

Dr Ridhi Bansal

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Professional Profile

Experienced and certified robotics engineer with a doctorate in Robotics and Autonomous Systems. Expert in designing, fabricating, controlling, testing, and maintaining complex robotic systems. Proficient in writing powerful codes and developing cutting edge products. Ability to understand complex problems and customer needs and deliver high-quality products and solutions. Research interests are innovation and the development of futuristic systems.

Work Experience

Industrial Contractor

15/01/24-30/06/24

- **Robotics Software Engineer, SYOS Aerospace, Plymouth**
Designed solutions to automate navigation and control complex robotic platforms and autonomous systems, such as boats. Designed navigation algorithms for automated optimised locomotion. Also looked at Setting-up communication between the autonomous systems and ground control. Used Autopilot software, Python programming, Json files, and CAN bus, and MAVLink.
- **Animatronics Specialist, Scruffy Dog, Birmingham**
Worked on CAD software (Solidworks, Fusion 360) and modelling software (Rhino 3D) to design models and simulation for theme park related installations. I also worked on SprutCAM to control KUKA robot to create the immersive props. I also worked with different mechanical and electronic components to fabricate the animation effect for the pop-ups.

Robotics Research Engineer (Postdoc level), University of Bristol, UK

2019 – 2023

- **Energy Harvesting project:** Harvest energy from the environment to convert it to energy to power autonomous robots, environmental monitoring systems, and wearable healthcare sensors, providing unlimited battery life. The project involved working with electronics, DEAs, data acquisition devices, Arduino, and MATLAB.
- **Synthetic Muscle Actuation project:** Understand the working of muscles and analyse the different ways to develop artificial muscles. Built electro-skin, electro-origami structures, and soft grippers which mimic muscles. The project was associated with Jaguar Land Rover and British Telecom.
- **UoBSat, Path Finder project:** Part of the software team for launching CubeSats (Satellites) in 2020 to keep an eye on volcanic eruptions. This involved working with the infrared camera, sensors, and control boards to capture data from volcanic eruptions and analyse the information. It was done in association with RAL Space and Boeing.
- **Teaching Assistant for Robotics and AI Workshops:** Supported during teaching in workshops and lectures and helped MSc Robotics and Computer students in programming (Python, Computer Vision, Machine learning, C++, ROS, and MATLAB), design verification, and robotics topics for their final dissertation projects.
- **Responsible Innovation Facilitator:** Organise workshops and outreach events to ensure responsible innovation and research for 8 CDTs (Centres for Doctoral Training, such as Robotics and Autonomous Systems, AI, and Quantum computing). To ensure research is conducted according to safety guidelines and in a responsible way.
- **Teaching Assistant for Fluid Mechanics and Heat Transfer Unit:** Supported student teaching during lectures and workshops, topics: heat and mass transfer and fluid flows.

Research Intern (Postdoc level), NuVision, NSERP program, University of Nottingham, UK

22/06/18 - 02/09/18

- Research in association with NuVision Biotherapies and NHS to automate the process of getting maximum amniotic segments (Omnigen) and quality grading using Machine learning in Vision techniques and MATLAB. This increased the speed of the process to get the segments, reduced wastage during manual cutting, and increased the number of better-quality segments. Additional skill: 3D printing.

Internship in IPDS and MPL department, BHEL, India

19/06/17 - 04/07/17

- Submitted a project on 3D modelling (IPDS, pipe routing, and equipment placing) in SmartPlant 3D software.
- Worked on MPL (CAESAR, Proposal, and engineering processes) Additional skill: AutoCAD, 3D

Software and Marketing Internship, Thingple, Shanghai, China

10/07/17 - 03/08/17

- Increased computer architecture efficiency and trained employees by changing storage and file setup from Virtual Machine to Docker. Researched the company's market potential for Radio Frequency Identification.

Supervisor, Universal Industries, India

15/12/16 - 06/01/17

- Supervised a production team of 20 to make shafts using Computerised Numerical Controlled machines. Managed customers and stakeholders

Founder and Manager, 'Classical Divas' Dance Academy, India

01/04/15 - 31/08/16

- Founded a dance academy to teach Indian classical dance and managed its finances and curriculum.
- Gained entrepreneurial, negotiation and communication skills during this endeavour.

[More information on each work experience on this link to LinkedIn](#)

Technical Skills

C++, Python, Java, ROS, Gazebo, MATLAB, robot simulation, digital twins, Simulink, Simscape, Nvidia Omniverse, Isaac Sim, designing of robots, robot controls, Arduino programming, protocols and frameworks (MAVLink, Ardupilot, etc), CAD/CAM, Creo, electronics, TensorFlow, SolidWorks, 3D printing, Docker, Virtual Machine, Machine Learning, Computer Vision, SprutCAM, Rhino 3D, Product design and development, mathematical modelling, robotics control, electronics, fluid dynamics/control, thermodynamics/heat transfer, web development, technical documentation, manufacturing, moulding, C, ABAQUS, FLUENT, SQL, e, Verilog, EAGLE, Basic, and Q-Basic.

Professional Skills

Project Management, research and innovation, time management, stakeholder and client management, frugality, communication, leading and managing diverse teams, and teamwork.

Education:

- PhD: Robotics and Autonomous Systems, FARSCOPE, University of Bristol (UoB) 2019 - 23
FARSCOPE CDT includes additional entrepreneurial, professional, and industrial training in robotics and automation.

PhD thesis topic- 'Soft Scalable Self-reconfigurable Modular Cellbot'

A self-configurable autonomous soft shape adapting modular robot. The modular units were bio-inspired from cells. The project developed simulation models and physical robots which could self-adapt their morphology and choose a desired control to locomote over different frictional terrains and perform different gaits. The robot was robust, energy efficient, fault tolerant, and employed a simple structure and control to perform complex behaviours, and could autonomously self-attach and self-detach units to adapt its shape or remove damaged cells. The study looked at the effects of actuation functions, the number of connected units, different robot morphologies, and friction values on robot locomotion. The aim was to optimise for desired locomotion gait. The potential applications for this technology are - outer space exploration, search and rescue for disaster affected areas, nuclear decommissioning, internal medical procedures, and turbine and pipe inspections. Simulations are created using Simscape and Simulink MATLAB models. Pneumatic control, linear actuators, Arduino, and sensors are used to control the physical robots. The robotic units are designed, manufactured, and cast from scratch for this project. Solid Works, 3D printing, Moulding, Casting, and CNC manufacturing were used to design and develop the robots. Computer Vision was used to control the inflation/deflation of units to generate robot locomotion.

Industrial projects: Projects to find solutions to the challenges faced by industries.

1. [Toshiba](#) (2021): Developed a solution to automate storage/retrieval process of a unit from a storage space of unknown dimension, while minimising energy, cost, time and maximising storage capacity.
2. [Thales Alenia Space](#) (2019): Designed a robotic manipulator and isolator unit for to test geological samples from Mars. Also, explored the legal and economic impacts of space sector.

[More information on each project on this link to LinkedIn](#)

- MRes; Robotics and Autonomous Systems, UoB (1st class honours, GPA 4.0/4.0), 2019 - 20
Projects and relevant units:

- **ROMI Path Finder:** Worked with sensors and Arduino to make a mobile robot detect and follow an obstacle course.
- **Bio-Inspired AI:** Designed a start-up pitch to improve the education system by using interaction feedback and artificial intelligence to adapt difficulty levels and types of games according to a child's needs.
- **Human-Robot Interaction (HRI):** Conducted a user study aimed to improve HRI by understanding human tolerance level and disagreement while interacting with a robot on a controversial topic.
- **Amazon Pick and Place Challenge:** Programmed robot to detect desired objects on a shelf then grip and place it in a bin. Used Vacuum controller, ROS, gazebo simulations, UR10, and vision (yolov3).
- Some of the units: Uncertainty Modelling, Intelligent Systems, Robotic Systems, and Robotic Technical skills.

[More information on each project on this link to LinkedIn](#)

- BEng (Hons); Mechanical Engineering, University of Nottingham (UoN) (1st class honours GPA 4.0/4.0) 2016 - 19
Dissertation- 'Autonomous Path Planning of Robots for Assembly Task' 01/10/18 - 12/06/19

Automated path planning process for an industrial robot (UR5) using Ant Colony Optimisation algorithms in a Digital Twin environment (Gazebo Simulation Software) before transferring it to an actual robot. The shortest collision free path was detected in both 2D and 3D environments. Inverse Kinematics was used to find robot joint angles. Programming was done in Python and MATLAB in ROS Environment.

[More information on educational qualifications on this link to LinkedIn](#)

Projects and relevant units:

- **Machine Learning:** Detected facial expressions using Neural Network, Decision Trees, and SVM.
- **Design and Manufacturing- 'Pneumatic Pick and Place Machine' (2016-17), 'Clutch' (2017-18), and 'Marine gearbox' (Jan - May 2018):** Amalgamated creative and technical skills to design machines using Computer Aided Engineering software (CREO) and manufactured them using CNC machines, lathe, drilling press, band saw, and milling machine.
- Some of the units: Machine Learning, Controls, Computer Modelling, Stress Analysis and Materials, Design and Manufacture, Thermodynamics, Fluid properties, Dynamics, Mechanics, Electronics, and Management.

Publications

- **Bansal, R.**, et al. (2023). "[Self-reconfiguring Soft Modular Cellbots](#)" In 2023 IEEE International Conference on Soft Robotics (RoboSoft) (pp. 1-6). IEEE. [\[Video for robot movement\]](#)
- **Bansal, R.**, et al. (2022). "[A Scalable Soft Robotic Cellbot](#)". In Biomimetic and Biohybrid Systems: 11th International Conference, Living Machines Proceedings, Springer International Publishing (pp. 199–211). [\[Video for robot movement\]](#)
- **Bansal, R.**, et al. (2019, Sept). "[Ant Colony Optimization Algorithm for Industrial Robot Programming in a Digital Twin](#)". In *25th International Conference on Automation and Computing (ICAC)* (pp. 1-5). IEEE.
- Ahmadiéh Khanesar, **M.**, **Bansal, R.**, et al. (2020). "[XOR Binary Gravitational Search Algorithm with Repository: Industry 4.0 Applications](#)". *Applied Sciences*, 10(18), 6451.
- Khanesar, M. A., **Bansal, R.**, et al. (2019, Oct). "[XOR Binary Gravitational Search Algorithm](#)". In *2019 IEEE International Conference on Systems, Man and Cybernetics (SMC)* (pp. 3269-3274). IEEE.
- Syam, W. P., **Bansal, R.**, et al. (2019). "[Image processing algorithm to determine an optimised 2D laser cutting trajectory](#)". In *25th International Conference on Automation and Computing (ICAC)* (pp. 1-6). IEEE.

Awards

- Nottingham Engineering Excellence Scheme Award for being in top 5% of department of 350 students (2016-17).
- [Bristol Plus](#) award for taking on challenging projects, co-curricular activities and attending insightful seminars. (2021)
- [BP excellence prize](#) (2018) for excellence in academics and co-curricular.
- [Outstanding Female Entrepreneur](#) (2018) for depicting professional and entrepreneurial skills.
- 3 Head of Department medals, University of Nottingham for academic excellence (2016-17, 17-18, and 18-19).
- [Nottingham Advantage Award](#) (NAA) (09/10/16-30/11/17) - Expanded my skill set by completing 3 co-scholastic modules (Boots Commercial Enterprise, Capital One - Business Decision Making, and Student as Change Agents).
 - o [Boots](#): Conducted Market analysis to design and develop a product to fill the market gap. Developed a product lifecycle plan, business, financial, and commercial plan, and pitched the project to investors.
 - o [Capital One](#): Business analysis by assessing numerical, strategic, and financial data for Credit Risk Management. Gave a presentation at the office headquarters to pitch my business plan.
 - o [Student as Change Agents](#): Designed survey and did analysis to predict the trend in education in small group settings and its benefits.

[For more information on each of the NAA projects](#)

- Won locomotion challenge for successful completion of robot course inside a pipe at [Robosoft](#), IEEE (2023)
- Best Undergraduate Course Representative at the University of Nottingham (2017-18).
- Gold medal (2019) and Silver medal (2018) in recognition of hard work with Education Network.
- Best research poster, Nottingham Summer Engineering Research Program, NSERP (2018).
- 1 Principal Gold Card, 3 Vice Principal Awards, 9 Principal honour cards, and 252 Teacher Awards (MCS).
- 3 First class Bachelor's Degrees - 1. Mechanical Engineering, University of Nottingham in 2019; 2. In classical dance, Kathak from [Kathak Kala Kendra](#) (5-year course) in 2014; and 3. In classical dance, Kathak from [Prayag Sangeet Samiti](#) (5-year course) in 2009.
- Awards in co-curricular: Pottery, Musical instruments, Painting, PowerPoint (2011), Math Olympiads (2011 and 2015).

[More information on each award on this link to LinkedIn](#)

Leadership Roles

- [Student Representative](#) at the University of Bristol to help my cohort have a better academic experience (2019-23)
- [EDI \(Equality, Diversity, and Inclusion\)](#) Representative at the University of Bristol to support students from minority groups (2020-23)
- Member on [Academic Appeals and Misconduct Panel](#) at the University of Nottingham (2017-18, 2018-19).
- [Course Representative](#) at the University of Nottingham (2017-18, 2018-19).

[More information on each role on this link to LinkedIn](#)

Volunteer Work

- [Outreach Ambassador](#) (2019-2023) to spread awareness about STEM education.
- Funded and trained 5 students free of cost at 'Classical Divas' from disadvantaged backgrounds every year in dance and creative skills to increase their self-reliance (2015-16).
- Lead team of 20 at '[Let's Strive Foundation](#)' to educate underprivileged in STEM subjects (2016).
- Volunteered as a fire safety representative in Willoughby Hall student accommodation (2017-18).
- [Switch off student ambassador](#) to increase awareness among students to save the environment (2018-19).

[More information on each volunteer work on this link to LinkedIn](#)

Membership

- IEEE: [RAS](#), [WIE](#), [EMBS](#), [Young Professionals](#)
- Council IEEE: [Nanotechnology](#), [sensors](#), [RFID](#)

Languages

- English (Fluent), Hindi (Fluent), French (Basic), Mandarin (Basic), Punjabi (Basic)