NEELARNAB DUTTA

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Profile:

Accomplished designer and innovator with a profound academic background in Design, and Engineering, complemented by 15 years of dynamic industrial design expertise. Recognized for receiving prestigious fellowships, grants, and awards, including the Prime Ministers' Research Fellowship and Bio-design Fellowship, driving groundbreaking advancements in medical device innovation. Exceptional proficiency in diverse domains—Product design, Interaction design, Biodesign, and more—bolstered by a robust portfolio of patented technologies. Adept at leading projects, mentoring, and fostering innovation while contributing significantly to academia through teaching engagements and impactful publications.

Achievements:

- Received **Prime Ministers' Research Fellowship (PMRF)** In 2020 for 4 years of Ph.D. Research
- Received **Bio-design i-Fellowship** in 2016, 2-year training, fostering med tech innovators, supported by Indian Govt., in partnership with top global universities.
- Received **BIRAC-Biotechnology Ignition Grant (BIG)** in 2019 as a Principal Investigator for the project titled "*A frugal multi-therapeutic wound care solution for resource constraint healthcare settings*".
- Received **BIRAC-Industry Innovation Programme on Medical Electronics (IIPME) Grant** In 2018 as a Principal Investigator for the project titled "*Combined Negative Pressure and Oxygenation Therapy for Accelerated Healing of Chronic Wounds*".
- Received **BIRAC-TIE Winer Award** 2018 for Innovating a multitherapeutic wound healing device.
- Received **Pfizer Entrepreneurship Award** 2018.
- **International Design Award (IDA)** 2008 winner for computer graphics character design
- Runner up at **Humanity online photo-realistic character design contest** 2008
- **All India Rank 7** In *Common Entrance Examination for Design* (CEED) 2007

Publications:

1. **Investigating Usability of Conversational User Interfaces for Interactive Artificial Intelligence System: A Medical Device Perspective**
   Authors: Neelarnab Dutta and Debayan Dhar
   Journal: *International Journal of Human-Computer Interaction,* Taylor and Francis (Q1, IF=4.7)
   DOI:10.1080/10447318.2023.2298534

2. **Investigating Medical Technology Innovation in Low- and Middle-Income Countries: Factors, Impact, and Model Proposal**
   Authors: Neelarnab Dutta and Debayan Dhar
   Journal: *She Ji: The Journal of Design, Economics, and Innovation*, Elsevier (Q1, IF=2).
   DOI: Not received yet, article recently accepted for publication

3. **From Industrial Design to Healthcare Innovation—A Comparative Study on the Role of User-Centered Design and Stanford Biodesign Process**
   Authors: Neelarnab Dutta and Debayan Dhar
   Book: Design for Tomorrow—Volume 3 (pp. 665--677). Springer
   DOI: 10.1007/978-981-16-0084-5_55

Patents (7 out of 9 granted):

- **Invention: A Wound Dressing for Combined Negative Pressure and Fluid Delivery System (Granted)**
  Inventors: Neelarnab Dutta, Dr.Shivani Gupta, Roshan Gurung, Dr.Taihei Fujii,
  Applicant: Department of Biotechnology, Government of India
  (1) US Patent no: 11596555, Date of Grant: 07.03.2023
  (2) Japanese Patent No: 7134991, Date of Grant: 02.09.2022
  (3) Indian Patent No: 349754, Date of Grant: 21.10.2020

- **Invention 2: Apparatus and Method for Screening of Gynecological Conditions of a Subject Body (Granted)**
  Inventors: Neelarnab Dutta, Debayan Dhar, Applicant**:** IIT Guwahati
  (4) Indian Patent No: 457400, Date of Grant: 09.10.2023

- **Invention 3: Multipurpose Geometric Instrument (Granted)**
  Inventors: Neelarnab Dutta, Mohit Arora, **Applicant**: Tata Elxsi Bangalore
  (5) Indian Patent No: 367094, Date of Grant: 20/05/2021

- **Invention 4: Screening and Diagnostic Apparatus and Method Thereof (Granted)**
  Inventors: Neelarnab Dutta, **Applicant:** Neelarnab Dutta
  (6) Indian Patent No: 488107, Date of Grant: 22/12/2023

- **Invention 5: A Wearable Medicine Carrier and Delivery System (Granted)**
  Inventors: Neelarnab Dutta, **Applicant:** Neelarnab Dutta
  (7) Indian Patent No: 504526, Date of Grant: 29/01/2024

- **Invention 6: Multitherapeutic Wound Healing and Diagnostic Device and Method Thereof (Published)**
  Inventors: Neelarnab Dutta, Debayan Dhar, **Applicant:** IIT Guwahati
  (8) Application no: IN202131004757, Date of publication: 05/08/2022

- **Invention 7: Portable Endoscope (Published)**
  Inventors: Neelarnab Dutta, Dr.Shivani Gupta, Roshan Gurung, Dr.Taihei Fujii,
  Applicant: Department of Biotechnology, Government of India
  (9) International Application no: PCT/IN2017/050559, Date of publication: 07.06.2018

Funded Projects:

- **Project Title**: "*A frugal multi-therapeutic wound care solution for resource constraint healthcare settings*".
  Funding Source: Received **BIRAC-Biotechnology Ignition (BIG) Grant** in 2019 as a Principal Investigator for developing the medical technology.

- Project Title "*Combined Negative Pressure and Oxygenation Therapy for Accelerated Healing of Chronic Wounds*".
  Funding Source: Received **BIRAC-Industry Innovation Programme on Medical Electronics (IIPME) Grant** In 2018 as a Principal Investigator for developing the medical technology.

Expertise:

Product Design, Biodesign, Interaction Design, Intelligent Product Design, Speech User Interface and Chatbot Design, Electronic Product Design, Design Methods, Design Thinking Process, User Study and Contextual Inquiry, Product Functional and Engineering Design, Design for Additive Manufacturing, Usability Evaluation and Engineering, Computer-Aided Design, Materials and Processes, Design for Manufacturing, Rapid Prototyping, Design Research Methods, Innovation Management, Intellectual Property Management.

Skills:

Design processes and methods:	User-centered design, Design thinking process, Biodesign process, Need analysis and design specification development, Functional decomposition, FAST and FLOW method, Product architecture design, UX architecture and design, Quality function deployment, Ideation techniques like brainstorming, TRIZ, Scamper, Trigger word techniques Morphology chart, Concept development and visualization, Design evaluation using weighted index method, Pugs Matrix etc.
Design Research:	Contextual inquiry, data collection via interviews, surveys, user shadowing etc., User study analysis using Empathy mapping, user journey mapping, Persona creation, Flow model, sequence model, journey mapping, cultural model, physical model etc., Task analysis, A/B testing and experiment, Cognitive walkthrough, Think allowed protocol, Data analysis via thematic coding, affinity mapping. Statistical analysis like mean, median, mode, standard deviation, hypothesis testing etc.
3D CAD/CAM:	Solid Works, Alias Design Studio, Key Shot, Flat CAM, Mesh Lab, Slicer, Cura.
2D CAD/manual skills:	Photoshop, Illustrator, Hand sketching, Marker rendering
3D Animation:	Maya, 3D Max, Zbrush, After effects, Premier Pro
Operating System:	Windows, Linux, Real time Operating System
Documentation:	MS Excel, MS Word, MS PowerPoint, Prezi
Prototyping and workshop Skills:	FDM 3D-Printing, SLA 3D-Printing, CNC Milling, Lathe machine operation, Drilling, Buffing, Cutting, Arc welding, Material handling and fabrication, Painting and surface finishing, Low-fidelity prototyping, PCB manufacturing, Product engineering detailing and manufacturing
Programming Languages:	C, Embedded C, Python, Assembly Language, Anaconda, NumPy, Pandas, Scikit Learn, Rasa
Embedded System:	Arm Cortex MCU, Programmable System on Chip, STM32 MCU. Arduino, Raspberry Pi, Keil MDK-ARM, Eclipse, EAGLE CAD, KiCAD, FreeRTOS, Tracelyzer
PCB CAD Tools:	Eagle CAD, KiCAD

Educational Qualifications:

Class X (2001)
Maths, Science, English, Hindi, Social science - 78.4 %
Kendriya Vidyalaya Namrup, CBSE

Class XII (2003)
Maths, Physics, Chemistry, Biology, English - 81.2 %
Kendriya Vidyalaya Namrup, CBSE

Bachelor of Technology (2003 – 2007)
Electronics and Communication - CGPA: 3.75/5 (75%)
North Eastern Regional Institute of Science and Technology, Itanagar (NERIST)

Master of Design (2007 – 2009)
Product Design and Engineering - CGPA: 5.6/8 (70%)
Indian Institute of Science Bangalore (IISc. Bangalore)

Master of Technology (2018 – 2020)
Data Science and Engineering - CGPA: 7.42/10 (74.2%)
Birla Institute of Technology Pilani (BITS Pilani)

Doctor of Philosophy (2020 – 2024)
Topic: Design approaches for medical technology innovation and implementation in low-and middle-income countries (LMICs)
Design - CGPA: 9.75/10 (97.5 %)
Indian Institute of Technology Guwahati (IIT Guwahati)

Professional and Educational Fellowships:

Biodesign i-Fellowship (2016 – 2017)
Medical Device Innovation and Entrepreneurship
School of International Biodesign at All India Institute of Medical Science (AIIMS), New Delhi

- Received 2-year international training on the Biodesign process and hands-on experience in designing two Medical technologies at AIIMS New Delhi. The program was supported by India's Department of Biotechnology, in collaboration with global universities like Stanford (USA), Tottori (Japan), and QUT (Australia).

Prime Ministers Research Fellowship (2020-2023)
During PhD research
Indian Institute of Technology Guwahati (IIT Guwahati)

- Received 4-year research fellowship during my Ph.D. for developing Low- and Middle-income countries (LMICs) specific design approaches for successful medical technology innovation. The fellowship aims to enhance research quality in higher educational institutions by offering attractive fellowships to top talents via rigorous selection and national review processes.

Professional Experiences:

Prime Minister's Research Fellow (Sept 2020- Dec 2023)
Department of Design, IIT Guwahati

- Took classes at nearby Design schools like Royal global university, Guwahati, Don Bosco University, Guwahati, NPTEL live classes.
- Conducted Biodesign Workshop at IIT Guwahati and Design thinking workshop at Tripura University

Founder & Director (Jun 2019 - till date)
Abhedya Innovations, Jorhat, India

- Developing medical technologies for early screening of cervical cancer, throat cancer, and breast cancer in collaboration with faculty from Safdarjung Medical College and Hospital. Currently embarking on the entrepreneurial journey through bootstrapping.

Co-Founder & Director (Jan 2017 – Aug 2019)
Inochi Care, New Delhi, India

- Developed medical technologies aimed at expediting the healing process of chronic wounds such as diabetic foot ulcers, pressure sores, and infected wounds. Engaged in all design stages, including conceptualization, system-level design, embodiment design, interaction design, UI design, alongside engineering design, and detailed product planning for manufacturing and regulatory compliance.
- Contributed to the engineering development of various medical devices, encompassing mechatronics system development, interface development, system software, and functional development.
- One of the technologies has already undergone a clinical efficacy trial at JPNA Trauma Center, AIIMS New Delhi.

Biodesign i-Fellow (Jan 2016 - Dec 2017)
All India Institute of Medical Sciences, New Delhi, India

- Received training in India, Japan, and Australia on medical technology innovation and entrepreneurship. This included understanding healthcare needs through extensive clinical immersion in various tiers of public and private healthcare facilities, training in the Stanford Biodesign innovation process, comprehension of the multifaceted aspects of healthcare innovation, and fostering an entrepreneurial mindset to realize these solutions.
- Acquired expertise in the complete lifecycle management of medical device design, encompassing identification of unmet medical needs, development of innovative clinical solutions, navigation of intellectual property management, understanding of clinical trial and regulatory processes, comprehension of market dynamics, and ultimately, bringing these innovative medical technologies to market.
- Patented and developed two technologies to address unmet clinical needs in the areas of wound healing and throat cancer for commercial implementation

Lead Product Designer (Nov 2011 - Dec 2015)
Tata Elxsi, Bangalore, India

- Acted as a designer responsible for managing a wide array of client projects encompassing FMCG design, product design, innovation, and space design.
- Additionally, contributed to automotive styling and transportation design projects, including the Tata Winger facelift project and a high-speed train design project for Bombardier.
- Led an Innovation Lab dedicated to crafting patented products and driving diverse innovative projects. This involved identifying unmet needs through user-centric research and market studies, followed by product conceptualization and proof of concept development using engineering solutions.
- Served as an Electronics Designer, offering support to the design house through embedded design and the development of hardware and firmware.

Contributed to the creation of marketing content and product demonstration reels utilizing computer graphics animations

Product designer – Consultant (Jul 2011 - Nov 2011)
VAKL Corporation, Masan, South Korea

- Worked in a startup environment to design and develop the company's first patentable product: a Customizable Multi-language Docking Keyboard for tablet PCs. Activities involved industrial design and interface design of an innovative keyboard capable of docking smart

tablets such as iPads and Samsung tabs. The Multi-Language Keyboard, designed by me, was exhibited by VAKL Corporation at the Hong Kong International Electronic Show in 2012.

Member of Engineering staff (Sep 2009 - Sep 2011)
Electronics and Telecommunication Research Institute, Daejeon, South Korea

- Responsible for user research, user experience (UX) design, and conceptual design of software tools and technologies related to computer graphics, animation, and mixed reality game design.
- Synthesized interaction design requirements based on user research data analysis and conceptualized computer vision technology-based solutions using wireframe designs and low-fidelity paper prototypes.
- Played the role of a CG Generalist in creating demo reels for in-house software tools and products. Involved in the computer graphics animation pipeline from initial concept design to final production.

Teaching Experiences:

Packaging Design (Jan 2021- Jun 2021)
Royal School of Design, Royal Global University (RGU), Guwahati

- Taken physical classes and taught “Packaging design” course to students of B.Des (Communication Design) at Royal School of Design of RGU.

Usability Engineering (Jan 2022 -April 2022)
National Programme on Technology Enhanced Learning (NPTEL)

- Taken two NPTEL course sessions for the Usability Engineering course instructed by Dr. Debayan Dhar at IIT Guwahati.

Mechanical Workshop (Jan 2022-May 2022)
Assam Don Bosco University, Guwahati

- Train students to operate Lathe Machine, Milling Machine, Vertical drill Machine, and work with different materials.

Packaging Design (March 2022-July 2022)
Royal School of Design, Royal Global University (RGU), Guwahati

- Taken physical classes and taught “Packaging design” course to students of B.Des (Communication Design) at Royal School of Design of RGU.

Functional and Conceptual Design (July 2022 - Oct 2022)
National Programme on Technology Enhanced Learning (NPTEL)

- Taken all online, 12 week long, weekly live lecture sessions and interacted with students for problem-solving and clarifying doubts

Usability Engineering (Feb 2023 - April 2023)
National Programme on Technology Enhanced Learning (NPTEL)

- Taken all online, 12 week long, weekly live lecture sessions and interacted with students for problem-solving and clarifying doubts

Functional and Conceptual Design (July 2023 - Oct 2023)
National Programme on Technology Enhanced Learning (NPTEL)

- Taken all online, 12 week long, weekly live lecture sessions and interacted with students for problem-solving and clarifying doubts

Workshops Conducted:

Medical Device Innovation Process (18th-19th March 2023, 22nd -23rd April 2023)
Department of Design, IIT Guwahati

- Taught design students about the Biodesign process, which involves innovating medical devices, and discussed considerations for low- and middle-income populations in medical device design.

Design Thinking Process (10th Oct 2023 - 12th Oct 2023)
Tripura University, Tripura

- Taught engineering students about the design thinking process and how the engineering design approach can be viewed from a needs-driven perspective.

Professional Certifications Courses:

Mechatronics Masterclass (2013)
By Kevin C. Craig, Marquette University

7 Day professional course undergone as a part of Tata Elxsi's employee development initiatives

IP Nucleus Advanced (2014)
By Global Institute of Intellectual Property, New Delhi

12-month professional course on IP management

Human-Computer Interaction (2014) By Scott Klemmer, University of California, San Diego	Online Coursera course
Machine Learning (2014) By Andrew Ng, Stanford University	Online Coursera course
Developing Innovative Ideas for New Companies: The First Step in Entrepreneurship (2014) By Dr. James V. Green, Maryland Technology Enterprise Institute, University of Maryland	Online Coursera course. Certificates Issued Oct 2014. Credential ID KZ9NZFGCVE
Innovation for Entrepreneurs: From Idea to Marketplace (2015) By Dr. Thomas J. Mierzwa, University of Maryland, College Park	Online Coursera course. Certificates Issued Mar 2015. Credential ID ABK8G4XK9Q
Introduction to Clinical Neurology (2015) By Daniel Lowenstein, School of Medicine, University of California, San Francisco	Online Coursera course. Certificates Issued Mar 2015. Credential ID ABK8G4XK9Q
Rural Health Nursing (2015) By Amy J. Levi, College of Nursing, University of New Mexico	Online Coursera course. Certificates Issued Apr 2015. Credential ID DVJNZQBCDP
New Venture Finance: Start-up Funding for Entrepreneurs (2015) By Michael R. Pratt, University of Maryland, College Park	Online Coursera course. Certificates Issued May 2015. Credential ID BQWKUYY55E

Professional Design Projects:

1. **MULTIPURPOSE GEOMETRIC TOOL (2012)**
   Organization: Tata Elxsi, Bangalore
   Role: Conceptual development, detailed design and prototyping
   - The invention here consolidates multiple traditional stationary geometric instruments (such as compasses, protractors, dividers, set squares, rulers, and writing instruments) into a single, versatile tool. By integrating the functionalities of these separate instruments, this invention offers a comprehensive solution for performing various geometric operations. Its design aims to enhance efficiency while ensuring portability, providing users with a convenient and compact alternative to carrying multiple individual tools.
   - The technology was patented and received a **patent grant on 20/05/2021**

2. **SACHET DISPENSER (2012)**

Organization: Tata Elxsi, Bangalore

Role: Conceptual design, embodiment design, engineering design and prototyping

- The product was a portable Sachet Dispenser designed for the retail market, intended to efficiently store, manage, and dispense strings of sachets of various sizes containing contents in all three states of matter. The electronic sachet dispenser was designed and developed to take user input on sachet type and number, automatically dispensing the correct number of sachets. Three versions of functional prototypes were developed.

3. VOICE OPERATED REMOTE CONTROL (2013)

Organization: Tata Elxsi, Bangalore

Role: Interaction design, embodiment design, engineering design and prototyping

- The project aimed to address an unmet need: simplifying user interaction while watching television by eliminating the complex button layouts commonly found in traditional TV remotes. To meet this challenge, a voice-operated remote control was developed, leveraging voice recognition technology to respond to user commands for channel navigation and other functions.
- TATA ELXSI showcased this groundbreaking concept at the Consumer Electronics Show in 2014, presenting the technology to industry experts, tech enthusiasts, and consumers, highlighting its potential to revolutionize TV remote controls and improve user convenience in television viewing.

4. INTERACTIVE WATER DISPENSER (2013)

Organization: Tata Elxsi, Bangalore

Role: Interaction design, embodiment design, engineering design and prototyping

- The project revolved around interaction design, specifically aimed at developing an inventive office water dispenser that served a dual purpose as a stress-relief solution for employees. This unique dispenser incorporated built-in mini-water games that activated whenever an individual desired water. Users could interact with the device through an exclusive touch interface designed for control and engagement.
- Moreover, the system was equipped with visual effects that provided information on various aspects such as the water temperature (hot or cold), the flow of water, and the alignment of the glass, ensuring a user-friendly experience and enhancing the functionality of the dispenser beyond its primary purpose of dispensing water.

5. WEARABLE HEALTH MONITORING BAND (2014)

Organization: Tata Elxsi, Bangalore

Role: Interaction design, Wearable electronic design, embedded system design and prototyping

- The project involved the creation of a health-monitoring wristband aimed at tracking multiple vital metrics for users. This device was engineered to monitor essential health parameters such as temperature, heart rate, movement, fall, ambient light, and UV exposure.

- It was developed entirely from scratch, encompassing the complete process from designing the printed circuit board (PCB) to crafting the hardware components and developing the software.

6. EHS WEARABLE DEVICE (2015)

Organization: Tata Elxsi, Bangalore

Role: Interaction design, Industrial design, IOT system design and prototyping

- The project entailed the creation of a wearable device specifically tailored for Tata Steel, with a focus on monitoring the health status of crane operators operating in perilous, high-altitude workplaces. This initiative was a component of the startup accelerator program named the Group Technology Office (GTO), which was under the leadership of the former Chairman of TATA Sons, Late Cyrus Mistry.
- The device underwent pilot production in 2018 and is currently commercially available for sale on the Tata Communications website.

7. MULTITHERAPEUTIC WOUND HEALING DEVICE (2017)

Organization: Inochi Care, New Delhi

Role: Product design, engineering development, prototyping and clinical validation

- The invention is a multifaceted therapeutic device designed specifically to facilitate the healing process of chronic wounds. It offers support for various treatment modalities like Negative Pressure Wound Therapy (NPWT), oxygenation, irrigation, and antibiotic therapy through the utilization of an innovative dressing system.
- This device underwent rigorous clinical trials at AIIMS New Delhi, where its effectiveness and capabilities were thoroughly assessed. The trials demonstrated its efficacy in treating chronic wounds afflicted with ischemic conditions as well as infections.
- A novel wound dressing to facilitate the therapies from the device was patented and received a **patent grant on 21/10/2020**

8. PORTABLE ENDOSCOPE (2018)

Organization: Inochi Care, New Delhi

Role: Product design, engineering development, prototyping

- The invention is a cost-effective and portable endoscope purposely designed for healthcare environments with limited resources. Its primary focus is the early detection of oral and throat cancer. What sets this device apart is its emphasis on single-hand operation, allowing clinicians to operate it with just one hand while leaving the other hand free for patient support or concurrent tasks.
- Additionally, the device is engineered to conduct all image analysis directly on a smartphone, eliminating the need for additional specialized equipment and simplifying the diagnostic process.

9. MODULAR CANCER SCREENING PLATFORM (2019)

Organization: Abhedya Innovations, Jorhat

Role: Product design, visual computation, engineering development, prototyping

- The invention was a versatile cancer screening platform developed specifically for the early detection of cervical, oral, and breast cancer. This innovative platform combines cutting-edge imaging technologies like narrow-band imaging and infrared imaging to detect potential signs of cancer in affected tissues.
- Beyond detection, this device goes a step further by aiding in assistive biopsy procedures. It achieves this by incorporating supplementary attachments and offering a user-friendly interface, streamlining the process for clinicians.
- The technology was patented and received a **patent grant on 22/12/2023**

10. CONVERSATIONAL AI-INTEGRATED WOUND HEALING DEVICE (2022)

Organization: Indian Institute of Technology Guwahati

Role: Interaction design, Speech user interface design, engineering development and prototyping

- The study involved integrating an offline AI bot for semi-autonomous healthcare delivery, specifically tailored for resource-limited settings. Two prototypes of Conversational AI (CUI) embedded Negative Pressure Wound Therapy (NPWT) devices were developed to facilitate AI assistance in the clinical process of wound therapy.
- The system and the Conversational User Interface were tested with over 40 users in the clinical process of wound therapy to identify usability and interaction issues. Subsequently, a set of 16 new heuristics for evaluating CUIs was proposed as a research outcome. The study was published in *the International Journal of Human-Computer Interaction* by Taylor and Francis.

References:

1. **Dr Debayan Dhar**
   Associate Professor, Department of Design, Indian Institute of Technology Guwahati, India
   Contact: +919545230066, Email: debayan@iitg.ac.in

2. **Dr Pratul Chandra Kalita**
   Professor, Department of Design, Indian Institute of Technology Guwahati, India
   Contact: +919864305145, Email: pratulkalita@iitg.ac.in

3. **Mohit Arora**
   Head of Design, Head of the Industrial Design team at Jio Platform Limited, Reliance India
   Contact: +919953781158, Email: mohit1.arora@ril.com