

ENGINEERUS

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**Internet
of
Things**

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Temasek
POLYTECHNIC

CLASSROOM OF THE FUTURE



The Internet of Things (IoT) has revolutionised the way we live, work and play, transcending almost every aspect of our lives – in the home, office, school or vehicle. **ENGINEERRUS** gives its take on the impact of IoT and other smart technologies in the education space.



At the start of a lesson, the lecturer whips out his mobile phone, switches on an app, and snaps a picture of the students seated in front of him. A program translates the faces into names, and the class attendance for the day is then automatically captured in the school server. He repeats the process later, identifying the latecomers who had sneaked into the classroom during the lesson.

The students then put on their VR goggles, watch a 3D animated clip, and wave their hands to select the answers to given questions, with their scores automatically uploaded to the school server.

Nope, this is not a scene taken from the latest sci-fi movie; it's a very likely classroom scenario in the not too distant future.

The technology for such applications already exist, so it is probably only a matter of time before this classroom of the future is seen in every school.

What is IoT?

These high-tech applications leverage on the Internet of Things, or IoT for short, which is defined as the inter-networking of physical devices (also known as “connected devices”) that can collect, exchange and analyse data. These devices can be integrated with other applications or appliances and make “informed decisions” to improve the quality of our lives.

IoT allows devices to be sensed and controlled remotely across existing network infrastructure, thereby creating opportunities for integrating our physical world with computer-based systems. This results in increased efficiency and accuracy, and very probably, less human intervention as well.

It is the last effect – less human intervention – which many people are increasingly concerned about, since it may lead to

loss of jobs as automation takes over human roles. It is also why IoT has been referred to as one of the most powerful “disruptive” technologies of our decade.

Already, IoT is being used all around us – from remotely switching on your home’s air-conditioner before you leave the office, or receiving an automated SMS informing you that your queue number would be called soon, to driverless vehicles and, most recently, a self-piloted flying car to be launched by Airbus.

TP’s Smart Campus

Temasek Polytechnic (TP), for one, has been rolling out IoT in its campus. A new project to install smart lighting has begun (see report on page 14), as part of the polytechnic’s broader “smart campus” initiative to provide a living test-bed for new smart ideas.

In the School of Engineering, students can write on interactive screens and even convert their handwriting into type-font to be saved. Lecturers can also choose to display different content on each screen, and switch the content from one screen to another, so that a different group of students can evaluate their classmates’ answer, and then transmit it back to the original group as feedback.



Looking ahead

Technology, such as IoT, adds a new dimension to teaching and learning, providing more varied and interactive activities that help to stimulate and motivate students, while widening a teacher’s repertoire of classroom activities.

Opinion is still divided, however, on whether technology will ultimately replace a teacher totally. What do you think?



WERE YOU HERE?

Hundreds of secondary school students visited TP's School of Engineering to catch a glimpse of Poly life, as part of the annual "TP Sneak Preview" event held from 18 – 20 Oct '16. They checked out the facilities, attended workshops to pick up Engineering-related skill-sets, and had fun learning. Were you one of them?



TP RAWKS 2016



About 600 students from various secondary schools congregated at Temasek Polytechnic (TP) for the annual year-end “Zouk-Out” event, dubbed “TP RAWKS”, held from 21 – 23 Nov '16.

They got a first-hand taste of polytechnic life through workshops, competitions, games and tours, while checking out the unique TP campus – reputed for its idyllic waterfront lifestyle.

The event culminated in a Jam & Hop on the final evening. Entertained by a live band and DJ-spun music, participants let themselves loose on the dance floor, releasing their emo after the stressful ‘O’ level exams, as they look forward to the next chapter of their learning journey.





Solar-powered portable refrigerator offers new hope to villagers in third world countries without ready electricity.

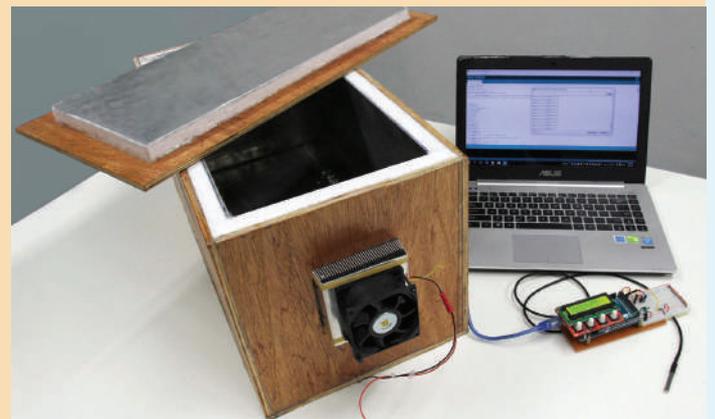
Two students from the Diploma in Clean Energy have designed a solar-powered “Thermo-electric Chiller Box” capable of providing portable refrigeration anywhere under the sun, literally.

Particularly useful in third world countries where electricity is not available, the chiller box enables farmers to store perishable food, thereby helping to enhance their livelihood.

A thermo-electric peltier module provides the cooling while a small blower fan circulates the air within the box. An Arduino microcontroller, linked to a temperature sensor, monitors the temperature inside the box and displays it on an LCD screen. Solar cells provide the power for the entire set-up.

The invention won a Merit award in the annual Energy Innovation Challenge, a competition organised by the

Science Centre Singapore and the Institution of Engineers Singapore (IES), in conjunction with Singapore’s National Engineers Day on 23 Jul ’16.



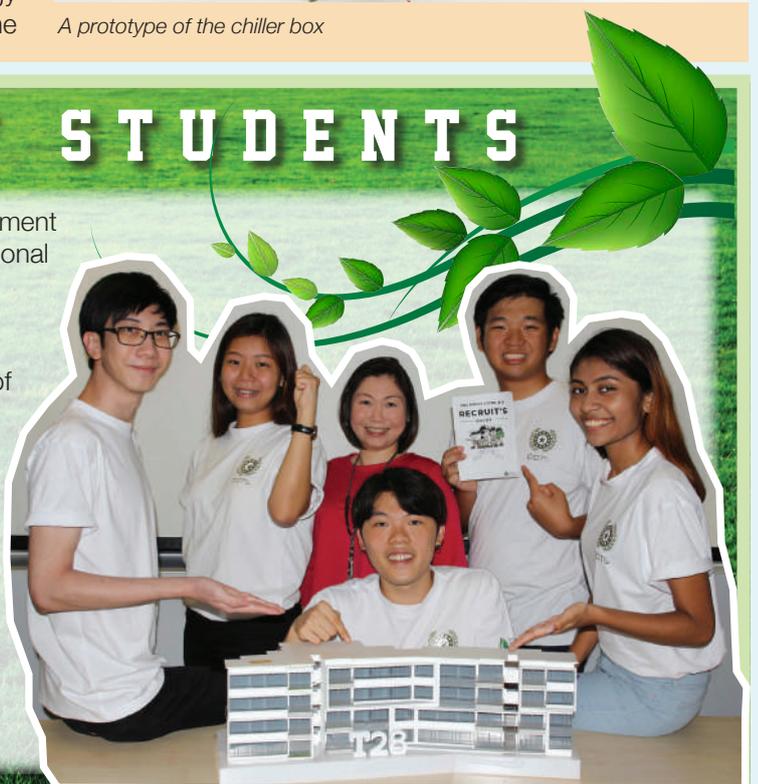
A prototype of the chiller box

GREEN-READY STUDENTS

Students from the Diploma in Integrated Facility Management clinched the Bronze award in the inaugural International Green Building Conference Student competition held on 7 Sep ’16.

Participants were given worksheets with a series of questions to answer and assigned tasks related to energy efficiency, water efficiency, sustainable innovation and indoor environment quality. Thereafter, they had to spearhead a student workshop to train secondary school students on what they had learnt.

Organised by the Building & Construction Authority, the competition aims to raise participants’ awareness about the importance of environmental sustainability in buildings, as well as the various components of the Green Mark Certification for buildings.



Take Me Home, Country Road



You've probably heard of driverless cars and buses. But a driverless motorised wheelchair? Well, now you have!

A team of students from the Diploma in Business Process & Systems Engineering has invented a revolutionary motorised wheelchair that can operate on its own.

While motorised wheelchairs are nothing new, this invention, dubbed the "Smart Mobility Wheelchair" (SMW), can operate autonomously, taking the user to a chosen location along a pre-determined route, safely and quickly.

Especially useful for the elderly suffering from memory-loss conditions, this SMW is equipped with a receiver that detects and reads the RF signals given off by transmitters mounted on public amenities such as lampposts and traffic lights, which act as "checkpoints" along the route.

Additionally, the front of this smart wheelchair is equipped with 6 photo-electric proximity sensors that are able to "lock-on" to a person – for example, a caregiver – walking in front of the wheelchair, and to automatically follow that person.

This invention, a potential game-changer for the "special needs" mobility scene, won the Bronze award in the inaugural LTA Engineering Challenge on 21 Oct '16. It was also exhibited at the Singapore International Transport Congress & Exhibition held from 19 – 21 Oct '16.



DETECTING HOT SPOTS

Students from the Diploma in Aerospace Engineering (AEG) propose more effective satellite system to detect illegal logging and burning of forests, promising clearer skies ahead.

If a technical proposal by a team of AEG students is implemented, governments might be able to detect and deal with forest "hot spots" more easily and quickly.

Based on intense research, the students proposed the use of a satellite system comprising an array of numerous satellites fitted with passive sensors, which could provide views of forested areas from multiple angles and therefore a fuller picture of the situation, as well as more accurate locations of the "hot spots", thereby allowing the authorities to take remedial action promptly.

Their proposal clinched the Merit award in the "Space Systems" category of the annual Singapore Space Challenge held on 24 Sep '16.

Organised by the Singapore Space & Technology Association (SSTA), the competition aims to inspire an interest in space-related studies among tertiary students.



WALKING THEIR WAY TO SUCCESS

Students from the Diploma in Business Process & Systems Engineering (BZE) hatch a business idea to tap into the growing silver market.



Applying what they have learnt from their diploma course, a team of BZE students leveraged on the rapidly expanding market created by a worldwide ageing population, by setting up a company, Auxilium Innovations, to design, mass produce and market mobility aids and rehabilitation devices for the elderly.

The team's flagship product, the Dynamic Agility Device (DAD) Walker, was developed to provide the elderly with a viable alternative to the stable but cumbersome 4-legged walking frame. This patent-pending DAD Walker is a handy walking stick that can be extended into a dual-legged walking frame to provide better support.



The team presented its idea at the Global Start-Up Business Plan competition, and was one of only 3 teams shortlisted. Representing Singapore at the world finals held in Vienna, Austria, on 23 Nov '16, they won a Silver award, beating all but one of the 1,100 teams from 94 countries across the globe which contested.

The competition was organised by the United Nations Industrial Development Organisation (UNIDO).

SHARP SHOOTERS

Two students from the Diploma in Integrated Facility Management (IFM) demonstrate their Building Information Modelling (BIM) skills to win Merit award.

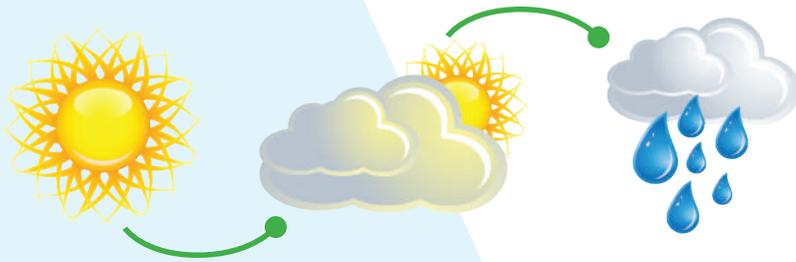
Racing against the clock, two IFM students designed a building model incorporating BIM concepts, and clinched a Merit award in the "Architectural" category of the annual Building Information Modelling (BIM) Shootout competition held on 26 Sep '16.

The BIM Shootout is a speed contest in which participants are required to use Revit software to create building models based on a given sample, within a time limit of 2 hours. Participants are judged not only on speed, but also the completeness and accuracy of the drawing.

The competition is organised by the Building & Construction Authority (BCA) and buildingSMART Singapore.



The team's winning drawing



LIGHTS! ACTION!... WATER!

Mechatronics students design a lamppost which can double-up as a rain harvester to provide third world countries with clean drinking water.

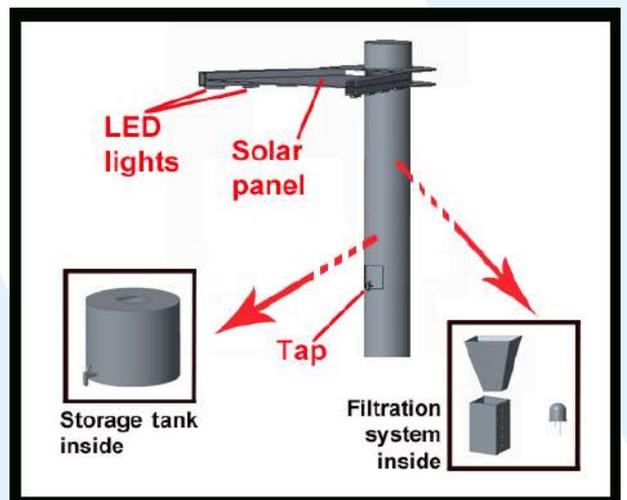
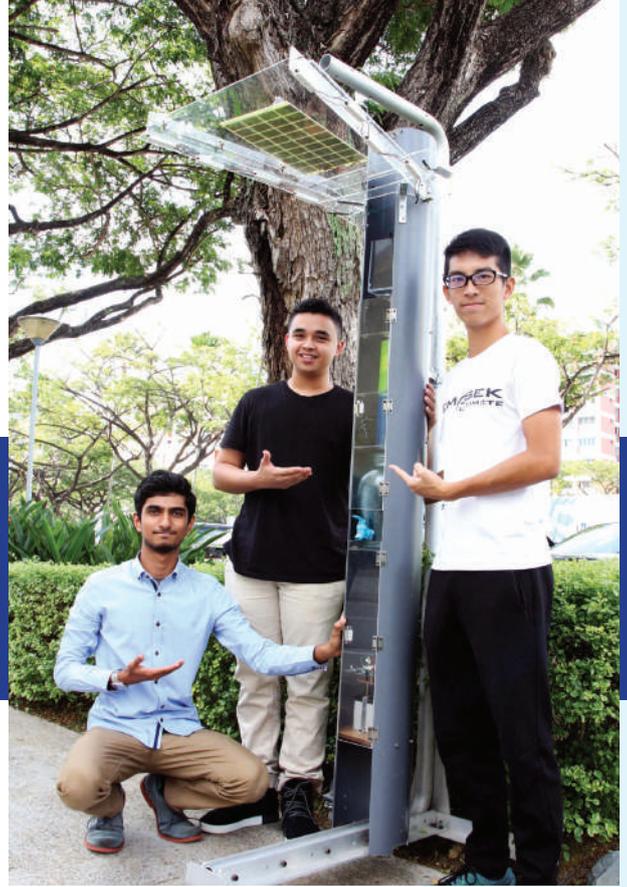
What do light and water have in common?

The answer: they are both supplied by the “Solar Lampurifier” – a lamppost which can collect rain water, filter it, and deliver clean flowing water to those who need it.

When it rains, a moisture sensor activates a barrier which opens up to allow rainwater to enter. The water then passes through a replaceable filtration system inside the lamppost, comprising pebbles, fine sand, activated charcoal, and a 254NM ultraviolet LED used to kill bacteria. The purified water is then stored in a container within the lamppost, and can be dispensed through a tap.

At the same time, a light sensor detects if ambient light is low, and automatically switches on four high-intensity LED lamps. The entire system is powered by a solar panel at the top of the lamppost.

The project won a Gold medal in the “Best Ideas” category of the Youth Citizen Entrepreneurship competition held in Berlin, Germany, on 9 Oct '16.



WORLDSKILLS SINGAPORE

Our students win 2 Bronze awards and a Medallion for Excellence at the biennial WorldSkills Singapore (WSS) competition.

Aerospace Engineering students, Teo Wei Wen and Ong Jian Xun, demonstrated the high level of skills which they have cultivated from their diploma course, by winning a Bronze award and a Medallion for Excellence in the “Aircraft Maintenance” category of the WSS competition held from 7 – 9 Jul '16.

The second Bronze award came from the “Mobile Robotics” team, comprising Seow Sin Kiat (Computer Engineering) and Teo Wei Qing (Biomedical Engineering).

The WSS is a biennial competition at which hundreds of skilled participants convene from around the world to compete in the skills of their various trades and test themselves against demanding international standards.





Silver INNOVATIONS

Elderly-friendly products designed by students from the Diploma in Business Process & Systems Engineering win 3 awards at the annual Cool Ideas for Better HDB Living competition held on 31 Aug '16.



ELDERLY-FRIENDLY MOP & PAIL



Do you dread mopping the floor at home? Now your cleaning chore will be a breeze with this mop and pail set!



The pail is fitted with a stopper at the base, which can be opened with a simple press to allow water to drain out, while the handle of the mop doubles-up as a pipe to channel water from the tap into the pail. These ensure that you do not have to lift the heavy pail at any stage. This mop and pail set costs \$42 – a small price to pay for preventing back injuries and accidents at home!



ELDERLY-SAFE TROLLEY

It looks like a standard shopping trolley... until you try pushing it up or down a slope. The front wheels are equipped with a braking system that detects if the trolley is moving downhill, and slows down its movement automatically. The rear wheels, in addition, are equipped with brakes that prevent the trolley from sliding backwards when it is being pushed up a slope. There's no need to grip or squeeze any lever!



SMART ACTIVE WHEELCHAIR



This space-saving wheelchair allows users with leg injuries or abnormalities to move around using their hands, as compared to a standard office chair which requires users to kick or drag themselves around with their legs. The huge wheels, mounted on an axle, are detachable and can be installed on any standard office chair.



FUN FOR A CAUSE

The school concourse was transformed into a mini street market on 18 Nov '16, when Engineering students played entrepreneurs for a day to raise funds for the Campus Care Network (CCN).

From waffles, hot cakes, bubble tea and ice cream, to flowers, clothing, hello kitty balloons, pokémon hair-bands, henna hand-painting, and even portrait-sketching, staff and students could indulge in immediate retail therapy right at their doorsteps!

In total, \$6,644 was raised at the half-day event, with the money going towards the CCN fund to help needy TP students.



Check out our story in photos!



A RIDE DOWN MEMORY LANE



Lecturers from the Diploma in Green Building & Sustainability (GBS) embarked on a cycling expedition to Coney Island on 26 Sep '16. One of them, Augustine Thong reports.

By Augustine Thong (GBS)

Mention Punggol Road to those who were born in the 70's or earlier, and they would remember that long shady stretch of road fringed by forests on both sides, the smell of dung from the pig farms nearby, and the myriad of restaurants at the end of the road where one could indulge in the freshest seafood and the famous Punggol mee goreng.

But today, Punggol Road has been transformed. To take a ride down memory lane – literally – as well as to recharge ourselves at the end of a hectic semester, we decided to embark on a cycling expedition to Coney Island, via the Punggol Park Connector Network.

From our starting point behind the SAFRA Punggol Clubhouse, we followed the park connector to Pasir Ris Coast Industrial Park 6 (where we had to jostle for road space with oncoming traffic!) before crossing a bridge at Serangoon East Dam into Coney Island. After a brief

sojourn there, we returned to the mainland, where we hugged the coastline, observing how the area has been transformed, en route back to our starting point.

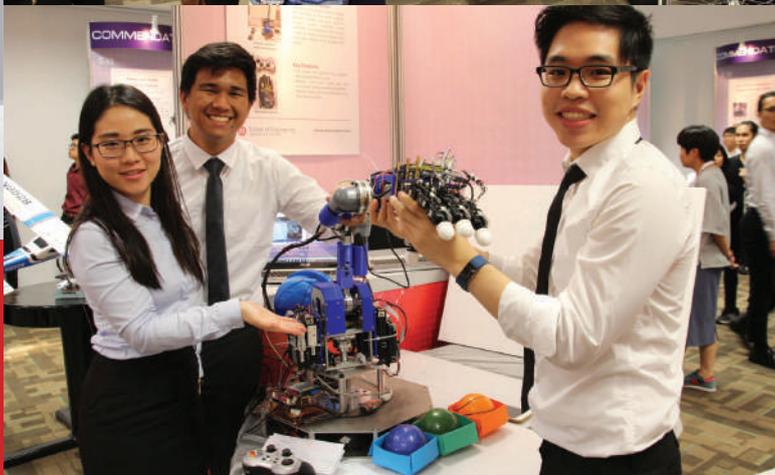
For most of us, completing the 25 km route proved an uphill task, in every sense. But the constant sea breeze, scenic views and camaraderie made the trip extremely pleasant – sore muscles and aching joints notwithstanding.



More than 9,000 visitors attended the School's Open House, held from 5 – 7 Jan '17, to find out more about the courses, programmes and facilities in the School.

Concurrently, 55 projects done by final year Engineering students, covering a wide range of technologies, were showcased at the annual Engineering Project Show.

Hundreds of 'O' level school leavers and their parents also sought professional advice from our course advisors during the Joint Admissions Exercise, from 11 – 16 Jan '17.





FACILITATING REAL LIFE LEARNING

Twenty-two students and 3 staff from the Diploma in Integrated Facility Management (IFM) went on a study trip to Japan from 10 – 16 Oct '16, bringing to life what they have learnt in the classroom. One of them, Wendy Leong, shares her experience.

By Wendy Leong (IFM)



Touching down in Nagoya, Japan, on a chilly morning, we kicked off our itinerary with a visit to the Toyota City Disaster Prevention Training Centre, where we experienced various simulated natural phenomena such as storms and earthquakes, and were taught how to respond to them.

In the Stormy Wind Simulation Area, we were blasted with strong winds and pelted with soft balls to simulate flying debris. We had to cling on to supporting bars to prevent ourselves from getting blown away. It was indeed a hair-raising experience!

The next day, we visited the Nagoya Institute of Technology, where we checked out various earthquake-proof buildings which had been reinforced with V-shaped pillars and eco-friendly buildings with heat-proof panels, as well as attended a 50-minute lecture and interaction session with the Japanese students there.

Visits to other built-up facilities such as the 333m-tall Tokyo Tower and the Solar City Tower also introduced us to the myriad of earthquake-ready infrastructure that Japan has set in place.

It was not all work and no play, though. We found time to take a therapeutic cruise on Lake Ashi, go on a spectacular cable car ride on the Komagatake Ropeway, visit the Imperial Palace, spend a joyful day in Tokyo Disneyland, and do lots of s-h-o-p-p-i-n-g too! Immersing ourselves in Japanese culture, we also attended a tea ceremony where we were taught how to make green tea.

It was indeed a fruitful and enriching trip which made learning come to life for us!



Wendy (arrowed) at the tea ceremony

CLEANING ENERGY



Nine students from the Diploma in Clean Energy helped to clean the homes of elderly residents on 11 Oct '16, as part of a collaboration with St Andrew's Senior Care. Eugene Ow Yong tells us about it.

By Eugene Ow Yong (CER)



Many of us don't even clean our own homes, let alone other people's homes. So it was an eye-opening experience when I volunteered to clean the home of Mdm Siti, a wheelchair-bound lady in her 70s', living alone in a small flat in Beach Road.

We had expected to be greeted by a dirty flat filled with garbage, broken furniture and creepy insects, and our worst fears certainly came true.

Armed with pails, mops, brushes and detergent, we trooped into the battleground in two contingents – one group targeted the kitchen, while another attacked the living room.

We removed thick layers of dust from the window grills, cleared the cobwebs, scrubbed the toilets, scraped off lizards' waste from the walls, fixed a broken fan, replaced blown light bulbs, and removed discarded items.

Seeing my fellow comrades cooperating and getting themselves dirty as they cleaned the place, made me forget about getting myself smelly or sweaty. At the end of the day, I realised that a simple gesture could actually make a great difference in someone else's life.



FIGURE IT OUT...

And win a limited edition 16GB wooden thumb-drive!



A bottle of beer costs \$2. In addition, for every 2 empty beer bottles that you return, you get 1 bottle of beer free. Furthermore, for every 4 beer bottle caps that you return, you get another 1 bottle of beer free. How many bottles of beer in total can you get with \$10?



This contest is open to secondary school and ITE students only.

Email your answers, with full name, school, and HP number, to: cheeseng@tp.edu.sg with the subject title, "Engineerrus Maths Puzzle 13".

The first 10 correct entries drawn after the closing date (1 June 2017) will each win a limited edition 16GB wooden thumb-drive. Winners will be notified by email.

ANSWER TO PUZZLE #12

The table below continues indefinitely in the format shown. What is the middle letter in the 731st row?

ROW 1	G	L	A	D	Y	S	G
ROW 2	L	A	D	Y	S	G	L
ROW 3	A	D	Y	S	G	L	A
ROW 4	D	Y	S	G	L	A	D
ROW 5	Y	S	G	L	A	D	Y
ROW 6	S	G	L	A	D	Y	S
ROW 7	G	L	A	D	Y	S	G
ROW 8	L	A	D	Y	S	G	L
↓							
ROW 731				?			

Answer : L

Winners:

Owen Piong (Maris Stella High), Angel Lim (Chua Chu Kang Sec), Gloria Esther Pham (Bendemeer Sec), Miguel Kyle (West Spring Sec), Lau Hong Yi (Junyuan Sec), Jovial Kok (Sembawang Sec), Nur Azreena Bte Sadik (Changkat Changi Sec), Toh Wei Ming (Beatty Sec), Sophie Wong (CHIJ St Joseph's Convent), Thon Xuan Yi (North Vista Sec).

A Smart INITIATIVE



Smart lighting that doubles-up as sensors to perform a variety of functions, including climate control, ambience setting, and even identifying who you are – will be implemented in the Temasek Polytechnic (TP) campus in 2017.

Two project ideas involving smart lighting have been selected for implementation in the TP campus in 2017, in collaboration with Philips (Singapore). The ideas were selected from 83 submissions by TP students from various diplomas as part of the “Light Beyond Illumination” competition held from Aug – Oct ’16. Both these winning ideas were proposed by students from the Diploma in Integrated Facility Management.



“MINEspace”

This is a facilities-booking mobile app, linked to smart lights installed in the facility. These lights, using Visual Light Communication (VLC) technology, are able to detect whether the user who made the booking has arrived. Hence, such lighting can be used to capture the attendance of students in a classroom automatically, while guests can use it to check-in to an apartment or hotel.

Data on room usage can also be collated and accessed by facility owners to help them in the allocation of physical resources.

“Occupants’ Comfort”

This system makes use of smart lights (called Power Over Ethernet, or PoE) to enhance the visual and thermal comfort in a classroom. Lecturers can adjust the lighting intensity and select the desired lighting ambience using a control panel.

The PoE lights also act as sensors to detect the temperature in various parts of the room, as well as whether there are any occupants, and automatically adjust the air-conditioning to achieve an ideal and consistent temperature throughout the space.

The system can also be used as an educational platform for students to explore how the different parameters (such as light intensity and temperature) affect energy consumption.





Most entrepreneurs dream of making huge profits from their business. But not **Daniel Justin Teo**, who graduated with a Diploma in Business Process & Systems Engineering (BZE) in 2008.

The 29-year-old social entrepreneur is guided by a passion to give old products a new life cycle: "It pains me to see a used item that is still in good condition being discarded, when there's someone out there who needs it," he laments.

Daniel set up Scorsers.com in 2016, a digital platform which links up buyers and sellers so that they can exchange used goods through bartering; no cash is involved. "My aim is to bring communities closer by encouraging them to reuse and recycle old products in a push for a greener earth," he explains.

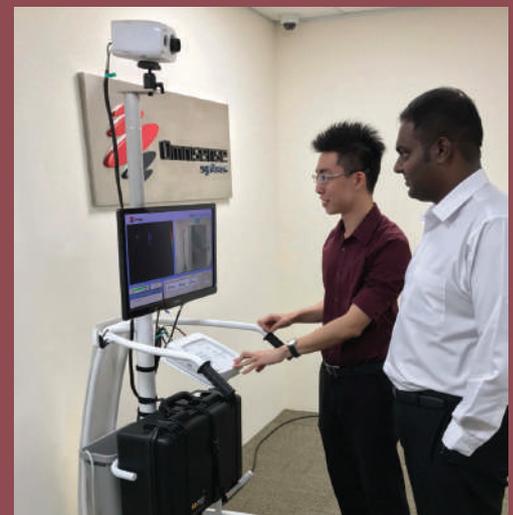
Sellers post their items in one of various categories such as clothing, home appliances, watches, or technology, just to name a few, and buyers offer another used item in exchange. If both parties agree, a transaction is recorded. A mobile app will soon be launched to complement his website.

So passionate is he about the cause, that Daniel has quit his full time job as a Corporate Account Manager at Omnisense Systems Pte Ltd, a company which manufactures and supplies thermal scanners and proprietary software, in order to concentrate on his business.

But can he make a profit from this recycling enterprise? "I would be happy if the revenue from online advertising can cover my operational costs; anything more would be a bonus. My main purpose is to provide

a service for the community, while helping to save the earth," explains the socially responsible youth and former Temasek Sec School student.

Daniel credits his BZE diploma for giving him the fundamental knowledge as well as motivation for his business: "The business modules, as well as topics such as Java and HTML programming, have empowered me in my social enterprise," he assesses.



Checking a fever scanner when he was at Omnisense



Temasek Polytechnic's (TP) Diploma in Integrated Facility Management (IFM) has won the Best FM Training Institution (Innovation Excellence) Award 2016, conferred by the International Facility Management Association (IFMA).

By winning the award, TP has shown that its IFM diploma programme is the best among local polytechnics offering similar facility management courses.

The judging criteria included the industry relevance of the diploma programme, how successful IFM diploma holders have been since graduating from TP and the significance of their contribution to their employers.

The award was presented at the inaugural Singapore FM Awards ceremony held at Marina Bay Sands on 30 Sep '16, in conjunction with the International FM Expo 2016 and International FM Conference 2016.

ENGINEERING DIPLOMA COURSES



- 3D Interactive Media Technology
- Aerospace Electronics
- Aerospace Engineering
- Aviation Management & Services
- Biomedical Engineering
- Business Process & Systems Engineering
- Clean Energy
- Computer Engineering
- Electronics
- Green Building & Sustainability
- Integrated Facility Management
- Mechatronics
- Microelectronics

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