

MECHATRONICS BOOK SERIES

CONTROL AND INTELLIGENT SYSTEMS

Momoh Jimoh E. Salami
Abiodun Musa Aibinu
Yasir Mohd Mustafah



IIUM Press

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

Momoh Jimoh E. Salami
Abiodun Musa Aibinu
Yasir Mohd Mustafah

MECHATRONICS BOOK SERIES

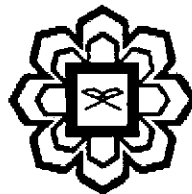
CONTROL AND INTELLIGENT SYSTEMS

EDITOR

Momoh Jimoh E. Salami

Abiodun Musa Aibinu

Yasir Mohd Mustafah



IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
©IIUM Press, IIUM

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without any prior written permission of the publisher.

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Momoh Jimoh E. Salami, Abiodun Musa Aibinu, Yasir Mohd Mustafah: Mechatronics Book
Series: Control and Intelligent Systems

Bibliography p.
Includes Index
ISBN

ISBN: 978-967-418-176-5

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IIUM PRINTING SDN.BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan
Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543
EMAIL: iiumprinting@yahoo.com

Table of Content

| | |
|---|----|
| PREFACE | v |
| EDITOR | vi |
| SECTION 1: INTELLIGENT CONTROL SYSTEM | 5 |
| Chapter 1 | 6 |
| Working Principle and Operating Mode of Atomic Force Microscopy Iskandar Al-Thani Mahmood | |
| Chapter 2 | 13 |
| Design and Development of controller of Active Power Filter for Industrial Usage part 1 M.M.Rashid ¹ , N.A.Ramin ² and Zahurul ² | |
| Chapter 3 | 21 |
| Design and Development of controller of Active Power Filter for Industrial Usage part 2 M.M.Rashid ¹ , N.A.Ramin ² and Zahurul ² | |
| Chapter 4 | 30 |
| Design and Implementation of Instant Noodles Vending Machine M.M.Rashid | |
| Chapter 5 | 39 |
| Development of Intelligent Belt Conveyor System (Part 1) M. M. Rashid, Faruok Alliays | |
| Chapter 6 | 45 |
| Development of Intelligent Belt Conveyor System M.M.Rashid, Faruk, M J E Salami | |
| Chapter 7 | 50 |
| Anti Skid Control System, A Tutorial M. J. E. Salami, A. M. Aibinu, A. F. Salami and Mohd Sofian Bin Basrah | |
| Chapter 8 | 54 |
| Design and Prototyping of Inertia Wheel W. Astuti, A. R. Kasim, M. I. Solihin, A.M. Aibinu, Momoh Jimoh E.Salami and Wahyudi | |
| Chapter 9 | 62 |
| Control of Automatic Drilling Machine by PLC Md Mozasser Rahman, Najiah Md Zain @Abdul Rahman and Mohd Syazwan Bin Jamil | |
| Chapter 10 | 74 |
| Automatic Storage and Retrieval System Abdul Kadir Abdul Jabar Abdul Kadir, M. J. E. Salami and A. M. Aibinu | |
| Chapter 11 | 80 |
| Control of Unmanned Underwater Vehicle Raisuddin Khan ^{1,a} , Faried Hasbullah ^{2,b} and Masum Billah ^{3,c} | |
| Chapter 12 | 85 |

| | |
|---|------------|
| Adaptive Sliding Mode Control for 3dof Helicopter Mostafa A. Hamood ^a , Rini Akmeliawati ^b | |
| Chapter 13 | 93 |
| Backstepping Control of an Autonomous Quadrotor Norafizah Abas ¹ , Rini Akmeliawati ² | |
| Chapter 14 | 103 |
| Piezoelectric Tube Scanner in Atomic Force Microscope Iskandar Al-Thani Mahmood | |
| SECTION II : INTELLIGENT CONTROL SYSTEM DESIGN | 111 |
| Chapter 15 | 112 |
| A Review on Control of Two-Wheeled Wheelchair System Salmiah Ahmad ^{1, a} , M. O. Tokhi ^{2, b} | |
| Chapter 16 | 121 |
| A Smart Car Surveillance System using Programmable Logic Controller (PLC) Siti Fauziah Tohaa and Mohammad Zafran Haja Mohideen | |
| Chapter 17 | 128 |
| Design of Controller for Elevator Group Using Fuzzy Logic Part 1 M.M.Rashid, Azhar | |
| Chapter 18 | 133 |
| Design of Controller for Elevator Group Using Fuzzy Logic Controller Part 2 M.M.Rashid, Azhar | |
| Chapter 19 | 139 |
| Fuzzy Logic-based Intelligent Control of Flexible Link Manipulator Ismaila B. Tijani and Rini Akmeliawati | |
| Chapter 20 | 148 |
| EEG based robot control A. Khorshidtalab and M. J. E. Salami | |
| Chapter 21 | 158 |
| Visual-Based Intelligent Solar Tracking System Rini Akmeliawati*, Samir A. Abdul Kareem, Riza Muhida | |
| SECTION III: INTELLIGENT SYSTEM DESIGN | 172 |
| Chapter 22 | 173 |
| Intelligent Air-conditioning System Amir A. Shafie, Raisuddin Khan, H. Al-haieaid M. Ebrahim | |
| Chapter 23 | 179 |
| An Intelligent Car Surveillance System: Design and Tools Selection Siti Fauziah Toha ^a and Mohammad Zafran Haja Mohideen | |
| Chapter 24 | 185 |
| Automatic Pipe Bursting Monitoring System M. J. E Salami, Syed Ahmed @ Hla Moe Win | |

| | |
|--|------------|
| Chapter 25 | 194 |
| Development of an Intelligent Laundry System | |
| Mohd Hafizi Azmi, Muhammad R. Affendy, M. J. E Salami and A.M. Aibinu | |
| Chapter 26 | 203 |
| Development of Palmprint based Biometric System | |
| M. A. Rotinwa-Akinbile, A.M. Aibinu and M. J. E. Salami | |
| Chapter 27 | 213 |
| Development of Smart Baby Chair | |
| M. J. E Salami, Fatanah M.S. and Fadiah Bt Ismail | |
| Chapter 28 | 219 |
| Intelligent Automatic Fruit Identification System | |
| M. Aibinu, M. J. E. Salami, N. Hazali, N. Termidzi , and A. A. Shafie | |
| Chapter 29 | 229 |
| Intelligent SCADA-Based Telemetry System for Monitoring and Controlling of Municipal Sewage Treatment Plant: IIUM, Gombak As a Case Study | |
| Momoh-J.E Salami. Abdulghafur A., Muhamad F. Sainal and Nasrodin T.. Mustapha. Ismaila B. Tijani | |
| Chapter 30 | 238 |
| Development of Prototype Real-time system for SCADA-based Monitoring and Controlling System for Sewage Treatment Plant | |
| Momoh-J.E Salami, Abdulghafur A., Muhamad F. Sainal and Nasrodin T.. Mustapha. Ismaila B. Tijani | |
| Chapter 31 | 250 |
| Intelligent Water Heater System | |
| M. J. E Salami and Khairul Ikram Bin Kamarul Bahrin | |
| Chapter 32 | 255 |
| Machine Intelligence: MIQ, MSQ, and MEQ | |
| Nahrul Khair Alang Md Rashid and Khairul Affendy Md Nor | |
| Chapter 33 | 260 |
| Coil Windings Determination Using Genetic Algorithm | |
| Abiodun Musa Aibinu, M. J. E Salami and Hafsat Farooqi | |
| Chapter 34 | 264 |
| Determination of Material Depth Using Artificial Neural Network | |
| Aalya Banu, Sharmila Fathima and Nahrul Khair Alang Rashid | |
| Chapter 35 | 278 |
| Design of Ink Refilling Machine For Marker Pen | |
| A. M. Aibinu, Rusnajaa Binti Mohd Yusoff And Liyana Bte Sani | |
| SECTION IV : MODELLING AND SIMULATION | 283 |
| Chapter 36 | 284 |
| Hajj Crowd Simulation Based on Intelligent Agent | |
| Teddy Surya Gunawan ^{1,a} , Mira Kartiwi ^{2,b} , Willy Wahyu Mulyana ^{3,c} | |

| | |
|---|------------|
| Chapter 37 | 292 |
| Kernel PCA – An Introduction | |
| Hamza Baali ^{1,a} , Momoh-Jimoh Eyiomika Salami ^{2,b} , Rini Akmeliawati ^{3,c} | |
| Chapter 38 | 297 |
| System Modelling of a Twin rotor System: Time and Frequency Domain Analysis | |
| Siti Fauziah Toha ^{1,a} and M. O. Tokhi ^{2,b} | |
| Chapter 39 | 304 |
| System Identification Technique for a Helicopter Using Genetic Algorithms | |
| Siti Fauziah Toha ^{1,a} and M. O. Tokhi ^{2,b} | |
| Chapter 40 | 311 |
| Advanced Noise Removal Techniques for the Detection of EMG Signal | |
| Md. Rezwatul Ahsan ^{1,a} , Muhammad Ibn Ibrahimy ^{2,b} and Othman Omran Khalifa ^{3,c} | |
| Chapter 41 | 322 |
| Active suspension system: Part 1 - Mathematical Modelling | |
| Aiman O. Bajaber ^a , Asan G. A. Muthalif ^b , Ayman S.I. Elzubair ^c | |
| Chapter 42 | 327 |
| Active Suspension System: Part 2 - Controller Design and Simulation | |
| Ayman S.I. Elzubair ^a , Asan G. A. Muthalif ^b , Aiman O. Bajaber ^c | |
| Chapter 43 | 332 |
| Book Shelving Robotics | |
| M. J. E. Salami ^{1,a} , Mohd Farid Md Alias ^{2,b} , Nurul Izzah Sidek ^{3,c} , Mohamed Mousa ^{4,d} | |
| Chapter 44 | 337 |
| Model Structure and Random Input for System Identification Technique for Flexible Manipulating System | |
| Siti Fauziah Toha ^{1,a} and M. O. Tokhi ^{2,b} | |
| Chapter 45 | 344 |
| Fault Tree Analysis, A case study of a simple Line Following Robot | |
| Abiodun Musa Aibinu, Haaris Ahmad Quadri, Mu Ham Mach A Mine, Almehmadi Tarig Saeed S And Hamide Rohimah | |
| Chapter 46 | 351 |
| Review of Malaysian Traffic Summon and Payment system | |
| A. M. Aibinu, Sharifah Nadiyah bt Syed Mohammad, Wan Nur Faezah bin Wan Azmi | |

Chapter 28

Intelligent Automatic Fruit Identification System

M. Aibinu, M. J. E. Salami, N. Hazali, N. Termidzi, and A. A. Shafie

Department of Mechatronics Engineering,
International Islamic University Malaysia (IIUM)
P O Box 10, 50728, Gombak, Malaysia.
E-mail: maibinu@iium.edu.my

28.1 Introduction

Fruits recognition and classification using machine vision and image processing techniques plays an important role in pre-harvesting, post-harvesting operations of various farm products. Various techniques have been suggested in the literature for fruits recognition and classification activities, these can be classified into: shape based; color based; dielectric based; conductivity based and more recently magnetic resonance imaging techniques. The need to sort fruits based on size, quality, types and grades need not be over emphasized. In a mono-fruit system, farmers or the packaging companies usually sort fruits by size, grade and quality in order to determine the price and post harvesting requirements of each type while in a multi-fruits systems or fruits selling outlets, the need to automatically identify and sort fruit packages into different level or compartment is usually a day to day activity.

Among the aforementioned techniques, three methods of fruits sorting will be discussed in this paper, these are shape based techniques, color based techniques and the fusion of color and shape based techniques. Shape based image analysis has been of keen research interest during the last few decades especially in the field of medical image diagnosis, machine vision, content retrieval system, surveillance, target recognition, industrial inspection, scene analysis [1]–[5]. Various authors have applied shape information in sorting fruits into various classes [1, 10]. Notable among the applied techniques include the use of Fourier descriptors, Autoregressive descriptors, farthest point techniques and so on. Despite the successful application of shape information in sorting fruits, it has been observed that the use of shape information only may not be appropriate since some fruits have almost the same shape.

Recently, the use of color information for fruits sorting is gradually gaining ground perhaps due to availability of personal computers and various machine vision based techniques. Various authors have reported higher recognition and classification accuracy from the use of color information compared to the use of shape information [6-9]. The use of the shape information in accurately sorting fruits into classes has also been reported in the literature [10].

The remaining part of this paper is organized as follows: brief review of some related work is covered in section II; the proposed technique is discussed in section III while results and conclusion is contained in section IV and V respectively.

28.2 Related Works

In [6], the paper describes a color image processing based vision system for sorting Fuji apples. Three CCD camera were installed at the top-left, top-right and above the fruits which hold 120° between each other to capture the apple images. Ohta color based image segmentation is used to segment apple colour and blob algorithm is used for noise removal.