ESD NEWSLETTER

ENGINEERING SYSTEMS AND DESIGN

Fall 2022
Volume 6, Issue 1

Welcome Greetings

Message by Lynette Cheah,
Associate Professor
and Acting Head of Pillar

Dear ESD community,

I am honoured to pen this greeting as the new Head of Pillar of ESD. I am excited to engage everyone in the continued development of the Pillar.

I would like to express my heartfelt gratitude for Professor Jackson's immeasurable contribution to our Pillar over its developmental years. Prof. Jackson has been a dedicated leader and shaped our Pillar in many ways. His accomplishments will continue to determine the Pillar's character and success for years to come. On behalf of all of us at ESD, I thank him for his outstanding service. While Prof. Jackson has stepped down as Head of Pillar for ESD, he will continue as a full professor in ESD and Director of SUTD's Aviation Studies Institute (ASI).

I am heartened to see how our Pillar has continued to develop confident, skilled graduates with analytical mindsets and systems perspectives, sought after by industry. Our students are ready to take on challenges and play a part in building a stronger society and a better world. Congratulations to the Class of 2022 graduates and their families, who celebrated their graduation on 10 September!

As we emerge from the pandemic, I am optimistic that we can return to activities that we miss, foster deeper connections with others and maintain a positive outlook. I am glad to see the campus abuzz again with more events and activities in person. I am also happy to see students embark once again on exchange programmes.

In this newsletter, you will see how we celebrate our community and Pillar activities. We featured our faculty achievements, students' projects, and celebrate our students' achievements. We welcome you to contribute your Pillar-related stories and events by writing to the newsletter editorial team at esd@sutd.edu.sg. I look forward to engaging you and building a thriving, learning community together.

Sincerely,
Lynette Cheah, Ph.D.
Associate Professor
and Acting Head of Pillar

Key Announcements

ESD granted full accreditation again!

Our Bachelor of Engineering (Engineering Systems and Design) degree was granted full accreditation by the Engineering Accreditation Board again for another 5-year from 2022-2026.

CERTIFICATE OF ACCREDITATION

This is to certify that in January 2022

The Institution of Engineers, Singapore
through its Engineering Accreditation Board

has granted Accreditation to the Degree Programme for

Bachelor of Engineering
(Engineering Systems and Design)

conducted by

Singapore University of Technology and Design

for the graduating class in academic years 2021/2022 to 2025/2026.

Dr Richard Kwok
President
The Institution of Engineers, Singapore

Dr Lim Khiang Wee
Chairman
Engineering Accreditation Board

The Institution of Engineers, Singapore is a Signatory to the Washington Accord.

Data and Business Analytics (DBA) Course Partnership Award 2022

Awarded to:
- Car Club
- Infineon
- TSH Synergy

In recognition and appreciation for outstanding contribution to the Data and Business Analytics (DBA) Projects for three consecutive years!

Mark These Dates!

More details will be announced via email closer to the event date. For those interested, do mark your calendar for these events!

ESD Info Session
For Term 3 Students
29 Sep 2022, Thursday

Welcome Session
For Term 4 ESD Students
1 Feb 2023, Wednesday

FACULTY ACHIEVEMENTS

Professor Peter Jackson

- Co-published an article titled “Teaching Humanitarian Logistics with the Disaster Response Game” under Decision Science - Journals of Innovative Education, published on 4 March 2022.
- Published an article titled “Support Vector Machines as Bayes’ Classifiers” under the journal Operations Research Letters, available online on 20 June 2022.

Associate Professor Lynette Cheah

- Review Editor for the United Nations Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6), Chapter 10, released in April 2022.
- Co-authored an article titled “Understanding Acceptance of Shared Autonomous Vehicles among People with Different Mobility and Communication Needs” in volume 29 of the journal Travel Behaviour and Society, available online on 1 July 2022.

Associate Professor Lingjie Duan

- Co-authored an article titled “Protecting Location Privacy by Multiquery: A Dynamic Bayesian Game Theoretic Approach” in volume 17 of the journal IEEE Transactions on Information Forensics and Security, published on 7 July 2022.

Associate Professor Stefano Galelli

- Co-authored an article titled “Satellite Observations Reveal 13 Years of Reservoir Filling Strategies, Operating Rules, and Hydrological Alterations in the Upper Mekong River Basin” for the journal Hydrology and Earth System Sciences, published on 5 May 2022.

Associate Professor Georgios Piliouras

- Received honorable mention as a runner-up for the AAMAS 2022 Best Paper Award for the paper “Poincaré-Bendixson Limit Sets in Multi-Agent Learning”.

Assistant Professor Nuno Ribeiro

- Co-authored an article titled “Passenger-Centric Slot Allocation at Schedule-Coordinated Airports” in the journal Transportation Science, published online on 17 August 2022

Assistant Professor Antonios Varvitsiotis

- Announced on 19 April 2022, Research and Development project team receives a grant of SGD 3.4 million under the Quantum Engineering Programme 2.0, for their project titled “Computer Science Approaches to Quantum Computing for Finance”.

New Faculty Member Introduction !

Meixia Lin
Assistant Professor
PhD
National University of Singapore (NUS)

My research interests lie in data science and operations research, with a special focus on large-scale optimisation algorithm and data-driven modelling. I will be an instructor for the courses 10.022 Modelling Uncertainty and 40.319 Statistical and Machine Learning.

I’m sure you will have a great time in SUTD. Hope that every student grows up into a successful citizen of tomorrow’s world!

Data and Business Analytics (DBA)

The Data and Business Analytics (DBA) course is the signature course in our client-facing curriculum. Our students get the first-hand opportunity to interact directly with industry players and business owners from various fields in solving real-life business scenarios. This course is offered each year in Term 4, as one of the ESD core courses. Throughout this course, our students will acquire the necessary knowledge, skills and techniques in data analytics, process improvement, optimisation, and the experience of applying these knowledge in providing recommendations and solutions to our company sponsors.

This year, we have resumed our physical DBA project showcase in April 2022. Our Term 4 students worked with a total of 15 industry projects sponsored by 12 unique companies. The list of the companies includes Car Club, Health Promotion Board, House of 28, Infineon Technologies Asia Pacific, International SOS, Johnson & Johnson Singapore, Patrick Dental Ceramic Arts, Rockwell Collins Southeast Asia, The Ngee Ann Kongsi, TSH Synergy, Uniweld Products (USA), and YHS (Singapore).

If you are keen to interact and work with real-life industry clients, come and join ESD!

2D Project: Engineering Systems Architecture (ESA) & Manufacturing and Service Operations (MSO)

Littlefield Brewery

Team Members: Gabriel Yong, Xin Haohong, Chirag Shivakumar, Noel Tan

Tasked with making a game that involved manufacturing and service operations (MSO) concepts, our group decided to take on the exciting challenge of making a brewery game. We decided to focus on inventory theory that we learned in our MSO classes. Coupled with the multi-step process of brewing, we developed a game that tested a combination of these concepts.

From building and designing this game, our group learned about designing databases for our game as well as how to organise code for projects of a larger scale. We also gained a deeper appreciation for inventory management and realised that real-life problems are more complex than what we learned in class.

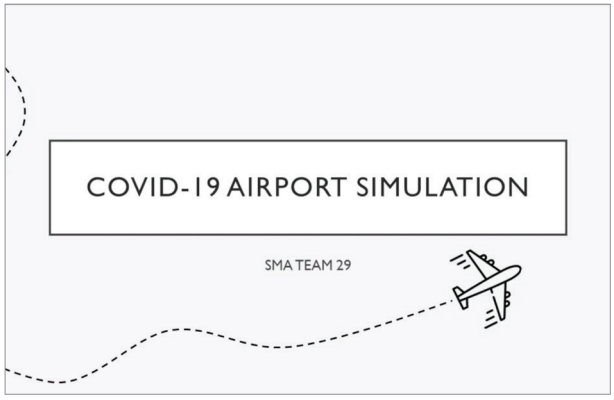
Titled Littlefield Brewery, the game requires the player to manage this brewery for the next 490 days. From the ordering of raw materials to the service of customers, one will have to do it all. There are challenges like selecting an appropriate supplier, how much to order and which customer to serve. However, the player has the option to automate all these processes which allow us to test the player's MSO concept understanding further.

CHECK OUT ALL 2D PROJECTS!

Our SMA project "Modelling Airport Arrivals in a Post-Pandemic World" was inspired by the difficulties faced by airports around the world in handling their arrivals as they adapted to the effects of the Covid-19 pandemic and the restrictions that come because of that.

Working on this project was an eye-opening and valuable experience. Using web development tools, mainly JavaScript, we built our model of an airport's arrival halls, where the usual immigration process has become more complicated as arriving passengers are now required to take a PCR and/or ART depending on where they arrived from. For future users of the model, our goal was to be able to provide better visualisation and justification of the number of immigration counters, test stations, and order of the stations for their airports, such that manpower and wait times are minimised.

Apart from the opportunity to gain better technical knowledge, this project has helped us gain a better understanding of how simulations work and how to create one that is not only interactive and attractive, but also easy-to-use for analysis purposes.



Simulation Modelling & Analysis (SMA) Project

Modelling a Post-Pandemic Airport Passenger Flow

Team Members: Vincent Leonardo, Sarah Ramjoo, Sarah Wong

CHECK OUT ALL SMA PROJECTS!

Capstone Project

N'able - a navigational wearable for the blind and visually impaired

Team Members: Leong En Yi (CSD), Keith Goh Guan Da (ESD), Nigel William Gomes (EPD), Lin Huiqing (CSD), Kwok Jing Ting Bernice (EPD), Ong Zi Min (EPD)

READ MORE HERE!

Keith Goh Guan Da
ESD Senior

My capstone project, N'able is to develop a navigational wearable for the blind and visually impaired. Thinking back on how ESD has shaped and prepared me for my capstone experience, I would say the most influential aspect would be the project management I learned in ESD. One module that is the most crucial in how it differs us from other SUTD pillars would be the Engineering Systems Architecture module that I took in Term 5. This module is at the core of what ESD is about and allowed me to contribute towards my capstone beyond my technical skills. Learning techniques such as affinity analysis, system analysis and logical architecture diagrams trained us to dissect the problem with another angle. Don't worry if all these terms seem foreign to you, I am sure the ESD faculty would explain it well to you if you do decide to join ESD.

2021 Digital Humanities Award

Project: Approaching Large Textual Archives as Big Data

Team Members: Mah Qing Long Hannah Jean (ISTD), Chua Yi Ling (ESD), Anantharajan Vivekbala (EPD), Lim Jun Wei (ISTD), Princeton Poh (ISTD)

READ MORE HERE!

As part of Dr Pang's HASS class 'East Asian Nexus', I teamed with 5 other ISTD students for our project "Approaching Large Textual Archives as Big Data." We used big data computing methods to analyse a corpus of telegrams sent among Communist allies during the Korean War to reveal shifts in sentiments between the Communist leaders. Our team's goal was to track the ways in which attitudes and relationships between the three Communist players of China, Korea and the Soviet Union developed as the Korean War progressed. From ESD's The Analytics Edge taken in term 5, we were introduced to text analytics and sentiment analysis using R, so that definitely came in useful for this project. Working with my ISTD teammates also exposed me to different methods to conduct sentiment analysis using Python and other tool packages, which was a great learning experience for me. The skills learnt in ESD allowed me to better analyse the results and draw links to specific historical events to justify the trends observed in our graphs and figures. It was a memorable experience working on this project, and I thoroughly enjoyed applying the technical skills learnt in ESD in a humanities context.

Chua Yi Ling
ESD Senior

Singapore University Games (SUniG) Champions

SUTD Women's Tchoukball Team

Team Members: Melodie Chew (ISTD), Sumi Boo (EPD), Adelle Chan (ISTD), Yeo Sze Yin (ASD), Chong Shuting (ESD), Chew Liu Im (EPD), Vanessa Ann Lim (Freshmore)

Congratulation to Shuting and her team defeating teams from SIM, NTU and SIT in the Singapore University Games and emerging as champions!

WHY I CHOOSE ESD

Gunjan Agarwal
ESD Junior

Engineering Systems Design was never my desired choice of degree, as for many of my peers. That being said, I never once had a moment of regret after joining it. It was a pillar that confused me due to the highly varied type of courses it offered, all the way from Supply Chain and Logistics to Aviation and Urban Systems. However, that is the beauty of this pillar; that it offers you an endless plethora of options to choose from.

What I love the most about ESD has to be the project-based approach to learning. Every concept or theory we learn is applied in a project. That's not all! We do projects that are client-based and multi-disciplinary. The client I worked with for my Data and Business Analytics (DBA) course project was Infineon Technologies. They gave us a project on Natural Language Generation (NLG) from structured financial data. The title sounds difficult because the project was indeed of a high difficulty level. But that's what ESD teaches us: to tackle a challenge no matter what it's difficulty level is.

If you think you enjoy logical thinking, mathematics and optimisation, ESD is the pillar for you!

Undergraduate Research Opportunities Programme (UROP)

Hear from Shyam as he shares with us his UROP project experience, together with a team of two post-doctoral fellows led by Associate Professor Georgios Piliouras, to analyse the stability of different blockchain ecosystems using mathematical models.

Project Background

As blockchains are disrupting and revolutionising the conventional ways in which people interact within large-scale financial and economic markets, both the sustainability (low environmental footprint and societal cost) and the stability of these technologies are crucial for their successful development. However, as state-of-the-art scientific literature suggests, these problems are far from understood, underexplored and still largely unresolved.

Our method to address these problems is to develop formal economical models that will capture the strategic incentives and multiagent interactions that occur within the blockchain ecosystem. While blockchains resemble conventional markets in some respects, they present a distinguishing blend of cryptographic and economic characteristics, such as anonymity of the interacting users, transborder distribution of their production resources and others, that starkly distinguish them from all existing economic paradigms. This limits the efficiency of off-the-shelf solutions and calls for the development of novel approaches.

Contributions

As an ESD student, I was able to deploy various skills that the pillar taught me in order to make meaningful contributions to this project. My first main task was to observe the blockchain ecosystem and collect the necessary data to motivate our research.

I then adapted existing formal mathematical and economic models to describe the interactions that occur between participants in the blockchain ecosystem. The technical courses at ESD such as Game Theory, Probability and Statistics, and the freshmore maths courses gave me the skills I needed to accomplish this.

Travelling to Amsterdam to Attend Ethconomics

As a part of this project, I got the opportunity to attend a conference titled Ethconomics, that took place in Amsterdam. Through a series of insightful talks and open discussions, the one-day event sought to examine the dynamics and tensions existing among the economic participants of the emergent blockchain system. It was an extremely exciting opportunity to go across the globe to a whole new continent and to take part in this conference that featured brilliant minds in this space including the Former Deputy U.S. Chief Technology Officer at the White House and Chief Technologist at the Federal Trade Commission. The trip was also culturally very enriching as I got to meet a variety of people across the globe and celebrate the famous Dutch festival - King's Day, at the heart of the city.

Shyam Sridhar
ESD Senior

ESD Graduate Programme

The ESD PhD programme aims to produce the next generation of leading engineering systems researchers and thinkers. It provides students with a strong technical foundation and puts an emphasis on inter-disciplinary and collaborative research.

Ryann Sim Wei Jian
ESD PhD Student

In my time as a PhD student in ESD, I've had the opportunity to work with an eclectic and brilliant group of collaborators across the globe, doing research into problems that I've spent years thinking about. One reason I like the programme so much is that ESD allows its students to tackle their research problems in a creative manner - there is a lot of freedom in how I choose to do my research and it's made the journey towards my thesis really rewarding. Moreover, the people I've met in the programme, not just collaborators but classmates, labmates, staff members and faculty have been friendly and endlessly helpful. Doing research in ESD feels like a group of nerdy friends who've gathered to solve some of the world's biggest engineering and mathematical problems, and it's wonderful.

Dialogue Sessions with ESD Head of Pillar

As part of our continual engagement with ESDians, closed-door dialogue sessions with ESD Head of Pillar are organized in every pillar term.

Do look out for email notifications for more details and don't miss the opportunity to meet with the ESD Head of Pillar personally for an open discussion!

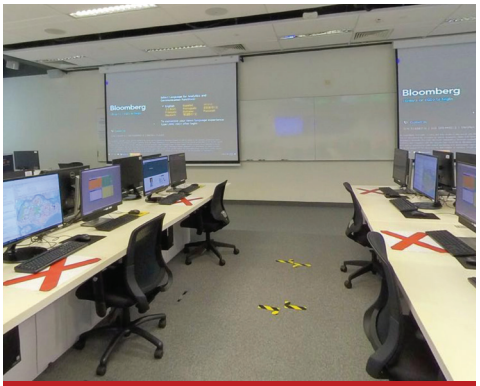
Facilities

Take a peek with ESD Facilities Virtual Tour!

The **Systems Design Studio** is an idea-friendly home for teams and design classes to meet and explore concepts that could change the world. There is ample white-space for sketching your ideas as well as display areas for showing off ideas in progress. We can cover large surfaces with sticky notes and engage in "Voice-of-the-Customer" affinity exercises. The space is re-configurable, so there is room for "body-storming" exercises to complement brain-storming activities. This is intended to be a low-technology room but we do intend to experiment with multi-touch display walls to spur and capture your creativity. This is the place to conceive your next big idea.

Systems Design Studio (1.615)

The **Data Analytics Lab** is where computational power meets systems thinking. This is the ESD home for simulation, optimisation, and analysis. It began life as a Trading Lab, simulating the research and trading activities of a financial professional. It is equipped with Bloomberg terminals giving you access to a wealth of up-to-date financial information on publicly traded firms. It also features a display board with running updates of current stock prices. But the lab has grown to embrace statistical analysis of large datasets, simulation of complex facilities, and optimisation of large scale multi-objective planning and design problems. It provides the latest tools that cover all three aspects of data analytics – descriptive, predictive and prescriptive analytics. We also host interactive, computer-based games where teams of students tackle realistic, fast-paced operational challenges such as bringing a large development project to completion on time and under budget in spite of disruptive events. This is the place to hone your computational and decision-making skills.



Data Analytics Lab (1.610)

Explore the ESD Curriculum

Core Subject Videos

Projects Showcase

ESD Games

SEE WHAT OUR ALUMNI SAY ...

SCAN TO READ ALL TESTIMONIALS

Pei Jinling
Class of 2021

International Graduate
Standard Chartered Bank

The ESD curriculum is very well designed to equip students with not only the technical skills such as system architecture design, mathematical modelling, and coding skills, but also data-driven solution delivery, visualization, and presentation skills. I learned how to build models and perform data analysis, but more importantly, got many opportunities to present the result of the analysis to different stakeholders. This is very relevant to my job in the Standard Chartered bank as the banking industry is very client focused. The opportunities that ESD has provided me to meet clients and deliver data-driven solutions that help the clients to make more informed decisions are truly valuable.

See Yong Chun
Class of 2021

Graduate Analyst
Cognizant

The ESD curriculum trained me to ask questions in order to better understand systems. As I am currently working with Amgen Biotechnology Singapore to support their Manufacturing Execution System (MES) systems, this enabled me to quickly gain a broad understanding of the MES system and its role in the Biopharmaceutical Manufacturing process. This, combined with the holistic perspective from knowing how to examine systems, helped me to better understand the pipelines and bottlenecks of the systems here, and how to prepare the required communications and information in advance to expedite the change process. Thus, ESD provided the foundation for me to exceed expectations at work.

Jordan Tay
Class of 2021

Research Assistant
Aviation Studies Institute (ASI)

ESD courses have equipped their graduates with skills to be work ready and adaptable to changes in dynamic working environments. This is achieved by introducing multiple projects tasked during our studies to materialize our theoretical knowledge into tangible outcomes impacting the real world. Moreover, having their students work with different people, not only develops our analytical and technical aspects but also hones our interpersonal skills. The ESD courses have helped me, a Researcher and aspiring Data Analyst, to obtain skills such as critical and logical thinking. These skills help me to create frameworks specifically for different research projects and use logical thinking to construct data analysis codes that are efficient and user-friendly.

Wong Kay Jan
Class of 2018

Senior Software Developer
GIC, Technology Group,
Risk & Performance
Solutions (RPMD)

The analytical and programming skills are the best takeaway from the ESD curriculum. To put the programming skills into practice, the frequent partnerships with companies and getting real world data allow me to get a sense of what a company data is like and how to process it in a way that fulfil the project objectives. Analytical skills are also honed as ESD curriculum is mathematically-driven as we study algorithms from queueing systems to machine learning algorithms. These technical skills are immediately applicable in my workplace as I solve business problems and code on a daily basis.

ESD Graduates Employment Statistics

According to the Graduate Employment Survey (GES) as at February 2022

Overall Employment Rate
95.5%

Average Gross Monthly Salary
S$4,778

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Engineering Systems and Design

esd@sutd.edu.sg
https://esd.sutd.edu.sg