

PAPERGAPER

Bio-Inspired Technology

PaperGaper, Pahal'20 wants to create and encourage bio-inspired solutions for the benefit of different disciplines prominent in the world including Robotics, Architecture and Material Science. As a medium to target the problems of these areas by one of the brightest minds of the world, PaperGaper serves the society as a whole.

Bio-inspiration is an approach to innovation that seeks sustainable solutions to human challenges by emulating nature's time-tested patterns and strategies. The goal is to create products, processes, and policies that are well-adapted to life on earth over the long haul.

The core idea is that nature has already solved many of the problems we are grappling with. Animals, plants, and microbes are the consummate engineers. After billions of years of research and development, failures are fossils, and what surrounds us is the secret to survival.

Sectors in focus-

1. Robotics
2. Architecture
3. Material Science

Robotics

Modern robotic technologies have enabled robots to operate in a variety of unstructured and dynamically-changing environments, in addition to traditional structured environments. Robots have, thus, become an important element in our everyday lives. One key approach to develop such intelligent and autonomous robots is to draw inspiration from biological systems. Biological structure, mechanisms, and underlying principles have the potential to feed new ideas to support the improvement of conventional robotic designs and control. Such biological principles usually originate from animal or even plant models for robots, which can sense, think, walk, swim, crawl, jump or even fly. Thus, it is believed that these bio-inspired methods are becoming increasingly important in the face of complex applications. Bio-inspired robotics is leading to the study of innovative structures and computing with sensory-motor coordination and learning to achieve intelligence, flexibility, stability, and adaptation for emergent robotic applications, such as manipulation, learning, and control.

Spot Mini from Boston Dynamics

Of course, when discussing bio-robotics, Boston Dynamics will always come up in the conversation as one of the leaders of bio-robot design. Makers of possibly some of the best-known bio-robots like the Wildcat and Atlas, one of their latest inventions may have a future place in your home and office. The Spot Mini is a small four-legged robot that weighs 30 kilograms (including a robotic arm) and is completely electric, having a power range of 90 minutes on a single charge. The robot can pick up and handle objects using its 5 degrees of freedom arm and is equipped with a sensor suite that includes stereo cameras, depth cameras, an inertial measurement unit, and position/force sensors in the limbs. The robot is small and quiet enough to be used in your office and home and has the ability to run autonomous tasks.



Architecture

The Lotus House in Delhi is a marvel of architecture based on the shape of, well, a lotus. That is mainly for looks, but there are multiple examples of buildings that are bioinspired and have multiple useful traits apart from just looks. For example, the Eastgate Centre in Harare, Zimbabwe, is a typical example of green architecture. The country's largest office and shopping complex is an architectural marvel in its use of biomimicry principles. The building has no conventional air-conditioning or heating, yet stays regulated year round with dramatically less energy consumption using design methods inspired by the self-cooling mounds of African termites! The Eastgate Centre uses less than 10% of the energy of a conventional building its size. These efficiencies translate directly to the bottom line: Eastgate's owners have saved \$3.5 million alone because of an air-conditioning system that did not have to be implemented.

Outside of being eco-efficient and better for the environment, these savings also trickle down to the tenants whose rents are 20 percent lower than those of occupants in the surrounding buildings.

NOTE: For more details, visit: <https://inhabitat.com/building-modelled-on-termites-eastgate-centre-in-zimbabwe/>

Material Science

Biological systems have clearly shown that large numbers of molecules, structures, and systems in living organisms possess attractive materials properties that are beyond the reach of current nonbiological synthetic approaches. Many of these molecules, structures, systems, and natural fabrication processes could serve as the basis for synthetic materials with enhanced properties. The challenge of using living organisms as a model for materials for future defense needs lies in identifying defense applications and then understanding and manipulating the biological systems to solve them. However, the integration of biology and materials science is hampered by discipline-driven education and the historical separation of biology and materials science in academic, industrial, and military laboratories.

Materials derived from biology, for example, biological molecules as the active element in sensors, and materials inspired by biology—for example, layered, hierarchical, abalone shell-like composites as the lightweight, tough armor.

RULES AND GUIDELINES

I. Eligibility

1. Only students of authorized institutions are allowed as participants.
2. Participation can either be individual or as a team.
3. A team is allowed to have a maximum of 4 members with atleast one female member.
4. Multiple teams from the same institution are allowed.
5. Teams comprising of members from different institutions are allowed.

II. Registration

All participants have to register on the official website: www.technex.in ->PAHAL->PaperGaper->Register.

IV. Event Structure

1. Each team has to select one of the above- mentioned fields (Robotics/ Architecture/ Material Science)
2. There will be 3 rounds as follows-
 - A) *Paper Submission*: Each team is supposed to prepare a paper in the format given below and send it to events@technex.in, with the subject "Teamname_papergaper" Selected teams will be notified through email.
 - B) *Peer review*: All the teams will be divided into 2 groups(I and II) and into subgroups(a and b). Each team in a subgroup will present their paper (ppt) and the corresponding subgroup will peer-review them on the basis of the criteria mentioned below.
 - C) *Final Round*: Top teams will be selected from Round b and will compete in the final round where they will be presenting their paper against a panel of esteemed judges

Time	Presenting Subgroup	Peer Review Subgroup
Day 1 Slot 1	I(a)	I(b)
Day 1 Slot 2	I(b)	I(a)
Day 1 Slot 3	II(a)	II(b)
Day 1 Slot 4	II(b)	II(a)
Day 2	Top 12	Judges

Note: Presence of every team of the peer group is mandatory in their respective time slot! Failing to this will lead to disqualification.

V. Paper format-

- The paper must be submitted in a pdf format.
- Font- Arial, Font Size- 11
- The paper should contain the following sections in the given order:
 1. Title
 2. Team Name, Team ID
 3. Every team is required to find and select a bio-inspired innovation(only in the respective field they have selected) and propose an in-depth analysis including-
 - i. Describe the innovation in brief.
 - ii. Why did you select this innovation and how is the innovation selected by you is better than the others in your field? Compare your innovation with others in the field listing pros and cons.
 - iii. How and which problem is bio-inspiration solving in the innovation selected by you?
 4. Apart from this, every team is expected to propose a bio-inspired solution to an existing problem in the field selected by you.
 - i. Describe the problem you are going to solve.
 - ii. Describe the solution proposed by you.
 - iii. Can this problem be solved without bio-inspiration? If so, how?

VI. Peer review judging criteria-

Each team sitting as the audience will be rating the performance of the presenting team. Rating will be a combination of presenting skills, analysis of selected technology and the proposed solution.

For example- In Day 1, Slot 1, each team in I(a) will be presenting one by one and will be rated by each team of subgroup I(b) (Presence of at least one member of all the teams of I(b) in this case will be mandatory).

VII. Terms and Conditions -

1. The decision of the judges shall be final and binding. All participants have to abide by the decision of the judges. No interim or later communication about the decision or its veracity shall be entertained and shall be viewed seriously.
2. Violation of any rules may result in disqualification of the team.
3. Technex holds all the right to change the dates for the submission and the participants will be informed about the same through email.

ALL THE BEST!