A·P·U
ASIA PACIFIC UNIVERSITY
OF TECHNOLOGY & INNOVATION
SCHOOL OF ENGINEERING

ENGINEERS INSIGHT

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Contents

'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

ENGINEERING TOYS

Figure 1: Heavenly Toys
(*Image from www.inhabitots.com*)

Figure 2: Teenager's Play Tool
(*Image from www.gifts.com*)

Toys are a kids' best friend. They serve children of all ages. Toys can function in two ways, either as an educating device or as an entertaining item. In either function, it is basically a thing or an item that can keep a child happy or simply just occupied. Kids love toys and people love buying toys for them. They normally say you can't buy happiness but you surely can put a smile on a kid with a toy. In order to meet these simple objectives of being happy or occupied, toys have to be interesting, eye catching or even challenging at times to suit age groups. Engineering is the basic substance to achieve these objectives notable with key ingredients such as creativity and innovation.

Most toys today have mobility functions, meaning that they can move, react or even make sounds. Basic engineering is required to stimulate these functions. The entire process of building a toy allows an engineer to actually experience the complete life cycle of a substantial and creative project in not only design engineering but also computer science. Most toys nowadays are not static and are built to be intelligent.

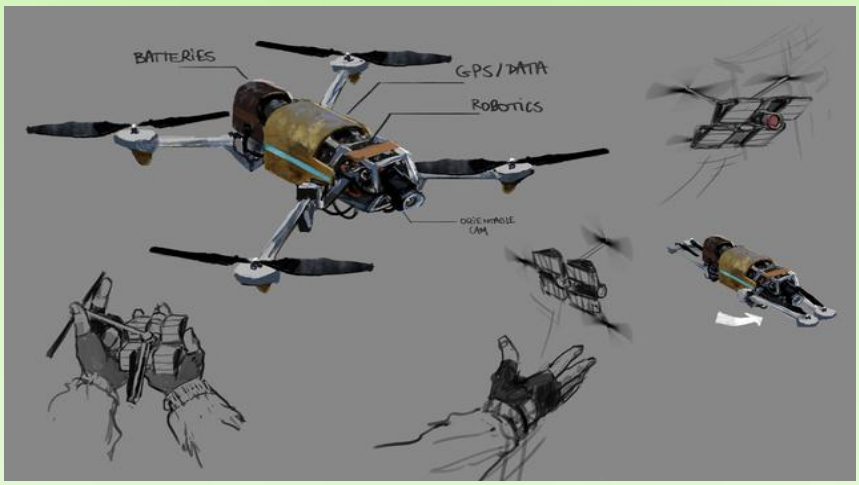


Figure 3 - Mechatronics that Allow for Flying (*http://kotaku.com/5889689/it-wouldnt-be-ghost-recon-future-soldier-without-these-high+tech-toys/*)

Engineers create digital logic circuits and program a microprocessor on a field-programmable gate array. Toys use a variety of I/O devices, such as a speaker, microphone, keyboard, mouse, LCD and VGA displays, secure digital card, serial port, and FFT co-processor. The entire design to assembly process will encompass areas of engineering such as number representation, digital circuits, assembly-language programming, computer architecture, I/O devices, digital audio, technical communication, teamwork, environmental, robotics, strength of materials and ethical implications of computing systems.

A lot of the engineering applications are learnt while at engineering school. In many parts within the manufacturing process these applications are used with great emphasis on product output. Some of these basic engineering education utilized are such as in the areas of:

• Technical problem solving and the creative engineering design process – solving and creating a requirement for kids, evolution of toys – smarter, faster or bigger.
• Preparation of written technical reports and oral presentations to communicate your great ideas to a broad audience – proposing or presenting new ideas to company heads, possible large clients such as McDonalds or Hamleys.
• Teamwork and team management – design brainstorming sessions.
• The influence of the engineer on society – products that can both educate and entertain.
• Professional responsibility – safe playing and working conditions.
• Sustainable engineering – plastics are heavily used but the strength against correct layering is vital and application of green materials.

Figure 4: Interactive Steel with Turbo Sword (*Photo Courtesy of Viman's Toy Chest*)

Figure 5: Mini Transforming Action Figures (*Photo Courtesy of Viman's Toy Chest*)

Develop a list of the world's leading toy makers, and names like Mattel, Hasbro and JAKKS Pacific will head it. Creata, the biggest toy maker you've never heard of, to your surprise will also be up there. Creata rather than build on numbers has been building on key client product satisfaction. As a supplier of promotional toys for McDonald's, Kellogg's and other large companies, Creata designs about 1,500 distinct products annually. It then manufactures and distributes those products for an annual production volume of more than 1 billion units per year. Even though the toys are free as they are fitted into a cereal box or with a value meal, they still have to be eye capturing hence the designs have to be unique.

Toys nowadays are produced with advanced molding techniques such as in-mold decoration and molded in optics. It has toys featuring actuators made from shape-memory alloys. Many engineers at toy companies are looking at minimizing cost and have moved into the usage of sustainable materials. This is indirectly in parallel leading to the development of new technologies as well. Some involve electronics, including low cost LCDs and printed circuitry for toys. Today's toys are also designed for very specific age groups, each heavily regulated by many safety guidelines. Engineers have also helped develop low cost thermoplastic formulations capable of replacing PVC which has tough to duplicate cost and tactile advantages, but has also come under environmental pressure of late. Another area is in the product finishing. Engineers have developed water based paint that quickly air dries but still reduces VOC emissions by more than 90 percent.

The outlook of the toy is as important to its function capabilities. Younger children are more attached to a cute figure rather than a version that is poorly manufactured. Hence the manufacturing process is vital in terms of quality control and assurance. Toy manufacturers emphasize on this based also on feedback received from parents and vendors. The assurances will also cover safety requirement checks which are high on the compliances for toy production. These plants must adhere to radical changes in which manufacturing paradigm changes are required in line with toy making technologies. Often new technologies are introduced that significantly change the labor percentage per unit produced and the equipment percentage per unit produced.

Figure 6: Toy Manufacturing Plants (*http://ideafart.com/blog/do-we-like-outsourcing-maybe-we-should/)*

Product quality and safety have their roots in the design process. Prior to production, the toy company's engineers scour 3D models for features that may cause manufacturing difficulties. More importantly, they screen designs for a range of safety issues. For example, they run the 3D models through a computerized choking model, a digital representation of a child's throat. They also look for strangulation and suffocation, as well as part features that could pinch, cut or poke a child.

I used to think that a career in aviation would be a great way to make a living, with each day presenting a new creative challenge with various aircrafts, different destinations worldwide, beautiful stewardesses and the proud feeling that comes with the uniform especially the Captain's Hat. That was before I discovered just how much fun toy designers were having developing toys and games. Talk about a job that brings out the child in you. Engineering tomorrow's toys can be a true excitement if you love to invent and construct gadgets for kids.

In summary, it'll take some effort if you want to make a living playing with toys, but for those with a child like creative minds, the rewards are far more than salary and benefits.

Figure 7: Disney Character – A Child's Heroes
(*http://ps3.mmgn.com/Articles/disney-infinity-preview-all-the-toys-in*)

By Assoc Prof Ir Dr Vinesh Thiruchelvam

Electric Car - a Green Approach towards Sustainable Automobile

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 or Hydrogen cars.
The electrical cars are becoming more common and commercially available nowadays as these cars are quieter, cleaner and cheaper to run than gas-powered cars. These cars have zero emission as it's fully driven by electric motor and powered by battery.
The first electric car was designed and manufactured by General Motors in 1996 which was commercially available in California, USA. This car was known as EV 1. However 10 years later in 2006 this car were destroyed by General Motors. To know more about why EV 1 was destroyed, watch the documentary on "who killed the electric car".
In 2013, another electric car was introduced, the Tesla model S which was voted as one of the best electric car as shown in Figure 2. 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 480KM at 80 kph and this car has a top speed of 200 kph. Moreover the charging time has been reduced to 30 mins to fully charge the batteries of the electric cars. There are other commercially available electric cars such as Nissan leaf, Volvo C30 Electric, Ford Focus Electric, BMW ActiveE, Renault Fluence Z.E, Renault Zoe, Honda Fit EV, Chevrolet Spark EV, Fiat 500e and many others.

Figure 1: EV 1 by General Motor (www.whokilledtheelectriccar.com)

Figure 2: Tesla model S (www.teslamotors.com)

Generally, the electric car has 3 main components which is the electric motor, the motor's controller and the batteries as shown in Figure 3. The controller functions by taking power from the batteries and delivers it to the motor. The accelerator pedal hooks to a pair of potentiometers (variable resistors), and these potentiometers provide the signal to the controller on how much power it is supposed to deliver.

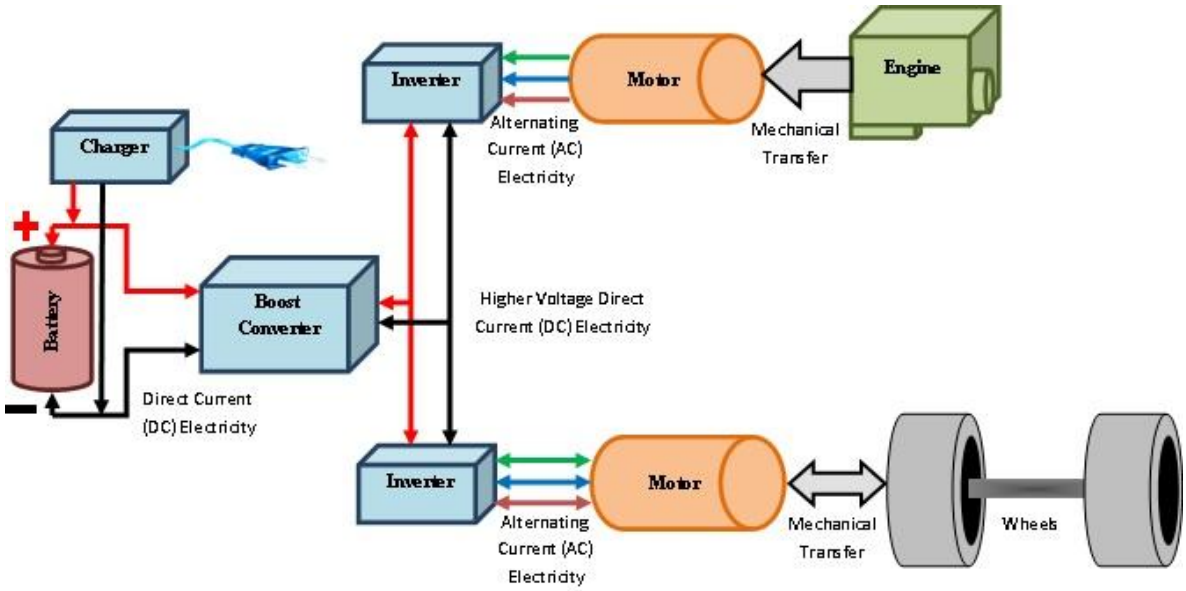


Figure 3: An Electrical Car System (www.electricdrive.org)

In an electric car, the controller takes in volts (DC) from the battery pack and then converts it into maximum volts (AC), three-phase, to send to the motor. This is done by using very large transistors that rapidly turn the batteries voltage on and off to create a sine wave. (www.ford.com/technology/electric) .

When you push on the gas pedal, a cable from the pedal connects to the two potentiometers; the potentiometers hook to the gas pedal and send a signal to the controller. The signal from the potentiometers tells the controller how much power to deliver to the electric car's motor; which controls the car's wheels.

The battery powers an electric motor that actually turns the driven wheels of the car. There's a differential with a reduction gear, but no transmission, since electric motors can run at a far wider range of speeds than a gasoline engine can. That means no transmission is required to match the engine's speed of peak output to the road speed--which makes electric cars much simpler to engineer.

Moreover the modern electric cars have a lithium-ion battery pack composed of smaller cells that are grouped into what are called modules. Most electric cars use large-format cells, between 100 and 200 modules. However Tesla electric cars from the Silicon Valley start-up take a different approach. They use thousands of much smaller cells, very similar to those in your laptop. Example; your laptop may use 6 or 9 such cells, while a Tesla uses 5,000 or more.

The battery pack is usually mounted low down in the car, to keep its substantial weight close to the ground. In some cars like Nissan Leaf and Tesla Model S, the batteries are actually thin and flat, and mounted underneath the passenger compartment.

The electric motor not only powers the car but also converts into a generator to recharge the battery as the car glides or the driver puts on the brakes. Electric cars are far more efficient than gasoline cars, even hybrids, and this so-called regenerative braking can recapture up to one-third of the energy expended to put the car into motion in the first place.

Beside the battery pack and the electric motor, there's a third set of electrical devices, collectively known as the power electronics. These are heavy-duty circuits and other components that change the voltage of the electricity used by different components, and also convert it from Alternating Current (AC) to Direct Current (DC) and vice versa. These include an on board charger that takes wall current from the charging plug and converts it to the right kind of electricity to recharge the battery pack.

Those three sets of components make up pretty much the entire powertrain of an electric car. There are usually one or more radiators that shed heat from liquid coolant that circulates through the battery, motor, and power electronics to keep them all operating at their best temperature which will considerably lengthen their life.
The comparison between Electric Vehicle with other powertrain type is shown in Figure 4.

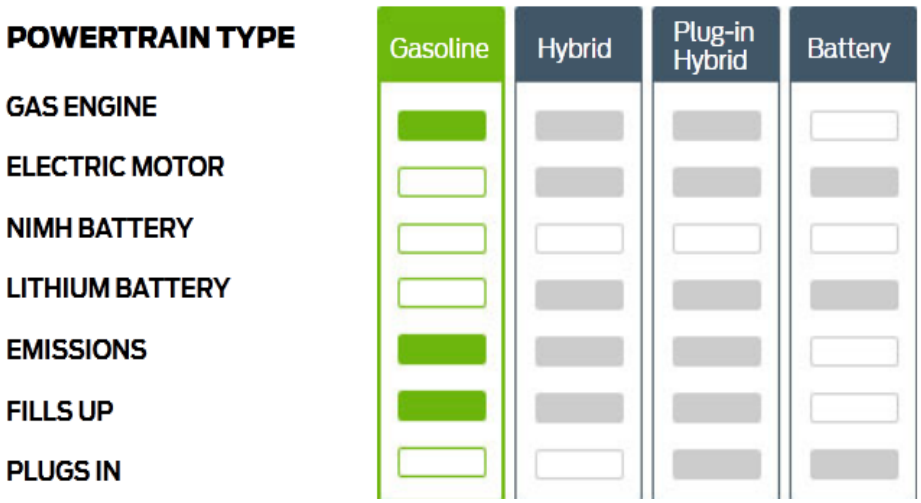


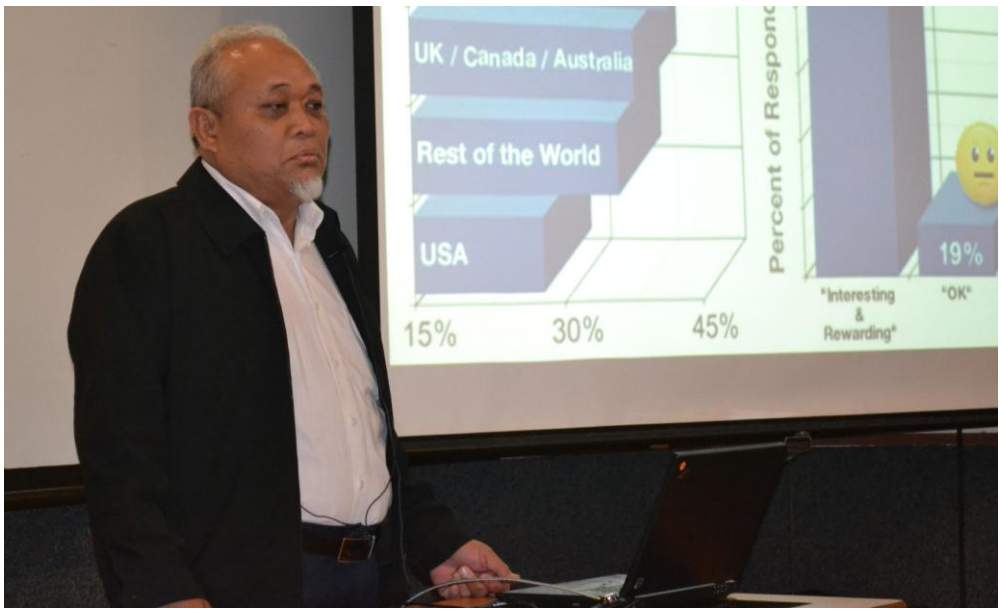
Figure 4: Comparison Chart for Electric Vehicle (www.ford.com/technology/electric)

However, 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.

- By Ms Vickneswari A/P Durairajah

Seminars & Workshops

Engineer – The Way Forward



On October 30, 2013 an inspiring talk on "Engineers - The way forward" was delivered by Prof. Ir. Dr. Hj. Kamsani Abdul Majid, Managing Director/Executive Chairman, Unipower Intelligent Sdn. Bhd. The talk was about good and bad engineering approaches and ethics of a good engineer. The seminar highlighted the responsibility of an engineer to uphold the prestige of the profession and to maintain a professional ethics rooted in ability, temperance, modesty, honesty, and justice. The seminar also highlighted the need for the engineers to be in compliance with the standards of worker protection as provided by the law and the need for the engineer to ensure the continuous improvement of his knowledge, particularly of his profession, disseminate his knowledge, share his experience, provide opportunities for education and training of workers, provide recognition, moral and material support to the society he belongs, thus returning the benefits and opportunities he has received. The statistics of the engineering projects and requirement for professional engineers projected by the presenter was an eye opener for the student attendees. 50 students and 5 staff attended the talk.

Seminars & Workshops

IEEE Robotics & Automation Society

On November 21, 2013 IEEE Membership and Motivational talk by IEEE RAS was organised and well received by 110 students and 15 staff. The main objective of this seminar talk is to address the students the importance of being IEEE member and to become integral part of world wide professional engineers society.

The motivational talk was also followed by the technical talks on “Advances in Robotic Assistive Technologies and Its Role in Rehabilitation” by Assoc. Prof. Dr. Irraivan Elamvazuthi and “Intelligent Strategies for Engineering Alternative Energy Systems” by Mr. Timothy Ganesan.

Seminars & Workshops

Go Green In the City – Schneider Electric

Go Green in the City

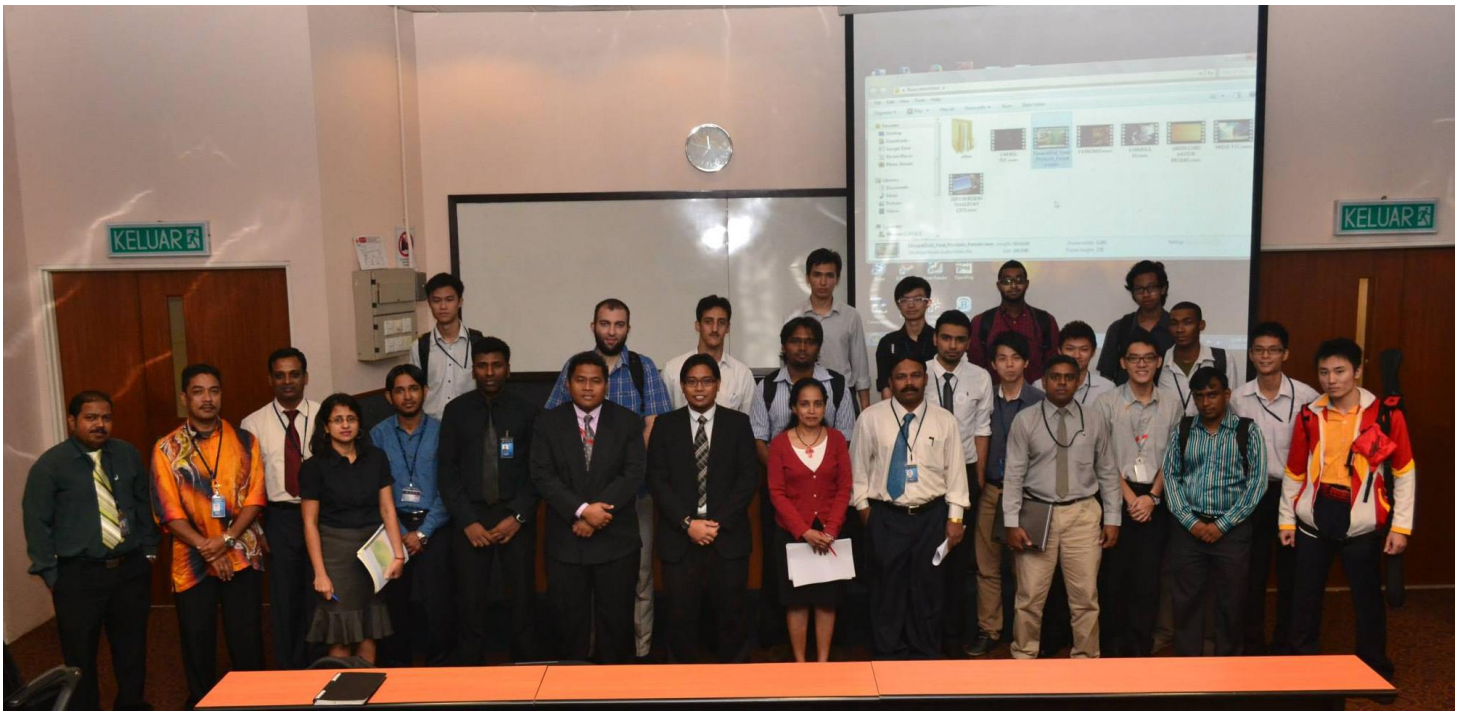
Paris, June 2014

Energy has become scarce, expensive and is undergoing a technology revolution. Increasing needs for electrical power must be balanced with social progress and environmental protection. As a global specialist in energy management, Schneider Electric makes the most of energy innovation opportunities. The university students in East Asia countries (Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand and Vietnam) will have the opportunity to challenge in the Fourth Go Green in the City - East Asia competition and the global competition final will be held at Paris. Schneider presented an introduction talk about the competition on November 28, 2013. 60 students and 10 academic staff attended the session.

Seminars & Workshops

Design Flow Process in Engineering

On December 12, 2013 a technical talk on design flow process in engineering was conducted by the 3D CAD software specialists from DreamEDGE. The talk involved teaching the engineering students on how to plan and proceed engineering projects involving 3D and 2D drawing, project management and digital analysis. Besides, the speaker went on explaining how digital engineering can support engineering sector which can bring enormous benefits to all engineering fields. He also enlightened the audience on how cost and time can be reduced using the correct method of managing an engineering project . The participants comprised of 40 students and 10 staff of SoE.



Seminars & Workshops

Four-Day Workshop on CNC Machine

Two seasons of four-day workshop on CNC Machining was conducted by Mr. Rasdi Bin Razalie on December 9-12 & 16 – 19, 2013. The four-day workshop covered the simulation of milling and turing, safety precautions while operating the CNC machines, hands-on experience in machine operation, set up tools, work-piece clamp, zero off set, design programme from the PC to the machine and machining of PVC material. 11 students attended the workshop.

Industrial Visits

MIMOS National R & D Center in ICT

MIMOS is a leader in ICT innovations, pioneering new market creations for partners through patentable technologies for economic growth. It has over 600 researchers, scientists and engineers who work on world-class design. On 8 October 2013, 30 students from APU, led by 2 engineering staff visited the Wafer Fabrication Facility, Failure Analysis Lab and Reliability Lab in MIMOS. The MIMOS business development and commercialisation manager, Ms Amy Letchumy welcomed us and accompanied us throughout the lab tour. In the Wafer Fab and Reliablity Lab, students were exposed to the silicon ingots, wafer fabrication process, lithography machines and failure anaysis machines, In the Reliability Lab, students learned how some internationally-compliant hardware were being tested in climatic chamber, thermal shock, blowing rain and so on. It was indeed a good exposure to the students in the field of electrical, electronics and mechatronics.

Industrial Visits

MCMC MMU MESCORP Conference 2013

The MESCORP Conference was mainly organized by Multimedia University (MMU) in order to share the knowledge of how NFC, RFID, WSN and LTE can impact our lives. Besides, there are several exhibitions such as 3D printing, Arduino, smart homes, mobile app adverts, public bus booking applications and others.

The MESCORP Conference was held on 12th November 2013 in Multimedia University (MMU) Campus. 9 students accompanied by a staff attended the conference. Our mechatronics engineering student, Moussa Mbarouk Shaaban won the Amazing Race quiz competition held as a part of the conference.

Industrial Visits

Top Glove Corporation Berhad

On 20th November 2013, IEM-APU Student Section organized an industrial visit to Top Glove Corporation Bhd. 28 students accompanied by 3 staff of SoE visited the factory. Top Glove is the world's largest rubber glove manufacturer having many years of experience and expertise in rubber glove production. Top Glove has very substantial growth and does not just become such a successful rubber glove manufacturer without effort paid. They started the business in 1991 with only 100 workers handling only 3 production lines. Currently, they are having 11,000 workers handling more than 500 production lines that are scattered in 185 countries around the world.

They produce many types of rubber gloves according to the market demands. As a large company, they offered APU students to have a chance to be exposed to the manufacturing process flow on how to fabricate a rubber glove in a proper manner with good durability and quality guaranteed. A plant tour was given by the senior engineers of Top Glove Company in their production line at Factory 9, which is the ancient factory base where the production first started. Nowadays, rubber glove's primary purpose is protection of the hands while performing tasks involving chemicals. Rubber gloves are worn during dishwashing to protect the hands from detergent and allow the use of warm water. Sometimes caregivers will use rubber gloves during the diaper changing process to prevent contact with the child's fecal material or urine. Health professionals use medical type of rubber gloves to perform proper surgical operations with good hygiene taken care of. Top Glove Corporation Bhd has proved us the way to accomplish the significance of having good quality rubber gloves in order to maintain the excellent outputs of all professions.

Industrial Visits

CERTO Sharing

On 23rd November 2013, IEM-APU Student Section had organized a trip to a research lab at Kajang for a sharing session organized by CERTO about Solar Power System and Power Management. 25 students accompanied by a staff of SoE benefited from the visit. During the presentation, students were all educated about the knowledge and context of Solar Power Systems and its power management by a professor who is preferred to be addressed as Mr. Foo (Row 1, 5th from the right). With more than 35 years of experience in his interest of researching solar power systems, he demonstrated to us the classification of the Solar Power Systems (Off-Grid and On-Grid) which are currently being installed on his personal owned properties. He also explained about harvesting solar energy and how to get revenue by selling these sunlight-harvested energy to the largest Electric Utility Company (TNB) in Malaysia. Apart from just systems demonstration, he also explained some significant electrical safety precautions that most people nowadays are less aware of. He taught us several ways of protection which could be practically applied as to safeguard our families. Additionally, CERTO company's marketing representatives explained the advantages of installing and investing Solar Power System in a house and justified the possible revenue that could be made within an estimated period with some mathematical calculations.

Lastly, they introduced their newly released Solar Powered product that uniquely known as Solar BBQ equipment. People could do cooking, grilling or frying their food under the sunlight which brings less harshness to the environment where the emission of carbons are recognizably zero.

IEM Handover Ceremony

IEM Office Bearers 2013 - 14

The New Office Bearers of IEM –APU Student Section of the academic year 2013 – 2014 was elected by the IEM-APU Student Section and an official hand over ceremony of the office to the bearers was held on November 12, 2013.

SoE Competitions

INOTECH 2013

"InoTech 2013" was an event planned and organized for innovative young engineering students to exhibit their talents on recent technologies in their relevant field of engineering in the Invention & Innovation Exhibition. The purpose of this activity was to equip students with the skills of thinking clearly and constructively, speaking persuasively, listening critically while exploring their ability to solve technical problems creatively and sustainably.

The event was conducted within the university campus on the 8th November 2013 and jointly organized with the Institute of Engineers, Malaysia (IEM). IEM Excomm annually supports a design competition within local universities and for 2013 we were fortunate to have their support for APU's Inotech 2013. IEM's contributions were to make available judges for the Inotech Design Competition, promote the event within the IEM circle of publications/magazines/bulletins and also to endorse APU as a partner is design innovation for the development of Science, Technology, Engineering and Mathematics (STEM) education in Malaysia.

A total of 11 groups participated in the event showcasing very impressive creations which wowed our guest judges into having a very tough time deciding on the winning project. The first prize winner was Brian Mooy Chi Ho for his project 'All Win-power'. In second place, Foong Lik Wei, Tee Hong Ping and Khalid Yousaf for their project 'Solar & Salt Powered Car' and in third place, Syed Abdullah Medni and Bander Hussein Abdulhabeb for their project 'Multipurpose Projector'.

SoE Competitions

EIMA Race 2013

Educational Innovation of Motorsports & Automotive Race (EIMA Race) is a design competition and racing a single-seater vehicle or cart organized by Japan International Institute of Technology and Universiti Teknologi Malaysia, Kuala Lumpur. The participants were drawn from students of higher learning institutions, polytechnics and institutes of skills throughout Malaysia. In this contest, participants are required to follow the specifications set by the organizers. Their vehicle will go through a variety of theoretical and physical testing. Tests are divided into two categories: static test and dynamic test. Some typical examples of static tests to be performed are vehicle inspection and presentation of design kart while dynamic tests are like testing dynamic braking, slalom test, acceleration test and endurance test. On 27 - 29 December 2013, student team of School of Engineering participated in the EIMA race at Litar Maktab Teknik PDRM Bakri, Muar.

SoE Competitions

National Invention Innovation and Design

On December 12, 2013 SoE sent in 2 student teams for the 3rd National Invention, Innovation and Design Compeition (NiiD) held at UiTM, Perak. The theme of the event was 'Envisioning Entrepreneurship Mind'. There were 215 participants from various local/public universities.

The results were as follows for the Higher Education Student Category - Innovation;

Team No.1 – Gold
Project Title – 'Motorized Folding Seat for Special Care'
Academic Mentor – Dr Thang Ka Fei
Students – Lim Zhi Chan, Aigerim Adilbolatkyzy, Alex Teoh, Lim Min Hong

Team No.2 – Bronze
Project Title – 'WiFri-Your Friendly Fridge'
Academic Mentor – Dr Lim Wee Han
Students – Bryan Ooi, Hee Tee Guan, Naji Mohammed, Salah Khaled, Muhammed Ashiq

SoE Collaborations

MIMOS BERHAD

On the 10th of October 2013, the Non-Disclosure Agreement with MIMOS was signed for the purpose of Final Year Projects and Internship Collaborations. A simple chat and signing ceremony was held at MIMOS. APU-SoE was represented by Assoc Prof Ir Dr Vinesh Thiruchelvam, Dr Thang Ka Fei and Tan Gim Heng. MIMOS were represented by En. Abdul Aziz Abdul Kadir (Chief Operating Officer) and Mr. Tan Kong Yew .

MIMOS Berhad is the national R&D centre for ICT and is a leader in innovations. We are lucky to have them as our neighbour and for us to have this collaboration with a high tech facility like MIMOS allows for future participation of our engineering students at their R&D centre. Currently there are 4 projects available for internship purpose. SoE have one student who has completed his internship and who is now embarking on his FYP based on his internship work. The student, Lim Chee Cheow executed his project work during his internship much to the high satisfaction of his industrial supervisor.

Envitech Engineering Sdn Bhd

As of 13th September 2013, the collaboration work with Envitech Engineering on the investigation and proposal for a signal-processing based consultation project kicked off. This is an academic support clubbed with a student's final year project allowing for academic involvement of consultancy mainly by Dr Thang Ka Fei and Mr Shankar Duraikanan with the development of an FYP by student Ong Tun Shean.

Envitech Engineering Sdn. Bhd. (www.envitech-engrg.com) is a specialist company dealing with Safety, Health and Environment consultancy and engineering. They serviec many industries primarily chemical, oil & gas, rubber and manufacturing. One of their major clients in the rubber glove industry is experiencing noise pollution in the manufacturing line due to high-pitch compressed air. Envitech is collaborating with School of Engineering to research and develop an Active Noise Cancellation (ANC) algorithm to solve the problem.

The signing of the MoA between Envitech Engineering and APU-SoE was conducted on 1st Oct 2013 at APU. Envitech was represented by their General Manager, Mr Aaron Ong.

SoE Conferences

2013 IEEE 11th Malaysian International Conference on Communications MICC 2013

Malaysia International Conference on Communications (MICC) is fully sponsored by IEEE Malaysia Communication Society & Vehicular Technology Society Joint Chapter which was incepted in 1993. MICC has since been organized biennially, a few times in collaboration with other major conferences. MICC conferences have been very well attended and supported by researchers from Asia-Pacific region and the world at large. 2013 IEEE 11th Malaysian International Conference on Communications - MICC 2013 was held in Kuala Lumpur on Novemeber 27 – 28, 2013. Dr Read Abdulla from School of Engineering attended the conference and presented his paper on 'Survey of WSN Technology Based Reliable and Efficient Active RFID'

2013 IEEE International Conference on Smart Instrumentation, Measurement and Applications

2013 IEEE International Conference on Smart Instrumentation, Measurement and Applications (IESIMA 2013) was organized by the IEEE Instrumentation and Measurement Society on November 26-27, 2013 at Royal Bintang Hotel, Kuala Lumpur. Mr. Ajmal Shah of School of Engineering attend the Conference and presented his paper on 'Design and Analysis of a Tri-band G-shaped Monopole Antenna for Bandwidth Improvement for Wireless Applications of Measurement Parameters in MIMO Environment'.

Interesting Advancements in Solar Power

Mr. Kudzai Nigel Chitewe – TP026206

Introduction

Electrical energy derived from the conversion of solar energy is one of the many reliable natural forms of energy known to man. For this reason, scientists around the world have made some mind blowing innovations in attaining this solar power.

Three major problems faced in the generation of electricity from solar energy are *efficiency, cost* and *environmental impact.* These are believed to be the main driving forces in the revolution in the solar panel field. Developments in this field are mostly linked to the discovery and recreation of new materials to absorb sunlight more effectively. Use of nanoparticles and anti-dust surfaces have been the highlight of the century and more and more ingenuity is being displayed by today's researchers.

Spray-on Solar Panels (SUNBELIEVABLE)

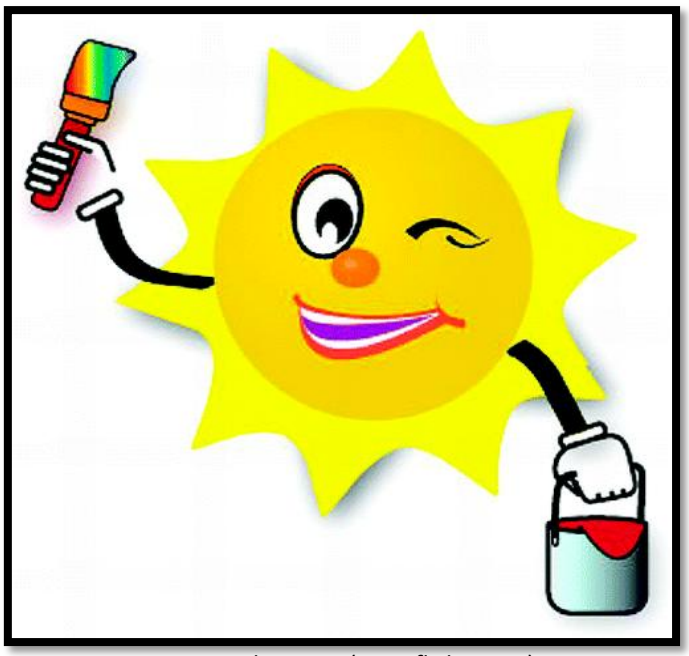


Figure 1 : Solar Paint (staticflickr.com)

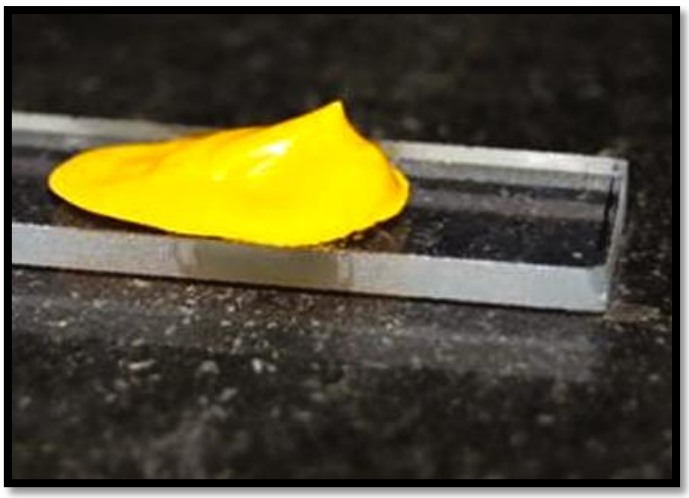


Figure 2: Solar Paint polymer on glass slide (http://www.geek.com, 2011)

This is probably the most widely talked about development in the industry. Spray-on solar cells are also called Sunbelievable. Applied almost as ordinary paint, but with the twist of gaining electricity, solar paint gives a whole new dynamic to solar panel technology. This technology was developed by a group of Notre Dame researchers.

How? This paint was from a binder-free paste of titanium dioxide (TiO_2) nanoparticles heated at 473K to increase its ductility. The paint is brushed on a conductive glass electrode and this is also attached to a counter electrode to create a complete circuit. (*Silverman, J, 2013.)*

How efficient is it? Though still under development it has been noted to have an electricity conversion rate of approximately 1% which is less than the ordinary solar panel of 15-20%. Professor Charles Stafford of the University of Arizona may have found a polymer that might solve this efficiency issue using polymer called polyphenyl.

How Much? Though the solar paint has low levels of efficiency it does have an upside of affordability. The diagram from Newcastle Innovation website further shows the differences between normal solar panels supply per kilowatt-hour (kwh) and Sunbelievable. *(Newcastleinnovationenergy.com.au,2013.)*

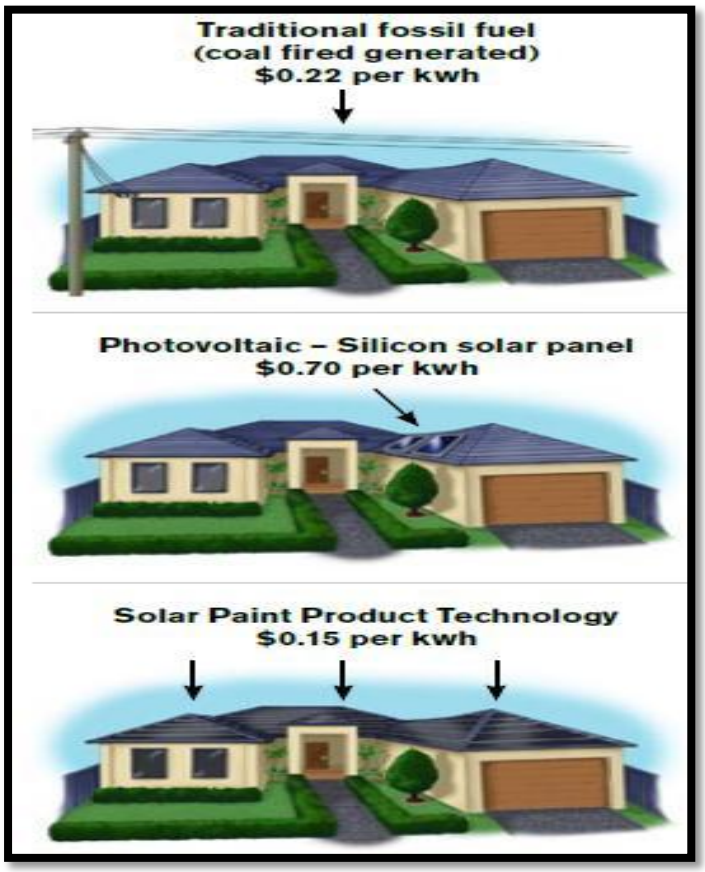


Figure 3: Cost Comparison (newcastleinnovationenergy.com.au)

Perovskites

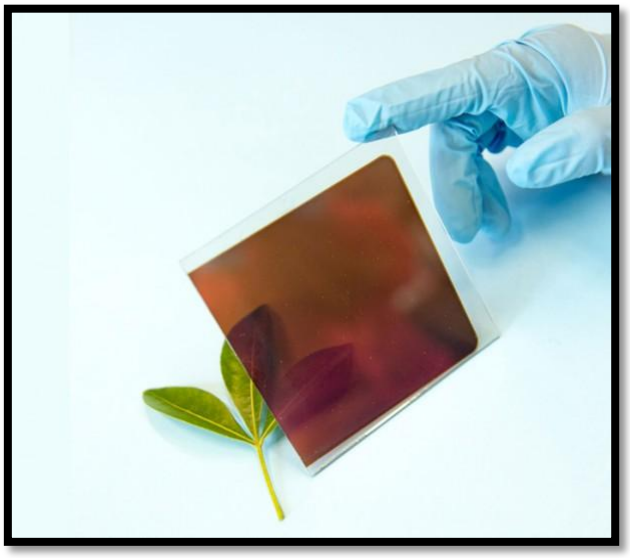


Figure 4: Pervoskite Cell *(Boshu Zhang, Wong Choon Lim Glenn, and Mingzhen Liu)*

The Pervoskite concept came about to address the issue of affordability without trading in the overhaul conversion efficiency. Developed by researchers at the University of Oxford in UK, it has an appearance of a thin solar cell. Pervoskite are basically compounds of calcium titanium oxide ($CaTiO_2$) setup into a mix of cube and diamond shapes.

How? Though they were originally used in the making up of standard solar cells since researchers believed that they did not offer effective conductivity, Henry Snaith of the University of Oxford discovered that the pervoskite was a noticeable semi-conductor and offered efficient electron transfer. These polymers where then reduced to slim film without compromising the general efficiency of it.

Unlike the ordinary photovoltaic cell which has one junction the complexity of this polymer allows it to have a heterojunction. The cell has two charge selective contacts that rely on the heterojunction to generate charges in waves.

How efficient? Pervoskite's are reported to be able to convert a warping range of +15% of the solar energy they attain into electricity and therefore meet the world standard of your basic photovoltaic cells. This is considered a breakthrough since previously they were used in small doses within the modern day photovoltaic cell (ordinary solar panel cell). (*News.sciencemag.org, 2013*).

How Much? The reason it is even being considered is the price and the environmental issues and proud to say the pervoskite's meet both expectations. In mass production pervoskite's will cost the consumer around RM 0.75 kWh (kilowatt-hour).

Self- cleaning solar panel

Self -cleaning solar panels have proved critical in the expedition of foreign planets like Mars which have a huge dust accumulation. Reason for such ingenuity was to maintain the efficiency of the solar panels as dust, grime, pollen and other related particles may reduce the efficiency of a solar panel up to 30%. This brilliant innovation was brought about by Malay K. Mazumder of Boston University.

How? The panel has a transparent electrically sensitive material mounted on top of the solar panel surface. Sensors are then strategically placed in-order to detect dust levels on the surface of the panel, once a maximum threshold of cover is detected on the surface an electrical pulse is transmitted. The electric charge sends a dust-repelling wave that wipes off dust to the edges of the surface thereby maintaining a level of cleanliness on the surface.

Figure 5: Solar Surface (*iStockphoto/Flavio Massari)*

How Efficient? This system has been put under strenuous test and is even used by NASA on their rovers and manned equipment. Within durations of two minutes the system can effectively remove up to 90% of dust on the surface.

These are only few innovations being brought forward towards the evolution of solar energy conversion. According to Malay K. Mazumder "only 0.04% of the world's energy is derived from solar", it is only through such innovations that a growth might be seen in this method of power generation. (*ScienceDaily. 2010*).

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Survey of WSN Technology Based Reliable and Efficient Active RFID

Dr. Raed Abdulla

Introduction

Sensing and communication are the two major functions of the WSN, while energy conservation and routing mechanism are two hot topics. A WSN is composed of a significant number of sensor nodes that can be deployed on the ground, in the air, in vehicles, or inside buildings. A sensor node consists of a sensor to monitor and control physical parameters at different locations, radio transceiver, a microcontroller (MCU), and a power source.

Survey of WSN Technology Based Reliable and Efficient Active RFID

Many different protocols have been defined under the IEEE standards, as shown in Fig. 1 [7]. In this work, four specific standards for WSN-based low-power wireless communication technologies are analyzed for the purpose of building an active RFID system, and one of these is implemented further on.

1. IEEE802.11 / Wi-Fi
2. IEEE802.15.1 / Bluetooth
3. IEEE 802.15.3 / Ultra Wideband (UWB)

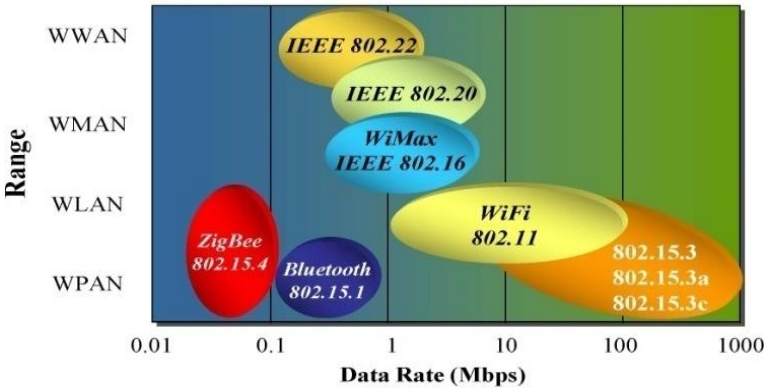

Fig. 1. The 802 wireless spaces a graphical comparison

Wi-Fi

Wi-Fi (IEEE 802.11) is a set of Wireless Local Area Network (WLAN) standards and was developed by the IEEE LAN/MAN Standards Committee. This protocol is usually utilized in PC-based systems because it was developed to extend or substitute for a wired LAN.

Bluetooth

Bluetooth (IEEE 802.15.1) is standard for Wireless Personal Area Network (WPAN). The Bluetooth research was begun in the mid-1990s by Ericsson and uses a master/slave-based MAC protocol, designed to present a user-friendly interface and provide secure and reliable communication.

UWB

UWB (IEEE 802.15.3) has gathered much attention as an indoor short-range and high-speed wireless communication technology [15] UWB has the ability to achieve low power consumption, low-cost implementation and high throughput

ZigBee

ZigBee (IEEE 802.15.4) is a wireless technology that builds upon the Institute of Electrical and Electronics Engineers (IEEE) standard 802.15.4, which defines the physical (PHY) and Medium Access Control (MAC) layers, and works on a low data rate standard.

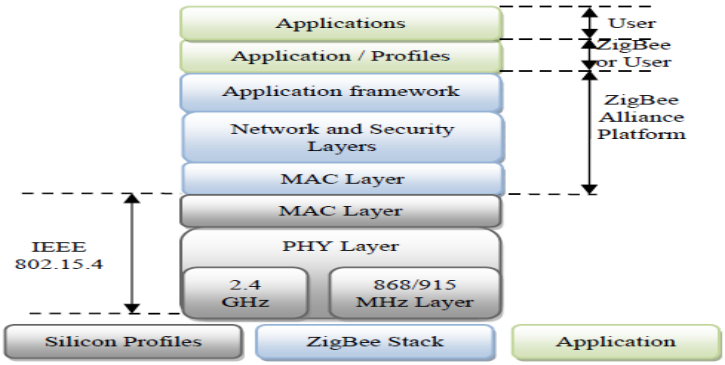

Fig. 2. The ZigBee Standard and IEEE 802.15.4

ZigBee Network Topologies

The ZigBee standard supports four multiple topology network configurations, namely, star, peer-to-peer, mesh and cluster tree topology. All topologies are established by only one coordinator. Fig. 3 illustrates all the ZigBee topologies. Advantages and disadvantages of each kind of topology depend on the individual application or situation.

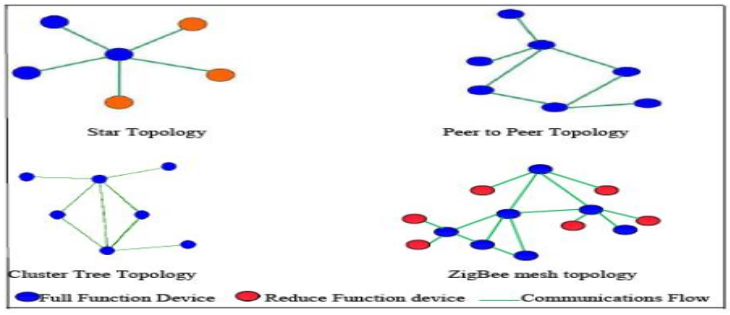

Fig. 3. ZigBee Topologies

Conclusion

Based on a comparison between the available wireless protocols, ZigBee offers trustworthy mesh networking, very long battery life and low overall cost. Furthermore, the benefits of integrating ZigBee technology into an RFID system have been discussed.

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Bandwidth Enhancement of CPW-fed G-shaped Monopole Antenna at 5.85 GHz for WiMAX and other WLAN Applications

Mr Ajmal Hussain Shah & Mr Sathish Kumar Selva Perumal

Introduction

In recent years, there has been incredible development in the wireless communication industry. Researchers from academic institutions and industry have been providing sustainable solutions to the industry. Antenna plays a vital role in communicating information in wireless communication. It is one of the fundamental elements of wireless communication equipments. There has been continual advancement in antenna design and development, and implementation due to high demand from the industry.

Recently diverse approaches to improve the gain and the bandwidth of micro strip patch antenna have been proposed. Various Micro strip patch antennas with Ultra wideband (UWB) characteristics have been proposed as well [1-3]. Here, we propose a modified Co-Planar Waveguide (CPW) feed G-shaped Mono[pole antenna which provides remarkable bandwidth enhancement at 5.85 GHz suitable for WIMAX applications.

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. First the length and width of the rectangular patch antenna is assumed to be the Length L1 and Length L2 which form the three sides of the proposed Capital "G-shaped" antenna. While the fourth side of the rectangular patch antenna is modified with two vertical and one horizontal section to form the proposed Capital "G-shaped" antenna as shown in Fig. 1. Furthermore, the Capital "G-shaped" antenna is Centre fed from the bottom by a CPW feeding line with 50 ohms impedance. The substrate thickness to be 1.6 mm with dielectric constant of 4.3 and tangent factor of 0.025 is selected for the design. The following steps calculate the Length (L1) of the proposed strip. TABLE I shows the various design parameters of the proposed antenna.

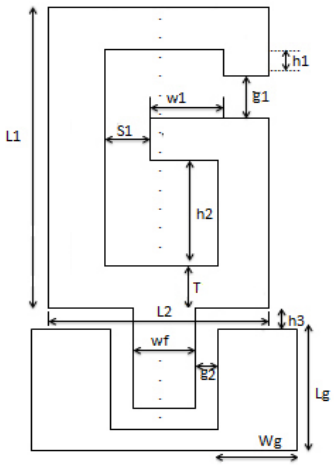

FIG. 1. Geometry of the Proposed G-shaped Antenna

TABLE I
GEOMETRY OF THE VARIOUS DESIGN PARAMETERS OF THE PROPOSED

Parameters	Measurement in mm
h1	1.2
g1	10
w1	10
S1	3.3
h2	10
T	3
h3	4.69
g2	1.35
wf	4.75
wg	5
Lg	10.75
L1	29
L2	20

Experimental Results

The performance of the antenna has been simulated and evaluated by Bandwidth, Directivity, Gain, Radiation Pattern, Return Loss and Voltage Standing Wave Ratio (VSWR). However the main objective is to attain improved bandwidth.

The proposed antenna is designed to resonates at 2.4 GHz as well as at 5.85 GHz, thus making it suitable for dual band. Fig. 2 shows that the antenna operates on wide bandwidth and provides a bandwidth of 3.7129 GHz (3.851 – 7.5639 GHz), which is 63.5 % with respect to the center frequency of 5.85 GHz. This wider bandwidth covers WiMAX applications. Fig. 3 and Fig. 4 show the simulated results of the gain and radiation pattern while Fig. 5 and Fig. 6 show the return loss and the VSWR respectively.

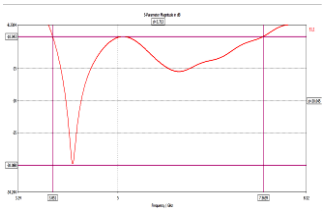

FIG. 2

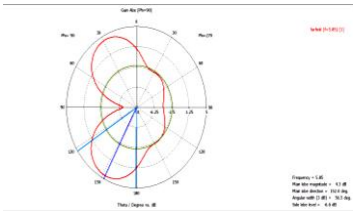

FIG. 3

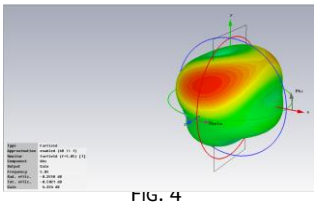

FIG. 4

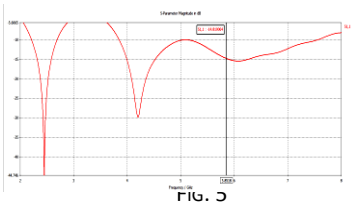

FIG. 5

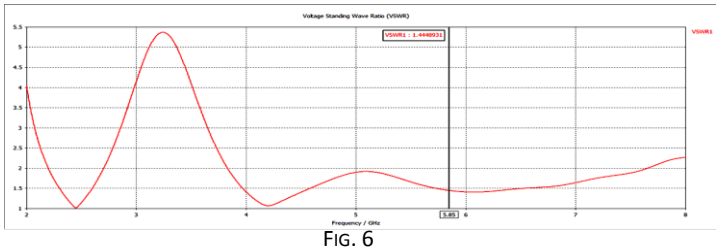

FIG. 6

The performance of the proposed antenna is evaluated at 5.85 GHz. The results are compared with the published results in the literature [3] and are presented in TABLE II.

TABLE II

S.No	Parameters	Proposed Design	Existing Design [1]
1	Centre Frequency	5.85 GHz	5.85 GHz
2	Bandwidth	3.7129 GHz	710 MHz
3	Percentage Bandwidth of Improvement	63.5 %	12.6 %
4	Gain	4.334 dB	-
5	Directivity	4.690 dBi	-
6	Return Loss	-14.81 dB	-
7	VSWR	1.111	-

Conclusion

A modified CPW-fed G-shaped monopole antenna with two modified vertical and horizontal patch sections for WIMAX applications is presented here. The proposed antenna has been simulated and analysed. The results show the significant bandwidth enhancement of 63.5% with 3.7129 GHz as compared to 12.6% with 720 MHz by the existing design. The antenna satisfies the radiating requirements of the WIMAX applications with the gain of 4.334 dB, the directivity of 4.690 dBi, the return loss of -14.81 dB and the VSWR of 1.11.

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All Win-Power

1st prize in Inotech 2013

Brian Mooy Chi Ho TP027840

With the advancement of technology and innovation, future generation homes should provide you with a sense of satisfaction and less worries. Hence, All Win-Power is created to facilitate this requirement.

All Win-Power and Its Applications

The main purpose of All Win-Power is to close the window itself during a rainy day. If the window is left open unintentionally during a rainy day, the rain water may damage the floor and items near to the window. In addition, All Win-Power has the capability of lowering the sunshade automatically when sunlight of high intensity enters the room. This helps to keep the temperature and brightness in the room at a more comfortable level. All Win-Power is powered by a deep-cycle rechargeable battery which is charged using a solar panel. By using renewable energy, a sustainable environment is preserved.

Figure 1: Dean of Faculty of Computing, Engineering and Technology, Mr Peter Hoornaert presented the first prize to Mr Brian Mooy (right).

Figure 2: Prototype

Project Details

The sensing element for rain is basically two sheet of aluminium foils, with a small gap in between them. When ionic liquid contacts the gap, this forms a closed circuit and the current can flow to the motor to shut the window.

For the prototype as shown in Figure 2, a small DC motor was sufficient and was selected to drive the opening and closing of the window. When the window has completed its closing process, a time limitation circuit is triggered to stop the motor.

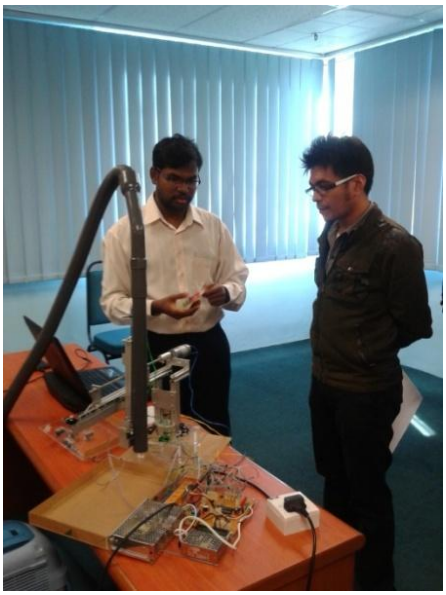
As for the automatic sunshade, the use of a Light Dependent Resistor, LDR was used to sense the high intensity sunlight. The circuit is designed in such a way that, once the sunshade is fully lowered it will stop its operation until the sunlight intensity is low and the sunshade will be levelled back up.

Inotech 2013 Experience

It was an amazing and valuable experience for me, a diploma student in the Electrical and Electronic Engineering to design and complete the project individually. Throughout the Innotech 2013, I have learnt how to innovate, project design and management, problem-solving skills as well as presentation skills. Last but not least, I would like to express my gratitude to all School of Engineering lecturers, especially Dr Lim Wee Han who encouraged and mentored me throughout.

SoE FYP Presentations Jan 2014








SoE Staff Year-End Gathering & Bowling

On December 19, 2013, SoE lecturers had a bowling and year-end gathering session at Bowling Fiesta. The staff enjoyed the bowling session with many even assisting in flushing the drains of bowling alley. Individual and team prizes were awarded. A big thank you to Rasdi for his ingenious idea and creation of the trophies. The night ended with a hearty meal filled with laughter and large bellies. SoE would like to thank Jacqueline and Brian Lim for organizing the event.

HAPPY NEW YEAR

If you would like to be a part of the 'Engineers Insight' editorial team or have an article/paper published please contact: shankar@apu.edu.my