



PROJECTS HIGHLIGHT 2019

A Celebration of Students' & Staff Projects

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REPUBLIC POLYTECHNIC

The first educational institution in Singapore to leverage the Problembased Learning approach for all its diploma programmes, Republic Polytechnic (RP) has seven schools and one academic centre offering 39 full-time diplomas in Applied Science, Engineering, Management and Communication, Hospitality, Infocomm, Sports, Health & Leisure, and Technology for the Arts. RP is committed to nurturing professionals with strong problemsolving capabilities through an innovative and entrepreneurial learning environment, based on a holistic and industry-relevant curriculum. RP's Academy for Continuing Education also offers a comprehensive suite of lifelong learning programmes to provide adult learners with skills upgrading opportunities.

SCHOOL OF INFOCOMM

At School of Infocomm (SOI), we are committed to foster strong partnerships between academia and industry. We focus on ensuring industry relevance of our programmes and aim to augment students' learning experience through active consultations and interaction with the industry frontrunners.

Besides our primary focus on education, our educators are also engaged in research and development (R&D) work that spans the entire infocomm landscape, with grants funded by public and private organisations.

We continuously seek for meaningful and engaging internship opportunities for our students. At the same time, we emplace staff on various industrial attachment opportunities to enable them to keep abreast with industry trends and in turn, our students will benefit from the transfer of industrial knowledge.

ABOUT US

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FOREWORD

Dr Michael Koh Teik Hin

Deputy Principal, Academic Services Republic Polytechnic

Thank you for taking time to read this booklet. Here we feature our students' outstanding Final Year Projects, mentored by a dedicated faculty from the School of Infocomm (SOI). Read about the prototype developed for a Secure Smart Home System (Penetration Testing) by our graduates Johnny, Ryan and Yee Loon, who were the sole representatives from S.E.A and the only polytechnic team to enter the finals of The International Multi-Case Study Competition organised by Kaspersky Lab, held at Czech Republic in 2017.

There is also a feature on an IoT AI "Happy Family" application developed by our graduates Kah Ho, Wenyu and Jiawei. This project, which harnesses Speech, Face and Emotion Cognitive APIs provided by Microsoft Azure, garnered the HealthTech Award at the SCS Splash Awards in 2018. Another feature, as part of a tripartite collaboration for community engagement programmes, a team of graduates worked with LDR Technology and The Istana to create heritage trails, complemented with interactive games that created a better understanding of the heritage and nature of the official residence and office of Singapore's President.

At RP, we strive to challenge students to inspire them to be caring, critical and creative thinkers. Together, our combined expertise and capability could make a realm of possibilities come true as we work to solve real world problems with innovative approaches ranging from developing data analytics insights, designing and proposing an IT network / security architecture for a SME, or creating an augmented reality applications fit for purpose. I invite you, once again, to partner SOI in our journey to build Infocomm leaders of tomorrow.

At the School of Infocomm, one of the platforms where our students get to work on real world problems is through their Final Year Project. They work on projects that are sponsored by industry with their project team mates. Through the process, students are exposed to problems or needs in industry and put their creative ideas, Information and communications technology (ICT) skills and knowledge to good use to create value for the sponsoring companies. The experience of working in such projects not only help students realise the usefulness and value of ICT skills. they become confident polytechnic graduands who are industry and

DIRECTOR'S NOTE

Wong Wai Ling

Director, School of Infocomm Republic Polytechnic

innovation ready. Our Connexus centres with the laboratory facilities equip our staff and students to work on industry projects in the areas of Internet of Things (IoT), cybersecurity, AI and data analytics. Staff members conduct applied research in collaboration with industry partners to exploit new technologies, develop new products and solutions. Some of these are featured in this publication. I would like to thank our industry partners for providing opportunities to collaborate with the school and my fellow colleagues for their efforts in auiding and inspiring our students in their transformative journey in RP.

RP-Samsung Mobile Lab

FACILITIES

We believe the best way to learn is to allow practice and experimentation. Over the years, we have established several well-designed and well-equipped joint laboratories with leading industry players to support our curriculum, research, capabilities development and industry collaborations which are used by both our staff and students.

- RP-IoT Solutions Centre (in partnership with element14)
- RP-Ixia Cyber Defence Lab
- RP-Microsoft Centre for Smart Technology Exploration
- RP-Palo Alto Networks Cyber Security Lab
- RP-RSA-Ensign Cyber Threat Intelligence Centre
- RP-RSA Security Operations Centre
- RP-Samsung Mobile Lab
- RP-Starhub Data Analytics Lab
- RP-Trend Micro Cloud & Visualisation Security Lab

CONEXUS CENTRES

Each Conexus Centre embodies the specific expertise within a defined area. Within the Conexus centre are the reservoirs of knowledge, experience, and expertise that can be drawn upon to bring together cross-functional teams capable of providing solutions to complex problems.

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RP-IOT SOLUTIONS CENTRE

The IoT Solution Centre was setup to promote the innovation and the adoption of IoT technologies to help local enterprises capitalise on this technology to sharpen their competitive edges, deepen collaboration with industry partners, innovate and showcase interoperable solutions and services to create a better life for our future.

RP-IoT Solutions Centre

It has received tremendous positive feedback and support from the industry, with the strong pool of industry partners which championed IoT.

CONEXUS CENTRES

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CONEXUS CENTRES

ARTIFICIAL INTELLIGENCE TECHNOLOGY CENTRE (AITC)

The Centre focuses on growing capabilities, expertise and knowledge in utilising AI technologies to create innovative industry driven solutions. Computer vision, natural language understanding, and data management and analytics are the three key development pillars for this centre. Many of the smart applications are powered by AI that can autonomously take higher accurate decisions based on its experiential learning. The underlying data analytics technology helps businesses to seize

new market opportunities, drive business outcomes and increase revenue growth. The works in the centre include developing AI applications through innovative R&D projects, and providing consultancy services to industries in adopting and accelerating their digitalisation process. These capabilities are driving AI integration into a wide range of applications in information and communication technology (ICT), healthcare, logistics, retails, banking and finance, and other sectors.

WAYS TO COLLABORATE

SPONSORSHIPS

Students should not be deprived of a quality education in RP because of financial challenges. You can make monetary contributions in the forms of scholarships, bursaries and book prizes, to help further motivate outstanding students and fund tuition fees for the underprivileged, allowing them to fully enjoy the whole polytechnic experience.

INTERNSHIP IMMERSION PROGRAMME (IIP)

All students undergo a 20 to 24 weeks attachment to experience the real world challenges associated with working in the industry. You can give them the opportunity to intern at your company, interact with industry professionals like yourself, and help develop their technical skills.

FINAL YEAR PROJECTS (FYP)

This is a capstone project module undertaken by all our final year students. Each project team typically consists of three to four students, guided by an academic staff. These projects provide students with vital and real world working experience, and create opportunities for industry to tap and develop raw talent. You can give our students a chance to put their skills to the test.

INDUSTRY ATTACHMENT SCHEME (IAS)

The scheme aims to encourage teaching staff to stay updated with the rapid technological changes and keeps curriculum current for RP students. You can give our staff a chance to evolve their skill-sets and refine their thinking.



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STUDENT PROJECTS



Penetration Testing on a Secure Smart Home Metering System

SECURITY is one of the major concerns in today's cyber world. To defend against malicious cyberattacks, both intentional and unintentional, countless preventive measures have been devised. Penetration testing is one of such.

In this project, penetration testing methodologies and techniques to counter various network attacks, such as leakage of confidential information and data falsification on secure IoT smart home metering system were conducted. From there, security assessment on the prototype setup along with working exploits and recommendations on ways to strengthen the smart home metering system were derived.

STUDENTS Pan Shi Han Johnny, Yu Yao Ming Ryan, Khoo Yee Loon

SUPERVISOR David Leong



huān yíng lái dào măn măn tông shì jiè 欢迎来到满满通世界

Stop-motion Animation on Orthopaedic Pain

ORTHOPAEDICS is the medical specialty that focuses on injuries and diseases of the body's musculoskeletal system, which includes the bones, joints, ligaments, tendons, muscles, and nerves that allows one to move, work, and be active.

Orthopaedic pain can happen to anyone when carrying out everyday activities such as working on the computer or combing the hair for too long. Stiffness on the shoulders and elbow or wrist pain can occur.

Working with Parkway Hospital Group, particularly Mount Elizabeth Novena Hospital, a stop-motion animated video was produced to create awareness on the different types of orthopaedic pains and their respective preventive measures.

3D Animation for MyChinaChannel

LAUNCHED in 2016, MaxToon (StarHub Ch322) is Singapore's first and only Mandarin kids channel, with top-rated Chinese programmes alongside local productions.

To promote MaxToon as a Chinese Edutainment provider for children

aged 3 to 12 and to proliferate the awareness of the its mascot, Professor Max, a 3D animated music video of the theme song was produced. The video was aired on both local cable television and on YouTube.

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Smartphone Training Video for Kwong Wai Shiu Care Centre

THE Kwong Wai Shiu Care Centre provides health and assisted-living services catered to the elderly as well as wellness activities to keep them active. A huge population of the elderly who visit the centre every day, are not equipped with the knowledge to operate a smartphone and they often questioned about the use of the features in the social media applications. In order to guide the elderly in navigating the smartphone and to expose them to the use of social media such as WhatsApp, Facebook and WeChat, training videos were produced. Through these videos, the elderly will be able to learn the fundamental use of a smartphone as well as social media so that they are able to stay connected with their families and friends.

STUDENTS

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SUPERVISOR

Vincent Ng

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Automation of Hardening and Security Audits on Virtual Machine Hypervisors

THE configurations of virtual machine hypervisors (VMWare ESXi, KVM and Microsoft HyperV) have to be hardened and tested before deploying to the production environment. Conversely, security audit checks have to be carried out to ensure the correct configuration of these platforms. These processes are usually labourious and manual. Multiple errors and inconsistencies

may be introduced in the process too.

Through automation of the hardening and checking processes, human error is reduced and proper security configurations of these hypervisor platforms can be ensured. This in turn give rise to the productivity and security levels for cloud computing environments.

STUDENTS

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Healthy Dietary on Every Dining Table Mobile App

THE Singapore government has recently identified numerous health problems associated with unhealthy diets. Such health problems are expected to create detrimental medical, social, and economic challenges to our nation, if remain ignored. Working alongside Gooloo, this mobile app aims to tackle the mentioned health problems by inducing dietary awareness, transforming dietary behaviours, and sustaining healthy consumption habits. The ultimate implementation is expected to serve as a key contribution to improving dietaryrelated issues in Singapore.

Healthy Dietary on Every Dining Table Admin System

FOOD delivery applications, operate food delivery with one order from one vendor to one customer. This can prove to be a hassle since the delivery staff would end up making multiple trips to the same area they may have just been, and the food condition might drop due to the trip time needed to reach the customer's location. Gooloo's system unlike other companies that operate food delivery, adopts multi-orders from multi-vendors to multi-customers. This makes their logistic movements more cost effective. However, the operation is limited within a geographical boundary so as to ensure all orders are delivered timely, with the food in its optimal condition and temperature for consumption.

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STUDENT PROJECTS

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Development of 3D Assets for The Istana

AS part of the tripartite collaboration for community engagement programmes, RP students worked with LDR Technology and the Istana to design interactive mobile trails hosted on LocoMole, a mobile application, for locals and tourists to discover and explore Singapore. The project aims to give visitors of the Istana a better understanding of the heritage and nature of the official residence and office of the President of Singapore. The 3D assets, showcased via Augmented Reality (AR) from the mobile app, creates an interactive and engaging experience for users on the Istana ground.

Games Development for The Istana

WORKINGalongsideLDRTechnologyandtheIstana,RPstudentsdevelopedfivegamestocomplementtheIstanaHeritageMobileTrail,whicharehostedonLocoMole, a self-guidedwalkingtourapp.

These games, which are designed to the theme of the Istana, are suitable to be played by users of all age groups. They are integrated into the LocoMole mobile app to facilitate gaining of knowledge and insights on the Istana in a fun and engaging manner.

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> SUPERVISOR Tan Hwee Yong

STUDENTS

Tan Jing Yee, Muhammad Haziq Bin Kuzaini, Pang Jing Jie

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STUDENT PROJECTS



Video Production for The Istana

WORKING alongside the Istana and LDR Technology, the RP students came up with four videos that help to promote the Istana Heritage Mobile Trail hosted on the LocoMole mobile app in a new and innovative manner. These videos aim to provide insights on the expectations from the mobile trail. In addition, visitors of the Istana will also get to learn the dos and don'ts while at the Istana ground. Believe it or not, the place is a lot friendlier than expected!

Video Production on "Tradition, Ethics and Sustainability"

GENDER equality at the workplace is an important issue that is close to the heart of every working professional. The video aims to raise awareness on the topic so as to bring about equal treatment and opportunities at the workplace, regardless of the gender of an individual. Working alongside Portfolio Magazine, students are exposed to various aspects of executing a social media campaign, from the planning stage to the execution of it. With the use of social and rich media, the editorial content was spruced up and life was given.

STUDENTS

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2D Infographic Animation for Course Promotion

SEVEN animated infographic videos were conceptualised and produced to help promote the in-house courses offered by OCBC Campus via their learning management system. These videos are used to share information about the courses and to arouse interest in the viewers so that they will enrol into them. For months, the students worked closely with the OCBC Campus to identify the key messages, to plan and to finally, to come up with the videos.

Company Website for UpnextLAB

A dynamic corporate website comprising a learning and development microsite presented through animated infographics, learning objects, learning videos and interactive content was developed for UpNextLAB Pte Ltd. The newly developed website allows cross-device compatibility for showcasing of the company's information & activities, learning design portfolio as well as educational content for educators.

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SUPERVISOR Aisha Zain

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STUDENT PROJECTS



F&B Stallholder Order App

THE traditional method of F&B order fulfilment services via thermal printing of orders is costly and non-scalable, thus restricting BevEat to expand its operations.

As a solution, a mobile app to receive multiple real-time food order requests with account management was developed. The users, who are the hawkers, are now able to inform their customers via the mobile app when the orders are ready for collection. This is not only costeffective, it also improves the work processes of users with certain disabilities as they are able to use android wear to assist in notifying their customers.

Implementing a Penetration Test Laboratory

COMPANIES and governments alike have gone through wave after wave of cyber attacks/hacks through different avenues such as networks, websites, malicious insiders, etc.

In order to counter these attacks, IT professionals need to be equipped with the knowledge of hacking. The shortage of IT security professionals and the lack of training grounds have always been the main concerns of Singapore as the nation progresses towards a Smart Nation. Data needs to be highly secured.

In this project, a penetrationtesting laboratory was set up for the purpose of ethical hacking training which covers steps to exploit the vulnerabilities and provide suitable countermeasures. This infrastructure can then be used to train IT security practitioners to harness their ethical hacking skills with cyber defence in mind.

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WorkFlow of the Project

Orthopaedic Trauma Workflow App

THIS project calls for the development of a smartphone application to assist the Orthopaedic team of doctors on the ground in prioritising Emergency Operating Theatre chits to facilitate smoother handover processes.

With this Android app, staff on the ground no longer need to manually

go through the Emergency Operating Theatre chits individually to arrange them. Doctors are also able to log in to the app to add or view patients' information as well as notifications. In addition, doctors are also able to enter patients' details, re-prioritise the patients who are in-queue for surgeries as well as track the reprioritisation history.

Presence Detection and Action

USING automation, the project aims to allow users to move around their homes with ease and to minimise the need to fiddle with the facilities at home in their daily routines.

A presence application (determined by an Android phone) that is connected to the cloud is built to facilitate the activation of smart devices in the home. Bluetooth Low Energy (BLE) beacons are placed at stationary locations such as the living room, the bedrooms and the kitchen, for detecting the need to switch on/off a household facility e.g. the ceiling light. With unused facilities switched off, electricity costs are also saved.

STUDENTS Yao Liang, Zhang Zhongtian, Kwok Xiang Wen

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SUPERVISOR Frankie Cha

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Life Speech Kidzo App

IN this technological age, children seldom learn and study with physical books. Electronic means have become the norm. In most cases, the electronic means are interactive and interesting, thus resulting in children being more engaged with their learning.

In this project, a mobile app that allows children with special needs

to learn fundamental English in the areas of nouns, prepositions, pronouns, verbs and concepts, was developed.

Quizzes to test the children's understanding after each lesson as well as features for parents to track their child's performance and understanding were also made available.

IT & Network System Administration - WorldSkills

IN this project, students learned to design a complex large-scale enterprise network, using suitable techniques and topologies. The project implementation was delivered on both windows and Linux systems in a secured LAN/ WAN environment. Systematic methods to identify and rectify hardware and software problems in client and server workstations as well as networking equipment were carried out too.

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STUDENTS Jamas Jeow Qi Long Ow Wei Jie

SUPERVISOR

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The HelpDementia App

HELPDEMENTIA is a mobile application for dementia helpers and patients. Dementia patient may have problems with short-term memory. They tend to forget their way home and people around them do not how to help them.

There are 2 parts to the app. HelpDementia Community provides means to help friends and families of dementia patients to contact their family members in the event that they got lost. HelpDementia Assist, on the other hand, presented some games to train dementia patients' memory such as by mixing and matching fruits and their family members according to their name and relationships. It also has a voice assistant function to assist dementia patients in their daily activities, such as setting reminders and providing them directions to go home.

IXIA ThreatARMOR Analytics Dashboard Apps for Splunk

AN application for analytics dashboard via Splunk, a Security Information Event Management (SIEM) software, to visualise the network logs received to correlate information and detect anomalies in the traffic was developed in this project.

From the application, there are several oblivious accomplishments. They include setting up Splunk & Splunk Stream, building dashboards, writing search queries and API scripts for building indicator of compromise (IOC) tables to match events against malicious traffic as well as creative documenting for the different kinds of dashboards to facilitate meaningful analysis purposes.

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> SUPERVISOR Shannen Ang

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SUPERVISOR Mapel Yap

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Happy Family

A winner of the HealthTech Award in SCS Splash Awards 2018, Happy Family is an Internet of Thing (IoT) and Artificial Intelligence (AI) project that can be used in a home setting to track and analyse the emotions of each family member.

This project comprises a mobile app and a web application where family members can post photos of happy moments. The project then uses cognitive services of some indices such as 'Happiness' and 'Togetherness' to analyse the happiness index of a family.

Happy Family is a social media platform for families to "compete" and to share moments of quality family time together. When the happiness index falls low for a family, notifications will be sent to remind members of the family of the importance of family bonding, coupled with recommendations and opportunities to raise the index.

Smart Scheduling

IN this fast-paced society, many young adults lead a hassle lifestyle and are thus, facing difficulties in managing their time and meeting schedules. A survey conducted by Student Engagement Insights further affirmed that 87% of the students nowadays are 'always' or 'sometimes' struggling with time management. The Smart Scheduling system is a smart alarm system encompassing smart devices, mobile app and cloud architecture to address these issues. Integrated with home automation and auto detection of current weather and/or traffic conditions, the system enables users to meet schedules by waking up on time and travelling to the meeting location with a planned and calculated route.

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STUDENTS Chua Yao Teng.

Lein Rou Xuan, Ni Jiaying

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Hive (Smart contracts on Blockchain for Lockers)

THE big idea behind Hive is "Your one key to unlock anything". Similar to bicycle sharing and pop station lockers, Hive assists one in finding and unlocking anything and it is backed by the security of Blockchain. This means that, there is no longer the need to share personal information with multiple corporations; they will simply become Hive partners.

Hive is a platform for businesses to find and attract new consumers

without a mass advertising spend. Simply register the business with Hive to immediately integrate the digital space with the business' physical Internet of Things (IoT).

Hive is a platform for consumers who need only sign up with Hive to get access to the services they know, as well as discovering wonderful new services as they become available.

RemindMe App

REMINDME is a smart reminding app that allows users to be more caring towards their family members. It helps to remind parents and children of incomplete tasks and/or events such that they can complete them on time. The completion of the tasks and/or events assists to bring the family closer. Apart from that, the app also features other information such as map location, weather details as well as delayed reminders for family members to action upon.

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SUPERVISOR Desmond Lee



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Application to Administer IPPT/Shooting Test

THE officers at AETOS Security are required to take the IPPT and Revolver Classification Shooting Test every year. The current process of registration for the tests as well as result tabulation are done manually on hard copy forms before transferring to Excel Spreadsheets. Such processes are tedious and may introduce errors. This project aims to resolve the labourious processes with automation via a mobile application and handheld devices to register the participants and collect the results. The collected results will then be synchronised and updated to the backend database.

Nitrate Monitoring and Control System for Aquaculture

IN the Aquaculture industry, it is crucial for the nitrate level to be controlled. Higher than expected nitrate level is toxic and can be fatal for aquatic lifeforms.

Through this project, a nitrate monitoring and control system prototype was developed. The system constantly monitors the nitrate level and triggers actions to reduce the level when the pre-set level is reached, such as turning on the valve to allow clean water to flow into the tank. At the same time, alerts via SMS are sent to the duty officer for him/her to investigate and take further remedial measures.

Done in collaboration with RP's School of Applied Science's Aquaria, the project results in reduced loss of livestock and shorter lead time of imminent danger situations as compared to labour-intensive routine manual inspections.

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Andy Lee





Home Care App

THIS project is a cross platform application that aims at providing convenience in health care services for people who experience difficulty travelling from their homes to a medical facility.

The application gathers information of service providers located within a

few kilometres from the users' home and provides a curated list of paraprofessional services available. For those who are less mobile, quality health care services are made more convenient by bringing them to their homes.

URL Classification using Machine Learning Techniques

WORKING alongside Starhub, this project works on processing URL data through Starhub's network. A program that uses Machine Learning to automatically separate URLs into Advertisements URLs and Website URLs was developed. Feature modelling was then performed on the datasets collected and a Spark-based Machine Learning Model was then developed using the features obtained and tested to run on StarHub's Big Data Servers. Results obtained were encouraging.

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STUDENTS

Jonathan Hon Zhiyu, Chua Wee Siang, Fraser Lew Zhen Yuan Jordan, Kelvin Ong Yan Da

SUPERVISOR





Mediated Learning Environment Systems (MILES)

TO learn effectively and to achieve better academic results, one must be able to stay focused and pay attention. However, many students are unable to stay focus due to factors such as unconducive environment and distractions, etc. They are also unaware that their minds are wandering away from their tasks on hand.

The system monitors the cognitive state of the user through realtime ECG readings and trigger actions to control ambient lighting, system sound, scent diffuser and air-conditioner or fan. Music on devices will also be turned on/off to improve mental preparedness when the specific state is achieved and distractions such as mobile phones will be switched to silent mode. ECG readings will be stored in the cloud and historical analysis of the level of attentiveness, mental effort, focus, mental preparedness achieved by the user will be displayed.

AWS Cloud Architecting

THE project aims to assist GoGreen Insurance Company in designing and implementing an Amazon Web Services (AWS) solution to resolve issues in their current Customer Relationship Management (CRM) web application and to achieve their goal of going "paperless" for all user data, documents and pictures. With the implementation of this new system in an AWS lab, the present performance and reliability issues of over-grown and overly expensive architecture as well as long processes of procurement and deployment were resolved.

STUDENTS

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Microsoft - SecuV

SECUV is a robot that can help to monitor the status of household members who are at home. Using facial recognition and emotion recognition functions, it is able to detect the emotion of the family members. It will also send a notification should an unknown person in the home be detected.

Apart from that, SecuV is also a patrolling robot programmed to detect and scout for lost items by autonomously navigating through its environment with the use of ultrasonic sensors.



Living Home

place.

LIVING Home is a Smart Home system designed to enrich the lives of its users. Using trending technologies, users are able to communicate with their devices without interacting with it physically. Switching off the lights and air-conditioners can be accomplished with some simple verbal commands or taps on the mobile phones.

Living Home provides extra assistance to users who are physically challenged, blind or of older age and are struggling to deal with daily activities. By having household appliances controlled via various platforms and through other devices, these users will be able to carry out their activities with much ease as there is no need for them to be physically moving around the

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STUDENT PROJECTS



Safe Smart Secure Carpark

LOOKING for a parking lot in a carpark can be time-consuming and troublesome for drivers.

Safe Smart Secure (sSs) Carpark is a project that makes parking cars easier by using Internet of Things (IoT) to transform a normal carpark to a smart carpark.

Drivers are able to book a carpark lot via a mobile application sSs at their convenience before reaching the carpark. If there is no available lot at the specified time, the driver will receive immediate notification so that he/she is able to either book another timeslot or book another parking location.

By leveraging on IoT, drivers can "communicate" and "interact" with the carpark system and are able to use the carpark in a smarter and more futuristic way.

Helping Hand

THE number of stroke patients increased from 5,578 cases in 2007 to 7,413 cases in 2016. It is one of the leading causes of death in Singapore.

More than 60% of stroke patients suffered paralysis on the opposite bodily side of the brain affected by the stroke. These patients require therapy sessions for better recovery. However, many stroke patients did not attend the therapy sessions due to the high medical costs associated with it. A cheaper solution is thus developed. This project, Helping Hand, aims to help stroke patients regain their hand muscle strength via repetitive movement. Helping Hand is a wearable, modified mechanical glove that can be bought off the shelf so that the patients can use them to carry out the therapy sessions at home.

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SUPERVISOR Vincent Ng 47



Implementing a Penetration Test Laboratory

THE widespread use of technology causes a rise in cybercrime. For the hackers, the possibilities increased exponentially, along with the potential rewards, e.g., "script kiddies" hoping for a modest payday by unleashing some ransomware. On top, there are also "statesponsored" hackers, who have switched to cybercrime as a method of war.

The fact that cybercrime now permeates every facet of the

society shows why cyber security is crucially important. More talents are needed in this field in order to safeguard information. In this project, an internal penetration test against a scenario of Damn Vulnerable Business (DVB), including the web server and internal network was performed. For the purpose of ethical hacking training, steps to exploit the vulnerabilities were undertaken and suitable countermeasures were provided.

2D Infographic Animation for Course Promotion

SEVEN animated infographic videos were conceptualised and produced to help promote the in-house courses offered by OCBC Campus via their learning management system. These videos are used to share information about the courses and to arouse interest in the viewers so that they will enrol into them. For months, the students worked closely with the OCBC Campus to identify the key messages, to plan and to finally, to come up with the videos.

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Text Mining using RapidMiner

EQUIPPED with the knowledge in Business Intelligence as well as System Analytics and Design, students in this project learnt and applied the processes and techniques of text mining in data analytics using the softwares, RapidMiner Analytics and Orange Data Mining, onto a given unstructured dataset, the Amazon Food Review. By applying the text mining techniques, a structured dataset was obtained and meaningful insights on the customers' feedback was derived. The results were then clustered and categorised into topics and the writers' sentiment towards the topics was further deduced.

TSH Synergy – Visual Analytics

MANUAL preparation of reports across multiple business units is tedious and time consuming. Human errors may be introduced in the process and therefore, result in inaccurate information gathered. This may affect the business decisions undertaken. This project seeks to resolve the issues with a data analytical dashboard to consolidate and integrate sales of the company, to ease interpretation of the purchase and delivery reports, as well as to link and automate the process of report generation in the bid to eliminate human errors.

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Visitor Tracking Application for Private Estates

IT is a common practice for visitors of private estates to register themselves (and their vehicles) at the guardhouse. For many private estates, this process is nonautomated whereby carbon copies of visitor slips are used. Given that the records are on paper, security guards, condominium managers and residences are not able to have realtime tracking of the visitors' entries and departures.

A web application to track visitors' record within the condominium will facilitate better access and exchange of information. This will lead to smoother and more efficient management of visitors within the private estates.

Student Overseas Trip (SOT) Chatbot

SOT enrichment programmes are highly popular with students. Prior to signing up for any trip, students tend to have many questions, such as the itineraries, costs and eligibility, etc. Such questions, which are repetitive, are attended to via briefing sessions and/or email correspondences. It can be tedious and time-consuming.

The chatbot aims to address the issues stated. It serves as an

intermediary to answer frequently asked questions regarding SOT. The solution was created using Telegram as the communication platform between the students and the chatbot. It was trained to catch certain key phrases pertaining to SOT and process students' information to give unique results for their enquiries.

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Drone Dance

DRONES are usually controlled via flight controllers and each drone has its own dedicated controllers.

This project goes beyond the norm by controlling multiple drones at the

same time. To do so, a python library of flight movements was developed to facilitate multi-drones control capability. A command centre is then set up to control multiple drones to perform a coordinated dance.

Inventory Management System

IN this project, a portal with a database that facilitate the automatic management of all maintenance assets with process workflow was developed to address the issues faced by NEC on their current manual way of inventory management. The use of a centralised database for maintaining, creating and updating of data ensures that information is coordinated and accurate. It also minimises the potential of redundancies and errors. The implementation provides convenience to the staff as they can now have easier, updated and real-time access to the inventory information.

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Environment Condition Detection System

THIS project builds on an IoT monitoring system that uses multiple sensors for detecting and collecting data on temperature, light, humidity and PM2.5 dust via a web-based system. House fan and indoor lighting will then be switched on or switched off based on the preset thresholds of some parameters. Alert messages will also be sent out to affected subscribers via a push notification.



CURRENTLY, students enrolling into Republic Polytechnic are required to submit their Tuition Grant Declaration Form in the form of hardcopies to the Office of Finance. The staff of the department will then manually enter the submitted details onto Excel spreadsheets. The process is tedious for both students and staff. Moreover, there are risks of human error as well as the forms being lost or misplaced. To align with the smart nation initiative to provide end-to-end digitalisation, an online Tuition Grant System that allows students to apply and submit tuition grant as well as allowing the Finance department to view all the tuition grant responses submitted by students was developed. With this, details can be assessed in real-time upon submission and the errors can be minimised or even eliminated. This system also includes a module for maintenance and administration purposes.

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Multilingual Speech Recognition & Translation System for Mobile Computing Devices

LIMITATIONS in the type of operating platform, costly licensing and the lack of ability to interpret local ascent and dialects as well as transcribing long speeches exist in the present transcribing/translation software programs.

In this project, a multilingual speech-to-text (STT) transcription and translation software that runs on common mobile devices, such as smart phones, tablets and laptop computers is built. The STT transcriber/translator is a lowcost assistive tool that facilitates effective communication for users and is developed with a localised context that is able to comprehend different Asian accent, which is essential in our multi-ethnic and multi-cultural society.

The STT transcriber/translator leverages on the mobile computing devices to provide a more effective real-time transcribing tool for the user to interpret spoken words and can be adapted for varied use in the hospitals, homecare services, retail outlets, schools, travel and the media, etc.

PRINCIPAL INVESTIGATOR David Leong





Securing IoT Smart Home Metering System

SMART meters are deployed to each household to measure the energy use of electrical appliances that form a Home Area Network (HAN). A Field Area Network (FAN) is a wireless mesh network in which a group of smart meters and concentrators are interconnected so that the collected energy usage data can be aggregated before they are forwarded to the Meter Data Management System (MDMS).

As the concentrator can access the energy data obtained from the smart meters before performing the aggregation, it may be compromised

to manipulate and tamper with the readings. This could lead to erroneous bills, energy thefts, and possible consumer disputes.

Communications

In this project, the idea of a chameleon hash function where the smart meters calculate a chameleon message hash periodically based on the previously reported usage data was adopted. This will permit the MDMS to verify the integrity and authenticity of the energy data sent by the concentrator so as to ensure the readings collected are accurate.

3D Virtual Laboratory

THIS 3D virtual laboratory developed for RP's School of Applied Science (SAS) is a training facility for new staff to assess work competency. It also prepares students prior to the commencement of their internship programmes and it introduces the applied science related professions to prospective students.

In this environment, users are provided with a comprehensive. immersive and realistic learning experience of a diagnostic laboratory and are able to experience the entire

spectrum of specimen handling, from pre-analytical, analytical to post-analytical phases. Besides that, users can also interact with virtual objects in the virtual reality (VR) programme guided by onscreen interactive elements in their learning.

The virtual environment allows mistakes to be learnt in a controlled and non-hazardous setting. Cost saving can be achieved too by reducing wastage of materials used as compared to the real life setting.

PRINCIPAL INVESTIGATOR David Leong

> FUNDED BY Ministry of Education

IN COLLABORATION WITH University of Glasgow and Wi-SUN Alliance **PRINCIPAL INVESTIGATOR** Kong Chee Chong

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Advertisement Analytics using Machine Learning & Deep Learning

IN this project, a web-based automatic system that performs analytics on advertisement from all heterogeneous social media data is developed.

The system differentiates corporate and consumer content and takes

into account content from analysing sentiment. It provides insights for understanding how combinations of advertisement exposures interact to influence consumers as well as measures the performance of an advertising strategy in real-time.

Distributed Artificial Intelligence Platform for Social Robots

THIS project aims to develop and build a distributed artificial intelligence platform to provide perception, decision-making and human-robot interaction services for social robots that can be deployed in the healthcare sector and concierge services as well as being a chat companion and in education. The platform leverages on the open source Robotic Operation System to provide command, communication and control. This implementation will bring about lower development cost by minimising the need for expensive mobile hardware and at the same time, improving shared intelligence among the robots.

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IoT System using Sigfox Network

IN an Internet-of-Things (IoT) system, a cluster of networked devices and/or sensors communicates periodically with a control station through a cloud-based backend. To speed up the adoption of IoT, a low power wide area network for battery-powered sensors based on Sigfox technology is developed.

The Sigfox network was chosen for deployment due to its lower cost and a wide coverage that is available in 22 countries around the world. For indoor reception, it is capable of achieving a range of at least 10km whereas for outdoor reception, it can go beyond 30km.

Such a system is suitable to be deployed in the healthcare and disaster relief zone as well as for area surveillance and security purposed and agricultural and crop monitoring.

Deep Learning for Multi-object Recognition

SIGNIFICANT work was made in the past few years on Convolutional Neural Networks (CNNs). The techniques were reviewed and Single Shot Detector (SSD) was applied to identify and label multiple objects that may exist in any given image.

The implementation can be deployed for security purposes or for commercial usage of driving

sales. One such example is the identification of imminent danger from a sudden spike in the human movement in a campus environment. Another example is identifying products through the mobile application for promoting sales and customer engagement in smart retail scenario.

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- Nexia TS Pte Ltd

- NextGen Ventures Pte Ltd
- Nparks
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- Parkway Pantai
- Pomefresh Organic Pte Ltd
- Resorts World Sentosa
- Singapore Youth Flying Club
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- Stranger Sports Pte Ltd
- The Photographic Society of Singapore
- Trevis Technology Pte Ltd
- TSH Synergy Pte Ltd
- TUV SUD Asia Pacific Pte Ltd
- UNABIZ PTE LTD
- University of Glasgow Singapore
- UpnextLAB Pte. Ltd
- YuViTime Pte Ltd

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