

MECHATRONICS

BOOK SERIES

SYSTEM DESIGN AND SIGNAL PROCESSING

VOLUME 2

Editors

Md. Raisuddin Khan

Md. Mozasser Rahman

Muhammad Mahbubur Rashid

Shahrul Na'im Sidek



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

**MECHATRONICS BOOK SERIES:
SYSTEM DESIGN AND SIGNAL
PROCESSING - VOLUME 2**

Editors

Md. Raisuddin Khan
Md. Mozasser Rahman
Muhammad Mahbubur Rashid
Shahrul Na'im Sidek

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

ISBN: 978-967-418-132-1

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

CONTENTS

Editorial Notes	v
About the Editors	vi
Contents	vii
1. A Brief Overview of Biomechatronics and Its Applications.....	1
<i>Nur Izatulnisha A.Rashid, Jamaliah Kassim and Asan G. A. Muthalif</i>	
2. Self-Powered Solar Tracking System Part 1: System Modeling and Hardware Selections.....	7
<i>Asan G. A. Muthalif, Dzairul Hafiz and Haris Shafiq</i>	
3. Self-Powered Solar Tracking System Part 2: System Design.....	14
<i>Asan G.A. Muthalif, Dzairul Hafiz and Haris Shafiq</i>	
4. Self-Powered Solar Tracking System Part 3: System Integration and Testing.....	19
<i>Asan G.A. Muthalif, Dzairul Hafiz and Haris Shafiq</i>	
5. Smart System For Monitoring Electrical Power Usage at Homes.....	25
<i>Kawthar A. Rahman, Asan G. A. Muthalif and Nurul F. Shua'ib</i>	
6. Vibration Based Predictive Maintenance: Common Rotating Machinery Faults and Their Signatures.....	30
<i>Siti F. Mansor, Asan G. A. Muthalif and Nurul 'I. Zaman</i>	
7. Modeling of Disc Rotor Induction Motor.....	38

M. M. Rashid, S. Abubakar and R. Tamjis

8. Computer Communication for a Smart Card Based Ordering System Via Visual Basic..... 52
Siti Fauziah Toha and Rosdiazli Ibrahim
9. Electronic Smart Ordering System: Graphical User Interface 59
Siti Fauziah Toha and Rosdiazli Ibrahim
10. Intruder Avoidance System Via Short Message Service (SMS)..... 65
Siti Fauziah Toha and Mohammad Zafran Haja Mohideen
11. Anti Skid Control System, A Tutorial..... 71
M. J. E. Salami, R. Khan, A.M. Aibinu, Syahrul Syazanizam Bin Md Said and Mohd Sofian Bin Basrah
12. Intelligent Anti Skid Control System..... 75
M. J. E. Salami, R. Khan, A.M. Aibinu, Syahrul Syazanizam Bin Md Said and Mohd Sofian Bin Basrah
13. Principles of FMCW Radar Signal Processing..... 91
Wahju Sediono and Andrian Andaya Lestari
14. Design and Implementation of a Simple Queueing System for Vehicle Traffic Simulator..... 99
Wahju Sediono
15. Determination of Target Speed from the FMCW Radar Data..... 107
Wahju Sediono and Andrian Andaya Lestari
16. Intelligent Egg Incubator: Introduction..... 116
Shahrul Na'im Sidek, Yasir Mohd Mustafah, Urwah Ismail, Nur Hasnaa Che Awang
17. Intelligent Egg Incubator: Mechanical Design..... 125

Shahrul Na'im Sidek, Yasir Mohd Mustafah, Urwah Ismail, Nur Hasnaa Che Awang

18. Intelligent Egg Incubator: System Integration And Results 137
Shahrul Na'im Sidek, Yasir Mohd Mustafah, Urwah Ismail, Nur Hasnaa Che Awang

19. Human Posture Recognition Classification And Recognition..... 157
Kyaw Kyaw Htike, Othman O. Khalifa and and Lai Weng Kin

20. Human Posture Recognition Preprocessing Techniques..... 162
Othman O. Khalifa, Kyaw Kyaw Htike, Lai Weng Kin and A. Albagoul

21. Path Detection Implementation Using Fuzzy Classifier 171
Imran Moez Khan, Yusof Zaw Zaw, Othman O. Khalifa and Lai Weng Kin

22. Mechanical Design Of Unmanned Underwater Vehicle 180
Md. Raisuddin Khan, M. Zuhdi and Masum Billah

23. Design And Development Of An Automated Café System..... 187
Md. Raisuddin Khan, MAS Kamal and Masum Billah

24. Speech Coding Using Compressive Sensing On A Multicore System 194
T.S. Gunawan, Othman O. Khalifa, A. A. Shafie and E. Ambikairajah

25. A Case For Cooperative Vision System..... 202
A. A. Shafie and N. Samudin

26. Path Following Autonomous Vehicle Based On Vision System..... 208
A. A. Shafie, E. A. Syukur and N. I. Sidek

27. Trajectory Planning Using Gps For Unmanned Aerial Vehicle With Microcontroller Based System 215
A. A. Shafie, Md. Raisuddin Khan and M Shehzad Islam

28. Digital Hearing Aids Analysis And Implementation.....	224
<i>Othman O. Khalifa, Aisha H. Abdalla and Sheroz Khan</i>	
29. Automatic Intelligent Ordering System: Design And Tools Selection	233
<i>Siti Fauziah Toha and Rosdiazli Ibrahim</i>	
30. Automatic Smart Card Purchasing System for Express Kiosk.....	240
<i>Siti Fauziah Toha and Rosdiazli Ibrahim</i>	
31. Finite Element Formulation of Piezoelectric Laminated Composite Plate	247
<i>Iskandar Al-Thani Mahmood and Md. Raisuddin Khan</i>	
32. A Review on Modeling And Shape Control Of Piezoelectric Laminated Composite Plate Using Finite Element Method.....	257
<i>Iskandar Al-Thani Mahmood and Md. Raisuddin Khan</i>	
33. Development of Auto Parking System & Auto Billing System Using Image Processing Technique (Part 1).....	267
<i>M. M. Rashid</i>	
34. Development of Auto Parking System and Auto Billing System Using Image Processing Technique (Part 2)	274
<i>M. M. Rashid</i>	
35. Development of Auto Parking System& Auto Billing System Using Image Processing Technique (Part 3).....	281
<i>M. M. Rashid</i>	
36. Automatic Car Parking Management System for Large Parking Lot.....	289
<i>M. M. Rashid</i>	
37. Development of Wireless Home Power Monitoring System	296
<i>M. M. Rashid</i>	

CHAPTER 22

MECHANICAL DESIGN OF UNMANNED UNDERWATER VEHICLE

Md. Raisuddin Khan^a, M. Zuhdi^b and Masum Billah^c

Department of Mechatronics Engineering, Kulliyah of Engineering, International Islamic University Malaysia, Malaysia

^araisuddin@iium.edu.my, ^bzuhdi@yahoo.com, ^cmasum.uia@gmail.com

22.1 Introduction

The ocean is a major part of the earth and is one of the main reasons why man is able to exist on it. Statistics show that 1) the ocean covers two-thirds of the earth and 2) about 37% of the world population lives within 100 km of the ocean. Even though its importance is clear, the ocean is usually forgotten as attention is focused on only land and atmospheric issues. The full depths of the oceans and its abundant living and non-living creatures have not been fully explored.

To classify underwater robots, there are Autonomous Underwater Vehicles (AUV) and also Remotely Operated Vehicles (ROV) [1]. The Unmanned Underwater Vehicle (UUV) comes under the AUV category. The applications of the UUV are in the fields of science such as seafloor mapping and investigating oceanographic events such as tsunami. The military has also been widely using the UUV for shallow water mine detecting and disposal besides spying [2-3]. Other applications include inspections of underwater structures, underwater communication and fisheries.

The UUV can float because of the weight of the water that it displaces is equal to the weight of the UUV [4-7]. This displacement of water creates an upward force called the buoyant force and acts opposite to gravity, which pulls the UUV down. To control the buoyancy, UUVs usually have ballast tanks that can be alternately filled with water or air. When it is on the surface, the tank is filled with air and the overall density of the UUV would be less than its surrounding water [8]. As the UUV dives in water, the tank is filled with water and the air in the tank is vented from the UUV until its overall density is greater than the surrounding water and the UUV begins to sink due to negative buoyancy [9]. In addition, the UUV has movable sets of short wings called hydroplanes on its body that control the angle of the dive. The hydroplanes are angled so that the water moves over the stern which forces the stern upward, causing the UUV to be angled downward.

22.2 Design of the Mechanical System of the UUV

The design of the Unmanned Underwater Vehicle is divided into three major components. Firstly, there's the mechanical design which involves the theoretical calculation and the integration of sensors and actuators. Secondly, there's the design of the decision algorithm which is based on the control system and navigation of the UUV. Lastly, there's the design of the controller together with the electronic and electrical components. The