

ASHUTOSH TIWARI

Ph. No: +917999519166

Email ID: ashutoshtiwari666@gmail.com/bmz168397@iitd.ac.in

Webpage: <https://ashutoshtiwari666.github.io/>

Indian Institute of Technology Delhi, Hauz Khas, New Delhi, 110016, India

❖ Research Interests

1. Human gait analysis, 2. Biomechanics, 3. Wearable device for gait application, 4. Assistive devices for movement disorders, 5. Human machine interface, 6. Lower limb prosthetics, exoskeleton & robotics, 7. Artificial intelligence & Machine learning, 8. Biomedical Instrumentation and signal processing
-

❖ Education

PhD., Biomedical Engineering

[Dec. 2021]

Indian Institute of Technology (IIT) Delhi, New Delhi, India
(Jointly with AIIMS New Delhi)

Thesis title: Development of Center of pressure-Based visual feedback system for improved minimum toe clearance (mTC): Validation in transfemoral amputees.

Supervisor: Prof. Deepak Joshi

Course work CPI (/10): 9.0

M.Tech., Biomedical Engineering

[Aug. 2015]

Indian Institute of Technology (IIT) Bombay, Mumbai, India

CPI (/10): 9.12

Supervisor: Prof. Soumyo Mukherji

B.Tech., Biomedical Engineering (With minors in Instrumentation Engg.)

[Aug. 2013]

Vellore Institute of Technology (VIT University), Vellore, India

CPI (/10): 8.14

❖ Work Experience

Research Associate (RA)

[Dec. 2021-Present]

Neuromechanics Research Laboratory (NRL)

Indian Institute of Technology Delhi, New Delhi, India

Responsibilities:

- *Development of wearable instrumentation for gait analysis in Parkinson's and Cerebral Ataxia patients*
- *Data collection at Department of Neurology, All India Institute of Medical Sciences (AIIMS), New Delhi*
- *Investigation of the Parkinson's gait before and after the Transcranial magnetic stimulation (TMS)*
- *Development of the deep learning model based on the gait parameters to predict the chances of the recovery in the Parkinson's and Cerebral ataxia patients after TMS therapy.*

Work done: Three pair of instrumented shoe and pressure insole has been developed and validated against the gold standard systems.

❖ **Peer reviewed Journals** (Journal papers: (I.F. = Impact Factor))

▪ **Published**

1. Ashutosh Tiwari and D. Joshi, "An Infrared Sensor-Based Instrumented Shoe for Gait Events Detection on Different Terrains and Transitions," in **IEEE Sensors Journal**, vol. 20, no. 18, pp. 10779-10791, 15 Sept. 2020, Doi: 10.1109/JSEN.2020.2994956. (I.F. = 3.3).
2. Ashutosh Tiwari and D. Joshi, "Template-Based Insoles for the Center of Pressure Estimation in Different Foot Sizes," in **IEEE Sensors Letters**, vol. 4, no. 8, pp. 1-4, Aug. 2020, Doi: 10.1109/LSENS.2020.3010373.
3. Ashutosh Tiwari and D. Joshi, "Design and Validation of a Real-Time Visual Feedback System to Improve Minimum Toe Clearance (mTC) in Transfemoral Amputees," in **IEEE Transactions on Neural Systems and Rehabilitation Engineering**, vol. 29, pp. 1711-1722, 2021, Doi: 10.1109/TNSRE.2021.3105139. (I.F. = 3.8).
4. Rishabh Bajpai, Ashutosh Tiwari, Anant Jain, Deepak Joshi, "A novel instrumented outsole for real-time foot kinematics measurement: validation across different speeds and simulated foot landing in Cerebral Palsy gait", Accepted in **IEEE Transaction on Instrumentation and Measurement**. (I.F. = 5.3).
5. R. Sharma, D. Singh, Ashutosh Tiwari and D. Joshi, "User-feedback based robust and simplified damping control for affordable transfemoral prosthesis," **IET Electronics Letters**, vol. 56, no. 8, pp. 366-367, 16 4 2020, Doi: 10.1049/el.2019.3401. (I.F. = 1.31).
6. Ashutosh Tiwari, Deepak Joshi, "Investigating the effect of real-time center of pressure (CoP) feedback training on the swing phase of lower limb kinematics in transfemoral prostheses with SACH foot" in **ASME Journal of Biomechanical Engineering**, Dec. 2021, Doi: 10.1115/1.4053364. (I.F. = 2.1).
7. D. Mehra, Ashutosh Tiwari, and D. Joshi, 2021, "Investigating neural correlates of locomotion transition via temporal relation of EEG and EOG-recorded eye movements", **Elsevier, Computers in Biology and Medicine**, p.104350, 2021, Doi: 10.1016/j.combiomed.2021.104350. (I.F. = 4.9).
8. Ashutosh Tiwari, A. Pai, and D. Joshi, "A shoe-mounted infrared sensor-based instrumentation for locomotion identification using machine learning methods". **Elsevier, Measurement**, p.108458, Jan. 2020. Doi: <https://doi.org/10.1016/j.measurement.2020.108458>. (I.F. = 3.9).

▪ **Preprints**

9. Ashutosh Tiwari, and Deepak Joshi (2022): Wearable Haptic Feedback System for Training Propulsion Force in Individuals with Solid Ankle Foot Orthosis: Development and Validation. TechRxiv. Preprint. <https://doi.org/10.36227/techrxiv.20024345.v1> (Under review in **IEEE Transaction on Neural System and Rehabilitation Engineering**).
 10. Rohan Khatavkar, Ashutosh Tiwari, Priyanka Bhat and Deepak Joshi (2022): A Novel Spatial Gait Parameter-Based Vibrotactile Cueing for Freezing of Gait Mitigation Among Parkinson's Patients. TechRxiv. Preprint. <https://doi.org/10.36227/techrxiv.20728165.v1> (Under review in **IEEE Transaction on Biomedical Engineering**).
-

▪ Manuscript under preparation

11. Ashutosh Tiwari, Deepak Joshi, "Investigation the effect of the varying plantarflexion stiffness of ankle foot orthosis on the lower limb kinetic and kinematic changes: A pilot study on the Able-bodied individuals"
12. Ashutosh Tiwari, Rohan Khatavkar, Deepak Joshi, "Foot Strike Angle Based Haptic Cueing System for the Improved Toe Clearance Among Parkinson's Disease (PD) Patients"
13. Ashutosh Tiwari, Rishabh Bajpai, Rohan Khatavkar, Deepak Joshi "Steady state and transition step length intent prediction using force myography for lower limb prosthetic application"
14. Ashutosh Tiwari and Deepak Joshi "Understanding the mechanics of the propulsion force generation and dynamic stability in the idiopathic toe walking children via mathematical modelling approach".

❖ Peer reviewed conference proceedings

1. Ashutosh Tiwari, Rishabh Srivastava, Kush Arora, Bhaskar Mohan Morari "Low-Cost Augmentative Technology to Assist People with Communicative Disorder," **International conference on Applied Mechanics 2013 (INCAM)** held at IIT Madras, Tamil Nadu, India.
2. Ashutosh Tiwari, S. Saxena and D. Joshi, "Instrumented shoe-based foot clearance and foot-to-ground angle measurement system for the gait analysis," 2019 **28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)**, New Delhi, India, 2019, pp. 1-6, doi: 10.1109/RO-MAN46459.2019.8956401."
3. Rishabh Bajpai, Ashutosh Tiwari, Deepak Joshi," AbnormNet: A Neural Network Based Suggestive Tool for Identifying Gait Abnormalities in Cerebral Palsy Children," **IEEE International conference on Advancement in Technology**, Goa, 2022.
4. Ashutosh Tiwari, Rishabh Bajpai, Deepak Joshi, "Exploring the center of pressure shift feedback at heel strike to modulate the step length," **IEEE International conference on Advancement in Technology (ICONAT)**, Goa, 2022.
5. Rohan Khatavkar, Ashutosh Tiwari, Deepak Joshi," Gait Step Length Classification Using Force Myography," **IEEE International conference on Advancement in Technology**, Goa, 2022.

❖ Patents

1. Soumyo Mukherji, Deepak Tyagi, Ashutosh Tiwari, Vimal Kumar Puthiyadath, Kunal Satish Raikar, Sareddy Vera Sudarshan Reddy Indian Patent Application No.: 6624/CHE/2015, entitled "SINGLE SNAPSHOT MICROARRAY READER", filed on December 2015. **[Granted]**
 2. Arnab Chandra, Ashutosh Tiwari, Deepak Joshi, Indian Patent Application No.: 202011029409, entitled "CUSTOMIZABLE AND FLEXIBLE FORCESENSING RESISTOR", filed on July 2020.
 3. Deepak Joshi, Ashutosh Tiwari, Indian Patent Application No.: 201911034729, entitled "INSOLE-BASED FOOT PRESSURE MEASUREMENT SYSTEM", filed on August 2019.
 4. Deepak Joshi, Ashutosh Tiwari, Indian Patent Application No.: 201811034806, entitled "WEARABLE GAIT ANALYSIS SYSTEM", filed on September 2018 **[Later funded by Department of Science and Technology (DST), Government of India]**.
-

❖ Awards and Recognitions

1. **Gandhian young technological innovation (GYTI) award** 2021, BIRAC, Department of Science and Technology (DST), Government of India.
2. Qualified **University Grant Commission-National Eligibility Test (UGC-NET)** exam for the entry to the Assistant Professor in the year 2017.
3. Qualified **Graduate aptitude test in Engineering (GATE)** exam 2016 (99 percentile) in Electronics and communication organized by IISc Bangalore.
4. Won first prize to showcase my innovation in an **Industry Day event** organized at IIT Delhi in 2018.
5. Won second prize in Poster presentation during Nation Biomedical Research Competition organized (**NBRC**) at AIIMS Rishikesh in 2018.
6. Won third prize in a Poster presentation during Nation Biomedical Research Competition (**NBRC**) organized at PGI Chandigarh in 2019.
7. My thesis is recommended for the best thesis award of IIT Delhi by the foreign examiner.

❖ Research grants

1. The research grant of INR 47 lakh for developing the working prototype of the instrumented insole and insole was received from the **Department of Science and Technology (DST), Government of India**, for the title ““A wearable system for quantitative assessment and recovery prediction during gait restoration in Parkinson’s and Cerebral Ataxia Patients (Project no. RP04110G)” [PI: Prof. Deepak Joshi, IIT Delhi].
2. The research grant of INR 1 lakh for developing the working prototype of the instrumented insole was received from the Department of Science and Technology (DST), Government of India. Grant award no. BT/BIRAC/SITARE-GYTI-0663.

❖ Teaching experience

- Instructor for the course on Biosensor and Bioelectronics as **teaching assistant (TA)** at IIT Bombay.
- Instructor for the course on Bioinstrumentation and Research technique in Biomedical Engineering as a **teaching assistant (TA)** at IIT Delhi.
- Conducted laboratory session for the Bioinstrumentation course for five consecutive semesters for the masters (M. Tech) student as a teaching assistant at IIT Delhi.
- Actively participated in **Global Initiative of Academic Network (GIAN)** course organization sponsored by the Govt. of India with my PhD supervisor and conducted demonstration for the devices like EEG, Foot pressure insole during the course.

❖ Key projects

- **Lab on a chip reader and software analysis using MATLAB.**
Supervisor: Prof. Soumyo Mukherji, IIT Bombay.

[May '14- June' 15]

-
- Development of microarray reader, a system that can read microarray (DNA/Protein) based on its fluorescence properties providing high resolution combined with seamless data analysis and extended dynamic range as well as higher sensitivity.
 - Imaging of large number of fluorochromes without photo bleaching.
 - Cost reduction to many folds as compared to the existing available products in the market.
- **Augmentative device to assist people with vocal cord dysfunction.**
Supervisor: Prof. Bhaskar Mohan Morari, VIT University. [November '12-May '13]
 - A device to mimic the act of non- functioning or paralyzed vocal folds with a speaker driven by an electronic oscillator which produces vibration at the frequency of desired range was developed.
 - This technology is inexpensive, reliable and advanced.
 - **Auto ranging measurement of capacitance.**
Supervisor: Prof. P.C. Pandey, IIT Bombay [July' 13-December' 13]
 - A circuit for the measurement of capacitance with auto ranging was developed.
 - The capacitance measurement was carried out using all pass filter and arduino based microcontroller.
 - Circuit is able to measure the capacitance in the range of picofarad to microfarad.
 - **Design and fabrication of a biocompatible microgripper for manipulation and handling of microscopic cells.**
Supervisor: Prof. R.S. Shrivastava, IIT Bombay [January' 14- April' 14]
 - It is based on micro-electro-mechanical system (MEMS) technique which allows holding of cells without imposing any structural deformation and biocompatibility issues with online feedback to help automate the system.
 - Low cost and efficient.
-

❖ **Presentation and talks**

- Seminar on the wearable sensing technologies for gait application at IIT Delhi, Sonipat campus.
 - Demonstration of the EEG (from Brain products, USA) and EMG (Delsys, USA) device on the patients virtually in the conferences at NIT Trichy.
 - Demonstration of the instrumented shoe for gait analysis at the exhibition organized by the ministry at Pragati maidan, New.
-

❖ **Research Advising and Mentoring**

- | | |
|--|-------------------------|
| ▪ Mr. Saurya Bhatt, Project associate, IIT Delhi | [Jan. 2018- Dec. 2018] |
| ▪ Mr. Dhruv Mehra, Summer intern, IIT Delhi | [April 2019- Aug. 2019] |
| ▪ Mr. Aditya Arora, Summer intern, IIT Delhi | [March 2018- July 2018] |
| ▪ Mr. Shreyas Sanghvi, Summer intern, IIT Delhi | [May 2018- Aug. 2018] |
| ▪ Mr. Ajey Pai, Project associate, IIT Delhi | [July 2018- Jan. 2019] |
| ▪ Mr. Arijit Dey, Masters student, IIT Delhi | [July 2018- April 2019] |
-

❖ **Academic services**

- Reviewer for *IOP Journal of Neural Engineering*
 - Reviewer for *IOP Measurement science and technology*
-

❖ **Technical skills**

- **Data acquisition experience:** Marker based motion capture system (12 IR camera-based system, BTS Bioengineering and three camera-based system by Noraxon), EEG (64 channel wireless, Brain products, Germany), EMG (12 channel wireless, Delsys, USA), Wireless digital goniometer by Biometrics
 - **Programming Languages:** C, C++, Matlab, R-Software
 - **Tools:** Keil, Corel Draw, Solid works, Unity (3D game development)
 - **Microcontroller:** Rasberri pie, All Arduino platform
-

❖ **Language Proficiency**

- English
 - Hindi
-