

**LEE KUAN YEW TECHNOLOGY AWARD 2025  
WINNING PROJECTS**

**Project Title:** Assistive Communication Device

**Members:** Ong Xuan Hui (Group Leader)  
Ng Jun Cheng  
Loke Jen Lin  
Fong Sze Jun

**Course:** *Higher Nitec* in Electronics Engineering

**College:** ITE College Central

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**Voice for All**

Children with intellectual disabilities or speech disorders face challenges in communicating their needs. Visual communication cards featuring pictures of items and words can help them express themselves. However, many of these children and their parents may find such cards inconvenient or uncomfortable to use, especially in public.

This prompted the team to create a mobile device that features a digital version of visual communication cards. Users can select from a range of images paired with corresponding words and objects to communicate with others. When an image is selected, an audio output reads the word aloud. The device can display up to four images on-screen at a time, allowing users to form a simple sentence that could be read aloud.

**Innovators' Inspiration**

*"While interning at AWWA School as a teaching assistant, I saw how children with intellectual disabilities or speech disorders struggled to communicate. They would often throw tantrums when they were unable to express their needs. The parents I met there shared that they and their children did not like to use physical communication cards, due to stigma. These experiences had a significant impact on me and inspired us to develop a solution that could help children with speech disorders communicate more effectively. Through our creation, we hope to empower everyone with the opportunity to express themselves and feel included in society."*

- Ong Xuan Hui

**What's So Special**

- The device is small and lightweight, making it portable and convenient for use.
- A parental control app is available for parents to download on their own mobile devices, allowing them to customise and add words to their child's device by capturing images of objects that the child can relate to.
- A passcode must be entered to exit the assistive communication app on the device, which prevents the child from misusing the device for other purposes.
- The device supports multiple languages, catering to users from different linguistic backgrounds.

**LEE KUAN YEW TECHNOLOGY AWARD 2025  
WINNING PROJECTS**

**Project Title:** IoT-Enabled Community Fridge

**Members:** Santos Rachel Ham (Group Leader)  
Phua Jian Sheng

**Course:** *Higher Nitec* in Electronics Engineering

**College:** ITE College Central

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### **A Smarter Way to Share**

Community fridges offer an innovative way to tackle food waste and combat food insecurity by fostering a culture of sharing. While they have gained popularity in local resident committees, challenges such as inadequate access management and a lack of data analysis to identify needy families have hindered its effectiveness. It has also led to inefficiencies, wastage and user dissatisfaction. To overcome these challenges, the team designed an IoT-enabled smart fridge to improve food distribution efficiency. The system tracks access and uses data analysis to better identify and support families in need, enhancing overall user satisfaction.

The smart fridge integrates multiple technologies to create a secure, efficient, and user-friendly system. Access is granted via an EZ-Link Card authentication system over a 4G network, ensuring that only authorised individuals can retrieve food items. An electromagnetic lock system provides secure access, while CCTV surveillance deters vandalism. Smart sensors monitor food conditions, including temperature and door status, ensuring safe storage. A cloud-based platform processes the data, allowing administrators to manage and monitor the fridge remotely. Additionally, the team developed a web application that provides real-time updates, helping administrators track food distribution and identify residents who may require additional support.

### **Innovators' Inspiration**

*"Seeing the struggles of those facing food insecurity, we wanted to make a difference by integrating IoT technology into community fridges. Through the implementation of smart access control with EZ-Link cards, we made the food exchange process easier for donors and residents. The access records can be analysed to improve services, ensuring food reaches those who need it most. This project not only showcases our technical expertise but also drives meaningful community impact, transforming innovation into action for a more connected, compassionate world."*

*- Santos Rachel Ham*

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

- An EZ-Link Card authentication system ensures that only registered residents can access food.
- Real-time cloud-based monitoring tracks fridge status and user access data, enhancing operational efficiency and enabling timely support for those in need.
- Fridge usage analytics help community leaders better understand food supply and demand, enabling better resource allocation. Administrators can also leverage on data insights to identify residents who may require additional financial support.
- The team tested their smart fridge with a community partner and received positive feedback. Plans are underway to expand and make more of these smart fridges available at more locations.

**LEE KUAN YEW TECHNOLOGY AWARD 2025  
WINNING PROJECTS**

**Project title:** Smart Water Recirculation System for Efficient Heater Operations

**Members:** Tan Boon Keng Brennan (Group Leader)  
Mikken Ng  
Kang Shao Ying Mervin

**Course:** Nitec in Mechanical Technology

**College:** ITE College Central

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### **Making Every Drop Count**

Picture this. You step into the bathroom, turn on the tap and wait several seconds for the water to heat up before starting your bath. This scenario is familiar to many of us. In conventional water heater systems, a significant amount of cold water is wasted while we wait for the water to reach the desired temperature, leading to unnecessary water wastage.

Having identified this gap, the team created the *Smart Water Recirculation System* to minimise water wastage when the heater is in use. The system is designed to optimise water usage by recirculating cold water back to the heater instead of letting it flow out of the showerhead. Once the water reaches the pre-set temperature, a check valve opens, releasing the water at the desired temperature.

### **Innovators' Inspiration**

*"A significant amount of water is wasted during showers while waiting for the water heater to heat up. This inspired us to design a kit to convert a conventional water heater into an instant one, reducing cold water wastage. We conducted trials and tests to fine-tune the design, applying our knowledge of material selection, fabrication and practical skills in piping, valves, electrical systems, and hydraulics. Despite challenges and set-backs in balancing the heating efficiency and energy consumption, we stayed focused, especially as feedback from our social circles was positive with many expressing interest in installing the system at home. We are proud to be able to apply our skills to address a real-world issue."*

*- Tan Boon Keng Brennan*

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

- System recirculates cold water back to the heater instead of allowing it to drain away.
- Helps households cut down on water and electricity costs with less water wastage.
- Supports the Singapore Green Plan 2030, saving up to approximately three litres of water per household daily. This translates to 15 million litres of water saved nationwide every day, accounting for about 27% of the national reduction target.
- System can be implemented for other activities such as dishwashing, face washing and toothbrushing.
- Has strong commercial potential for homes and facilities that require pre-heated water for operations, especially in cold countries where warm water is essential for daily activities.

## LEE KUAN YEW TECHNOLOGY AWARD 2025 WINNING PROJECTS

**Project Title:** Repurposing Charcoal for Sustainability

**Members:** Keanu Skye Swyny Fonseca (Group Leader)  
Lei Sijia  
Sharifah Aisyah Alsagoff Binti Agil  
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**Course:** *Higher Nitec* in Mechanical Engineering  
*Higher Nitec* in Bio-Chemical Technology

**College:** ITE College East

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### Transforming Waste into Worth

Local *bak kwa* (meat jerky) businesses rely heavily on charcoal to enhance the smoky flavour of their products. However, the disposal of used charcoal contributes to water wastage and rising waste management costs. To tackle this, the team comprising mechanical engineering and bio-chemical technology students combined their expertise to repurpose charcoal waste into two practical innovations.

First, they used burnt charcoal ash to create a charcoal-infused soap, offering a natural and biodegradable alternative to chemical-based cleaning agents. Second, they treated burnt charcoal chunks to produce activated charcoal for a water filter which enhances water purification by trapping heavy metals and impurities through adsorption. To further sustainability efforts, the team used 3D printing to develop a compact water filtration unit to house the charcoal filter. The water filtration unit can be easily reproduced and adapted for both household and industrial use.

### Innovators' Inspiration

*"Charcoal waste from food production is often overlooked, leading to pollution and resource wastage. Seeing so much discarded charcoal in the food industry, we wanted to give it a second life. By transforming burnt charcoal into useful products, we not only reduce waste but also create sustainable alternatives for everyday use. Whether it's chemical-free soap or water purification, small innovations can lead to significant environmental benefits."*

- Keanu Skye Swyny Fonseca

### What's So Special?

- The charcoal-infused soap is made from burnt charcoal ash and biodegradable materials. Due to charcoal's high absorbency, it traps dirt and impurities more effectively, requiring less water for rinsing.
- Burnt charcoal chunks which are used in the water filter undergo activation through steam or carbon dioxide, increasing their surface area from 5.0m<sup>2</sup>/g to 1000m<sup>2</sup>/g. The charcoal chunks are also soaked in 85% phosphoric acid. These treatments significantly boost their adsorption capacity.
- The charcoal water filter's effectiveness was proven through microscopy studies and ICP-MS (Inductively Coupled Plasma Mass Spectrometry) heavy metal analysis.
- Supports Singapore's Sustainable Living goals under the Singapore Green Plan 2030, which emphasises the importance of reducing waste and promoting circular economy practices.
- By merging their cross-disciplinary expertise, the team successfully developed a solution that is technically sound and environmentally impactful.

**LEE KUAN YEW TECHNOLOGY AWARD 2025  
WINNING PROJECTS**

**Project Title:** FoodPal

**Members:** Ng Cai Yi, Brandon (Group Leader)  
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Muhammad Haiziq Bin Sufian  
Crystal Jade Tan  
Lim Wei Mabel

**Courses:** Nitec in Mechatronics and Robotics  
Nitec in Asian Culinary Arts

**College:** ITE College West

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### **Track, Not Toss**

The sight of spoilt food items in the refrigerator underscores a food waste problem that could be avoided through effective tracking. This prompted the team comprising mechatronics and culinary students to investigate methods for monitoring and managing perishable items within a refrigerator. Following extensive research into scanning mechanisms, app integration, and the nutritional analysis of recipes, the team developed *FoodPal*, an AI-powered food inventory management app.

With a simple photograph of their refrigerator's contents, users can leverage the app's AI model to accurately identify food items, track quantities and monitor expiration dates. The team also implemented push notifications for food expiration and personalised recipe suggestions based on identified refrigerator contents.

This interdisciplinary collaboration resulted in an innovation that helps users manage their food inventory effectively, promoting consumption prior to spoilage and contributing to the reduction of household food waste.

### **Innovators' Inspiration**

*"Isn't it sad to toss out expired food items? Especially when it hasn't even been cooked. With this app, we can see what's in the fridge without even opening it. My mom loves that everyone can help track groceries remotely. I'm incredibly proud of my team for overcoming the obstacles to create this useful tool. It was definitely a challenge, but I believe life is most rewarding, and way more fun, when you challenge yourself."*

- Ng Cai Yi, Brandon

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

- Food items are auto-identified by an in-app object detector AI model. This saves the user time from manually entering the information. The user can also add or remove items easily from the app.
- *FoodPal* sends periodic reminders, notifying users three days before food items expire and continuing until the expired items are removed.
- The integration of ChatGPT 4.0 into the app combats food waste by providing recipe recommendations based on available ingredients, addressing the issue of unused ingredients caused by lack of cooking inspiration or knowledge. Users can select the preferred cuisine, key ingredients, dietary requirements, and specify the number of servings required.
- Aligned with the Singapore Green Plan 2030, *FoodPal* supports sustainable development by reducing food waste, promoting efficient resource use, and fostering eco-conscious habits.
- The app's functionality can be expanded to monitor consumable goods and raw material shelf life in the retail and manufacturing sectors, respectively. The app's Gen AI can also suggest discounts or bundles for soon-to-expire stock in retail and recommend efficient production plans based on material availability and expiration in manufacturing.

## LEE KUAN YEW TECHNOLOGY AWARD 2025 WINNING PROJECTS

**Project Title:** Just in Time

**Members:** Law Heng Siang (Group Leader)  
Wan Xuan Jing Edna  
Gwendolyn Neo Su Ping

**Course:** *Higher Nitec* in Security System Integration

**College:** ITE College East

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### A Helping Hand

Ensuring patient safety in hospitals and care facilities is an ongoing challenge. Many bedridden patients, whether eager to regain independence or hesitant to call for help, attempt to get up on their own, increasing their risk of falls and serious injuries. At the same time, caregivers must manually check catheter bags, a repetitive and time-consuming task that, if overlooked, can lead to bladder overexpansion, infections, and severe medical complications.

To tackle these issues, the team developed *Just in Time*, a smart caregiver bed system with automated real-time monitoring capabilities. Equipped with motion and water level sensors, the system detects patient movement and catheter bag fill levels, instantly alerting caregivers via mobile notifications. This ensures timely intervention, enhancing both patient safety and caregiver efficiency.

### Innovators' Inspiration

*"A loved one of mine developed severe discomfort and blood in the urine due to a delayed catheter bag change, resulting in an extended hospital stay and higher medical costs. This incident left a deep impact on me. When our team later found out that our teacher had experienced the same issue, we realised that these are not isolated incidents. This inspired us to create 'Just in Time' – an automated system designed to prevent falls and ensure timely catheter monitoring. We hope to make a meaningful difference in healthcare by easing the workload of caregivers and improving patient safety."*

- Gwendolyn Neo Su Ping

### What's So Special?

- By integrating fall prevention and catheter monitoring into a single system, *Just in Time* offers a smart and proactive approach to patient care. Its bed exit alert function uses multiple sensors to detect when a patient attempts to sit up or move toward the edge of the bed, triggering immediate alerts for timely intervention.
- A water level sensor continuously tracks the catheter bag's fill level, sending notifications when it reaches a set threshold to prevent overexpansion and related complications.
- Powered by an ESP32 microcontroller with Wi-Fi capabilities, the system enables real-time alerts via Telegram or hospital monitoring networks, ensuring that caregivers can respond even when not in close proximity. Additionally, its multiple GPIO (General Purpose Input/Output) pins allow seamless integration of additional sensors to support different healthcare settings.
- Designed for affordability and easy deployment, *Just in Time* makes advanced patient care solutions accessible to hospitals and care facilities.

## LEE KUAN YEW TECHNOLOGY AWARD 2025 WINNING PROJECTS

**Project Title:** Sustainable Smart Mobility Aid for Visually Impaired

**Members:** Koh Si Yee (Group Leader)  
Nurul'Syafa'Ah Binte Nasir  
Lim Jie Wei  
Prithikka Divyashini  
Lim Chee Chye

**Course:** Higher Nitec in Chemical Process Technology

**College:** ITE College East

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### Heads Up!

According to a 2021 *The Straits Times* article, obstacles located above waist-level cannot be detected by canes or guide dogs. This significantly increases the risk of collision for the visually-impaired. Often, the impact leaves them with head injuries. The *Sustainable Smart Mobility Aid for Visually Impaired* was created by a team of four Chemical Process Technology students to address this issue. They hope that with this device, visually-impaired individuals become more independent with safer mobility.

Drawing inspiration from a dolphin's echolocation ability, the team attached an Arduino-powered ultrasonic sensor onto a cap. When worn, the sensor emits sound waves. Upon encountering an object, the sound waves are reflected, allowing the sensor to calculate the distance the user is from the object. The device then emits beeping sounds to alert the user of the object's distance. The team found great success with this device – their test participant was able to avoid all obstacles safely when wearing it.

### Innovators' Inspiration

*"One of our team members came across an article in The Straits Times that highlighted 94% of 300 visually-impaired respondents surveyed had experienced head injuries after colliding with an obstacle. This inspired us to design a device to help prevent such accidents. We saw it as an opportunity to apply our knowledge by integrating both process control and mechanical aspects to come up with a solution. We felt a great sense of pride and accomplishment seeing our device function effectively. It was even more rewarding when we received positive feedback from visually-impaired individuals from the Singapore Association of the Visually Handicapped – they expressed interest in purchasing it if it was available in the market!"*

- Koh Si Yee

### What's So Special?

- The device is able to help the visually-impaired detect obstacles and assess its distance by emitting distinct audio tones – fast beeps when an object is near, and slower beeps when it is further.
- The device can also help people working in environments with limited visibility 'see' better. For example, it can help firefighters operating in smoke-covered areas detect dangerous obstacles in their pathway.
- By using sound waves to mimic echolocation, the team is able to ensure that the device can identify obstacles made of a wide variety of materials. For example, infrared sensors rely on light, so they struggle to detect transparent and translucent materials, making it less reliable than sound waves in detecting such objects.
- In line with sustainability initiatives, the team used a rechargeable battery that utilises solar energy to power their device. This reduces e-waste.
- The team improved on the device's wearability by attaching the sensors to a cap. The cap is not only visually appealing, but also comfortable for the wearer. A cover protects the sensor from bumps and the elements. Reflective material at the side of the cover makes it easier for motorists, cyclists and pedestrians to spot the wearer.
- The prototype cost less than \$60 to develop. The team plans to integrate the components into a smaller circuit to reduce cost further.

## LEE KUAN YEW TECHNOLOGY AWARD 2025 WINNING PROJECTS

**Project Title:** CNN-Based IoT Transformer

**Members:** Chan Tian Ci (Group Leader)  
Lim Boon Yu  
Laetitia Lim Ruoyun

**Course:** *Higher Nitec* in Mechatronics Engineering  
*Higher Nitec* in Business Administration

**College:** ITE College West

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### Smart Meters in Disguise

In Singapore, the process of manually reading water meters for each household is tedious and labour-intensive. Meter readers are required to visit each residence to record readings by hand, making the process time-consuming and inefficient. This traditional approach not only increases manpower and operational costs but also the chances of human error.

Recognising this challenge, the team came up with an innovative solution to transform traditional water meters into IoT-enabled devices without requiring replacement or modification. By using a cost-effective, non-intrusive converter, traditional water meters can be upgraded seamlessly. The device features an in-built camera and AI-powered image processing to capture and interpret meter readings automatically. The data is then transmitted to a cloud-based dashboard for real-time monitoring and analysis, eliminating the need for manual reading and reducing manpower requirements.

### Innovators' Inspiration

*"Growing up, I learned to view every challenge as an opportunity to innovate. Just like the meter readers who diligently check each household, I realise that their work is essential yet often overlooked. With the knowledge I have gained from ITE, I am inspired to research and develop a converter that not only eases their workload but also enhances efficiency. Imagine a world where smart meters provide accurate billing, eliminating the guesswork and ensuring fairness for everyone."*

- Chan Tian Ci

### What's So Special?

- The device is an innovative and practical approach to IoT adoption in water metering.
- It provides a seamless, plug-and-play upgrade for traditional water meters, making automated data collection accessible without disrupting existing systems.
- By integrating AI, IoT, and cloud analytics, this solution not only modernises meter readings but also enhances efficiency, accessibility, and sustainability in a scalable manner.
- Unlike conventional water meters, this solution is adaptable, cost-effective, and ideal for short-term monitoring.
- The website can read out meter readings, which is especially useful for visually impaired users.

**LEE KUAN YEW TECHNOLOGY AWARD 2025  
WINNING PROJECTS**

**Project Title:** Gaming Chopstick Therapy

**Members:** Ang Teng Poh (Group Leader)  
Lai Siang Rui Jae  
Wayne Soh Kai  
Gavin Siew Kah Juen  
Elisha Lee Jia Xuan

**Course:** *Higher Nitec* in Mechatronics Engineering  
*Higher Nitec* in Service Management

**College:** ITE College West

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### **Pick-Me-Up**

Motor skills are essential for daily tasks such as drawing, writing, folding clothes, fastening a zipper and using a pair of scissors. If these motor skills are underdeveloped, individuals may struggle with basic activities, affecting their confidence and quality of life. Apart from the elderly, many individuals, including those suffering from numerous ailments, impairments, post-accident injuries, as well as children with slower motor skill development, require therapy to improve their hand movement and coordination. They are often required to attend therapy sessions at hospitals where therapists guide them to perform basic exercises, but unsupervised home therapy can be hard to track. Older patients also tend to be more resistant and unmotivated to attend therapy sessions.

To address these challenges, the team developed the *Gaming Chopsticks Therapy*, an interactive rehabilitation device that digitises and gamifies the therapy process. The chopsticks feature inertial sensors to measure different forms of movement, along with force resistive sensors to measure the force applied by user's wrist. Users use the chopsticks to play a series of simple games. The data collected will be used to help therapists personalise therapy programmes. This reduces the reliance on physical therapy sessions, supports remote monitoring and makes rehabilitation more fun and engaging.

### **Innovators' Inspiration**

*"Seeing a lack of digital solutions in physical therapy, we saw an opportunity to make a difference by applying our knowledge of sensors, microcontrollers and coding, service design principles, and stakeholder research to develop an innovative solution. While it was a steep learning curve, especially as we had to explore areas beyond our syllabus, such as creating graphical games and learning new programming languages, our class advisor guided us through the technical challenges. There were times we felt like giving up, but our passion kept us going. Through this process, we learned to be adaptable, communicate effectively and work together as a team."*

*- Ang Teng Poh*

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

- The device is lightweight and user-friendly.
- It reduces the reliance on physical therapy sessions while allowing therapists to monitor patients' progress remotely.
- The device serves to encourage patients through the aspect of gamification and the element of fun.
- This serves as a good foray into therapy device development.

## LEE KUAN YEW TECHNOLOGY AWARD 2025 WINNING PROJECTS

**Project Title:** Sustainable Smart Machine

**Members:** Samuel Tan Le Wen (Group Leader)  
Kavier See Wei Xun  
Oh Kai Wunn Clayden  
Wong Kai Kit  
Lim Yu Heng Marcus

**Course:** *Higher Nitec* in Electronics Engineering

**College:** ITE College West

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### Enhancing Technology, Advocating Sustainability

To tackle the issue of e-waste to achieve a more sustainable environment, a local small and medium-sized enterprise, METech Recycling Pte Ltd, introduced e-waste recycling smart bins, known as *SG Recycle Smart Machines*. These bins offer real-time data regarding bin fill levels, allowing for greater efficiency in waste collection and reducing unnecessary trips to check bins manually.

However, these bins rely on grid electricity and consume high power, resulting in increased carbon footprint which contradicts sustainability goals. Furthermore, deployment of the bins is limited to locations with grid electricity, restricting its scalability.

To address these issues, the team developed the *Sustainable Smart Machine*, a first-of-its-kind solar-powered e-waste recycling bin. Featuring an integrated solar power system, the bin operates independently off grid electricity, enabling deployment to more locations while significantly lowering carbon emission levels.

### Innovators' Inspiration

*"Our team collaborated with METech Recycling Pte Ltd to enhance the sustainability of their e-waste bins. We wanted to apply our engineering skills to make a real impact and create a greener world. Through this project, we drew closer as a team and had the opportunity to experience how it is like collaborating with external organisations to conduct site surveys. These experiences have better prepared us for the workforce. We hope to inspire others to stay committed to their goals and to always embrace feedback as a key to continuous improvement."*

- Samuel Tan Le Wen

### What's So Special?

- The *Sustainable Smart Machine* is designed to achieve long-term carbon neutrality by running on solar energy.
- The system itself is more environmentally friendly, reinforcing the message on sustainability. It serves as a greater encouragement on public recycling.
- The e-waste bins which were only deployable to locations with grid electricity can now be deployed in outdoor and remote areas. This increases the scalability of the service.