OREPA

Legacy - Fueled
Future - Focused
2025-26

NEWSLETTER

Newsletter of Old Royalists Engineering Professionals' Association | January 2026

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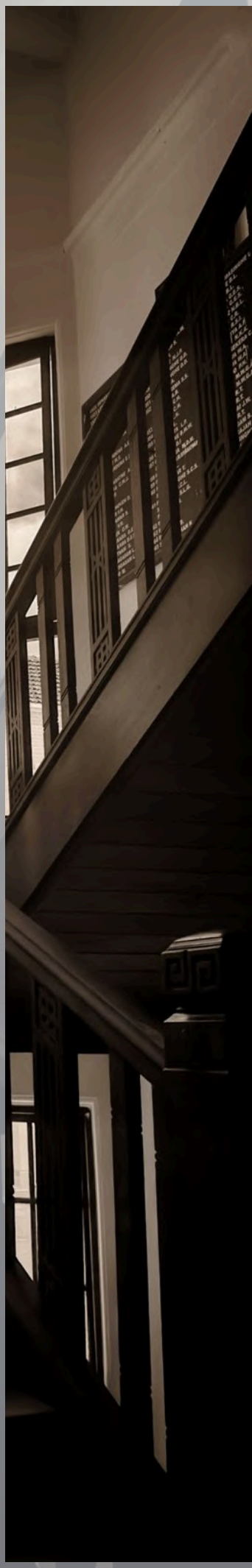

MESSAGE FROM THE STUDENT CHAPTER PRESIDENT

Dear Members, Partners, and Friends of OREPA,

I'm delighted to welcome you to the latest edition of the OREPA Newsletter. As a community that unites engineering professionals and aspiring engineers, it is a great honor for us to publish this newsletter to connect with a wider audience.

OREPA has been focused on creating opportunities and leaving a lasting impact. These allowed both undergraduates and school students to interact with professionals who inspired them through their work and values, gain exposure to industry expectations, and develop practical skills. An outline of such endeavours is included in this newsletter.

Furthermore, this newsletter has a strong technical focus as it features engineering-related content designed to inform and inspire. The content here is intended to improve knowledge outside of the classroom, ranging from useful insights to cutting-edge technologies. We hope that this technical content piques your interest, promotes dialogue, and inspires you to investigate, create, and use engineering principles to address significant issues.

These pages bear testimony to the hard work our members have done to ensure OREPA gives the best to the community. I want to express my heartfelt gratitude to everyone who helped, including our Main Body members, our partners who supported our vision, and everyone who gave their time. Your participation and connection are what make OREPA influential and impactful.

The spirit of OREPA cannot be encapsulated in words. Nevertheless, you will feel the essence of that spirit in our genuine attempt to do so.

So take a read, and I hope you enjoy this edition as much as we did crafting it.

Warm regards,
Kavin Siriwardana,
President,
OREPA Student Chapter

EDITORS' NOTE

This edition of the OREPA Newsletter represents more than a collection of articles, it reflects the evolving spirit of engineering among Old Royalists. Through innovation, shared knowledge, and collaboration, our community continues to grow stronger and more connected.

The content featured in this edition highlights emerging technologies, diverse engineering perspectives, and the journeys that shape us as professionals and undergraduates. Each contribution reflects curiosity, discipline, and a commitment to progress.

I sincerely acknowledge the contributors whose time, effort, and willingness to share knowledge have shaped the quality of this edition. My appreciation also extends to the OREPA Student Chapter Executive Board and the Joint Editor for their commitment and collaboration throughout the editorial process.

I hope this newsletter not only informs but also inspires curiosity, encourages innovation, and strengthens the bond among Old Royalists, serving as a platform that connects ideas and motivates active engagement within the engineering community.

Chehara Amarasekara,
Editor-in-Chief,
OREPA Newsletter,
Faculty of Engineering,
University of Ruhuna

Welcome to this edition of the OREPA Newsletter! I am delighted to present the creative work of our talented students, including many who are contributing to the newsletter for the first time.

This issue brings together engaging articles, thought provoking insights, fascinating global facts, and fun puzzles, all carefully curated to inform, inspire, and connect local perspectives with global trends.

At OREPA, we believe in nurturing curiosity, encouraging innovation, and celebrating the spirit of learning.

I sincerely thank all our contributors for their dedication, creativity, and hard work, your efforts are what make this newsletter meaningful and memorable. To our readers, I invite you to explore, reflect, and be inspired by the ideas shared here, and to join us in continuing this journey of discovery and knowledge.

Sithum Yapa,
Joint Editor,
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Faculty of Computing,
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THE YEAR 2030: How Artificial Intelligence Will Redefine Our World

Athsara Fernando,
Undergraduate,
Department of
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University of Colombo
School of Computing

We are living through the fastest technological shift in human history. Artificial Intelligence is no longer an abstract concept, it's the invisible engine quietly reshaping everything from classrooms to industries. By 2030, AI won't just assist us; it will shape how we learn, work, and think. The question is no longer if it will change our lives, but how ready we are for that change.

A Glimpse into 2030

Picture this: it's 7:00 AM in 2030. Your AI assistant wakes you at the perfect moment in your sleep cycle, schedules your day around live traffic updates, and orders breakfast that fits your health goals. At university, your AI tutor knows your learning style better than you do, adapting every lesson in real time. Your doctor doesn't wait for you to get sick, predictive models flag risks weeks in advance.

Autonomous buses run across Colombo, while engineers design smarter bridges with AI copilots that simulate thousands of possibilities in seconds.

This isn't fantasy. Every example already exists in prototype form today. The next five years will decide whether we use these systems wisely or let them use us.

The Acceleration Phase

From 2025 to 2030, AI will mature from assistance to autonomy. Education will become hyper-personalized; your curriculum will adapt dynamically based on your progress. In workplaces, humans and AI will collaborate daily, algorithms managing data while people focus on creativity, leadership, and empathy. Engineers will rely on generative tools that can draft designs, test failures, and optimize energy efficiency in hours instead of months.

But progress brings pressure. Automation will displace routine jobs. Data and privacy will become new currencies. Biases in algorithms will have real human costs. The future demands not just smarter machines - but wiser humans.

How to Be Ready

Students entering this decade stand at a crossroads. AI will not replace you, but someone using AI will. Learn the fundamentals: how data is processed, how models learn, and how to question the outputs they produce. Don't just use AI; *understand it*.

Then, double down on what machines lack: imagination, intuition, ethics, and emotional intelligence. The people who thrive in 2030 will be those who know when to trust machines and when to challenge them. Your value will come not from competing with AI, but from combining its logic with your humanity.

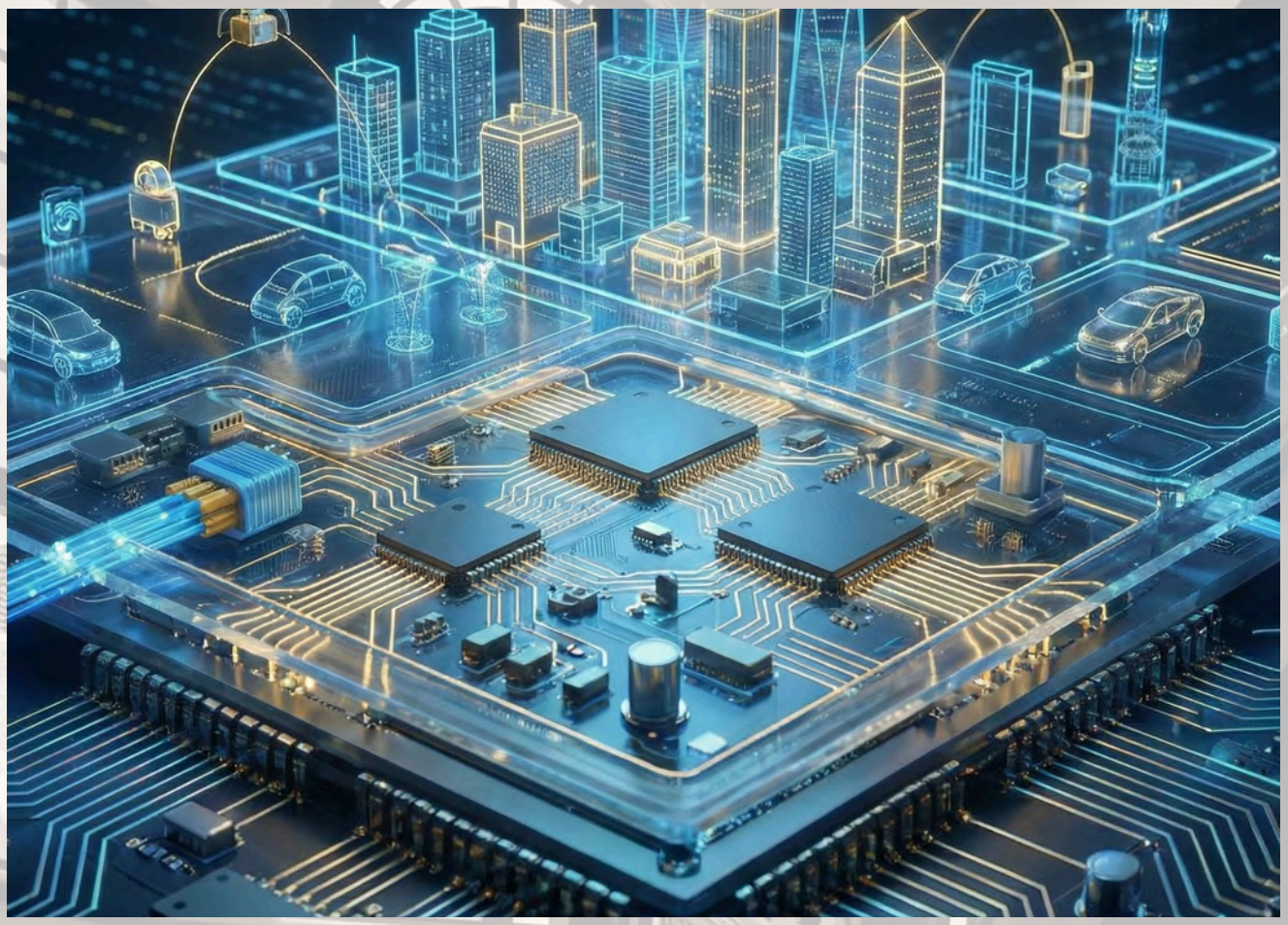
The Future Engineer

For tomorrow's engineers, AI will be both a partner and a test. It will handle calculations, modeling, and optimization, but the human engineer will decide why and for whom systems are built. You'll be designing not just machines, but ecosystems of trust, safety, and sustainability. In 2030, the best engineers won't only understand code - they'll understand consequences.

Living Intelligently with Intelligence

The Year 2030 isn't a distant future; it's five years away. AI will not make the world better or worse, it will magnify whatever we choose to do with it. Those who adapt, stay curious, and take responsibility for how technology is used will lead the next era.

The real revolution is not artificial intelligence. It's human intelligence, amplified by courage, creativity, and conscience.



ELECTRONICS IN 2030: The Technology Beneath Today & Tomorrow's World

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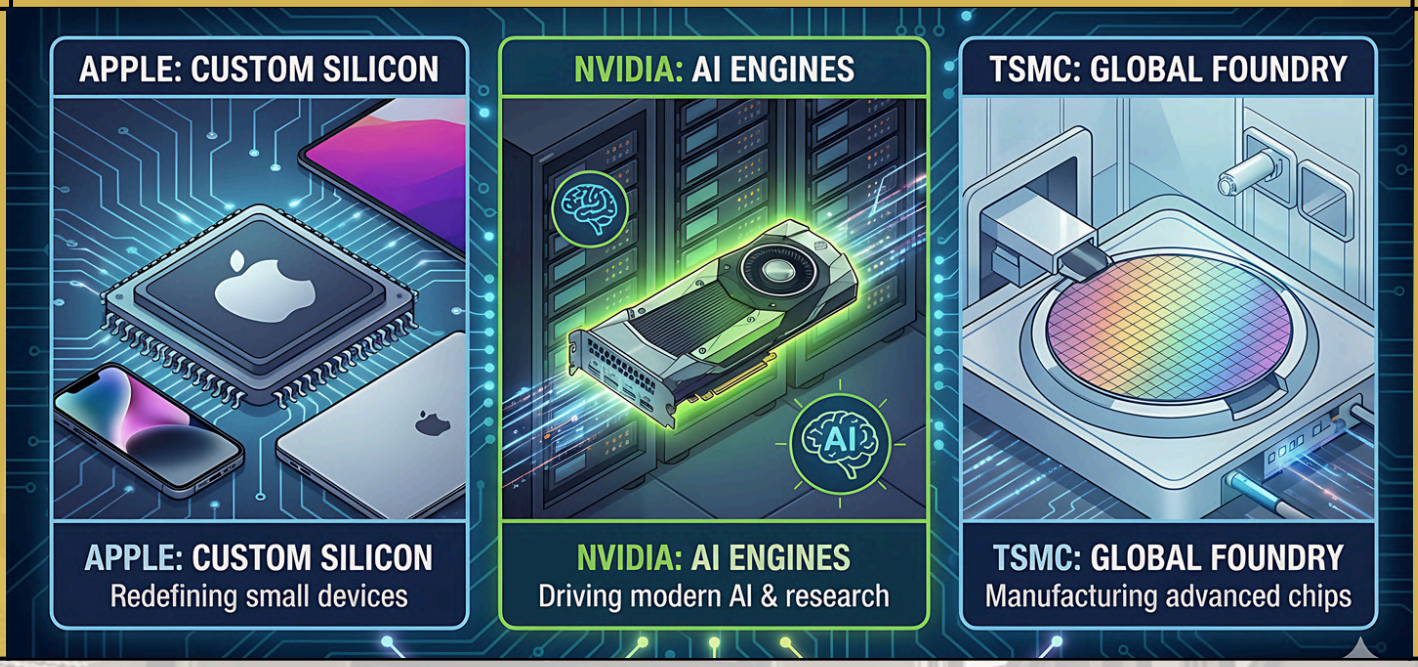


When we imagine the future, our thoughts often drift toward artificial intelligence, autonomous vehicles, smart cities, and robots capable of tasks we once believed impossible. Yet behind all these headline-grabbing ideas lies a field that operates quietly and consistently, powering every part of this transformation: electronics. If AI represents the intellect of modern technology, electronics is the body and the nervous system that allows it to exist in the real world.

What makes the coming years particularly fascinating is how easily we overlook this foundation. The world is moving toward an era where intelligent systems become a natural part of daily life, and that shift depends almost entirely on advances in electronic hardware.

Major companies shaping global technology today—Apple, NVIDIA, TSMC—are not merely consumer brands. They are deeply rooted in semiconductor innovation. Apple's custom chip designs have redefined what small devices can do. NVIDIA's GPUs are now the engines driving modern AI, from language models to scientific research. And TSMC manufactures the advanced chips that sit inside everything from smartphones to satellites, quietly enabling the digital age.

By 2030, the influence of this hardware will become even more visible. Many ideas that still feel experimental today will likely slip into everyday routines. Homes will adjust their own energy usage through intelligent power electronics, optimizing solar, battery, and grid input without human involvement.

Wearable devices will continuously track vital signs using miniature, ultra-efficient sensors, providing early warnings long before symptoms appear. Transportation systems may rely on live communication between vehicles and infrastructure, smoothing traffic and reducing delays. Even classrooms will change, integrating virtual electronics laboratories that allow students to test circuits and run experiments without touching a piece of physical equipment.

None of this is driven by software alone. Every improvement in AI, robotics, communication, and healthcare depends on the capabilities of the hardware underneath. Faster, smaller, and more efficient circuits allow intelligence to move from large datacenters into everyday devices.

A self-driving car, for example, isn't powered simply by clever algorithms—it depends on sensors, processors, communication modules, and power systems working in perfect coordination. As electronics evolve, the systems built on top of them become more capable and more accessible.

For students at Royal College, this offers a perspective that is both grounding and exciting. Many encounter electronics through simple beginnings—Taking myself as an example I was exposed to electronics by an Electronics workshop done by the Young Inventors Club. Apart from that robotics competitions, small projects, competitions, or even a curiosity sparked by taking apart a device at home can make the spark. These early interactions may seem modest, but they often form the first steps into understanding how technology really works.

The journey into engineering rarely begins with a grand decision. More often, it begins with a question: "How does this work?"

What makes electronics particularly meaningful for the next generation is that it provides a window into the inner workings of the modern world.

It is not only useful for designing gadgets but also for understanding how communication systems connect nations, how renewable energy is stabilized, how medical devices save lives, and how AI learns. The field rewards curiosity, persistence, and the simple habit of wanting to understand things more deeply.

As we look toward 2030, electronics will remain one of the quiet forces shaping our lives—from the way we move and communicate to the way we study, heal, and create. Most people will experience the results of these advancements without ever seeing the circuits behind them. Yet for those who choose to explore the field more closely, even gradually, the coming decade will offer opportunities to participate in the world's most significant technological transformations.

Not because anyone insisted on choosing engineering, but because understanding the foundations of technology naturally opens doors. The future may rely on many fields working together, but electronics will continue to be one of the places where that future truly begins.

Royalists shine in local and global stages in various fields. So why not in electronics? Cheers to the builders of the future and make humanity better!

DATA SCIENCE, Business Analytics, and AI: Shaping Sri Lanka's Future

Sithum Sasmika Yapa,
Undergraduate,
Faculty of Computing,
General Sir John Kotelawala Defence University

When we think about the future of business and technology, our minds often drift toward artificial intelligence, predictive analytics, and intelligent systems. Yet behind every smart decision, automated process, or innovative solution lies a foundational element: data. If AI represents the intellect of modern organizations, data science and business analytics are the eyes, ears, and nervous system that allow that intelligence to function effectively.

Global Context

Worldwide, businesses are realizing that their most valuable asset is no longer just capital or technology it is data. Tools like machine learning, predictive modeling, and data visualization help organizations turn raw information into actionable insights.

From retail giants predicting consumer behavior to banks detecting fraud in real time, data-driven decision making is transforming industries.

Sri Lankan Perspective

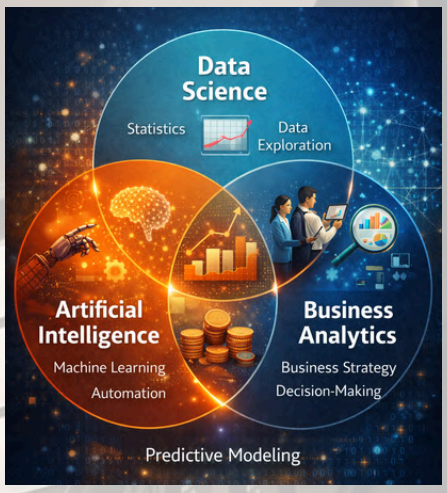
Sri Lanka is quietly catching up in this global revolution. Banks are applying analytics for credit scoring and customer segmentation. Startups and BPO companies are leveraging data to improve services and open new markets. Government initiatives like the Digital Sri Lanka 2030 agenda highlight the country's commitment to data-enabled growth. Yet, challenges remain: a shortage of skilled data scientists, uneven adoption of analytics tools, and limited awareness at the secondary and tertiary education levels.

Why This Matters for Students and Professionals

The rise of data science and business analytics is not just a technical trend it is a career-defining opportunity. Data professionals are needed across sectors: finance, healthcare, logistics, retail, and government. They can help organizations make informed decisions, optimize operations, and unlock new business opportunities. Early exposure through school workshops, small projects, or online courses can spark the curiosity needed to thrive in this field.

The Role of AI in Enterprise Transformation

Sri Lankan companies are also pioneering enterprise AI. Firms like hSenid Mobile Solutions are developing context-aware AI tailored to local industries, from telecom to finance. These AI solutions do more than automate processes they analyze behavior, predict outcomes, and optimize workflows, enabling businesses to become smarter and more efficient. The integration of AI with data analytics allows organizations to move from reactive decision making to proactive strategy, both locally and globally.



Opportunities and Way Forward

The next decade promises a surge in demand for professionals who can bridge the gap between data science, business strategy, and ethical practice. Building local capacity in data analytics not only strengthens businesses but also positions Sri Lanka as a competitive player in the global digital economy.

Conclusion

Data science, business analytics, and AI are quietly shaping the future of Sri Lanka. For students and young professionals, understanding these fields offers a chance to contribute meaningfully to the country's digital transformation. The journey begins with curiosity, continues with learning, and can ultimately lead to innovation that impacts both local and global communities.

ENGINEERING PUZZLE CORNER

Challenge your logic, creativity, and engineering mindset.

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ACROSS CLUES

01. A long projecting beam fixed only at one end, used in bridge and balcony construction.
02. Architectural style from the 1950s characterized by simple, block-like forms and raw concrete.
03. A type of firehose connection found on the exterior of buildings for civil safety.
05. In networking, the time delay between a cause and the start of an effect.
07. A networking device that forwards data packets between computer networks.
08. Country linked to Donald Rutnam, Royal-Thomian cricket captain and 1924 Olympic tennis player.
11. The base-2 numbering system that forms the foundation of all modern computing.
12. ----- flux refers to a type of electric motor design where the magnetic flux flows parallel to the axis of rotation, offering advantages in compactness, efficiency, and power density.
13. Science fiction film directed by Christopher Nolan that illustrates theoretical physics concepts like wormholes, black holes, and gravity's effect on time, awarded an Oscar for Visual Effects.
15. The prominent tree at Royal College is the ------- Tree a natural landmark on the main grounds, historically a famous meeting spot and pavilion for students.

DOWN CLUES

01. Essential software used by architects and civil engineers.
03. Engineering field focused on capturing energy from the sun.
04. In fluid engineering, ------ often refers to components that are installed directly in the path of the fluid flow.
06. The second Latin word of the Royal College motto meaning Work conquers all'.
09. Before 1881, the premier school in Colombo 7 was known as the Colombo -------
10. Royal College, Colombo in Sri Lanka was granted the prestigious '-----' title in 1881 by Queen Victoria, placing the school among a select few outside the United Kingdom to receive such recognition from a British monarch.
12. A set of rules or protocols that enables software applications to communicate with each other to exchange data, features and functionality.
14. ------ gears are gears that rotate around their own axes while simultaneously revolving around a central gear called the sun gear.
15. A measure of rotational force, commonly used in mechanical and civil engineering contexts.
16. A two terminal electronic component that conducts current primarily in one direction.

Puzzle Contributor:
Thidas Insilu Jayathunga
2027 AL

THE 5 PILLARS OF THE Streamline™ Framework

Sanjeev Dananjana

Engineer BSc. Eng. (Hons), AMIE (SL),
AEng (ECSL), GradIEAust, M.ASCE

Flow with purpose, Pass with intent! occasionally can be mistaken so be careful when putting it into practice.

What I'm gonna take you through is a water stream/ a river. The feedback I got from the people who used it was very positive and they were really energized more than ever.

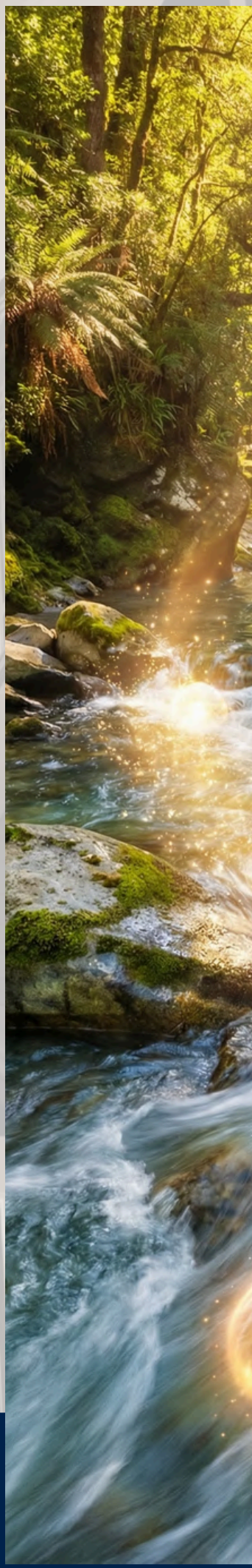
The first question I have for you is this: are you the reason the world keeps rotating, another day begins, and the daily routine unfolds or is it all involuntary? Hmm, a motivational article is coming up, nope nope, you all good, this is better, you'll be your own motivator.

Okay now again, your life and another day is unfolding are not in your hands completely. Just like an object drifting in a river, you're carried by the current. Water is a powerful element; it all depends on how you see it, and how you choose to use it through science. So what we can do is make it more interesting, let's make it an adventure of a lifetime. and we are dealing with water, remember? Yet what truly matters is the energy you bring into that flow, your aura. Wherever you go, wherever you work, let your presence influence the space around you!

You can apply this to any of your projects, your studies, your work. After all, your life is the biggest project you're working on.

If you take any project, if you plan your START, EXECUTION, COMPLETION very well, the chances of you acing it are significantly higher. But most of us are struggling in the execution part. Why? The flow breaks! Oh no, can't keep up with the river! For this, communication matters, along with the ability to navigate sudden obstacles you encounter. Just like rocks and boulders in a river, these are the distractions that challenge your flow. Whenever that happens and you are stuck in just one task, there comes the disaster.

There were a few parts missing before I could share it as a complete framework. But now, working with Prof. Ranjith Dissanayake, a renowned academic and leader, and learning from him, I've been able to put this framework together, I call it the Streamline™ Framework.



THE 5 PILLARS OF THE STREAMLINE™ FRAMEWORK

1. **Catch the Current**

Recognize when a task lands with you. Own it mindfully, not indefinitely.

2. **Act Swiftly, Pass Smoothly**

Do it now or define when. Pass the ball - don’t let it sit.

3. **Flow Transparency**

Use simple systems to visualize task movement without blaming individuals.

4. **Support Without Judgment**

Blocks aren't a weakness. They're signals to re-route and support each other.

5. **Celebrate the Flow**

Highlight momentum, not just output. Make speed of collaboration the win.

Core Concept: *A task is like a ball in play - whoever receives it has the opportunity to act immediately and pass it forward. The faster the play, the smoother the game. Delay creates bottlenecks; momentum creates results.*

Core Concept: *A task is like a ball in play - whoever receives it has the opportunity to act immediately and pass it forward. The faster the play, the smoother the game. Delay creates bottlenecks; momentum creates results.*

This is what we have to address most in our projects, how long are we holding on to one task. We need to be mindful that a project is made up of a series of subsequent tasks, and holding on to one task for too long not only creates stress but also hinders the entire process.

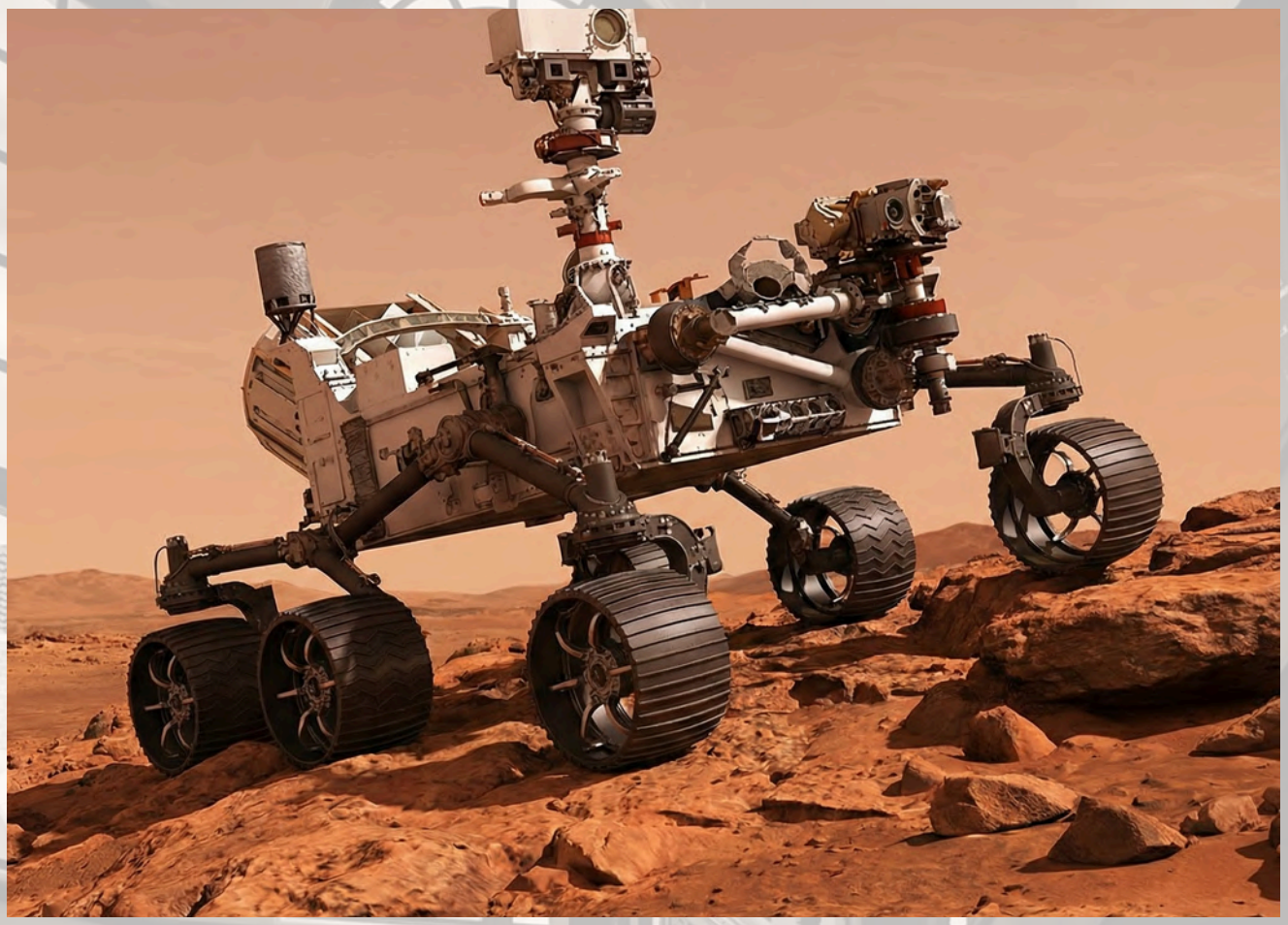
So it's better to finish one task and move to the next, that way, you'll not only meet your goals on time but often exceed expectations. This is how you can bring a real difference to the table. The more you strive to make something innovative, the more energy you generate, and with that, a stronger, more positive aura.

If you are working on a solo project such as your studies or even life, break it down to tasks then you can clearly see how you are going to achieve your goals and remember always, don't hold on to one task for such a long time. Quickly finish off your tasks one by one, you will get closer to your goals smoothly.

Life, much like a river, never stops moving, and neither should you. When you align your energy, purpose, and action, every current begins to work in your favor.

The Streamline™ Framework isn't just a method for managing tasks; it's a mindset for living with clarity, agility, and impact. Flow with purpose, pass with intent, and let your aura ripple through every project, every team, and every moment you touch.

Finally, the reason I chose the river, the flowing stream, as my metaphor is because I strongly believe that nature holds the best algorithms. Every time we seek solutions to our challenges, we're essentially sampling what nature has already perfected. Something to think about :) you all are bright minds, see how you can apply this to win in your life!

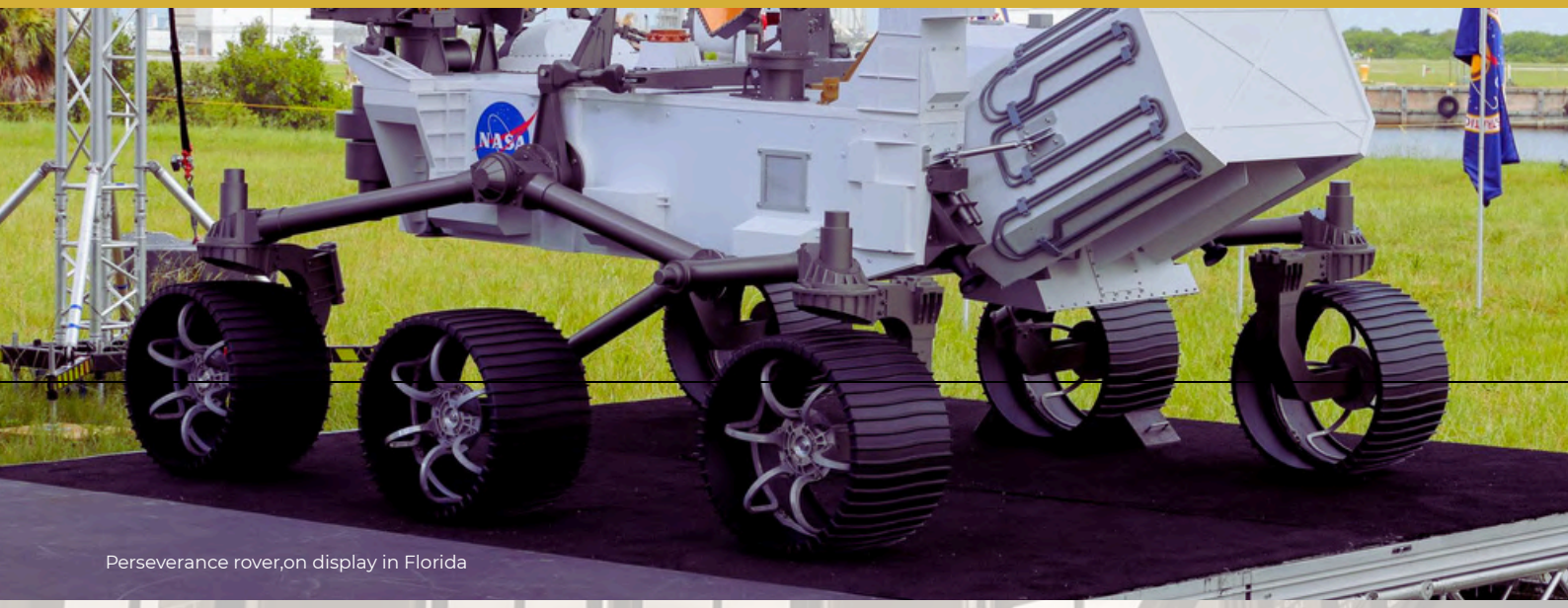


NAVIGATING ON Mars

H.I.J.Gunarathna,
Undergraduate,
Department of Electrical and Information Engineering,
University of Ruhuna

At a distance of 58 million kilometers to the interplanetary surface of Mars, and billions of dollars in deployment and development costs, the rovers on Mars need to navigate with precision and safety around obstacles. Even though navigation is not based solely on the rover itself, communication with the ISS and GPS systems are immaculate but the focus here is on the development of the "Rocker-Bogie" suspension system used on wheeled rovers like Curiosity, Perseverance, and Sojourner.

As the name implies “rocker” refers to the larger arm that pivots at the rover's body, and “bogie” refers to the smaller arms attached to the rocker, connecting two wheels each. Developed by NASA in the late 1980s, this specific system has been used on five Mars rovers from 1997 to 2021.

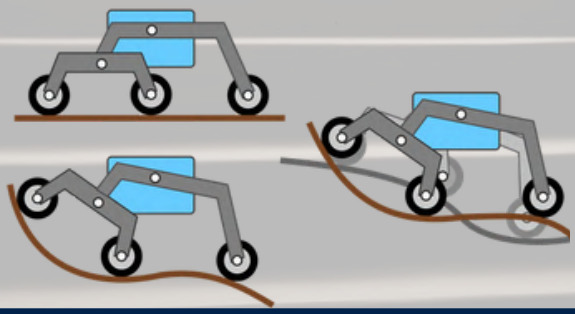


Perseverance rover,on display in Florida

With Sojourner in 1997 navigating at 1 cm/second and the latest **Perseverance** and **Zhurong** rovers operating at 5.5 cm/second, even though speed is a massive tradeoff in exploration, the most important things are safety, power, and communication latency.

Mechanism Overview

The key feature when overviewing this passive load-balancing system is that each wheel of the rover can independently move up and down.



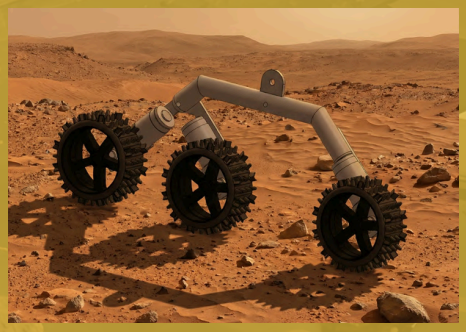
The rover body stays relatively level even though the wheels are at different heights, and most importantly, all six wheels maintain contact with the ground at all times, even on extremely rocky terrain, with six independent motors for each wheel. As a result of this mechanism, the wheels can move over rocks twice their diameter.

At the center of the rover, there is a differential bar that connects the left and right rockers like a seesaw, making the system naturally distribute the rover's weight evenly.

This reduces wheel damage and uneven motor wear, giving all wheels adequate traction on sandy terrain.

According to the International Journal of Science and Research Archive, theoretically, the Curiosity rover can achieve a tilt angle of 50 degrees, and Perseverance can achieve a 45-degree tilt angle in any direction without tipping over.

Even so, rovers are designed to avoid terrain with tilt angles greater than 30 degrees. As with any suspension system, tilt stability is limited by the height of the center of gravity.



Innovation through years

Even though all wheels can rotate and operate independently, the Mecanum wheel integration improves the agility and application of moving in omnidirectional ways without rotating the wheels, so this hybrid system provides agility and lateral movements on terrain surfaces.

Applications on Earth

As with every innovation, adaptability to another field is a benefit of research. The *International Journal of Aerospace Engineering* proposes the optimized rocker-bogie system for autonomous rovers in agriculture fields, autonomous ore transport in harsh conditions in mining operations, and post disaster rescue missions over rubble for search and rescue operations.

AEROSPACE ENGINEERING IN GERMANY:

A World of Opportunity for Sri Lankan Students

Mandinu Vithanage,
Undergraduate,
Department of Engineering and Design,
Technical University of Munich

Germany is known to be one of the leading countries in engineering, innovation, and high-tech research. Among its strongest fields, aerospace engineering, stands out for its strong connections to global industry. Especially for students, who are interested in pursuing a career aerospace engineering, Germany offers an exceptional pathway that blends with excellence and affordability.

What is Aerospace engineering?

Aerospace engineering is the field of engineering related to the development of aircrafts and spacecrafts. This has two main branches: aeronautical engineering and astronautical engineering. Flight vehicles are subjected to changes in air pressure and temperature, along with the structural load. So they are a product of aerodynamics, fluid mechanics, thermodynamics, aircraft design ,avionics etc ,which are also the elements included in the degree.

Requirements to study Aerospace engineering in Germany

To study aerospace engineering in Germany, Sri Lankan students must meet several key academic and language requirements. For bachelor's programmes, students typically need either good A/L scores or completion of a recognised pathway such as a foundation year or one year of university studies.It is also noted that German universities value students, who performed both O/L's and A/L's under the same certification framework, such as the GCE or Cambridge. For master's programmes, a relevant engineering or science degree is required.

While many aerospace programmes are offered in English, universities usually ask for proof of language proficiency through exams like IELTS or TOEFL. In addition, students must show financial proof for their visa—often through a blocked account—as well as health insurance coverage.These requirements ensure that students are academically prepared to meet the high standards of German engineering education.

Top tier universities offering Aerospace engineering

- Technical University of Munich (TUM)
- RWTH Aachen University
- TU Braunschweig
- University of Stuttgart
- Bremen University & TU Darmstadt

Advantages of studying Aerospace engineering in Germany

- *Highly affordable education with global recognition*

One of Germany's most appealing advantages is its low-cost education model. Many public universities charge little to no tuition fees, even for international students. This makes Germany one of the most financially accessible destinations for higher education—especially in engineering fields where tuition in other countries can be extremely high.

Instead of tuition fees, students typically pay a small semester contribution that may even include a public transport pass. Combined with Germany's relatively low-cost student accommodations, the overall expense remains manageable for Sri Lankan families compared to countries like the UK, USA, or Australia.

- *High employability and strong industry links*

Germany is home to world-renowned aerospace institutions, including the German Aerospace Center (DLR), Airbus facilities in Hamburg and Bremen, MTU Aero Engines in Munich, and numerous specialised research institutes and engineering clusters.

These institutions play a central role in designing aircraft, developing sustainable aviation technologies, and contributing to European Space Agency (ESA) missions. These employers offer specialised trainee programmes for international graduate. Graduates from German universities are eligible for an 18-month post-study job seeker visa, allowing them to find employment within the country.

- *The course is taught in English*

Although German language skills are a requirement to enter German universities many of the courses, including aerospace engineering are taught in English. Therefore international students can follow lectures, participate in projects, and engage in research smoothly.

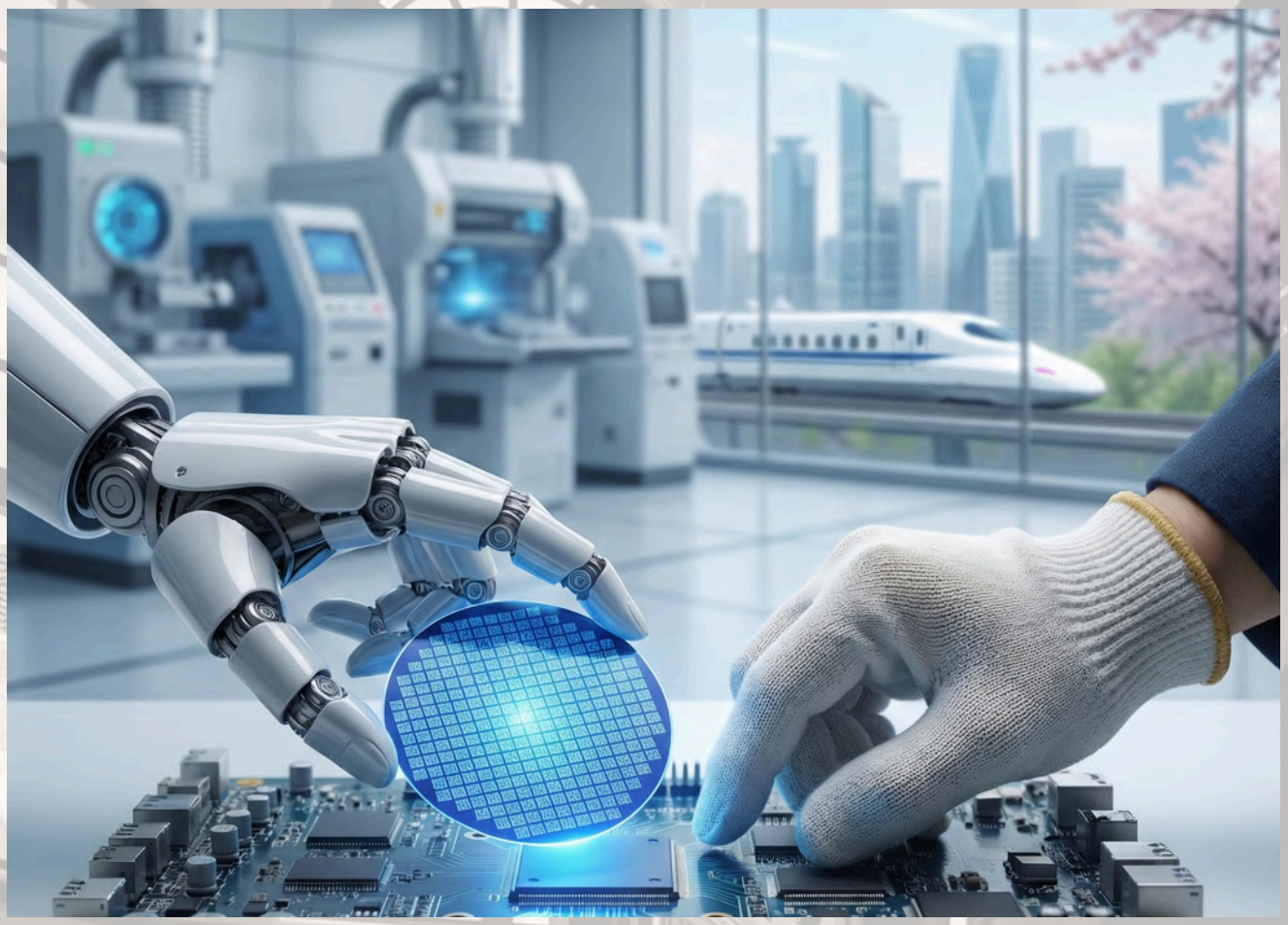
- *Cultural and Personal Growth*

Living in Germany exposes students to a multicultural society, advanced transportation, safe cities, and a focus on sustainability. International students can experience punctuality and direct communication(like a true German) participating in a vibrant student life via clubs and social events, and exploring Germany's rich traditions like Oktoberfest,Christmas markets, music, art and food.

Especially for Sri Lankan students,

For Sri Lankan students, studying aerospace engineering in Germany offers several unique advantages that directly support their academic and professional growth. With Sri Lanka's aviation sector slowly expanding, graduates with international aerospace expertise are becoming increasingly valuable. Returning students can contribute to areas such as aircraft maintenance engineering, UAV development, aviation safety, and airport operations through institutions like the Civil Aviation Authority, SriLankan Airlines Engineering, and Airport and Aviation Services (AASL). At the same time, a German degree opens doors to global opportunities in Europe, the Middle East, and Asia, where aerospace professionals are in high demand.

Aerospace engineering is one of the few fields that naturally leads to international collaboration and global career opportunities. Germany, with its strong engineering background and open approach to international talent, offers Sri Lankan students a launchpad to enter this exciting and future driven industry.

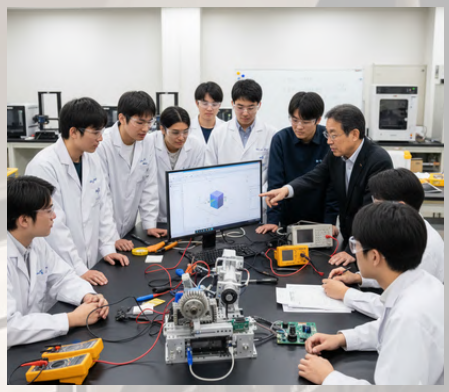


FROM MONOZUKURI TO MECHATRONICS: Japan's Engineering Renaissance

Senesh Jayawickrama,
Undergraduate,
Kyoto University of Advanced Science,
Department of Mechanical and Electrical Systems Engineering

For many, “Made in Japan” still evokes images of precision cameras and bulletproof reliability. But Japan’s engineering landscape is quietly transforming once again. As a student of mechanical and electrical systems engineering here, I see firsthand how traditional manufacturing strengths are being fused with digital intelligence. Japan is not simply adapting, it is reclaiming leadership in the foundational technologies of the next industrial era.

At the heart of this shift is **Mechatronics**, a term coined in 1969 by Japan’s Yaskawa Electric. Mechatronics integrates mechanical engineering, electronics, control systems, and software into intelligent machines. What began as factory automation is now the backbone of smart manufacturing, where robots collaborate safely with humans and production systems self-optimize in real time.



This evolution reflects **Monozukuri** -Japan's philosophy of craftsmanship, reimagined for the 21st century. The focus is no longer only on making things precisely, but on creating systems that can adapt, learn, and operate sustainably.

Japan's renewed momentum is especially visible in strategic high-tech fields. In 2025, the government-backed consortium **Rapidus** successfully prototyped a **2-nanometer semiconductor** in Hokkaido, placing Japan alongside global leaders in advanced chip manufacturing. These chips are critical for AI, autonomous vehicles, and future computing, and the project represents a national effort to rebuild technological sovereignty.

At the same time, Japanese researchers unveiled the country's **first fully domestically developed quantum computer**, showcased at Expo 2025 Osaka.

From cryogenic systems to control electronics, every component was designed in Japan, demonstrating world-class expertise in integrating complex mechanical and electrical systems.

Robotics remains another strength. At the 2025 International Robot Exhibition, Japanese firms demonstrated "physical AI," where robots perceive their environment and adapt their motion in real time. This marks a shift from rigid automation to true machine intelligence.

Looking ahead, Japan is also advancing **sustainable engineering** through energy-efficient manufacturing and renewable integration,sometimes called ecomechatronics. Engineering here is increasingly purpose-driven, balancing productivity, resilience, and environmental responsibility.

This national direction is mirrored in Japanese engineering education. At universities such as the Kyoto University of Advanced Science, engineering programs are designed to closely reflect real industrial practice. Students engage in long-term, industry-collaborative projects with companies including Daihatsu, Shimadzu, and SCREEN, working in multidisciplinary teams under both academic and industrial supervision.

These projects are not simulated exercises but address real engineering challenges faced by industry, such as reducing the weight of automotive components without compromising strength, developing intelligent control systems for automation, or redesigning mechanisms to improve manufacturability and reliability. In many cases, the solutions proposed by students are directly tested, refined, and implemented on actual production lines.

This hands-on, project-based approach cultivates not only technical competence but also systems thinking, teamwork, and problem-solving skills, ensuring that graduates are prepared to contribute immediately and effectively in Japan's highly demanding engineering environment.

For students, Japan offers a rare environment where theory, craftsmanship, and cutting edge technology meet. Today's **"Made in Japan"** is no longer just about quality,it represents intelligent systems, strategic autonomy, and engineering with purpose.

RAIN, RIVERS, AND SLOPES: Engineering Sri Lanka's Defence Against Floods and Landslides

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The end of this November was an ending that no one wishes for.

Sri Lanka faced one of the most disastrous natural disasters in recent years, killing 474 people and 356 people are still missing at the time this article is written. Floods, and landslides caused by the heavy rain due to the cyclone Ditwa, affected a total of 1,586,329 individuals from 448,817 families in 25 districts. According to the Disaster Management Center of Sri Lanka, 971 houses have been destroyed while another 40,358 residences have been damaged in recent days.

As usual the humanity of Sri Lankans rose. People who were not affected by the situation gathered for the ones who were suffering. Rescue operations were deployed by the Tri forces and the Police. Temples, churches and mosques were turned overnight into relief centers, to shelter the victims. Dry food, clothes and other essential items were collected, and distributed.

Temples, churches and mosques were turned overnight into relief centers, to shelter the victims. Dry food, clothes and other essential items were collected, and distributed. In a disaster that washed away roads, bridges, and homes, it was this instinct to care for each other that kept communities from collapsing entirely.

This tragedy is also a painful reminder that compassion alone is not enough. The way we plan, build and maintain our surroundings can either multiply the damage or quietly protect us. Many of the flooded neighbourhoods and collapsed slopes were not accidents waiting to happen, but the result of years of building on riverbanks, blocking natural drainage paths, and cutting unstable hillsides without proper engineering guidance. This is where civil engineering steps in, not just to rebuild what was lost, but to rethink how we live with our rivers, our hills and our rain.

Civil engineering reduces flood risk by controlling where the water goes, how fast it moves, and where people are allowed to build. Structurally, engineers design dams and reservoirs to temporarily store excess runoff, and floodwalls to keep rivers within their banks, and spillways to safely route extreme flows away from cities.

In urban areas, they improve stormwater drainage with larger drains, detention/retention ponds, roadside ditches, and culverts, and now increasingly use nature based solutions like wetlands, green roofs, permeable pavements, therefore more rainwater can soak into the ground instead of rushing straight into drains.

Beyond concrete, civil engineers also work on non-structural measures, setting floodplain zoning and building regulations therefore houses are not built in high risk areas, preparing design standards based on realistic “design floods”, planning evacuation routes, and supporting early-warning systems with river gauges and rainfall monitoring. Put simply, we cannot stop the rain, but smart civil engineering can give that water safe pathways and keep people and infrastructure out of its way.

Civil engineering tackles landslides by doing two main things. Keeping slopes stable and keeping people and structures out of danger. To stabilize slopes, engineers first study the soil, rock, groundwater and slope geometry, then apply solutions like proper drainage to remove water that weakens the soil. They design retaining walls, gabion walls, soil nailing, rock bolts and ground anchors to give extra support, and sometimes re-shape slopes by cutting them to gentler angles, adding benches, or relocating road alignments to safer ground. Bio-engineering methods such as planting vegetation help bind the soil and reduce erosion, especially on roadside and cut slopes.

To reduce destruction when landslides do occur, civil engineers also work on planning and protection. They help prepare landslide hazard maps and recommend where building should be restricted or avoided, and set building codes for foundations, slope setbacks and drainage around houses and roads. They contribute to early warning systems, using rainfall thresholds, instruments and remote sensing to detect movement before failure. Safe evacuation routes, protective berms and debris flow channels are also planned so that, even if a slope fails, the impact on lives and key infrastructure is minimized. In short, good civil engineering does not just "fix" slopes after a disaster, it designs the terrain, structures and communities then that landslides are less likely and far less deadly.

As future civil engineers, especially in a country as exposed to floods and landslides as Sri Lanka, we have a responsibility to turn these lessons into action. That means not only designing stronger structures, but also speaking up when development plans ignore basic safety principles, and helping communities understand why certain areas should not be built on.

University research, government planning and local knowledge must come together, and that hydraulic models, soil tests and hazard maps are not just academic exercises but tools that shape real decisions on the ground.

In the end, the disaster at the end of November showed both the fragility and the strength of Sri Lanka. The rain, rivers and slopes reminded us how vulnerable we are, but the way people cared for each other reminded us what we are capable of. Civil engineering cannot prevent every cyclone or storm, but it can greatly reduce how many lives and homes are lost when they arrive. By combining humanity with good science, careful planning and ethical engineering, we can work towards a future where extreme weather does not always mean extreme tragedy, and where communities are not just rebuilt, but rebuilt safer than before.

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