

## Curriculum Vitae

Name and full correspondence address : Atul Thakur, Ph.D.  
R115/Block-3  
Department of Mechanical Engineering  
Indian Institute of Technology Patna,  
Bihta  
Bihar - 801106

Emails and Contact numbers : athakur@iitp.ac.in  
atul.thakur@gmail.com (alternate)  
+91-611-523-3158 (office)  
+91-8406055697 (mobile)

### 1. Academic Qualifications

Degree	Year	Subject	University/Institution
Doctor of Philosophy (Ph.D.)	2011	Mechanical Engineering	University of Maryland, College Park, Maryland, USA
Master of Technology (M-Tech.)	2006	Manufacturing Engineering	Indian Institute of Technology Bombay, Mumbai, Maharashtra, India
Bachelor of Engineering (B.E.)	2003	Production Engineering	University of Mumbai, Mumbai, Maharashtra, India

### 2. Work Experience

Sr.	Positions held	Institute	From	To
1	Associate Professor	Indian Institute of Technology Patna, Bihar, India	December 5, 2019	Continuing
2	Assistant Professor	Indian Institute of Technology Patna, Bihar, India	September 10, 2012	December 4, 2019

3	Postdoctoral Research Associate	University of Maryland, College Park, Maryland, USA	September, 2011	August, 2012
4	Design Engineer	General Electric, Bangalore Technology Center, Bangalore, Karnataka, India	August 2006	June 2007

### 3. Awards/Recognition

Sr.	Name of the Award / Fellowship	Awarding Agency	Year
1	2013 ASME Computers and Information in Engineering Division's Best Dissertation Award.	American Society of Mechanical Engineers (ASME)	2013
2	Computer-Aided Design 2012 most cited paper award for the article "Survey of CAD model simplification techniques for physics-based simulation applications"	Elsevier	2012
3	2012 NSF travel award to present research poster at Performance Metrics for Intelligent Systems (PerMIS'2012)	National Science Foundation (NSF), USA	2012
4	A. James Clark Graduate School Fellowship	University of Maryland, College Park	2007-2009
5	General Electric Night on the Town Award	General Electric, Bangalore Technology Center	2007

### 4. Publications

#### 4.1 Journal Articles

J. 33. Agarwal, D., Kamble, Y., Raj, A. et al. Biomechanical parameter estimation using untethered nonprehensile magnetic microrobot. J Micro-Bio Robot (2023). <https://doi.org/10.1007/s12213-023-00164-7>

J. 32. Sinha, K. N. R., Kumar, V., Kumar, N., **Thakur, A.**, Raj, R. (2023) Dataset for boiling acoustic emissions: A tool for data driven boiling regime prediction, Data in Brief, 109793, ISSN 2352-3409, <https://doi.org/10.1016/j.dib.2023.109793>.

- J. 31. Singh, M., K., Hait, S., and **Thakur, A.** (2023) Hyperspectral imaging-based classification of post-consumer thermoplastics for plastics recycling using artificial neural network, *Process Safety and Environmental Protection*, 179, 593-602. <https://doi.org/10.1016/j.psep.2023.09.052>.
- J. 30. **Thakur, A.** (2023) Gait Parameter Tuning Using Bayesian Optimization for an Alligator Inspired Amphibious Robot. *Defence Science Journal*, 73(5), 519-530. <https://doi.org/10.14429/dsj.73.18315>
- J. 29. Ojha, P., **Thakur, A.** AD\*-Based Dynamically Feasible Replanning Technique for Anguilliform-Inspired Robot. *J Intell Robot Syst* 108, 53 (2023). <https://doi.org/10.1007/s10846-023-01902-6>
- J. 28. **Thakur, A.**, Sahoo, S., Mukherjee, A., and Halder, R. (April 17, 2023). Making robotic swarms trustful: A blockchain-based perspective." *ASME. J. Comput. Inf. Sci. Eng.* doi: <https://doi.org/10.1115/1.4062326>
- J. 27. Kamble, Y., Raj, A., and **Thakur, A.** (April 2023). Artificial neural network-aided computational approach for mechanophenotyping of biological cells using atomic force microscopy." *ASME. J Biomech Eng.* July 2023; 145(7): 071007. <https://doi.org/10.1115/1.4056916>
- J. 26. Nishad, S. R., Halder, R., Banda, G., and **Thakur, A.**, "Development of a Lizard-Inspired Wall-Climbing Robot Using Pressure Sensitive Adhesion," in *IEEE Access*, vol. 10, pp. 72535-72544, 2022, doi: 10.1109/ACCESS.2022.3189162.
- J. 25. Agarwal, D., Thakur, A.D. and **Thakur, A.**, Magnetic microbot-based micromanipulation of surrogate biological objects in fluidic channels. *J Micro-Bio Robot* (2022). <https://doi.org/10.1007/s12213-022-00151-4>
- J. 24. Agarwal, D., Thakur, A. D., **Thakur, A.**, A feedback-based manoeuvre planner for nonprehensile magnetic micromanipulation of large microscopic biological objects, *Robotics and Autonomous Systems*, 148, 2022, 103941, ISSN 0921-8890, <https://doi.org/10.1016/j.robot.2021.103941>.
- J. 23. Feng, R., Jiang, J., **Thakur, A.** and Wei, X. (2023), "Lightweight design of two-level supports for extrusion-based additive manufacturing based on metaheuristic algorithms", *Rapid Prototyping Journal*, Vol. 29 No. 4, pp. 850-866. <https://doi.org/10.1108/RPJ-01-2022-0038>

- J. 22. Zhang, H., **Thakur, A.**, and Wei, X., Patch-size Segmentation of Small-Scaled Magnetic Resonance Images of the Prostate with Prior Information, *Computer-Aided Design & Applications*, 19(1), 2022, 38-53
- J. 21. Sinha, K. N. R., Kumar, V., Kumar, N., **Thakur, A.**, Raj, R., Deep learning the sound of boiling for advance prediction of boiling crisis, *Cell Reports Physical Science*, Volume 2, Issue 3, 2021, 100382, ISSN 2666-3864, <https://doi.org/10.1016/j.xcrp.2021.100382>.
- J. 20. Gundupalli, S.P., Shukla, R., Gupta, R., Hait, S., **Thakur, A.**, Optimal Sequence Planning for Robotic Sorting of Recyclables from Source-Segregated Municipal Solid Waste, *Journal of Computing and Information Science in Engineering*, 2021, 21(1), 014502.
- J. 19. Feng, R., Li, X., Zhu, L., **Thakur, A.**, Wei, X., An Improved Two-Level Support Structure for Extrusion-Based Additive Manufacturing, *Robotics and Computer-Integrated Manufacturing*, 2021, 67, 101972
- J. 18. Feng, R., Jiang, J., Sun, Z., **Thakur, A.** and Wei, X. (2021), "A hybrid of genetic algorithm and particle swarm optimization for reducing material waste in extrusion-based additive manufacturing", *Rapid Prototyping Journal*, Vol. 27 No. 10, pp. 1872-1885. <https://doi.org/10.1108/RPJ-11-2020-0292>
- J. 17. Sharma, N. K., Tiwari, M., **Thakur, A.**, and Ganguli, A. K., A Systematic Review of Methodologies and Techniques for Integrating Ergonomics in Development and Assessment of Manually Operated Equipment, *International Journal of Occupational Safety and Ergonomics*, 2020, DOI: 10.1080/10803548.2020.1862552
- J. 16. Raj, A., and **Thakur, A.**, Hydrodynamic Parameter Estimation for an Anguilliform-inspired Robot, *Journal of Intelligent and Robotic Systems: Theory and Applications*, 2020, 99(3-4), pp. 837–857.
- J. 15. Kumar, A., Gunjan, M.R., Jakhar, K., **Thakur, A.**, Raj, R. Unified framework for mapping shape and stability of pendant drops including the effect of contact angle hysteresis, *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 2020, 597, 124619
- J. 14. Raj, A., and **Thakur, A.**, Dynamically feasible trajectory planning for Anguilliform-inspired robots in the presence of steady ambient flow, *Robotics and Autonomous Systems*, 118:144-158, 2019.

J. 13. Sinha, K. N. R., Ranjan, D., Raza, M. Q., Kumar, N., Kaner, S., **Thakur, A.**, and Raj, R., In-situ acoustic detection of critical heat flux for controlling thermal runaway in boiling systems, *International Journal of Heat and Mass Transfer*, 138:135-149, 2019.

J.12. Gundupalli, S., P., Hait, S., and **Thakur, A.**, Classification of metallic and non-metallic fractions of e-waste using thermal imaging-based technique Article reference, *Process Safety and Environmental Protection*, 118:32-39, 2018.

J.11. Jakhar, K., Chattopadhyay, A., **Thakur, A.**, and Raj, R., Spline Based Shape Prediction and Analysis of Uniformly Rotating Sessile and Pendant Droplets, *Langmuir*, 33(22):5603-5612, 2017.

J.10. Gundupalli, S., P., Hait, S., and **Thakur, A.**, Multi-material classification of dry recyclables from municipal solid waste based on thermal imaging, *Waste Management*, 70:13-21, 2017.

J.9. Gundupalli, S., P., Hait, S., and **Thakur, A.**, A review on automated sorting of source-separated municipal solid waste for recycling, *Waste Management*, 60:56-74, 2017.

J.8. Raj, A., and **Thakur, A.**, Fish-inspired robots: design, sensing, actuation, and autonomy—a review of research. *Bioinspiration & Biomimetics*, 11(3):dx.doi.org/10.1088/1748-3190/11/3/031001, 2016.

J.7. **Thakur, A.**, Chowdhury, S., Švec, P., Wang, C., Losert, W., and Gupta, S., K., Indirect pushing based automated micromanipulation of biological cells using optical tweezers. *International Journal of Robotics Research*, 33(8):1098-1111, 2014.

J.6. Chowdhury, S., **Thakur, A.**, Švec, P., Wang, C., Losert, W., and Gupta, S., K., Automated Manipulation of Biological Cells Using Gripper Formations Controlled By Optical Tweezers, *IEEE Transactions on Automation Science and Engineering*, 11(2), 338-347, 2014.

J.5. Švec, P., **Thakur, A.**, Raboin, E., Shah, B., C., and Gupta, S., K., Target Following with Motion Prediction for Unmanned Surface Vehicle Operating in Cluttered Environments. *Autonomous Robots*, 36(4), 383-405, 2014.

J.4. **Thakur, A.**, Švec, P., Gupta, S., K., GPU based generation of state transition models using simulations for unmanned surface vehicle trajectory planning. *Robotics and Autonomous Systems*, 60(12), 1457-1471, 2012.

J.3. **Thakur, A.**, Gupta, S., K., Improving performance of rigid body dynamics simulation by removing inaccessible regions from geometric models. *Computer-Aided Design*, 44(12), 1190-1204, 2012.

J.2. **Thakur, A.**, and Gupta, S., K., Real-time dynamics simulation of unmanned sea surface vehicle for virtual environments. *Journal of Computing and Information Science in Engineering*, 11(3), 2-11, 2011.

J.1. **Thakur, A.**, Banerjee, A., G., Gupta, S., K., A survey of CAD model simplification techniques for physics-based simulation applications. *Computer-Aided Design*, (41):2, 65-80, 2009.

#### *4.2 Peer-Reviewed Conference*

C. 40. Sankar, K.M., A. K., A., **Thakur, A.** (2024). A Two-Legged Robot for Climbing Vertical Surfaces Based on Pressure-Sensitive Adhesion and Peeling. In: Youssef, E.S.E., Tokhi, M.O., Silva, M.F., Rincon, L.M. (eds) *Synergetic Cooperation Between Robots and Humans. CLAWAR 2023. Lecture Notes in Networks and Systems*, vol 810. Springer, Cham. [https://doi.org/10.1007/978-3-031-47269-5\\_23](https://doi.org/10.1007/978-3-031-47269-5_23)

C. 39. Verma, N., Ojha, P., Sharma, A. K., and **Thakur, A.**, "ROS-based Hardware-in-the-Loop Simulation Framework for Fish-Inspired Robot for Safe Control Gain Tuning," 2023 IEEE 7th Conference on Information and Communication Technology (CICT), Jabalpur, India, 2023, pp. 1-6, doi: 10.1109/CICT59886.2023.10455219.

C. 38. Yadav, R., Halder, R., Banda, G., and **Thakur, A.**, A Lightweight Deep Learning-based Weapon Detection Model for Mobile Robots. *Proc. of the 6th International Conference on Advances in Robotics (AIR '23)*, IIT Ropar, India, 5-8 July 2023. ACM Press.

C. 37. Anugrah, A. K. and **Thakur, A.**, Bio-Inspired gait trajectory design for lizard inspired wall climbing robot 47th International Conference on Mechanisms and Robotics (MR) at 2023 ASME-IDETC, Boston, MA, USA, August 20-23, 2023.

C. 36. Sharma N.K., Tiwari M., and **Thakur A.**, Ganguli A.K. (2022) Biomechanical simulation and a detailed analysis of the roadside cleaning activity. In: Black N.L., Neumann W.P., Noy I. (eds) Proceedings of the 21st Congress of the International Ergonomics Association (IEA 2021). IEA 2021. Lecture Notes in Networks and Systems, vol 223. Springer, Cham. [https://doi.org/10.1007/978-3-030-74614-8\\_22](https://doi.org/10.1007/978-3-030-74614-8_22)

C. 35. Das, A., Halder, R., and **Thakur. A.**, Deep Reinforcement Learning-Based 3D Exploration with a Wall Climbing Robot. Proc. of the IEEE International Region 10 Technical Conference (IEEE TENCON '21), Auckland, New Zealand, 7-10 Dec 2021. IEEE Press.

C. 34. Sarwar, M. M. S., Yadav, R., Samanta, S., Ray, R., Halder, R., Banda, G., Bhattacharya, A., and **Thakur, A.**, A Robotic Software Framework for Autonomous Navigation in Unknown Environment, 2021 International Symposium of Asian Control Association on Intelligent Robotics and Industrial Automation (IRIA), 2021, pp. 345-350, doi: 10.1109/IRIA53009.2021.9588693.

C. 33. Rishikesh, Bhattacharya, A., **Thakur, A.**, Banda, G., Ray, R., and Halder, R., Secure Communication System Implementation for Robot-based Surveillance Applications, 2021 International Symposium of Asian Control Association on Intelligent Robotics and Industrial Automation (IRIA), 2021, pp. 270-275, doi: 10.1109/IRIA53009.2021.9588788.

C. 32. Ojha, P., and **Thakur, A.**, Real-Time Obstacle Avoidance Algorithm for Dynamic Environment on Probabilistic Road Map, 2021 International Symposium of Asian Control Association on Intelligent Robotics and Industrial Automation (IRIA), 2021, pp. 57-62, doi: 10.1109/IRIA53009.2021.9588792.

C. 31. Nishad, S., Halder, R., Banda, G., Ray, R., Bhattacharya, A., and **Thakur, A.**, A Lizard-Inspired Quadruped Robot Based on Pressure Sensitive Adhesion Mechanism for Wall Climbing, Proceedings of the 5th International Conference on Advances in Robotics 2021, June 30-July 4, 2021. Kanpur, UP, India.

C. 30. Darekar, A. Y., and **Thakur, A.**, Trajectory planning in the presence of dynamic obstacles for Anguilliform-inspired robots, Proceedings of the 5th International Conference on Advances in Robotics 2021, June 30-July 4, 2021. Kanpur, UP, India.

C. 29. Kumar, B., Bhatt, C., and **Thakur, A.**, Deep Learning Based Real-Time Computation of Thrust for a Robotic Fish, Proceedings of the 5th International Conference on Advances in Robotics 2021, June 30-July 4, 2021. Kanpur, UP, India.

C. 28. Pedapudi, B. R. B., Hait, S., and **Thakur, A.**, Multi-Layer Perceptron-Based Classification of Recyclable Plastics from Waste Using Hyperspectral Imaging for Robotic Sorting, Proceedings of the 5th International Conference on Advances in Robotics 2021, June 30-July 4, 2021. Kanpur, UP, India.

C. 27. Sharma N.K., Tiwari M., **Thakur A.**, Ganguli A.K. (2022) Biomechanical Simulation and a Detailed Analysis of the Roadside Cleaning Activity. In: Black N.L., Neumann W.P., Noy I. (eds) Proceedings of the 21st Congress of the International Ergonomics Association (IEA 2021). IEA 2021. Lecture Notes in Networks and Systems, vol 223. Springer, Cham. [https://doi.org/10.1007/978-3-030-74614-8\\_22](https://doi.org/10.1007/978-3-030-74614-8_22)

C. 26. H. Shaw and A. Thakur, "Shape memory alloy based caudal fin for a robotic fish: Design, fabrication, control and characterization," in Proceedings of the Advances in Robotics 2019, ser. AIR 2019. New York, NY, USA: Association for Computing Machinery, 2019. [Online]. Available: <https://doi.org/10.1145/3352593.3352666>

C.25. Thati, S., Raj. A., and **Thakur, A.**, Optimal and dynamically feasible path planning for an anguilliform fish-inspired robot in presence of obstacles. ASME Mechanisms and Robotics Conference, Quebec City, Canada, August 26-29, 2018.



C.24. Agrawal, K., Jain, K., Gupta, D., Shrivastav, R., Agnihotri, A., and **Thakur, A.**, Bayesian optimization based terrestrial gait tuning for an 12-dof alligator-inspired robot with active body undulation. ASME Mechanisms and Robotics Conference, Quebec City, Canada, August 26-29, 2018.

C.23. Raj, A., Kumar, A., and **Thakur, A.**, Automated Locomotion Parameter Tuning for an Anguilliform-inspired Robot. In Systems, Man, and Cybernetics, 2016 IEEE International Conference on, Budapest, Hungary, October 9-12, 2016.

C.22. Paulraj, S.G., Hait, S., and **Thakur, A.**, Automated municipal solid waste sorting for recycling using a mobile manipulator, 40th International Conference on Mechanisms and Robotics (MR) at 2016 ASME-IDETC, Charlotte, NC, USA, August 21-24, 2016.

C.21. Kulkarni, P., Kumar, A., Thakur, A., D., and **Thakur, A.**, Automated non-prehensile magnetic micromanipulation in presence of spatially varying flow field, 10th International Conference on Micro- and Nanosystems (MNS) at 2016 ASME-IDETC, Charlotte, NC, USA, August 21-24, 2016.

C.20. Shah, B., C., Švec, P., **Thakur, A.**, and Gupta, S., K., Path Planning for Unmanned Vehicles Operating in Time-Varying Flow Fields. ICAPS Workshop on Planning and Robotics (PlanRob 2016), London, UK, June 13-14, 2016.

C.19. Sathish, G.P., and **Thakur, A.**, Automated Municipal Solid Waste Sorting for Recycling using a Mobile Manipulator, 40th Mechanisms and Robotics Conference (MR), ASME-IDETC, Charlotte, UNC, USA, August 21-24, 2016.

C.18. Das, A., Thakur, A., D., and **Thakur, A.**, Image guided automated non-prehensile magnetic micromanipulation of cells, 9th International Conference on Micro- and Nanosystems (MNS) at 2015 ASME-IDETC, Boston, MA, USA, August 2-5, 2015.

C.17. Shriyam, S., Mishra, A., Nayak, D., and **Thakur, A.**, Design, fabrication and gait planning of alligator-inspired robot, International Conference on Advances in Mechanical Sciences, Hyderabad, AP, India, January 9-11, 2014.

C.16. Chowdhury, S., **Thakur, A.**, Švec, P., Wang, C., Losert, W., and Gupta, S., K., Enhancing range of transport in optical tweezers assisted microfluidic chambers using automated stage motion. ASME International Conference on Micro and Nanosystems, Portland, Oregon, August 4-7, 2013.

C.15. Chowdhury, S., **Thakur, A.**, Wang, C., Švec, P., Losert, W., and Gupta, S., K., Automated indirect manipulation of irregular shaped cells with optical tweezers for studying collective cell migration. IEEE International Conference on Robotics and Automation (ICRA '13), Karlsruhe, Germany, May 6-10, 2013.

C.14. **Thakur, A.**, Chowdhury, S., Švec, P., Wang, C., Losert, W., and Gupta, S., K., Automated indirect optical micromanipulation of biological cells using indirect pushing for minimizing photo-damage. ASME International Conference on Micro and Nanosystems, Chicago, Illinois, August 12 -15, 2012.

C.13. Švec, P., **Thakur, A.**, Shah, B., C., and Gupta, S., K., USV trajectory planning for time varying motion goals in an environment with obstacles. ASME Mechanism and Robotics Conference, Chicago, Illinois, August 12-15, 2012.

C.12. Chowdhury, S., **Thakur, A.**, Wang, C., Švec, P., Losert, W., Gupta, S., K., Automated indirect transport of biological cells using planar gripper formations. IEEE International Conference on Automation Science and Engineering (CASE 2012), Seoul, Korea, August 20-24, 2012.

C.11. Švec, P., Schwartz, M., **Thakur, A.**, and Gupta, S., K., Trajectory planning with look-ahead for unmanned sea surface vehicles to handle environmental disturbances. In Intelligent Robots and Systems (IROS), 2011 IEEE/RSJ International Conference on, San Francisco, California, September 25-30, 2011.

C.10. **Thakur, A.**, Švec, P., and Gupta, S., K., Generation of state transition model using simulation for unmanned sea surface vehicle trajectory planning. ASME Mechanisms and Robotics Conference, Washington DC, August 28-31, 2011.

C.9. **Thakur, A.**, Gupta, S., K., A computational framework for real-time unmanned sea surface vehicle motion simulation. ASME Computers in Engineering Conference. Montreal, Canada, August 15-18, 2010.

C.8. Gupta, S., K., Anand, D., K., **Thakur, A.**, Švec, P., and Schwartz, M., A simulation based framework for discovering planning logic for Unmanned Surface Vehicles. ASME Engineering Systems Design and Analysis Conference, Istanbul, Turkey, July 12-14, 2010.

C.7. Schwartz, M., Švec, P., **Thakur, A.**, and Gupta, S., K., Evaluation of automatically generated reactive planning logic for unmanned surface vehicles. Performance Metrics for Intelligent Systems Workshop September 21 - 23, Gaithersburg, Maryland, September 2009.

C.6. **Thakur, A.**, Gupta, S., K., Context dependent contact preserving off-line model simplification for interactive rigid body dynamics simulations. ASME Computers and Information in Engineering Conference, San Diego, August 30-September 2, 2009.

C.5. **Thakur, A.**, Gupta, S., K., Anand, D., K., Brough, J., E., Kavetsky, R., A., and Schwartz, M., A survey of the virtual environments-based assembly training applications. Proceedings of Virtual Manufacturing Workshop, Turin, Italy, October 7-8, 2008.

C.4. Pavanaskar, S., S., **Thakur, A.**, Sunil, V., B., and Pande, S., S., WebNC: An internet based system for global product development. Proceedings of 7th Global Conference on Sustainable Manufacturing, 2009, Chennai, India, December 1-4.

C.3. **Thakur, A.**, S., S., Pande, A web based system for sheet metal modeling and process planning, Proceedings of 1st International and 22nd All India Conference on All India Manufacturing Technology Design and Research, 2006, Roorkee, India, December 21-26.

C.2. **Thakur, A.**, Pande, S., S., SIBAM: A web based feature modeler for sheet metal components. Proceedings of 22nd International Conference on CAD/CAM, Robotics and Factories of future, Vellore, India, July 19-23, 2006.

C.1. Pavanaskar, S., S., **Thakur, A.**, Sunil, V., B., and Pande, S., S., FBMod: A web based feature modeler for prismatic components, Proceedings of the National Conference on Design for Product Cycle (DPLC-2006), Pilani, India, February 17 - 18, 2006.

#### *4.3 Book Chapters*

B. 2. Chowdhury, S., **Thakur, A.** and Gupta, S.K. Manipulation of biological cells using optical tweezers: Challenges and solutions. In Autonomous Robot-Aided Optical Manipulation for Biological Cells, Elsevier Science, 2021.

B.1. Schwartz, M., Svec, P., **Thakur, A.**, and Gupta, S. K., Simulation based synthesis of planning logic for autonomous unmanned sea surface vehicles. Simulation Driven Innovation and Discovery, Energetics Applications, CALCE EPSC Press, College Park, 2011.

#### *4.4 Patent*

P.1. Raj, R., Thakur, A., Banerjee, S., and Pandey, U., "A System and Method for Controlling Buoyancy of an Underwater Submersible," Indian Patent Office 453932, Patent granted on 22/09/2023.

P.2. Anugrah AK, **Thakur, A.** Halder, R., Design of adhesion based omni orientation surface traverse mechanism in crawling quadruped trot-gaited robot" *Application filed (202331026910)*.

### **5. R&D Projects**

i.) Project Title: Robust Motion Planning for Amphibious-Inspired Robots

Sponsor: Department of Science and Technology, Government of India

Project Cost: ₹ 17.81 lakh

PI/CoPI: PI

Duration: 2013 – 2016

Present Status: Completed

- ii.) Project Title: Development of Low Cost, Efficient, Mechanism for Collection of Garbage and Dirt for Municipal Corporations, Panchayats

Sponsor: Swacchta Action Plan, MHRD

Project Cost: ₹ 16.71 lakh

PI/CoPI: Co-PI

Duration: 2018 – 2021

Present Status: Completed

- iii.) Project Title: Development of Lizard-like Robotic Spy Surveillance System

Sponsor: SERB

Project Cost: ₹101.49 lakh

PI/CoPI: Co-PI

Duration: 2019 – 2022

Present Status: Completed

- iv.) Project title: Intelligent Partition of Complicated Multiscale 3D Models for Rapid Additive and Subtractive Manufacturing

Project Cost: 300,000RMB

PI/CoPI: CoPI

Duration: 2018 – 2020

Present Status: Completed

- v.) Project Title Assessment of the Use of Modern Robotic and Machine Learning Tools for Addressing Operational Challenges at 3×660 MW Capacity Coal Fired Supercritical Power Plant

Sponsor: Prayagraj Power Corporation Limited

Project Cost: ₹ 8.76 lakh

PI/CoPI: PI

Duration: 2022 – 2023

Present Status: Ongoing

- vi.) Project Title: Development of Affordable Ergonomic Exoskeleton for Ameliorating Manual Work for Improving Safety and Dignity

Sponsor: Swacchta Action Plan, MHRD

Project Cost: ₹ 26.64 lakh

PI/CoPI: PI

Duration: 2023 – 2026

Present Status: Approved

## **6. Consultancy/Commissioned Work**

- i.) Project Title: Preparation of Detailed Project Report for Central for Robotics Center and Central Instrumentation Facility

Sponsor: Department of Science and Technology, Government of Bihar

Project Cost: ₹3.25 lakh

PI/CoPI: PI

Duration: 2016 – 2018

Present Status: Completed

- ii.) Project Title: Design, Fabrication and Installation of Motorized Sliding Security Gate at Reserve Bank of India, Patna

Sponsor: Reserve Bank of India, Patna

Project Cost: ₹3.52 lakh

PI/CoPI: PI

Duration: 2018 – 2019

Present Status: Completed

- iii.) Vetting of design documents for Integrated Command and Control Center (ICCC) and Smart Components of Muzaffarpur Smart City

Sponsor: Shapoorji Pallonji And Company Private Limited

Project Cost: ₹11.8 lakh

PI/CoPI: PI (along with Dr. Raju Halder, Dr. Samrat Mondal, and Dr. Subrata Hait)

Duration: 2022

Present Status: Completed

## **7. Teaching, Mentoring, and Advising**

### *7.1 Courses Taught at IIT Patna*

- Mobile Robotics (ME512)
- Robot Motion Planning (ME510)

- Modeling and Simulation of Mechatronic Systems (MH504)
- System Dynamics and Control (ME312)
- Bio-inspired Robotics (ME335)
- Fundamentals of Mechatronics (MH501)
- Control Systems (ME309)
- Kinematics of Machinery (ME304)
- Engineering Mechanics (ME101)
- Engineering Drawing (ME111)
- Mechatronics Lab I and II (MH519 and MH520)
- Control of Mechatronic Systems (EE501)
- Seminar for Masters' Students (SE507)

## *7.2 New Courses Developed at IIT Patna*

- **Mobile Robotics (ME512):** This course provides an overview of the aspects of design, fabrication, motion planning, and control of intelligent mobile robotic systems and is offered to senior undergraduate and graduate students. The focus of the course is distributed equally on the computational aspects and practical implementation issues and thereby leads to a well-rounded training. As part of this course, the students design and fabricate a mobile robotic platform and program it to apply learned theoretical concepts in practice as a semester long class project. The topics covered in this course include: Robot locomotion, maneuverability, controllability, mobile robot kinematics, dynamics, and motion simulation, robot perception, localization, introduction to planning and navigation focusing especially on graph search techniques.
- **Bio-Inspired Robotics (ME335):** This course covers the fundamentals and applications of bio-inspired robots. The aspects covered in this course include the following: bio inspiration vs biomimetics, types of locomotion, hopping robots, biped, quadruped and hexaped robots, crawling robots, wheeled robots, fish-inspired aquatic robots, stability, maneuverability, and controllability. The course provides the students an opportunity

to design and fabricate a mobile robotic platform and program it to apply learned theoretical concepts in practice as a semester long class project.

- Robot Motion Planning (ME510): This course covers the prominent motion planning algorithms used in the area of mobile robotics. The course will cover various motion planning algorithms and analyses. The contents covered in this course include: Configuration space and topology, potential functions, roadmaps, cell decomposition, sampling-based algorithms. The students are allotted several mini-projects wherein they are challenged to implement motion planning algorithms that implement the theoretical concepts taught in the class. For the simulations, CoppeliaSim™ software and Matlab™ are used.

### *7.3 Laboratory Course Developed at IIT Patna*

The mechatronics lab includes experiments on data acquisition, sensors and actuators, microprocessors, microcontrollers, rapid prototyping techniques, robot manipulation, CNC machining, hydraulics, pneumatics, and PLC. In addition to the development of pedagogical aspects described above, I also established the lab and populated it with various relevant equipment like CO2 Laser cutting machining, PCB prototyping machine, 3D printers, table top milling machines, hydraulic and pneumatic breadboards, and robotic manipulators.

### *7.4 Short-term Training and Continuing Education Program*

- Organized a Short-term Training Program for the Engineers of Building Construction Department, Govt. of at IIT Patna in collaboration with Dr. Subrata Hait, Department of Civil and Environmental Engineering, IIT Patna during May 20 to June 12, 2013. Number of participants was 25.
- Organized a CEP course “Introduction to robotics: Mechanics, Control, and Programming” during October 26 – 28, 2018. Number of participants was 31.
- Conducted an FDP on Mobile Robotics funded by AICTE under its ATAL program during June 16-20, 2021. Number of participants was 200.
- Conducted an FDP on Advanced Mobile Robotics funded by AICTE under its ATAL program during September 20-24, 2021. Number of participants was 88.



## *7.5 Students Mentored*

### *Ph.D. Thesis Completed*

1. Sathish P. Gundupalli, 2019
  - Thesis title: Automated segregation of recyclables from solid waste stream using thermal imaging technique
2. Aditi Raj, 2019
  - Thesis title: Trajectory planning for underwater anguilliform-Inspired robots operating in presence of ambient flow
3. Dharmveer Agarwal
  - Robotic Nonprehensile Magnetic Micromanipulation of Large Microscopic Biological Objects (Thesis Submitted)

### *Ph.D. Thesis Ongoing*

1. Neelesh Sharma (jointly guided with Prof. Mayank Tiwari, ME, IITP)
2. Mukesh Kumar Singh
3. Pritam Ojha
4. Yuvaraj Kamble (jointly guided with Dr. Abhishek Raj, ME, IITP)
5. Kadali Manisankar (jointly guided with Prof. Mayank Tiwari, ME, IITP)

### *M-Tech. Thesis Completed*

1. Anand Kumar Mishra, 2014
  - Thesis title: Design, fabrication and planning of bio-inspired quadruped robots
2. Sherbahadur Yadav, 2014
  - Thesis title: Design and planning of unmanned ground vehicles for human following
3. Akash Das, 2015 – Joint guidance with Dr. Ajay D. Thakur, Department of Physics
  - Thesis title: Automated motion planning of magnetic microrobot
4. Guddi Kumari, 2015 – Joint guidance with Dr. Rishi Raj, Department of Mechanical Engineering
  - Thesis title: Temperature feedback control for enhancing critical heat flux during pool boiling.

5. Sumit Banerjee, 2017 - Joint guidance with Dr. Rishi Raj, Department of Mechanical Engineering
  - Thesis title: Boiling-based buoyancy controlled underwater robot
6. Biswaranjan Das, 2017
  - Thesis title: Anguilliform-inspired robot
7. Himansu Shaw, 2017
  - Thesis title: A shape-memory alloy actuated robotic fish
8. Kishan Gopal Karwa, 2017
  - Thesis title: Magnetic microrobot for non-prehensile manipulation of cells
9. Krishna Agrawal, 2017
  - Thesis title: Automatic gait adaptation for alligator-inspired robot
10. Aaditya Asati, 2018
  - Thesis title: Haptic feedback from virtual environment for laparoscopic surgical simulation using cutaneous and kinesthetics haptic Interface
11. Rajan Sippy, 2018
  - Thesis title: Development of android powered eye tracking-based wheelchair control with autonomous navigation
12. Adnan Jawed, 2018
  - Thesis title: Design and fabrication of carangiform robotic fish
13. Shubham Pathak, 2019
  - Thesis title: Control of boiling-based variable buoyancy robot
14. Sushrut Lingayat, 2019
  - Thesis title: Laparoscopic simulator with haptic feedback
15. Amit Kumar, 2019
  - Thesis title: Design of a dragonfly-inspired micro air vehicle
16. Aditya Sudeep Ratnaparkhi, 2020
  - Thesis title: Model-based backstepping leader-follower formation control of unmanned surface vehicles
17. Abhishek Sharma, 2020
  - Thesis title: Design and control of haptic interface for laparoscopic simulator
18. Pedapudi Bharath Raja Bhoopal, 2021
  - Thesis title: Classification of recyclable plastic from waste using hyperspectral imaging technique
19. Akshay Y. Darekar, 2021

- Thesis title: Trajectory planning for fish-inspired robots in the presence of dynamic obstacles
20. Ajayan, 2022
- Thesis title: Development of experimental setup for robotic sorting of plastic waste
21. Ninad Kuware, 2022
- Thesis title: Prognosis and control of boiling crisis by leveraging acoustic emissions and deep learning.
22. Anugrah A. K.
- Miniaturization and Rapid Prototyping of Lizard Inspired Robot for Swarm Application

*M-Tech Thesis Ongoing*

1. Kundan Saha
2. Purusottam Pradhan
3. Kodidasu Purna Rama Sai Usha Pranav

*B-Tech Thesis Completed*

1. Delip Thomas and Srinivas Gunti, 2014
  - Thesis title: Design and fabrication of snake-inspired robots
2. Shivam Chourey and Vora Nishant, 2014 – Joint guidance with Dr. Ajay D. Thakur, Department of Physics
  - Thesis title: Development of magnetic microrobot
3. Ashesh Chattopadhyay, 2015 – Joint guidance with Dr. Rishi Raj, Department of Mechanical Engineering
  - Modeling of droplet geometry on surfaces exhibiting different contact angles
4. C. Nitish, 2015
  - Thesis title: Design and fabrication of glove for augmented reality applications
5. Samiran Mondal, 2015
  - Thesis title: Design, control and fabrication of an alligator-inspired underwater swimming robot
6. Pranav Kulkarni, 2016 – Jointly guidance with Dr. Ajay Thakur, Department of Physics

- Thesis title: Control of magnetic microrobot in the presence of environmental flow
- 7. Abhijeet Agnihotri and Raunak Srivastava, 2017
  - Thesis title: Control of quadruped gait in an alligator-inspired robot
- 8. Ashwin Goyal and Chirag Jain, 2017
  - Thesis title: Estimation of crowd density using a quadcopter
- 9. Amit Kumar and Maneesh Meena, 2018
  - Thesis title: Stair-climbing gait control of a 12-DOF quadruped robot
- 10. Kushagra Jain, 2018
  - Thesis title: Gait parameter estimation using Bayesian-optimization for an alligator-inspired robot
- 11. Santhosh Thati, 2018
  - Thesis title: Optimal trajectory planning for an anguilliform-inspired robot
- 12. Rajendra Verma and Rahul Dilare, 2019
  - Thesis title: Quadruped robot based on mammalian gait
- 13. Rishabh Shukla and Rohit, 2019
  - Thesis title: Sorting of municipal solid waste using robotic hand
- 14. Bansal Kumar and Chandan Bhatt, 2021
  - Thesis title: A deep learning-based real time computation of thrust for fish-inspired robot
- 15. Aman Kumar and Akshat Jain 2022
  - Thesis title: Modelling and simulation of adhesive force and climbing in a lizard-inspired robot
- 16. Maria and Anisha, 2022
  - Thesis title: Animal health monitoring tool
- 17. Pranay and Hareesh, 2022
  - Thesis title: Sanitization robot
- 18. Kritadhi Maity and Ayush Gupta
  - Advance Prediction of Boiling Crisis through Acoustic Signal Analysis
- 19. Anushkha Singh and Gogineni Charishma
  - 3D ObjectT Reconstruction from Multiview Monocular Images

#### *Research Engineers and Programmers*

1. Amarjeet Kumar (September 2016-September 2019)

2. Satyendra R. Nishad (September 2019-April 2022)
3. Rajeshwar Yadav (September 2019-April 2022)
4. Harshang Shah (January 2023-April 2023)
5. Ravi Shekhar Tiwari (December 2022 – May 2023)
6. Batchu Madhu Sri Kiran (September 2023 – continuing)

## **8. Invited Talks**

- Actuation and Control of Micro- and Nano- Robots for Biomedical Applications, March 2024, NIT Jamshedpur
- Fundamentals of Robotics: Mechanisms and Kinematics of Manipulators, March 2024, NIT Sikkim
- Autonomous Underwater Robotics at Various Size Scales: Challenges and Opportunities, November 2023, Paris-Saclay University & UEVE University (online)
- Bioinspired Mobile Robotics: Sensing, Actuation and Autonomy, Darbhanga College of Engineering, October 2023, Darbhanga, Bihar, India
- Teaching Methodology in Engineering Education, Bihar Institute of Public Administration and Rural Development, July 2023, Gaya, Bihar, India.
- Applications of AI and ML in Robotics: Basic Concepts, NIMS Jaipur, November 2022, Jaipur, Rajasthan, India.
- Mechatronics and Robotics Research at IIT Patna, Prayagraj Power Generation Co. Ltd., April 2022, Prayagraj, UP, India.
- Structural Health Monitoring: Collaboration proposal between IIT Patna and NTPC, National Thermal Power Generation Ltd., Vaibhav Singhal, Udit Satija, and January 2022, India. (online)
- Actuation and Control of Micro- and Nano- Robots for Biomedical Applications, IIT BHU, August 2021, Varanasi, UP, India. (online)
- Actuation and Control of Micro- and Nano- Robots for Biomedical Applications, NIT Silchar, June 2021, Silchar, Assam, India. (online)
- Actuation and Control of Micro- and Nano- Robots for Biomedical Applications, Indian Institute of Technology Indore, MP, December 2020, Indore, India. (online)
- Underwater Robotics at different size-scales, GIET Gaya, December 2020, Gaya, India. (online)

- Underwater Robotics at different size-scales, Shanghai Jiaotong University, December 2019, Shanghai, China.
- Underwater Robotics at different size-scales, NIT Silchar, May 2019, Silchar, Assam, India.
- Underwater Robotics at different size-scales, IIT Bombay, February 2019, Mumbai, Maharashtra, India.
- Research on Fish-Inspired Underwater Robot at IIT Patna, IIT Gandhinagar, October 2017, Gandhinagar, Gujarat, India.
- Introduction to Mobile Robotics, Bhagalpur College of Engineering, November 2016, Bhagalpur, Bihar, India.
- Introduction to mobile robots and research on fish-inspired underwater robots, G H Patel College of Engineering & Technology, December 2016, Surat, Gujarat, India.
- Dynamics-aware online motion planning for mobile robotic systems operating in stochastic environment, System and Controls Group, IIT Bombay, October 2014, Mumbai, Maharashtra, India.
- Magnetic Microrobot Assisted Selective Non-Prehensile Cell Micromanipulation, Indian Institute of Science Education and Research Bhopal, December 2015, Bhopal, MP, India
- Physics-Aware Planning of Robot Motion: Unmanned Surface Vehicles to Bio-Inspired Robots, 11th National Conference on Industrial Problems on Machines and Mechanisms (IPRoMM-2014), February 2014, Delhi, India.
- Robotics based indirect optical manipulation of biological cells for studying collective migration, Mahavir Cancer Sansthan, September 2013, Patna, Bihar, India.
- Robotics Research at IIT Patna, Center for Mechanical Engineering Research Institute, March 2013, Durgapur, WB, India.
- Robotics Research at IIT Patna, Center for Artificial Intelligence and Robotics, Bangalore, Karnataka, India.
- Advances in Modeling and Simulation for Physics-Aware Planning in Robotics, Indian Institute of Technology Delhi, April 2012, Delhi, India. February 2013,
- Real-Time High Fidelity Rigid Body Simulations for Virtual Environments, Tata Institute of Fundamental Research, August 2011, Mumbai, Maharashtra, India

## **9. Academic Service**

- Serving as Associate Editor of IEEE Robotics and Automation Letters (RA-L)
- Serving as Associate Editor of Journal of ASME *Journal of Computing and Information Science in Engineering* (JCISE)
- Served as reviewer for Robotics and Autonomous Systems, Robotica, Waste Management, Nature Computational Intelligence, Applied Intelligence, CAD.

## **10. Institutional Service at IIT Patna**

- Associate Dean Academic Affairs, July 2021-July 2022
- Secretary, Department Academic Program Committee of Mechanical Engineering Department, 2016-2020.
- Member, Department Purchase Committee of Mechanical Engineering Department, 2016-2019.
- Member, Committee for Developing Executive M-Tech Program in Mechatronics, 2021
- Member, Committee for Developing Dual Degree B-Tech (Mechanical)+MBA Program in collaboration with National Institute of Industrial Engineering (NITIE) 2022
- Member, Institute Wellness Center, 2018-2022