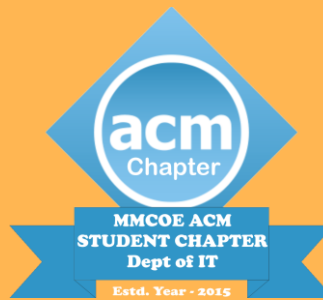## Department of Information Technology

InTegenious

Volume VIII | Issue 1| June 2022 – December 2022
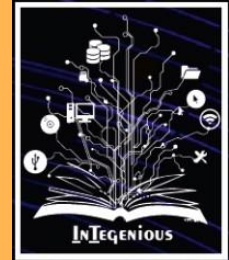
Highlighting Events

- One Week FDP on "Introduction to DevOps"

- Soft Skills Training by Barclays for Students of B.E.

- ACM and ISTE student chapters sponsored HackSprint v4.0 Hackathon competition

Student Chapters/ Associations

MMCOE ACM STUDENT CHAPTER Dept of IT
Estd. Year - 2015

Once We Commit We Never Rollback
ITSA
Est-2014
INFORMATION TECHNOLOGY STUDENT'S ASSOCIATION

MoU's with Industries

CarvingIT

SoftTech Data Securities
Build | Innovate | Contribute

cybervault
Endlessly Alert.

ATS Infotech Pvt. Ltd.

KasNet
Trusted Partner in your Growth
INDIA | USA

AgileSoft
Methodologies

Hirameki Solutions
GANESHA

ecoRise
Software Solutions

InTegenious

A biannual newsletter from the Department of Information Technology, MMCOE

Volume VIII | Issue 1 |June 2022 - December 2022

Contents

Vision of Department:

To emerge as a centre of excellence in education, research and innovation in Information Technology for enrichment of Society.

Mission of Department:

- **To cater industry with engineers having theoretical & practical background and competent IT skills.**
- **To pursue advanced knowledge in the field of information technology.**
- **To inculcate budding IT Engineers with professional and interpersonal skills.**

1. *Message from HOD*

Dear Readers,

      I feel glad to introduce you to, our first issue of volume VIII, of IT Dept. e-newsletter "InTegenious". In this issue we have covered almost all the activities of the dept. for Academic Year 2022-23 Sem - I. Major activities I would like to highlight are - FDP organized by the department on DevOps as well as the 30 hour long coding competition "Hacksprint v4.0" in association with ACM Student Chapter of MMCOE.

      I appreciate the efforts taken by E-newsletter team and wish them all the best for upcoming issues.

Programme Educational Outcomes (PEO's):

PEO 01: Adequate knowledge and skills in Information Technology for implementation of complex problems with innovative approaches.

PEO 02: Inclination and technical competency towards professional growth in the field of Information Technology.

PEO 03: Ethics and value based interpersonal skills to facilitate lifelong learning and societal contributions.

- *Team InTegenious :*

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Our Mentor   **:** Dr. Rupali M. Chopade, HOD IT.

Faculty Editor   **:** Ms. Neelam Jogalekar, Assistant Professor, Dept. of I.T.

Student Editor   **:** Ms. Vishvjita Savkare, SE IT

2. *Student Placement Details*

Sr. No.	Name of Student	Company	Package (in Lacs)
1	Kedar Khedkar	Bitwise	6
2	Akre Sharwari Amol	Capgemini	4.25
3	Aryan Madhur Hamine		4.25
4	Chougule Mitali Kundlik		4.25
5	Saurabh Lohokare		4.25
6	Role Sharvari Raju		4.25
7	Piyush Terkar		7.5
8	Lalge Rutuja Vinod		4.25
9	Aishwarya Bhujayya Swami		4.25
10	Tikone Sourabh Baliram		4.25
11	Bhongale Stuti Ravindra	Carve InforTech	3.5
12	Darade Aniket Gangadhar	Einfochips	4
13	Barhanpurkar Piyush Jayant	Hexaware	4
14	Wanjale Keshav Chandrakant		4
15	Khodake Snehal Devidas		4
16	Killekar Atharva Suresh	Hike Education	6.42
17	Prajesh Gawhale	JIO	5
18	Yash Ghan		5
19	Vishwajeet Satish Deshmukh	Juspay	11
20	Lokesh Yadav	Persistent	5.01
21	Anushka Vaidya		5.01
22	Amey Abhay Deshingkar		7.8
23	Shubham Surwase		5.01
24	Pawar Riddhi Rajendra		5.01

25	Pratik Pawar		5.01
26	Jadhav Vijay Rajaram		3.36
27	Khedkar Ved Sanjay		3.36
28	Raut Achal Dashrath	TCS	3.36
29	Rupde Pratiksha Kiran		3.36
30	Pranay Dilip Pawar		3.36
31	Deo Aneeket Dipak		7
32	Jadhav Siddhant Ajay	Tech Mahindra	3

3. *Student Achievements*

Sr. No.	Name of Student	Achievement Details
1	Saurabh Lohokare	Smart India Hackathon 2022 Winner with cash prize of Rs. 1 Lac
2	Kedar Khedkar	Smart India Hackathon 2022 Winner with cash prize of Rs. 1 Lac
3	Yash Ghan	Smart India Hackathon 2022 Winner with cash prize of Rs. 1 Lac
4	Saurabh Lohokare (Team Hash Clashers)	UNESCO India Africa Hackathon 2022 winner with cash prize of Rs. 3 Lac
5	Kaustubh Wayfalkar	Finalist - Smart India Hackathon 2022
6	Akanksha Unde	Finalist - Smart India Hackathon 2022
7	Swarali Suryawanshi	Winner, Exploratory Data Analysis conducted by IT Department, MMCOE.
8	Mahesh Pimparkar	Winner, Exploratory Data Analysis conducted by IT Department, MMCOE.

Student Internships

Sr. No.	Class	Students Name	Company Name
1	BE	Vishwajeet Deshmukh	Juspay Technologies Private Limited
2	TE	Nagesh Wadgure	Exposys Data Labs
3	TE	Jayesh Kulkarni	Exposys Data Labs
4	TE	Swarali Suryawanshi	EduSkills
5	TE	Nikhita Watpal	EduSkills
6	TE	Bhuvnesh Rajekadam	EduSkills
7	TE	Mahesh Motale	Quick Report Software Private Limited
8	BE	Paneet Rai	Quick Report Software Private Limited

Internship Certificates of Students

4. *Student Publications*

Sr. No.	Name of Author	Paper Title	Journal/ Conference
1	Nagesh Pawade, Akshay Tale, Amit Kadam, Amit Gujar	Crop Yield Prediction Using Naïve Bayes Algorithm	International Journal of scientific Research in computer Science, Engineering and Information Technology
2	Chetan Urkudkar, Isha Ghaisas, Tanvi Karale, Padmaja Lole	Mental Health Chatboat and Mental Illness Identification System	International Journal for Research in Applied Science and Engineering Technology
3	Varun Malpani, Vaibhav Nikas, Shubham Katkar, Raghav Hedda	Implementation of UI based on Gesture Recognition for Hospital Enquiry System	International Journal for Research in Applied Science and Engineering Technology
4	Abhishekh Lalwani, Harsh Gangawane, Bhaghyesh Hatwalne, Rutuja Khire	Revenue Prediction and Donor Segmentation for NGOs	International Journal of Computer Applications
5	Abolee Dhore, Akash Sawant, Chirag More, Swaroop Satav	Criminal Face Identification System	International Journal of Advances in Engineering and Management (IJAEM)
6	Preeti Badave, Bhakti Bhomaj, Bhargavi Bindu, Riddhi Shivarkar	Ecommerce Website with Recommendation System Including Chatbot and Reverse Image Search	International Journal for Research in Applied Science & Engineering Technology (IJRASET)
7	Sneha Kambley, Himani Chaudhary, Anuja Dhamal, Pooja Sonawane	A Lightweight Authentication system for Digital Banking using QR code and Visual Cryptography	International Journal of Research and Analytical Reviews (IJRAR)
8	Vinayak Tumbagi, Gaurav Belakar, Saurabh Mahalankar, Aditya Wakankar	Loan Prediction System using Machine Learning	International Journal of Research and Analytical Reviews

5. Workshops & Technical Events Conducted by Department

1. One week FDP on "Introduction to DevOPS" in association with The Institution of Engineers :

Event name: One week FDP on "Introduction to DevOPS" in association with The Institution of Engineers

Event date: 23rd To 27th August 2022

Platform: Google meet

Department of Information Technology had organised an event named One Week FDP on "Advances in Web Technology". It was an faculty training program specially organized for Faculties.

The event was open for faculties from Computer and IT branch. We received over 140 registrations from colleges all across Maharashtra. The event was coordinated by Dr.Bharati Vasgi and Ms. Shruti Kulkarni.

The event was conducted via Google meet. All the resource person's namely Mr. Swami Panjala, Mr.Tushar Kute, Mr.Mahesh Bodhgire spoke in detail about Web Technology and also conducted a very informative hands-on sessions for the participants.
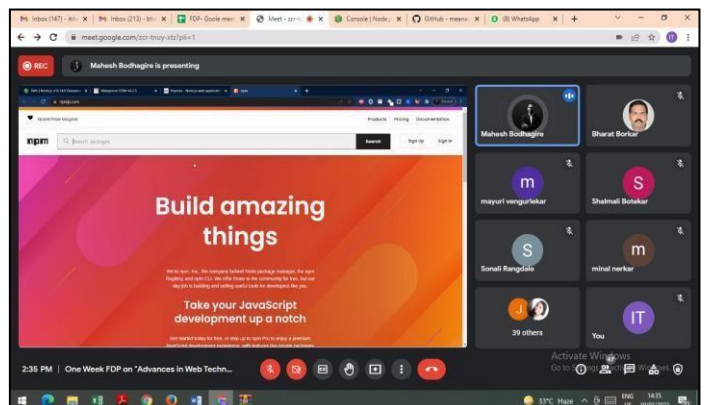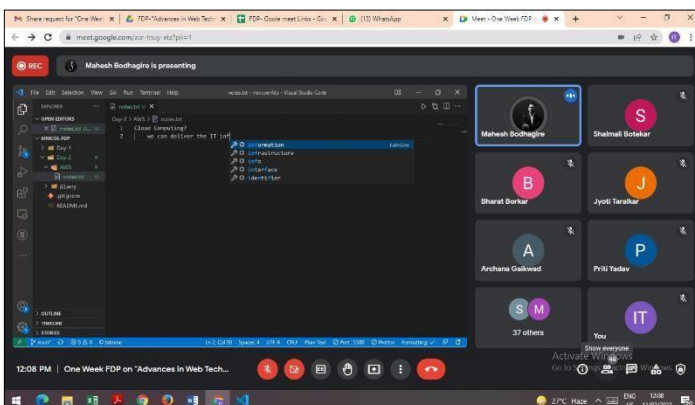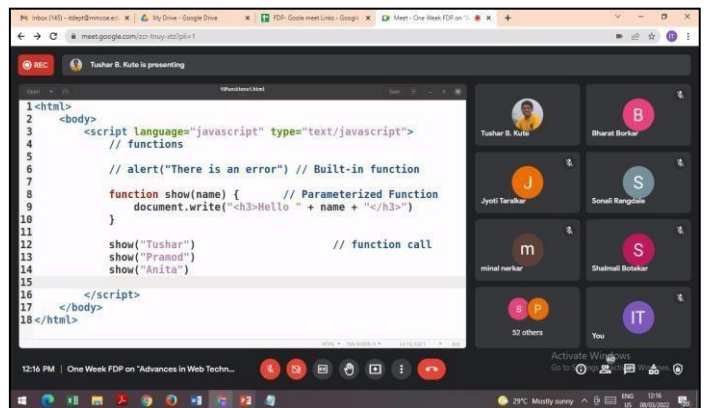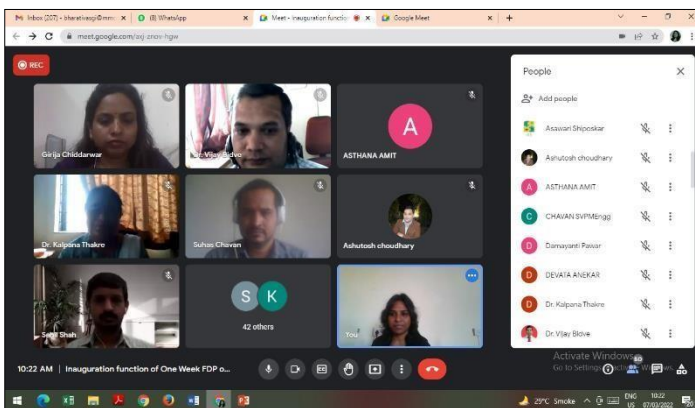
- ## Soft Skills Training for BE IT Students :

Event name: Soft Skills training for BE IT Students
Event date: 29th To 31st July, 2022
Venue: AC 401
Conducted By: GTT Foundation- Barclays

Soft skills training program was organized by the Department of Information Technology, Marathwada Mitra Mandal's College of Engineering (MMCOE) in association with AICTE and ISTE. The program was scheduled for three days from 29th July to 31st July 2022. The sessions were conducted by trainer Ms. Vidisha Joshi from Barclay's. The training program was organized to make students ready for upcoming placement drives.

The program covered communication skills, resume preparation, grooming for personal interviews, mock group discussion, mock personal interviews. The program was supported by principal Dr. Gohokar.

- ## Spoken Tutorial :

Event Name : Spoken Tutorial Online Test

The summary of the result of the spoken tutorial test for Sem-II were as follows :

Branch	Year	Course Name	Candidates Appeared	Candidates Passed	Passing Percentage
IT	S.E.	Python 3.4.3	74	74	100
IT	T.E.	RDBMS PostgreSQL	78	78	100
IT	B.E.	PHP and MySQL	79	76	96.20
Computer	S.E.	C	159	153	96.20
Computer	T.E.	RDBMS PostgreSQL	139	139	100
Computer	B.E.	Python	108	101	93.51

• <u>Parent Teacher Meeting</u> :

Event Date: 17/09/2022
Mode of Conduction: Offline
Venue: AC 401, IT Department, 4th Floor, MMCOE, Karvenagar.

Parent Teacher meeting for the academic year 2022-23, Semester-I was conducted on 17th September 2022 in the college campus. Around 40+ Parents from SE, TE and BE were present for the Meeting.

Commencement of the Parent Teacher meeting took place at 11:00 am with the welcome speech by Mrs. Preeti Joshi. Dr. V. N. Gohokar, principal of MMCOE addressed the parents. Overview of T&P Activities undertaken by the college by Ms. Rohini Mulay, Director, CRD and Mr. Rahul Undegaonkar, TPO, MMCOE.Department presentation regarding infrastructure details and academic policies followed by the department was presented by Dr. Rupali Chopade, HOD. Questions of the parents addressed by HOD Dr. R. M. Chopade and faculty members of the Department. At the end, a vote of thanks was given by Mr. N. S. Dhavase. The parent teacher meeting concluded at 12:30 pm.

➢ *Following points were discussed in Meeting:*

1. *Last year and Current year placement scenario were discussed with the parents.*
2. *Discussed the efforts taken by the Department and College for placement and internship.*
3. *Mrs. Rohini Mulay, Director, CRD and Mr. Rahul Undegaonkar, TPO, MMCOE.*
   discussed various initiatives taken by the college for Students' Internships and Placements.
4. *One of Parents, Mr. Rahul Sharma of Computer Department, being an Alumni himself, ensured the overall progress of the institute and the department.*
5. *Discussed the various activities conducted in the department like skill-development programs, Curriculum gap bridging Lectures, Guest Lectures, Workshops, coding competitions and other events conducted under ITSA, IT Tech. Club, ACM student chapter and Center of Excellence.*
6. *Many parents were concerned about getting details of departmental activities via whatsapp/ e-mail.*
7. *Information regarding Industrial Visits and personality development programs was requested and disseminated to the parents.*

6. *Seminars / Guest Lectures Conducted by Department*

Sr. No.	Name of Resource Person	Designation and Organization	Topic of Lecture	Date	Beneficiary class
1	Mr. Amit Lande	Consultant, HSBC Pune	Design Pattern in Java	18/11/22	SE
2	Mr. Atul Bodas	Senior Director, HPC Technologies Group CDAC, Pune	Introduction to SuperComputing and PARAM Net-3	29/11/22	SE
3	Dr. Dnyanada Deshpande	MD Psychology, Mangeshkar Hospital, Pune	Stress Management	15/11/22	SE
4	Mr. Milind Jadhav	Senior Consultant,TCS.	Ethics & Values in IT	18/11/22	SE
5	Mr. Harshal Tupsamudre	Senior Threat Research Engineer, Qualys, Pune	Complexity Classes	17/11/22	TE
6	Mr. Yogesh Shinkar	Linux System administrator, Persistent Systems, Pune	Linux Redhat and Suse Linux	13/11/22	TE
7	Mr. Vijayanand Banahatti	Lead Researcher, TCS Research, TRDDC.	Interaction Design for Cyber Security	11/11/22	TE
8	Mr. Ankit Rao	Senior Software Engineer, Zscaler, Pune.	Cloud Databases and its ,ecurity	17/11/22	TE
9	Ms. Shruti Channagari	Hirameki Solutions Pune	Japanese Language	11/11/22	TE
10	Mrs. Prachi Joshi	Program Manager, Accenture	Devops in Practice	09/11/22	BE
11	Mr. Abhishek Bang	Assistant Vice President(Business Analyst) at Citi	Agile Project management & Industry standard tools	19/11/22	BE
12	Mr. Akshay Pandita,	Lead Engineer, HCL Technology, Pune	AR, VR and Unity 3D	13/11/22	BE
13	Ms. Mrunal Joshi	Data engineer at Barclays solution, Pune.	Data engineering/data platforms, Machine learning basics, Deep learning concepts, CNN, RNN, LSTM	09/11/22	BE
14	Mr. Amey Tambe	Director, SoftTech Data Securities, Pune.	Copyrights and Patents	20/10/22	BE
15	Ms. Shruti Channageri, Mr. Masato Sampei	Hirameki Solutions Pune Founder and Director, Asia to Japan	Orientation Session on Japanese Language Culture and Placement	16/09/22	SE, TE, BE
16	Mr.Praveen Pandey	Network engineer,NITS Global,Pune	Advance networking concepts	12/12/22	SE

7. ACM Student Chapter Activities

The students selected for the mentioned posts of MMCOE ACM Students chapter (http://mmcoe.acm.org), for the AY 2022-23 are as below:

Sr. No.	Name of Post	Name of Student
1	Chairperson	Mr. Aditya Paranjape
2	Vice Chairperson	Ms. Bhargavi Patil
3	Treasurer	Mr. Keyur Joshi
4	Joint-Treasurer	Ms. Shruti Savanur
5	Secretary	Ms. Isha Agarwal
6	Joint-Secretary	Ms. Tejal Khadke

Inauguration of ITSA and ACM office on Engineers Day

- ## ACM Event/Workshop :

Event Name: **Hacksprint v4.0**
Event Date: 14/10/2022 - 15/10/2022.
Mode: Offline

The ISTE Student's Chapter of Marathwada Mitra Mandal's College of Engineering, Pune in collaboration with ACM Student's Chapter, MMCOE, Pune organized a 30 hr. hackathon - HackSprint v4.0 on 14th Ocober 2022 and 15th October 2022.

The competition was organized at a national level with over 33 teams constituting about 130+ participants from various colleges like VIT, VIIT,Cummins, AISSMS, MIT WPU, Modern, Sinhgad-SKN, Sinhgad-RMD and MMCOE. The event was conducted in a digital space encompassing 2 different platforms, GitHub and Google Meet in association with TATA Technologies, SoftTech, Express Analytics, Scrobits, Atomic Loops, Wolfram One, Jetbrains and GiveMyCertificate.

Glimpses from Hacksprint v4.0

- **ACM Brain games :**

Event Name: Brain Games
Event Date:End of Every Month
Venue: Online
Platform: Google Forms

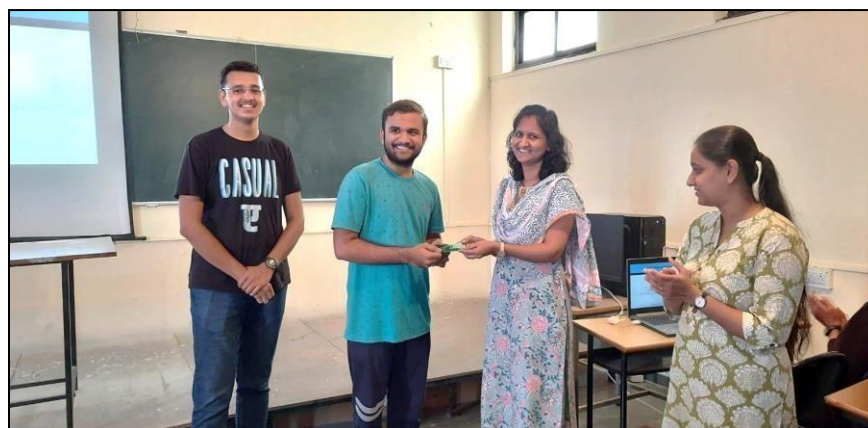*The ACM Student's Chapter of Marathwada Mitra Mandal's College of Engineering, Pune*
successfully conducted "ACM Brain Games" for the months of August and September 2022
The quiz questions were divided into general knowledge and technical knowledge. The quiz consisted of a total of 14 questions. The total points for the quiz were 20.

To select a winner from multiple top-scorers a digital lucky draw was developed in house. Every month, the winner was awarded with ACM Googies.


Brain games winner declaration

• ACM Hour of Code:

Event Name: Hour of Code
Event Date: 7ᵗʰ December, 2022
Venue: 4ᵗʰ Floor, Department of Information Technology, MMCOE

The **Department of Information Technology, Marathwada Mitra Mandal's College of Engineering, Pune** in association with **Information Technology Students' Association (ITSA) and ACM Students' Chapter-MMCOE** organized a social event "**Computer Literacy Program**" on **7ᵗʰ December, 2022**. Fifty students form 5th and 6th class of **ITEACH SAV School, Karve Nagar, Pune** attended the event. Members of Information Technology Students Association conducted the session on "**Computer Science Education**" under which the students were taught about the basics of computers, Hardware & Software Devices, Input & Output Devices, Microsoft Office Tools and Paint.
This was followed by the the session on "**Hour of Code**" which was undertaken by the members of the ACM Students' Chapter MMCOE During this session, students were taught how coding can be fun using various pre-designed modules from ACM and they developed a **Flappy Bird game program** using basic English-like words.
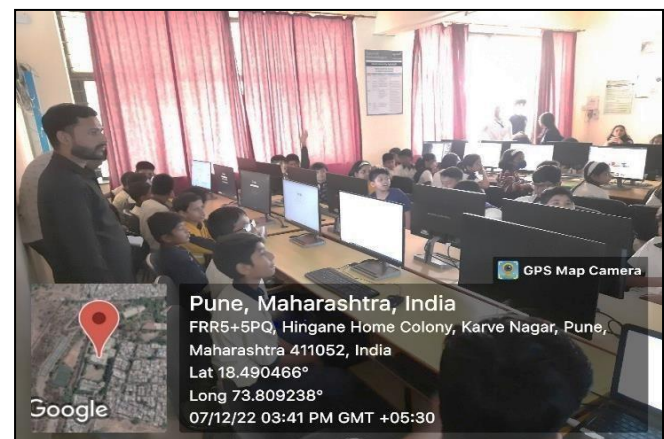
Glimpses from Computer Literacy Program

8. *Students Association (ITSA) Activities*

- ITSA is an association of IT department students for the students by the students of the students. ITSA was formed in AY 2014-2015.

- ITSA Student Committee for 2022-23:

Sr. No.	Post	Name
1	President	Mr. Om Kenge
2	Vice President	Mr. Bhuvanesh Rajekadam
3	Secretary	Mr. Varad Mahajan
4	Department GS	Mr. Anish Kulkarni
5	Technical Head	Mr. Mahesh Pimparkar
6	Social Media Head	Mr. Rohan Pathak
7	Creative Head	Ms. Reva Pethe
8	Treasurer	Mr. Shreyas Kolharkar
9	Member	Ms. Nikhita Watpal
10	Member	Ms. Swarali Suryawanshi

● **List of student Activities (AY 2022-23 Sem I) are as follows:**

Sr. No.	Event Conducted	Event Date
1	SQL Challenge	30/07/22
2	SE Induction Program	22/08/22
3	Exploratory Data Analysis	24/09/22
4	Computer Literacy Program	07/12/22

SQL Challenge

Industrial Visit to GMRT, Kodad

SE Orientation Program

Exploratory Data Analysis

Computer Literacy Program

9. *Center of Excellence - Computational Intelligence*

- **List of student Activities (AY 2022-23 Sem I) conducted under the CoE are as follows:**

Sr. No.	Event Conducted	Event Date
1	SQL Challenge	30/07/22
2	Exploratory Data Analysis	24/09/22

SQL Challenge

Exploratory Data Analysis

Ongoing Projects under CoE

Sr. No.	Project Name	Domain
1	E-Voting System using Blockchain and Authentication using Machine Learning	Machine Learning and Web Development
2	Automatic student progress assessment using Artificial Intelligence technique	Machine Learning and AI
3	DDMS: Department Data Management System (Attendance Monitoring Application + CO Attainment Calculation Sheet)	Web and Android Development, Data Science
4	Image based crack detection system	Deep Learning
5	Detection of Malicious Activities performed on social media platforms	Machine Learning
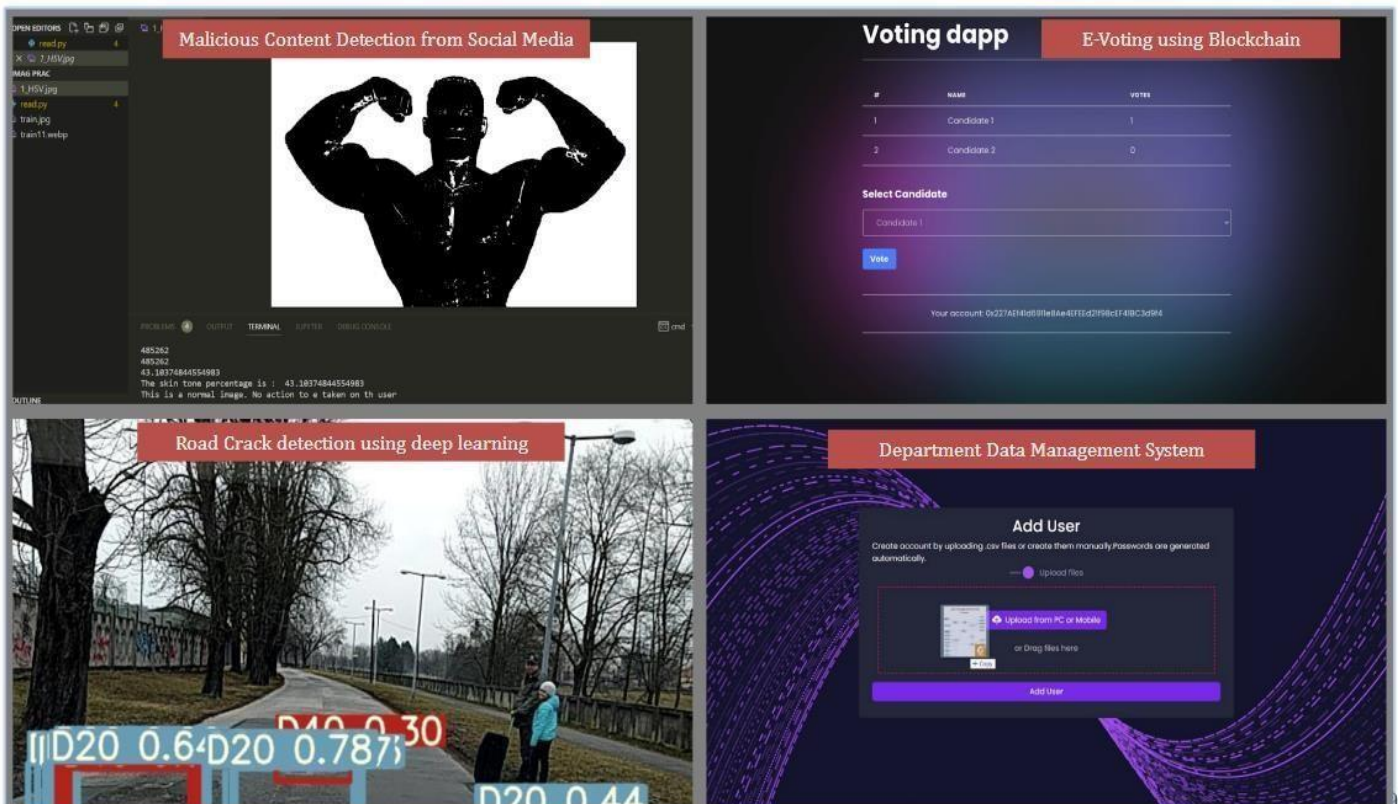
10. *Result (AY 2022-23 Sem III)*

Sr. No.	Class	No. of Students Appeared	Passing Percentage
1	SE	77	72.73
2	TE	79	74.68
3	BE	85	92.94

Our Toppers

Class	Rank	Name of Student	SGPA
SE	1	Velankar Isha Shivaji	9.18
	2	Ladhe Vaibhavi Vikas	8.55
	3	Sanchaniya Harsh Harshit	8.23
TE	1	Khadke Tejal Bahubali	9.71
	2	Kolhatkar Rohan Chandrashekhar Kulkarni Anish Suhas	9.29
	3	Bahaddarpure Kirti Madan	9.14
BE	1	Deshpande Aditi Anilrao Nayan Hitesh Kacha	9.7
	2	Kango Anisha Sachin	9.25
	3	Akre Sharwari Amol Chougule Mitali Kundlik Ghosh Tanmay Sachchidanand Isha Girish Kulkarni Lohokare Saurabh Prasad	9.1

11. Technical Blogs by Students

Author : Mahesh Pimparkar (TE-IT)

➢ Flutter is the future :

Google developed the open-source Flutter framework for building mobile apps. It enables development cycle and simplicity of usage. Flutter enables developers to create a single codebase that can be used to build apps for several platforms, which saves time and resources and is one of the primary advantages for startups. The development process is additionally sped up by Flutter's hot reload functionality, which enables developers to make changes to their code and see the results right away. Several libraries and tools are also available for Flutter that can help startups to build and scale their apps quickly. There are numerous third-party plugins that can enhance an app's functionality, and Flutter, for instance, offers a wealth of configurable widgets that are simple to style to match a company's identity. Overall, Flutter is a strong platform that startups may utilize to swiftly create and release mobile apps. Whether it is the "future" for startups ultimately depends on the particular business and its requirements, but it is undoubtedly a common option for many entrepreneurs wanting to develop cross-platform mobile apps.

Why flutter ?

▪ Flutter is fast:

By enabling developers to make changes to the code and immediately see the consequences, Flutter's hot reload functionality has sped up and improved the development process. One of the features that makes Flutter popular among developers is its hot reload capability. Without having to manually stop and restart the app, you can quickly and efficiently test updates to your code. The development process can be greatly accelerated by using this, especially when rapid compilation times for Flutter are also used. Flutter offers a variety of additional capabilities in addition to hot reload that enhance its overall performance and quickness. For instance, it makes use of the Skia graphics package, which is designed for fast rendering on a range of systems. The framework itself is meant to reduce the amount of work that needs to be done by the device's CPU and GPU, and Flutter's built-in widgets are also quick and effective. All of this contributes to the user's perception of Flutter apps as quick and responsive.

▪ Flutter is easy to learn:

Flutter is a fantastic option for developers who are new to developing mobile apps due to its simple structure and clear documentation. Flutter is a simple framework to understand and use, according to many developers. This is due in part to the programming language used, Dart, which is simple

to read and comprehend, especially for engineers who are already familiar with Java or C#. In addition, it's simple to get resources and support when learning the framework thanks to Flutter's thorough documentation and sizable developer community. Additionally, there are a ton of online tutorials and classes that can assist you in quickly learning Flutter. Overall, Flutter is an accessible framework for developers of all skill levels, thanks to its simple programming language and thorough documentation.

▪ *Flutter has excellent documentation:*

The thorough documentation and illustrative examples provided by Flutter make it simple for developers to get started and produce high-caliber apps. The documentation for Flutter is usually regarded as being quite detailed and organized. Every part of the framework is thoroughly covered in the documentation on the Flutter website, from the fundamentals of creating an app to more complex subjects like custom widgets and platform connection. Along with the official documentation, Flutter also has a sizable and vibrant developer community that contributes to the framework and produces its own materials and tutorials. As a result, it is frequently simple to locate an answer online if you have a query or need assistance with something. Overall, it is simple for developers to learn because to the availability of thorough official documentation and a helpful developer community.

▪ *Flutter is cross-platform:*

Using a single codebase and Flutter, developers can create apps for iOS and Android, saving time and resources. The fact that Flutter is a cross- platform framework that allows you to create apps for several platforms a single codebase is one of its key advantages. You can make apps using Flutter that work on iOS and Android devices, the web, and even desktop operating systems like Windows, macOS, and Linux. When compared to using native tools to create individual apps for each platform, this can save a lot of time and work. in addition to working across several platforms.

Additionally, Flutter comes with a sizable array of built-in widgets and features that make it simple to create apps that have a native feel and look on each device. As a result, while still being produced more quickly, your Flutter app can have the same degree

▪ *Flutter has a large and active community:*

There is a sizable and vibrant community of developers who work on Flutter and support one another. This makes it simple for developers to locate support and materials when they need them.

There are numerous resources available for learning about and keeping up with the most recent Flutter advancements, and the Flutter community is

renowned for being helpful and welcoming to new users. Additionally, there are a lot of Flutter conferences and meetings organized all over the world where developers may interact with other members of the community and gain knowledge about the framework.


- **Conclusion** :

Flutter is a flexible and potent framework for creating cross-platform mobile applications, to sum up. It boasts a sizable and vibrant developer community, rapid development tools, and an easy-to-use API. It is a wonderful option for both

inexperienced developers and seasoned developers who wish to quickly create high-quality, performant mobile applications. Flutter is a dependable option for developing mobile applications because it has significant backing from Google and is updated and enhanced.

Author : Anay Dongre (BE-IT)

➢ The Power of Transformer Reinforcement Learning
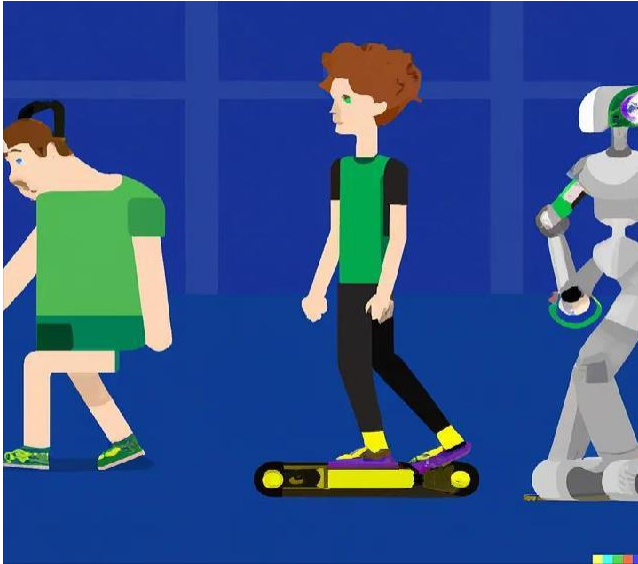
Robots learning to walk. Image from Dalle-2

Transformer Reinforcement Learning (TRL) is an innovative approach to machine learning that combines the power of transformers with the flexibility of reinforcement learning (RL). TRL uses transformer-based models to represent the current state of an agent and its environment, allowing the agent to make better decisions and learn from its mistakes through trial and error.

▪ Introduction :

Imagine you're a student trying to learn a new skill. You have a textbook, but it's dense and difficult to understand. So you turn to a tutor who can break down the material into manageable pieces and give you personalised feedback.

Now imagine that instead of a student, you're a machine learning agent trying to navigate a complex environment. You have access to a lot of data, but it's noisy and hard to parse. That's where Transformer Reinforcement Learning (TRL) comes in.

TRL is like a tutor for machine learning agents. It uses a type of neural network called a transformer to help the agent understand its environment and make better decisions. The transformer acts as a guide, highlighting important information and filtering out noise.

Just like a tutor, TRL can also provide personalised feedback to the agent based on its actions. This feedback helps the agent learn from its mistakes and make better decisions in the future.

TRL has already shown promising results in a variety of applications, from game playing to robotics. And as it continues to develop, it has the potential to be applied to even more complex and humanistic applications, like personalised language learning or healthcare decision-making.

So if you think of machine learning agents as students trying to learn, TRL is the tutor they need to succeed.

▪ Background :

Transformer Reinforcement Learning (TRL) is an innovative machine learning algorithm that combines two powerful techniques: transformers and reinforcement learning (RL).

Transformers were introduced by Vaswani et al. in 2017 as a neural network architecture for natural language processing. They are able to learn long-range dependencies between words in a sentence by using self-attention mechanisms. Transformers have achieved state-of-the-art performance in a variety of language-related tasks, such as language translation and text classification.

Reinforcement learning, on the other hand, is a type of machine learning that allows an agent to learn by interacting with an environment. The agent takes actions in the environment and receives feedback in the form of rewards or penalties. The goal of the

agent is to maximise its cumulative reward over time by learning which actions lead to the best outcomes.

By combining transformers and RL, TRL is able to handle complex, high-dimensional state spaces. The transformer component allows the agent to represent the state of the environment in a way that captures important features and filters out noise. The RL component allows the agent to learn from its actions and adjust its behaviour accordingly.

How does Transformer RL work ?

At a high level, TRL operates as follows:

1. The agent observes the state of the environment and uses a transformer-based model to represent the state. The transformer helps the agent filter out irrelevant information and focus on the most important features.
2. Then the agent selects an action based on the current state, using a policy function that maps states to actions. The policy function is learned through RL, which allows the agent to learn from its past experiences and improve over time.
3. Afterwards the agent receives feedback from the environment in the form of a reward signal, which indicates how well the agent is performing. The agent uses this feedback to update its policy function and adjust its behaviour for future actions.
4. The process repeats, with the agent observing the new state of the environment, selecting a new action, receiving feedback, and updating its policy function.

By repeating this process over and over, the agent is able to learn how to navigate the environment and maximise its cumulative reward over time.

▪ *Architecture :*

The key idea behind Transformer RL is to use sequence modelling to learn from past experiences and make better decisions over time.
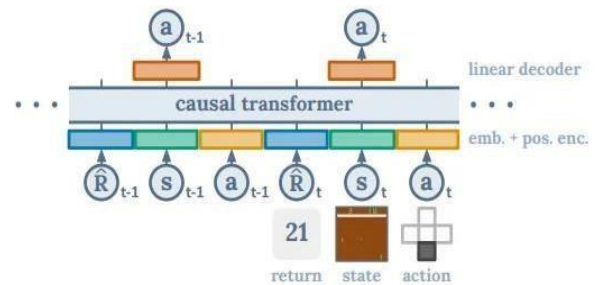
Decision Transformer Architecture. Image taken from the paper

At a high level, the architecture of Transformer RL consists of three main components: the encoder, the decoder, and the value network. The encoder is responsible for processing the input sequence of states and actions, while the decoder generates the output sequence of actions. The value network is used to estimate the expected cumulative reward for a given state and action, which is used to guide the agent's decision-making process.

The encoder in Transformer RL is based on the transformer architecture, which has shown great success in natural language processing tasks such as machine translation and language modelling. The transformer consists of multiple layers of self-attention and feed-forward neural networks, which allow the network to focus on the most relevant parts of the input sequence and make more accurate predictions about future outcomes.

The input to the encoder is a sequence of state-action pairs, which are embedded into a high-dimensional vector space using an embedding layer. The embedded inputs are then fed through a series of transformer layers, each of which consists of a self-attention mechanism and a feed-forward neural network. The self-attention mechanism allows the network to focus on the most relevant

parts of the input sequence, while the feed-forward network applies non-linear transformations to the input to capture more complex relationships between states and actions.

The output of the encoder is a sequence of hidden states, which are then used as input to the decoder. The decoder in Transformer RL is also based on the transformer architecture, and is responsible for generating the output sequence of actions. The input to the decoder is a concatenation of the previous action and the previous hidden state, and the output is a distribution over possible actions.

The decoder consists of multiple layers of self-attention and feed-forward neural networks, similar to the encoder. However, in the decoder, the self-attention mechanism is augmented with a causal mask, which ensures that the decoder can only attend to previous states and actions, and not future ones. This is important because in RL, the agent does not have access to future information, and must make decisions based on its current state and past experiences.

The output of the decoder is a distribution over possible actions, which is used to select the next action to take. The action is sampled from the output distribution using a stochastic policy, which balances exploration and exploitation to ensure that the agent continues to learn and improve over time.

The final component of Transformer RL is the value network, which is used to estimate the expected cumulative reward for a given state and action. The value network takes the hidden state of the encoder as input, and outputs a scalar value that represents the expected cumulative reward for that state and action. The value network is trained using a supervised learning objective, with the target values being the actual cumulative rewards obtained by the agent during training.

▪ **Comparison :**

Algorithm	Approach	Advantages	Disadvantages
Deep Q-Networks (DQN)	Q-value function approximation with neural network	Effective in many environments, achieves state-of-the-art results on many benchmarks	Slow to converge, struggles with large action spaces
Proximal Policy Optimization (PPO)	Policy gradient approach	Effective in many environments, achieves state-of-the-art results on some benchmarks	Sensitive to hyperparameter choices, computationally expensive to train
Trust Region Policy Optimization (TRPO)	Policy gradient approach	Effective in many environments, achieves state-of-the-art results on some benchmarks	Computationally expensive to train, sensitive to trust region size
Transformer RL	Sequence modelling approach	Handles environments with large action spaces, efficient parallelizable architecture, handles long-term dependencies	Still relatively new and being compared to other algorithms

Image from the author

▪ **Applications of Transformer RL :**

1. Natural language processing (NLP): Transformer RL can be used to improve the performance of NLP tasks such as machine translation, text summarization, and question answering. This is because Transformer RL can handle the long-term dependencies and variable-length action sequences that are common in NLP tasks.

2. Robotics: Transformer RL can be used to train robots to perform complex tasks in a variety of environments. This is because Transformer RL can handle environments with large action spaces and long-term dependencies, which are common in robotics.

3.   *Game playing: Transformer RL can be used to train agents to play complex games such as chess, Go, and video games. This is because Transformer RL can handle environments with large action spaces and long-term dependencies, which are common in game playing.*

4.   *Autonomous driving: Transformer RL can be used to train autonomous vehicles to navigate complex environments. This is because Transformer RL can handle environments with large action spaces and long-term dependencies, which are common in autonomous driving.*

5.   *Finance: Transformer RL can be used to optimise trading strategies and portfolio management. This is because Transformer RL can handle environments with large action spaces and long-term dependencies, which are common in financial markets.*

6.   *Healthcare: Transformer RL can be used to optimise treatment plans and predict patient outcomes. This is because Transformer RL can handle environments with large action spaces and long-term dependencies, which are common in healthcare.*

▪ *Future Scope :*

Looking to the future, there are many exciting possibilities for the continued development of Transformer RL and other reinforcement learning algorithms. These advancements could have significant impacts on fields ranging from healthcare and finance to transportation and natural resource management.

One promising area of future research is the exploration of new applications for Transformer RL. There are many fields where it has yet to be fully utilised, and researchers could uncover new opportunities for its use in fields such as climate modelling or quantum computing.

Improving the underlying techniques used in Transformer RL is another important area for future development. As RL algorithms become more complex and capable, researchers will need to develop new methods for handling long-term dependencies, variable-length action sequences, and other challenges. Another area of future research is the scalability of Transformer RL and other RL algorithms. As these algorithms become more capable, they will need to be able to scale up to handle larger and more complex problems. Developing techniques for improving scalability will be an important area of future research. Incorporating human feedback into RL algorithms is also a promising direction for future research. This could enable RL to learn from human experts and make more human-like decisions in complex environments.

▪ *Conclusion :*

In summary, Transformer RL is a new and innovative way to approach reinforcement learning that has great potential for solving complex problems in a variety of fields. By using advanced techniques such as sequence modelling and attention mechanisms, Transformer RL can handle long-term dependencies and variable-length action sequences, which makes it suitable for challenging environments. Transformer RL has already demonstrated impressive results in areas such as natural language processing, robotics, and game playing, and it has surpassed the state-of-the-art performance on many RL benchmarks. It has become an important tool for researchers and practitioners, who are continually working to improve its capabilities and explore new applications.

As Transformer RL and other RL algorithms continue to evolve, they offer exciting opportunities for advancement in science, engineering, and industry. With the ability to solve complex problems and handle challenging environments, these algorithms represent an important step forward in the field of reinforcement learning.

12. *Faculty Highlights*

1. <u>**Seminar/ Workshop / Conferences Attended :**</u>

Sr. No.	Topic	Name of Faculty	Particulars
1	"Mentoring Pedagogy and Classroom Delivery Enhancement Techniques" by E&ICT Academy IIT Guwahati	Dr. R. M. Chopade	FDP
2	"Recent Trends in Computations" by VIT, Pune	Dr. B. P. Vasgi	FDP
3	"Recent Trends in Computations" by VIT, Pune	Dr. V. S. Bidve	FDP
4	"Fundamental of DevOps" by MMCOE	Ms. P. S. Joshi	FDP
5	"Deep Learning With Python" by AISSMS IOIT, Pune	Ms. S. A. Kakad	FDP
6	"Machine learning using Python" by ISBN CoE, Pune	Ms. S. A. Kakad	FDP
7	"Mentoring Pedagogy and Classroom Delivery Enhancement Techniques" by E&ICT Academy IIT Guwahati	Mr. N. S. Dhavase	FDP
8	Workshop on "Cloud Computing Lab Sessions" by PICT, Pune	Mr. N. S. Dhavase	FDP
9	"Programming in Java", NPTEL AICTE	Mr. J. R. Chavan	FDP
10	"Amazon Web Services" Organized by AIT, Pune	Mrs. S. A. Kulkarni	FDP
11	"Deep Learning With Python" by AISSMS IOIT, Pune	Mrs. S. P. Mankar	FDP
12	"Amazon Web Services" Organized by Army Institute of Technology	Mrs. S. P. Mankar	FDP
13	"Data Science Tool and Research" organized by VIIT, Pune	Ms. N. S. Jogalekar	FDP

2. <u>Faculty Achievements :</u>

1. *Dr. Rupali Chopade* was presented the EduTech Leadership Award at the EduTech Leadership Award by World Education Congress 2022.

2. *Dr. Rupali Chopade* was presented with a Certificate of Appreciation from the AICTE-EduSkills Virtual Internship Program.

3. *Dr. Rupali Chopader* received Grade "A" Certificate by E&ICT Academy.

4. *Dr. Bharati Vasgi* was invited as a Session Chair for the 4th International Conference on Communication and Information processing Elsevier SSRN India July 2022.

5. *Ms S. A. Kakad* was invited as a Reviewer for the River Publisher - Journal of Web Engineering, June 2022.

6. *Mr. Jitendra Chavan* received Elite NPTEL Certification for NPTEL, Online Certification in "Programming in JAVA" course.

7. *Ms S. A. Kakad* was invited as a Reviewer for the IEEE International Conference on Interdisciplinary Approaches in Technology and Management for Social Innovation, ABV-IIITM Gwalior, December 2022.

8. *Mr. Nikhil Dhavase* was recognised for his Exceptional Contribution as a SPOC and Exceptional Contribution as a Mentor for the Smart India Hackathon, 2022.

9. *Ms S. A. Kakad* was invited as a Reviewer for the Elsevier- Education & Information Technology, June 2022.

13. *List of faculty members in the Department*

- List of Teaching Staff Members :

Name of the Staff & Designation		Name of the Staff & Designation	
Dr. Rupali M. Chopade *Associate Professor* *&* *Head of the Department*		**Dr. Vijaykumar S. Bidave** *Associate Professor*	
Dr. Bharati P. Vasgi *Associate Professor*		**Mrs. Preeti S. Joshi** *Assistant Professor*	
Ms. Sheetal A. Kakad *Assistant Professor*		**Mrs. Rashmi M. Bhattad** *Assistant Professor*	
Mr. Nikhil S. Dhavase *Assistant Professor*		**Mr. Jitendra R. Chavan** *Assistant Professor*	
Ms. Shraddha Prakash Mankar *Assistant professor*		**Mrs. Shruti Amit Kulkarni** *Assistant Professor*	

Ms. Neelam S. Jogalekar *Assistant Professor*		**Mr. Bhushan M. Borhade** *Assistant Professor*	
Mrs. Gauri Y. Gunjal *Assistant Professor*			

- List of Non-Teaching Staff Members :

Name of the Staff & Designation		Name of the Staff & Designation	
Mrs. Smita Kari *Lab Assistant*		**Mr. Dinkar R. Patil** *Technical Assistant*	

"Intelligence is the ability to avoid doing work,
yet getting the work done."

**Linus Benedict Torvalds
December 28, 1969**

"Creator of the Linux Operating System"

Leading supporter of Open Source software.