

Education

- **Bachelors of Technology - Indian Institute of Technology Guwahati** [7.52 CPI]
 - Major Degree - Mechanical Engineering
 - Machine Design
 - Computer-Aided Design and Manufacturing
 - Additive Manufacturing
 - Robotics and Robot Applications
 - Control Systems
 - Minor Degree - Electronics and Communication
 - Signal Processing
 - Communications
 - Analog and Digital Circuits
 - Electives
 - Biomedical Devices and Systems
 - Neural Imaging and Signal Processing

Key Courses Indicated
 - **Higher Secondary (Class XII) - TSBIE** [96.4 %]
 - **High School (Class X) - CBSE** [10 CGPA]
-

Publications

- **A Portable Mechanical Ventilator for Respiratory Emergencies**
Patent Application No. 202031045726
[REGISTERED PROVISIONALLY] [CGPDTM]
Design of a rapid manufacturable ventilator with dynamically variable linkage parameters for simple mechanical and online adjustment of breathing cycle variables
- **Rapid Manufacturing of Biomedical Devices - Process, Alternatives and Selection (S. Jhunhunwala, S. Kapil)**
Chapter in: Advanced Micro- and Nano-manufacturing Technologies
[PUBLISHED, LISTING IN PROGRESS] [Springer]
A comprehensive review of rapid manufacturing in biomedical design, prototyping and production - elaborating upon process classification, biomedical requirements, allied technologies for hybrid methods, process selection and planning, advantages and constraints. Tabulated summary of process types, specific technologies and their vendors, compatible materials, applications and build characteristics.

- BPNN based design of Sit to Stand Exoskeleton at Seat-off Position for Paraplegic Children (J. Narayan, S. Jhunjunwala, M. Gupta, S.K. Dwivedy)**
Conference: ICCAR 2020 Singapore
 [PUBLISHED] [IEEE]
 Design and modelling of a sit-to-stand exoskeleton for paraplegic children with provision for adjustable height. Simplified mathematical formulations to find foot and knee joint torques at seat-off position during sit-to-stand motion. Two backpropagation neural network models (BPNN-I and BPNN-II) designed to predict centre of mass distances and joint torques in case of knee and foot. It is observed that both neural network models show potential conformity of predicted outputs as compared to simulations.
 - 3DP During COVID 19 (J. Narayan, S. Jhunjunwala, S.K. Dwivedy)**
Chapter in: Emerging Applications of 3D Printing During CoVID 19 Pandemic
 [PUBLISHED] [Springer]
 Following the spread of the pandemic and the subsequent breakdown of supply chains, 3D printed alternatives of medical devices were accessible through community-sourced design and fabrication. With such high volume usage of additive methods - associated challenges in design, manufacturing, and deployment of such medical products was brought to critical attention. This work evaluates such challenges by examining instances and their solutions, and discusses product issues arising from the shift in production methodology from conventional to additive.
 - A Comparative Performance Analysis of Backpropagation Training Optimizers to Estimate Clinical Gait Mechanics (J. Narayan, S. Jhunjunwala, S. Mishra, S.K. Dwivedy)**
Chapter in Predictive Modelling in Biomedical Data Mining and Analysis (Elsevier)
 [ACCEPTED, IN PRODUCTION] [Elsevier]
 An existing open-access database of 50 healthy subjects is utilized to predict the kinematics and kinetics using a multi-layered backpropagation neural network (BPNN). A comparative analysis of three optimization algorithms, i.e. , Levenberg-Marquardt (LM), resilient propagation (RP), and gradient descent with momentum (GDM) shows potential of LM-BPNN over other models for estimating gait mechanics. Estimation is carried out for a male subject (30 years) to show the effectiveness of BPNN models.
 - AutoInject - Design and Modelling of Novel Mechanized Injection Platform (S. Jhunjunwala, J. Narayan, S.K. Dwivedy)**
Conference: Advances in Robotics 2019, The Robotics Society
 [PUBLISHED] [ACM]
 A mechanized medical injection platform designed to further develop a versatile device that can administer injections at various sites on the human body, via remote access.
 - 3D Printing in Podiatrics**
 [ABSTRACT ACCEPTED] [Springer]
 - Venous Imaging and Force Feedback Needle Guidance Paradigm for Remote Medical Injections for Drug Delivery and Phlebotomy**
 [MANUSCRIPT IN REVIEW]
 - Controlled Manipulation of a Serial Linkage based Mechanical Ventilator - Linkage Exploration, Optimization and Mapping of Characteristics**
 [MANUSCRIPT IN DRAFT]
-

Experience

- **Engineering Officer**

September 2020 - Present

Maintenance Department, Visakh Refinery, Hindustan Petroleum Corp. Ltd.

On-site execution of maintenance of static mechanical equipment - heat exchangers, reactors, vessels, columns, furnaces, piping, structures, etc. - on planned, unplanned, shutdown and emergency timelines.

- **Execution:** responsible for timely planning and execution of field jobs including measurement, cross referencing with drawings, bill of material listing, fabrication, rigging and fitting of repaired equipment.
- **Coordination:** continuous followups with various departments (Inspection, Technical, Operations) for standardized and safe maintenance, employing work permit systems, ERP integrated material and work listing, in accordance with statutory advisories and budgeted financial limits.
- **Fabrication:** close monitoring of manufacturing processes such as welding, bending, cutting, forming, bolting, hot-tapping etc. along with quality assurance techniques such as stress relieving, radiography, DPT, hydrotesting, etc.

- **Co-founder**

March 2020 - Present

Mitochondrial

Product venture focused on understanding the translation of biomedical products from concept to market, via research. Currently in development of a modular orthopedic crutch for lower limb ailments, aimed at ergonomic optimization towards ease of use and maximum comfort.

- **Gait Module:** Design and prototyping a universal modular attachment for crutches to enable gait monitoring and assist the user towards maintaining and optimum cycle.
- **IntuBox:** Design, fabrication and distribution of intubation boxes ensuring maximum ease of fabrication and transportation to minimize supply chain dependencies during peak of the COVID-19 Wave-I in India, 2020.
 - Prototyping in collaboration with DRDO Solid State Physics Laboratory, New Delhi
 - Vendor identification, material sourcing, transportation and manufacturing done via remote coordination in accordance with travel and movement limitations
 - Raised funds via crowdfunding, while collaborating with *Alcheringa* on an awareness campaign for the same.
 - Delivered to hospitals in New Delhi, Jaipur, Lucknow and Hyderabad, whilst recording feedback for iterative improvements.

- **Research Intern**

September 2019 - July 2020

Mechatronics and Robotics Laboratory, Department of Mechanical Engineering, IIT Guwahati

Development of Platform for Remote Medical Injection (under *Prof. S.K. Dwivedy, HOD*) Control design and prototyping of the previously published design as part of my Bachelors' Thesis Project at the Mechatronics and Robotics Lab. Developed a vision module for vein detection and needle guidance. Currently working on the control paradigm for semi-automatic operation.

Projects

- **NUCLEUS Biosatellite**

4i Labs, Technical Board, IIT Guwahati

With the aim to study microbial life in low earth orbit designed as a Tardigrade-Rotifer interaction experiment, worked on the observation chamber design and prototyping as a member of the payload mechanical design team.

- **Ergonomic Modular Crutch**

Inter IIT Tech Meet 2018, IIT Bombay

Posed by the BETiC Medical Innovation Challenge, the problem required solving issues faced with long term use of orthopedic crutches such as axillary nerve damage, difficulty of use and storage. Designed, prototyped and analysed (FEM - ANSYS) a modular crutch design developed based on interactions with patients, doctors and experts. Made extensive first hand usage of workshop equipment such as milling machines, lathes, 3D printers (SLA and deltabot based FDM).

- **In-Situ Casting based Additive Manufacturing**

August 2019

Dr Sajjan Kapil, Department of Mechanical Engineering, IIT Guwahati

Design and modelling of a modular technique for improving isotropic strength and build time for fused deposition modelling based 3D printing.

- **Prosthetic arm with haptic response**

October 2016

Designed an artificial arm with calibrated vibrators strapped around the upper arm of the user, enabling a habitually redeveloped sense of touch.

Thesis Work

- **EEG Dataset Preprocessing** - Staging, epoch tagging and feature extraction of spatio-temporal streams for offline processing.
- **Patent Review - Wireless Helmet based on Ag/AgCl Electrodes for BCI**
- **Single Crystal Superalloys - Methodology and Applications**
- **CAPP in Micromanufacturing of Monolithic Designs**

Tinkering

- **Bed-Top Table** - design and fabrication of custom mountable desk for bed-ridden patients
- **AudioField** - binaural audio based Equalizer for customisable surround sound experience on stereo
- **Monoducted Drone** - CAD modelling of a single ducted UAV with coupling capabilities
- **E-Rickshaw Dataset** - design of DAQ box for carts operating within the campus, analogous to KITTI.

Technical Skillset

- **CAD Packages:** Solidworks, SolidEdge, ANSYS*
- **Graphical Tools:** Inkscape, PhotoView 360
- **Programming Languages:** MATLAB, C, Python*, Git*, HTML/JavaScript*
- **Microprocessors:** Raspberry Pi, Arduino, Cleanflight*

**Experimental Understanding*

Conferences & Hackathons

- **AIR 2019, IIT Madras:** Presented the paper on AutoInject, followed by a poster session with extensive interaction with delegates from various technical backgrounds.
- **Inter IIT Tech Meet, 2018:** Won the **Gold** medal in the BETiC Biomedical Innovation Challenge at IIT Bombay by redesigning the orthopaedic crutch, ergonomically.
- **Department Change, 2017:** Awarded to the top 10% of freshmen
- **Quadcopter Hackathon, Kriti 2016:** Secured 2nd position in the inter-hostel contest.
- **Teach Finance, Kriti 2016:** Explained via presentation, the Brexit conundrum to secure 2nd position.
- **MIT COVID 19 Hackathons - BEAT THE PANDEMIC I, II**
 - Local.ly - designed and presented an e-token based queueing system for locally serving shops and stores towards safe and optimized continuation of business during lockdowns
 - CoviCare -

Positions of Responsibility

- **Head, IIT Guwahati Model United Nations** 2018-19
Spearheaded a team consisting of 25 individuals, managing finances, logistics, collaborations and dynamics of the team. Enabled the establishment of the IITGMUN Workshop.
 - **Executive (Deputy Secretary-General):** 2017-18
Prepared the agenda for deliberation in the United Nations General Assembly, on the impasse over the Northwest Passage.
- **Literary Secretary, Kapili Hostel** 2017-18
Organised and chaired group discussions, and reworked the hostel library.
- **Head Boy, Gitanjali Devashray** 2013-14
 - **Deputy Head Boy** 2012-13
 - **House Coral Prefect** 2011-12

Extracurriculars

- **Theatre:** Played the **leading role of a child artiste** in a documentary produced by the French NGO Aide et Action. **Directed** and **acted** in the 1st place winning street play at OakFest 2013. Acted in various short films and dramas within IIT Guwahati.
 - **Writing:** As a **Coordinator International Press**, contributed regularly to the IITGMUN conference blog and newsletter. At the **Dell Microsoft Study Buddy contest 2012**, secured a **national level** cash prize in the essay and presentation contest.
 - **Debate:** Participated in numerous MUN conferences and parliamentary debates through the school years.
 - **Sensitization:** Was among 16 students selected from the country to visit the **TERI** centre in Mukteshwar, Uttarakhand. Attended the **EFI** talk 2012, at **Google** Hyderabad.
 - **Sports:** Was among the Inter-IIT basketball probables. Secured 2nd position in the games organized in the freshman week.
-