WINDOW
SEE THROUGH

DEPARTMENT OF
ELECTRONICS AND COMMUNICATION

A YEARLY MAGAZINE
EDITION(2021-2022)

This job is a great scientific adventure. But it's also a great human adventure.

VCET

Vision

- To emerge and sustain as a center of excellence for technical and managerial education upholding social values.

Mission

Our aspirants are:

- Imparted with comprehensive, innovative and value based education.
- Exposed to technical, managerial and soft skill resources with emphasis on research and professionalism.
- Inculcated with the need for a disciplined, happy, married and peaceful life.

Goals

- Uncompromising regularity and punctuality.
- Academic excellence, depth in subject and general knowledge.
- Suitable placement or higher education or entrepreneurship.
- Curiosity of learning, research and development.
- Proficiency in Communication skills.
- Professional values and Social ethics.
- Keeping good health and following good habits.

About the department

A hearty welcome to the Department of Electronics and Communication Engineering, Velammal College of Engineering and Technology, Madurai. Since its inception in 2007, the department of ECE has been the front runner in imparting quality technical education to the students. The department has well qualified and motivated faculty members passionate towards moulding the younger generation. The rich technical ambience, highly enthused faculty members, state of the art laboratories and the able support from the management have made the students perform with distinction in the career pursuit. Moreover, the department of ECE is making huge strides in Research and Development. It has procured funded projects from DRDO, AICTE and DST to the tune of Rs 1.31 crores in a short span of three years. Students relish the placement in top MNC companies like TCS, CTS, Wipro, Accenture, Aricent, HP, UST Global, Zoho, Athena Healthcare etc. The department also has a worldwide reach with its vibrant alumni network. Working shoulder with shoulder with the institution, it is constantly aiming towards reaching greater heights to serve the needs of the society and meet the aspirations of the student community.

Vision

- To emerge as a vibrant centre of repute, moulding students to excel in Electronics and Communication Engineering with ethical responsibility.

Mission

To excel in producing competent Electronics and Communication Engineering professionals by

- Imparting strong theoretical background in the fundamental concepts.
- Providing self directed learning opportunities to meet a variety of career choices.
- Training students to realize ethical responsibilities for the betterment of mankind.
- Entailing the students in Research and Development activities.

Program Educational Objectives

- Graduates will have successful technical career or pursue higher education in Electronics and Communication engineering and related fields.
- Graduates will design/develop products for socially relevant engineering problems with multidisciplinary knowledge.
- Graduates will exhibit communication, team work and leadership qualities in their chosen career with ethical values.

Program Specific Outcomes

PSO I : Apply the knowledge of mathematics, physics, chemistry, electronics and communication to solve complex engineering problems in Electronic Devices and Circuits, VLSI, Embedded systems, Analog & Digital communication and other associated topics.

PSO II : Select and apply modern engineering hardware and software tools to analyze complex Electronics and Communication engineering problems.

Chairman's Message

Every young Indian of this great country should dream big!. It is not enough if they only dream but they should work hard to make it a reality! We at Velammal College of Engineering and Technology, Madurai, provide the necessary platform to many aspiring youths of this region to become very enterprising Engineers, so that they could provide the right kind of engineering solutions to propel our nation to greater heights! We sincerely believe in imparting quality engineering education laced with deep social values to ensure that every individual who is graduated from our Institution not only become a competent Engineer but also a very responsible citizen! It is high time that we got away from the age old practice of testing "standardized testing" to "creative teaming"! It has been our earnest endeavor to produce such Engineers who could offer very creative solutions! Life would not provide any warranties and guarantees and it provides only possibilities and opportunities! We want all our budding Engineers to remember this and make the best use of them. We are on an incredible journey and we expect every Velammalian to do the right thing, at the right time, the right way and for the right reason!". Please come and join us in our exhilarating journey!

Shri M.V. Muthuramalingam, Chairman

Vice Chairman's Message

Velammal College of Engineering and Technology, Madurai is providing the necessary platform to many aspiring youth of this region to become very enterprising Engineers, so that they could provide the right kind of engineering solutions to propel our nation to greater heights! We sincerely believe in imparting quality engineering education laced with deep social values to ensure that every individual who is graduated from our Institution not only become a competent Engineer but also a very responsible Citizen.

Mr. Ganesh Natarajan, Vice Chairman

Principal's Message

VCET has a world class infrastructure and state-of-the-art laboratories. The members of the faculty are highly experienced and committed to provide comprehensive technical education. The systems established in this college ensure that the engineering professionals produced are capable of meeting the global standards. Consistent campus placements and our alumni occupying premier positions in leading organisations worldwide stand testimony to quality of education and processes in this institution.

Dr. N. Suresh Kumar, Principal

HOD'S Message

In this electronics regime, the innovations improving rapidly through multi-folds by the professionals and enthusiast lead to the ever growing tree in the development of new technologies. I welcome whole heartedly the participants to join hands in supporting our endeavors by all means of interaction.

Dr. S. Vasuki Professor & Head, ECE, VCET

MESSAGE FROM THE EDITORIAL TEAM

It gives us immense joy and satisfaction to present "WINDOW", the yearly magazine from the department of Electronics and Communication Engineering. Just like the saying "A lot of hard work is hidden behind nice things", a lot of effort is gone into the making of this magazine. This magazine includes articles, poems and art works of students and faculties. WINDOW brings out innovative ideas and literary skills of our student community.

We would like to thank everyone for their contribution towards the magazine. We hope you enjoy reading this magazine as much as we have enjoyed making it.

Happy reading!!

ECE ASSOCIATION UPCOMING EVENTS (2021-2022)

Name of the Event(2021-2022 ODD Online)	Date
ECE Association Inauguration	23-08-21
Literary Events Contest- Essay Writing, JAM, Quiz (II ECE)	31-08-21
Virtual Teacher's Day Celebration	04-09-21
Dr.S.R.Ranganathan Trophy	15-09-21
Short Film Contest on given theme	25-09-21
VCET-ECE APP Challenge Contest	04-10-21
Online Poster Presentation Contest on given topic	20-10-21
Code Jam and Debugging Contest	22-10-21

Name of the Event(2021-2022 EVEN Online)	Date
Adzap Contest	22-01-22
Intradepartmental Paper Presentation Contest	29-01-22
Best Collage Maker Award Contest	11-02-22
Hardware Hackathon Contest-II ECE	26-02-22
Hardware Hackathon Contest-III ECE	07-03-22
Web Page Design Contest	11-03-22
ECE Association Valedictory	26-03-22

LABORATORIES

OPTICAL AND MICROWAVE LAB

Optical and Microwave laboratory provides an opportunity to explore the concepts in optical devices and microwave systems in a laboratory setting with an emphasis on measurement techniques.

SIGNAL AND IMAGE PROCESSING LAB

Digital image processing is the use of a digital computer to process digital images through an algorithm. It allows a much wider range of algorithms to be applied to the input data .

Centre for Unmanned Systems Research Lab (3 Lakhs)

The Signal and Image processing Lab (SIPL) was established in 1975 in the Department of Electrical Engineering of the Technion. It has been active since in research and teaching in a wide range of signal processing topics. Particularly, in the development and implementation of algorithms for processing speech, audio, image, video, physiological signals, point clouds and more.

NETWORKS AND SIMULATION LAB

Centre for Excellence Research Lab for "IoT" (11.98 Lakhs)

Network simulation offers an efficient, cost-effective way to assess how the network will behave under different operating conditions.

FACULTY CORNER

Distributed Massive MIMO: Algorithm for TDD Reciprocity Calibration

THE CHALLENGE

Distributed Massive MIMO exploits diversity more efficiently and can potentially offers much higher probability of coverage, but still faces the challenges of backhaul, synchronization, and time division duplex (TDD) reciprocity calibration. This work focuses on an algorithm to improve TDD reciprocity calibration for equally distributed co-located arrays.

THE SOLUTION

Distributed systems can be created by connecting two 32-antenna test beds to the main chassis with a 10 m optical fiber cable using NI USRP RIO, LabVIEW Communications Systems Design Suite, and MIMO Application Framework. Hierarchical-based calibration method can be used to address the huge dynamic range between the channel gain of intra subarrays and inter subarrays. To increase diversity and array gain during intercluster calibration, maximum ratio combining and maximum ratio transmission can be applied. Therefore, unlike when using the conventional method, all multiple input single output (MISO) gain can be collected in one shot during intercluster calibration. Distributed antenna arrays can be used to help decorrelate closely collocated users in both LoS and NLoS scenarios.

Expected outcome of the Research

Pilot contamination effect can be emulated using two cells that share the spectrum.

Based on the channel characteristics, Pilots can be efficiently assigned in two virtual cells and reduce pilot contamination. Frame structure modification with joint beamforming technique can also be used to reduce pilot contamination. With the virtual two-cell test bed, performance in the real world environment can be measured.

A two 32-antenna DM-MIMO BS station setup established in the KU Leuven Research Lab at Belgium. To enlarge the path-loss by blocking LoS in between the clusters, two absorbers were placed in between the arrays.

Mr. A. SUBAN
ASSISTANT PROFESSOR/ECE

ENVIRONMENTAL HYGIENIC AUTOMATIC GARBAGE WASTE DISPOSAL SYSTEM IN RESIDENCE

1.ABSTRACT OF PROJECT:

The wastes are collected and automatically segregated into bio-degradable and non-bio-degradable wastes. The bio-degradable wastes like food wastes are converted into organic manure which can be used as a bio fertilizer for plants and crops. Along with food wastes the non-biodegradable wastes other than plastics, which do not pollute the environment are also crushed at the mouth of the garbage collector using a rotary zigzag blade mechanism. Then the crushed waste is dropped in a container in which the water level is maintained automatically by solenoid valve. Since the density of plastics is less that makes them to float over the water. A built-in wavery mechanism pushes the floating plastics towards the conveyor belt. And a suction device sucks the plastic and drops them inside the oxygen free chamber

2.DESCRIPTION:

No need for manual separation of bio degradable from non bio degradable wastes. The waste is prevented at source level. Hence there is no dumping and accumulation of waste which degrades and affects the environment. The degradation of soil is prevented at large scale as there is no non biodegradable waste disposed. There will be no water logging as well as to arrest air borne diseases. Through which pollution free environment assured to the society. There is no need for transportation of waste and the existing methods like landfill which includes large area of land, incineration which produces many bi-products like ash, composting which takes long time to convert wastes into manure can be totally avoided. It finds huge applications in

- Households
- Commercial establishments including hotels and markets
- Parks
- Public and Private Health Sectors
- Government and regulatory bodies

Agriculture field.

Mr. V. Karthick
ASSISTANT PROFESSOR/ECE

On the Land of Tokyo

India's Tokyo 2020 Olympics medal winners

Olympics Gold Medalist Neeraj Chopra became only the second Indian individual Olympic champion. PV Sindhu won her second Olympic medal while the men's hockey team won an Olympic medal after 41 years.

Weightlifter Mirabai Chanu opened India's medal account at the Tokyo 2020 Olympics with a silver in the women's 49kg - her first medal at the Olympics. **Lovlina Borgohain - Bronze medal - women's welterweight (64-69kg)** On her Games debut, Lovlina Borgohain won a bronze medal..

PV Sindhu - Bronze medal - women's singles badminton

Badminton queen PV Sindhu became the first Indian woman and only the second Indian athlete - after Sushil Kumar - to win two individual Olympic medals. **Ravi Kumar Dahiya - Silver medal - men's 57kg freestyle wrestling** The 23-year-old Ravi Kumar Dahiya lost to twice world champion Zavur Uguev of ROC in the final of the men's 57kg freestyle wrestling, thus ending up with a silver medal. **Indian hockey team - Bronze medal - men's hockey**

After a 41-year wait, the Indian men's hockey team finally has an Olympic medal since the gold at the 1980 Moscow Olympics.

Bajrang Punia - Bronze medal - men's 65kg wrestling

Wrestler Bajrang Punia became the third Indian debutant to win a medal at Tokyo 2020. **Neeraj Chopra - Gold medal - men's javelin throw**

Neeraj Chopra became India's second individual Olympic champion - after Abhinav Bindra - with his men's javelin throw gold at Tokyo 2020. It was India's first track-and field medal at any Olympic Games. Neeraj Chopra threw 87.58m to wrap up the gold medal.

Bow to champs…….

Ms.A.Alaimahal, AP/ECE

TECH BIT

VISUAL POSITIONING SYSTEM

What is Virtual Positioning System (VPS)?

VPS is the logical progression from a globally connected network, exhaustive data and new cloud storage accessibility. VPS is the blend of artificial intelligence (AI) image recognition technology and augmented reality technology, which combine symbols on the apps screen with real-life street images.

- It combines the live camera with Google's extensive back-end data in order to analyse the surrounding, which helps to identify the location of a user with greater accuracy.
- It uses augmented reality to give additional information.
- The technology was recently used in the Chandrayaan II mission.

How Visual Positioning System Works?

A monitor and IMU are at its heart, the Intermodal Visual positioning system-VPS. Using the data from these devices, the world will be studied and measured and identified. If you replay a mapped location, VPS uses Google's extensive back-end data and your device's camera to analyze the surroundings where you are in. The greater accuracy of the features makes it really easy for them to identify where you are. New onboard sensors can improve tracking with sensing fusion -GPS(1).

- **Localization:**
  - Position tracking sensors.
  - Identify location with the help of the map.
- **Mapping:**
  - Map updates.
  - Sharing of maps.
  - Overlay the map manually or based on computer knowledge with or without a floor plan.

Current Challenges of VPS

Measuring position has been a dramatic success for outdoor navigation system, and there is a strong push to repeat that indoors. Being able to locate a person inside a building can help in many different ways. From finding the right office in a tower block

to locating a required department or even a specific product in a shop or providing highly targeted deals as you walk around the supermarket.

Real World Uses Cases of VPS

Visual positioning system VPS extract visual point feature from Geo referenced images due to increasing popularity of location-based services VPS is poised to supplement existing location data models to further advances in navigation marketing and even robotics.

Three major use cases cited by a direct challenge to Google Fantasmo includes,

1. **Augmented Robotics**; Autonomous Robots from drones to dogs to cars, could access VPS services via and SDK doing so would dramatically improve their ability to navigate overusing GPS alone.
2. **Augmented Marketing**; Major brands worldwide are well underway in capitalizing on the immersive potential of AR to create compelling marketing content.
3. **Augmented Navigation**; one of the most impressive demonstration at this year google I/O developers conference was an extremely effective proof of concept an AR mode edit to Google Map employed VPS to overlay helpful AR artifacts which helped user navigate to their without consulting a map in one of the first truly compelling use cases for mobile AR**.**

Coming Attractions: Future Trends

Google's "world positioning" approach is to incorporate another sensor to make you feel more focused. Existing objects, such as vehicles and systems that can calculate magnetic and gravitational fields are quickly distorted, "resulting in errors up to 180 degrees unreliable." VPS provides an imagery-based unit positioning instead of GPS. Next, VPS generates maps using an image set, which has a defined location and analyses them in order to create a detailed and easily searchable database of the visual features with key visual features like a contour of structures or bridges. VPS compares picture processing in the phone to the VPS index in order to find a device. However, both the images and the position associated with it have a great impact on the accuracy of the location through VPS. Google views VPS as a Street View index data in 93 countries worldwide, with "trillions of solid metrics to implement triangulation," which first "filters out transient sections of the scene and focuses on permanent structures which are static over time." Machine learning is applied to eliminate trees that, depending on the season, are different in complex light movement and construction.

Conclusion

Technologies like GPS and VPS are revolutionizing digital mapping that are of immense help in our daily life. Therefore, with such technological evolutions, the services offerings are expected to be more virtual, customized and augmented for each person.

- Mohith Veereshwar
III ECE-B

VIRTUAL REALITY AND AUGMENTED REALITY TECHNOLOGY

Augmented and virtual reality technologies are already used to improve the efficiency of the product design process. In the automotive industry, for instance, manufacturers used to create clay prototypes of new vehicle designs

The Future of Virtual and Augmented Reality Technology

It is expected that businesses will continue to find new and exciting ways to use virtual and Augmented reality technology in the future.

Some of the ways that these technologies could be used in the future include:

- Remote Workplace Trans format
- Promote Social Good
- Available and Affordable Healthcare
- Improve Quality of Life For the Disabled

As a result, this use of virtual and augmented reality technology could help more workers successfully shift to remote work. There are a number of factors that are expected to drive this significant growth, including Better devices: Many consumers weren't initially interested in these technologies because the headsets and glasses were bulky and uncomfortable. But now, the designs are becoming sleeker, lighter, and more comfortable to wear, which could attract a wider range of consumers. Substantial investments: Over $4 billion was invested in he virtual reality and augmented reality market in 2019 alone. These investments will most likely translate to massive growth in this industry over the next decade. Virtual reality and augmented reality technology can help manufacturers get an idea of how their processes are performing, as it can help them spot problems and areas ripe for improvement. According to Tata Technologies, virtual reality can be used to accelerate and improve decision making in the manufacturing process. Augmented and virtual reality technology have come a long way since they were first introduced to the world, but there's no doubt that the best is yet to come. Over the next decade, these technologies will continue to change the way people communicate, shop, learn, travel, and make basic decisions in their everyday life.

-Arun Sundar K
III ECE-B

3D BIOMETRICS

What is 3D Biometrics?

It is a multi factor authentication scheme that combine KNOWLEDGE BASED + TOKEN BASED + BIOMETRICS in one authentication system.

Advantages

- It provides user options to choose the type of authentication of his/her own choice.
- It eliminates a brute force attack.
- Provides high level security to the system which contains more importan tdata.
- Secure against a software like a key logger.

3D Password mechanism is more secure and reliable compared to other authentication mechanisms. By using 3d Password we can make any system more secure and it will be beneficial for applications used in cooperate world, government sector and in personal use.

- A. Jothika
III ECE-A

Intelligent Process Automation

What makes up IPA?

Intelligent process automation (IPA) is a combination of technologies used to manage and automate digital processes.

In short, IPA essentially augments RPA technology with additional emerging Digital Transformation technologies

It is comprised of 4 core technologies.

Benefits of IPA

- Increasing process efficiency
- Improving customer experience
- Optimizing back office operations
- Reducing costs as well as risks
- Optimizing the work force productivity
- More effective monitoring and fraud detection
- Product and service innovation

The value of IPA

- While IPA takes over rote tasks, human workers can focus on delighting customers and thinking about how new troves of data outside the organization from news, events, social media, embedded sensors, and elsewhere can help achieve business goals.
- Although the full range of benefits comes from implementing the complete IPA suite, companies can unlock significant value quickly through individual elements.

IPA in Action

Let's consider a financial services firm in which a customer support agent must pull information from a dozen different systems in order to provide basic level, day to day service. With IPA employed, software robots can interpret text communications, make decisions that don't require pre-programming, offer suggestions to clients and provide real-time tracking and visibility into the workflow between systems and human agents.

- D. Buvisa
III ECE-A

Repurposed communications satellites could help save humanity from an asteroid impact

A repurposed telecommunication satellite about to hit an asteroid to safe humankind from extinction.

Large satellites used for TV broadcasting could be quickly and easily repurposed as asteroid deflectors if a space rock were to threaten Earth, according to a study by the European aerospace company Airbus.

The study, part of a mission concept called Fast Kinetic Deflection (FASTKD), was commissioned by the European Space Agency (ESA), as part of its effort to prepare for an apocalyptic scenario that will certainly happen one day (even though that day might be in a very distant future).

Telecommunication satellites that sit in the so-called geostationary orbit at the altitude of 22,000 miles (36,000 kilometers) circle Earth at a speed that matches the rotation of the planet, thus appearing permanently suspended above a certain region. These satellites are usually very large, like a small bus. They might weigh 4 to 6 tons, which would give them enough force to affect the trajectory of an approaching space rock.

It would require maybe 10 such spacecraft hitting a 1,000-foot-wide (300 meters) asteroid within a short period of time to sufficiently change its trajectory to avoid the planet.

- Harshan.S

POET STREET

YOURSELF

When you see good in others, see good in YOURSELF,
when you motivate others, don't forget to motivate YOURSELF,
when you like someone's character, take a look at YOUR own character,
when you give love to others, give some to YOURSELF,
because YOU define your life,start being the best version of you.

- Urmika g.s
III ECE-A

அன்னை எனும் அழகும்

அம்மா என்ற சொல் அன்பு நிறைந்தது
கள்ளம் இல்லா வெள்ளை மனம் உடையது
அழகு மிம்பமாய் நெஞ்சில் பதிந்து உறைவது
சொல்லுக் கடங்கா கொள்ளை இன்பம் தருவது
அல்லி அணைத்து உச்சி முகர்ந்து அழகும் ஊட்டினாய்
அன்பு காட்டி அரவணைத்து உலகம் உணர்த்தினாய்
நெருக்கமான தோழியாகி நேற்றம் காட்டி திருந்தினாய்
நல்லது கெட்டது யாவுமே நாகுக்காய் ஊரிச்சென்றாய்
வருந்தி நிற்கும் வேளையில் தலையைக்கோதி விட்டாய்
என் நலமே உன் நலமாய் வாழ்ந்து காட்டி விட்டாய்
உன் அருமை உள்ள போது எனக்குத் தெரியவில்லை.
தெரிந்து உணர்ந்த போது நீ இங்கு இல்லை
நாலங்கள் உருண்டோடி காலன் உமை எடுப்பினும்
நீ காட்டிய பாதையிலே நான் நடப்பேன் பெருமையாய்

- By.
K.S.M. Athika Rani
II ECE - A

God’s present to men

Woman are the real architects of the society,
One of the god’s creation with finest beauty,
Being born as a women is a boon,
The things against you will change soon.

Your eyes tricked me drive somewhere,
Your lap has a mystery of sleeping wonder,
You are wonder with more and more care,
And I feel the presence of god around you.

Mother is the person who makes all joy,
And women are not men’s toy,
Shame to born as a man in this nation,
Laws should be rigour for this section-376b

We should give them way, not block them,
We should give them feathers not to clean but to fly,
We should give them encouragement not empowerment,
We are men who are hide in you ”women”

- Sivamanibala
III ECE-B

THE ART FACTORY

J. NIVETHA
II ECE-B

EUGENE JOSE PUSHPA G

SHREEHARINI M
II ECE-B

MADHURA A
IV ECE-B

SANJU VIGASINI K S

SUBASHI S
II ECE-B

DEEPTHI J H
III ECE-B

CLICK ART

HARSHAN S

PRASANNA VENKATESH.M.G

KARTHIK VASUDEV V H

R. SRISIVAKUMAR

ALUMNI CORNER

Grretings to all,

I'm Asif Ismail my college life starts from the day you set foot in VCET. Department life starts from your second year. Although the department is just one among many others in the college, ECE is worlds apart from the rest. In fact, it's an altogether different experience in the ECE department compared to the overall college experience. When one lives under the realm of the department, he easily forgets the other things that surround him. Lecturers claim each class their own, and our beloved HOD kindles the fire for winning the shields from Slowly our entire lives revolve around the various sports, cultural, and literary events. By the time we learn to juggle between our extracurricular and the various cycle tests, the second year comes to a closure and the next year brings with it, The Symposium. The next year, the mad rush of placements and the fresh fragrance of fun and freedom it brings. Projects, times spent in labs, slam books and farewells. Over the years one tends to overlook the immense support and strength our staff and HOD offer us. The endless fights during the various literary and sports events, on and off the pitch, our staffs were always there, like the fight was their own. Any typical software engineer from an MNC, when asked to look back at his college life would most likely recall either affairs or automobiles. Only someone from ECE, VCET would be able to recall all that I've mentioned above.

Greetings to all, I'm Tharani, one of the alumni's of our dept from 2011-2015 batch. First of all, a hearty wishes to our ECE ASSOCIATION which has been continuously working towards the benefits of students. We are very proud that our magazine named "WINDOWS" is going to be launched for this academic year too, I am so happy to share my experience with our department in this magazine. Our department is a place where I learnt about TEAMWORK Every year all of our department students work together to win the academic shield. We work hard to prove that we are the champions of our college. As a result of this integration of every individual in our department, we are the defending champions for the past 7 years. Our department staffs are very friendly and they encourage students not only in studies but also in extra-curricular activities. I have also given a small contribution for our department by means of receiving prizes and awards from IIT, IISC and various institutions. I request all the students to utilize the opportunities provided from our department to have a bright future. Thank you for giving me this opportunity.

Life would never been this easy if we weren't in this department, When I chose CSE in my counselling my dad forced me to ECE. He was right! He pushed me into the department of fortunes, liveliness and fun. ECE taught me many things. It taught me teachers can be friends, exams can be easy and a department can be a family. When we recollect all those memories we really miss our college days. Who won't miss a life where you have a HOD who never scolded you, a class in charge who always cares you, a senior teacher who is your friend, a placement in charge who is your brother, a department in charge who believes you, a lab in charge who is a Google. Thank you ECE

-SATHYA MOORTHY

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