
Editorial

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Biographical notes: S.G. Ponnambalam has earlier served as a Full Professor at the Faculty of Manufacturing and Mechatronics Engineering Technology at University Malaysia Pahang and in the School of Engineering at the Monash University Malaysia. His area of expertise includes manufacturing, optimisation, and swarmrobotics. He is serving as an Associate Editor and as editorial board member for many international journals. He has over 300 articles published in various referred journals, refereed conferences. His articles are published in different peer reviewed journals those include *International Journal of Production Research*, *International Journal of Advanced Manufacturing Technology*, *Journal of Cleaner Production*, *Computers & Industrial Engineering*, *Journal of Intelligent Manufacturing*, and *IEEE Transaction on Cybernetics*. He is holding a senior membership positions in various professional institutions such as, Fellow of Institution of Mechanical Engineers (UK), Fellow of The Institution of Engineers (India), senior members of IEEE (USA) and also holding CEng (UK) certification.

D. Dinakaran has about 18 years of experience in teaching, research and industry in the field of robotics and automation. He is one of the key persons in the development of a service robot called 'SEVILI' which was deployed in COVID 19 isolation wards at government hospitals. He has many research projects funded by DST-SERB, Royal Academy of Engineering, UK, and MTRDC-DRDO. He has research collaborations with leading universities like Warwick University, Northampton University, Leeds University, and London Southbank University. Under his guidance five scholars have completed their PhD degree. To his credit, he has published about 50 research papers in reputed international and national journals. He has been awarded as a Young Technology Faculty by EET India for his research and academic excellence. He is an executive member of condition monitoring society of India and member of IEEE, IET, ISNT, ISTE and AUVSI.

M.M. Ramya research activities focus on machine learning, with particular emphasis on image processing applications. She has published over 40 refereed papers and two chapters in books. She has over 15 PhDs in her research team with funding over Rs. 2 crores sponsored by funding agencies like DRDO, Royal Academy of Engineering, UK. She is an Associate Editor of *Image Analysis and Stereology*, life member of Institution of Engineering and Technology and board member of International Society for Stereology and Image Analysis.

R.M. Kuppan Chetty has about 15 years of experience in teaching, research, and industry in the field of robotics and automation. His research interests are in the field of intelligent robotics, path planning and navigation, heuristic approaches, magnetic and electrostatic actuators, sensors and artificial perception, etc. He is currently involved in a joint research project funded by Royal Academy of Engineering, UK and completed projects funded by various agencies. He has published about 40 research articles in peer reviewed international journals and conferences and edited book proceedings. He has been awarded with National Doctoral Fellowship (NDF) from AICTE and research internships from National Institute of Informatics (NII), Tokyo, Japan and from PMAR dimec, University delgi Genoa, Italy. He is a senior member of IEEE – Robotics and Automation Society and also a member of IE (India), IACSIT and SPIE.

1 Introduction

The Second International Conference on Robotics, Automation and Non-destructive Evaluation (RANE – 2019), was held during 29th and 30th August 2019, at Hindustan Institute of Technology and Science (HITS), Deemed to be University, Chennai, India. This conference is an annual event organised by Centre for Automation and Robotics (ANRO), HITS and sponsored by Royal Academy of Engineering UK. RANE 2019 attracted about 100 research articles under the verticals of robotics, automation and non-destructive evaluation. All the articles were blind reviewed by at least three domain experts. After strict review process, 39 research papers were selected for presentation in the conference, with the acceptance rate of 39%.

Amongst the 39 research papers that were presented at the conference, 11 papers were selected and recommended by the panel of experts for possible publication in the RANE 2019: Special issue on: ‘Intelligent mechatronic systems and additive manufacturing’, *International Journal of Advanced Mechatronic Systems*.

These articles were extended versions presented in the conference and once again underwent blind review by a minimum of two field experts. Out of 11 articles, 7 research articles were accepted for publication in the special issue. The research reported in these seven papers are presented with the paper title and the work reported in brief.

‘Obstacle avoidance system and wireless communication for an unmanned underwater vehicle for low depth water surfaces’ – the design and development of an unmanned underwater vehicle (UUV) with integration of sensor-actuator network to avoid obstacles. The hydrodynamic behaviour of the proposed UUV is carried out through computational fluid dynamics (CFD). The motion analysis is carried out for pure surge and heave motions along with the obstacle avoidance and the performance results are reported discussed.

‘Maze path planning of mobile robots by gradient map rendering and gradient follow’ – Path planning of mobile robots’ operation in a maze is addressed in this work through gradient map rendering algorithm. A maximum or minimum local gradient technique is used to find its way to destination cells and provides an optimised path for the robots while in maze. Performance of the proposed algorithm is investigated through simulations in MATLAB and the results are presented and discussed.

‘Structural design and analysis of a lower limb exoskeleton for elderly’ – presents the design of the lower limb exoskeleton to assist elderly people during sit-to-stand (SIS) cycle. The exoskeleton is designed with the adaptability to varying body shapes of elderly and tested for its structural strength. Structural analysis for stand position and the modal analysis for determining the natural frequency vibrations is carried out in Ansys. The deformation of the exoskeleton with respect to the mode vibrations is presented and discussed.

‘Machine learning based ovarian detection in ultrasound images’ – presents an intelligent automatic detection and ovarian classification with grading based on integration of intensity and texture features using artificial neural network. Three texture features such as autocorrelation, sum average and sum variance obtained from grey level co-occurrence matrix (GLCM) and intensity obtained using k-means clustering were fed as input to the multilayer feedforward backpropagation network for ovarian detection. Ovarian morphology was used for classification and grading of ovary. This novel technique helps the physician to grade the follicle/cyst. Performance metrics like sensitivity, specificity, accuracy, precision, F-measure, Mathew’s correlation coefficient and receiver operating characteristic curve were used to prove the effectiveness of the proposed machine learning-based ovarian detection (MLOD). The MLOD classifier yielded an average detection accuracy of 96% which is an increase of 2% as compared to the combined texture and intensity based ovarian classification (TIOC) algorithm.

‘Design and development of robotic end-effector position measuring device’ – presents a cost-effective solution for the measurement of position of robot end-effector. An end-effector position measuring device is designed and developed in spherical coordinate system using two absolute rotary encoders and a draw-wire sensor. A mathematical model for the end-effector position measuring device is developed to determine the position of the end-effector with respect to a reference coordinate system using 3D homogeneous transformation approach. End-effector position measuring device is tested for ABB IRB 1600 for numerous poses and for a straight-line path. The newly developed end-effector position measuring device is found to be capable of measuring the end effector position with an accuracy of 2 mm and hence can be implemented in calibration of industrial robots.

‘Platform tilt stabilisation using inertial measurement unit sensor’ – presents a development of low cost two-axis pan-tilt platform stabilisation setup using a low-cost inertial measurement unit (IMU) sensor, utilise elegant and widely used sensor fusion and control algorithm, and demonstrate the performance of such a system. Techniques such as sensor bias removal, digital low pass filtering (DLPF) and sensor fusion algorithms are deployed for platform stabilisation. A first-order impulse response (FIR) filter is chosen as the DLPF algorithm and the complementary filter (CF) is chosen as the sensor fusion algorithm as these are widely recognised for their need of very less computational power. Finally, the pan-tilt stabilisation is performed by two separate PID servo control tuned using Zeigler-Nichols manual tuning rules and finally the performance of the control system in tracking the angular estimates is finally studied.

‘Development of pass-through augmented reality interface for human robot interaction’ – presents a vision based pass-through augmented reality system is developed that enables the user to command the mobile robot for

various mobility and navigation tasks. A pass-through augmented reality setup is achieved by a combination of a typical virtual reality headset and a stereo camera with depth perception. The stereo camera and a leap motion sensor mounted on a wearable VR headset acts as the vision system for the user and the gesture recognition system

respectively. Necessary graphical user interface with the list of functions and information will appear on the VR headset display from which the user can select the option/command to be given to the mobile robot. The gesture made by the user in the GUI is detected and communicated to the robot through wireless means to perform the corresponding task.