT drive program. One of them – EntryPass Corporation Sdn. Bhd – where I would spend the next 4 months “experiencing” the industry life of an engineer.

The apprehension I was feeling was natural, I knew that. There is always the “what if” factor associated with an internship in a foreign country. Granted, the interview process was nice and smooth, but the fact that I had met only my supervisor during that process, did not make it any easier to picture my co-workers and co-interns, if any, with whom I would have to interact for some time to come. A horrific picture, of being “the only foreign guy” in a company, otherwise populated by locals, was slowly painting itself unconsciously in my mind. Imagine, then, my pleasant surprise, when I discovered during the introductions to the other staff, that from the fourteen members of the R&D team at EntryPass, there were four Koreans and one Iranian employee as well. A sigh of relief – at least I was not going to be singled out.



The first few days were more or less as expected. Study the documentation and working of the products that I may later have to handle. In this, I was asked to clarify any doubts with the other intern, who was leaving shortly - a nice move on the part of my supervisor, to make me get along with the junior employee to start with, rather than a senior employee. Soon, I realized that this was done with a specific underlying intention – I was to carry on his unfinished work, after his departure. That was when, almost nearing the end of the first month, the big stumbling block hit me square in the face. The size of the code he was handling was literally enormous, compiling to something to the tune of 25000 lines of embedded driver-level C language, separated into almost 30-35 modules. I.WAS.FLABBERGASTED. It took me a couple of weeks, and frankly, he was gone by the time I could digest half of what I was expected to.

But I did it. Perseverance finally paid off. I even suggested an improvement to some part of the code, and coded it out as well. My supervisor DID NOT accept the improvement. Quite understandably, I was yet to comprehend the industry standards of “modularity” in code, and my “improvement” was breaking this. Lesson learnt – college code and industry code are as far apart as the two poles. Also it may be beneficial, in the early days, to not step out of your supervisor's guidelines. I should mention here that EntryPass is primarily involved in developing microprocessor-based security systems for enterprise purposes and thus my primary task became the interfacing of two microprocessors, each of which had different workloads. The best part – the communication protocol to be used was almost unknown to anyone in the R&D team. I was literally on uncharted waters.

Struggle has another name, it's the same as mine. For almost a month I was left like a paper-boat in a stormy sea, while I tried to figure out some way of making the two microprocessors talk to each other. They obstinately refused. And then, one weary afternoon, I finally HAD IT. I simply tried something that I was specifically instructed not to. Lesson learnt – no human is the all-seeing almighty; follow supervisor's instructions first; if it does not work, take your own initiative, there is nothing to lose. If it pays out, all is golden and you are satisfied secretly. The industry is interested in results, not so much in the methods.

Almost exactly after this, I was asked to coordinate with one of the Korean staff members, to construct an XML based communication protocol for an entirely different project. He was a very nice person, but that did not contribute to make our inherent communication gap easier. Hours were spent trying out hand gestures and line diagrams to explain simple concepts to each other. But as usual – successful. Albeit, after a couple of weeks. Lesson learnt – learn Korean! This also demonstrates how a junior employee may be assigned random tasks, in an effort to get him quickly familiarized with totally differing concepts – a necessary exercise. A little bit of product testing and documentation was part of my job description as well.

Anyway, once I had the two microprocessors talking to each other, I believed my hurdles were over. Not so. Each and every aspect of my coding had a “childishness” factor, which was brushed up and brought to industry standards by my supervisor. I clearly remember having written five completely different pieces of code to de-bounce a switch, till the last one met his approval. Still a month to the end of my 4-month internship, every day I humbly discover a newer and improved version of my own code, guided by my supervisor’s impeccable knowledge.

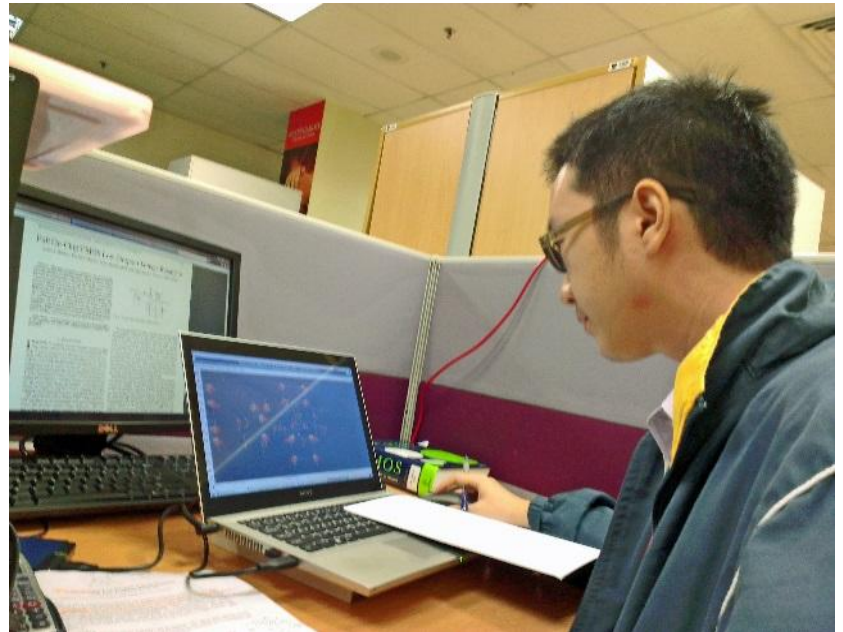
So, here, I leave you, dear reader, to decide for yourself, whether you consider the above experiences, “awesome”, “good”, “ok” or “bad”. For myself, I always say, there are no “good” or “bad” experiences; there are only “experiences”. It is how the “experience” is utilized in the future that determines its goodness. The internship at EntryPass is one that I am not likely to forget in a hurry. I have come out of it stronger, wiser and definitely with a fuller grasp of the fact that perseverance, not necessity, is the mother of all invention.

Challenging Days in MIMOS

Lim Chee Cheow TP019807

I have been given golden opportunity for internship placement in Research & Development of Analog Integrated Circuit Design in MIMOS, Malaysia’s national R&D centre in ICT.

Currently I am working on power management circuit for portable gadgets, one of the hottest areas of research. Conventional voltage regulator has a big external capacitor on PCB to ensure stability from no load to full load condition. Nevertheless, limited space for system-on-chip solution hinders such usage. If removed, its characteristics suffer significantly. Therefore, new circuit topologies has to be invented, including complex feedback loops within the regulator block, serving as compensation mechanisms.



Being a “practicing” researcher, I appreciate that new knowledge is gained everyday via independent research & study skill through books, journals, discovering what techniques have been successfully implemented as well as their improvements and problems created. The process is not easy, as cracking the head to understand the theory behind the circuits created by members of professional association (eg: IEEE) could take up to several weeks.

To further verify the theory, prerequisite mathematical analysis and modelling the circuits are required. Schematic and post-layout simulation are then performed using custom IC design software, Virtuoso Cadence to confirm the result from theoretical analysis, to not mention that learning the software up to a decent level could take some time too. Frustration is always there when failure happens.

However, at the end of the day, success will eventually come. This is the most enjoyable moment, as there is a Chinese proverb saying “if one does not plow, there will be no harvest!”

Wireless Electricity

Bryan Ooi Joon Kit TP025421

Entering the 21st century, there is without a doubt an incredible spike in the development of new and innovative electrical products. Be it smart phones, ultra thin laptops, OLED televisions or electric cars, the modern world has much to offer and the innovations are still rapidly growing. However, as each electrical device runs on electricity, it needs to be charged. And to do so requires an electric source and of course, wires or power cords to conduct the current. For consumers and developers alike, wires present complications. But imagine if the wires were out of the picture. Imagine if your phone automatically charges itself as you enter your house without having to plug in. Or if an electric car charges itself as it enters its own garage. This has been made possible with wireless electricity technology.

Background

The idea of transferring electricity wirelessly was inspired by the operations of a transformer as it transfers energy from the primary coil to the secondary coil without a direct electrical connection through the principle of magnetic induction. However this system can only function efficiently if the magnetic coupling between the primary coil and the secondary coil is large, thus the coils have to be in close proximity and positioned carefully with respect to one another [1]. To transmit power wirelessly over a large range, a group at Massachusetts Institute of Technology (MIT) came up with a non-radioactive approach that uses resonance to enhance the efficiency of energy transfer. This approach is referred to as highly resonant wireless power transfer (HR-WPT) [2]. Through this concept, they were able to wirelessly light a 60 Watt light bulb at a distance of 2 meters as shown in Figure 1. Today, the technology of wireless energy transfer is being developed and manufactured by WiTricity, an American engineering company [3].



Figure 1: A light bulb being powered through HR-WPT method [4]

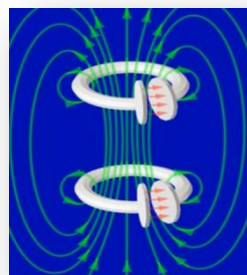


Figure 2: Strongly coupled magnetic fields during resonant energy transfer [2]

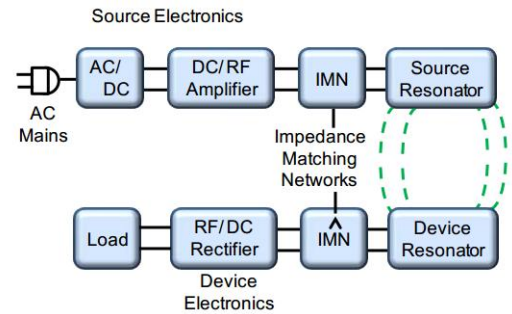


Figure 3: Block diagram of a wireless energy transfer system [1]

How does it work?

Referring to Figure 3, the Source Resonator is a coil which has been set to resonate. When the source coil resonates, it will pulse at very high alternating current frequencies. As this happens, when a capture coil (Device Resonator) is brought close enough to the source, resonant energy transfer occurs. Resonant energy transfer is described as efficient energy exchange between tuned resonant objects. Therefore, for this to work the capture coil has to belong to a device that only functions at the exact same frequency as the one being generated by the source coil. If this criteria is met, the magnetic field from the source coil will induce current in the capture coil and a magnetic field around it as shown in Figure 2. The shared magnetic fields of the two coils become strongly coupled and thus transfer of magnetic energy between the coils occur. Simply put, electric energy is converted into a magnetic field at the source coil and back into usable electric energy at the capture coil. Hence, wireless power transfer.

Evidently, wireless power transfer is a prevalent technology that may play a big role in many areas in the near future. From simplifying everyday tasks such as charging phones wirelessly to powering medical devices like pacemakers, this is a technology worth developing. We may never have to plug in again.

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Automated Glove Defect Identifier and Classifier

Nawar Moosa Saleh TP021982

The necessity to remain competitive and succeed in the global market has resulted in increased demands on manufacturers to offer high quality products. In order to deliver consumer's requirements and needs, manufacturers are developing new strategies to enhance and control the value of products. Quality control is primarily dependent upon detecting problems and then tracking corrective activities. Inspection is a considerable process in the overall control of product quality and defect identification. Inspection is usually carried out before and during manufacturing, and after the completion of manufacturing, in order to ensure that the product quality level is consistent with the design standards and the product will meet users' requirements. Therefore inspection is one of the most important manufacturing activities. Moreover, inspection is not the only key for success, nowadays manufacturers adopt systems that can contribute to the sustainable development

Background

Currently, one of the most important manufacturing industries seeking for ways of improving quality control system in manufacturing process is gloves manufacturing. When producing gloves, defect in dimensions and thickness are major problems that manufacturers face daily. These parameters lead to material waste and hazardous exposure to the consumers when they are not identified during manufacturing. The aim of this research is to be able to develop a suitable system that is capable of identifying defects and promote sustainability in glove manufacturing industries .

The main purpose of this research is to use image processing techniques to create an automated inspection system and classifier . The system proposed in this research will help in reducing material waste and promote recycling in order to contribute in sustainable development.

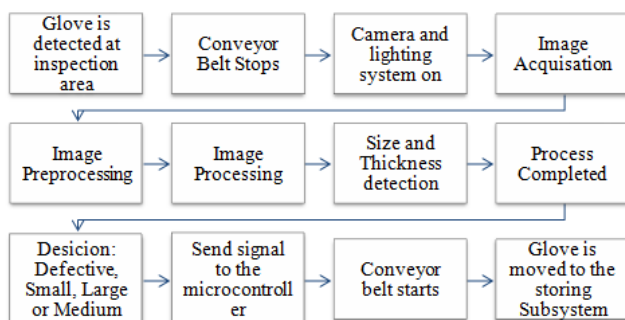


Figure 1: Block diagram of the system

Working Principle

The prototype proposed is a PC based system that uses visual inspection to detect defects in gloves. The system is equipped with camera that provides data for the inspection. The images captured from the camera will be processed through a computer based system called Matlab.

The system is using a camera attached on top of the conveyor belt and supported by two beams connected together in H shape. In this project, the feeder tray is the belt and gloves are manually placed on the conveyor belt.

The carrier mechanism is the conveyor belt connected to a 12V DC motor. Two rollers along with bearing and a shaft capable of rotating are attached to the extreme ends of the belt. The DC motor will be attached to one of the belt rollers in order to create the rotating motion to the conveyor.

The storage mechanism in this design consists of linear rails attached to a ball bearing power screw which is connected to a 12V stepper motor. Boxes are attached on top of the rails for the glove storage.

The electronic subsystem constitutes the brain of the system. Here, inputs and outputs components of the system are connected together through a microcontroller to control the functions of the proposed system. The microcontroller selected for this project is a Programmable integrated circuit named PIC16F877A. Matlab and the microcontroller interface through a serial communication device RS232 and MAX232 driver/ receiver .

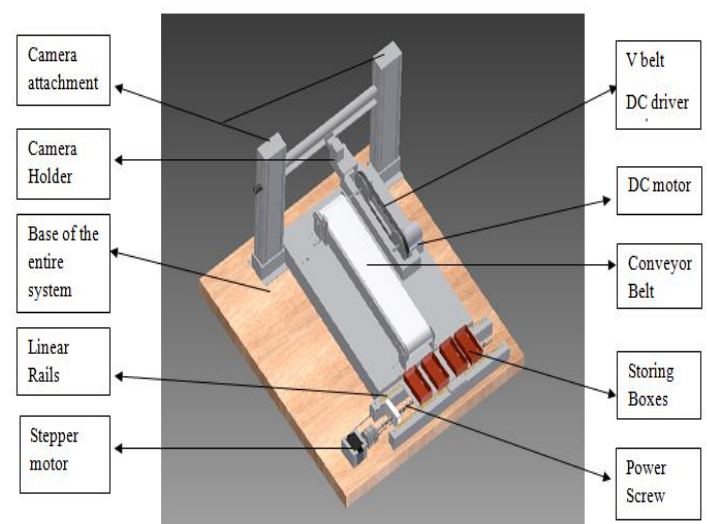


Figure 2: Mechanical Structure of the system

Rapid technological advancement has led to the invention of computers and smartphones, they have become our daily life companion. They process signal digitally with ease as digital signals are more robust, immune to noise and thus high tolerance to errors. Nevertheless, analog signals cannot be neglected as analog circuits are the most fundamental building block for all of the devices, for example: power management circuit used to regulate and power up all the IC circuitry in the gadgets from power plugs or battery.

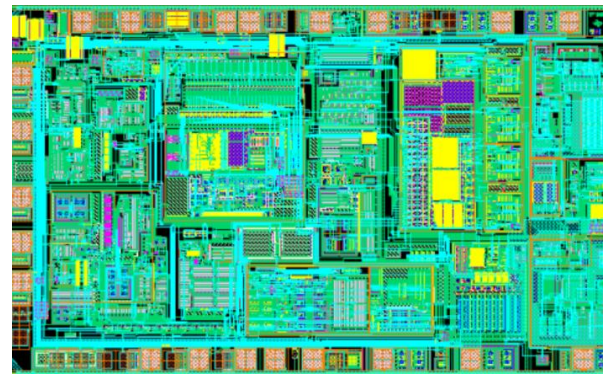


Figure 2 Physical Layout of SoC [2]

Signals Processed	Digital	Analog
Processing functions	80%	20%
Time required to design	20%	80%
Pass/Success ratio	1	>2
Cell libraries standardisation	yes	no
Design/route automation	yes	no

Table 1: Typical mixed-signal circuits in SoC solutions

So, what is so unique about analog circuits? To start with, consider the characteristics of a typical mixed-signal circuit in system-on-chip (SoC) solution in Table 1. Analog circuits are not perfect in every parameter, there will be trade-off between power consumption, speed, noise immunity and stability, depending on process technology and applications. Schematics and layout of digital circuits are done automatically via CAD tools; whereas for analog circuits, different topologies exist to suit different applications, for example: there are tonnes of operational amplifier designs exist. This is analogous to painting an artwork using creativity. The design flow is illustrated in Figure 1.

Furthermore, the shrinking in transistor size (process technology) poses even more serious threats to analog circuit designers due to reduced dynamic range, lower impedance (lower gain), increased non-linearity, extreme deviation from square law behaviour, high mismatches in physical layout, extreme fluctuation of threshold voltage and increased flicker noise. Thus, designers have to come out with completely new circuit topologies to accommodate the threats.

In general, steps to design analog circuits are more complex than digital. Therefore, a competent designer must be able to co-relate multiple circuit concepts simultaneously such as DC biasing/mirroring technique, frequency response, feedback & stability theory, noise and matching. A complex analog circuit must be also modelled in order to make appropriate simplification and correct assumptions. Combined with the correct use of simulation, the circuit designers are able to validate their theoretical studies.

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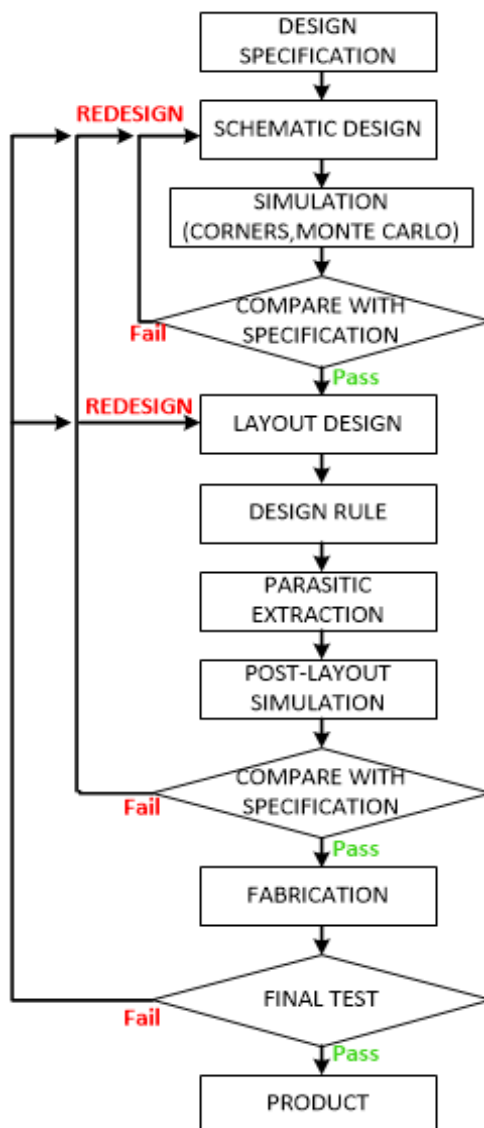


Figure 1 Design flow of Analog IC [1]

Design Optimization for Diminution of 5.75 GHz Chebyshev Band Pass Filter

Shankar Duraikannan

Introduction

Radio Frequency (RF) and microwave filters were developed since World War II. [1] Thereafter a variety of structure has been demonstrated by researchers in terms of filter compactness and frequency selectivity. Parallel coupled line, comb line, inter digital and hairpin line are significant designs of band pass and band stop filters which shows a good response, however robust and efficient filter structures are need of the hour. [2] The size reduction has becoming a major consideration for practical application in broadband wireless access communication system. However, the performance of the filter must not be influenced by the reduction in size and the designed compact filter should achieve fine system performances such as good bandwidth, low return loss and accurate center frequency. [2]

Design Perspective of Chebyshev Band Pass Filter

Chebyshev filter exhibits a better performance compared to Butterworth filter in terms of frequency response [3-5]. The insertion loss method which is the most commonly used method is adopted in the design as the network synthesis characteristics allows accuracy in frequency response analysis. Fig. 1 represents the process of filter realization.

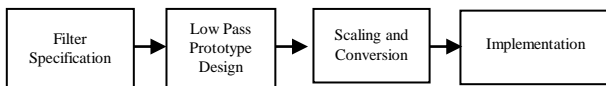


Figure 1: Block Diagram of Filter Design Flow in Insertion Loss Method

In filter design the most important thing to be considered is the specification such as center frequency, bandwidth, insertion loss, stop band attenuation and the ripple of the desired filter. The filter specifications listed in Table 1 are with reference to the RF filter specifications proposed for WLAN applications. [4]

Specifications	Desired Values
Center Frequency	5.75 GHz
Bandwidth	100MHz
Insertion Loss	Less than -10 dB
Stop Band Attenuation	25dB at 2.85GHz
Ripple	0.5 dB

Table 1: Filter Specification for Chebyshev Band Pass Filter

The design is initiated with a low pass prototype which is a passive, reciprocal low loss two port network, designed to operate from 1Ω generator into a 1Ω load. The filter response has a low pass characteristic with its pass band-edge frequency at $\omega = 1$ [3]. The low pass filter can be converted into other desired frequency range and impedance level through transformation. Scaling and conversion are used to design high pass, band pass and band stop filter [3]. It is easy to fabricate multi-section parallel coupled line band pass in microstrip technology with bandwidth less than that of 20%. As the bandwidth of the filter gets wider, it becomes difficult to fabricate because the coupled line are required to get more closely to each other. Parallel coupled line filter has properties of superposition of even and odd mode excitations. [6-8]

N-type Chebyshev 9th Order Bandpass Filter

The N type filter minimizes the size of the structure mainly by changing the shape of the parallel coupled lines. Fig. 2 is the design of the N-type Chebyshev 9th order band pass filter using TLY-5A. The N type filter exhibits a area reduction of 60 % compared to the conventional filter.

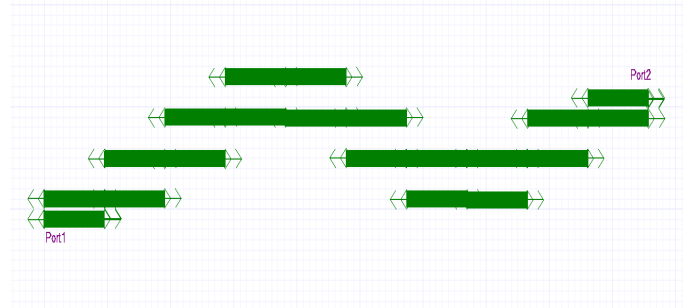


Figure 2: Layout of N-type Chebyshev 9th order band pass filter using TLY-5A

Table 2 is the comparison of N-type Chebyshev 9th order band pass filter simulation results.

Parameters	TLY-5A		FR4	
	Conventional	N-Type	Conventional	N-Type
Frequency GHz	5.75	5.75	5.75	5.75
Insertion Loss, S_{21} dB	-5.97	-5.23	-10.9	-9.67
Return Loss, S_{11} dB	-15.10	-14.17	-11.41	-11.85
Bandwidth MHz	100	84	463	388

Table 2: Comparison of N type and Conventional Chebyshev Band Pass Filter

The size of the band pass filter is reduced by 60 % compared to conventional filter. The results also indicate that the filter designed with TLY-5A exhibits a comparable response in comparison with conventional filter.

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Improved Bandwidth for CPW-fed G-shaped Monopole Antenna for 2.4 GHz WLAN Applications

Ajmal Hussain Shah

Introduction

The Wireless industry has experienced a massive evolution in the recent years from the past due to enormous research activities being taken place. Antenna, an important component in the wireless transmission and radio wave communication is impossible without an antenna. Antenna design, development and implementation are at a faster rate in the research field due to its high demand in the RF industry.

Low-profile antennas may be essential in high-performance aircraft, spacecraft, satellite, and missile applications, where size, weight, cost, performance, ease of installation, and aerodynamic profile are constraints. With similar specifications, there are many other government and commercial applications such as mobile radio and wireless communications [1-6]. Wireless Local Area Network (WLAN) antennas have many bands and to mention a few one of the assigned band according to IEEE 802.11 are 2.4 GHz (2.4 – 2.484 GHz) and 5.2/5.8 GHz (5.15-5.35 GHz / 5.725 – 5.825 GHz) [1-5]. However, the bands that are assigned for the Worldwide Interoperability Microwave Access (WiMAX) application based on the IEEE 802.16 are 2.5/3.5/5.5 GHz (2.5 – 2.69/ 3.4 – 3.69/5.25-5.85).

Antenna Design

The proposed antenna consists of two strips of Length L1 and Length L2 and a Co-Planar Waveguide (CPW) feeding line. The Capital "G-shaped" is obtained from a rectangular patch antenna. Let L1 is the length and L2 is the width of the rectangular patch antenna which form the three sides of the proposed antenna. While the fourth side of the rectangular patch antenna is modified with two vertical and one horizontal sections to form the proposed Capital "G-shaped" antenna as shown in Fig. 1. The two vertical and one horizontal sections are determined by the Heights h1 and h2, the Gap g1, the Width W1 and the Space S1. Furthermore, the Capital "G-shaped" antenna is Centre fed from the bottom by a CPW feeding line with 50 ohms impedance. It has a width of Wf, with the gap g2 between the feeding line and the ground. The existing antenna presented in [6,11] is modified by placing two equal ground planes, length Lg and width Wg, on each side of the feeding line. The distance between the Capital "G-shaped" structure and the ground plane is h3. The substrate thickness is 1.6 mm with dielectric constant of 4.3 and tangent factor of 0.025 are selected.

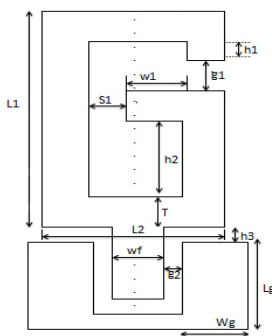


Figure 1. Geometry of the Proposed G-shaped Antenna

The quarter wavelength can be computed using the following expression as follows:

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{2.4 \times 10^9} = 1.25 \times 10^{-1} \text{ m} = 125 \text{ mm}$$

$$r_d = 0.47 \times \frac{v}{f} = 0.47 \times \frac{1.45 \times 10^8}{2.4 \times 10^9} = \frac{0.6815 \times 10^8}{2.4 \times 10^9}$$

$$= 0.28396 \times 10^{-1} = 28.396 \text{ mm}$$

Where 'f' is the frequency and 'v' is the actual propagation speed on the dipole radials which in turn depends on the substrate's effective dielectric constant.

Thus the value of the resonant dipole length r_d is assumed to be L1, which is the overall length of the Capital "G"- shaped antenna and hence $L1 = 28.396 \text{ mm} \approx 29 \text{ mm}$.

Experimental Results

The antenna is designed and simulated at the resonant frequency of 2.4 GHz and 2.45 GHz. Fig. 2 and Fig. 3 show the simulated radiation pattern and the VSWR at 2.4 GHz .

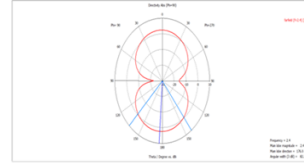


FIGURE. 2

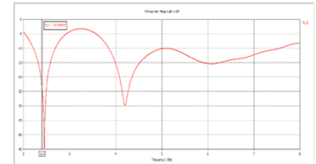


FIGURE. 3

Table I. PERFORMANCE EVALUATION PROPOSED ANTENNA (2.4/2.45 GHz)

S. No	Parameters	Measured Values	
		2.4 GHz	2.45 GHz
1	Centre Frequency	2.4 GHz	2.45 GHz
2	Gain	2.062 dBi	-
3	Directivity	2.361 dBi	-
4	Return Loss	-23.5 dB	-44.75 dB
5	VSWR	1.144	1.011

Table II. PERFORMANCE COMPARISON OF PROPOSED AND EXISTING ANTENNA

S. No	Parameters	Proposed Design	Existing Design [7]
1	Centre Frequency	2.4 GHz	2.4 GHz
2	Bandwidth	480.16 MHz	236MHz
3	Percentage Bandwidth of Improvement	19.6%	9.7%
4	Gain	2.062 dBi	2.7 - 3.1 dBi for lower band (2.3 - 2.536 GHz)
5	Directivity	2.361 dBi	-

TABLE I shows the simulated results at two different resonant frequencies of 2.4 GHz and 2.45 GHz, while TABLE II represents the performance comparison of the existing antenna and the proposed antenna. It is evident that the proposed antenna at 2.45 GHz out performs in terms of the return loss and the VSWR with -44.75 dB and 1.011 respectively. The results are compared with the existing antenna design [7]. It is concluded that the bandwidth is improved by 19.6 % with a bandwidth of 480.16 MHz as compared to 236 MHz produced by the existing design. The achieved bandwidth covers the WLAN standards and WIFI applications standards.

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Efficient Illumination Design and Energy Saving Through Occupancy Control for Building

Ravi Lakshmanan

In any nation, energy is the fuel for its economic development. Realizing the utmost importance of energy, enormous efforts have to be taken in order to secure the energy availability of a nation. Therefore, it is necessary to increase the efficiency of electric energy usage and make use of the renewable energy sources in order to extend the availability of these fuel resources. This article focuses on the efficient illumination design and occupancy control of the main building of Asia Pacific University of Technology & Innovation (APU). A detailed load and energy audit was done for APU main building and the summary of which is shown in Figure 1. For efficient illumination design the existing lighting design was reviewed and the steps involved is shown in Figure 2. The potential energy saving by delamping the lights were determined and validated with actual photometric measurements and are shown in Figure 3. The energy saving through occupancy control was also determined and the amount of energy saving is shown in Figure 4.

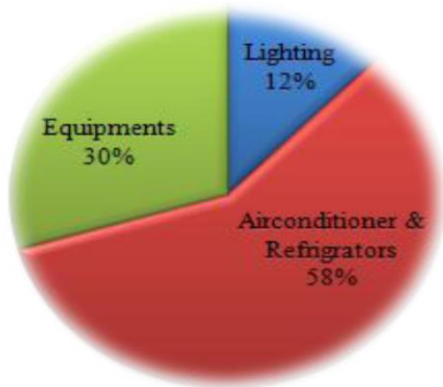


Figure 1 Load and Energy Audit of APU

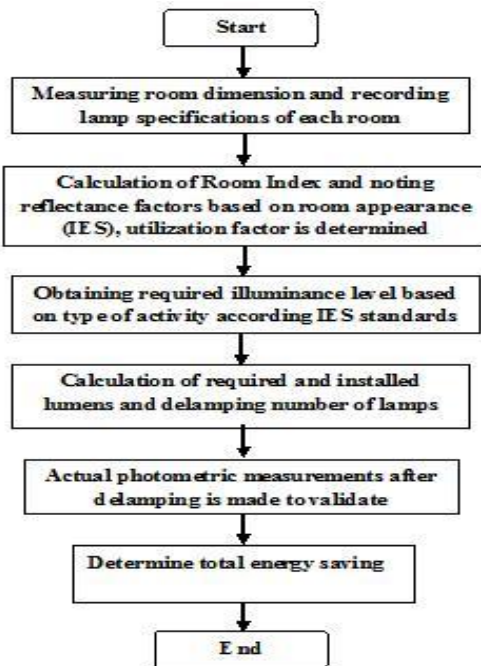


Figure 2 Efficient Illumination Design Steps

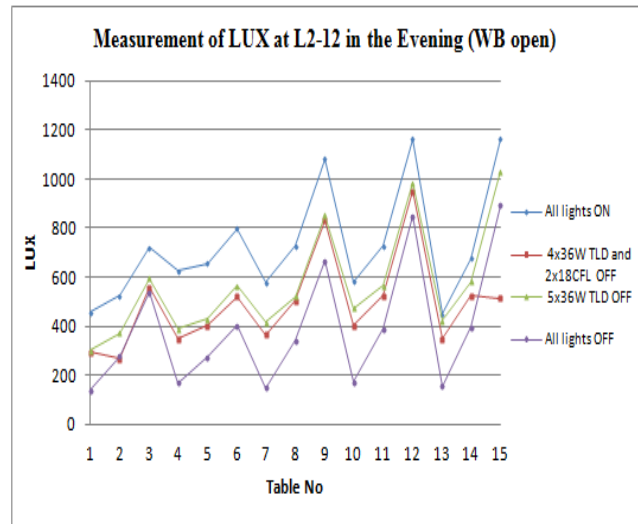


Figure 3 Measurement of LUX at a Classroom

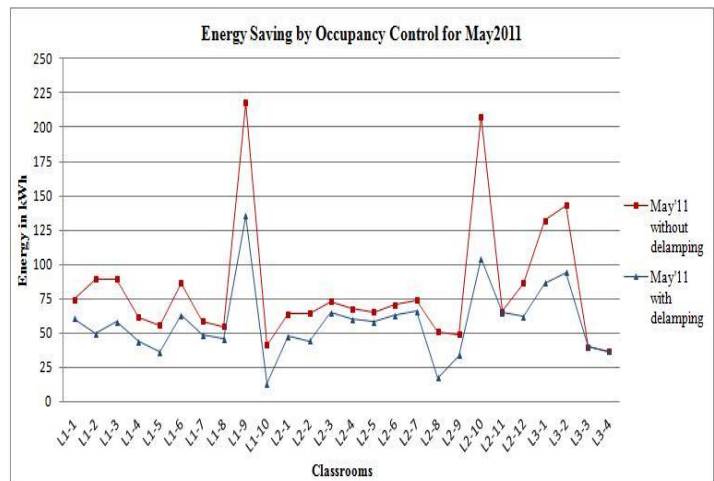
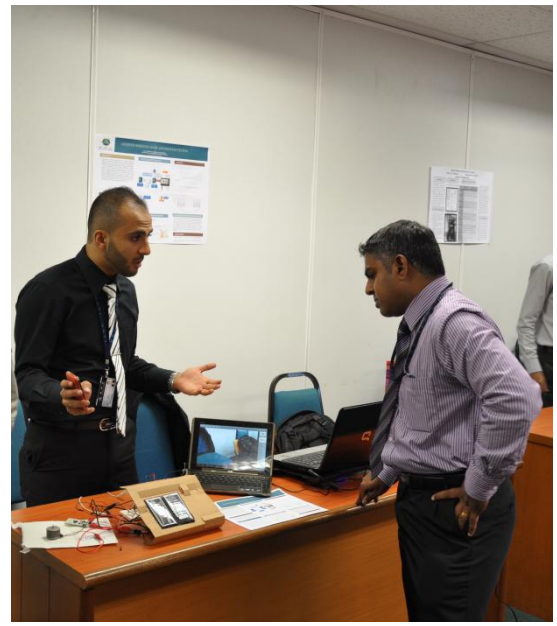


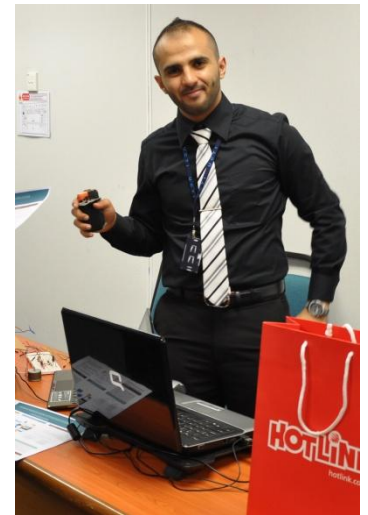
Figure 4 Energy saving by Occupancy Control

The load and energy audit investigations resulted in total connected load 981kW, maximum demand 735.3kW, and average energy consumption 183,017kWh monthly and 2,196,200kWh annually. The energy saving through efficient illumination design is achieved by switching OFF 395 lamps due to excess of illuminance than the required as per IES standards. It resulted in a total power saving of 16.59kW per day and 11 hours taken as the normal operation hours (7:30am to 6.30pm) an energy saving of 182.9 kWh has been achieved. Average annual energy saving of 50,000kWh has been achieved excluding weekends and public holidays (around 255 days), which contributes to 2.28% of the total energy consumption. Energy saving through occupancy control is achieved. An approximate average of 2,200kWh without de-lamping and 1460kWh with de-lamping of energy can be saved in a month, by switching OFF the lamps when they are not occupied. An overall energy of 17,520kWh is saved annually by this method incorporating de-lamping of lamps due to excess illuminance levels and with proper occupancy control measures which contributes to 0.8% of the total energy consumption. A total of 67520kWh is saved by the above two methods which contributes to 3.08% of the total energy consumption.

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