

2021 IEEE 16th International Conference on Industrial and Information Systems (ICIIS 2021)

Kandy, Sri Lanka
12 September – 12 November 2021



IEEE Catalog Number: CFP2158A-POD
ISBN: 978-1-6654-2638-1

**Copyright © 2021 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP2158A-POD
ISBN (Print-On-Demand):	978-1-6654-2638-1
ISBN (Online):	978-1-6654-2637-4
ISSN:	2164-7011

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

Table of Contents

Conference Organizing Committee	iii
International Review Panel	vi
Message from the General Chair, ICIIS 2021	viii
Keynote Speakers	ix
Author Index	xv

Session 1 Track AISIP (Room A)

Session Chair: Dr. Achala Pallegedara Session Co-Chair: Dr. Janaka Wijayakulasooriya

Underground Water Leakage Detection Using Magnitude Squared Coherence

Malith M. Rathnayake, Kanishka Ravindranath, Janaka Wijayakulasooriya, 1
Ruhan Deshapriya

Deep Learning-Based Consumer Profiling From Smart Meter Data

Pamuda Balasuriya, Ranilka Perera, Sachini Rajapaksha, Janaka Wijayakulasooriya, 6
Janaka Ekanayake, Ronald Comester, Lankanath Deshapriya

EEG Based Neuromarketing Recommender System for Video Commercials

Sathsarani K Bandara, Uvini C Wijesinghe, Badra P Jayalath, 11
Saumya K Bandara, Prasanna S. Haddela, Lumini M. Wickramasinghe,

Multispectral Imaging System to Estimate Sugar Adulteration Level of Black Tea

E. M. S. L. B. Ekanayake, W. A. N. D. Wickramasinghe, A. D. Wijesinghe, 17
D. Y. L. Ranasinghe, M. A. C. S. Wijedasa, H. M. H. K. Weerasooriya,
M. P. B. Ekanayake, H. M. V. R. Herath, G. M. R. I. Godaliyadda, T. Madhujith

Optimum Music: Gesture Controlled, Personalized Music Recommendation System

Ravin Wijekoon, Dilshan Ekanayaka, Mahela Wijekoon, Dewmal Perera, 23
Pradeepa Samarasinghe, Oshada Senaweera, Ajantha Peiris

Integrated Video Based Crowd Density Forecasting Framework with a Review of Crowd Counting Models

L. B. I. P. Thilakasiri, D. M. P. M. Alwis, R. T. Nanayakkara, G. M. R. I. Godaliyadda, 29
M. P. B. Ekanayake, H. M. V. R. Herath, J. B. Ekanayake

Session 1 Track CIE (Room B)

Session Chair: Prof. Disala Uduwawala Session Co-Chair: Dr. M.U.S. Navarathne

Bandwidth Optimization for Fleet Monitoring Systems

Subodha Gunawardena, Tharukshti Dissanayake, Pasindu Piyathilaka, Rasha Mohammed 35

Integrated RAN to Meet the QoS of Modern Wireless Application

Sameer Kumar Singh, Rohit Singh, Brijesh Kumbhani 40

Design of a Passive RFID Tag Antenna with a Modified T-match Structure

Shyama Wickramasinghe, Jeevani Jayasinghe, Melaka Senadeera 46

Performance Improvement of Printed Log Periodic Dipole Array Antennas

H. M. S. M. Herath, J. M. J.W. Jayasinghe, D. N. Uduwawala 52

Feasibility Study on the Use of Printed OLEDs for Wireless Data and Power Transmission in Light-Based Internet of Things (LIoT)

Amila Perera, Marcos Katz 58

Study of a Switch Architecture for Survivable Routing in Elastic Optical Networks

Krishanthmohan Ratnam, Roshan G. Ragel, Suthaharan Satkunarajah, Balakayan Kumaravel 62

Session 1 Track CCDM (Room C)

Session Chair: Dr. Dhammadika Elkaduwa Session Co-Chair: Dr. Isuru Dissanayake

Product Recommendation and Context Validation Based E-Commerce System With Currency Free Economy

D. T. Siriwardana, H. Ulpathakumbura, T. Wanniarachchi, L. Bhagya, Samantha Thelijjagoda 68

Imputing Large Gaps of High-resolution Environment Temperature

Lakmini Wijesekara, Liwan Liyanage 74

Blockchain Based Employee Rewarding System Assajie Bandara, Anjana Illankoon, Rasanga Jayaweera, Hashini Dassanayake	80
--	----

Expert Prediction System for Spice Plants Grown in Sri Lanka: An Incentive for Planters Rashmi Gunasekara, Hasarangi Withanage, Nethmini Wimalachandra, Lakshitha Hettiarachchi, Buddhima Attanayaka, Samantha Thelijjagoda,	86
--	----

Data Mining System for Predicting a Winning Cricket Team Dinithi Hasanika, Roshani Dilhara, Dulanjali Liyanage, Asitha Bandaranayake, Sampath Deegalla	92
--	----

Session 1 Track PEHV (Room D)

Session Chair: Prof. Sunil Abeyratne Session Co-Chair: Prof. Aruna Gunawardena

An Image Based Approach of Energy Signal Disaggregation Using Artificial Intelligence Manuri Senarathna, Madhawa Herath, Thakshila D. Thilakanayake, Migara H. Liyanage, Chitral J. Angammana	98
---	----

Time Optimal Control of Active Loads in DC Microgrids Ramitha K. Dissanayake, Ujala Anuradhi, Anushka M. Dissanayake	104
--	-----

Proper Grid Voltage Control For Distribution System With High Solar PV Integration W. M. P. S. Wijethunga, Y. M. B. C. Yapa, Shanmugarajah Vinothine, Rajan Ratnakumar, Arulampalam Atputharajah	110
--	-----

Flexibility Metric For Power System Planning Under Forecast Uncertainty Akila Herath, Kithsiri M. Liyanage, M. A. Mohammed Manaz, Taisuke Masuta, Chan-Nan Lu	116
---	-----

Semi-Automated Tool for Location Identification to Improve the Solar PV Penetration in Sri Lanka Anushika Lakmini, L. P. M. A. Liyanage, Sahras Hamsa, A. L. A. P. A. Kumara, M. A. U. S. Navaratne, Akila Herath	122
---	-----

A Voltage Regulating Radial Feeder With Enhanced Hosting Capacity Under Constrained Conditions

Kamesh I. B. Heenkenda, Ravindi S. Ranatunga, Thimila B. Ranaweera,
Sunil Gamini Abeyratne, Kirthi S. Walgama, G. A. I. Mihindukulasuriya

128

Session 2 Track AISIP (Room A)

Session Chair: Prof. Roshen Ragel Session Co-Chair: Dr. Maheshi Dissanayake

Sentiment Classification of Sinhala Content in Social Media: A Comparison Between Stemmers and N-Gram Features

Pradeep Jayasuriya, Ranjiva Munasinghe, Samantha Thelijjagoda

134

Sentiment Classification of Sinhala Content in Social Media: An Ensemble Approach

Pradeep Jayasuriya, Ranjiva Munasinghe, Samantha Thelijjagoda

140

Critical Sentence Identification in Legal Cases Using Multi-Class Classification

Sahan Jayasinghe, Lakith Rambukkanage, Ashan Silva, Nisansa de Silva,
Amal Shehan Perera

146

Real-Time Sinhala Writing Assistant for Kids

A. L. D. S. Arambewela, Supunmali Ahangama, D. M. A. K. Dissanayake

152

Part of Speech Tagging for Tamil Language Using Deep Learning

Hemakasiny Visuwalingam, Ratnasingam Sakuntharaj, Roshan G. Ragel

157

Singlish to Sinhala Transliteration using Rule-based Approach

Lahiru De Silva, Supunmali Ahangama

162

Session 2 Track AISIP (Room B)

Session Chair: Prof. Vijitha Herath Session Co-Chair: Dr. Roshan Godaliyadda

Transfer Learning for Accurate and Efficient Tomato Plant Disease Classification Using Leaf Images	168
L. A. Chamli Deshan, M. K. Hans Thisanke, Damayanthi Herath	
Traffic Sign Recognition Using Convolutional Neural Network and Skipped Layer Architecture	174
W. H. D. Fernando, S. Sotheeswaran	
Transmittance Multispectral Imaging for Adulteration Assessment of Coconut Oil	180
Neranjan Senarath, Dhananjaya Jayasundara, Lakshitha Ramanayake, D. Y. L. Ranasinghe, Sanjaya Lakmal, H. M. H. K. Weerasooriya, Parakrama Ekanayake, Vijitha Herath, Roshan Godaliyadda, W. M. T. Madhujith	
Suspicious Object Detection in Environments with Tear Gas	185
K. Thiruthanigesan, Ruwan D Nawarathna, Roshan G. Ragel	
Automated Gastrointestinal Abnormalities Detection From Endoscopic Images	191
Premananth Gowtham, Mahesan Niranjan, Anantharajah Kaneswaran	
Hands Off: A Handshake Interaction Detection and Localization Model for COVID-19 Threat Control	197
A. S. Jameel Hassan, Suren Sritharan, Gihan Jayatilaka, Vijitha Herath, Parakrama B. Ekanayake, Roshan I. Godaliyadda, Janaka B. Ekanayake	

Session 2 Track BBE (Room C)

Session Chair: Dr. Ruwan Ranaweera Session Co-Chair: Dr. Nalin Harischandra

Machine Learning Based Weight Prediction System for Bariatric Patients	203
W. M. C. D. K. Weerakoon, W. P. J. Pemarathne	
Non - Invasive Technique to Automate General Movements Assessment	209
Dr. Subodha Gunawardena, Dharmananda D. P. M. H., Wimalasena D. C. V. A., Piyathma U. R. R.	

Fetal Movement Identification from Multi-Accelerometer Measurements using Recurrent Neural Networks Janith Bandara Senanayaka, Eranda Somathilake, Upendra Delay, Samitha Gunarathne, Roshan Godaliyadda, Parakrama Ekanayake, Janaka Wijayakulasooriya, Chathura Rathnayake	215
A Customized Preprocessing Framework for Ayurvedic Nadi Signals H. E. J. Umasha, R. D. B. Ranaweera, J. V. Wijayakulasooriya	221
Melanoma Skin Cancer Detection Using EfficientNet and Channel Attention Module S. Papiththira, T. Kokul	227
<hr/>	
Session 2 Track PEHV (Room D) Session Chair: Prof. Janaka Ekanayake Session Co-Chair: Dr. Prabath Binduhewa	
Decentralized Controller Using Active Power Control With the Aid of Sensitivity Matrix Ujala Anuradhi, Ishan Bandara, Piumi Chathurika, Sunil Gamini Abeyratne, Janaka Ekanayake, K. R. M. Nimal Rathnayake	233
Global Horizontal Irradiance Modeling from Sky Images Using ResNet Architectures I. M. Insaf, H. M. K. D. Wickramathilaka, M. A. N. Upendra, G. M. R. I. Godaliyadda, M. P. Ekanayake, H. M. V. R. Herath, D. M. L. H. Dissawa, J. B. Ekanayake	239
Study of Small Signal Stability of Wind Integrated Power Systems Using Dynamic Phasor Approach W. A. Damsith Lakshan, Darshana Prasad Wadduwage, Upuli Jayathunga	245
Optimized LCL Filter Design for Single Phase Solar Inverter H. E. Udawatte, R. V. A. S. Rajapaksha, W.K. A. D. Warnakulasuriya, P. J. Binduhewa, L. Samaranayake, S. G. Abeyratne, J. B. Ekanayake	251
Single-Phase Fault Behaviour of Grid Connected Three-Phase Solar Plants Eshan Karunaratne, Prabath Binduhewa, Janaka Ekanayake	256

Estimation of Electric Field and Temperature in HVDC Cables Under Different Environmental Conditions Sathyamoorthy Dhayalan, Aritra Das, Pranav Johri, C. C.Reddy	262
---	-----

Session 3 Track AISIP (Room A)

Session Chair: Dr. Nalin Harischandra Session Co-Chair: Dr. Damayanthi Herath

Artificial Neural Networks Based Dengue Diagnosis Prediction Model Lathesaparan Ramachandran, R. M. Kapila Tharanga Rathnayaka, Wiraj Udara Wikramaarachchi	265
--	-----

A Convolutional Neural Network Based Early Warning System to Prevent Elephant-Train Collisions Shanaka Gunasekara, Maleen Jayasuriya, Nalin Harischandra, Lilantha Samaranayake, Gamini Dissanayake	271
--	-----

AI-based Behavioural Analyser for Interviews/Viva Dulmini Yashodha Dissanayake, Venuri Amalya, Raveen Dissanayaka, Lahiru Lakshan, Pradeepa Samarasinghe, Madhuka Nadheeshani, Prasad Samarasinghe,	277
--	-----

Screening Child's Screen Time Kaushalya Madushani, Navoda Edirisinghe, Kaushalya Koralage, Rashini Sahabandu, Pradeepa Samarasinghe, Lumini Wickremesinghe	283
---	-----

Machine Learning Based Emotion Level Assessment Lumini Wickremesinghe, Dakheela Madanayake, Anuradha Karunasena, Pradeepa Samarasinghe	289
---	-----

Ensuring Academic Integrity of Online Examinations Mohamed Irfan, Mohamed Aslam, Ziyan Maraikar, Upul Jayasinghe, Mohamed Fawzan	295
--	-----

Session 3 Track CCDM (Room B)

Session Chair: Dr. Asitha Bandaranayake Session Co-Chair: Dr. Achala Pallegedara

Intruder Detection System Through Walking Pattern Analysis for Home Security R. C. P. D.Peiris, R. Tharmikka , H. M. V. R. Herath, M. B. Dissanayake, U. S. Navaratne	301
---	-----

Exploring Deep Learning and Tree-Based Ensemble Models for Chiller Energy Consumption Predictions Udaree Kanewala, Supun Weerakoon, Ruwan Nawarathna	306
--	-----

Analysis on the Risk and the Categorization on Test Automation in Sri Lankan Software Industry Sakthi Sundaralingam, U. U. Samantha Rajapaksha	312
--	-----

SimplyTrans: A Simplified Approach to SinhalaBased Coding and Introductory Programming Language Localization Piumi Perera, Supunmali Ahangama	318
---	-----

Session 3 Track EIES (Room C)

Session Chair: Prof. Lilantha Samaranayake Session Co-Chair: Dr. Wasanatha Abeygunasekara

FPGA based Implementation of IEEE 802.11p/WAVE Protocol and Performance Evaluation Ravindu Perera, Janindu Uduwanage, Chandana Gamage	324
---	-----

Numerical Modeling of Nano Structure Enhanced Organic Solar Cells for Better Optical Performance M. A. R. P. Mataraarachchi, S. J. N. P. Marthinu, H. J. Munasinghe, W. L. Abeygunasekara, L. Samaranayake	330
--	-----

Development of an Embedded Device to Characterize the Orientation of a Cricket Bat in Three-dimensional Space Surath Gajanayake, Pramod Karunarathne, Shehan Fernando	336
---	-----

Design and Construction of a Communication Module for Nano-Satellites Perera M. T. N., Manchanayake M. P., Gajanayake I. H. , Dayarathna M. T. L. , Gunawardane A. U. A. W.	341
---	-----

Session 3 Track RACE (Room D)

Session Chair: Dr. Parakrama Ekanayake Session Co-Chair: Dr. Tharindu Weerakoon

Optimization of Regular Pick and Place Tasks Via Parallel Manipulators and Modelling

347

Isurie Akarawita, Sandaruwan Senadheera, Harith Samarasinghe, Shehan Fernando

Design of a Computed Torque Controller based Joint Controller for PUMA 560 Manipulator

353

Shanaka Ramesh Gunasekara, Lilantha Samaranayake, Nalin Harischandra

A Sovereign Button Detection and Measure the Alignment Using Image Processing

359

Sajani Karunaratne, Ridma Ganganath

iRetina : An Intelligent Mobile Application for the Visually Impaired in an Indoor Environment

365

A. Labeeshan, S. A. R. L. P. Satharasinghe, A. M. Dhananjana, T. D. Rupasinghe, U. U. Samantha Rajapaksha, Prasanna S. Haddela

Behavior Based Tracking for Human Following Robot

371

Keshiha Jeyatharan, H. E. M. H. B. Ekanayake, K. D. Sandaruwan