

# IT EXPRESS '22

1930

WORKSTATION  
COMPUTING

1986

PERSONAL  
COMPUTERS

2010

SMARTPHONE/  
TABLETS

**NOW**

EXTENDED  
REALITY



Kathmandu University  
Department of Computer Science and Engineering  
Dhulikhel, Kavre



**Prof. Dr. Manish Pokharel**  
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It is my immense pleasure to know that the Department of Computer Science and Engineering is going to publish the annual magazine 'IT Express' on the occasion of IT Meet 2022 with the effort of Kathmandu University Computer Club (KUCC). A substantial amount of work has been performed in developing this magazine and I believe that the audience will observe the effort reflected in this new edition.

As we look at IT Express, it is crucial to consider that it represents the collective thought of a group of innovative faculties as well as students who are able to make considerable contributions in the field of IT to this magazine. I am proud of entire editorial members and happy to be able to draw upon their individual and collective knowledge, talent, judgment, and disciplinary backgrounds to advance engagement. I am excited about what the magazine will add to our ability to communicate with broad audiences on matters of different areas of IT innovations and scholarly works.

I would like to thank our students, advisors and faculties who supported publishing this magazine. I look forward to our journey together as we develop the Technical Magazine into a grand success. Also, my best wishes for the monumental success of IT Meet 2022.



**Prof. Dr. Janardan Lamichhane**  
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It fills me with excitement to learn that the Department of Computer Science and Engineering (DoCSE) and the Kathmandu University Computer Club (KUCC) will be publishing a new volume of the departmental magazine as IT Express 2022 in order to kick off one of the most impressive departmental events, The IT MEET 2022.

I have no reason to expect that this year's edition of IT Express will deviate from the magazine's long-standing tradition of delivering to its readers interesting and informative articles on a wide range of technical topics and application methods. IT express has carved out a special place for itself in the industry by becoming a learn-share platform. On this platform, it exhibits the combined opinions of students and faculty members who have a variety of different areas of knowledge.

They have made significant contributions to the magazine by writing articles on a wide variety of topics, including artificial intelligence (AI), the internet (Web), databases (Databases), and cloud computing (Cloud Computing), etc., which has resulted in the readers having a higher level of appreciation for the publication.



In a similar vein, the team working on IT Express 2022 has done an excellent job of bringing forth the magazine's core values and principles. Each team, from the editorial team and the volunteer team all the way up to the design team, has worked just as diligently and actively engaged with one another in order to make the magazine for this year, IT EXPRESS 2022, more appealing to the viewers and readers. I can't wait to get my hands on a copy of this year's issue of the magazine so that I can find out what new and interesting information it has on various fields of research and advancements relating to information technology.

I would like to express my gratitude to each and every member of the staff, including the faculty, the advisers, and the students, for their contributions to the creation of this magazine. I would like to offer my sincere appreciation to the members of the IT Express team for all of the effort and commitment they have shown. In addition, I hope that the magazine IT EXPRESS 2022 is a smashing success.

Last but not least, I have high hopes that the division will carry on the tradition of IT Express well into the foreseeable future.





**Dr. Bal Krishna Bal**  
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It gives me immense pleasure to pass my message in the capacity of the Head of the Department of Computer Science & Engineering to the new edition of IT Express, an annual magazine published by the Kathmandu University Computer Club (KUCC). IT Express, since the very beginning, has been playing a crucial role not only in publishing articles on the cutting-edge technologies related to IT but also in terms of publicizing the Departmental activities to the general public. With every new edition, the magazine introduces new and interesting themes and topics. In the days to come, I duly hope that it will also include research papers, thereby providing a platform for young minds to publish their works. The editorial team and all those who are involved in the publication of the magazine have put in every sincere effort. Hats off to all of them. I wish the magazine every success.



## Dr. Gajendra Sharma

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It brings me great pleasure to know that the Kathmandu University Computer Club (KUCC) is publishing the IT Express, an annual magazine of the Department of Computer Science and Engineering (DoCSE). Our students have taken the time and dedication to continue publishing this magazine and I hope that the new edition will inspire all of us to continue to share and enhance the learning process.

This magazine facilitates a great intuition to the latest developments in the field of IT. The articles authored by faculties and students are always motivating and exciting to read. My sincere thanks to all reviewers, editors, managing editors, contributors and finally, the members of the editorial board for their untiring effort to bring this magazine to this stage.

My best wishes to the entire team of IT Express.



## Sagar Uprety

President, KUCC

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The world around us is changing. Life is a journey that helps us experience and is a part of these changes. It feels like yesterday when I was enrolled at KU with full enthusiasm and a new world to be discovered. Today, as I am writing this message for the IT Express, KUCC, and the DoCSE family, I am full of joy and memories wandering in my mind.

The year 2022 is special as it marks the Silver Jubilee of Kathmandu University Computer Club. Since its inception in 1997, it has been working together with students and the department to nourish young students with industry-level skills through various initiatives such as the Kathmandu University Open Source Community (KUOSC), talk shows, seminars, workshops, and our mega-annual events such as the IT Meet and KU HackFest. We are community-driven, meaning we also identify the needs outside KU and focus on uplifting the tech standards in nearby schools, hospitals, and other sectors. We are not just a club but more so a family; a family that shares everything cares for each other and celebrates together.

One of the most highlighted legacies of KUCC is the IT Express. I consider it a creative hotspot for students, faculty, alumni, and the entire family of the Department of Computer Science and Engineering. From in-depth technical articles to trending-tech blogs, interview series, community works, and research articles, you will find it all here. These are the words from our DoCSE family that tell you stories beyond anything else and for generations of students before and after us. When you return to KU in the future after graduation, you will find your articles imprinted on the shelves of the KU Library, and that feeling is unparalleled. So make sure you grab a cup of coffee and enjoy the stories



## Meet the team

### Coordinator



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## Message from the team: IT Express 2022



“

**"No one can whistle a symphony. It takes a whole orchestra to play it." - H.E. Lucckock**

To play a symphony people must come together, each bringing with them their different instruments such as their differing experience, talents, skills and they must choose to play together in order to create the beautiful harmonies that become a masterpiece. IT EXPRESS is the masterpiece that is a result of constant effort of the team members who were passionately dedicated towards contributing to the magazine as designers, editors, and volunteers.

It gives us immense joy and satisfaction to finally publish this annual magazine. We have tried our best and have dedicated several hours to ensure that this magazine turns out to be great. With its release every year, we try to create something unique for the readers. This year we have searched for the best of the best articles, which hold different insights on various topics that engage readers throughout the course of reading the magazine.

**"Cooperation is the thorough conviction that nobody can get there unless everybody gets there." – Virginia Burden**

Coming up with such a comprehensive magazine with different teams handling different aspects, was a challenge in itself. But with the cooperation among the team members and their sincerity towards the deadlines we were able to complete the magazine on time. Hope you enjoy reading the magazine as much as we enjoyed making it.

”



## Meet the faculty

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## KUCC Board 2021-2022

### Executive Committee



**Sagar Uprety**  
President



**Ashutosh B. Rajan**  
Vice President



**Salina Koirala**  
General Secretary



**Jenny Tamang Waiba**  
Treasurer



**Aayush Pokharel**  
Club Secretary



**Sajan Mahat**  
KUOSC Coordinator



**Shubhechchhak  
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**Kabin Bhandari**  
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**Dikshya Poudel**  
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**Saurav Ghimire**  
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**Bibhushan Saakha**  
Executive Member



**Sadikshya Pokharel**  
Executive Member



**Shashwat Khadka**  
Executive Member



**Angelina Ghimire**  
Executive Member

## Communities under KUCC and their co-ordinators



Sajjan Mahat  
KUOSC Coordinator



Ishar Maharjan  
Python Community



Sabin Thapa  
JavaScript Community



Bisheshwor Neupane  
Machine Learning  
Community



Kushal Manandhar  
Design Community



Sushant Subedi  
Design Community



Gaurav Rizal  
Dart Community



Aadarsha Dhakal  
Dart Community



Aditi Baral  
Game Development  
Community



Hritik Thapa  
Cybersecurity Community



Siza Adhikari  
Documentation  
Community

## Labs under DoCSE

### ILPRL

Information and Language Processing Research Lab  
Department of Computer Science and Engineering, Kathmandu University

The Information and Language Processing Research Lab (ILPRL) at the Department of Computer Science and Engineering, Kathmandu University was founded in the year 2004. The lab was found on the wake of the PAN Localization Project, <http://pan10n.net>, a multi-national localization Project that was conducted in 11 countries and 22 partners of South and South East Asia. Kathmandu University was a collaborating partner along with Madan Puraskar Pustakalaya (MPP) representing the Nepal Country component. The PAN localization project was a forerunner in the domain of Software Localization and Natural Language Processing in Nepal and the participating countries.

#### Projects:

1. NepaLinux Project [2004 -2009]
2. Dobhase Project [2005 – 2006]
3. E-Gov and Trust Issues [2010 – 2012]
4. Nepali OCR Project – Phase I [2016-2017]
5. Nepali Text-to-Speech (TTS) Project [2017-2018]
6. Popularity Tracking and Trend Analysis of Named Entities and Political Figures in News Media – [2017 – 2019]
7. Tamang - Nepali Bilingual Machine Translation Project [2018-2020]
8. Nepali Image Captioning Project [2020-Ongoing]
9. Nepali Speech Recognition Project [2021-Ongoing]

### DLRL

Digital Learning Research Lab  
Department of Computer Science and Engineering, Kathmandu University

The DLR Lab was established in 2016 to promote research culture in the university with following objectives:

- To promote online learning and e-learning pedagogy in higher education of Nepal.
- To develop online system to assist teachers and educators in professional teaching and learning.
- Empowering digital innovation in Education by using ICT.

#### Research Projects:

1. Integrating Knowledge Management Techniques and HCI Principles for Effective Online Learning, funded by University Grants Commission (UGC).
2. Student Retention in Higher Education using Machine Learning Technology.
3. Implementing Data Mining methods in Online Learning System.



4. Study of Pedagogy in Online Learning System.
5. Identification of Online Learning Users in Online Learning System.
6. Developing MOOC on Scientific Research Writing, funded by Nepal Academy of Science and Technology (NAST).
7. MOOC for Higher Education in Nepal, funded by IDRC, Canada and administered by FIT-ED, Philippines under the theme "Digital Learning for Development (DL4D)".
8. Enhancing Online Learning by implementing Knowledge Management Tools and Techniques.
9. Usability Evaluation of MOODLE in Kathmandu University.

## Active learning lab

The Active Learning Lab was established in 2019 under the financial support of the Department of Computer Science and Engineering and Active Learning in Engineering Education (ALIEN) project funded by Erasmus+ Capacity Building in Higher Education Project 586297/2017.

It was established with the following objectives:

- To research and design an Active Learning methodology based on PBL (Project/Problem) supported by simulators and games to support real-life issues that relate to math, science, and engineering concepts.
- To facilitate research and innovation in the field of Teaching-Learning Technologies.

### Projects:

1. Project ALIEN
2. Project ICT-INOV
3. Analyzing the effectiveness of project-based learning
4. LMS through KU high-performance computing cloud

## News and Events

### AI Gaming KU



AI gaming is a rapidly developing market and has impacted how games are to be played. Artificial intelligence has been an integral part of video games since their inception in the 1950s. It serves to improve the game-player experience rather than machine learning or decision-making. On January 23, 2021, a virtual event targeted at tech enthusiasts who were interested in cloud services and gaming was conducted. The participants were familiarized with advanced cloud cognitive services. The event was a perfect blend of beginner's try and professional's skill show.

### Software Freedom Day

Software Freedom Day (SFD) is an annual worldwide celebration of Free Software. The Digital Freedom Foundation has been organizing Software Freedom Day every year on the third Saturday of September intending to increase awareness about Free Software and encourage its use. So on September 19, 2021, KUCC celebrated this day by conducting a virtual event open to the public. The motive behind conducting this event was to celebrate software freedom and people who have contributed to this field.

### Git and Github Workshop

Undergrad years challenge students to consummate different projects for their overall academic evaluation. So, a two-day session on Git and GitHub was conducted by the KUCC Club. The event was presented by Mr. Sagar Uprety, president of KUCC Club, and Sabin Thapa, JavaScript Community Coordinator, KUOSC and was conducted virtually through Zoom Meeting. The session was themed around version controlling with Git/GitHub and focused on familiarizing the students of DoCSE with the concepts of version control using Git and GitHub, introducing basic commands of Git, and acquainting the participants with basic workflows of project management using GitHub.

### BLENDER BASICS

#### Blender Basics WORKSHOP

Animated films, interactive 3D applications, virtual reality, and video games have become an important part of youth culture. With the increase in passion for using such technologies, people are even more interested to develop one of their own. What could be a better way to start the journey of developing such technologies than learning the Blender basics? Blender is a free and open-source 3D application that has great tools for modeling, rendering, animation, simulation, motion tracking, and some game and video creation options. So for this KUCC organized a workshop on Blender Basics. The main key point of the workshop was low poly 3d object creation. The presenter successfully taught the way to make a low poly model of a train during the workshop.



### Blank paper syndrome

It's not uncommon to feel anxious when one has to start writing on a blank piece of paper. However, that brief mental blockage of creativity is quite burdensome and might lead to self-doubts. To help students cope with blank paper syndrome an hour-long virtual workshop was held on 13th February 2021. The event discussed blank paper syndrome and ways to deal with it. The speaker and presenter of the workshop were Mr. Bishwa Nepal and Sujan Nepal respectively. A Q&A session was also held where the participants interacted with the presenter.

### Idea Pitching Competition

On the auspicious occasion of National Science Day, September 19, 2020, the Kathmandu University Computer Club (KUCC) in collaboration with Nepal Development Research Institute organized a virtual idea pitching competition with the vision of providing participants an early experience for future entrepreneurship. The theme for the competition was Prospective Application of AI for developing Innovative and Business Ready Solutions. The participants were allowed to present their business ideas to a panel of judges and the winners were announced.



### Cybersec 101 Workshop

Cyber security has always been a concern in this growing world of technology. With that in mind, the cybersecurity community organized a workshop on the 4th of April 2022 with the theme of cyber threats to our system and ways to overcome them. The event discussed cybersecurity and its importance, the current threat to technology, network security, different kinds of attacks and the ways to avoid them, and career prospects in this field. To familiarize participants with the common terminologies used in cybersecurity and the importance of cybersecurity was the primary purpose of the workshop.

### Machine learning workshop

Machine learning is used almost everywhere at present. As a computer enthusiast, it's becoming inevitable to have at least basic if not in-depth knowledge of machine learning. With the motto of providing information on the basics of machine learning and mathematics' underlying significance in it, the machine learning community conducted an online workshop on 28th May 2021. The event also demonstrated Fashion MNIST(Modified National Institute of Standards and Technology dataset) classification using ANN(Artificial Neural Network).

### Linux Talk Event

On September 18, 2021, on the auspicious day of "Software Freedom Day", an event on Linux Talk was organized by KUCC. The motive of this session was to introduce the topic of Linux and open-source software to the participants. The session included the use of basic Linux commands and vim text editor. The event was presented by Parth Chalise, Aashish Dhakal, Aadarsha Dhakal, Ayush Paudel, and Anurag Timilsina.



### Interactive session on Frontend and Backend Development

To remove the dilemma of using frontend or backend or both, an interactive session on the front and backend was conducted to understand both frontend and backend and how to get started with either one. The theme for the session was "Demystifying frontend and backend technologies" and was conducted virtually through Google Meet. by Mr. Sagar Uprety. The interactive session was for first-year students to help them understand web and application development. The emphasis was also given on how these two technologies communicate with each other using APIs and interact with databases. The meeting was later garnished with a Quiz session to test and evaluate the participants' understanding of the topics.

### Articles publication and Interviews conducted by Documentation Team

The documentation team published various articles on different topics related to science and technology-based on students' demands throughout 2022. The articles included popular topics like the growth of technology during covid, the reality of coding, females in STEM, Engineering: expectation vs reality, and many more. The documentation team also had been actively taking interviews with students who are working actively in different fields. To quench the thirst for knowledge of students who are exploring different fields, the team interviewed experienced seniors from different fields and published them. The interview included team coordinators working in fields like designing, game development, and machine learning.

### Javascript Community Gathering

On 23rd march 2022, the javascript community conducted an hour-long meeting to gather javascript enthusiasts and introduce them to the world of javascript. Besides that, other objectives of the event were to give an overview of the overall plans of the community and collect suggestions regarding the plans and events from the participants. With freshers being the primary target, the event was completed successfully with the number of participants exceeding thirty.

### Flutter talks

Flutter is undoubtedly the most popular open-source UI software development kit to create cross platforms applications of today's time. So, to familiarize students with the Flutter framework and Flutter development roadmap, Flutter talks with Damodar Lohani, Nepal's First Flutter GDE, were held on 24th February 2021 via google meet. The target audience was flutter enthusiasts from Kathmandu university. The event was 1.5 hours long with 20 participants.

### OpenGL with C++ WORKSHOP

### OpenGL WITH C++

C++ programming language has been the basic area of expertise of every DoCSE student. With the enthusiasm for implementing this knowledge of C++ for game development, many students happen to choose gaming projects as their semester projects. A virtual event was conducted by KUCC on November 20, 2020, for the students to help guide them through their projects. The students got help with getting started with the game development, setting up visual studio code, and knew the basic graphic library by the end of the session.

## Inauguration of IT Express 2021

We would cordially like to invite all of you to our launch of the magazine

### IT EXPRESS 2021

14th June, Monday 2:30 PM to 3:00 PM

IT Express, the magazine of DOCSE, is launched annually before IT MEET. IT Express 2021 was inaugurated virtually through Zoom. The magazine was launched under the leadership of Ms. Siza Adhikari, the Express Coordinator for the year 2021. The theme/motto of the magazine was "Welcoming the New Insights". Mr. Aayush Pakharel presented the event with the volunteering committee of Salina Koirala, Aashish KC, and Siza Adhikari. This event focused on the importance of such magazines to showcase students' knowledge/writing skills on any Tech-related subject matter and can share their insights on the topics to the broader audience.

## KU HackFest 2021



KU HackFest 2021 was held virtually from 19th to 21st February 2021 via different platforms such as discord, zoom, and google meet. It was the grandest international digital hackathon in the history of Nepalese hackathons with prizes over \$50,000. More than 600 students from 29 countries took part in the hackathon and created 50+ innovative projects in six different categories. The major objectives of the hackathon were to gather creative minds from all over the world, provide the students with a platform to learn and collaborate with other technology enthusiasts, and ultimately promote hackathon culture. With the successful collaboration of organizers, participants, judges, volunteers, and media partners the event was completed in 48 hours.

## Workshop on API 101 with Postman

On September 25, 2021 workshop on API 101 was held through the Zoom call where 50 participants were present. The event was held for 1.5 hours and was presented by Sagar Uprety. The workshop was targeted at students with beginner-level/no knowledge of API. In this event, the students learned what an Application Programming Interface (API) is. There was a hands-on session for students to learn different request methods such as GET, POST, PUT, PATCH, and DELETE using Postman.

## Developer Communities Introduction and Career Roadmap

An online workshop was held on 17th April 2021 to introduce different developer communities to freshmen of the computer department. The event was also focused on solving different doubts related to career options and developer communities. There were short presentations by each of the Community Coordinators introducing their communities with a short Q&A session at the end.



### Report Writing Workshop

To help the juniors with the documentation of their projects, a workshop was conducted to familiarize them with the things to be considered while writing a report, especially a semester project report. This event was organized by the KUCC club on the 6th of April, 2022 in block 9, room 304. The first and second-year students of the Department of Computer Science and Engineering were the targeted participants. By the end of the workshop, the students were quite confident about report writing, formatting, and presentation aspects of their semester project.

### Email Writing Workshop

As a professional, it was being able to write technical emails and other documents is just as important as being skillful in that field of work. So the documentation committee organized an email writing workshop on 31st March 2021 to help the undergrads write better professional emails. The workshop mainly covered the do's and don'ts of writing technical emails and procedures to make digital signatures in google mail. The event was finally wrapped up with a short Q&A session at the end.

### Workshop on Distributed Computer Protocol

#### Workshop on Distributed Compute Protocol(DCP)

A SUPERCOMPUTER AT EVERYONE'S FINGERTIPS



A workshop on Distributed Computer Protocol was held on July 22, 2021, and July 29, 2021, through google meet where 40+ participants were present. Participants were introduced to the topic of distributed Compute Protocol (DCP): a powerful and easy-to-use web-based parallel computing platform. The Workshop was organized with the help of members of Distributed Compute Labs where Daniel Desjarindins, Ellie Mehl, and Topaz Glazer were the speakers and Ayush Poudel was the presenter. The speakers gave detailed descriptions of the DCP's architecture, and their organization's goals and showed the DCP working on jobs related to fractals.

### Workshop on Git and Github



Git and Github are important for students for their group project collaboration. Keeping that in mind a workshop on Git and Github was held virtually on July 15, 2021, through Google meet by Aashish KC. The event targeted first-year students of the Computer Department to give them an idea about Git and Github. The workshop focused on introducing the basics of Git and Github to freshers and helping them work remotely on their projects. The presenter beautifully showed each step and guided the participants to implement the commands in their machines. The workshop was held for an hour and 20+ participants benefitted.



## Qt Workshop

QT workshop was held on April 10, 2022, through google meet. The workshop was conducted in response to requests from the first-year second-semester students to help them tackle the problems they were facing in their semester projects. However, it was also made available to the students of the first semester to make them get the idea of semester projects. The session was conducted well by Ashish Thapa from second-year CE. The main objective of the workshop was the discussion of essential concepts like pointers, references, macros, lambda functions, design patterns, etc, and to introduce interfacing with Qt Creator and Qt designer. The participants were also taught the concept of database integration of the Qt application with AWS RDS and Qt SQL.



## Getting started with Flutter- Mini Bootcamp

A 6 days long mini-boot camp (3 hrs. each day) that targeted absolute beginners was conducted to help them kickstart their mobile application development journey. It covered key concepts starting from the very basics of Flutter to different essential ideas like OOP, asynchronous programming, UI development, etc. The mini-boot camp was successful enough to provide ideas to the participants to build and deploy apps on their own.

## Python Community Gathering 2022

What makes Python one of the top-notch programming languages is its large community where people altruistically share information and resources about this language. Likewise, Kathmandu University has its Python Community guiding python enthusiasts with their expedition with this language. The community recently conducted Python Community Gathering 2022 physically in Block 9, Room No. 402. The pre-meet event was conducted by Ishar Maharjan, Python Community Coordinator, and was followed by further workshops and events. The gathering aimed to introduce the python community and its plan, ease up and initiate the interactions and engagement with the community and its members, convey how to work with, get help, and support the community, and familiarize the beginners with the Python language, its applications, and importance.

## AI Gaming 2.0

KU Gaming 2.0 was a farrago of fierce competitiveness and a friendly learning environment. The event was targeted at tech enthusiasts who were interested in cloud services and gaming. It was presented by the team consisting of Sagar Uprety, Srishti Poudel, Bimal Timalsina, Sabil Shrestha, and Anurag Timilsina virtually through Google Meet. The event was themed "Using Azure cognitive services to play a rummy vision game" and aimed at familiarizing students and enthusiasts with advanced cloud services like Microsoft Azure and making them understand the use of AI to play a rummy vision game and improve their critical thinking of the players by exposing them to cognitive APIs and bot modifications.

## Flutter and Dart Meetup

Do you want to start your application development journey with Flutter? If yes, the Dart Community is always there to help you. The community conducts monthly meetups to assist beginners with their app development journey. The Flutter and Dart Community conducted a meetup for February 2022 targeting beginners and intermediate flutter developers to establish a connection among the dart enthusiasts and to help them kickstart in application development careers by discussing these two crucial topics. At the event, Gaurav Rijal presented the Flutter Development Roadmap and Adarsha Dhakal arated about Demystifying Widgets Rendering in Flutter. General discussion and Q&A sessions were held at the end of the meetup.

## Welcome Programme



Welcome parties are the most awaited events for every student during their university days. This party is thrown by seniors to give warm welcome to newcomers that join the university. The seniors from DoCSE threw a welcome party for the newcomers which included different performances, speeches, and Mr./Mrs. Freshers Competition. It was a fun event with amazing concerts and dance performances where students performed wholeheartedly. The organizing team made the function very professional and creative. They had put their special efforts to make this function memorable for all who attended the event.

## Python Bootcamp

The fondness for the Python Programming Language is increasing among freshers/beginners. It might be due to the flexibility the language provides or due to the large committee it upholds. So, to fulfill the demand cycle for this language, a Bootcamp was organized. The workshop was presented by KUOSC Coordinator, Mr. Aashish Dhakal, and was conducted virtually through Zoom. The workshop aimed to understand the basics of Python, grasp the knowledge of a new programming model, OOP (Object-Oriented Programming), and understand the basics of visualization and data manipulation so that they can forge their journey to web/application development or Artificial Intelligence. The event was topped with effective Q&A sessions to clarify the doubts of the participants.

## Workshop on Javascript

Being named one of the best programming languages in the world, JavaScript builds most of the websites that you can find on the Internet. With demanding frameworks like React, NodeJs, and Express.Js, the job market desires future employees to have dexterity in this language. So, in high demand of JavaScript enthusiasts, the JavaScript committee organized a workshop on JavaScript themed around Vanilla JavaScript. The committee coordinator, Mr. Ashish Pokhrel, presented the event through Zoom Meeting. The workshop was targeted to impart the basics and some of the advanced concepts of JavaScript and demonstrated how powerful the language is along with its application.



## Q&A with Prof. Sudan Jha



### **Prof. Sudan Jha, PhD**

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#### **Area of Interests**

Internet of Things, Neutrosophic theory and  
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#### **Interviewed by**

Sushankhya Chapagain and Prajwal Adhikari



**Q** Throughout your journey of teaching and learning, how would you sum up the experience of working in the field of computer technology? How has it proliferated over the years?

**A** My overall experience of teaching and learning started from the blackboard and white chalks, whiteboard, and marker to the digital on-screen technology, with almost all years/semesters having enthusiastic students. Summing up, today technology has become an integral part of both teaching and learning methodology.

Earlier, about 20+ years back many such teaching and learning did not have the proper technology. We had very limited access to the Internet. Not every individual had access to mobile phones. Today internet has become basic and essential whether it is a part of teaching or learning. We could see the extensive use of technology during the recent pandemic. Within the last 2 decades, technology has been recognized as the most life-changing and successful invention in solving problems in human life. Today, where business caters, there you find applying computer usage. In the educational sector, health, transportation, and communication sector, we can see the influence and application of technology. Now it has become very difficult to survive without adopting the use of new technology.

Technology and Human Life have become proportional and so the education, teaching, and learning. I have seen exponential growth through the technology intervened in every sphere of human life such as Mobile phones, TV shows, Supermarkets, Hospitals, Matrimonial, Share Tradings, Online Purchasing, Banking, Sports, Traffic controls, Security Surveillance systems, Job Recruitment, Robotics, Machine Learning, Artificial Intelligence, etc. are a few of them, perhaps challenging to list all. Technology has brought people close together and facilitated contact between them using Email, Chatting, Videoconferencing, Mobile Phones, and Social media. Computers connected to the internet can publish ideas, thoughts, criticism, etc, instantly across the world. Social networking sites like, Facebook, Twitter, Blogger, Youtube, Whatsapp, etc. opens another sophisticated yet easy-to-use viral communication, revealing the importance of computer and human life. Our younger generation is fully dependent on these tools for their day-to-day work.

No doubt! The computer has made a massive makeover in the education field. Two decades ago, if anyone doubted to be clarified in a learning process, finding the right expert itself was a cumbersome task and there may not be available further opinion about the subject. Although the different and easiest clarification or solution is available on the other side of the world, we were unable to know its whereabouts because of lack of communication. Today "Google search" has revolutionized every aspect, especially by adopting Artificial Intelligence.



**Q** Recently you published your fifth book titled "Industrial Internet of Things - Technologies, Design, and Applications", what can readers expect from the book? What motivated you to write a book on this particular topic?

**A** Internet of Things (IoT) has evolved as an integral part of our life from Smart appliances, Smart Wearable devices, connected cars, and smart healthcare devices to smart energy meters. The IoT has not only comforted human life but has prospered the surrounding systems with intelligent services. But since IoT is in the initial stage of development, there are plenty of research opportunities available. The Industrial Internet of Things (IIoT) focuses on the use of cyber-physical systems to monitor the physical factory processes and make data-based automated decisions.

So, why adopt Industrial IoT? The reasons are basically "interoperability", "security", "data analysis and transfer" and "convergence". Interoperability has become the biggest challenge in the industrial internet because most machines and protocols are yet to be interconnected and are not interoperable. Secondly, most of the connected machines share information directly to the cloud, and therefore it is very likely that they get exposed to security threats and attacks. Likewise, an enormous amount of data is collected and generated from edge devices and sensors but due to inadequate storage and computing power, it has become a hot issue to perform advanced machine learning and analytical tasks. So it is very difficult to align manufacturing processes with existing IT systems due to the lack of convergence between them.

Thus, this book covers almost all the topics, starting from the introduction, tools, algorithms, applications, and also security issues and solutions relevant to the field of IIoT. More importantly, the book gives a glimpse of new research areas in IIoT for the persons who are willing to do research in this domain.

**Q** Can you please give an overview of what Microservices Architecture is and how its implementation has impacted various organizations?

**A** On a short note, Microservice architecture divides a single application into a small set of services, each running on its own but communicating with each other through APIs. A service implements some of the features or functionality such as customer management, partner management, and so on.

Microservice is a service-based application development methodology. In a service-oriented architecture, entire software packages will be sub-divided into small, interconnected business units. Each of these small business units will communicate with each other using different protocols to deliver successful business to the client. Now the question that may arise is, how Microservice Architecture (MSA) differs from SOA? In one word, SOA is a designing pattern and Microservice is an implementation methodology to implement SOA or we can say Microservice is a type of SOA.

Following are some rules that we need to keep in mind while developing a Microservice-oriented application.

**Independent** - Each microservice should be independently deployable.

**Coupling** - All microservices should be loosely coupled with one another such that



changes in one will not affect the other.

**Business Goal** - Each service unit of the entire application should be the smallest and capable of delivering one specific business goal.

Let us consider an example of an online shopping portal to understand microservice in depth. Now, let us break this entire E-commerce portal into small business units such as user management, order management, check-in, payment management, delivery management, etc. One successful order must proceed through all of these modules within a specific time frame. Each of these business modules should have its business logic and stakeholders. They communicate with other third-party vendor software for some specific needs, and also with each other. For example, order management may communicate with user management to get user information. Now, considering you are running an online shopping portal with all of these business units mentioned earlier, you do need some enterprise-level application consisting of different layers such as front-end, back-end, database, etc. If your application is not scaled and completely developed in one single war file, then it will be called a typical monolithic application. According to IBM, a typical monolithic application should possess the following module structure internally where only one endpoint or application will be responsible to handle all user requests.

**Q** Since your areas of interest include the Internet of Things, Artificial Intelligence, Machine Learning (Deep Learning), Neutrosophic theory, and Neutrosophic Soft Set Systems. When did you realize that these were the areas you wanted to explore and what would you suggest to the students who are struggling to find their areas of interest and passion?

**A** It all depends upon the interest and enthusiasm of students. You should choose a field that you are interested in so that you can become an expert in your field. Exploring many fields and choosing what is best for you can certainly be beneficial. Coming to 3rd and 4th year, students must be in a position to realize their choice of subjects.

**Q** You have been in this field of technology for so many years and with your experiences of success, you might as well have faced challenges that demotivated you? Can you please tell us about the challenges you faced and how you overcame them? Moreover, what would your suggestions be for the students of DoCSE?

**A** I have worked in various colleges in Nepal as a principal and as a Dean, and HOD in the top 10 private universities of India and other countries. I believe that teaching is the only honest profession in the world. It is a service given without any selfish motive. A teacher should be honest when he is inside a class to educate them properly. Throughout my tenure, there were no such major challenges but 20 years back there was great difficulty in making the students understand the topic. Same C, C++ which is taught now was taught even before and the same books like William Stallings for Operating System were used before. The major challenge used to be how to clear the concepts of students as resources earlier were very limited. Now you have many platforms like Youtube, HackerRank, HackerEarth, and many more to clear your concepts and practice as many problems as possible but the situation previously was quite difficult as students did not have access to these kinds of resources.



The teaching methodology previously too was quite different. The teacher had to teach using chalk and a blackboard which would fill their clothes and hands with chalk powder. Today we use whiteboard and marker which causes no such problems and due to advancement in technology, even these markers and boards are replaced by smartboards, laser pointers, and PowerPoint slides which are very easy to operate and makes teaching convenient. Messaging, file sharing, and video conferencing have made it easy for us to answer students' queries. I remember in my time when I used to stay in the hostel the normal culture there was to go through the books till late at night to understand various concepts and the next day with incomplete sleep and red eyes we had to go to class. The evolution of technology has acted as a blessing to the students in the learning process. The other problem was there was no ethics and enthusiasm regarding research and methodology for an engineering student two decades back when I started my carrier. Today the students too are very creative and keep on learning new skills for self-growth. Previously the students only had the mentality of getting the degree and getting a job or going abroad for a master's degree. Even today students going abroad refuse to come back due to the huge opportunity and resources there as compared to here. Still, there are power cuts and irregular internet bandwidth that act as a barrier to our learning process especially when you are studying Computer Science and Engineering.

For the students, I would like to say that maintain discipline and go through the subject matter for at least one or two hours after the class. Also now having only book knowledge is not enough so try to learn from different resources and become an expert in a particular subject. In developed countries more than your marks your skills and knowledge about the subject are given more importance. The interviewer looks at your project and asks questions about your area of interest. So it is very necessary for building up a deep knowledge of the subject.

## Q&A with Dr. Sushil Shrestha



### **Dr. Sushil Shrestha**

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#### **Interviewed by**

Jackie Lhowa and Priyanshu Sharma



**Q** Sir you have a deep research interest and consider research your passion? Can you please tell us why researched-based education is necessary and how it can be beneficial for students?

**A** I think education without research is incomplete because when you do research, it makes you explore many things that will help you build innovative technologies.

Suppose, for the semester project, a group of students developed a mobile application. Now, this project can be converted into research. In doing so, students will be navigating and exploring existing related applications. Not only does research assist students in scrutinising the behaviour of such applications, but it also helps students in weighing their pros and cons, which will eventually lead students to attempt to build an innovative version of the technology.

Not just only researching on the topic but publishing your findings/papers in the form of a journal can be invaluable. Your paper then can resonate with many authors and researchers all over the world who will know about your work and approach you for collaboration or take you under their wing for future Master's and Ph.D. programs.

**Q** Due to the recent pandemic, everything including education has become digital. Now the pandemic is almost over but universities have well adapted to the eLearning approach. According to you how can learning standards be enhanced in universities using technology?

**A** During the lockdown, we all embraced the approach of online education through different media like Google Meet and Zoom. Hence, regarding the future of education, I think there is no other option other than going towards online education and embracing its technologies because this type of pandemic can happen anytime and can occur at any unexpected moment. To enhance the e-learning standards, we need to develop a system with a key focus on managing asynchronous content so instructors can upload their lectures and provide different additional resource links from which students can learn those contents in their preferred time. Moving forward, we must also embrace the concept of flipped learning and personalised adaptive content.

**Q** One of your fields of expertise includes Data Mining. Can you please explain about data mining? How can data mining be useful for prediction and forecasting learning and institutional improvement needs?

**A** There is a huge amount of data generated every day due to the increasing number of users on online platforms. So it's a great opportunity for people interested in IT to process and analyse this data and find meaningful information that can come in very handy later in predicting different human and non-human behaviours.

In my research lab (Digital Learning Research Lab), we are developing the educational system and analysing different types of data to predict students' performance levels in class. This system also provides warnings/signals to motivate and scaffold the weaker students so that they can compete with other students.



One of the researches done under my supervision was the analysis of our KU Canteen data. The result from the analysis helped us to know about the food items which were sold very often and also about the association of different items.

**Q** Since you have completed your ISC, Undergrad, Grad and Ph.D from the prestigious Kathmandu University, we share a common ground. However, the opportunities that you received during your days are a lot lesser than what we receive being a student today. But with this the competition in the field of computer science and technology is way more than what it was before. Do you think the amount of opportunities we receive won't make a significant impact in our careers if we don't grab them and make the most out of them? Because we can see in every class there is a student who is taking part in every hackathon, hackfest, and the same class also has that student who is just giving best in academics. What do you want to suggest to them?

**A** In my time, the number of students produced every year was less. But now the scenario has changed due to the establishment of many public/private institutions. Even the competition level was lesser back then and the level of competition today is enormous. With students' interest increasing progressively in the field of computer science and technology, the success ratio for a student to sustain a career in this field is slimming down.

So my suggestion for the students wanting to sustain themselves in this field is to be unique in whatever they do. One way to be unique is by doing academic research and publishing papers during undergraduate. Their papers can stand alone as a wow factor leading to getting scholarships for Masters and Ph.D. programs in Nepal as well as in foreign countries. Even the Professors want to hire students as RAs (Research Assistants) who have some publications. Such publications can also cover up for their lower GPA, as Professors always want good researchers who have some experience doing research beforehand. Also, regarding students participating in several activities like hackathons, hack fests, and IT Meets, I suggest they develop their soft skills; for example, when they organise such events they face many challenges during event management from which they learn problem-solving skills.

**Q** So in your entire career, you might have faced similar challenges. And there may have been things that you didn't know in the past, but you feel like you should have known earlier. So what are those suggestions and how would you sum up your challenges and experiences of life, and what would you suggest to the students of today's generation?

**A** When I was a student at Kathmandu University, there were fewer faculties, from which only a few instructors completed a Master's degree (with no Ph.D. holders). This made our chance of getting research opportunities minimal. But now our department is one of the strongest departments in the University, with numerous faculties having diverse expertise. This has created a platform for present students to get several kinds of research. They can search the profile of the faculties and explore their area of interest. If it aligns with their interest, they can approach the respective instructor and get involved in some kind of research.



# A Survey on Load Balancing in Cloud Computing

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## Introduction

As seen in Figure 1, cloud computing offers web-based services with a user's information, processing, and software. It also allows for instant access to shared resources such as servers, storage, networks, applications, and services [1]. Cloud computing gives a good platform and infrastructure to its users. Every one of the administrations provided by servers to consumers is provided by a cloud service provider (CSP), which is fundamentally analogous to acting as an Internet service provider (ISP) in electronic registration. Figure 2 depicts the virtualization idea, in which the user may access all resources over a high-speed network at a minimal cost. This innovation is intended with the new idea of organizations providing services to clients without acquiring these organizations and storing them on their local memory [12]. Virtualization technology in cloud computing enables corporations or organizations to lease registering power to clients in the form of virtual computers. Clients may employ an unlimited number of virtual computers [13].

End users and organizations utilize the cloud network to exchange, process, and store data in third-party data centers [2]. It is based on the sharing of resources using the virtualization technology. The memory interface for a visiting OS is virtualized and provides substantial storage capacity via a virtualized memory stockpiling system [14]. As shown in Figure 3 [3], cloud computing consists of three levels: cloud customer or client or user, cloud service provider (CSP), and cloud network (transmission media or channel of the cloud).



Figure 3: Three level of Cloud Computing [3]

This paper gives an overview of Load Balancing in Cloud Computing. The rest of the paper is structured as follows: Section 2 provides features and characteristics load balancing strategies. Section 3 discusses some of the deployment model. Section 4, list various research areas and Section 5 presents overview of load balancing architecture. Section 6, presents an overview of different load balancing classification and Section 7, with its advantages. Finally, Section 7 concludes paper with remarks.

## Features and Characteristics

The following are the features [4] and characteristics [2] of cloud computing:

- **Mobility and wide network access:** All necessary services are available anywhere on the globe.
- **Saves time:** Users are able to obtain and read the information they require.
- **Popular:** The majority of users obtain their services via the cloud.
- **Cost:** It is incredibly cost-effective because of the pay-as-you-go model.
- **Maintenance:** maintenance is easy in cloud computing.
- **Throughput:** Because several people may work on the same data at the same time, cloud computing produces good results.
- **Reliability:** The aspect of cloud computing is reliable.
- **Elasticity:** On demand, resources and data are pooled.
- **Security:** The information is secure.
- **Scalable:** The size of cloud computing can be easily increased.



Figure 1: Cloud Computing [1]

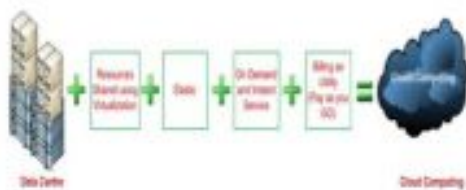


Figure 2: Schematic diagram of Cloud Computing [2]



- On-demand self-service: In cloud computing, clients may keep track of the server's time, capacity, and designated organizing capacity on a continuous basis..
- Resources pooling: resources are being used by users on demand.
- Rapid elasticity: Its end client has access to a wide range of services as well as assets.
- Measure services: Every asset that is used may be evaluated, managed, and declared for both the provider and the purchaser. IT administrations are billed on a pay-per-use basis.

## Cloud Deployment Model

There are four sorts of cloud deployment models:

- Private cloud: This cloud computing is managed by a single organization or a specialized organization, and its infrastructure is also used by this organization.
- Community cloud: This cloud is managed by a few organizations, supports a certain network, and contains common applications or services.
- Public cloud: This concept is owned and managed by a large cloud service provider (CSP). All clients that require resources on a participation or membership basis.
- Hybrid cloud: It is a hybrid of at least two of the preceding models, namely the public, private, and communal models.

## Research Areas in Cloud Computing

There is a lot of room for study in cloud administration since it encompasses so many different locations, difficulties, organizational strategies, and particular computing techniques. The subjects that follow provide a wealth of knowledge for cloud framework researchers. Table 1 displays a variety of research disciplines.

Table 1: Various research field in cloud computing

Load Balancing	Cloud access control
Security	Energy improvement
Virtualization	Information isolation security
Data isolation and recuperation	Verifiable calculation
Scheduling for asset improvement	Failure discovery and forecast
Cloud cryptography	Task scheduling

## Load Balancing Architecture

Load balancing, as seen in Fig. 5, is composed of four principles: the client, the data center controller, the load balancer, and the computation to be used.

The following steps are used by the client to carry out a solicitation.

1. Every client request is routed to the data center controller.
2. The data center controller queues up all incoming solicitations and queries the central load balancer about solicitation assignment.
3. The central load balancer comprises a database that

stores tables that are parsed after the calculation to be utilized, determines the most appropriate virtual machine and returns the ID of the selected VM to the data center controller.

4. Finally, the data center controller distributes the request to the VM whose ID is provided by the central load balancer.

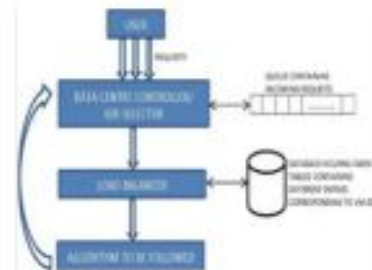


Figure 5: Load balancing architecture

## Load Balancing Classification

There are two types of load balancing: static load balancing and dynamic load balancing.

### 1) Static Load Balancing

This kind of load balancing is only employed in identical situations and is not adaptable, which means that it cannot modify its property. All of the entities have a fixed nature. This approach does not examine the incoming requests or the node's status [10]. Here are some examples of static algorithms:

- Round robin load balancing algorithm (RR),
- Load balancing min-min algorithm (LB Min-Min),
- Load balancing min-max algorithm (LB Min-Max).

- RR Algorithm : The task or assignment is allocated a defined quantum time in this computation. It distributes employment to all hubs in a roundabout way. A roundabout request is used to assign processors. Because of the proportionate remaining job at hand appropriation among methods, this calculation provides a speedier answer. Regardless, a few centers or hubs may be overcrowded, while others remain dormant and underutilized.
- LB Min-Min : A list of available jobs is maintained, and the shortest fulfillment time for all available hubs is determined. The machine is assigned the job that requires the least amount of time to complete. It produces excellent results when a small amount of effort is expended.
- LB Min-Max : A list of available jobs is maintained, and the shortest fulfillment time for all available hubs is determined. The job with the longest completion time is assigned to the machine.

### 2) Dynamic Load Balancing

To spread the load, this technique makes use of the hub's previous and present states. At runtime, the user needs and resources might be adjusted. They are suitable for both homogeneous and diverse situations. There are two kinds of dynamic load balancing.

- Distributed : This method of load balancing modifies the load calculation performed by all data centers and distributes the load among them.



- Centralized : In this case, a central hub is in charge of balancing the load over the whole structure. This focal hub communicates with other hubs [10].

Some common dynamic algorithms are as follows:

- Throttled load balancing algorithm,
- Equally spread current execution (ESCE) load balancing algorithm,
- Modified throttled load balancing algorithm,
- Throttled modified algorithm (TMA),

a) Throttled load balancing algorithm [10, 12, 16–18] : This approach is used for load distribution on VMs that are entirely deployed. When the client delivers the request, the load balancer rapidly receives notice and scans for the gathering that can supervise efficiently and distribute that request.

b) ESCE [10] : This approach maintains the shutdown of whole virtual machines and jobs. When this algorithm receives a solicitation, it filters the list of VMs. If a VM that can deal with the customer's request is identified, the request is allocated to that specific VM. This calculation spreads the equal weight over all VMs.

c) Modified throttled load balancing algorithm [16, 17] : The load balancer maintains a file table of virtual machines including the province of VMs in this algorithm. The computation employs a strategy for selecting a VM for handling consumer solicitation in which the most easily available VM is selected. If the machine is available, it is distributed with the request and the VM's ID is returned to the data center controller; otherwise, (-1) is returned. When the next solicitation appears, the list table is filtered from the record beside the effectively allocated VM and the next VM is selected based on the province of the VM.

d) Throttled modified algorithm (TMA) [16] : The TMA load balancer adjusts the strain by updating and maintaining two record tables. Accessible index: the status of VMs is '0'. Busy index: VM status is not accessible '1'. It outperforms other load balancing algorithms in terms of performance.

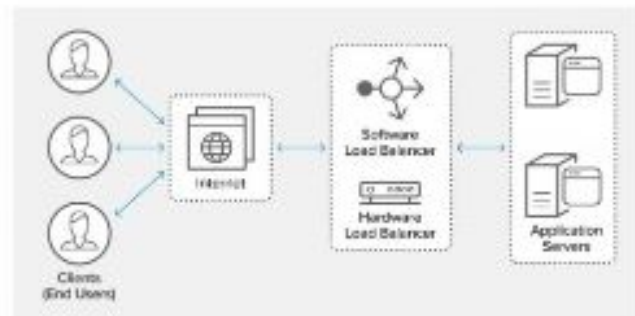
## Advantage of Load Balancing

Various advantages of load balancing are described as below [9, 11] :

- Throughput: it improves the result or throughput.
- Fault tolerance: system must be free from failure.
- Migration: resources are moved from hub to hub to improve performance.
- Response time: measuring to take the resources for service.
- Scalability: improve the system scale and performance.
- Cost-effective: system improves their performance with lower cost

## Conclusion

Cloud computing gives a good platform and infrastructure to its users. Every one of the administrations provided by servers to clients is provided by CSP, which is fundamentally analogous to acting as the ISP in electronic registration. Load balancing aids in the efficient use of resources and enhances the framework's presentation. It distributes workload requests from diverse resources over several PCs, frameworks, or servers. As seen in Table 1, there are several study topics accessible in load balancing. The primary aims are to maintain framework solidity and to improve framework execution.



## Discourse on ICTs and Smart Village Initiatives

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### ICT and Development

Information and Communication Technologies (ICTs) are the fastest growing technologies in the world. Over the past few decades, ICTs have shown significant influence on the development of countries and societies, especially in driving today's innovation, efficiency, and effectiveness across all sectors, including health, education, communication, business, research, and scientific inventions. With digital technology or ICTs, countries around the world are accelerating socio-economic development, connecting citizens to services, and strengthening processes toward building a better future (World Bank, 2019). In fact, ICTs have been the fastest growing sector for a generation (Tjoa & Tjoa, 2016).

For a long period, it was a debate in the information system societies 'if ICTs could lead to development?' But the thought processes now are gradually changing and the debate has shifted to the discourse on 'how ICTs can be used for development?' Here, a key challenge remains in understanding the process by which development can take place as a result of ICT interventions (Hatakka, Sæbe, & Thapa, 2019). Different processes and contexts are being researched to find out how ICTs can foster development. Most often ICT and development studies are focused on the ideas of how these technologies can contribute to the betterment of socio-economic conditions in low- and middle-income countries (LMICs). Sahay and Avgerou (2002) argue that "ICTs are expected to play a key developmental role. Many see in these technologies the potential for turning around uncompetitive industries and dysfunctional public administration, and for providing unprecedented opportunities for the information-intensive social services, such as health and education".

### SDGs, ICTs and Development Prospects

The United Nations Organization (UNO) has formulated 17 SDGs to fight poverty, improve healthcare, provide better education, foster gender equality, and extend global partnerships for development. The main aspiration behind the SDGs is to provide equal access to rights, empowerment, and a better world for all, irrespective of age, sex, race, religion, and region. SDGs are expected to play an instrumental role in addressing global challenges and are built upon the achievements of the Millennium Development Goals (MDGs). These are to be addressed by 2030 (UN, 2015). The goals are diverse and, at the same time, interconnected with each other. Although none of the 17

SDGs particularly refer to ICTs, and only several targets mention ICTs and relevant technologies, the 2030 Agenda for Sustainable Development still claims that ICTs can substantially accelerate the development process of human beings and may greatly bridge the digital gaps, to construct knowledge-based communities (Wu, Guo, Huang, Liu, & Xiang, 2018; Batchelor, Hearn, Peirce, Sugden, & Webb, 2003 ). So, we can not neglect the prominent role of science, technology, and innovation as well as the dissemination of these new technologies to a society where no one should be left behind (Tjoa & Tjoa, 2016). However, it should be kept in mind that implementing ICTs alone does not automatically lead to increased capabilities. We need to explain under what circumstances the actions of ICTs can lead to improvements.

ICTs can provide the momentum to achieve SDGs in several ways. First, ICTs spread very fast, the best examples of which can be the expansion of personal computers, the internet, and mobile technologies. Next, ICTs can help to reduce time and cost in disseminating services like health, education, and finances. Also, ICTs can be used to create awareness about new innovations and technologies through their extensive mobile networks and other electronic channels. The flow of information at national and international levels can be enhanced through ICTs. Most importantly, ICTs can be used to establish online platforms to educate people, workers, and other human resources in an organization or society. This way, the capabilities of ICTs can be utilized in achieving SDGs that cover three dimensions of economic prosperity, social equity, and environmental sustainability by 2030.

### Smart Village

Smart cities, digital cities, and knowledge-based societies have been hot topics in the world of information systems in recent decades.

Villages are backward in many ways as compared to cities. People in the villages have problems with education, health, economies, and other modern infrastructure and services. In this regard, a part of the answer to achieving higher levels of sustainability and SDG in the villages is to find the right ways to deal with economic disparities, accessibility to modern technologies, and other necessary infrastructure that can make them smart.

A smart village is a similar concept to smart cities. The basic concept of a smart village is to collect community efforts and the strength of people from various streams and integrate them with ICTs to provide benefits to the rural community. Smart village initiatives provide "global means



to meet the local needs" (Somwanshi, R., Shindepatil, U., Tule, D., Mankar, A., Ingle, N., Rajamanya, G. B. D. V., & Deshmukh, A., 2016). We can completely agree that a smart village like a smart city enables its inhabitants to make use of contemporary technological and social achievements while its infrastructures are still being developed and offer an opportunity to efficiently deal with future issues of socio-cultural, local, and circular economies.

The concept of a smart village was introduced by the researchers Viswanadham and Vedula in their book entitled "Design of Smart Village" (Viswanadham and Vedula, 2010). A smart village model followed a model from a smart city as an effect of integrated technology changes to be implemented in remote areas (Abinash and Josephine, 2018). The smart village aimed to help it solve all problems through the implementation of ICTs and GIS (Ahlawat, 2017).

The scope of smart villages can vary depending on the population distribution, geographical situation, socio-cultural practices, and the economic activities of the people living therein. The concept of Smart Village has only recently gained momentum. The smart dimension of the development might not always be addressed under the label 'smart' but could also be intertwined with other dimensions, as in the case of SDGs where the smart dimension is addressed in most of them addressing other specific aspects—sustainability, well-being, (inclusive and equitable quality) education, empowerment of women and girls, management of water resources, accessibility of sustainable energy, sustainable economic growth, and decent work, building resilient infrastructures, fostering innovation, reducing inequalities, making human settlements more inclusive and sustainable, taking actions to combat climate change, protecting ecosystems, etc. (Zavratnik, Kos, & Stojmenova Duh, 2018).

## Why ICTs for the Smart Village Initiatives?

The world is moving fast and forward with information technology. Nations leading in the production and use of digital technology and tools (or ICTs) in different sectors also demonstrate sound progress in the overall functioning of their societies, including administration and public sectors (Dutta, Geiger, & Lanvin, 2015). The developed countries which are making extensive use of ICTs tend to have a high economic index, while most of the LMICs, which have not aligned their economic development with the use of ICTs, don't show comparable growth, and consequently, there are poor results in public services, including education, health, and human development more broadly (Hamel, 2010). Thus, LMICs also arguably need to urgently integrate ICTs into their development spheres and address the challenges of the digital divide (Fong, 2009). However, it should be noted that technologies developed in developed countries cannot immediately address the actual needs of developing nations and villages.

The ICTD research, despite its remarkable theoretical capabilities to study technological innovation in relation

to socio-economic context, remains weak in forming convincing arguments on IT-enabled socio-economic development. Hence the digital divide is getting even deeper with the gradual development of time. As a result, developing countries especially the remote villages and the populations living therein will lag far behind and will be prone to the consequences of the 'digital divide' signifying a new form of inequality.

It is essential that the people living in the developing countries and the villages enjoy equal access to the advancements and move forward together with the people living in other parts of the world. This certainly can be achieved with ICTs. However, while implementing technologies implementing systems with a focus on local and indigenous knowledge based on the collective insights of villagers with the socio-technical knowledge of experts to design, develop, and implement ICT-based solutions can address the development challenges.

Avgerou (2010) argues that research on ICTs in developing countries acknowledges and addresses contextual distinctions. The context in which a new technology artifact and business model first took shape may be different from the context where this combined artifact and model are implemented as part of information system innovation practice in a developing country. Two factors—diffusion and transfer—are referenced when studying the significance of ICTs in development. Diffusion is implementing what is developed in the context of developed countries, which is most often found to be less effective empirically, while the approach of transfer of technological knowledge and development of organic cultivation is seen as more effective (Avgerou, 2010).

ICTs possess the potential to develop strategies for 'leapfrogging' to narrow down the gaps between developed and developing nations, as well as between developed cities and underdeveloped villages. In the future, possibilities for this leapfrogging seem even brighter owing to the emergence of internet technologies and other ICTs (Dahal, 2019).

Avgerou (2010) argues that "the development and use of ICT artifacts in developing countries concern the construction of new techno-organizational arrangements in the local context of a developing country," so the marginalized communities and villages in developing countries can be empowered using existing technologies.

Villages are often faced with slow and unreliable ICT infrastructure networks. This limits their access to information and services, which can boost economic and social development (Lela, Milicia, and Milos, 2020). The smart concept utilizes the solutions provided by ICT to promote the sustainable development of a village based on the characteristics and needs of rural development (Zhang and Zhang, 2020). Among the numerous areas smart villages need to address, a very few fundamental areas relating to the discourse on smart village initiatives are briefly discussed below.



## i) Education

Education is one of the fields most significantly influenced by ICT. Worldwide research has shown that the use of ICTs can lead to improved student learning and better teaching methods. ICTs can also serve as an effective and reliable tool to enhance distance education and content management for interactive multimedia teaching purposes. Education facilities in the villages are very poor due to the lack of qualified teaching faculties and also due to inadequate teaching-learning resources. So, a virtual learning platform could be implemented, and with assistance from a well-resourced school in the city, the classes in the village schools could be synchronized. The COVID-19 pandemic has explored the unprecedented potential of ICTs to facilitate the education process both in cities and villages. Best practices explored during the pandemic can be evaluated and applied in the context of smart villages too.

## ii) Health

Health is one of the core elements of development. Information Technology has become a vital element in every governance structure, including the health sector. For smart villages in terms of health, we need to focus on the implementation of Health Information Systems (HISs) at the health facilities in rural villages. The focus of HISs should be on improving the effectiveness and quality of health service delivery. The strength of a country to meet its health-related goals significantly depends on the capacity level of its health workforce, i.e., the knowledge, skills, motivation, and deployment of the people responsible for organizing and delivering health services. ICTs can be instrumental in strengthening the HISs and the workforce related to them (Dal Poz, Gupta, Quain, Soucat, & Organization, 2009). Discourses on smart villages need to rigorously study how ICTs can be appropriate tools to improve the health conditions of the people through timely and quality health services.

## iii) Virtual Marketplace

Agriculture is the main economic activity of the people living in the villages. To help alleviate poverty in the villages and introduce other advanced technologies, it is very important to reform the economic activities of the population living therein. For this virtual marketplaces can be implemented and the consequences of technological intervention can be examined for their relevance to smart village initiatives.

In a similar context, a project Haatbazar was introduced in rural villages of the Myagdi district of Nepal by a Ramon Magsaysay awardee Mahabir Pun. To help generate income-earning activities the project developed an intranet-based e-commerce platform. On the Haat Bazar websites, villagers could advertise local products (cows, buffaloes, goats, chickens, vegetables, and cheese) for sale. Mahabir described the haat bazaar as follows: "They can use it (Haatbazar) for advertisements in the village. Thanks to the Internet, we can promote local products such as Doko, Namlo, Nepali spices, mushrooms, and cattle. Anyone who wants to sell their products may use services like Haatbazar on the Net. They contact the Internet operator, who will put the information online for other people to see and buy that product." (Sæbø, Sein, & Thapa, 2014)

Besides these fundamental areas of education, health, and local economy, smart villages encompass several other tools and IoT-based technologies that can be integrated into the village ecosystem. The ultimate goal of the smart village initiatives is to enhance the lifestyle of people, promote security, proper access to services, and better information dissemination and service delivery from the village administration.

## Conclusion

ICTs have been an inevitable part of human life and development in modern times. There is no more doubt if ICTs can lead to development. The only question that remains unresolved is how ICTs can promote development? Factors such as economic conditions, technological competencies, people's perception of IT, educational qualifications, work habits, and other factors have impacts on the way ICTs can make changes. We need to work out adaptations appropriate for the villages. Especially when ICTs are implemented in resource-constrained settings or villages, people find it difficult to understand the values of ICTs and the significance of ICTs in changing the way people can live, different factors come across. Implementing ICTs does not automatically lead to smart villages and increased capabilities. First, we need to be able to explain under what circumstances the possibilities of ICTs lead to individual improvements. Then we can identify and implement relevant ICTs to improve the service delivery and promote the quality of life of the people living in the villages. Identifying suitable methods and finding proper approaches to solve the problems of villagers can gradually pave the path for smart village initiatives.





## SPOTIFY : Will it ever rule the world of Music?

You got the beats, you got the groove, you got the rhythm, you set a tune, and then vibe with your mood.

**T**his is the power of music and letting us the users enjoy the music via a medium is what the music players do. And whenever someone says the word, "MUSIC PLAYER", the first thing that strikes our mind is, "SPOTIFY," which is a combination of two words, Spot and Identify. Spotify is a digital music, podcast, and video service that is used in 180+ countries, and has 422 million active users, and a library of 82 million songs with other content from creators all over the world. As a user, the basic functions such as playing music are totally free, and also if a user wants to have upgraded content, they can upgrade it via premium.

Back in 2002, when the controversies for Napster, the file-sharing network were on hype, the idea of creating a service that was better than piracy as well as in the meantime compensating the music industry struck the mind of EK. He followed his dream and finally landed up with his partner Martin Lorentzon, who had just acquired Advertigo, and there started the journey of Spotify, in 2006. In one of the interviews, Daniel Ek said, "Looking back at the past, we made money when we were incredibly young, and in the beginning, we didn't handle it well. In addition, if you are a computer geek, you think you want to be the guy with all the girls at the table, buy a red Ferrari, and indulge in the nightlife. I realized, it ain't me."

In 2011, Spotify announced it had one million subscribers, and to this Ek reminisced and added, "Hatching ideas for a new music service in a tiny office-cum-apartment with a broken coffee machine was really something worth remembering. I do not know, but coffee is great when you are working on a big project. It just adds to the CEO's vibes." As the music industry is growing by 18.5% as per the data given by the Global Music Report, paid subscription streaming revenues increased by 21.9% US\$12.3 billion. There were 523 million users of paid subscription accounts to which Total streaming (including both paid subscription and advertising-supported) grew by 24.3% to reach US\$16.9 billion, or 65.0% of total global recorded music revenues. From this data, we can see today's music market is the most competitive of all times. Fans are enjoying more music than ever and in so many different and new ways. Knowing this fact, let's dive more into what and how on Spotify!



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## What's the bright side of Spotify?

Spotify currently has a 47-partner ecosystem, like Musixmatch, whose system is integrated into Spotify, allowing users to follow lyrics live when playing a song. According to the Interactive chart of historical net worth (market cap) for Spotify Technology (SPOT) over the last 10 years, Spotify Technology's net worth as of July 11, 2022, is \$19.83B. Since the market is totally grooved by podcasts, taking this scenario as an opportunity, Spotify is bidding high on podcasts. It aims to generate a huge revenue of about \$659 million and is willing to invest the amount extensively into content creation to make sure that people get the best listening experience on the app. Spotify aims at seeing itself as the default app for podcasts. The music giant further aims at enhancing the user experience. They are still working on what they call the "right exclusivity formula" to be a notch in this realm too.



## How is Spotify slowly losing its spot?

Just like any other company, there were a number of challenges that it faced and is still facing, that is taking away the hopes and dreams that were once built by the founders of the company. Spotify is cutting its losses; it still loses close to \$1.5 billion a year. They have to find additional revenue streams or find ways to turn a huge number of free subscribers into paid ones soon. As Spotify uses the Free-mium business model that makes an enormous bevy of free users that are subsidized by a small proportion and end up paying for some sort of premium plan. Not only that, Spotify faces criticism from artists and producers, who argue that it does not fairly compensate musicians. As Spotify is in a 'two-sided marketplace', its success also depends on making its artists and writers happy. Taking a look over the past few years, a widely highlighted problem facing Spotify is "allegations of unfair artists compensation". This problem stems from the lower end of the spectrum, as niche artists are the "grassroots referendum on the music industry". The degradation of creative labor fuels artists' requests for fair treatment. Spotify's 4 models "over-reward stars at the expense of everybody else" using a pro-rata system. This collates money from ads and subscribers and distributes it by dividing the number of streams, giving top percentage holders money from users who have never listened to their music. The most voiced problem is the way Spotify is using Algorithmic recommendations that favor discovering only the famous artists rather than promoting grassroots creators, thus widening the gap. Alternate platforms such as SoundCloud have adopted a user-centric model which evenly distributes money based on what each user listens to.

We can see tremendous growth of Spotify over the years across the internet, yet, Spotify is a Software as a Service (SaaS), which means potential customers are restricted only to those with access to the internet. Despite the ever-growing world interconnectivity, there is still a lack of global telecommunication infrastructure due to the cost of connectivity, excluding 37% of the world population. Therefore, Spotify's international expansion is limited to certain developing countries for future years.

Though Spotify has been developed independently, it relies on third-party providers as well as competitors like Apple5 and Google which means it requires a platform such as Apple's App store as the primary gateway for accessing and installing mobile apps. Like Apple, Google hosts the Google Play store with both tech giants developed music streaming services that compete with Spotify. Apple gains a competitive advantage over Spotify, which pays a 30% commission on fees to Apple on revenues generated from their iOS app as Apple defines subscription fees as digital purchases.

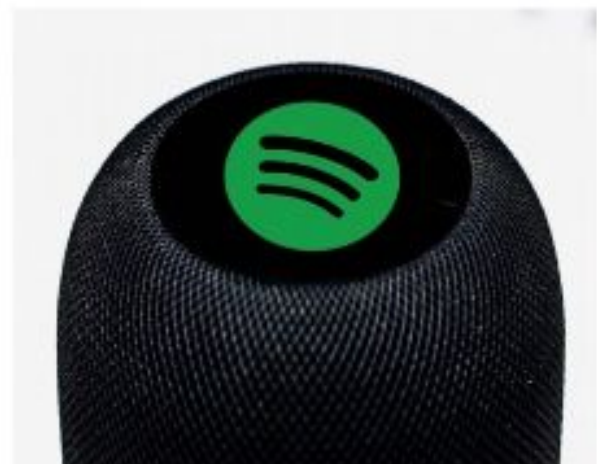
The other thing that is making Spotify lose its spot is the evolution of the internet to Web 3. Evolving decentralized streaming platforms may allow users to illegally stream music better than before. However, the lack of certainty around free music streaming outweighs Spotify's monthly cost.



## What's in the store for Spotify?

However, some challenges will become more problematic for Spotify, especially publicity involving their unfair treatment of content creators at the lower end and the evolution of a decentralized internet. Even though we know as users we do share music, understanding what motivates us and implementing the features to increase the sharing of music on the Spotify application and create an intuitive sharing experience that amplifies Spotify's mission to help people listen to whatever music they want, whenever they want, wherever they want.

Spotify has evolved the music streaming service and used its platform to create a new way to develop and present content other than just music. It can utilize its platform to gain new partnerships and rework the current business and revenue model that they have. It could take an exploratory approach to create new strategic alliances within internal and external industries.



Leaving the rest to you to ponder, the question, "Will Spotify ever rule the world of music?"



## DALL-E 2 and existentialism



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I was lucky enough to get access to DALL-E 2. It's the most advanced image-generating AI to date, which can take prompts written in the English language and generate the thing you want it to with it.

When you get your hands on it, it feels like you have the power to do anything. That is how I feel. Anything I dreamt of or thought of can be expressed tangibly and shared. It feels liberating to do that, but DALL-E 2 is not perfect.

There are many limitations. For instance, I can't make any political or violent content. These terms are arbitrary terms to me that do not have any defining characteristics. But when I tried my first prompt - "Nepali woman shooting a fascist with a gun," a very political and violent prompt, I got a warning. So I tried my second prompt, also about a Nepali woman, and I did that because I thought DALL-E wouldn't know what to draw, but it still blew my mind as it showed this:



FIG: DALL-E 2 generates an image from the prompt: "A Nepali woman walking through a meadow with a backdrop of the Himalayas"

It is wild. When you can show this picture to people, they think it's a real photo, but it's not. It's made by DALL-E 2. I played with the AI more and generated many other images I'd like to show:



FIG: "House atop a mountain during rain oil painting"

All I can say is that these are very beautiful. When I got it, I was so overwhelmed that I felt stupid because I didn't know what to write at all. The possibility is so endless and vast that I could not comprehend what to do with it, so I asked my friends to give me prompts which I fed DALL-E 2, which generated fascinating results.



FIG: "Cyberpunk vibes in Nepal"

Tell me you haven't been to a Galli like this. The same prompt generated this other image:



It's weird how a machine that doesn't even understand human language can produce such marvelous pieces of art that give us real human feelings of nostalgia, sadness, awe, and even sentiments of perplexity.

I tried on more abstract prompts. I was baffled when DALL-E 2 generated two of the most flattering when I typed the prompt, Gazing into the abyss, dark fantasy.





The thing with DALL-E is that it's so good that when it doesn't perform as you expect it to, you start blaming yourself. I tried a prompt: "An octopus with spider legs," and it couldn't generate a definite image, and I legitimately started blaming my understanding of the English language. Maybe it was the way I wrote, so I changed the prompt to "An octopus that has spider legs," and it still didn't generate what I wanted. Then I tried changing the prompt again to "An octopus that has the legs of a spider," and it still failed to generate it, and that is when I knew this AI was still limited, wasn't creative, and just mimicked millions of works it learned.

I also tried the prompt, "A man standing in front of a wall with eyes," and it generated something abstract. Hence, I changed it to "A wall which has human eyes that has a man standing in front of it facing against the wall," and it still failed to generate the definite image I wanted. I felt defeated, even when the generated image was close to my reality. However, it was not actually what I wanted, which made me question whether it was my fault or the fault of DALL-E 2 itself.

Even though it has been more than 10 days since I last accessed it, I still can't stop myself from questioning how I perceive language and its associativity with different material realities, drastically different from how DALL-E 2 looks at things. I think that maybe if I understood DALL-E 2 and how it perceived language associativity, I would be able to get all the images I desire.

I am unsure how differently we connect verbal sounds or letters written to their meanings compared to how DALL-E 2 does it. How do we know what an apple is? Is it any different than how DALL-E 2 knows what an apple is? We both think of a red blob, but we have more parameters. We have spatial recognition, flavor, feelings, and smell, while the poor old AI only has an image. But that question itself is very existential and scary. I don't think anyone wants to think about it too much, I'd rather just be at awe over the things it creates than try to understand these abstract philosophical questions, but I can't stop myself.

Anyways, enjoy some of these beautiful creations:



FIGURE: "Charon rowing a boat in the underworld"



FIGURE: "Aurora borealis in the Sahara desert"



FIGURE: "Charon rowing a boat in the underworld"

# What is DNS? | How does DNS work ?



Let's say, You are given the name of a person and nothing else, And you are told, to go and get some specific information from this person. You've got no contact number, no email address, nothing. Now the only chance you can take is to go out and search for them and hope that you bump into them somewhere. Which, let's admit, is pretty unlikely.

Wait! but here is another situation: what if you conveniently had a contact list with this person's number in it? It makes stuff a lot easier doesn't it? Now you can just call them, and get what you need. Our computer would get stuck if we just typed the URL and told the computer to go get the stuff we want. But now, it has this phonebook equivalent containing addresses to contact this exact computer. And this address is what's called an IP Address. IP Address is a unique numerical label for every computer connected to the internet. Something like 93.184.216.34. So, DNS (Domain Name System) serves as the phone book for the Internet by translating human-friendly computer hostnames into IP addresses.

Since a URL or a domain name like ku.edu.np doesn't point a computer to another. We need this rule in place to resolve this. And this is a universally followed rule, thus called a Protocol. An etiquette could be akin to a protocol, when you present yourself to someone and want to be polite, you have these general social gestures that if followed, you are considered polite. But for this to work, the other party that you are trying to be polite to needs to understand that, these gestures are considered polite. If not, they might find it to be impolite or straight-up offensive. Similarly for a protocol to function, both the parties need to act on a common set of rules most of the time.

The next question here is, why did we not stick to IP addresses? Why did we have to use human-friendly computer hostnames?

Since a domain name points to an IP address, the end user who is trying to contact your computer isn't affected if your IP address changes because DNS records can be updated, like changing a person's phone number in your contacts. You don't search for the phone number when searching up a contact, but rather their name.



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DNS also plays a vital role in the functioning of cloud services. When you try to access a distributed internet service using a URL, that domain name can be translated to an IP address that is near the user.

This ubiquitous feature is what allows DNS to simultaneously give different translations for the same domain name. Which greatly improves the communication by reducing the response time of the servers.

Ok, now that we know somewhat about what a DNS is.

## Let's get to how it actually works.

You want to visit a website, say ku.edu.np. your computer first checks if you've previously visited the website. If yes then it already knows what IP address to contact. This cached record stays relatively small, each record having an expiration date.

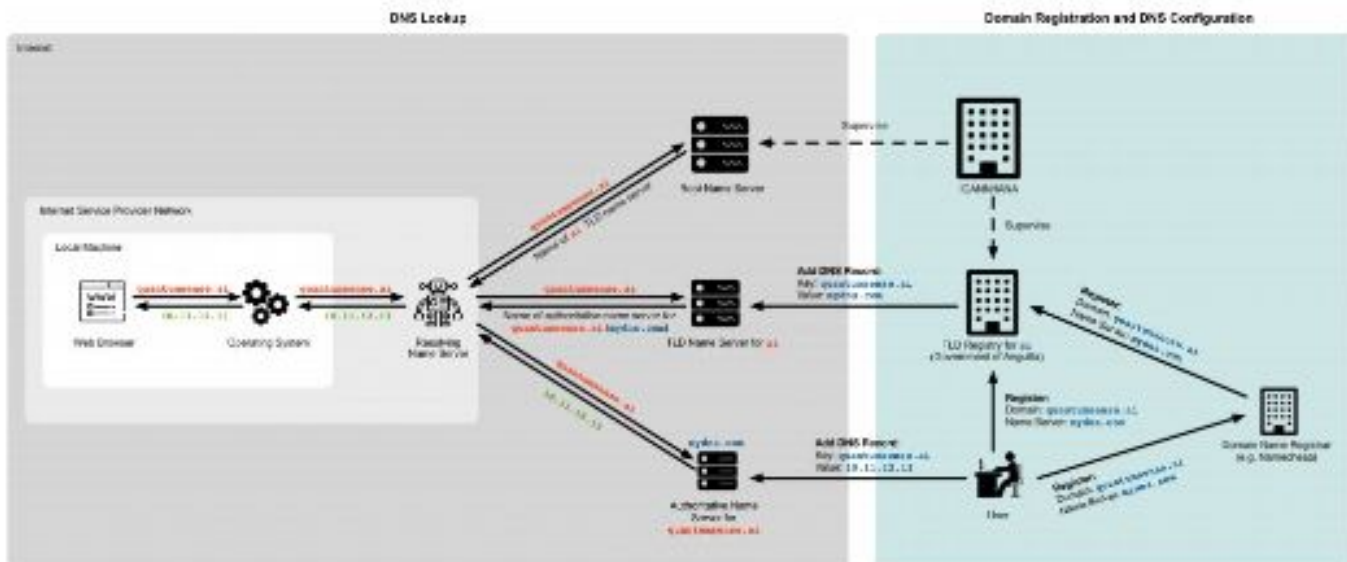
But what if you don't have the record of the domain name in your local cache. The next place your computer goes to, is the ISP, to request resolution of the domain name into an IP address. Or if you've configured to use a custom DNS server then it goes to that server asking for the resolution.

You can check the records in your browser by typing this in your address bar:



Chrome/Edge/Brave: `chrome://net-internals/#dns`  
Firefox: `about:networking#dn`





Now, the server has received your request and now it has to resolve the query for you. It checks its own DNS cache for the incoming query. If not, that server has something called a recursive resolver. A recursive resolver is a program that tries to resolve a DNS query by asking multiple servers at different DNS hierarchies to resolve this query. First, the resolver asks the root server.

These root servers are at the top of the root of the DNS hierarchy, 13 sets of these servers are present around the world and strategically placed. Operated by 12 different organizations like the University of Southern California, US Army, NASA, and more.

They go from a.root-servers.net to m.root-servers.net. Each set has its own IP address. These root servers themselves don't know what the IP address is but they know where to send the resolver.

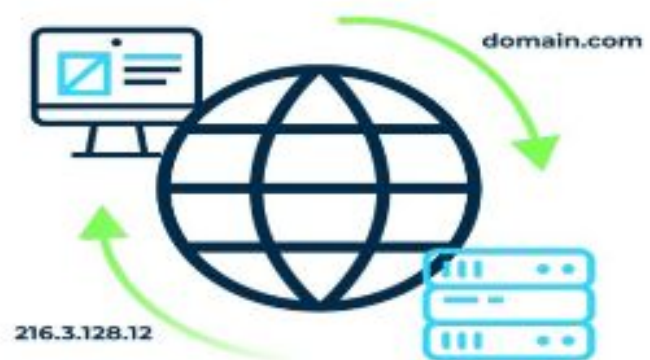
The root server then sends the resolver to a specific TLD server.

TLDS i.e. Top Level Domain Server of the .np domain. Now the resolver server asks the TLDS for the IP address. These TLDS stores the address info of top level domains such as .com, .net, .org, etc. but they themselves don't know the IP address of ku.edu.np.

And they point the resolver to the Authoritative Name Server.

The authoritative name server will know everything about the domain which includes the IP address. They are the final authority. then the resolver sends us the IP address of ku.edu.np to us and we then ping ku.edu.np, to view the website.

This system is a lot more clever than this, so this resolver then stores the address of ku.edu.np in its cache with a time to live and for that amount of time any computer asking the resolver for the address of ku.edu.np will be able to get the answer directly from the resolver server, And all these resolvers, like your ISP's name server, will have cached info. So all this basically functions like a distributed database. These queries are sent out by the resolvers with their own queryID so they don't get all jumbled up.



# Blockchain Technology

## Introduction

**B**lockchain technology was first introduced in the 1990s but became very popular after 2009 when an anonymous person named Satoshi Nakamoto introduced Bitcoin. Blockchain is the list of records called blocks linked together via cryptography. It can be understood as a ledger, where each block contains relevant data like financial transactions, medical records, etc. A block contains a unique hash, which is the digital signature of the data in the block and helps uniquely identify a block from other blocks. The initial/first block is known as the genesis block. Each block links with other blocks and each succeeding block contains the hash of the preceding block.



## Why does Blockchain technology matter?

As mentioned earlier, a block contains a unique hash belonging to the previous block, so if anyone tries to tamper with the data or information stored, the hash of the block gets changed. As the next block stores the hash of the preceding block, changing it will result in the next block being invalid as it no longer stores the previous hash.

Also, blockchain is a distributed database, i.e., there is no central system or server and the data is available to computers globally. Users from all over the network can get a full copy of the blockchain, i.e., all of the data like transactional data, records, etc., which they can verify and keep track of, which helps maintain transparency.

## Some Applications of Blockchain:

Blockchain technology has become a crucial element in the progress/expansion of new technologies and ideas like Cryptocurrency, Web3, NFT, and Decentralized Voting applications (DApps).

Here in this article, we will explore two trending applications of Blockchain, i.e. Cryptocurrency and NFT.



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## Cryptocurrency

In the present time, where every little object, whether a tool or an asset, everything has taken its grand entry into the digital platform. Once we pause and ponder about it, it's extraordinary and feels magical. Estimating the pace of digitization, it was obvious that the centralized currency system was heading towards extinction.

## Let us understand what exactly cryptocurrency is.

A cryptocurrency is a digital or virtual-based currency, where every transaction is secured and recorded using blockchain technology. Since it works on blockchain technology, it does not have central issuing or regulating authorities and is decentralized, i.e. the payment is sent directly from one party to another without going through financial institutions. In case we make payments or transactions with cash or digital payment service provided by banks or e-wallets, the transactions go from sender to receiver through the middleman like banks and other financial institutions. The services provided by such institutions are beneficial and convenient, but there are some ways where things could get wrong and cause inconvenience.

Some of the few scenarios would be:

1. Technical issues like the system being down
2. Bank account being hacked
3. The transfer limit being exceeded
4. The capital loss due to the middleman (transaction cost)

Blockchain technology can help prevent these situations. Since the cryptocurrency contains no broker/mediator, the transactions are simply from sender to receiver using a system that checks the necessary criteria like required balance, user authentication, etc. and the transaction takes place in a matter of minutes.



## Top 10 Cryptocurrencies in March 2022 as listed by Forbes are:

- Bitcoin
- Ethereum
- Tether
- Binance Coin
- US Dollar Coin
- XRP
- Terra
- Cardano
- Solana
- Avalanche

## NFT

NFT stands for Non-Fungible Token. They are digital representations of assets on blockchain with unique identification codes. The unique identification codes make the token unique, and the assets non-replaceable. Assets can be anything like music, digital painting, video game skins, tweets, etc.

Let us understand the term 'non-Fungible' with a simple example. Suppose, you and your friend each have a bitcoin. You can digitally exchange your bitcoin with your friend's bitcoin, resulting in both having the same value for the bitcoin. But suppose you have a painting, and if you exchange it with your friend's painting, you will get a whole new value for the previous unique painting, i.e., it does not have the same value. NFT allows the buyer to own the original item and contains built-in authentication, which validates the ownership. The unique identity and ownership are stored in a blockchain, typically on the Ethereum blockchain.



Nowadays, selling digital artwork using this technology is a great hype. The most influential Bollywood actor, Amitabh Bachchan, made seven crores selling his NFT collection. Not only for celebrities, but it also has made ordinary people millionaires. Reminiscing the story of Sultan Gustaf Al Ghozali, an Indonesian student, who took a photo of himself daily for five years and sold his selfies as NFTs made a collection that reached a trading volume of more than \$1 million. Buying selfies for this splendid sum of mon-

ey may seem absurd, but some potential buyers have the habit of collecting this kind of thing which opens the door to new opportunities for many creative people.

Not only digital arts but also tweets of famous personalities have been sold as NFT for an astounding price. Jack Dorsey, CEO of Twitter, sold his first tweet as an NFT for an astronomical \$2,915,835.47. NFTs are typically bought and sold with cryptocurrency. NFT has now become a great medium to sell your creations online in the digital world.

## Potential & feasibility of Blockchain Technology in Developing Countries like Nepal

Blockchain technology has great potential in developing countries like Nepal. The implementation will still bring some challenges moving forward. The transaction records and other prime data centralized to a single institution make it easy to manipulate and tamper with the data by authority figures of the institution for their benefit. If we use Blockchain technology to store such data, it cannot be modified and tampered with easily for some personal benefit. So, this can be a fundamental step in solving corruption. Blockchain technology can be a driving piece in conducting a fair and transparent election by ensuring that the votes have gone to the desired candidate and be beneficial for the government to keep and manage records of its citizens. Blockchain technology eliminates mediators/brokers like banks and other financial institutions for financial transactions and is convenient for detecting the product's authenticity. For example, if you buy a vegetable from a store, how will you know the origin of the vegetable to ensure its quality? Hence, blockchain technology will help trace the product's authenticity so that the citizens can buy quality goods and food items for a better lifestyle.

## Conclusion

So, Blockchain technology is blooming from good to great, as it has been implemented successfully in furnishing new technology like Cryptocurrency, NFT, and concepts like Web3. Blockchain has led the foundation for building a decentralized and transparent system for the people, industries, various institutions, and an entire country for economic and financial development. Information and data can easily be traced and cannot be tampered with by implementing blockchain technology. This proves that blockchain technology will not be limited to the present application of technologies and services but will have an immense impact on other technologies in the coming days.



# Outernet and its contribution to Transhumanism

What is the first thing you go for when you wake up in the morning? I'm not all that different from most of you; I also reach out for my smartphone. And if you ask me why, I will not duck any of your questions as I have good, convincing reasons.

Let me ease this for you!

As soon as my father opens his eyes, he goes to get the newspaper. My grandmother similarly prefers the radio. Why isn't this conduct being investigated right now? These things most likely would have been questioned when they were at their busiest. These are the quickest resources available to my parents and grandparents for keeping up with world events. In a similar vein, I have access to the internet and smartphones. And I cannot guarantee whether or not this will still be the case when I become a father. The main thing to observe in this case is the evolution of the time that has resulted in the virtual and real worlds coming together to form what is now known as the 'Outernet'. The two realities are now merging into only one, and it is mind-blowing how outernet has become the new reality.



As Trendone quotes, "The outernet has made the digital world as important to us as oxygen, and we now take it for granted to such an extent that we hardly notice it anymore". If you look around, you'll see that the biggest economies are drastically changing to adapt to the outernet, and the ones that are expanding the fastest are doing so. Our home, vehicle, and even the toy & gadget like an electric toothbrush, we provide our young toddlers, are all considered to be 'smart'. The adaptation has produced a subliminal habit that is accepted as normal today.

Nobody was keen enough when "Pokémon Go" unexpectedly became an overnight success. However, this started a chain of response in which businesses began to adapt and offer services utilizing "Augmented Reality", and soon "META", the most recent landmark that represented the fusion of reality and virtuality, became the most talked-about topic.

You may also have heard of natural user interfaces: where we can use voice or gesture control to operate touchless devices. What about location-based services, where restaurant recommendations are recommended based on your current location? Or perhaps you ought to begin by implementing the internet of things in your own life, such as a smartwatch.



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This is where our inquiries and the idea of 'Transhumanism' collide. This series of incidents are causing transhumanism to adapt and evolve. In simple terms, the concept of "Transhumanism" is all about research and development of robust human-enhancement technologies with the motive to vastly enhance human health and lengthen human life spans, as well as augment or increase human sensory reception, emotive ability, or cognitive capacity. Such alterations resulting from the addition of biological or physical technologies would be more or less permanent and integrated into the human body.

The convergence of human and machine consciousness will be possible when artificial intelligence reaches the singularity, which is how transhumanists define it. The length of human lifetimes will significantly increase due to that convergence which will also herald an improvement in human consciousness, physical fitness, emotional stability, and general health.

The 'Neuralink' can be regarded as a significant step forward in transhumanism thus far. It has consistently emphasized its opportunities, which will benefit not only us but also people dealing with deformities. It is believed to be effective in dealing with Parkinson's disease, all paralysis, and other forms of functional disorientation.

Finally, the profound concern is how these astounding developments will impact people in the long run. And can we be capable of handling them? Or maybe it would be better to take things a little slower? Although there are many opportunities and prospects, we must wait for them to materialize for the time being; there is no other choice.



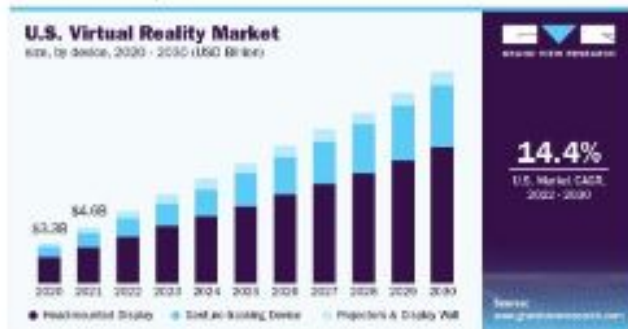


# WHY VR IS THE NEXT BIG THING

**V**R, known as Virtual Reality, is the computer technology to create a simulated 3-D environment that can be interacted with using special VR equipment. Head-mounted displays, or HMDs, are the most popular way for us to use VR technology. Oculus Quest and HTC Vive are the two most popular models of such gadgets.



One of the first virtual reality technologies was built back in 1957. That's 65 years ago! Even though VR might have a long history of 65 years, one of the most consequential years for its development was 2014, when Facebook acquired Oculus for \$2 Billion. The Covid-19 pandemic and Facebook announcing the Metaverse also proved to be major contributing factors to the development of VR technology. From recent evaluation, the VR industry has grown to be a \$4.6 Billion industry in 2021.



I believe VR will be the next BIG thing in the coming years just thinking of all the possibilities. VR had been used in the past for military training and simulation. With recent advancements in VR technologies, you can do a wide variety of things in VR, from gaming to having a virtual tour of the Louver Museum in Paris. VR for mental health also has been gaining popularity as studies have shown VR to be effective for the treatment of phobias and depression through exposure therapy. The key industry in which VR is predominant nowadays is the gaming industry. So, get ready for FPS games to feel like FPS games.



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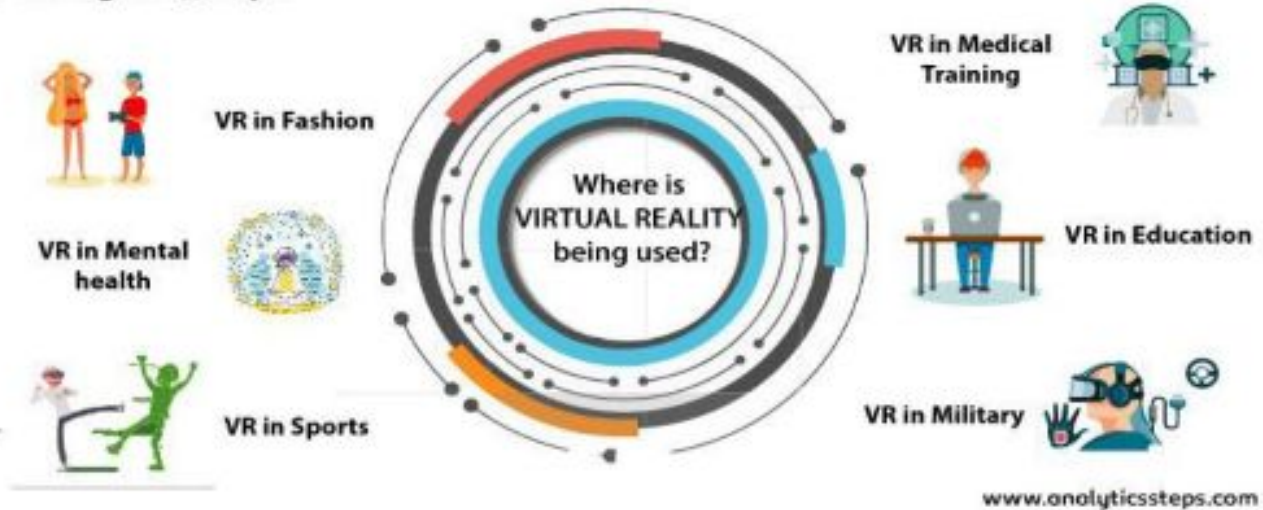
Ever since Meta acquired Oculus, it has been a valuable player in the VR industry. The big news that gained traction a couple of months ago was the announcement of Metaverse. For those unfamiliar with the term, the Metaverse is simply a concept or location you can visit using VR or AR devices focusing on social connection, gaming, and various other secondary uses. It is the virtual counterpart of the real world accessed through VR devices. Ever since the term metaverse was coined in 1992 in Neal Stephenson's sci-fi novel Snow Crash (I highly advise you to read it if you haven't already), it has been steadily growing in popularity. In his novel, the characters could go to a virtual place to escape the totalitarian reality called the Metaverse. The Metaverse that Meta is working on might not be so different from the novel. Only time will tell.



Just reading this article will not make you realize just how cool of a technology VR is. You will need to experience VR on your own through a headset that you can even build using cheap materials, looking through online tutorials. Once you have a VR headset, I recommend you go through the various VR 360 videos on YouTube and have a great time. VR, even being a 65 years old technology, is continually making progress and has rapidly increased its rate in the past couple of years which is exciting for us. You can know a lot of things about various places without even needing to go there through VR. Ultimately, VR is a really promising technology, but there are still some limitations that the VR industry has yet to solve to go to the next level of VR development.



**analytic Steps**



Let's talk a little bit about the limitations of VR headsets in today's age. One such limitation is the lack of good graphics. If we compare the kind of graphics with PC games, the difference will be monumental and slightly depressing. If the VR industry grows, it should be able to surpass this limitation and make better-looking applications. One of the prime reasons for such lackluster graphics is that VR games are tough to make. Making a VR game is complex and very different from making traditional games. To build a good VR game with great graphics, the amount of time, money, and effort it demands would not please the stakeholders of the gaming company. Despite this fact, efforts are being made to make good VR games.

Another major limitation of VR headsets is locomotion sickness. During the VR experience, our brain will perceive us to be in motion, especially if we use applications containing numerous moving objects and scenes. But the seizing of motion signals by the fluid in your ears, controlling your ability to balance, might confuse the brain and cause dizziness in some people.

Some other problems that VR developers need to fix are the weight of the headset and its price. Hefty headsets can strain the neck and cause posture problems plus prolonged use can cause eye problems. On the other hand, being very expensive will mean that the general population won't be too keen to buy this technology. If technology is made cheap and accessible, then only can it be desired among the masses. The ideal VR headset needs to be lightweight with long battery life and should be able to combat all the limitations of its predecessors. Changing material science and using various polymers to create the materials of the VR are slowly helping to fix these problems. We will just have to wait these out for the time being.



There are two ways to look at new technologies: optimistically or pessimistically. Even though virtual reality has the potential to improve our quality of life, it also has the potential to destroy our social lives by causing us to become addicted to it. Government officials and major corporations are concerned about the potential negative effects of virtual reality on human society. But, in the end, it all comes down to public awareness. VR will ruin your life if you start using it without understanding the serious negative consequences. However, if you use VR to build social connections and as a form of entertainment, I believe you are on the right track. All I can conclude is that the future we have in front of us will be full of excitement.





## Digital forensics in uncovering a crime

Often in movies, we have seen the investigator or detective going through the computer and accessing the data and whereabouts of the criminal at the time of crime. This may have fascinated everyone about how computers and other devices can be used in crime detection. This is where digital forensics comes into play. Digital forensics is a subject of interest in the investigation, identification, and preservation of evidence from computers and other digital devices. It starts with the accumulation of information in a way that maintains its integrity. Investigators then analyze the data or system to determine if it was modified, how it was modified, and who made the modifications. The evidence collected can be useful in uncovering the crime and can be presented in court. According to Kruse and Heiser (2002), digital forensics is all about the preservation, identification, extraction, documentation, and interpretation of data from different devices.

There are two main branches of digital forensics: investigation and data recovery. An investigation is uncovering the pieces of evidence, which may be documents, browsing history, or metadata from the devices. Whereas data recovery is the process of restoring the evidence which has been destroyed intentionally or unintentionally. The data is recovered from various devices such as broken hard drives, crashed servers, and other compromised devices.



## History of Digital Forensics

With the growing realization of the benefits of computer data in investigating crimes, the importance of computer forensics has increased significantly. With recent advancements in computer forensics, the investigation process can uncover a lot of evidence that is collected from different devices of the victim or suspects.

Considering the fact that digital forensic can determine the prime suspect of the crime, in 1984, the USA began working with FBI CART (Computer Analysis and Response Team) providing a lot of digital forensics analysis and support in finding the suspects and proving them guilty in the court. In 1985, a computer unit called "Fraud Squad" was set up by the UK Metropolitan Police to investigate



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the crimes.



## Digital forensics techniques

There are different methodological models that are used in computer forensics, such as Kruse and Heiser model, USDOJ model, DFRWS model, and so on. Each of the models has its advantages and disadvantages. The steps that are common to all the models are:

- Identification: Identifying the need for investigation and finding the evidence.
- Collection: After the identification process, the data are collected from different sources.
- Preservation: The collected data are preserved and stored in a secured location so that nobody tries to destroy the evidence.
- Analysis: The evidence preserved is further investigated and a conclusion is drawn.
- Reporting: After the conclusion is drawn, the documentation and investigation are done.
- Among all the methodological models, Kruse and Heiser's model is the earliest model used in digital forensics. Kruse and Heiser's model consists of three different phases:
  - a. Access: Accessing and finding the data.
  - b. Acquire: Extracting and preserving the data from destruction.
  - c. Analyze: Analyzing the data without modification.

## Types of digital forensics models

There are different types of digital forensics based on for what purpose they are being used.

- **Disk forensics:** Recovering the data from different storage devices such as hard disks.
- **Wireless forensics:** Retrieving and extracting data from the different wireless communication networks.
- **Network forensics:** Collecting the data of illegal devices on the network.
- **Database forensics:** Analyzing and examining the database.
- **Malware forensics:** Identifying code or files consisting of viruses, malware, etc.
- **Email forensics:** Retrieving deleted emails.
- **Memory forensics:** Collecting evidence from system memory such as cache, RAM, etc.
- **Mobile phone forensics:** Gathering information from the phone such as call logs, message history, images, etc.



## Digital forensic tools

There are different tools and software that can be used to identify, collect and preserve digital evidence to present in court and determine the culprit. These tools are digital forensic tools.

- **Autopsy:** for disk forensic
- **Volatility:** for memory forensic
- **Wireshark:** for network forensic



## Digital forensics in Nepal

- With the increase in crime and the need for technology in crime detection and solving, Nepal police established Digital Forensics Technology in 2015. This has helped the Nepal Police in solving many criminal cases. They have also been using digital forensics to fight against various cybercrimes.





# James Webb Space Telescope XML Database



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The JWST is a 6-meter-long aperture infrared space telescope that was primarily designed to conduct infrared astronomy. It has a five-year mission with a design goal of ten years. It will continue advancing breakthroughs in our comprehension of the origins of the earliest stars by detecting the first starlight and other questions about the early universe. JWST was launched on December 25, 2021 and was placed in orbit at L2\* at 2:05 pm EST (19:05 UTC) on January 24, 2022. The JWST team includes several partners in multiple locations.



Figure 1: Lagrange points

The XML database plays a key role in exchanging information, migrating ground system components, and reducing the testing needed for each database release of the different systems.

All of the JWST teams are actively using the JWST XML database in their local facilities in coordination with the central database at Science and Operations Center located at the Space Telescope Science Institute (STScI) in Baltimore MD. An overview of the interaction between these JWST various teams using the JWST XML database is shown in figure 2. The success of the JWST database, actively used since January of 2002, is due in large part to the flexibility of the XML technology.



Figure 2: JWST XML Database Team Interaction

## JWST Database History

JWST decided to use a COTS product for the command and telemetry system for both I&T and operations. JWST Project aims to use the same ground system through I&T that the operating systems of other missions will be using. A team of JWST system engineers gathered in 2000 to look at various options, technologies, and industry trends. It is important to note that during the team deliberations, there were no restrictions placed on the team. All database options were open for consideration. The traditional NASA database systems using Microsoft Access and Oracle were considered early in the process. Visits to several NASA missions were accomplished, as well as bringing in personnel to the team with experience in large-scale database systems. The team, looking at the need for a 20-year database, quickly concluded that the data needed to be non-proprietary since companies and products will change over time.

Once the team chose XML as the database format for data storage, the immediate challenge was to explain this selection to the JWST Project. Since this was a departure from previous GSFC/NASA database structures and was "new" technology, there were many skeptics. XML created quite a firestorm in its raw form. The concept of separating the application from the data and the lack of an intuitive relational database were the main reasons cited for rejecting the XML database. The JWST system engineers had been concentrating early in the JWST database development by creating and organizing the XML tags. The team also knew in the final product that the user experience was crucial and that viewing, editing, and writing raw XML was not desirable. Until the development of user interfaces, raw XML was what the various JWST database reviewers saw and manipulated. Thus, immediately started questions about the wisdom of using XML. Also, there were requests for changing back to known heritage GSFC/NASA database systems using Oracle and Microsoft Access.

As the JWST database matured in both its uses and interfaces, the XML took on a life of its own among the JWST Project users. The JWST Project users began not only to accept the use of the XML for command and telemetry definitions but also added XML to other systems, such as GSFC spacecraft and table load files.

JWST is a leader in using XML on large-scale spacecraft databases. Working with NASA along with various international standards groups, JWST is spreading the knowledge and experience gained during our database development. The JWST database has three years of use and at least 22 more years to go, which indicates a lot of history is still to be written.



## XML The Early Days

It became very evident early in the process that for JWST to be successful in its goods, the database data portion must be separated from any application. Companies and Commercial-Off-the-shelf (COTS) products will come and go over the 25-year life of the JWST database. XML allows the data to be stored in a manner that allows it to be transformed, ingested, and accessible to many other systems smoothly. XML in the commercial industry was taking off with Apple iTunes and Microsoft Office products migrating to XML, which resulted in more tools becoming available to view and edit XML.

In 2001, the team started prototyping the JWST XML using the Earth Observation System (EOS) Aura satellite database. This database had about 25,000 data items for command and telemetry, which is the expected size of the JWST database. It took approximately two weeks to convert all the data into the JWST XML structure because we were using very basic tools. Now that we have a database with test data, the first steps in verifying performance, sizing, and allowing for the development of the first user interfaces for viewing the data

Performance testing showed that database conversions to multiple formats could be accomplished in minutes using a standard desktop PC running Windows 2000 NT with 256MB RAM at 1.8GHz. For the JWST database, each command and telemetry mnemonic will be a separate container or file. For example, if there are 200 commands in the database, then 200 containers will be delivered in a command folder. The sizing testing indicated no issues with each command and telemetry file about 4KB in size, for a total of 100MB. The user interfaces, as shown in figure 3, were developed using a few key goals. The first goal is to use standard web browser interfaces so any workstation can use the database interface without having special software. The second goal is to remove any XML tags and code from the user experience. The third and final goal of the input form is to check for legal values to identify as many errors as far forward in the process as possible to reduce the amount of re-work the user would need to do.

After the prototyping success and demonstrations of the user interface, the JWST database started to prepare the Interface Control Document (ICD), ingest the current GSFC flight software command and telemetry definitions, and work on information exchange with the prime contractor.

## JWST XML growth

Once the XML standard became approved by the JWST Project and the databases were being produced using command and telemetry definitions, many other products, including an exquisite definition of command and telemetry, were added to the database.

The growth of the JWST XML database, as with the growth of any system, presents a challenge in maintaining compatibility with the tools used, the systems ingesting the data, and the existing data in the database. The JWST has implemented a Change Control Board (CCB) for the database that includes a wide range of users and JWST system engineers to evaluate not only the merits of a change request but also the impact of such a change. The JWST database tools, available to all users, include a cross-referencing tool to allow a user to evaluate the impact of a change before proposing it.

## JWST XML today

At Nasa, the JWST database is one of the largest XML spacecraft databases for real-time and offline systems. Figure 8 shows the current database system available to 24 different laboratories: each geographically dispersed and each having local database tools to work with the XML databases. Each of these laboratories' database tools is used for exporting and importing data both locally and to the central database system, inputting data into the database certification process, and providing various reports. The STScI maintains the centralized certified database repository of JWST.

JWST is working with various systems suppliers to incorporate the XML, more directly, limiting the conversions, including the Eclipse® system. JWST has found that these conversion processes, while not difficult, will add time to the whole database building process. The goal of JWST is to build a complete database within 15 minutes. This goal is to reduce the database shortcuts found in some I&T environments that do not follow the configuration management process. If the database builds quickly enough, users will be less likely to implement the shortcuts. Using a direct XML import, such as with PSS, there is no database build time. However, with the Eclipse system, the database currently must be converted to a Microsoft Access database and then to a flat file which takes 13 minutes.

JWST is participating and meeting with the various industry standard groups, such as the Object Management Group (OMG) and the Consultative Committee for Space Data Systems (CCSDS) spacecraft monitor and control working group, to ensure the JWST-XML maintains a level of compatibility. The JWST Project also works with various GSFC projects, and the JPL Mars missions to provide a level of consistency between the various NASA projects.



## Emulators and How they are built



**E**mulators may sound like a nerdy topic but it is quite simple and fascinating. Emulation in the computing sense is the imitation of the behavior of an electronic system in another type of system. In simple terms, we just imitate the behaviors of a system on a different device or system. You may have also heard about the term virtualization. Although the terms virtualization and emulation sound a bit similar, they are different. Virtualization allows the running of software that can run on the underlying hardware.

An example of this is running a Linux distro on Windows using virtualization clients. Emulation, on the other hand, is a superset of virtualization. It allows the running of software that doesn't necessarily support the underlying hardware. Now, carrying on with the topic, I guess you are familiar with BlueStacks. BlueStacks is an Android emulator which allows us to run android apps on our PC or macs. From playing Mobile Legends to even scrolling Instagram, BlueStacks has a wide range of support. I extensively used it back when I was around 6th-7th grade to play the most popular game of that time, Clash of Clans (you are not a gamer if you haven't played it, lol). You are also definitely familiar with emulators if you like to play retro games. From playing the games of the Pokémon franchise, the Mario games and Legends of Zelda these are some of the most popular games even today. The most popular emulators are the ones for game consoles which allow us to play games in the comfort of our PC. These emulators are being further developed to run on Android and iOS systems. The consoles released in the 90s and early 2000s have some popular emulators like Dolphin (Wii), Visual Boy Advance (GBA), DeSmuMe (Nintendo DS), PPSSPP (PSP), and many more. The emulator scene is still expanding, with some more modern consoles like the Nintendo 3DS (Citra) and Nintendo Switch (Yuzu, Ryujinx). Although they have their limitations, these emulators surprisingly support a wide variety of games, allowing us to enjoy the games we love without having to pay a hefty sum for the console and the games. They also support quality of life improvements like resolution scaling and higher frame rates, which enhance the experience.



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You may be wondering if it allows us to play the games without purchasing consoles and the games. Is it legal? The answer to this question is YES. The emulators are legal. They are just programs that act the same as physical devices. Henceforth they behave the same when we run the software that was intended for it. However, uploading and downloading games (generally called ROMs) is considered copyright infringement. If you own the copy of the game then it can be ripped and used personally without any legal issues.



Now let's briefly get the idea about how the emulators for the consoles are built. The major concept used in this process is Reverse Engineering. Reverse Engineering is the process of analyzing and deconstructing a thing to learn what it is made of and how it is constructed. Extensive research of the targeted system is required going down to the microprocessor level. The game consoles have their custom processors and are generally different from the commonly available processors. Games written for one CPU will not work on the other due to the difference in design and instruction set. They may also contain custom-designed GPUs. The programmers start by creating the software version of the hardware components. Then, the OS code is remade in the language and instruction set supported by the emulating device. The BIOS used in the system is dumped from which the programmers code the central program to emulate the system as effectively and resource-saving as possible. After these steps are completed. The emulator replicates the system of the console. The games and applications, on the other hand, are written specifically for the hardware of the console. An interpreter is also built which translates each of the instructions of the game to an equivalent in the emulating machines design and instruction sets. The interpreters are capable of translating sets of instructions that are complex to develop but are much more efficient. This is the general idea of how the emulators are built.

The performance and speed of the emulator depend upon the robustness of the interpreter and the implementations of the hardware components in the software version. The capacity of the emulating machine also plays an important role in determining performance. The emulators have their system requirements, which must be noted to get the best performance. Although various consoles have their emulators, there are also many consoles for which the emulator has not been created. The complex architectures, hardware boundaries, and hard-to-get-around software have made the emulators for consoles like the PlayStation 4, and Xbox One difficult to emulate. Emulators are the biggest enemy to the console manufacturers so they focus on creating consoles that are very difficult to reverse engineer.

After reaching this far, your interest in emulators may have increased a bit. So, why not get nostalgic by playing the games you played back in the day? This too at the comfort of your PC. Even if you have not tried the games, why not try the games that you may have wanted to try? Like the famous Super Mario Bros series or even the Pokémon games.

The field of emulation is expanding not only in the console space but in other fields as well. NASA, SpaceX, and other research institutes also use emulators to study the prototypes and the various factors affecting the device. Big tech companies like Advanced Micro Devices (AMD), Intel, and many more make use of emulators to gather information and data on their products.



Fig: Super Mario Odyssey on Yuzu Emulator





# Elon Musk's impact on Twitter and Tesla's stock price

The narrative behind the huge decision and how one man's decision swayed the entire stock market



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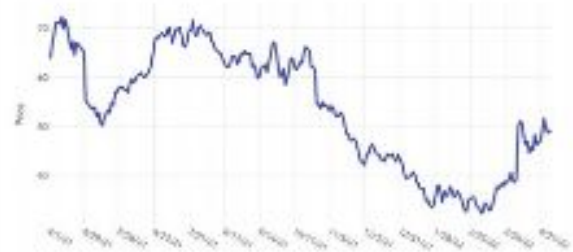


With this poll, it seemed that Elon was giving serious thought to either building a social media platform to compete with Twitter or buying Twitter outright.



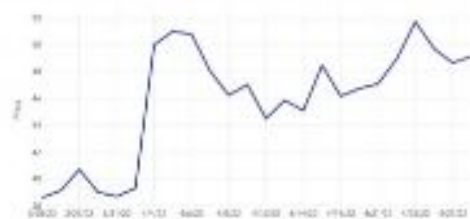
**D**o you think one man can bring stock values down or up? Do you believe that a single tweet can cause a wave of buying and selling of stock prices? In this post, you will look at how Elon Musk did just that this summer.

Elon Musk is a well-known name in the global market. Musk was born and raised in South Africa but moved to the United States after spending time in Canada. Musk studied physics at the University of Pennsylvania and started his career as a serial tech entrepreneur with early successes such as Zip2 and X.com, which later merged with a business that became PayPal.



Elon then used most of the proceeds from his PayPal stake to found Space Exploration Technologies Corporation, the rocket developer commonly known as SpaceX. According to Musk, he spent \$100 million in 2002 to find it. Long known for his stance on free speech absolutism and active tweeting, Elon began to openly discuss Twitter's shortcomings on the platform earlier this year.

Twitter stock price from April 1, 2021 to April 29, 2022  
On April 4, 2022, according to a regulatory filing published Monday by the Securities and Exchange Commission, people found that Elon had bought a 9.2% stake in Twitter. This stake was equivalent to 73,486,938 shares of Twitter common stock and is worth \$2.89 billion based on the company's closing price on Friday, April 1, 2022. Also, he became the company's largest shareholder overcoming Twitter co-founder Jack Dorsey by 7%.



Twitter stock price from March 25 to April 29, 2022

After news of Elon purchasing Twitter stock broke, Twitter share price soared by around 25% in early trading on Wall Street on Monday, April 4, 2022.

Over the next few days, the stock experienced massive volatility. On April 5, Twitter announced that Musk would be joining its board.

In a shocking turn, Twitter CEO Parag Agrawal tweeted that Elon would no longer be joining its board.



Suddenly, on April 13, Elon attempted to buy 100 percent of the Twitter stock at \$54.2 per share in cash for Twitter, valuing the social media company at \$43 billion. But did not say on how he did not say how he would finance the acquisition.

With this action, Twitter turned cold, adopting a defensive measure known as a poison pill on April 15. At the opening of the market on April 18, the stock price declined and reached 46.1 from 48.4

A poison pill defense tactic allows current shareholders to buy additional shares at a reduced price, effectively diminishing the hostile party's ownership stake. Poison pills are frequently used by corporations facing activists, investors, or hostile takeover situations.



Timeline of Elon Musk's decision for Twitter buyout

On April 21, a stock exchange filing showed Musk has lined up \$46.5 billion in financing. With this decision out, the stock again rose from 47.08 to 48.93. And when the price was 51.7 on April 25, Twitter confirmed it was selling the platform to Elon for \$44 billion.



## Twitter employees react

Employers claimed they were kept in the dark about the implications of the billionaire's purchase of the company for them and their stock.

Twitter's Edward Perez tweeted that:



If you're wondering what Twitter employees think, I can only speak for myself: It's a time of genuine discomfort and uncertainty.

Most of us believe deeply that Twitter is much more than a tech platform; we have a deep responsibility to society. I hope our new owner gets that.

Twitter co-founder Jack Dorsey stated that no one or corporation should own Twitter, but applauded Elon Musk's acquisition of the company as the greatest plan for the company. "Taking it back from Wall Street is the correct first step."



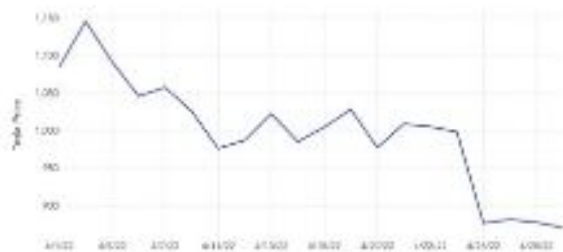


## Ripple effects

Tesla works in the design, development, manufacture, and sale of fully electric vehicles and energy generation and storage systems. Its stock was bearing the brunt after CEO Elon made a deal to buy it on April 25, resulting in a decline from 998.02 to 876.42.



With the decision of Elon lines up \$45.6 billion in financing, there was seen rise in price from April 20, 2022. This was because Elon was funding the deal with a mix of his cash, a buyout loan, and a loan against his own Tesla stock.



With the decision of Elon buying Twitter, there was down-fall in Tesla's stock

Some reports say that other things have impacted Tesla stock, including COVID lockdowns in China that have hindered production at Tesla's Shanghai plant. The overall market is much weaker too.

## Status of the Deal

On May 13, Elon tweeted: Twitter deal temporarily on hold pending details supporting calculation that spam/fake accounts do indeed represent less than 5% of users.



With this, Twitter CEO Parag Agrawal said in May that Musk's method for calculating bot accounts would not work, noting that such an analysis would require private information that Twitter cannot share. Now, on June 8, 2022, according to a Washington Post report, Twitter is giving in to Elon Musk's request for access to its "firehose" of internal data. With this still, we are not sure when the deal will succeed.

Twitter's board unanimously recommends that the social media company's shareholders approve the merger agreement, according to a document filed with the Securities and Exchange Commission (SEC). Additionally, the board has requested shareholder approval for any compensation that would be due to executives as a result of the merger. Though this decision will probably reassure Musk, the company's shareholders won't vote on the matter until at least August 2022.

On July 9, 2022, Elon stated that he wanted to back out of the purchase since Twitter did not provide a review of spam and fraudulent accounts on its site. Twitter claimed that it would make Elon complete the transaction regardless.

## Elon surpassed 100M followers!



On top of this, according to data from Social Blade, Musk surpassed 100 million followers between Sunday and Monday. Over the past 30 days alone, he has increased his Twitter following by more than 4 million and became the sixth person to reach 100 million followers on Twitter and the first among notable business figures. This also seemed to be one of the impacts of Musk's decision to acquire Twitter.

## What for Tesla and Twitter Investors?

For Tesla investors, this deal is very crucial. If the deal goes through, Musk will have to find the cash to finance the purchase. Most likely, he will have to sell some Tesla stock to fund the deal, which has already been foreseen since he announced the source of funding for the Twitter takeover. If he resumes selling Tesla stock, the stock will almost certainly fall under pressure. And for Twitter investors, the price increased promptly, but they also experienced a downfall. Due to various reasons, Elon's take on the Twitter ecosystem is more likely to trade below the price. However, the recent news of Elon backing out has created a new sensation.

## Are you also following Elon on Twitter?

And what do you think the acquisition of Twitter by Elon is worth?





# A Brief Introduction To Generative Adversarial Networks



Anil Kumar Shrestha  
Computer Science  
2016 Batch



a)



b)

Figure 1: Results of GAN

(a) Images generated using CELEBA-HQ dataset by paper Progressive Growing Of Gans For Improved Quality, Stability, And Variation

(b) Class-conditional samples generated by paper Large Scale GAN Training For High Fidelity Natural Image Synthesis.

How amazing are these photos? They are some regular photos we can find on the Internet, right? Well, no. They are all fake images generated by some form of GAN - now that's amazing!

"There are many interesting recent developments in deep learning...The most important one, in my opinion, is adversarial training (GAN). This, and the variations that are now being proposed, is the most interesting idea in the last 10 years in ML."  
— Yann Lecun (Chief AI Scientist at Facebook)

## About GANs

The idea of the Generative Adversarial Network (GAN) was introduced by Ian Goodfellow and other researchers at the University of Montreal in 2014. Since then, there has been a deluge of papers and progress, e.g. Conditional Generative Adversarial Network (CGAN) in 2014 by Medsi Mirza and Simon Osindero. Then in 2015, a standardized

approach called Deep Convolutional Generative Adversarial Networks (DCGAN) was proposed by Alec Radford, et al. followed by CycleGAN in 2017 by Jun-Yan Zhu et al.

GANs are widely used in image generation, video generation, music generation, voice generation and text-to-image generation. You can see the sample results of GANs in Figure 2, which shows how GAN models have been able to produce high resolution synthetic images. The results are improving every year, making us almost unable to distinguish between the real and the fake. GANs' potential for both good and evil is huge, and they can be used to mimic any data distribution. They can be taught to create art or fake media.

"...Meta and YouTube have taken down a deepfake video of Ukraine's president talking of surrendering to Russia." - BBC

Check out this cool site that generates photos of people that do not exist: <https://thispersondoesnotexist.com>

A Generative Adversarial Network (GAN) has two deep networks - a Generator G and a Discriminator D.

- The generator G outputs synthetic samples from data  $x$ , given random noise  $z$  and learns to fool the discriminator by creating results close to a real data distribution.
  - The discriminator D learns to decide if the sample is from the model distribution or the data distribution. It gives the probability that the output came from the data distribution. So, if the sample is real,  $D(x) = 1$ .
- So from a game theory point of view, we can think of it as a minimax two-player game. The generator and discriminator both try to beat each, and this rivalry allows us to see rapid improvements in both.

The generative model can be thought of as analogous to a team of counterfeiters, trying to produce fake currency and use it without detection, while the discriminative model is analogous to the police, trying to detect the counterfeit currency. Competition in this game drives both teams to improve their methods until the counterfeits are indistinguishable from the genuine articles.

- Generative Adversarial Network, 20



Figure 2: Improvement in GAN results from 2014 - 2018, Image source: Ian Goodfellow

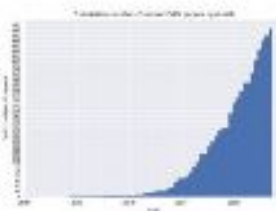


Figure 3: Graph showing the number of papers over the years, Image source: The GAN Zoo

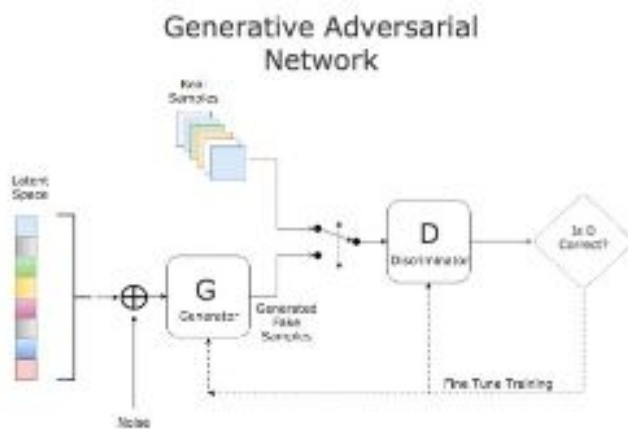


Figure 4: Illustration of GAN, Image source: kdnugets  
The Math behind GANs

Given,

$p_z$  Data distribution over noise input  $z$

$p_g$  Generator's distribution over data  $x$

$p_{data}$  Data distribution over real sample  $x$

The discriminator  $D$  gives  $D(x)$  indicating the probability that  $x$  is a real sample. Our goal is to train  $D$  to maximize the probability of recognizing real samples as real and generated samples as fake. Simultaneously, we want to train  $G$  to minimize  $\log(1 - D(G(z)))$ . Here,  $G$  and  $D$  play the following two-player minmax game with the value function  $V(G,D)$ :

$$\min_G \max_D V(G,D) = \mathbb{E}_{x \sim p_{data}(x)} [\log D(x)] + \mathbb{E}_{z \sim p_z(z)} [\log(1 - D(G(z)))].$$

## What is the Optimal Value for D?

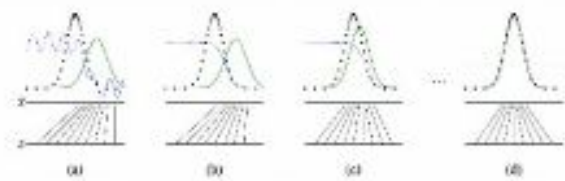


Figure 5: Obtaining Optimal value for D, Image source: GAN

In the figure 5, the lower horizontal line is the domain from which  $z$  is sampled, the upper horizontal line is the part of the domain. The blue dashed line is the discriminative distribution  $D$ . The green solid line is the samples from generative distribution  $p_g$  and the black dotted line is the samples from the data distribution  $p_x$ . The arrow shows how the mapping  $x = G(z)$  imposes  $p_g$  on transformed samples. We get the best value of the discriminator as:

$$D_G^*(x) = \frac{p_{data}(x)}{p_{data}(x) + p_z(x)}$$

- (a) An adversarial pair near convergence.
- (b)  $D$  is trained to discriminate samples from data converging to  $D^*(X)$ .
- (c) After an update to  $G$ , the gradient of  $D$  has guided  $G(z)$  to flow to regions that are more likely to be classified as data.
- (d) After several steps of training, if  $G$  and  $D$  reaches optimal point at which both cannot improve further,  $p_g = p_{data}$ . The discriminator is unable to differentiate between two distributions. So,  $D(x) = 1/2$ .



## Where are we using GANs?

There are a large number of interesting applications of GANs which cannot be explained here in a single article. I shall list a few below:

### 1. Generate images of human faces:

The paper Progressive Growing of GANs for Improved Quality, Stability, and Variation demonstrated a plausibly realistic human face generation model. The model was trained on celebrity faces so the faces might look familiar, however they are synthetic people from a GAN's dream. Figure 1 shows some of the results as shared in the paper.

### 2. Image-to-image translation:

A paper Image-to-image Translation with Conditional Adversarial Networks, published in 2016 by Phillip Isola, et al., showed image-to-image translation like translating photos of days to night, black and white to color, sketches to photograph, and many more.



Figure 6: Translations done by pix-to-pix, Images source: Image-to-Image Translation with Conditional Adversarial Networks Besides this, CycleGAN can convert images from one domain to another. Imagine transforming a zebra into a horse or a photo to a painting or vice-versa( yes, that's doable). CycleGAN can translate real scenery to a Van Gogh painting, or a zebra to horse, or summer to winter.



Figure 7: Different translation done by CycleGAN, Image source: Unpaired Image-to-Image Translation using Cycle-Consistent Adversarial Networks

### 3. Generating training samples:

GANs are used for generating new plausible training samples when obtaining or storing real training data is expensive or infeasible, especially in medical training images.

### 4. 3D Object generation:

Generating 3D models from 2D images is one of the well known problems in the Computer Vision field. Jiajun Wu, et al. in their paper Learning a Probabilistic Latent Space of Object Shapes via 3D Generative-Adversarial Modeling tried to generate 3D model of chair, gun, table, and other simple objects from 2D images



Figure 8: High and low resolution 3D model, Image source: Learning a Probabilistic Latent Space of Object Shapes via 3D Generative-Adversarial Modeling

## GAN Playground - give it a shot

GAN Lab: This helps you visualize generators and discriminators.

Link: <https://poloclub.github.io/ganlab/>

GAN Paint: GAN paint enables you to add and remove objects in different scenes.

Link: <http://gandissect.res.ibm.com/ganpaint.html>

## Acknowledgement

I am thankful to my supervisor, Sr. Computer Vision Engineer Santosh Adhikari and colleague, Prashant Ghimire and EKbana AI team for giving me the opportunity to conduct research on GANs. Written by: Anil Kumar Shrestha

<https://www.linkedin.com/in/anilkumarshrestha/>

<https://anikshrestha.com.np/>

## Extra Reading

- <https://arxiv.org/pdf/1710.10196.pdf>
- <https://arxiv.org/pdf/1809.11096.pdf>
- <https://arxiv.org/pdf/1406.2661.pdf>
- <https://arxiv.org/pdf/1411.1784.pdf>
- <https://arxiv.org/pdf/1701.00160.pdf>
- <https://arxiv.org/pdf/1611.07004.pdf>
- <https://jonathan-hui.medium.com/gan-whats-generative-adversarial-networks-and-its-application-f39ed278ef09>
- <https://machinelearningmastery.com/what-are-generative-adversarial-networks-gans/>
- <https://wiki.pathmind.com/generative-adversarial-network-gan>
- <https://junyanz.github.io/CycleGAN/>

# The Immersive Magic of WebXR

**I**n my seventh semester, I got selected for the MLH (Major League Hacking) Fellowship. In the fellowship, individuals get placed into different projects where they work under the guidance of engineers from different companies. I got a chance to work on the Facebook project, and it was where I heard the term WebXR for the first time.

I got to learn a ton of things. Facebook sent me an Oculus Quest 2 that I got to keep and became part of many other wonderful experiences. I could just keep on writing about it, but for now, let's talk about WebXR.



## So, what is WebXR?

In simple words, WebXR brings the AR/VR experience to your browser, eliminating the need for additional hardware or software. It allows you to develop VR and AR experiences on the Web. With immersive experiences being brought to computers and smartphones so smoothly, the opportunities for gaming, entertainment, data visualization, and marketing are endless.

Technically, WebXR is a group of standards that are used together to support rendering 3D scenes to hardware designed for presenting VR and AR worlds.

XR is the new exciting technology. There has been a lot of talk about it, especially after the metaverse announcement. XR, Cross-Reality, or Extended Reality is the umbrella term that covers VR (Virtual Reality - immersive virtual world), AR (Augmented Reality - adding graphics imagery to the real world), and MR (Mixed Reality - both of those). But how much of the NEW technology is it?



Awan Shrestha  
Computer Engineering  
2017 Batch



## A Bit of History Lesson

The present virtual reality technologies are built upon ideas that date back to the 1800s. In 1838, the first stereoscope was invented, using twin mirrors to project a single image. In 1956, the first VR machine was developed, which was more of a movie booth combining 3D, color video, audio, smells, and a vibrating chair. In 1968, the first AR headset was created. Jumping back to today, we can see the adoption of XR technologies across sectors as diverse as manufacturing, education, healthcare, construction, and even law enforcement.

Current virtual reality gear owes a debt of gratitude to the pioneering inventors of the past six decades, those who paved the way for low-cost, high-quality devices that are easily accessible.

Talking about accessibility, WebXR is one of the latest evolutions in the extended reality sector, tapping into the power of the web along with the unification of realities.





## The WebXR Device API

There is a built-in browser API called WebXR Device API, which provides various features to help you develop immersive AR/VR applications, called WebXR Device API. The WebXR Device API implements the core of the WebXR feature set, managing the selection of output devices, rendering the 3D scene to the chosen devices at the appropriate frame rate, and managing motion vectors created using input controllers.

The applications can be experienced through browsers that support WebXR, either standalone or PC-connected VR headsets, AR headsets, and mobile devices with or without headsets. At the most basic level, what WebXR does is find compatible VR/AR output devices and then render the 3D scene at the appropriate frame rate, adjusting to both the eyes of the viewers by computing the exact eye position and presenting the image in a single frame.

WebXR is not a rendering technology and does not provide features for managing 3D data or rendering it to the display. While WebXR manages the timing, scheduling, and various points of view relevant but when drawing the scene, it does not know how to load and manage models; how to render and texture them, and so forth. Fortunately, WebGL and the various WebGL-based frameworks and libraries are available to make it much easier to deal with the above limitations.

## Benefits of doing it on the Web

So, there are already native ways of doing things for the XR development. One may ask about the need to do more for the Web.

WebXR helps with instant deployment to any XR platform with a WebXR-enabled Web browser. Since rendering is handled by WebGL, you gain the benefit of its rich development tool ecosystem and a large, active developer community. No app stores or large downloads are required; users get immediate access to your project experience without needing to leave your website. There are minimal code changes required to support VR and AR together. And while we are talking about code, if you are already familiar with HTML, CSS, and JavaScript, you can get started quickly.

Adding to that, if you are already familiar with 3D graphics and libraries, it is a cherry on top.

If you have already built a 3D JavaScript project in the past, it would just take a few minutes and a couple of lines

of code to get that project VR ready. Sounds unbelievable!



## Getting Started with WebXR

The WebXR device API relies on graphics APIs like WebGL & WebGL2 to work; these graphics libraries and frameworks come with built-in WebXR support.

The official documentation can be found at the W3C WebXR Device API site. The Mozilla WebXR Device API article outlines the current status of the API and details on implementation. Exploring frameworks or libraries such as AFrame, Three.js, ARCore, AR.js, and React-XR would be helpful.

## What if I don't have a VR Headset?

This is where the beauty of WebXR comes in. The extended reality feature now comes to your browser. We can easily develop our projects and view them on our mobile devices using the browser and opening the URL of our project. Most of the major browsers that run on our mobile devices are supported. You could just open up and see the project on your mobile device. Something like Google Cardboard would come in handy, or you might just pick up some cardboard, scissors, and DIY.

WebXR Emulator extension for Chrome and Firefox enables users and developers to run and test WebXR content in desktop browsers without using a real XR device.

## The Challenges

Good XR experiences depend on low latency, high precision, and large amounts of data processed rapidly to render out scenes. The Web also has added specific challenges because traditional methods of communication, such as Web Sockets, are not fast enough. High amounts of data to visualize scenes can push the limits of WebGL rendering as well. But with the advent of 5G and the cloud, the future of XR seems very exciting.

## My Experience with the WebXR

I have built quite a few projects in the past year using WebXR and it has been a worthwhile experience. My favorite project, by far, would be the fellowship project, where I worked on hand inputs using WebXR. We had to work on implementing basic hand interactions such as finger motions, touch, pinch, select, etc. And we got adventurous with it and also built Spiderman's web-shooting feature and the ultimate Thanos's Snap, which eliminates half of the elements inside the current VR world.



It is fascinating to see how your project comes to life. As a child, I used to do a lot of paper crafts. And coming to this day, creativity and a sense of building something is one of the best things I love about software engineering. And the fact that I could be inside my project once I put on my Oculus and pressed that "Enter VR" button was awesome.



## Final Thoughts

The world of virtual reality has just scratched the surface, and the real thing is yet to come. With the use of extended reality in many sectors for many good purposes, it truly seems like we are entering a new era. With the rapid developments in the field, it is amply clear that immersive experiences will be the norm in the future, bridging the gap between the real and digital universe.

What only concerns me is how it is going to change us. Some long time ago, when mobile phones started to emerge, when I got to use them for the first time, I used to think they came as a substitute for telephones. Now you can call from anywhere without wires. Of course, the snake games and space impact were addicting, but the way today's smartphones and the content they provide shallow up the time of humans, which we didn't see coming.

Such small devices, illuminating glasses, could entirely absorb the focus of human eyes (with a visual field or angle of vision of 120 degrees) and minds entirely upon them and detach them from the real world. XR experiences can take one to a new world.

It's not only about what kind of worlds, but also what could or would be. It's about what kind of world would OURS be?





## Message from the alumni



Ashish Pokhrel  
Batch 2017  
Computer Engineering  
Software Engineer at Leapfrog  
Technology Inc.

“

I came to Kathmandu University with the aim to study computer engineering. But turns out it taught me more than I signed up for. I learned about life, love, enjoyment, friendship, failure and success from Kathmandu University. I still recall those night walks from hostel to dhu likhel talking about Tech Stacks, movies, football and more with my friends, those late night chicken parties in KUBH, those chit-chats near the fountain, those assessment deadline days staying up all night just to finish it in time. These four years were nothing but full of new experiences and memories that I will carry for life long.

Looking back to the first semester where I was struggling very hard. It felt like I simply couldn't make it. KU uplifted me to change my methods which I did and the results were astonishing. And then came the second semester project, where I was struggling to put logic into codes. KU taught me `while (result != success) { effort ++; tryAgain() }`. Likewise each semester has upskilled me.

To all my juniors I would love to share that, Like mine each and everyone of you will have your journey. So live it to the fullest. And like Steve Jobs said "Don't let the noise of others' opinions drown out your own inner voice" So hear your internal voice and act accordingly. KU will teach you all in these four years and you will come out as a better version of yourself. The only thing it will demand is dedication and it shall pave a beautiful path for you. So enjoy these moments and have fun.

”



Sumiksha Bhatta  
Batch 2014  
Computer Science

“

Looking back, I would say that my four years at Kathmandu University, moulded me into the person I am now. These are the four years that you will cherish for a lifetime. So, don't be afraid to explore your potential. Seize the moment while it lasts!

”



Kamal Shrestha  
Batch 2016  
Computer Engineering  
Indian Institute of Technology, Hydera-  
bad (IITH)

“ At the very onset, I extend my warm regards and heartiest thanks to my alma mater, the entire KU family.

Kathmandu University, for me, is one of my life's proudest journeys. Reminiscing those four years, many memories could be talked about. Here, I learned to work hard, be more focused and disciplined, aspire to new perspectives, and be responsible. KU is the foundation of my personal life and career, and it is very strong. I could never forget those acoustic nights, those late-night strolls, those project presentation days, and the photoshoot that followed, those deadline rush hours, that unpleasant uphill walk in the mornings, that football on a rainy day, that KU V IOE Match, those FIFA days, those IT MEETs and many many more. Now that I am here, I have realized those were the best days of my life.

I want to take this moment to especially thank Dr. Prakash Poudyal, to whom I owe a great deal to shaping my career and propelling me in the right direction.

For my fellow juniors, remember there is no alternative to hard work, you have to put in the effort if you see yourself successful in the future.

If you have anything to ask, whatever you feel like, please find me at: [shresthakamal.github.io](https://shresthakamal.github.io)

”





**Bibek KC**  
Batch 2015  
Computer Engineering

“ KU has been one of the most amazing journeys of my life. I wanted to be a software engineer, but I was worried about my programming skills. In group projects, I was not the first guy to initiate a project with a git repo. I was exploring photography instead of contributing to group projects.

In 4th year, I started exploring Javascript. After countless hours of sleep, while learning javascript, I learned some basic concepts of JS. Even though I had good knowledge of databases, algorithms, and ML while constantly getting good grades, deep down, I felt like programming wasn't going to work out for me.

Considering my interest in creativity, I was introduced to UI/UX Design during my internship. That was the turning point in my life, I was doing something which aligned with my passion (photography). Even today, I'm happy that I'm in this field.

To all the folks out there, I want you to be patient, work hard, do some research about what you want to be in your life and most of all, believe in yourself. Computer science/engineering is a direction toward a broad industry. I believe you'll find something in the industry that suits you.

”



**Mala Deep Upadhaya**  
Batch 2016  
Computer Science

“ KU is a self-explanatory brand that defines the turned stone, ready to conquer the world. My takeaways from KU were possibilities, opinions, and accolades. The faculty prioritizing research and staff providing family-like guidance influenced my career and aspirations. The Massachusetts Institute of Technology- Global Startup Lab (MIT GSL), which I could join because through KU, was one of the opportunities that changed how I see the world.

The message I wish to impart to prospective undergraduates is that there will always be something for you to learn. If you decide to focus your efforts on just one area of the field, you should also be aware that you will need to address other issues. KU will present the opportunities you need to seize; utilize them!

Focus on research at all times, and your academic and professional careers will be much better.

”

## Photo gallery



DoCSE faculty | Dhulikhel



DoCSE faculty (AI) | Panchkhal





Computer Engineering | Batch of 2018



Computer Science | Batch of 2018





Computer Engineering | Batch of 2019



Computer Science | Batch of 2019





Computer Engineering | Batch of 2020



Computer Science | Batch of 2020





Computer Engineering | Batch of 2021



Computer Science | Batch of 2021





Artificial Intelligence | Batch of 2021



KUCC Board | 2021-2022



IT Express Team | 2022



IT Meet Team | 2022





Redefining the possibilities from 0s to 1s



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