

XSI TIMES

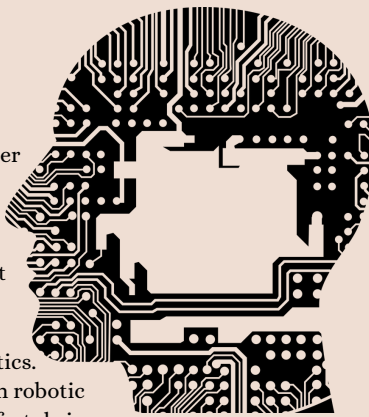
NEWSLETTER

The Department of Science brings to you the second edition of XSI-Times, a newsletter which explores the various dimensions in which modern science and technology are developing. The theme of the newsletter is 'Entrusting Humanoids with Humanity'. Considering the recent innovations in the field of robotics, as well as the to numerous humanoid robots being designed all over the world, we decided to adopt a theme which clarifies a lot of confusion, misinformation and preconceptions that people have regarding humanoids, artificial intelligence, and robotics. You will learn about the recent advancements made in robotic technology. You will realize how our contemporary lifestyle is affecting us, and our environment, and how we can improve upon it. You will, of course, get to understand some of the complex ideas behind humanoids and their applications.

The purpose of this newsletter is to provide a platform for the students and teachers of the Department to exhibit their literary skills and innovative ideas. I want to express my sincere gratitude to all those who have contributed to make this effort a success. I would like to profusely thank the college management for their ceaseless support and encouragement in this venture. I am very grateful to Dr. Aparna Dixit, Head, Department of Science, for providing this opportunity to all of us, and for helping with the formulation of this newsletter. I would like to thank Rituman Sharma for the assistance he provided with editing and compilation. A special thanks to Jahnvi Yadav, Ishita Tiwari and Lakshyaraj Singh for turning this newsletter into a colourful piece of art. Last but not the least, I would like to acknowledge the Department students for the erudite articles they have contributed for this newsletter.

We truly hope that the pages which follow will make for interesting reading!

— Dushyant Pareek (XSI Coordinator, Student Editor-in-Chief)



This second edition of 'XSI-Times', the Science newsletter of St. Xavier's College, Jaipur, witnesses to the fact that scientific temper and authentic research are not alien to the Department of Science. In a concrete and creative way, the ideas are scribbled on papers. During this joyful and learning journey, while shouldering various roles from literary masters to graphic designers, the editorial team and club members travelled far and wide in imagination and actualization. 'XSI' - the Xavier's Science Club is dedicated to increasing the curiosity for learning, higher appreciation for actualizing one's potential, a critical worldview of perceived realities of life, and creating space for diverse ideas and practices.



Dr Aparna Dixit (Head of Department- Science, Editor-in-Chief)

XSI Club (Xavier's Scientific Eye Club)

The purpose of XSI is to promote interest, understanding, and knowledge of the scientific world throughout the college and local community. The area of emphasis shall include any subject under the umbrella of the mother subject science, and much more. The club shall seek to foster honest scepticism that is necessary for lifelong learning.

The purpose is to develop your interest in science, to introduce you to a variety of scientific disciplines and to develop skills in fieldwork, research and project presentations. Members help each other as they develop their projects. Peer review is extremely useful. This enables students to carry out self directed activities in areas of interest in science and opportunities for students to develop initiatives and creativities.

The major highlights of the year would be as follow:

- Certificate and Value Added Courses.
- Organizing seminars, workshops, symposiums, International Conference, student exchange programs, and educational visits to important science-based companies.
- Broaden the Information Technology of the members.

Rector's Message

Newsletters of an academic institute rightfully provide an insight into the essence of education imparted and form part of the valued possessions that are passed on from one batch to another in the form of well-researched articles and informative write-up. I am proud to see the second edition of the science newsletter 'XSI-Times 2022' is so meticulously put together by our students and the teachers. This endeavour has given literary wings to our young scientists to showcase their creativity. I appreciate the efforts of the teachers and the young thinktanks who have put their heart and soul into the publication, making it an extremely interesting and intellectual outcome. Continue the excellent work Xavierites.

Rev. Fr. Dr. S Aroky Swamy SJ



Principal's Message

St Xavier's College - Jaipur has grown leaps and bounds from its inception and is continually evolving to impart quality learning that helps in the all-round development of our students. I feel humbled to be a mentor to such a progressive and dynamic edifice of learning. Our College is committed to maintaining academic excellence and professional competence with human values by encouraging our enterprising students in multiple ways. It gives me immense pleasure to pen a few words for our in-house Science Newsletter XSI-Times'22 which is meant to promote the latent writing skills, communicative competence, and overall personality development of our students. I congratulate the studious Editorial Board and all the wonderful contributors for bringing out this issue. Let us give our best and make Xavier's a great temple of learning through our diligence, devotion, and dedication. Let me wish you all the best!

Rev. Fr. Dr. A Rex Angelo SJ



Vice Principal's Message

I have great pleasure in conveying my best wishes to all of you, as the second edition of Science Newsletter of the college is ready to treat the readers with content and knowledge. We all know that the science is progressing with the speed of light in this century. To keep pace with its developments, we need to walk the talk every moment. In this field the Science Department of our college is progressing and spreading its wings towards the horizon smoothly. I would like to congratulate each one of the students and faculty who has come up with such a well-compiled publication. This is a tribute to its standard of excellence in academics and commitment to quality education wish you all the best for achieving greater success and scaling newer heights in your education and career ahead.

Rev. Fr. Dr. Raymond Cherubin SJ



H

umanoids friends or foes?

Humanity has always been fascinated with creating machines which emulate us in shape and behaviour. From the Greek 'automata', written about by various ancient philosophers more than 2000 years ago, to Sophia, who became the first robot to receive citizenship of a country, we have progressed by leaps and bounds in the creation of humanoids. However, this rapid development has also intensified the speculations that someday humanoids may end up conquering humanity.

First, we must understand what the term 'humanoid' truly means. Essentially, a humanoid is a robot which resembles the human body in shape. 'Androids' are humanoid robots which are identical to the human body in every way. Humanoids are very useful in several scientific areas. Initially, of course, attempting to simulate the human body leads to a better understanding of it. Humanoids can be used in development and testing of complex prosthetics. Humanoids can serve in rescue forces as they are sturdier and stronger than humans. For the same reasons, they can also be used for industrial purposes. Humanoids can also be used for educational, personal assistance, nursing, aviation, agricultural, transportation, and military purposes. They can even be used for space exploration.

But the question still remains: Will humanoids take over humanity, or will they be our friends and take us to unforeseen horizons? Something worth noting here is that, according to researchers, it would be impossible for humanoids to harm humanity in any way. This is because currently, humanoids lack emotions; and scientists have not yet found any means (or reason) to allow humanoids to gain emotions. It may seem that the humanoids' absence of emotions validates the concerns that they may try to suppress humans, after all, if they cannot feel compassion or empathy, why would they hesitate in enslaving us? But actually, this apathy implies a lack of ambition or animosity towards humans, which means humanoids would not care either way about humans, and so, would not be capable of (or interested in) harming us deliberately.

As for whether they can be our friends, like so many things in nature, it depends. We will have to be patient and try to develop humanoids in a direction which is beneficial to all of humanity. Using humanoids selfishly, for the gain of a few individuals, will certainly lead to creation of such machines which are capable of destroying or enslaving all of us. In the end, it comes to whether we use humanoids (and all other technology, for that matter) altruistically or not. Clearly, the future of humanity is in our own hands — as it has always been — and a conscientious and responsible attitude in the development of humanoids will only lead to a magnificent era of prosperity and well-being for all of us.

— Dushyant Pareek (B. Sc. III)

For decades, humans have been trying to create artificial organisms. We built machines which look like humans, we created softwares which are more intelligent than humans, yet this is the first time we have produced a completely biological machine, from scratch, called xenobots. Basically, xenobots are microbiological self-powered tiny robots around a millimeter wide that can move toward a target, perhaps pick up a payload and heal themselves after being damaged.

The word Xenobot is derived from two words – xeno and bot; where 'xeno' comes from 'xenopus laevis', the scientific name of the African clawed frog and 'bot' comes from robots. Xenobots are neither traditional robots nor any known species of animal. They are an entirely new class of animals, a living but programmable organism. These bots are prepared out of synthetic materials and therefore, have no brain or digestive system inside them. They are considered robots because they are designed to behave in particular ways.

Xenobots are made out of stem cells harvested from the embryo of the African clawed frog (which is why Xenobots are named after them) and a sophisticated computer algorithm. This algorithm generates a blueprint that allows the scientists to build a new form of life.

Two types of stem cells are used to build Xenobots - skin cells and heart cells. Skin cells bond together to form the passive C-shaped structure of Xenobots and heart cells control contraction and relaxation, with the goal of manufacturing a tiny engine that propels the Xenobot.

XENOBOTS

LIVING ROBOTS THAT CAN REPRODUCE

After observing natural dynamics between skin and heart cells, the data is fed into an evolutionary algorithm which runs on super computers. Based on the provided data, the algorithm creates millions of different cell configurations. Out of these millions of configurations, only the fittest configurations advance to the next stage, where designs are converted into digital models. After hundreds of tests, only a few best configurations are selected and built into actual living organisms.

These biobots can propel themselves, moving in straight lines or circles. If scaled up, Xenobots can be used for regenerative medicine like repairing organs, growing body parts for transplants, inserted into the blood stream, programmed to clear plaques from clogged arteries, or even detect cancers. Xenobots help in gathering plastic pollution in oceans and searching for radioactive contamination.

Presently, Xenobots are still basic and restricted in their reproduction abilities. These bots are not easy to create as it requires hours of microsurgery to create just one bot. But, as technology develops, we may soon be using Xenobots for treatment of diverse diseases and ailments. In fact, soon we may see living biological humanoids which are identical to humans in every way.

— Jeevant Adania (B. Sc. II)



Did you know?

Woolly mammoths may seem ancient, but some of them were still alive when the Great Pyramid at Giza was built.

Ameca

• The world's most advanced human shaped robot •

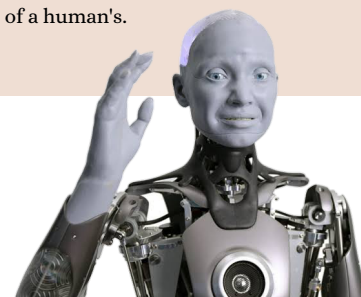
Robotic Technology is counted amongst some of the most incredible creations of mankind so far, which has not only eased the lifestyle, but also marked its traces forever in the history of humanity.

Ameca is one such robot which has played havoc in robotics technology. It is the world's most advanced humanoid robot, formulated while keeping in mind to deliver a platform for human-robot commerce. This extraordinarily realistic humanoid robot is designed and developed by Engineered Arts. Its artificial 'body' — an assortment of artificial intelligence with machine learning — outputs a forum which can be used to test and evolve robots by other associations through cloud computing.

The genialness of Ameca reflects the possibility of human relations in any metaverse or digital environment, and the user can access its data from anywhere in the world. Apart from governing the general tasks, this multi-functioning robot can show some fundamental human behavior such as smiling, blinking, staring, gasping, and scratching.

Ameca stands as a conjunction between the contemporary robotic technology and the humanoids which we expect for the future — a robot which is capable of actions at par with those of a human's.

— Jahnvi Yadav (B. Sc. III)



News Piece

Capsule Endoscopy

• A robotic pill for virtual examination •

Listening to the word 'robot', an image of human-resembling, complexly-programmed machinery strikes the mind. But can you ever imagine a robot passing through our gastrointestinal tract and letting us know our gut health without visiting the doctor?

Recently, this robotic technology was demonstrated at Jitex Global 2022 held in Dubai for the very first time. It is prepared by a silicon valley based company named Endia TX. The company claims that this pill sized robot can be prescribed by doctors to those who suffer from gastrointestinal issues and can be administered to people to have an endoscopy-like test from the comfort of their homes. The doctor can view abdominal movements over a virtual call and prescribe the required treatment.

This robotic pill looks and is ingested like a usual vitamin-sized capsule. It is a drug made of polycarbonate, consisting of a camera which has its own light source and takes pictures of the alimentary canal, showing it to the doctor connected over a virtual call. The medicine passes through the body naturally.

This technology could be an alternative to the usual endoscopic procedure which requires sedation and also eliminates the risk of bleeding and discomfort with fewer complications. The drug has been sent to the US Food & Drug Administration for approval.

Artificial Intelligence has left no stone unturned, even creating petty microrobotic pills which are competing with the traditional ways of healthcare. Witnessing this scenario, humanoids can be foreseen humongously contributing to medical sciences.

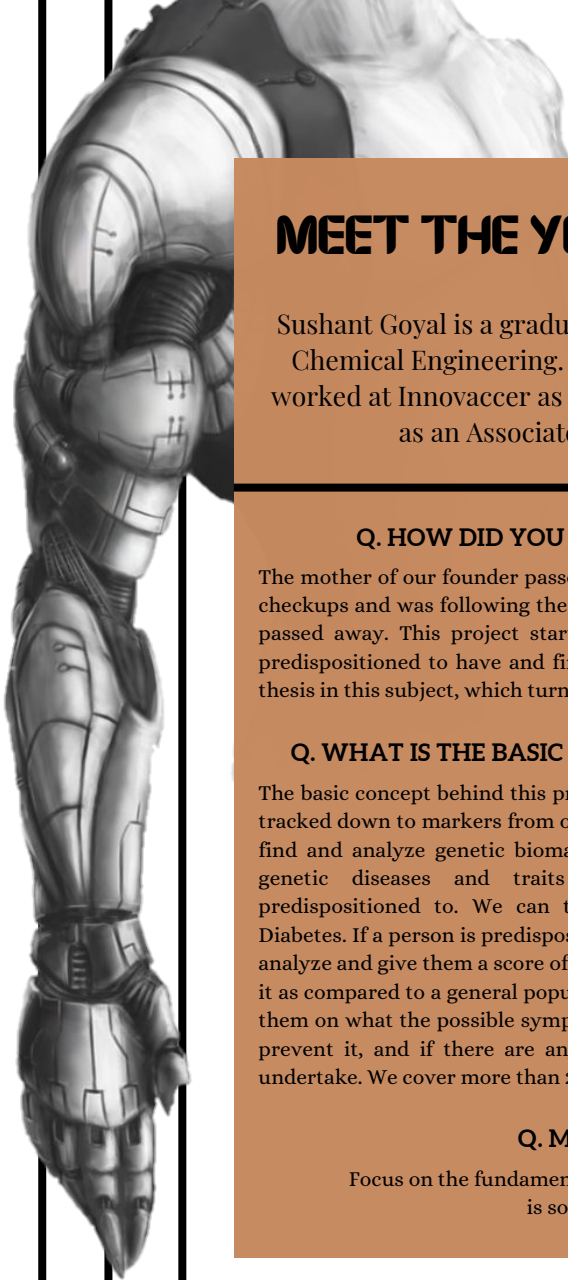
— Rituman Sharma (B. Sc. II)

Did you know?



• About 50-80% of earth's oxygen comes from oceans, much more than trees. Marine organisms like seaweed, algae and planktons produce most of this oxygen.

• If the entire history of Earth is compressed in a single day, then every single second will be equal to more than 52000 years and humans would appear about 1 minute and 17 seconds before midnight.



MEET THE YOUNG RESEARCHER!

Sushant Goyal is a graduate from BITS Goa with a degree in Chemical Engineering. Before starting PreGenics, he had worked at Innovaccer as a Product Manager, and at Goodera as an Associate in the Founder's Office.



Q. HOW DID YOU COME UP WITH THE IDEA FOR THIS PROJECT?

The mother of our founder passed away in 2019 due to a brain aneurysm. She used to have monthly checkups and was following the right wellness plan, as suggested by her metabolic markers, yet she passed away. This project started in order to check in advance the diseases and traits we are predisposed to have and find a way to prevent it. So, the founder went on to do his master's thesis in this subject, which turned into what is now 'PreGenics'.

Q. WHAT IS THE BASIC CONCEPT BEHIND IT?

The basic concept behind this project is that our health can be tracked down to markers from our daily lives and genetics. We find and analyze genetic biomarkers of an individual to find genetic diseases and traits the individual could be predisposed to. We can take the example of Type 2 Diabetes. If a person is predisposed to developing T2D, we analyze and give them a score of how likely they are to develop it as compared to a general population. We will also then guide them on what the possible symptoms are, what they can do to prevent it, and if there are any medical tests they need to undertake. We cover more than 200 such diseases and traits.

Q. WHAT IS YOUR TAKE ON RELEVANCE OF SCIENCE IN TODAY'S SCENARIO?

If we take any problem that is ailing society today, it can and will be solved by science. Be it in the field of environment, education, or healthcare, it is going to be the new age technologies that will get scaled and bring about a relevant and positive change in the world.

Q. MESSAGE FOR YOUNG RESEARCHERS

Focus on the fundamentals, everything else will follow. Strengthening of core subjects is something that is lacking in the current world.

THE ROBOTIC ARM

FOR HUMANS, BY HUMANS

While prosthetic legs were running in the Olympics, arms were being left behind.

The landscape of prosthetic offerings today is quite a spectrum. It includes a very simple passive device, which looks like a hand, but does not have any type of movement or function beyond aesthetics or cosmetics. Another one is body-powered using a classic hook-and-claw system, allowing the user to shrug a shoulder and move their body just enough to be able to close and open their fist. The next class is quite a wide one, employing myoelectrics, which is a more robotic field. Beyond that, it approaches the research level which incorporates brain-controlled devices that universities and research labs are developing.

The biggest concern that people have regarding prosthetic is their cost. Prosthetics can be rather expensive, especially ones which operate on robotic technology. Presently, the use of 3D-printed materials helps keep costs down. But in the beginning, the 3D-printing landscape looked a lot different than it does today. It has come a long way from the most simple 3D-printers made out of laser-cut wood which used a very simple plastic which was not durable enough. Then, the world started looking into what was happening in the landscape of 3D-printing. The California-based company HP created an incredible machine that prints in full colour using a very strong nylon material. Innovations in 3D-printing meant a stronger material which hopefully translates to much more resilient devices.

Another problem faced in using prosthetics is the lack of the sense of touch. The way prosthetics work now, people can shortcut around a lack of touch by seeing whether stuff is being gripped by the robotic fingers, but this process (called eyeballing) is less helpful when the object is slippery, moving, or just out of sight. In everyday life, we don't necessarily rely on vision for a lot of the things. When we are interacting with objects, we often use our sense of touch. The human brain is bidirectional: it takes information in while also sending signals out to the rest of the body, telling it to act. Even a motion that seems as straightforward as grabbing a cup calls on our brain to both command our hand muscles and listen to the nerves in our fingers.

Researchers believe that a paralyzed person's brain could both stimulate a robotic arm and be stimulated by electrical signals from it, ultimately interpreting that stimulation as the feeling of being touched on their own hand. Many scientists are working to make the life of paralyzed people easier. The world is constantly doing research and data collection that helps influence the future of the product. With the help of the rapidly-developing technology we have, the time when prosthetics are available to everyone may not be far off.

— Vanshika Sharma (B. Sc. I)

HUMANOIDS HUMANOIDS HUMANOIDS

The next step in space technology

We have all heard of Curiosity, one of the Mars rovers, the robot that treads the fourth planet in our solar system. There are many robots like the rovers in space, belonging to different countries. In fact, most satellites are considered robots by space organisations because of their versatility.

However, there are limitations to using robots for space exploration as well. They are not as manoeuvrable as humans, nor do they possess human qualities and thinking power, which is the major reason for why advancement in space research has come to a screeching halt.

This begs the question: Why don't we send humans for missions like this? The answer to that question is very simple, yet very down-reaching. The human body is rather fragile, reactive and sensitive compared to the metal body of a robot. It can only withstand so much trauma and abuse. We can send robots to space without having to worry about their safety. Unfortunately, the same cannot be said about humans.

The best and simplest solution to this problem are humanoids. Humanoids have physical attributes of a robot but are much smarter in terms of calculations, have better decision-making ability, and are quite manoeuvrable. They are, essentially, the perfect tool for further space research. They don't need food or water, and have a lifespan far more than that of a human. The most remarkable part about humanoids is that if one dies, its consciousness can be transferred into a newer body, hence forming a never-ending stream of information and knowledge.

There is a functioning humanoid presently in NASA, known as the robonaut. It is used to help astronauts during space walks. We have come a long way indeed since the launching of Vostok 1. But this is just the beginning, as very soon, NASA is planning to send its current robonaut, R2, to walk on the moon. Now that would be one small step for humanoid, but a giant leap for mankind.

— Kushagra Upadhyay (B. Sc. II)

EMOTIONAL AI

As artificial intelligence learns to interpret and respond to human emotions, leaders should consider how it could change their industries and play a critical role in their firms

We can expect that this accuracy will increase with more advancement in technology. What we considered to be science fiction theories 50 years ago have now come true. There is always scope of improvement in science.

Companies have historically used focus groups and surveys to understand how people felt. Now, emotional AI technology can help businesses capture the emotional reactions of both employees and consumers in real time — by decoding facial expressions, analyzing voice patterns, monitoring eye movements, and measuring neurological immersion levels. Companies like Boston-based startup Cogito are giving businesses the tools to help their employees interact better with customers. Its algorithms can not only identify fatigue in customer service agents, but also guide agents on how to respond to callers via an app. An upset customer might, for example, call to complain about a product. Recording and analyzing the conversation, the app would then suggest the agent to slow down or prompt them about when to display empathy. This level of advanced technology is available today. It is only one example among many others.

However, emotion AI also faces some challenges in interpreting emotions. The biggest challenge is the humongous diversity in cultures and traditions in our world. Different cultures have different facial expression for different emotions. For example, while smiling is common in German culture in both casual and formal way, the Japanese culture is not so open, so smiling is not very abundant there. Therefore, if a German AI software tries to depict a smile to a Japanese tourist, the interpretation is likely to be wrong. Hence, we need a diverse team to create softwares for different cultures — which is not an easy task with so many cultures, religions and languages present in this world.

The best way to combat this problem is to use the personal data of each person on the planet and create a database which records the numerous gestures and social cues and their interpretations. After all, when it comes to personalized data of a person, which can be stored easily by their mobile phone, laptop or any other personal gadget, this cultural barrier breaks down. As the digital lifestyle of each person develops, as people start spending more time in the various metaverses, this solution certainly becomes simpler. In a few years, AI will certainly be able to detect and interpret the emotions of people all over the globe with ease.

Emotion AI, also known as Affective Computing or Artificial Emotional Intelligence, is a branch of Artificial Intelligence where machines study non-verbal cues of humans like body language, facial expressions, gestures, and tonality of voice to detect their emotional state.

Nielsen study has shown the accuracy of neuroscience technologies such as facial coding, biometrics, and electroencephalography (EEG) found when used alone have accuracy levels at 9%, 27% and 62% respectively. When combined they have accuracy levels shot up to 77%. Testing results with a survey brought this up to 84%

— Lakshyaraj Singh (B. Sc. II)

THE NEXT
STEP IN
HUMAN
EVOLUTION

AI

“A computer would deserve to be called intelligent if it could deceive a human into believing that it was human.” Alan Turing, the father of modern computer science, said these words long ago, which perfectly depict the times we live in, a time where we call our gadgets smart. But what does ‘smartness’ metaphorize here?

It's the artificial intelligence that we are referring to when we call our gadgets 'smart'. Artificial intelligence (or AI) is a branch of computer science associated with building machines which can 'think' like humans to carry out tasks that distinctively employ human intelligence. AI is an umbrella term for devices capable of perception, learning, problem-solving, planning, reasoning, and identifying patterns.

Outside the realms of computer science and software development, the concept of AI is familiar to most people as a science fiction trope often mentioned with threatening or apocalyptic implications. However, AI no longer belongs to a fictitious future. It is already part of our world and is poised to have a rapidly growing impact on our daily life.

Artificial Intelligence concerns every field in the present era, from genetically engineering microorganisms to exploring this ever-expanding cosmos. While the field has existed since the 1950's, the emergence of big data and recent advances in machine learning techniques, paired with advances in key-enabling technology (such as robotics and sensing) have fuelled an explosion of interest in AI and its real world applications. Some examples include virtual assistance, cyber security, automated online customer support, banking fraud detection, online transactions, social media interactions, automated vehicles, and a lot more. AI has already helped us navigate natural disasters, reduce poaching, map rugged terrains, and use global positioning systems (GPS).

It makes a worm of skepticism crawl into human minds as they witness AI subsumed in every field and its future aspects; but there can be no replacement for human creativity, consciousness, discernment, and volition, which give us an edge over these humdrum machines and encourage us to employ our intellects to artful and ingenious aspects of life.

— Ishita Tiwari (B. Sc. II) & Rituman Sharma (B. Sc. II)



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