Ravi Vaidyanathan

Reader in Biomechatronics
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Career Synopsis

- Biomechatronics academic; research focus in sensory-motor control and cybernetics
- Director: *Biomechatronics Laboratory*, Imperial College London (18 full-time researchers)
- Awarded 20+ research grants in the US, UK, and Singapore; £10 million+ in support
- Authored 50+ journal publications; 4 patents, 5000+ citations, H-index 28 (Google Scholar)
- Inventor on 5 pending patents; 4 spin-out companies founded from academic research; former holder of 2 industrial directorships
- Recipient of international accolades for research innovation from organizations including: Google, Sony, IEEE (Robotics/Automation Society), IET (UK), UK National Health Service, SAGE Publishers, Robotics Society of Japan (RSJ), AIAA, and many others
- Research featured for impact in public press on 30+ occasions by groups including: New Scientist, the Discovery Channel, ITV News, Gadget Show, IEEE Spectrum, and the BBC

Education

Ph.D., Mechanical Engineering (Bioinspired Systems), Case Western Reserve University (Case), Cleveland, Ohio, USA, 2001
Dissertation: "An Insect-Inspired Orientation Reflex for Autonomous Vehicles"

M.S. Mechanical Engineering (Robotics and Control), Case Western Reserve University (Case), Cleveland, Ohio, USA, 1996

Professional Experience

Full-Time Academic Appointments

- Senior Lecturer/Reader in Biomechatronics, Department of Mechanical Engineering, Imperial College London, London, UK 5/11-present
- Senior Lecturer in Biologically Inspired Systems, Department of Mechanical Engineering, University of Bristol, Bristol, UK 1/08-5/11
- Senior Fellow in Neural Engineering, School of Rehabilitation Sciences, University of Southampton, Southampton, UK 10/06-12/07

Selected Industrial Appointments

- Chief Technology Officer (co-founder), Serg Tech, London, UK 7/19-present
- Research Director (co-founder), AthleTec, Inc., Manchester, UK 10/15-present
- Chief Executive Officer (co-founder), BioRobots, Ltd., Cleveland, USA 7/03-9/06

Selected Honours and Awards

Finalist: Best Paper: *IEEE Intl Conf on Advanced Robotics & Mechatronics (ARM)* July 2022
Microphone Mechanomyography Sensors for Movement Analysis and Identification; nominated "Best Paper in Conference"; "Best Robotics Paper"; "Best Mechatronics Paper"

Google Research Innovation Award Nov 2021
Improving engagement in human-robot interaction and facilitating mental health telemedicine; Award (financial gift) from Google recognising dementia robotics research

Finalist: Best Paper: *IEEE Transactions on Mechatronics* June 2021
IEEE Transactions on Mechatronics; 1 of 5 finalists for **Best Paper in Journal** (2020) "An Extended Complementary Filter for Full-Body MARG Orientation Estimation"

Winner: Sony Start-up Acceleration Program May 2021
Spinout company *Serg Tech* 1 of 4 winners in Sony Europe start-up boot camp

Featured Presenter: Prime Minister's Roundtable on British Technology June 2018
Invited as 1 of 7 presenters 'showcasing top British Technology' to UK Prime Minister's technology roundtable at 10 Downing Street (Prime Minister's Residence), London

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Best Paper*: IEEE Int. Conf on Intelligent Systems Engineering (ICISE)* March 2018
"Walking Activity Recognition with Sensor Array using CNNs", Kuala Lumpur, Malaysia

Featured Speaker: New Scientist Live Sept 2017
Featured speaker at science showcase, *New Scientist Live Festival* (30,000 attendees)

Winner: UK Institute of Engineering Technology (IET) Innovation Award June 2016
"Most Promising Innovation in Robotics" (Robot Therapy for Parkinson's Disease)

Finalist: UK Big Chip Digital Industry Award June 2016
"Most Innovative Application of Technology" (Corner Smart Boxing System)

Winner: UK National Health Service (NHS) Innovation Challenge Jan 2016
"Innovations for self-rehabilitation and monitoring of arm disability"

Best Paper: *Journal of System and Control Engineering* (SAGE) May 2013
"Reflexive Control Based on a Neural Model of the Cockroach Escape Response"

Winner: N-Power Energy Challenge June 2010
Faculty advisor to team winning first prize out of several hundred entrants in the UK and Germany; solution presented at UK Parliament June 2010

New Technology Foundation Award on Robots and Systems Oct 2007
"Human Medical Assist based on Aural Flow"; sponsored by Robotics Society of Japan; awarded as one of the most innovative robotics worldwide from 1987-2007

Best Paper: *IEEE Intl Conf on Intelligent Robots and Systems (IROS)* Aug 2005
"Human-Machine Interface for Tele-Robotic Operation Based on Aural Flow", Sendai, Japan

Selected Research Grants (taken from 20+ in total)

1. Co-Lead Investigator, NuRO.sense - An intelligent wearable to identify, assess and monitor the motor symptoms of neurodegeneration, Innovate UK grant 10022189, £520,000, June 2022-Dec 2023
2. Co-Lead Investigator, *Closed-Loop Electronic Stimulation (ES)- Mechanomyogram Sensor (MMG) System for Passive Tremor Suppression Treatment*, National Institute of Health Research (NIHR) Grant NIHR202133, April 2021-April 2023, £1 million
3. Principal Investigator: *Robotics*, Co-Investigator, *Dementia Research Institute Care Research & Technology Programme*, UK Medical Research Council (MRC), Alzheimer's Society, and Alzheimer's Research UK, June 2019-June 2025, £20 million
4. Co-investigator, *Mechanical Muscle Activity with Real-time Kinematics (M-MARK*, UK NIHR Grant II-LB-0814-20006, Nov 2015-Nov 2017, £1 mil
5. Research Board Member, *Centre for Doctoral Training (CDT) in Neurotechnology*, UK EPSRC, Oct 2013-Oct 2018, £10 million
6. Principal Investigator, *Robotic Instruments for Adaptive Neurostimulation and Interface with the Basal Ganglia*, Engineering and Physical Sciences Research Council (EPSRC) Centre for Doctoral Training (CDT) in Neurotechnology, £330,000, Oct 2016-Oct 2021

Patents

1. R Vaidyanathan, R. Woodward, N. Nowlan, S. Shefelbine, *Biomechanical Activity Monitoring,* US Patent 10,335,080 B2, 2019; UK patent GB2519987 B, 2021 (EU EP3065628A1; pending),
2. R Vaidyanathan, S Wilson, D Farina, T Watts, *A muscle stimulation and monitoring apparatus*, UK patent Application 2019867.7, final disposition pending
3. R Vaidyanathan, S F Atashzar, C S Mancero, S Wilson, *A Mechanomyography Apparatus and Associated Methods*, UK patent application: 2010270.3, final disposition pending
4. S Vanaswami, P Iyengar, C Raikar, R Vaidyanathan, *Adaptive Learning System for Localizing and Mapping User and Object using an Artificially Intelligent Machine*, Indian Patent Office - E-106/201/2020/MUM; International PCT/IN2021/050165; EU/USA pending

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Selected Refereed Publications (taken from 60+ in total; 25 + in last 2 years)

- C S M Castillo, **R Vaidyanathan**, S F Atashzar, " Synergistic Upper-limb Functional Muscle Connectivity using Acoustic Mechanomyography", *IEEE Transactions on Biomedical Engineering*, doi: 10.1109/TBME.2022.3150422, 16 pp, 2022
- M Wairagkar, M R. Lima, D Bazo, R Craig, H Weissbart, A C Etoundi, T Reichenbach, P Iyenger, S Vaswani, C James, P Barnaghi, C Melhuish, **R Vaidyanathan**, "Emotive Response to a Hybrid-Face Robot and Translation to Consumer Social Robots", *IEEE Internet of Things Journal*, 9, 5, pp 3174-3188, doi: 10.1109/JIOT.2021.3097592, 2022
- W Huo, H Moon, M A Alouane, V Bonnet, J Huang, Y Amirat, **R Vaidyanathan**, S Mohammed, "Impedance Modulation Control of a Lower-Limb Exoskeleton to Assist Sit-to-Stand Movements", *IEEE Transactions on Robotics*, 38, 2, pp 1230-1249, doi: 10.1109/TRO.2021.3104244, 2022
- N Natarajan, S Vaitheswaran, M Lima, M Wairagkar**, R Vaidyanathan**, "Acceptability of Social Robots and Adaptation of Hybrid-Face Robot for Dementia Care in India*", American Journal of Geriatric Psychiatry*, 30, 2, pp 240-245, doi: 10.1016/j.jagp.2021.05.003, 2022
- M Lima, M Wairagkar, M Gupta, F Rodriguez Y Baena, P Barnaghi, D J. Sharp, **R Vaidyanathan**, "Conversational Affective Social Robots for Ageing and Dementia Support", *IEEE Transactions on Cognitive and Developmental Systems*, doi: 10.1109/TCDS.2021.3115228, 20 pp, 2021
- C. Caulcrick, W. Huo, W. Hoult, **R. Vaidyanathan**, "Human Joint Torque Modelling with MMG and EMG During Lower Limb Human-Exoskeleton Interaction," *IEEE Robotics and Automation Letters*, 6, 4, pp. 7185-7192, doi: 10.1109/LRA.2021.3097832, 2021
- N Natarajan, S Vaitheswaran, M Lima, M Wairagkar, **R Vaidyanathan**, "Acceptability of Social Robots and Adaptation of Hybrid-Face Robot for Dementia Care in India: A Qualitative Study", *American Journal of Geriatric Psychiatry*, 10.1016/j.jagp.2021.05.003, 8 pp, 2021
- M Lima, M Wairagkar, N Natrajan, S Vaitheswaran, **R Vaidyanathan**, "Robotic Telemedicine for Mental Health: A Multimodal Approach to Improve Human-Robot Engagement*", Frontiers in Robotics and Artificial Intelligence*, 8, 37, pp 1-16, doi: 10.3389/frobt.2021.618866, 2021
- L. Formstone, W. Huo, S. Wilson, A. McGregor, P. Bentley, **R. Vaidyanathan**, "Quantification of Motor Function Post-Stroke Using Novel Combination of Inertial and Mechanomyographic Sensors," *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 29, pp. 1158-1167, doi: 10.1109/TNSRE.2021.3089613, 2021
- S O H Madgwick, S Wilson, R Turk, J Burridge, C Kapatos, **R Vaidyanathan**, "An Extended Complementary Filter (ECF) for Full-Body MARG Orientation Estimation*", IEEE Transactions on Mechatronics*, DOI: 10.1109/TMECH.2020.299229610 pp, 2020 (**Finalist: Best Paper**)
- W Huo, P Angeles, S Wilson, Y F Tai, N Pavese, M Hu, S Wilson, **R Vaidyanathan**, "A Heterogeneous Sensing Suite for Multisymptom Quantification of Parkinson's Disease", *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, DOI: 10.1109/TNSRE.2020.297819710, 10 pp, 2020
- F. Russell, P. Kormushev, **R. Vaidyanathan**, P. Ellison, "The Impact of ACL Laxity on a Bicondylar Robotic Knee and Implications in Human Joint Biomechanics*," IEEE Transactions on Biomedical Engineering*, 67, 10, pp. 2817-2827, DOI: 10.1109/TBME.2020.2971855, 2020
- M. Hopkins, **R. Vaidyanathan**, A. H. McGregor, "Examination of the Performance Characteristics of Velostat as an In-Socket Pressure Sensor," *IEEE Sensors Journal*, 20, 13, pp. 6992-7000, doi: 10.1109/JSEN.2020.2978431, 2020
- S Wilson, H Eberle, Y Hayashi, S O H Madgwick, A McGregor, XJ Jing, **R Vaidyanathan**, "Formulation of a New Gradient Descent MARG Orientation Algorithm: Case Study in Robot Teleoperation", *Mechanical Systems and Signal Processing*, 130, 1, pp 183-200, 2019
- RB Woodward, MJ Stokes, SJ Shefelbine, **R Vaidyanathan**, "Segmenting MMG Muscle Activity Phases Using Inertial Data*", Nature: Scientific Reports*, 9, 1, 5561, 1-10, 2019
- R Woodward, S Shefelbine, **R Vaidyanathan**, "Gait analysis using pervasive motion tracking and mechanomyography Fusion", *IEEE Transactions on Mechatronics*, 22,5, 2022-33, 2017