SanchitJhunjhunwala

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

- **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. Jhunjhunwala, 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 - elaborates upon process classification, biomedical requirements, allied technologies for hybrid methods, process selection and planning, advantages and constraints, and tabulates an overview 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. Jhunjhunwala, M. Gupta, S.K. Dwivedy)**
  Conference: ICCAR 2020 Singapore
  [PUBLISHED] **[IEEE]**

Design and modelling of a novel sit-to-stand exoskeleton for paraplegic children having a provision of different heights. Simplified mathematical formulations are presented to find knee joint and foot torques at seat-off position during sit-to-stand motion. Centre of mass distances from knee joint and foot are calculated using a CAD model. Two backpropagation neural network models (BPNN-I and BPNN-II), are designed to predict the 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 simulated ones, within acceptable limits of error.

- **3DP During COVID 19 (J. Narayan, S. Jhunjhunwala, 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 the foreground of critical attention. This work evaluates such challenges as it examines instances and their solutions, and discusses 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. Jhunjhunwala, S. Mishra, S.K. Dwivedy)
  Chapter in Predictive Modelling in Biomedical Data Mining and Analysis (Elsevier)
  [ACCEPTED, IN PRODUCTION] **[Elsevier]**
  Acquisition of gait data requires the physical presence of test subjects. With the advent of emerging machine learning algorithms, the estimation of clinical gait mechanics can be carried out based on anthropometric, biological and spatiotemporal parameters of different individuals. In this work, an existing open-access database of 50 healthy subjects (age: 6–72 years, mass: 18.2–110 kg, height: 116.6–187.5 cm) is utilized to predict the kinematics and kinetics using the 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) is carried out for training the network. The results of correlation coefficients show the noteworthy potential of LM-BPNN model over RP-BPNN and GDM-BPNN models while estimating gait mechanics. Finally, gait mechanics of a male subject (30 years) are estimated and presented extensively to show the effectiveness of BPNN models.

- **Design and Modelling of Novel Mechanized Injection Platform**
  (S. Jhunjhunwala, 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 Injections**
  [MANUSCRIPT IN REVIEW]

- **Ventilator Controlled Manipulation - Mapping of Characteristics and Sensitivity**
  [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.

- **Co-founder**
  Mitochondrial
  Product venture focused on understanding the translation of product 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 (unde**r** *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 Sajan 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.

- **AutoInject**
  Bachelors Thesis Project, Prof. S.K. Dwivedy, IIT Guwahati

- **Serial Linkage based Mechanical Ventilator - Linkage Exploration and Optimization**
  Prof. S. Kapil, IIT Guwahati

- **Mito Gait Module**
- **EEG Dataset Preprocessing**
- **Mutli - Arm Additive Manufacturing**

Tinkering

- **Stereo Imager**
- **Quadcopter**
- **AudioField**
- **E-Rickshaw Dataset** *Independent Project*
  Acquisition of data from electric rickshaws operating within the campus, analogous to KITTI.
- **Monoducted Drone** *Long term Hobby Project*
  Design of a UAV with a single duct, an imitation of the Cleo drone with coupling capability.
- **Bed-Top Table**
- **Hospibutler**
- **CAPP in Micromanufacturing of Monolithic Designs**
- **SC Superalloys**

Technical Skillset

- **Mathematical:** Linear Algebra, Kalman Filter, FFT, DSP
- **CAD Packages:** Solidworks, SolidEdge, ANSYS*
- **Graphical Tools**: Inkscape, PhotoView 360
- **Programming Languages**: MATLAB, C*, Python*, Git*, HTML/CSS*
- **Microprocessors:** Raspberry Pi, Arduino,
  *Experimental Understanding

Workshops & Hackathons

- **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
    - 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, Uttrakhand. 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.
