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Old Royalists Engineering
Professionals' Association

ROYAL CHRONICLES

The Braking System of Formula 1 cars

Fraternite '23

CyBots: the Robotics Workshop

PLUGSI

Automated Dishwashing

Hydrogen for Sustainability

Cruise Control

Field Familiarization and Mentor Training

Fun Time

Flash Hydrogen



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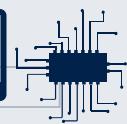
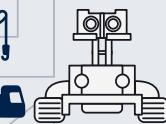
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MESSAGE FROM THE MAIN BODY PRESIDENT



Dear Esteemed Members, and Future Engineers,

It is with great honor and humility that I address you as the newly elected president of the Main Body of the Old Royalists Engineering Professionals Association. Having embarked on this journey with fresh eyes and a heart full of gratitude, I am profoundly moved by the opportunity to serve an organization that has shaped the lives and careers of so many outstanding individuals.

Studying at Royal College Colombo was a transformative experience for me, as it is for countless others. It was here that I learned the true meaning of camaraderie, surrounded by peers whose brilliance and talent inspired me daily. In the halls of Royal College, we were taught not only academic excellence but also the invaluable lessons of humility and respect. In a community where everyone excels in their own unique way, there is no room for arrogance, only admiration for each other's strengths.

As engineering professionals who have emerged from the halls of Royal College, we carry with us a deep sense of responsibility to our alma mater and to society at large. It is our privilege and our duty to give back, to honor the legacy of those who came before us by paving the way for those who will follow.

To all the engineering undergraduates, I extend my warmest wishes and heartfelt encouragement. As you embark on your journey towards becoming engineers, remember that your education is not just about technical proficiency, but also about the values you uphold and the impact you make on the world around you. May you strive for excellence in all your endeavors, guided by the principles of integrity, innovation, and service to humanity.

In closing, let us reaffirm our commitment to excellence, unity, and service—a commitment that defines not only our association but also our shared legacy as Old Royalists. Together, let us continue to inspire, to innovate, and to make a difference in the world.

With warm regards,

Lahiru Wijerathna,
CEO - Modern Pack Lanka (Pvt) Ltd
(A CBL-Affiliated Company)
President,
Main Body
Old Royalists Engineering Professionals' Association

MESSAGE FROM THE STUDENT CHAPTER PRESIDENT



Dear Fellow Members,

It is with great honor that I address you in this, our annual magazine. As we reflect on another year, I am filled with immense satisfaction for the accomplishments of our esteemed association.

The Old Royalists Engineering Professional's Association has consistently served as a pillar of excellence, fostering camaraderie and professional growth among our members. We have hosted insightful lectures, organized industry visits and gatherings, and provided invaluable mentorship opportunities for our members.

Looking ahead, we are brimming with exciting plans for the coming year. We aim to further develop the connection between the OREPA Student Chapter and the Main Body along with increasing the engagement of the A/L science section students.

I encourage all of you to actively participate in our upcoming events and leverage the vast network our association offers. Together, let us continue to uphold the legacy of excellence and make the Old Royalists Engineering Professionals Association a beacon of innovation and collaboration whilst serving our alma mater.

With warm regards,

Jeewaka Aponso,
President,
Student Chapter,
Old Royalists Engineering Professionals' Association



EDITOR'S NOTE



It gives me immense pleasure to welcome you to another edition of the annual newsletter of the Old Royalists Engineering Professionals' Association. This annual tradition is an opportunity to unite and commemorate the achievements, experiences, and endeavors that link us as prestigious Old Royalists.

This year has been a year of continuous flourishing of our association, a testament to the dedication and exemplary competence of our engineering professionals and undergraduates. The features contained herein are a reflection of the excellence that defines our community, spanning the horizons of pioneering projects, research initiatives, and the inspiring journeys undertaken.

Despite countless challenges, the indomitable spirit of the Old Royalists Engineering Professionals' Association has remained steadfast. It is through our collaborative efforts that we have contributed to our alma mater, society, and the engineering realm as a whole.

As you peruse the contents of this newsletter, you will encounter a rich tapestry of diverse and engaging articles that capture the essence of our association. It is our aspiration that these articles inspire and invigorate all our readers.

My thanks are due to the Executive Board of the Old Royalists Engineering Professionals' Association Student Chapter for their collective efforts in continuing the legacy. I would like to extend my heartfelt gratitude to all our contributors, whose willingness to share their knowledge and experiences has breathed life into this newsletter. Your commitment is wholeheartedly appreciated.

We anticipate yet another year of growth, synergistic collaboration, and notable achievements. As we advance on our journey, let us ensure that the connections established during our years at Royal College continue to endure and flourish.

I hope you enjoy reading this year's newsletter. In the spirit of brotherhood and shared aspirations, we look forward to the opportunities and challenges that lie ahead.

I wish each of you the very best in your personal and professional endeavours!

Warm regards,

Kavin Siriwardana (Editor),
Faculty of Engineering,
University of Moratuwa



THE BRAKING SYSTEM OF A FORMULA ONE CAR

Written by

Sujith Perera

Second Year Undergraduate
Department of Electrical Engineering
-University of Moratuwa-

Why is braking so important, and how does it work?

Braking is a crucial process in a Formula One car. If the driver is unable to slow down the car to the required speed in a corner, factors like taking the right racing line, carrying optimum speed through the corner, and getting the required power at the exit of the corner are affected. These factors have a great impact on the diver's lap time.

Similar to road cars, Formula One cars also apply brakes to all four tyres. There are two master cylinders connected to the brake pedal in a Formula One car. One cylinder is for the front braking system. Like a normal car, fluid pressure is delivered to the brake calipers in the front tyres. Those calipers apply force to the brake disk using six pistons. The second master cylinder is connected to a pressure sensor to transmit pressure to the rear brakes. There are 3 ways to decelerate the rear tyres in a Formula One car. That is, by engine braking, electrical braking, and the friction generated by brakes. Due to these three systems, the rear braking process is much more complex than front braking.



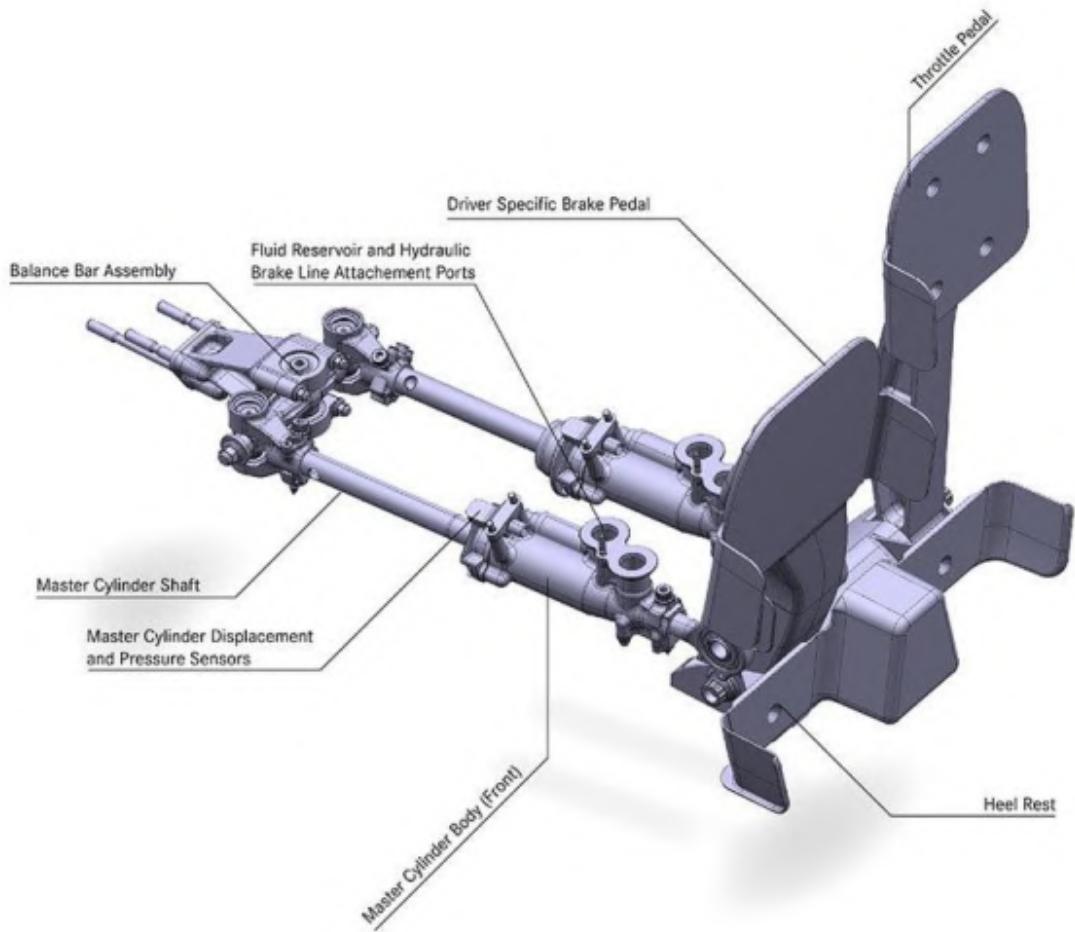
Why rear braking is so complex

As mentioned earlier, there are three ways to decelerate the rear wheels of the car. Engine braking means slowing the speed of the car by applying resistance from the spinning engine. Electrical braking means generating electrical energy by the MGU-K (Motor Generator Unit - Kinetic). For an optimal braking scenario, coordination between all three systems is crucial.



The driver can adjust these parameters using the steering wheel according to his requirements. When the driver presses the brake pedal, the fluid pressure is converted to an electrical signal by the fluid pressure sensor in the second master cylinder. Then, the signal is sent to the ECU (Electronic Control Unit). The ECU is in charge of controlling the gearbox, engine, brake system, energy recovery system, etc. Then the ECU issues commands to brake the rear of the car. When the driver presses the brake pedal hard, more signals are issued by the ECU to the brake calipers, engine braking system, and electronic braking system in order to decelerate the car rapidly.

During a race, determining when to apply brakes depends on factors like the amount of fuel load in the car, the state of the tyres, the type of tyre bolted to the car (3 compounds: soft, medium, and hard), the level of tyre management the driver is currently doing, etc. With time, fuel is burned and the car becomes lighter, so the force needed to stop the car becomes less. As a result of this, the driver needs to adjust the brake point accordingly (brake point – the place in the track where the driver starts to apply brakes).



Why maintaining temperature in optimal condition is so crucial

Brake disks are made of carbon. During a lap, these disks can heat up to 1000 °C or more. If the heat persists in the brake disk for a long time, it can lead to issues with the braking system.

There are cooling inlets mounted to the brakes of the car to reduce the temperature by allowing air to flow through the brake disk and calipers. This process mainly happens when the car travels in a straight line. To cool the disk efficiently, there are about 1000 holes drilled in the brake disk. This increases the surface area of the disk, so more heat is lost from the surface. On the other hand, if the temperature of the brakes drops too much, drivers can't get the required deceleration. So it is crucial to maintain the right temperature.

What is a lock-up?

Lock-ups happen when too much force is applied to the brakes, causing the disc to stop or rotate slower than the car's motion. This is a common incident in Formula One. Due to that, the tyre scrubs the surface of the racetrack, and most of the time it generates smoke. Due to the aerodynamics used in Formula One car, it generates a lot of downforce when traveling at higher speeds. When the downforce is increased, there is more grip in the car due to increased frictional force. So decelerating a car running at higher speeds is easier than running at lower speeds.



CYBOTS: THE ROBOTICS WORKSHOP FOR BUDDING ROYALISTS

Written by



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Mihiran Wickramaratne

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Understanding robotics is crucial for the youth because it equips them with essential skills they would need for the industry. By familiarizing themselves with robotics at a young age, youths are better prepared to navigate an increasingly digital world and pursue opportunities in fields like engineering, computer science, advanced manufacturing.

It shapes the learner's mind to think in a logical way. Therefore Cybots was started with introducing the programming concepts to participants. Python was the main language taught in this workshop series.

Essentially, learning robotics empowers youngsters to adapt to technological advancements and become active contributors to future innovation and progress.

This was the thought process behind CyBots: the robotics workshop organized for young Royalists by the Student Chapter of OREPA. This is organized for pupils aged from 13 to 17 years. This year's edition was an utmost success.

The project mainly consisted of 3 main stages. They are as follows.

1. Programming Fundamentals
2. Microcontrollers
3. Final Project

Programming Fundamentals Stage

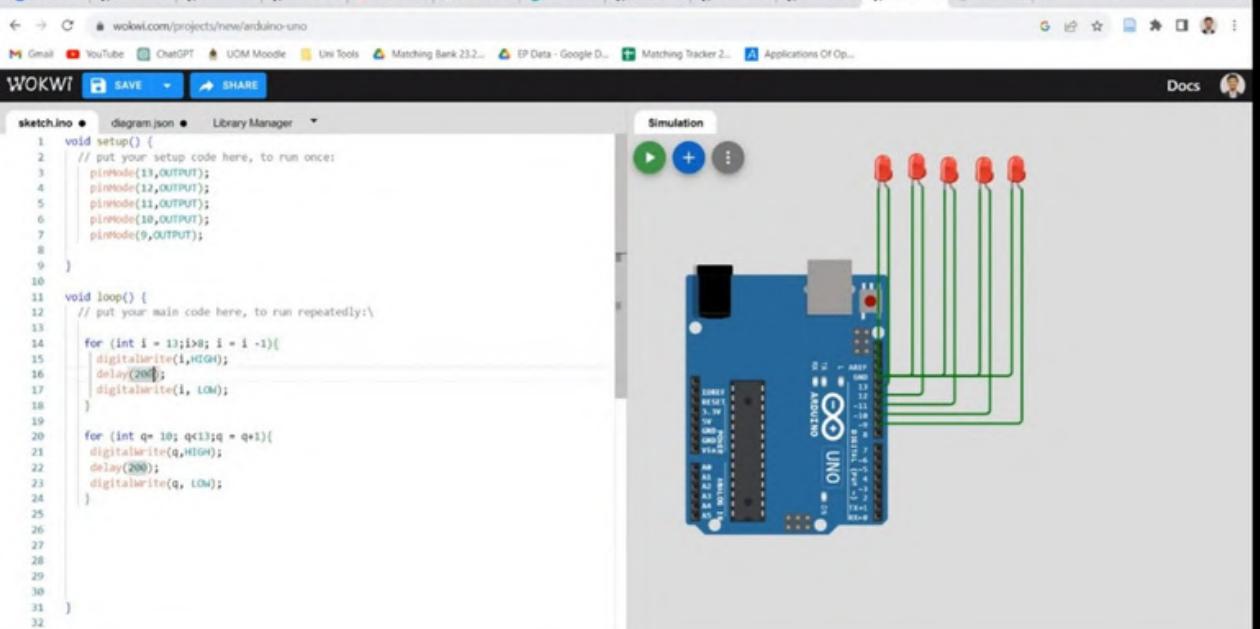
Programming is an initial step in engineering, and also a cornerstone when it comes to Robotics.

Microcontrollers Stage

Microcontrollers play a crucial role when it comes to modern robotics. And it is the stepping stone to the robotics world. We were able to introduce the participants to this vivid world through an online lecture series which was mainly focused on hands-on experience. Arduino was the main topic we covered here. Participants were introduced to various varieties of sensors and actuators and how to integrate them with the Arduino platform. Then they were given some real-world problems that could be solved using these concepts.

Final Project

This was the stage where participants got the chance to showcase their skills that were gathered through the workshop series of Cybots. Participants were given a task to solve a real-world problem using a microcontroller. We decided to make this with very less constraints thus letting their imagination run wild. And the outcomes were far beyond what we expected. The projects that were done by these individual bright minds are given below.



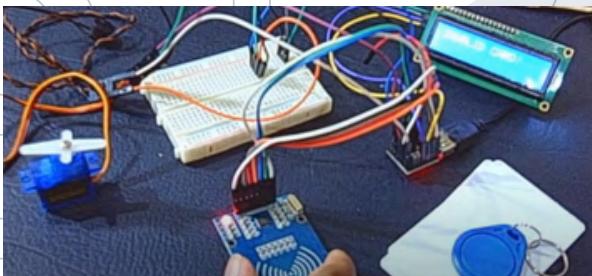
Photos of some projects done by the participants of CyBots are depicted below.



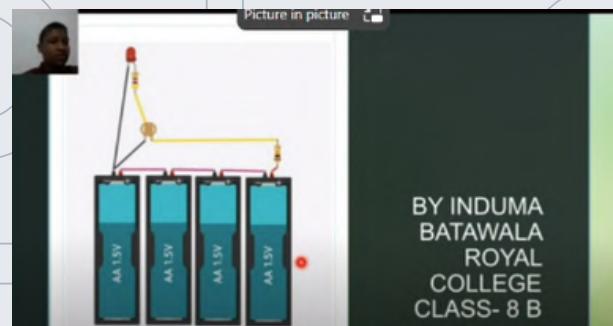
Fish Feeder



Arduino Obstacle Avoiding Jeep



Building Access System



Circuit using LDR

The team of OREPA members behind the success of CyBots:



Anjana
Wickramaarachchi
(Event Lead)



Anujaya Vidmal
(PR Lead)



Tharindu Perera
(Resource Person -
Microcontrollers
Stage)



Chamikara
Siriwardana
(Resource Person -
Microcontrollers
Stage)



Thusith
Wijewardena
(Resource Person -
Programming
Fundamentals
Stage)



Akindu Kalhan
(Resource Person -
Programming
Fundamentals
Stage)



Anjana Viduranga
(Resource Person -
Programming
Fundamentals
Stage)



FULLY AUTOMATED DISHWASHING SYSTEM



Written by

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In modern industries, automation and robotics have ushered in a new era of efficiency and precision, revolutionizing sectors like automotive and electrical engineering. However, the implementation of these technologies in the food industry has been somewhat limited, primarily due to the challenges posed by unstructured environments and diverse handling needs.

While the concept of dishwashers dates back to the late 19th century, fully automating dishwashing processes has proven to be a complex endeavor. Addressing this gap, researchers and engineers have embarked on a journey to develop a comprehensive robotic dishwasher system that promises to redefine cleanliness and efficiency in both domestic and industrial settings.

At the heart of this groundbreaking initiative lies the integration of three key components: automated dish retrieval and placement, an efficient washing mechanism within a dedicated chamber, and automated dish placement in racks. These components work in harmony, leveraging sophisticated technologies such as image processing, machine learning, and robotic manipulation to streamline the dishwashing process and achieve superior cleaning outcomes.

Automated Dish Retrieval and Placement: Precision through Image Processing

The first component of the robotic dishwasher system focuses on automating the retrieval and placement of dishes, a task traditionally performed manually. Leveraging advanced processing techniques, strategically positioned cameras capture images of the dishes and their surroundings, providing crucial visual information to the robotic system.

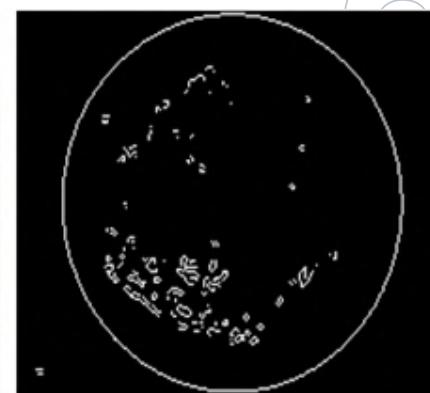
Real-time image processing algorithms analyze these images, enabling the robot to identify, categorize, and locate dishes with remarkable precision.



Origin

Key concepts in image processing for robotic dishwashing systems include image capture, object recognition, image processing algorithms, quantitative image analysis, and dishwashing quality assessment.

Cameras, whether 2D or 3D, serve as the robot's eyes, capturing detailed images of the dishes and their spatial arrangement. Object recognition algorithms, powered by neural networks like AlexNet, enable the robot to identify various objects, including plates, in the captured images. Image processing algorithms extract valuable information from these images, while quantitative analysis provides specific metrics about detected dishes, such as dimensions and spatial locations. Dishwashing quality assessment, facilitated by edge detection methods, ensures that dishes are thoroughly cleaned before being placed in designated racks.

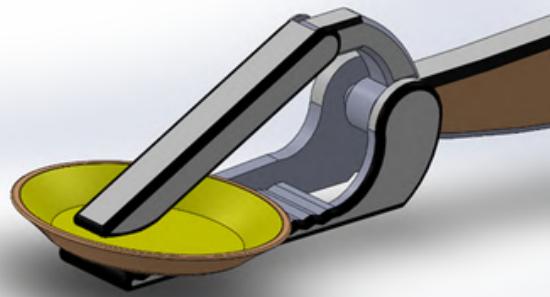


Articulated Robotic Arm: Precision in Motion

The second component of the robotic dishwasher system revolves around the articulated robotic arm, a sophisticated tool designed to handle dishes with precision and efficiency. Featuring three joints and an underactuated robotic hand, the robotic arm demonstrates significant reach within a 1.5-meter radius, allowing it to cover a wide range of dish placements within the dishwasher. High-torque electric motors power the arm, ensuring smooth and controlled movements essential for loading and unloading tasks.



The hardware design of the robotic arm is meticulously crafted using 3D printing technology and PLA filament, prioritizing lightweight yet sturdy construction. Computational programming orchestrates the arm's movements based on data obtained from image processing, enabling the robot to grasp and manipulate dishes with unparalleled accuracy. The underactuated robotic hand further enhances efficiency, featuring versatile grasping capabilities and efficient manipulation of stacked dishes. Its cost-effective design minimizes complexity, making it a practical solution for dishwashing applications.

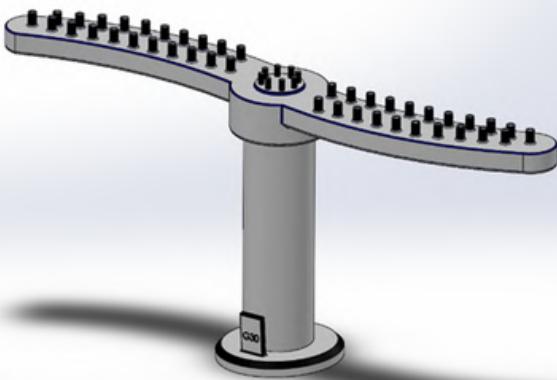


Cleaning Mechanism: Precision and Efficiency in Action

The third component of the robotic dishwasher system focuses on the cleaning mechanism within the dedicated chamber, where dishes undergo thorough cleaning before being placed in racks. Automation plays a central role in optimizing the cleaning process, with an automated loading mechanism introducing dishes into the cleaning chamber via a conveyor belt equipped with molded dish-holding structures. Sensors strategically placed along the belt ensure precise alignment of the dishes for efficient cleaning.

Water management is meticulously orchestrated to achieve effective cleaning, with a controlled release through an inlet valve directing the water into a tray at the chamber's bottom. A pump unit circulates water and cleaning agents, while a heater maintains optimal temperature. A sophisticated spray system channels water to upper and lower rotors, ensuring comprehensive coverage and spotless dishes.

A user-friendly control panel provides real-time information on detergent and water levels, enhancing operational awareness and facilitating proactive maintenance.



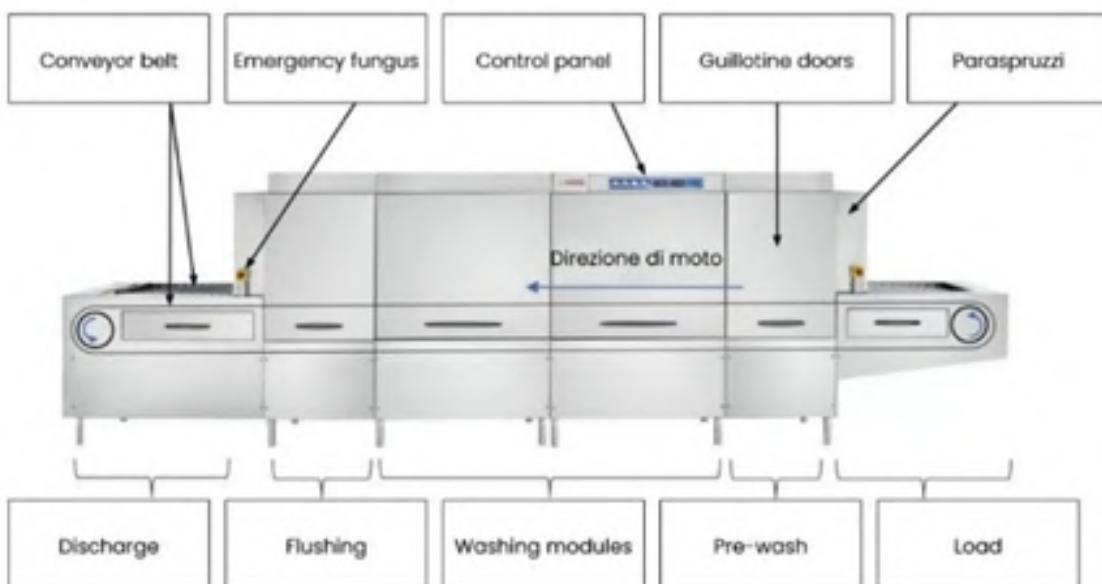
By integrating advanced technologies such as image processing, machine learning, and robotic manipulation, this innovative system promises meticulous and efficient cleaning, setting new standards in cleanliness and efficiency. Moving beyond traditional dishwashing models, this research paves the way for a future where intelligent systems seamlessly integrate into everyday tasks, promoting sustainability and efficacy in both domestic and industrial settings.

Upon cleaning completion, the conveyor belt resumes, ensuring continuous and efficient operation of the dishwashing system. This automated sequence epitomizes the system's commitment to streamlining dishwashing workflows, ensuring superior cleaning outcomes while prioritizing user convenience and operational efficiency.

With precision, efficiency, and innovation at its core, the robotic dishwasher system redefines the dishwashing experience, offering a glimpse into the future of automation in the food industry.

Transforming Dishwashing for the Future

In conclusion, the development of a comprehensive robotic dishwasher system represents a significant leap forward in automated dishwashing technology.





CRUIISING THROUGH CRUISE CONTROL: THE STORY OF AN UNFINISHED CRUISE



Written by

Kavin Siriwardana

Second Year Undergraduate
Department of Mechanical Engineering
-University of Moratuwa-

Since its inception, cruise control has come a long way traversing decades of innovation and refinement. It has not only transformed the way people drive but has also contributed significantly to improving the overall driving experience. Through this read, let us dive into vehicle cruise control while also looking into the impact of artificial intelligence and the roadmap toward fully autonomous driving.

What is Cruise Control?

In simple terms, cruise control is a feature that allows drivers to set and maintain a consistent speed without adjusting the accelerator or brake pedals.

It is helpful on lengthy highway trips since it takes over the speed control, allowing drivers to concentrate on steering. Furthermore, cruise control improves overall safety by maintaining constant speeds. By enhancing engine performance and providing a smoother and more cost-effective ride compared to manual speed variations, it also helps to improve fuel economy. In essence, it combines convenience and technological innovation to enhance the driving experience.



How does it work?

The mechanism of cruise control regulates the throttle of the car to sustain the current speed of the vehicle.

In more traditional mechanical configurations, the throttle valve is engaged through a cable attached to an actuator, which controls the engine's power output to maintain the desired speed. However, cruise control is totally electronic in more recent vehicles with drive-by-wire throttle bodies, providing a more accurate and adaptable system. The system allows to decelerate or accelerate as required to attain or maintain the desired speed. The driver must first turn on cruise control before choosing the desired speed. Yet, the driver has complete control over the vehicle as cruise control can be deactivated by pressing the brake or clutch pedal, or by using the button designated for deactivating it.

What are the Different Types of Cruise Control?

Let us now take a look at the different types of cruise control systems available.

Conventional Cruise Control

Conventional cruise control, as previously explained, is the standard mode of cruise control. It allows the driver to establish and maintain a predetermined speed for their vehicle.

Speed Limiter

When compared to conventional cruise control, a speed limiter still needs you to keep your foot on the accelerator. What it does is it prevents you from exceeding a predefined speed limit.

Adaptive Cruise Control (ACC)

Adaptive Cruise Control or ACC provides a more intelligent alternative to conventional cruise control as drivers can choose not just their preferred speed but also the distance they want to keep between their car and the one in front of it. When ACC is engaged, the car moves at a preset speed while using sensors to keep track of the speed of the car in front of it.

ACC will automatically drop the vehicle's speed to match that of the preceding vehicle if it is moving at a slower speed. Nevertheless, if the car in front accelerates faster than the speed you have selected for ACC or changes lanes, your car will keep going at the preset speed.

Semi-Autonomous Cruise Control

While semi-autonomous cruise control resembles adaptive cruise control in certain ways, it adds a new layer of innovation providing lane guidance and steering capabilities. There are several variants of semi-autonomous cruise control, each designed to provide the driver with more functions. In terms of lane guidance, it assists the driver in staying within the lane. This implies that the car can make little steering adjustments to assist it in staying in its lane. Moreover, additional features such as the ability to navigate highway interchanges, adaptive speed control depending on traffic signals, and even automatic lane changes can be available with semi-autonomous cruise control.



A Timeline of Cruise Control

1940s: The Inaugural Notion

In the 1940s, Ralph Teetor, a brilliant inventor who was blind, had a groundbreaking idea. Teetor imagined an automatic speed control system that would maintain a constant speed independent of external distractions since he was frustrated by his friends' chaotic driving habits. What we currently know as cruise control was sparked by his speculations.



1950s: Patenting the Future

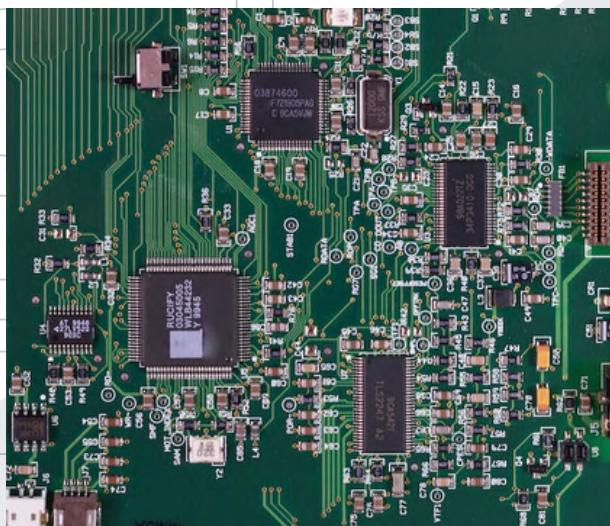
When Ralph Teetor obtained a patent for the first car speed control mechanism in 1950, his goal came true. This significant accomplishment served as the starting point for cruise control's long evolutionary journey.

1958: Chrysler's Pioneering "Auto-Pilot"

In 1958, Chrysler made history in the automobile industry by introducing the first commercially successful cruise control system, termed "Auto-Pilot." Although mechanical in nature, this technology used a servo mechanism to regulate the vehicle's throttle, signaling the beginning of automatic speed control.

1970s-1980s: The Electronic Metamorphosis

The cruise control industry underwent a transformation during the 1970s and 1980s. Electronic components replaced mechanical components. These technologies showcased unparalleled proficiency in controlling the throttle and brakes, improving driver safety and reliability.



Late 1990s: The Advent of Adaptive Cruise Control (ACC)

The advent of adaptive cruise control (ACC) in the late 1990s was a crucial turning point. This development smoothly integrated radar and sensor technology to monitor how close the car in front is. The capacity of ACC to calibrate the vehicle's speed for a secure following distance completely changed the landscape of automobile convenience and safety.



Early 21st Century: Semi-Autonomous Realities

Early in the twenty-first century, cruise control underwent a transformation as certain autonomous characteristics were embedded during this time. Together with adaptive cruise control, systems like lane-keeping assistance played a crucial part. The combination of these technologies reduced the stress on the driver by enabling lane-keeping and constant speed, which led to a paradigm change in driving dynamics.

The Rise of Artificial Intelligence

The destiny of cruise control systems was fundamentally changed with the inception of artificial intelligence and machine learning. These cutting-edge technologies paved the path for a previously unheard-of potential to adapt to a wide range of driving conditions. A seamless integration of adaptive cruise control, automatic lane changes, and highway interchange navigation was implemented with the development of smart cruise control, which was exemplified by Tesla's "Autopilot" system.



The Roadmap to Fully Autonomous Vehicles

Automobile companies are now on a journey toward completely autonomous vehicles. Self-driving technology is being developed by vehicle manufacturers to completely eliminate the need for human involvement.

While there are still technological, safety, and legal obstacles to be overcome, the possibilities of a future in which we may travel while unwinding are becoming more and more real.

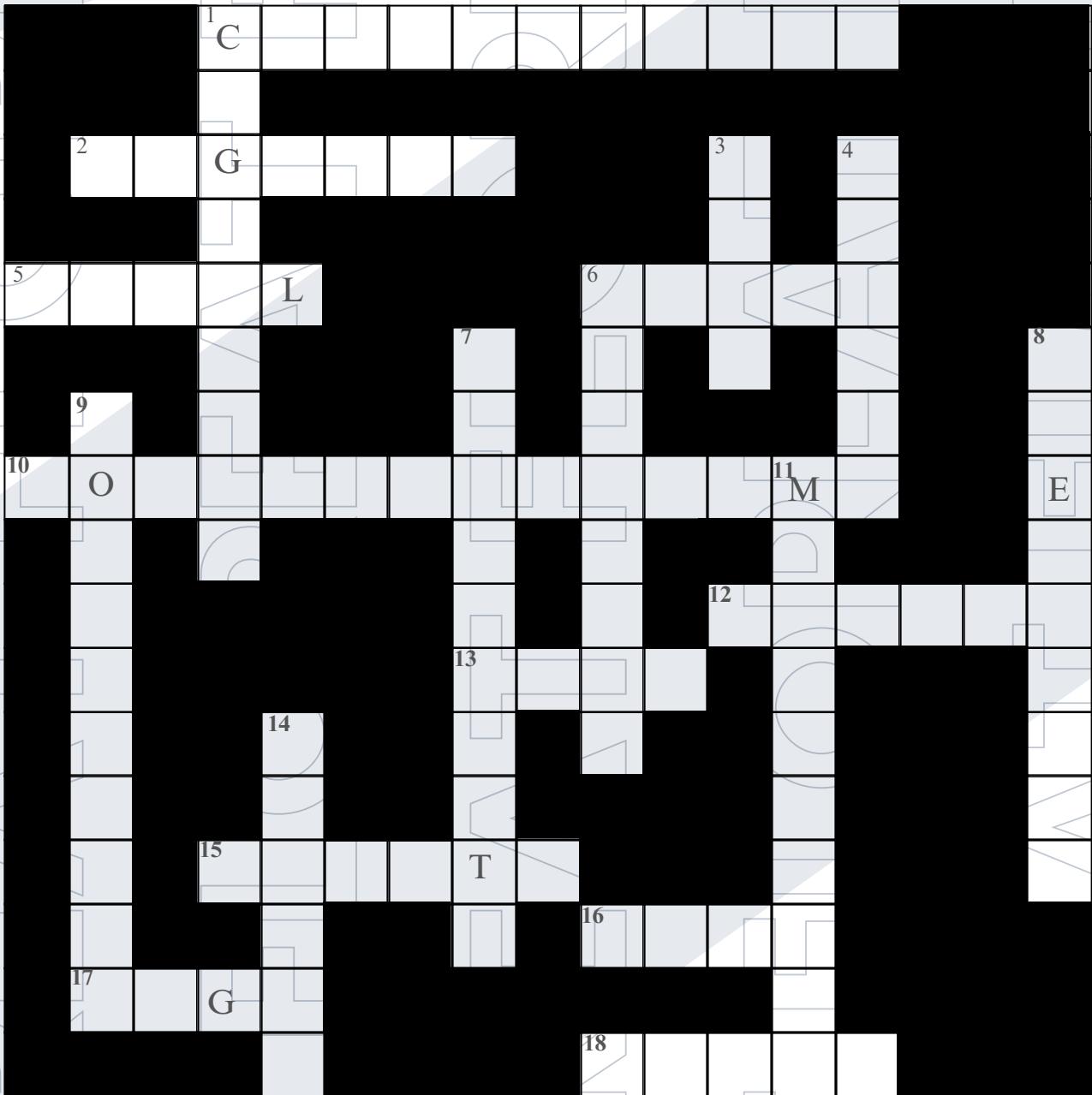


The Bottomline

The development of cruise control has been astonishing. Today, cruise control is not just a useful tool but also a key component of a car. Of course, we may anticipate a lot more advancements in the field of car automation as technology develops, which will make our road trips safer, cozier, and more convenient than before. A cruise-tastic future awaits!

Fun Time

Here's a crossword puzzle for you to solve. Enjoy!



Across

1. The first name of the director of the science fiction action thriller movie ‘Tenet’
2. The Royal Thomian Rowing began in 1962
5. Gustave Eiffel was an engineer who specialized in this field
6. A Serbian-American inventor, electrical engineer, and mechanical engineer who was awarded about 300 patents for his inventions
10. Before 1881, Royal College was called by this name.
12. An machine is a famous encryption machine used by the Germans during WWII to transmit coded messages
13. The last name of the principal of Royal College who penned the school song
15. This is the name of the robotics workshop conducted by the OREPA Student Chapter to Royalists.
16. Royal College marked 100 years at Avenue
17. The musical festival which is being organized by Royal College since 2004
18. The last name of the founding headmaster of Royal College

Down

1. This US-based startup made an announcement of the world’s first fully autonomous AI software engineer
3. The US government agency that is responsible for science and technology related to air and space
4. is the annual rugby encounter between Royal College, Colombo, and Trinity College, Kandy
6. The Battle of the Blues is second only to this cricket encounter in terms of longest-running cricket encounters in the world
7. This is the name of the annual get-together of OREPA
8. The movie in which a computer hacker learns from mysterious rebels about the true nature of his reality
9. The main entrances of Royal College are called thus
11. The name of the project organized by the OREPA Student Chapter aimed at the A/L students of Royal College for academic guidance
14. The annual Royal Thomian water polo encounter is played for this trophy



FRATERNITE '23

A NIGHT LIKE NO OTHER



Written by
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Department of Chemical and
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-University of Moratuwa-

Fraternite '23, the annual gathering of the Old Royalists Engineering Professionals' Association, took place on October 27th.

This event serves as a vital platform for Royalists to come together, fostering connections between freshmen and senior engineering Royalists. The aim is to facilitate the sharing of experiences and information, ultimately forging bonds that may lead to future career opportunities.



Recognizing the limitations of formal events in nurturing genuine connections, OREPA introduced Fraternite as a groundbreaking initiative within the engineering community. It marked a significant departure from traditional gatherings and set the precedent for similar events in other schools.



Set against the stunning backdrop of Mount Breeze Hotel in Mount Lavinia, Fraternite'23 offered attendees a picturesque view of the sea and sands. Despite a slight drizzle, the weather remained nearly perfect, adding to the charm of the evening.

Members of the OREPA Student Chapter from universities across the island came together for the event, accompanied by DJ Arosh, whose music kept everyone grooving throughout the night. Further, members of the OREPA Main Body joined the vibe. This was good for the undergraduates as they could have informal discussions with the engineers in the field and forge new connections.

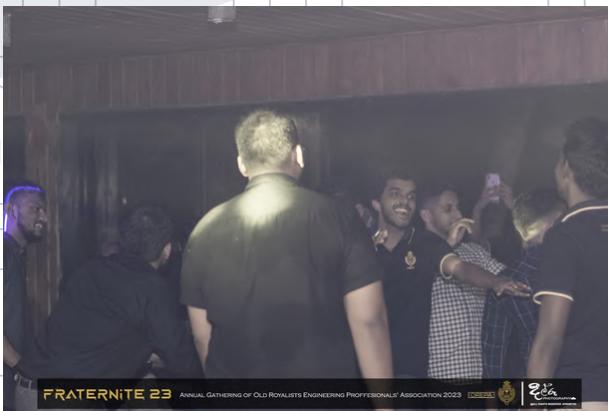


The evening was filled with laughter and camaraderie as attendees engaged in lively party games, making lasting memories.

Guests savored the delectable cuisine and beverages provided by the organizing committee. The dance floor was alive with energy as members danced enthusiastically to enthralling beats.



Organizing an event of this scale in challenging times was no small feat, but thanks to the dedication of the OREPA Executive Board, it was executed seamlessly. The organizing committee worked tirelessly, ensuring that every detail was taken care of, while still enjoying the process.



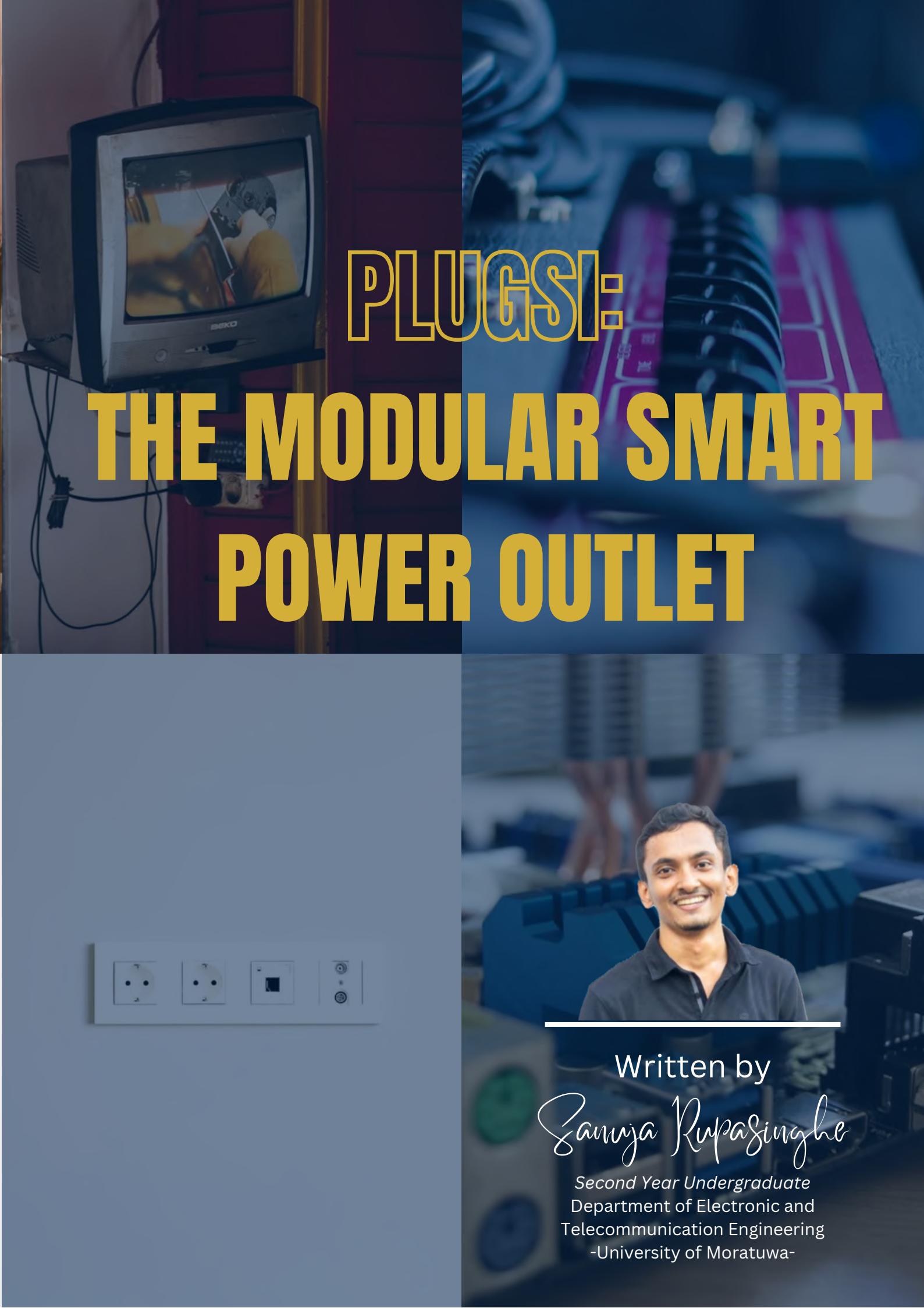
FRATERNITE 23 ANNUAL GATHERING OF OLD ROYALISTS ENGINEERING PROFESSIONALS' ASSOCIATION 2023



Looking back on Fraternite'23, it is evident that the event achieved its objectives, serving as a testament to the strength and unity of the OREPA community.



FRATERNITE 23 ANNUAL GATHERING OF OLD ROYALISTS ENGINEERING PROFESSIONALS' ASSOCIATION 2023



PLUGS!: THE MODULAR SMART POWER OUTLET



Written by

Samanya Rupasinghe

Second Year Undergraduate
Department of Electronic and
Telecommunication Engineering
-University of Moratuwa-

To begin with, PLUGSi is basically a revolutionary idea that can revolutionize the way we think about power outlets.

Introduction - Who We Are

We are 4 undergraduates from the Electronic and Telecommunication Department of the University of Moratuwa. For our Electronic Design Project module, We proposed this idea and implemented it.

Philosophy - Modularity

Modularity is a philosophy that is not used in the current smart power outlet industry. This is where PLUGSi comes in handy.

You may see a cube-looking thing called a "smart power outlet" (which is indeed smart) containing everything inside it (Maybe Alexa, Google Home, timers, Bluetooth Controllers, Wi-Fi controllers) to control a few things including your table lamp, AC, and so on. Some are product-specific, and some give additional functionality that you'll never use but you have already paid extra money for it.

Use Case

Assume that you are a smart plug user and one day, your girlfriend comes to your house. She wants to control the light that is plugged into your smart plug only using Bluetooth. What if your Smart plug does not support that functionality? You have a few options. Change your girlfriend 😅 (be careful) or buy a new smart plug that has Bluetooth support 💰 (maybe somewhat expensive).

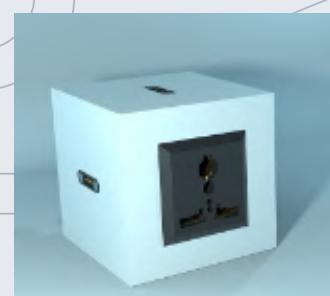
But with PLUGSi, you have to do neither, because we are giving you another option.

Functionality - Base, Modules, and Apps

PLUGSi consists of 2 main parts: the Base and Modules. (Timer module, Wireless module, Wi-Fi modules, Bluetooth modules, IoT-based modules, Alexa modules, reprogrammable modules, etc.)

You can plug modules over the base and modules over other modules; it's your choice. Modules are the ones that add functionalities to the base. Users can attach, detach, and reattach the modules as they wish. The other option is when you already have a PLUGSi base. Then you can just buy a Bluetooth module. You can save both your money and your girlfriend!

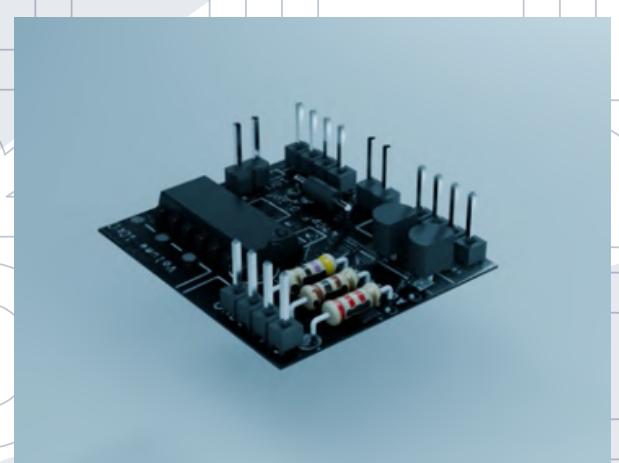
We made a prototype (MVP) for demonstration



Base

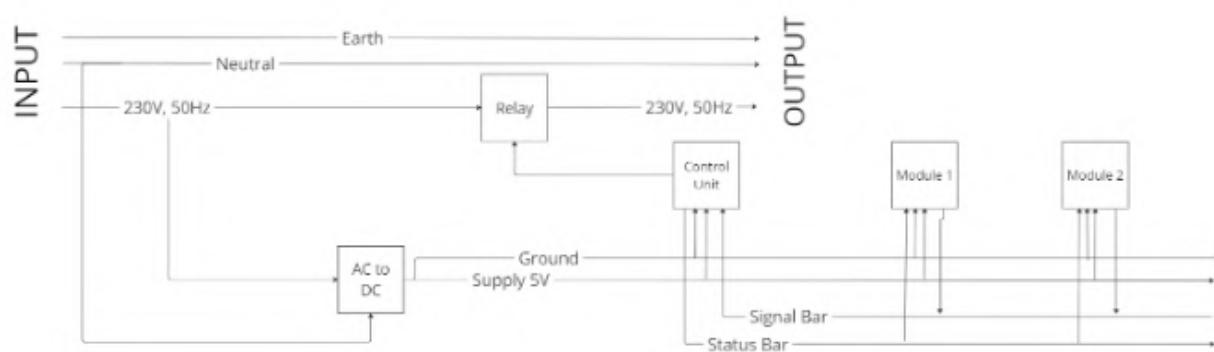


IoT Module



Base PCB

Architecture of the product



About Modules

For the Bluetooth module, we will provide the users with a Bluetooth app from Play Store.

For the IoT module, we will provide the users with a web dashboard, and an app that gives a brand-new user experience, (a Digital Twin) by allowing them to experience a Virtual Representation of the IoT module with Augmented Reality.

We have also made timer modules with a 5-minute fixed timer and an adjustable one.

For the IoT part, we are using the standard communication protocol MQTT which is used in the IoT industry. We made a pulse communication protocol that communicates between the Base and Modules from scratch.

For whom did we make it?

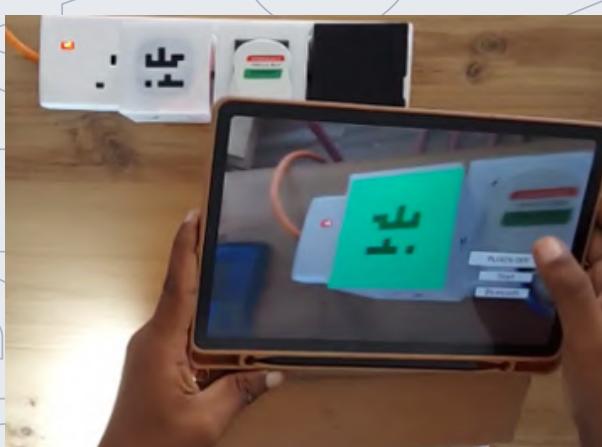
Current smart plugs focus only on smart home systems and automation. Of course, that is one of our targets.

We will give a safe environment to the DIY community; so that they can develop over our PLUGSi.

You may have seen that there are hundreds of thousands of Videos on YouTube that teach how to use Arduino-related items, relays, and so on to make your home smart. If you are a parent, you may not allow your child to do those due to safety concerns. Needless to say, the child would have to work with an AC line which requires proper guidance.

But with PLUGSi, we are providing a fully functioning Base. There is no need to worry about the AC line; even a 5-year-old can build and automate their house by buying a Base and Reprogrammable Module. We will provide them with a simple IDE; so that they can drag and drop the functions, program that module safely, and do anything they like.

Further, 3rd parties will be able to make modules and then they can be a part of the PLUGSi ecosystem.



For the IoT App (This is not the end product. This is just for the prototyping.)

Our achievements

- Finalists - INSL Sri Lanka Business Stage 2024
- Semi-Finalists - SLIoT Challenge 2023

Conclusion

To achieve infinite modularity, simplicity, unlimited customizability, and adaptability there is no way other than PLUGSi.

Our Team



Mihiran

Sanuja

Dinuka

Danidu

This is our team consisting of 4 innovative OREPA members



HYDROGEN FOR SUSTAINABILITY



*Written by
Hasindu Warnapura*

*First Year Undergraduate
Department of Chemical and
Process Engineering
-University of Moratuwa-*

Sustainability in Today's World

"Sustainability" has become one of the hottest topics in today's rapidly changing world. With its widespread use, there's no need for big explanations.

Sustainability is defined as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs.'

-the [United Nations Brundtland Commission](#)

In the process of achieving sustainability, we can see that countries pay keen attention to "Hydrogen".

But Why? Let me explain it.

How to produce Hydrogen?

According to the way we produce hydrogen, Hydrogen is classified as Gray Hydrogen, Blue Hydrogen, and Green Hydrogen.

1. Gray Hydrogen

- **Production method** - Steam reforming of natural gas(CH₄) with high-temperature steam(H₂O). In this process, Methane(CH₄) will break down into H₂, CO and CO₂. Further steps separate the hydrogen gas. This is the most commercially viable production method in the present world.
- **Carbon emissions** - High emissions of CO₂, a major greenhouse gas contributing to climate change.

2. Blue Hydrogen

- **Production method** - Similar to gray hydrogen, using steam reforming of natural gas. However, carbon capture and storage technology is used to capture the CO₂ and reduce carbon emissions during the process.
- **Carbon emissions** - Lower emissions than in gray hydrogen production. But not entirely neutral since some CO₂ leakages can occur during the process.



3. Green Hydrogen

- Production method** - Electrolysing the water using electricity from renewable sources like solar, wind, etc. This process splits water molecules into H₂ and O₂.
- Carbon emissions** - Since there is no usage of any carbon content from energy source to production, carbon emission is zero.

According to these production processes, it is clear that Green Hydrogen is the ideal zero carbon emission strategy. Therefore if we are concerned about zero carbon emission, Green Hydrogen is the best way.

But, why do we have to produce Green Hydrogen rather than using renewable energy directly?

Though directly using renewable energy should be prioritized, there are some limitations in using it. Here are some key reasons to produce green hydrogen.

Limitations in electrifying sectors

Industries like steel manufacturing, heavy freight transportation, and long-haul aviation face challenges in being directly powered by electricity due to technical or practical limitations. Actually, Green Hydrogen is considered a clean energy carrier; which means it stores and transports energy from where it's produced to where it's used. Therefore Green Hydrogen, used in fuel cells or converted to synthetic fuels offers ways to use clean energy without barriers.

Versatility

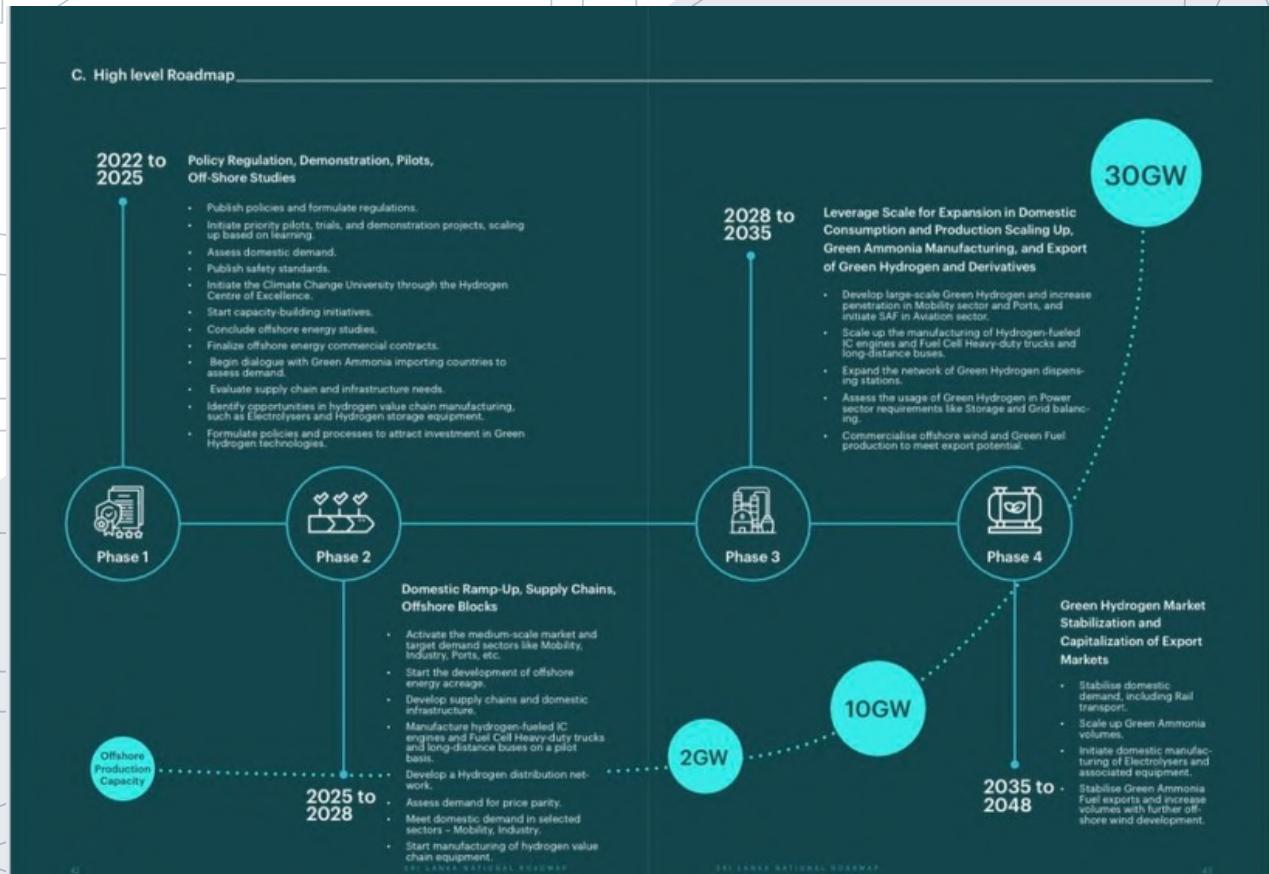
Green Hydrogen can be used for various purposes beyond just fuel, industrial processes, and chemical production.

Grid Balancing

Storing renewable energy such as hydrogen can help balance the grid, smoothing out fluctuations in energy production and demand. Most of the time, renewable energy sources like wind and solar production depend on weather conditions. However, storing renewable energy as green hydrogen ensures a reliable energy supply.



Ultimately, it is very clear that Green Hydrogen is so important to achieve the target of zero carbon emission and that is why most of the countries introduce their strategic roadmap towards the Green Hydrogen Economy. Though Green hydrogen is so expensive at present, we have high hopes that it will become affordable as technology matures and infrastructure develops in this rapidly changing world.



FIELD FAMILIARIZATION AND MIND GUIDES MENTOR TRAINING PROGRAM

Written by

Saranya Mafshan

Second Year Undergraduate
Department of Electrical Engineering
-University of Moratuwa-

The OREPA Field Familiarization and Mind Guides Mentor Training Program 2023, organized by the OREPA Student Chapter, took place on September 21st, 2023, at the University of Moratuwa premises, targeting first-year engineering undergraduates from Royal College.

The primary aim of the field familiarization program was to provide participants with insights into various engineering disciplines, enabling them to make informed choices about their future career paths.

The event commenced with Mr. Jagath Manatunge, the then President of OREPA Main Body, who served as the main guest, sharing his expertise and insights. His presence set the tone for an enlightening and enriching experience for all participants.



Following this, senior undergraduates from diverse engineering fields shared their experiences and perspectives, offering valuable insights into the practical aspects of their respective domains. By exposing participants to a wide array of engineering fields, the program facilitated a deeper understanding of the industry, empowering students to make well-informed decisions regarding their academic and professional pursuits.



The following OREPA members contributed to the sessions.

- Department of Chemical & Process Engineering - Chamika Ananda
- Department of Civil Engineering - Kushen Gooneratne
- Department of Computer Science and Engineering - Akila Induranga
- Department of Electrical Engineering - Jeewaka Aponso
- Department of Electronics and Telecommunication Engineering - Prabhashwara Kahawalage
- Department of Material Science & Engineering - W. A. Isuru
- Department of Mechanical Engineering - Isuru Wickramaarachchi

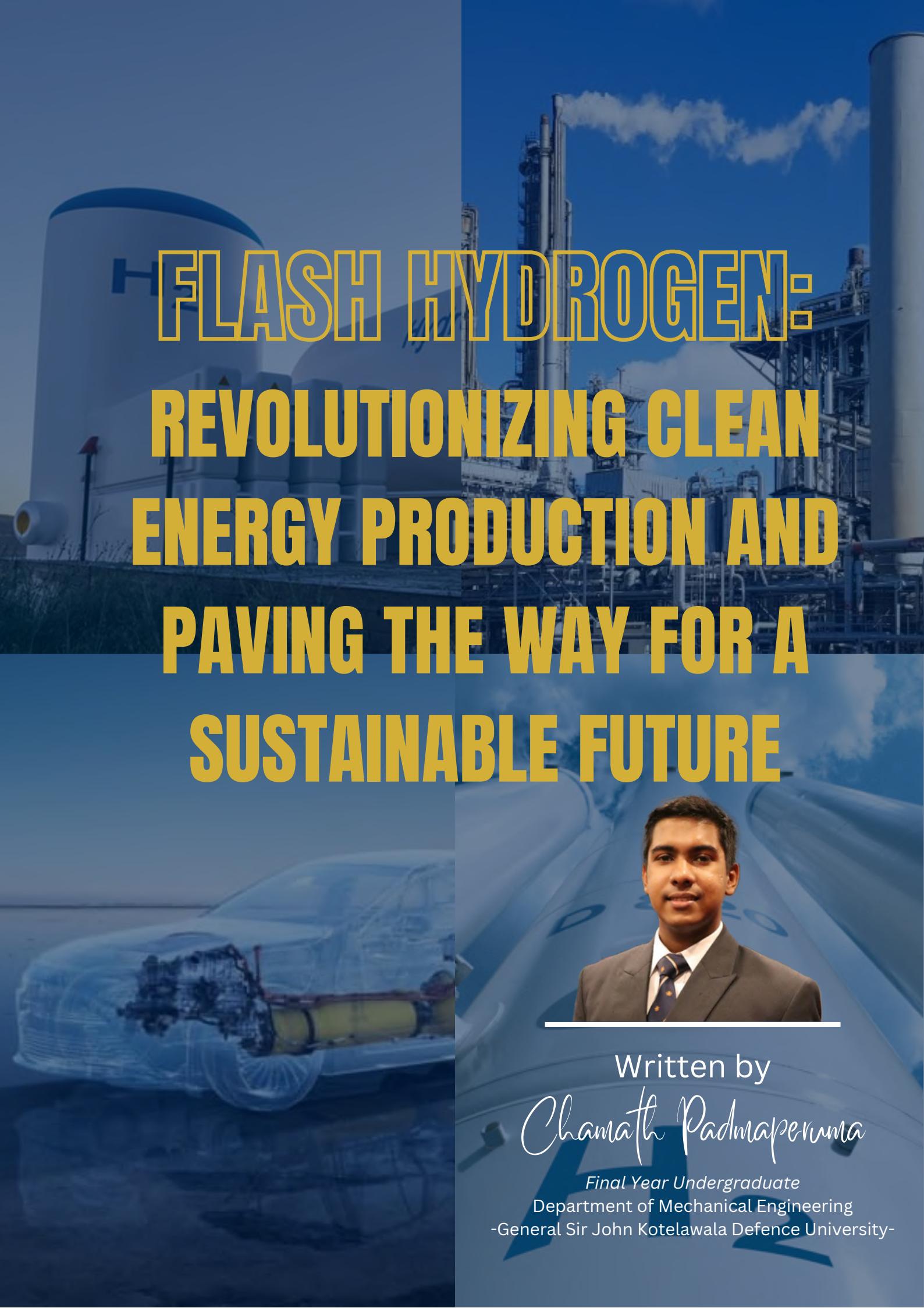
Following the Field Familiarization Program, the Mind Guides Mentor Training Workshop, led by Mr. Dehan Vithana, was conducted.

This workshop was tailored for individuals who would serve as mentors for A/L students at Royal College. Through interactive sessions and engaging activities, participants were equipped with essential mentorship techniques and strategies to effectively guide and support students. The workshop emphasized the crucial role mentors play in shaping the academic and personal development of students, underscoring the significance of fostering a supportive environment.

By providing insights and tools to excel in mentorship roles, the workshop aimed to empower participants to make meaningful contributions to the lives of Royal College students.



The entire event was well-organized, offering participants a valuable and enriching experience. From Mr. Jagath Manatunge's insightful talk to the engaging sessions led by senior undergraduates, attendees gained a deeper understanding of various engineering fields. The transition to the Mind Guides Mentor Training Workshop, led by Mr. Dehan Vithana, was seamless, providing practical skills for mentoring students effectively. Overall, participants left the program with newfound knowledge and confidence, highlighting its success in delivering positive outcomes.



FLASH HYDROGEN: REVOLUTIONIZING CLEAN ENERGY PRODUCTION AND PAVING THE WAY FOR A SUSTAINABLE FUTURE

Written by

Chamath Padmaperuma

Final Year Undergraduate
Department of Mechanical Engineering
-General Sir John Kotelawala Defence University-

In recent years, the search for clean and sustainable energy sources has become increasingly crucial in the fight against climate change. Among the various alternatives, hydrogen has emerged as a promising solution, with its potential to reduce greenhouse gas emissions and decrease our reliance on fossil fuels. However, not all hydrogen is created equal.

This process tackles two major environmental challenges simultaneously: the need for clean energy and the global plastic waste crisis.

Recognition and Support

The potential of flash hydrogen has caught the attention of the Earth-Shot program, a global initiative aimed at addressing environmental challenges. The program has recognized flash hydrogen as a key technology in achieving its goal of producing clean, affordable, and accessible energy.

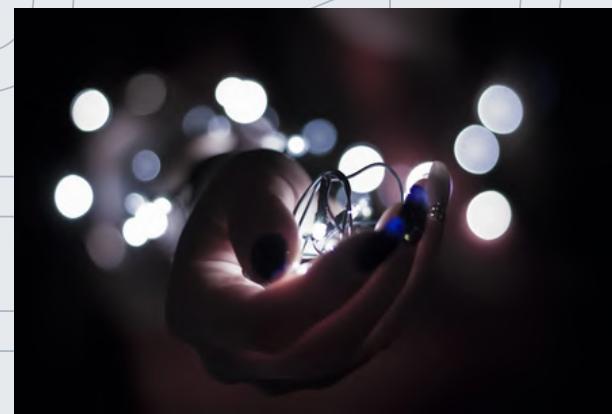
Traditional Hydrogen Production Methods

Traditionally, hydrogen production has been categorized based on the feedstock and production method, with gray, blue, and green hydrogen being the most well-known types. Gray hydrogen, the most common, is derived from fossil fuels and results in significant carbon emissions. Blue hydrogen involves carbon capture and storage to mitigate emissions, while green hydrogen is produced using renewable energy sources like solar or wind power.



Flash Hydrogen: A New Approach

Flash hydrogen, a new addition to the green hydrogen family, offers a unique solution by utilizing waste plastics as a feedstock. Through flash Joule heating, waste plastics are rapidly heated to high temperatures, causing them to break down into hydrogen and solid carbon byproducts.



Advantages of Flash Hydrogen Production

The use of flash Joule heating in the production of flash hydrogen offers several advantages over traditional methods. This technique enables rapid heating rates and high temperatures, resulting in a more efficient and cost-effective process. Moreover, the solid carbon byproduct produced during the process has the potential to be used in various applications, such as battery electrodes or construction materials, further enhancing the sustainability of the technology.



Impact on Energy and Transportation Sectors

As the world strives to reduce carbon emissions and combat climate change, flash hydrogen presents a promising solution for the energy and transportation sectors. Hydrogen fuel cell vehicles, which emit only water as a byproduct, have the potential to significantly reduce the automotive industry's carbon footprint, which currently accounts for 10% of global energy-related CO₂ emissions.



Conclusion

In conclusion, flash hydrogen, with its ability to produce clean energy from waste plastics, is set to revolutionize the hydrogen production industry and contribute to a cleaner, more sustainable future. As research and development in this field continue, flash hydrogen is poised to play a crucial role in addressing some of the most pressing environmental challenges of our time.

OREPA - an overview

The Main Body of Old Royalists Engineering Professionals' Association for the term 2024-25 is as follows.

President - Lahiru Wijerathne

Vice President - Niranjan Dissanayake

Vice President - Chamod Hettiarachchi

Vice President - Navaka Navaratne

Secretary - Dehan Vithana

Asst. Secretary - Bhanuka Abeygoonawardana

Treasurer - Gayan Indeera

Asst. Treasurer - Naveen Avishka

Committee Members:

- Charana Udugama
- Sandesh Weerasinghe
- Jeewaka Aponso
- Pathum Liyanarachchi
- Roshan Madhushanka



A Journey to Remember

As the sun sets on another remarkable year, it's time for the Executive Board of the Old Royalists Engineering Professionals Association (OREPA) Student Chapter to reflect on the journey we've embarked upon. The year 2023-24 has been nothing short of extraordinary, filled with brotherhood, impact, and unforgettable moments.

An Unforgettable Brotherhood

From the outset, it was evident that the bond within the Executive Board of the OREPA Student Chapter was strong. Our shared passion for engineering and our alma mater, the Royal College, united us. The meetings we had weren't just about official matters; they were opportunities to share stories, exchange ideas, and strengthen our friendships. Whether it was brainstorming for upcoming events or simply enjoying a coffee break, each interaction reinforced the sense of belonging within the team.

Impactful Initiatives

Our commitment to making a difference in the engineering community was strong. Throughout the year, we organized a series of impactful initiatives. Some of them are Cybots, Mind Guides, Academic Guidance, Student Intern, Field Familiarization, etc. Through all these initiatives, we could make a big impact.

Fun-filled Memories

Amidst our busy schedules, we made sure to carve out time for fun and relaxation. No matter what the occasion was, laughter and joy were constant companions. One highlight was our annual gathering 'Fraternite,' where the OREPA fraternity got together to enjoy a night of music, dance, and camaraderie. These moments of levity rejuvenated us and strengthened the bonds that held our team together.

A Productive Year

As we look back on the past year, it's evident that our collective efforts have borne fruit. We've not only expanded OREPA's reach but also deepened its impact on the engineering community. Our dedication, teamwork, and innovative spirit have set new benchmarks for excellence, inspiring others to follow in our footsteps. While challenges undoubtedly lay ahead, we approach the future with optimism and determination, knowing that together, we can overcome any obstacle.



The Executive Committee of the OREPA Student Chapter for the term 2023-24 is as follows.

EXECUTIVE BOARD

OREPA

23-24



BOJITHA LIYANAGE
Treasurer



CHAMOD HETTIHEWA
Vice President



JEEWAKA APONSO
President



KAVISHKA
GUNATHILAKA
Secretary



NIMESH
RANGACHODA
Asst. Secretary



KAVIN SIRIWARDANA



BUMUTH GAJAKUM

Directors of Public Relations



LAKDINU DE SILVA
Director of Research
& Development



SAMOD DHARMARAJA



ABHISHEK THENUWARA

Directors of School Projects



ADHEEB THOWFEEK



LITHIRA RANSIKA

Directors of Events



THARINDU PERERA



PASAN GIMHANA

Directors of Information Management
& Marketing



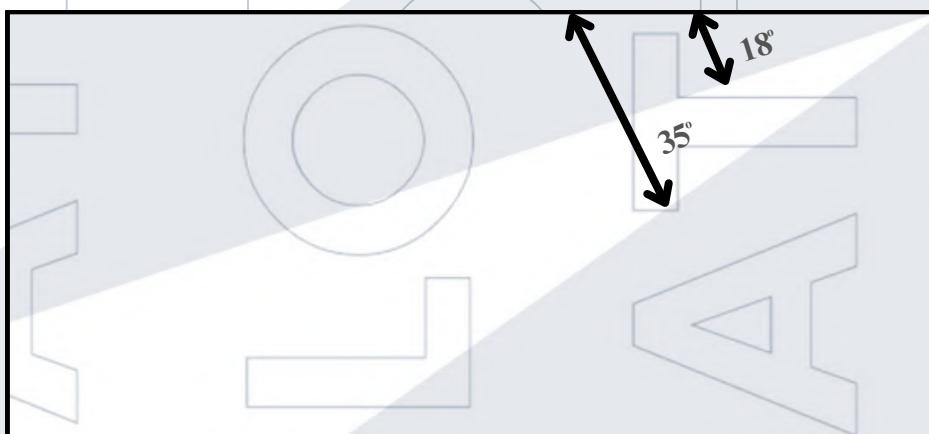
CHARITH BELPAGE DANUSHA HEWAGAMA

Directors of Membership

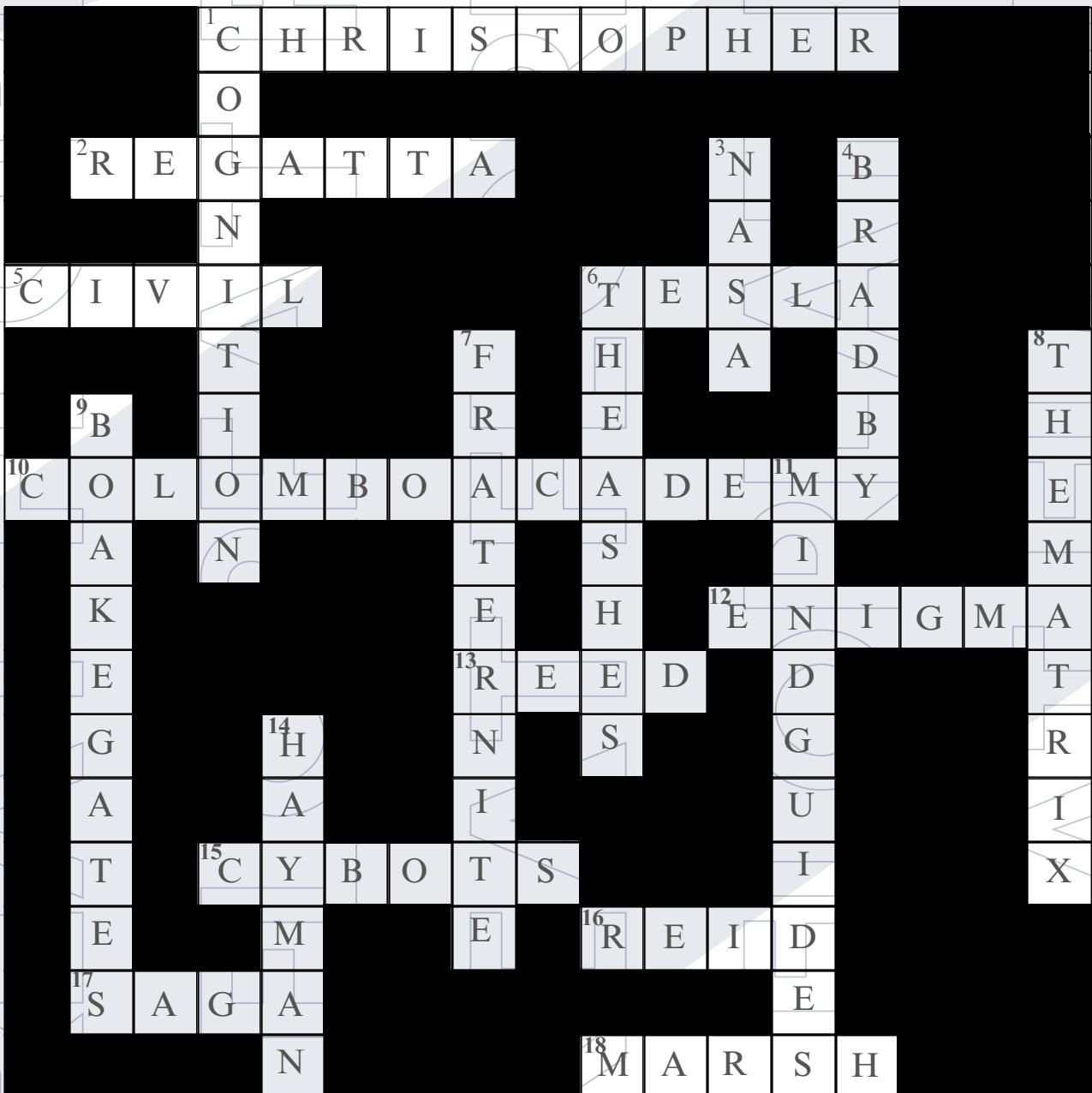
What you probably missed

There is a feature that we have included on purpose to improve the quality of our newsletter. We are sure that you may have most probably missed it. So, let us show you what it is.

The background design of each page is also significant. The white design element is designed at angles of 18 degrees and 35 degrees respectively. It symbolizes the year of inception of our alma mater: 1835.



Answers for the Puzzle



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