

**LEE KUAN YEW TECHNOLOGY AWARD 2020  
WINNING PROJECTS**

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 Muhammad Harith Syafiq B M Y  
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**Courses:** *Higher Nitec* in Marine Offshore Engineering  
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**College:** ITE College Central

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### Secure Deliveries Anytime, Anywhere

With online shopping becoming increasingly popular, problems related to unsuccessful deliveries have also become more common. These include lost or misplaced parcels when no one is around to receive the deliveries.

To address such issues, the team developed a locking device called **eLocktric** which can be retrofitted to any box or cabinet with a door to form a “mailbox” outside users’ homes. The lock system is protected by a user password.

eLocktric facilitates secure deliveries, by enabling users to remotely operate the lock system using an application on their mobile phones. This is made possible through eLocktric’s built-in Wi-Fi connectivity.

### Innovators’ Inspiration

*“We were inspired to create this device from our personal experiences, both as shoppers and deliverymen. On occasions when no one was at home to receive deliveries, our items may end up being placed on the floor outside our homes. This has led to items being stolen.”*

*Some of us have worked as food deliverymen, so we also understand the challenges that deliverymen face. Certain customers would ask for the food to be placed outside their apartment. The unattended food may be taken by others. When this happens, the customers would lodge a complaint and we would get unfairly faulted. Through eLocktric, we hope to ease all these problems and enable convenient and secure deliveries for everyone.”*

- Muhammad Fadhullah

### What’s So Special

- eLocktric was designed to be attached to boxes or cabinets that blend in with regular items outside someone’s home. This minimises chances of people meddling with it.
- Through the device’s built-in Wi-Fi connectivity, users will receive notifications on their mobile phones whenever the device is locked or unlocked.
- For added security, eLocktric features an alarm system which will be activated if the door of the “mailbox” is forced open or not locked properly.
- A security camera can be installed on the device to deter theft of items in the “mailbox” or even theft of the “mailbox”!
- eLocktric is powered by self-sustaining batteries that can last at least six months.

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**Taking the Heat off Temperature-Taking**

Temperature-taking has become a norm, with the outbreak of COVID-19. However, recording temperatures of students in schools is a time-consuming process. For a class of 40 students, it can take up to 30 minutes!

Through the **IoT Classroom Monitoring** device, the same task can be accomplished within 10 minutes! Students simply have to tap their student cards on the mounted device, then place their foreheads close to it for their temperatures to be taken, recorded and stored in a cloud server. The data can even be compiled into an Excel spreadsheet for easy monitoring!

**Innovators' Inspiration**

*"We created this device for the Sigfox Universities Challenge in 2019, which is a competition open to students from institutes of higher learning worldwide. It requires competitors to develop Internet of Things (IoT) projects that solve real world problems, using Sigfox communications technology. We took part and were judged as one of the top projects.*

*Initially, we created the device with SARS and H1N1 conditions in mind. With the emergence of COVID-19, we believe an automated temperature monitoring device like ours is very timely."*

- Aden

**What's So Special**

- The IoT Classroom Monitoring device does not involve any physical contact with equipment, enabling hygienic usage by multiple users.
- If a user is detected to have fever, the device immediately sends an alert via email to notify staff or teachers. The user can then be quickly isolated.
- Temperatures taken by the device have been tested to be accurate – the team had compared the device's results with those taken by different types of thermometers.
- With the use of Sigfox technology, the device has a 40km transmission range and can transmit data in areas without Wi-Fi. This makes it portable and ideal for off-site use.
- The device can also be used to monitor class attendance, as students tap their student card before temperature-taking.

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### **Living Small, Thinking Big**

Space-saving furniture has become highly popular, especially among those living in smaller apartments. To help owners of small apartments maximise space, the team created a multi-purpose product which combines three household items into one.

Called **My Home Giz**, it features the functions of an ironing board, a ladder and a chair. The ironing board rests at the top of the product, and can be flipped vertically to form the backrest of a chair. Through some adjustments, steps can be extended from the base of the chair to form a ladder.

Three essential but bulky household items have become just one!

### **Innovators' Inspiration**

*"My family was living in a small apartment in an old estate for a while, and we did not have much space at home. As a result, we had problems storing bulky household items. Drawing inspiration from that experience, our team decided that we wanted to combine a few bulky but essential household items into one to save space. As the materials for this product are cheap, we are able to make it affordable for our target audience - lower-income families living in small apartments."*

- Mohamad Anwar

### **What's So Special**

- A customised cover was designed for the base of the ironing board, so that it becomes a more comfortable backrest when the user is in the sitting position.
- To ensure secure support of the ironing board, its levering arm was carefully designed to achieve optimal thickness, length and curvature.
- A rubber base for the seat of the chair was used to make it non-slip when it is stepped on as a ladder.
- Wheels were added to make the product more portable and easier to move.

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### **Safe Mobility for the Visually Impaired**

Navigating around places has always been difficult for the visually impaired, especially in an urban city like Singapore. While they could rely on walking sticks, navigating roads is still a key challenge for them.

To help them navigate road crossings safely, the team developed the **Optical Recognition Assistant**. The device is programmed to identify traffic lights through a camera module. Upon detecting traffic lights, it will provide an audio cue to alert users to stop safely before the crossing. With an adjustable neck strap, the device can be comfortably worn by users as they move around.

### **Innovators' Inspiration**

*"In our daily lives, we have come across quite a number of visually impaired people. We saw that many of them struggle to move around using walking sticks, especially when crossing the road. As they are alone most of the time, there is usually no one to help them. Some of them may also be shy to ask for help. From our visit to the Singapore Association of the Visually Handicapped, we learned that one of the main difficulties faced by the visually impaired is that they are unable to identify traffic light crossings easily.*

*All these inspired us to create something to help them navigate road crossings more safely. We hope that our device can empower them to achieve more independence in their lives."*

- Kynan

### **What's So Special**

- The Optical Recognition Assistant is believed to be the first assistive device for the visually impaired that uses image recognition to support navigation.
- The device can be programmed to identify up to 91 objects that guide the navigation of users. These include colours of traffic lights, which enable it to prompt users on whether it is safe to cross the road.
- Attached earphones enable audio cues to be heard clearly by users.
- A heat sink is installed in the device to keep its temperature at optimal levels.
- The device is chargeable by a power bank that is fitted into a slot within the device.

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**Saving the Search**

In times of emergency, quick action could make a difference between life and death. This requires life-saving equipment such as first aid boxes, automated external defibrillators (AED) and fire extinguishers to be located promptly. However, there could be instances when such equipment cannot be located.

With **GrabHelp**, the location and availability of life-saving equipment can be accessed readily and accurately. A mobile application that uses location-based technology, GrabHelp provides real-time information on the available life-saving equipment within a vicinity. This enables responders to retrieve the necessary equipment and attend to emergencies promptly.

**Innovators' Inspiration**

*"When it comes to emergencies, every second matters. I remember rushing to a site to get a first aid box but it was missing. I had to run to another place to get first aid supplies. That experience reinforced my belief that time should be spent on saving lives during critical situations, not searching for first aid equipment."*

*"This app facilitates access to first aid tools and prompts the owners of such devices to ensure that the equipment is ready for use anytime. Our goal is to increase the chances of survival of those in need during emergencies."*

- Isaac

**What's So Special**

- The team's project won the Gold Medal at the International Exhibition for Young Inventors 2019 competition in Indonesia.
- To enable easier searches, GrabHelp enables filtering of search results by categories of life-saving devices.
- When an equipment is taken from its position, a specified administrator will receive an alert. This facilitates the planning of follow-up actions such as calling for an ambulance.
- Besides showing the location of life-saving equipment, GrabHelp also provides the location of the nearest clinics.
- The backend server can record the expiry date of the equipment and prompt a specified administrator when an equipment is due for maintenance or replacement.

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### **Cooking without Fire**

Unattended cooking has been a leading cause of household fires. Such incidents often involve the elderly. To address this problem, the team developed a device that could detect unattended cooking and send alerts to caregivers. Called **SMARSTOVE**, it is built into portable stoves and connected to a mobile application via Bluetooth.

Through the mobile application, caregivers for the elderly can monitor the stove status. If the stove has not been switched off after 30 minutes, an alarm or audio reminder is activated. If the stove is not switched off after 60 minutes, an SMS alert will be sent to the caregiver.

### **Innovators' Inspiration**

*"My teammates are from two very different courses - Nursing and Engineering. However, we all agree that technology should help the elderly, especially those who suffer from dementia, perform daily tasks such as cooking independently and safely."*

*"For this project, we combined our respective domain knowledge to design SMARSTOVE. In the process, we benefitted by learning from each other. The nursing students picked up programming skills while the engineering students learnt more about healthcare."*

- Danish Iskandar

### **What's So Special**

- The audio reminder to switch off the stove is pre-recorded in a language of choice!
- Powered by batteries, the device is low-maintenance and requires only periodic battery replacement.
- The mobile application for SMARSTOVE features visual animation that enhances engagement and user-friendliness.
- Besides stoves, the device can be installed in other home appliances with a knob switch.
- SMARSTOVE can be designed with built-in Wi-Fi to support a larger connectivity range with its mobile application.

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### **All-In-One Mobility Device**

We commonly see different types of mobility devices – walkers, wheelchairs and Personal Mobility Devices (PMDs). The **Mobility Aided Robot** combines all that into one design!

With this device, users can choose how they want to move. They can use it like a walker to walk with support, stand on to it, or sit on it like they are using a wheelchair.

The device also supports walking without support, by detecting movement of users through infrared sensors and following them as they walk. Its audio function warns users of potential dangers and even provides encouraging words to cheer them on!

### **Innovators' Inspiration**

*"The inspiration for this device partly came from observations of my grandmother. At times, she did not want to use her walker, as she wanted to train her walking. However, after walking unsupported for some time, she would get tired and require a wheelchair. Subsequently, she would complain that her body was aching from sitting for too long and she would want to stand.*

*We wanted to create a device that could better meet the mobility needs of different people, by giving them a choice on how they want to move around. I showed my grandmother our device and she said that it would be helpful for her. I hope it can help more people like her."*

- Wei Liang

### **What's So Special**

- The device has sensors on its front and sides, which enables it to detect obstacles and gaps around the user.
- Using Internet-of-Things technology, the device can track, monitor and relay data on the user's activity to the caregiver.
- Should the user fall while walking unsupported, the device will sound an alarm and send a text message to the user's caregiver.
- Movement can be controlled using the device's press control or joystick control.

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**A Smart Knee Brace**

Osteoarthritis is a condition where the cartilage between joints wears away, causing joint pain. It commonly affects the knees, especially among the elderly. A knee brace is often used as an assistive device for those with knee osteoarthritis, and can be described as passive or active in form.

A passive knee brace provides compressive support, while an active knee brace features a powered exoskeleton that assists knee movement. Combining the functions of the two, the team created the **Osteoarthritis Assistive Brace**. Through an electromagnetic clutch, the device can be switched to the active knee brace mode. Sensors detect and send data on the user's movement to a cloud server, which allows doctors or family members to monitor the user's condition.

**Innovators' Inspiration**

*"I witnessed my grandmother suffer from osteoarthritis for over 20 years. Therefore, I can understand the pain and struggles that those with osteoarthritis go through. Knowing that knee osteoarthritis is a common condition affecting the elderly, our team wanted to create something that would help them with this problem.*

*We started the project with very limited knowledge of the science of the knee. It took us many trial and error attempts to get the multiple parts of the device fabricated correctly. This project is a labour of love from our team. We hope our device can make a positive difference to those struggling with knee problems."*

- Wai Harn

**What's So Special**

- The device is believed to be the first to combine the functions of an active and passive knee brace. Common braces typically offer either one of the two functions.
- Weighing approximately 1kg, the device is light-weight and compact. This enhances mobility of users.
- As the casting of the device is made through 3D printing, it can fit the knee structure of different users.
- The device is built with Wi-Fi connectivity, which enables data on the user's activities to be sent to a cloud server.



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### **Radiation Alert!**

Radiation is found everywhere – in the air we breathe, the earth we tread, and even our bodies. It is also used for medical treatments and diagnosis.

While radiation is a natural part of our daily lives, exposure to large doses of ionising radiation has negative health effects. Ionising radiation deposits a large amount of energy in the matter it passes through, and include gamma rays and X-rays.

To enable convenient detection of harmful radiation, the team built a hand-held ionising **Radiation Detector**. The device provides instant readings on the types of radiation that are present, as well as their quantities.

### **Innovators' Inspiration**

*"We were inspired to embark on this project, after watching a video on the Chernobyl nuclear disaster. We were horrified by the devastating consequences of the disaster, where many people suffered long-lasting side effects, injuries and death.*

*As radiation is found all around us, we wanted to build a user-friendly radiation detector which can detect harmful radiation in our environment. Through this device, we hope to raise radiation safety awareness among people.*

- Hong Soon

### **What's So Special**

- Being a battery-operated handheld device, it can be used at home, in the office, or at industrial sites.
- Due to its compact and lightweight design, the device is highly portable.
- Readings of radiation levels that are captured by the device can be simultaneously viewed and recorded through a computer.
- Data collected can be analysed to provide indications of whether certain areas are hazardous.
- There is potential for the device to be affixed to a drone, which enables users to remotely control the device and perform radiation detection from a safer distance.

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### Stopping PMD Problems in Their Tracks

The **Smart Personal Mobility Device (PMD) Guardian** tackles two problems of PMD usage – improper battery charging and speeding. It comprises a charging device called the **Smart PMD Charger** and a speed control component called the **Smart PMD Logger**.

The Smart PMD Charger monitors the battery charging process. It stops the charging when the battery is fully charged or charged for too long, if the current and voltage levels are not optimal, or if the battery temperature is too high.

The SMART PMD Logger monitors the PMD's speed through affixed LED light strips. At various speed levels, different coloured lights will be activated. If the user rides beyond 25 km/h for ten seconds, it will slow the PMD to a stop.

### Innovators' Inspiration

*"We were inspired to create the Smart PMD Guardian, as we saw an increasing number of news reports on fires caused by the improper charging of PMDs and accidents arising from speeding riders. We felt that we can use technology to help riders use their PMDs correctly, for the right purpose that PMDs are built for. We believe that PMDs still have their merits as an alternative means of transport. They are environmentally friendly and efficient. Through our SMART PMD Guardian, we hope to address concerns that people have about the risks of PMDs, and promote safe usage of PMDs.*

- Muhammad Haziq

### What's So Special

- Different coloured light indicators on the SMART PMD Charger provide information on the status and condition of the battery. A green light means the battery is fully charged and in good condition, a blue light means the battery is being charged and in good condition, while a red light means the battery is not in good condition and power supply has been cut off.
- During the charging process, a screen on the SMART PMD Charger displays real-time details of the battery current and voltage, its temperature and safety status.
- A text notification will be sent to the user, when the SMART PMD Charger detects unsafe conditions and stops charging the battery.
- For the SMART PMD Logger, yellow lights represent the lowest speed range, orange lights represent the moderate speed range, and red lights represent the highest speed range.
- The SMART PMD Logger can send a text notification to alert stakeholders such as parents, when the user exceeds speed limits on the PMD.