



**UNIVERSITY DEPARTMENTS OF ANNA UNIVERSITY**  
**DEPARTMENT OF PRODUCTION TECHNOLOGY**  
**Madras Institute of Technology Campus**  
**Chennai-600044**



# BIONOHACK-2023

## Problem statement:

- Design and development of a 6-DOF Five fingered motorized Bionic hand for trans radial amputation with the necessary motors, power module, control circuits, sensors and proper wire routings to perform the following gripping operations  
❖ Pinch ❖ Power ❖ Tripod ❖ Lateral
- Design and implement a compact PCB module with required power, controls and sensors circuits.

## Design/Prototype Criteria:

- Fingers in Bionic hand should be individually controllable using EMG.
- Bionic hand should be able to lift up to 2 kg weight.
- Bionic hand should have Mechanically articulated joints with 6 Degrees of freedom (DOF) and above.
- Maximum weight of the Bionic hand should not exceed 750 g.
- Motors, boards, batteries, connectors, and connecting wires should full; be enclosed within the hand.
- Bionic hand should be designed to hold prismatic objects.



## Contact us

✉Email: [bionohack@gmail.com](mailto:bionohack@gmail.com)

☎Phone No: 8056075768

8681892379

- *INNOVATION NEVER ENDS*

## Instructions:

- Students pursuing B.Tech./B.E./M.Tech./M.E. in any branches of Engineering.
- Maximum 10 Students per team.
- At least 30% Girl students in a team is mandatory.
- A team of students representing a college should be from multidisciplinary departments.
- Proficiency in 3D Modelling/Simulation software, PCB designing software and hardware development is essential.

## Prizes & Awards:

- First Prize: **Rs.30,000/- per team**
- Second Prize: **Rs.15,000/- per team**
- Participation certificate will be issued for all registered teams.

## Registration Fee:

Registration fee per team: **Rs.10,000/-**

## Account Details for Fee Payment:

- A/C Name: **The Association of Production Engineers**
- A/C No: **490759182**
- Bank Name: **Indian Bank, Chromepet**
- IFSC code: **IDIB000C028**

**Venue: TANII, 3<sup>rd</sup> floor IOT Building, MIT Campus**

## Important Dates:

### Round 1: (No registration fee)

- Program Start date : **01.11.2023**
- Last Date of Idea Submission : **30.11.2023**
- Announcement of shortlisted teams: **05.12.2023**

### Round 2: (Registration fee applicable)

- Last Date of Registration : **15.12.2023**
- Date of Final Prototype Display : **26.01.2024 & 27.01.2024**

## Organizing Committee

### Chief Patron

**Dr. R. VELRAJ**  
Vice Chancellor  
Anna University

### Patron

**Dr. J. PRAKASH**  
Registrar i/c  
Anna University

### Co- Patron

**Dr. J. PRAKASH**  
Dean,  
MIT Campus,  
Anna University

### Convener

**Dr. A. SIDDHARTHAN**  
Professor and Head, Dept. of Production  
Technology, MIT Campus,  
Anna University

### Coordinators

**Dr. P. GANESH**  
Associate Professor  
Dept. of Production Technology,  
MIT Campus, Anna University

**Dr. E. PAVITHRA**  
Assistant Professor  
Dept. of Production Technology,  
MIT Campus, Anna University

## Schedule

### Day 1 (26.01.2024): Review & Clarification as per norms

- Problem discussion and ideas brainstorming
- Participant ideas and solutions discussion with the committee and doubt Clarifications
- Minor modification & correction in the developed prototype
- Testing of operations

### Day 2 (27.01.2024): Final Prototype Demonstration & Presentation to Experts

## Benefits

Top 2 teams will have an exclusive opportunity to undergo **INTERNSHIP** at reputed industries that offer a valuable hands-on experience and a chance to contribute to cutting-edge developments in the field of bionic hands for disabled communities/ training at reputed Industries.



## **BIONOHACK-2023**

### **RULES AND REGULATIONS**

#### **FIRST ANNOUNCEMENT**

Welcome to **BIONOHACK**, where innovation takes centre stage in a mission to develop a bionic hand for disabled communities. **BIONOHACK** has a strong tradition of nurturing talent through various avenues, be it scholarships, internships, or online courses. And now, we are excited to present a challenge that exemplifies our commitment to fostering innovation.

This hackathon is an opportunity for budding engineers to showcase their willingness to push the boundaries of technological advancement. We're looking for individuals who are unafraid of taking risks and explore innovative solutions to address the real-world needs of the disabled communities.

This hackathon will empower participants to step into the shoes of an entrepreneur, encouraging them to design technologies that enhance efficiency and productivity in the workplace, particularly focusing on the development of bionic hands for the disabled persons.

Besides accolades by cash prizes and certificates, the winners of this hackathon will be offered the valuable opportunity to secure internships at reputed industry, equipping them with practical skills and experiences that will pave the way for their future careers.

We extend our warm invitation to you to join us in shaping a technological revolution in business management and making a meaningful impact on the lives of disabled individuals through the development of bionic hands. Let's innovate and create a brighter future together!

#### **Eligibility:**

- Students pursuing B.Tech./B.E./M.Tech./M.E. in any branches of engineering.
- Maximum 10 Students per team.
- At least 30% Girl students in a team is mandatory.
- A team of students representing a college should be from multidisciplinary departments.
- Proficiency in 3D Modelling/Simulation software, PCB designing software and hardware development is essential.

#### **Problem Statement:**

- Design and development of a 6-DOF Five fingered motorized Bionic hand for trans radial amputation with the necessary motors, power module, control circuits, sensors and proper wire routings for the following gripping operations
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  - \* Power
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- Design and implement a compact PCB module with required power, controls and sensors circuits

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## **HACKATHON TIMELINE**

### **Round 1 (No Registration Fee)**

Program start Date : 01.11 2023

Submission of Idea : 30.11. 2023

Announcement of Shortlisted Teams : 05.12.2023

### **Round 2 (Registration Fee Applicable)**

Last date of Registration : 15.12.2023

Date of Final Prototype Display : 26.01.2024 & 27.01.2024

Registration Fee : Rs.10,000- per team

## **CASH PRIZE:**

First Prize : Rs.30,000/- Per team

Second Prize : Rs.15,000/- Per team

Participation certificate will be issued for all registered teams.

## **INTERNSHIPS:**

In addition to the exciting rewards, the top 2 teams will have an exclusive opportunity to secure an internship at reputed industries. These internships offer valuable hands-on experience and a chance to contribute to cutting-edge developments in the field of bionic hands for disabled communities / training at reputed Industries.

## **RULES:**

1. **Team Formation:** Team should only be formed with individuals who have officially registered for the hackathon. Ensure that all team members meet the eligibility criteria, as ideas from ineligible teams will be disqualified.
2. **Team Building:** Team size can be with maximum of 10 students (At least 30% girls students in a team is Mandatory and the Team should be interdisciplinary from the same institute)
3. **Prototype Submission:** Submit the 3D CAD Model comprising of finger mechanism, motors, Link, electronics circuits, design calculations and any relevant documents to "bionohack@gmail.com". It's important to note that prototype submission is not necessary for Round 1.
4. **Submission Deadline:** The final date for submitting your work for 1<sup>st</sup> round is 30<sup>th</sup> November 2023. Be sure to assemble your teams and submit your ideas before this deadline.
5. **Originality Requirement:** This hackathon encourages participants to develop unique and innovative ideas. Plagiarism will result in disqualification.
6. **Intellectual Property (IP) Rights:** By default, the intellectual property rights for the products created during the competition remain with the respective candidates. However, **BIONOHACK** reserves the right to use any of the products developed during or for the competition.
7. **Consent for Communication:** By granting permission for the sharing of your information with **BIONOHACK**, you consent to receiving information from **BIONOHACK** and its partners via phone and email.

## FAQs

1. Is there a registration fee to participate in the BIONOHACK?  
There is no registration fee for Round 1 participation. Shortlisted teams of Round 1 have to register with Rs.10,000/- per team for Round 2.
2. What qualifications do I need to participate in this hackathon?  
Under graduate students and Post Graduate students of Engineering colleges currently in roll, passionate about contributing to the development of bionic hands for disabled communities is encouraged to participate.
3. How do I submit my project for the hackathon?  
To submit your project, you'll need to upload your work to [bionohack@gmail.com](mailto:bionohack@gmail.com), along with any required documentation or files. Detailed instructions for submission will be provided closer to the submission deadline.
4. Is it necessary to have a fully functional bionic hand prototype?  
While a fully functional prototype is not mandatory for Round 1, your submission should demonstrate a working concept or a significant part of the bionic hand project during Round 2.
5. Are there specific modelling software requirements for project development?  
There are no restrictions on cad modelling software (preferably Solid work/Pro E). You're free to choose the tools and technologies that best suit your project.
6. Do I need to be online for the entire duration of the hackathon?  
No, you do not need to be online for the entire duration of the hackathon. You can work on your project offline and submit it within the specified time period.
7. Should I provide a live demo of my project?  
Live demo is mandatory during Round 2 for showcasing your project's functionality. If you are selected from Round 1, you will be invited to present your project at Round 2.
8. Is it acceptable to submit a prototype without a fully developed product?  
Yes, it is acceptable to submit a prototype without a fully developed product. You can focus on demonstrating the core functionality and concepts of your bionic hand project.
9. Who will own the intellectual property rights for the projects created during the hackathon?  
Participants will retain ownership of the intellectual property rights for their projects. However, it's important to note that the projects may need to be open source for evaluation by the judges and **BIONOHACK** reserves the right to use any of the products developed during or for the competition.

If you have additional questions or need further clarification, please feel free to contact our support team for assistance.

Dr S.MuthuKumaran (8056075768)

Mr P.Vignesh (8681892379)

## **EVALUATION PARAMETER**

### **Evaluation Parameters for Idea Submission:**

#### **1. Concept:**

- **Understanding of the Problem:** Assess the depth of comprehension regarding the challenges being addressed for disabled individuals in need of a bionic hand.
- **Background Research:** Evaluate the extent of research on existing techniques and solutions in the field, demonstrating a solid knowledge base.

#### **2. Creativity:**

1. **Novelty and Innovativeness:** Measure the level of originality and innovation in the proposed idea, highlighting unique aspects that set it apart.
2. **Maturity of Technology:** Assess the readiness and maturity of the technology employed in the idea, considering its potential for practical application.

#### **3. Impact:**

- **Practical Usability Potential:** Analyse the potential for real-world usability, focusing on how the idea addresses practical needs and challenges faced by the target user group.
- **Viability on a Global Scale:** Evaluate the idea's potential to make a global impact, addressing diverse needs and contexts.

#### **4. Implementation:**

- **Feasibility and Scalability:** Examine the practical feasibility of implementing the idea within given resources and constraints, while also considering its scalability for broader adoption.
- **Complexity and Constraints:** Assess the complexity of the proposed solution and how it navigates various constraints, including technical, economic, and social factors.
- These parameters will guide the evaluation process to identify innovative and impactful ideas for the development of bionic hands that can truly make a positive difference in the lives of disabled individuals.

## **Prototype Evaluation Parameters:**

1. **Functionality:** Assess the core functionality of the bionic hand prototype. Does it serve its intended purpose effectively and reliably?
2. **Innovation:** Evaluate the uniqueness and originality of the prototype. Does it introduce novel solutions or concepts to the field of assistive technology?
3. **User-Centric Design:** Consider how well the prototype caters to the needs and preferences of disabled users. Is the design user-friendly and accessible?
4. **Durability:** Assess the robustness and durability of the prototype. Is it built to withstand daily usage and potential wear and tear?
5. **Cost-Efficiency:** Analyze the cost-effectiveness of the prototype's design and materials. Is it feasible for a wide range of users, considering affordability and scalability?
6. **Adaptability:** Evaluate how adaptable the bionic hand prototype is to different scenarios and users with varying needs.
7. **Safety:** Ensure that the prototype prioritizes user safety and minimizes potential risks or hazards.
8. **Integration:** Consider how easily the prototype can be integrated into existing assistive technology systems or workflows.
9. **Aesthetics:** Assess the overall design and aesthetics of the prototype. Does it offer a pleasing and non-stigmatizing appearance for users?
10. **Demonstrated Impact:** Examine the potential real-world impact of the prototype on the lives of disabled individuals. Does it address specific challenges and needs effectively?
11. These evaluation parameters can help judges and organizers fairly assess the prototypes developed during the hackathon, ensuring that the winning solutions make a meaningful difference in the lives of disabled communities.

## **Here are some key parameters to consider during the development process:**

### **1. Control System:**

**EMG Sensors:** Evaluate the effectiveness of the electromyography (EMG) sensors used to detect muscle signals for controlling the myoelectric hand.

**Accuracy:** Assess the accuracy and responsiveness of the control system in interpreting muscle signals and translating them into precise hand movements.

### **2. Prosthesis Design:**

**User Comfort:** Consider the comfort and ergonomic design of the myoelectric hand to ensure it can be worn comfortably throughout the day.

**Appearance:** Evaluate the aesthetics and appearance of the prosthesis to reduce stigma and boost user confidence.

### **3. Durability and Reliability:**

**Material Durability:** Assess the durability of the prosthesis materials to withstand everyday use and potential wear and tear.

**Robustness:** Ensure the prosthesis can withstand various environmental conditions and accidental impacts.

### **4. Customization:**

**Individual Fit:** The ability to customize the myoelectric hand for each user's unique needs and physical characteristics.



Adjustability: Consider the ease of adjusting the prosthesis to accommodate changes in the user's needs or preferences.

## **5. Functionality:**

Grip Patterns: Evaluate the range and adaptability of grip patterns to perform various tasks and activities.

**Sensory Feedback:** Consider the integration of sensory feedback systems to provide users with information about grip force and object manipulation.

## **6. Battery Life:**

Power Efficiency: Assess the efficiency of the power management system to maximize battery life, ensuring a longer time between charges.

## **7. User Training and Support:**

Training Programs: Provide effective training programs and resources for users to adapt to and make the most of the myoelectric hand.

**Customer Support:** Evaluate the quality and availability of customer support to address user questions, concerns, and technical issues.

## **8. Affordability and Accessibility:**

Cost: Consider the cost-effectiveness of the myoelectric hand to ensure it is accessible to a broad range of users.

Insurance Coverage: Evaluate options for insurance coverage and reimbursement to ease the financial burden on users.

## **9. Regulatory Compliance:**

Compliance with Standards: Ensure the prosthesis complies with relevant industry and safety standards, and navigate the regulatory landscape for medical devices.

## **10. User Feedback and Usability Testing:**

Continuously gather feedback from disabled users and conduct usability testing to refine the design and functionality of the myoelectric hand.

## **11. Interoperability:**

Consider the integration of the myoelectric hand with other assistive devices or technologies that users may rely on.

## **12. Ethical and Social Considerations:**

Evaluate the ethical implications of the technology, considering issues related to consent, privacy, and the social impact on users.

## **13. Data Security:**

Address data security concerns related to the storage and transmission of user-related data from the myoelectric hand.

By carefully addressing these parameters, developers can create a myoelectric hand that is not only functional and effective but also meets the unique needs of the disabled community. Additionally, involving disabled users throughout the design and testing phases can provide valuable insights and ensure the prosthesis aligns with their preferences and requirements.