

MECHATRONICS BOOK SERIES SYSTEM DESIGN AND SIGNAL PROCESSING VOLUME 1

Editors

**Asan G. A. Muthalif
Amir Akramin Shafie
Siti Fauziah Toha
Iskandar Al-Thani Mahmood**



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

**MECHATRONICS BOOK SERIES:
SYSTEM DESIGN AND SIGNAL
PROCESSING - VOLUME 1**

Editors

Asan G. A. Muthalif
Amir Akramin Shafie
Siti Fauziah Toha
Iskandar Al-Thani Mahmood



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

ISBN: 978-967-418-173-4

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 Energy Harvesting For Wide Area Sensor Networks.....	1
<i>Nahrul Khair Alang Md Rashid and Mohamad Ghazali Ameer Amsa</i>	
2 Design And Development Of Automatic Paper Box Folding Machine.....	8
<i>Md Mozasser Rahman, Anwar Hussain bin Mohamed Rasied and Ahmad Zulkamal Ismail</i>	
3 Intelligent Shoe Guard System.....	20
<i>M. J. E. Salami,, A. M. Aibinu, Siti Sarah binti Mohd Sufian</i>	
4 Applications of Mechatronics Engineering In Modern Agriculture.....	29
<i>Nahrul Khair Alang Md Rashid</i>	
5 Mathematical Modeling of Counter Flow Scrubber Using Eulerian-Lagrangian Approach.....	34
<i>Bashir Ahmed Danzomo and Momoh Jimoh E. Salami</i>	
6 Auto Landmarks Generation For SLAM Algorithm.....	42
<i>Nahrul Khair Alang Md Rashid and Imama Karim Manba Usama</i>	
7 Automatic Intelligent Ordering System Design and Tools Selection.....	46
<i>Siti Fauziah Toha and Rosdiazli Ibrahim</i>	
8 Design And Development of a Sorting Machine Using Multiple Sensory System.....	52
<i>Md Mozasser Rahman1, Siti Fatimah binti Abdul Rahim</i>	

9	Design And Development Of Intelligent Wiper For Vehicle Windshield: Mechanical Design	58
	<i>Shahrul Na'im Sidek, Abd Rahman Ibrahim</i>	
10	Design and Development of Intelligent Wiper for Vehicle Windshield: Electrical Design	63
	<i>Shahrul Na'im Sidek, Mohammad Afhamuddin Ab Aziz</i>	
11	Design and Development of Intelligent Wiper for Vehicle Windshield: Final Assembly And Results.....	68
	<i>Shahrul Na'im Sidek, Mohammad Afhamuddin Ab Aziz</i>	
12	Design and Prototyping of Inertia Wheel.....	73
	<i>W. Astuti, A. R. Kasim, M. I. Solihin, A.M. Aibinu, Momoh Jimoh E.Salami and Wahyudi</i>	
13	Design and Implementation of Instant Noodles Vending Machine.....	80
	<i>M.M.Rashid</i>	
14	Mathematical Model for Three Tank System.....	88
	<i>W. Astuti, R. Alimuddin, A.M. Aibinu, Momoh Jimoh E.Salami and Wahyudi Martono</i>	
15	Design of Software Tool to Detect QRS Complex from ECG Signal.....	98
	<i>Wahju Sediono</i>	
16	Development of a Jet Powered Floating Platform (In Air).....	104
	<i>M. Zharif, Raisuddin Khan and Masum Billah</i>	
17	Development of Experimental Station for Earthquake Prediction.....	109
	<i>A. M. Aibinu, M. J. E. Salami, Asan Gani Muthalif, Sumaiyah Mior Badri, Sarah Khalidah and Nuruleeman Saat</i>	
18	Development of Robotic Manipulator to Assist Human by Using Brain Signal.....	117
	<i>Rodhiah, Raisuddin Khan and Masum Billah</i>	
19	Development of Unmanned Aerial Vehicle – Part 1.....	123
	<i>Shahrul Na'im Sidek, M. Ismail Mohtar, A Mushawwir M Khalil</i>	

20	Development of Unmanned Aerial Vehicle – Part 2.....	129
	<i>Shahrul Na'im Sidek, A Mushawwir M Khalil, M. Ismail Mohtar</i>	
21	Earthquake Prediction And Monitoring Using Unusual Animal Behavior.....	134
	<i>A. M. Aibinu, W. Astuti, M. J. E. Salami, R. Akmelawati and Asan Gani Muthalif</i>	
22	Development of Automatic Rocking Baby Cradle.....	141
	<i>W. Astuti, N. F. Azlan, A.M. Aibinu, Momoh Jimoh E.Salami and Wahyudi Martono</i>	
23	Electrooculography (EOG)-Controlled Wheelchair.....	149
	<i>Shahrul Na'im Sidek, M. Iqbal Zakaria and A. Ridwan A.Aziz</i>	
24	Conceptual Design of an Intelligent Coconut Dehusking.....	155
	<i>M. J. E. Salami, A. M. Aibinu</i>	
25	An Electrooculogram (EOG) Signal for Wheelchair Motion Control.....	163
	<i>Salmiah Ahmad, Nurul Muthmainnah Mohd Noor</i>	
26	A conceptual Paper on Intelligent Car Battery Monitoring System.....	171
	<i>Abdul Hafiz Bin Sahar, Khairul Azhar Bin Muhamat, M. J. E. Salami, and A. M. Aibinu</i>	
27	GIS-Based Vehicle Traffic Simulation.....	177
	<i>Wahju Sediono</i>	
28	Intelligent Postal Mails Sorter.....	183
	<i>Mohd Arif Faiz Bin Omar, Mohd Zain Bin Ismail, M. J. E. Salami, A. M. Aibinu</i>	
29	Intelligent Wet Scrubber System for Industrial Air Pollution Control.....	188
	<i>Bashir Ahmed Danzomo and Momoh Jimoh E. Salami</i>	
30	Leveraging on Nature for Systems Design.....	194
	<i>Nahrul Khair Alang Md Rashid and Safinaz Kader Mohideen</i>	
31	Natural Ventilation of Yam Storage System.....	199
	<i>Murtala Abdulazeez, M.J.E. Salami, Md. Raisuddin Khan</i>	
32	Self-Repair Capability in Engineering Systems.....	208
	<i>Nahrul Khair Alang Md Rashid and Aous Naji Rasheed</i>	

33	Simulation of Airflow and Temperature Distribution in Yam Storage System	213
	<i>Murtala Abdulazeez, M.J.E. Salami, Md. Raisuddin Khan, Nabeel Adeyemi</i>	
34	Sound Identification in Noisy Environment.....	218
	<i>Nahrul Khair Alang Md Rashid, Nor Hidayati Diana Nordin and Alim Sabur Ajibola</i>	
35	Intelligent CCTV-Based Monitoring System for Kulliyah of Engineering, IIUM.....	225
	<i>M. J. E. Saslami,, A. M. Aibinu and Nur Syahrain binti Mohd Jahini</i>	
36	Virtual Modeling of Two-Wheeled Wheelchair using Msc Visual Nastran 4D.....	231
	<i>Salmiah Ahmad, M. O. Tokhi</i>	

CHAPTER 19

Development of Unmanned Aerial Vehicle : Part 1

Shahrul Na'im Sidek¹, M. Ismail Mohtar, A Mushawwir M Khalil

¹ Mechatronics Engineering Dept., Faculty of Engineering, IIUM, PO Box 10,
50728 Kuala Lumpur, Malaysia

¹snaim@iium.edu.my

19.1 Introduction

Nowadays, technology has evolved rapidly and continues to serve human kind to live a better life. Unmanned Aerial vehicle (UAV) is another groundbreaking discovery such that it is able to serve human in vast field of applications, for example monitoring reserved area and the country's border down to search and rescue missions. In this chapter a development of a small scale UAV to perform specific task namely recording videos using wireless camera is discussed. The ability to efficiently and steadily communicate the data recorded to the ground control is paramount. The UAV had two different flight mode; manually-controlled and auto-pilot mode. By means of RC Transmitter, it could be manoeuvred manually and in auto-pilot mode. It could autonomously navigate its way to the designated coordinate by comparing its current location to the end point set by GPS unit. Thermopile sensor is used to stabilize the UAV during its autonomous navigation. In general, the entire structure is made of Styrofoam, backboned by carbon fiber tube and choroplus to make it light weight, yet durable enough for the application of the UAV. Plus, the material used is easily replaceable and affordable.

19.2 Background

A low cost auto-pilot small-scale UAV platform with the ability to stabilize the absolute attitude stabilization system based on thermal horizon detection using thermopile sensor is developed. The system includes auto navigation system which utilized fuzzy logic algorithm to determine the heading of the aircraft towards the destination from the data received from the GPS module onboard. Thus, the literature review focuses only on the relevance type of UAV.

The need of a small low cost UAV is increasing nowadays as the technology becomes more available to the public. It can act as a research platform for scientist. Small scale UAV development is growing around the world due to the high cost of operating of an aircraft or a standard UAV which involving expensive hardware, sophisticated software and the need of a highly qualified operators to handle even a simple mission such as photographic missions.

In [1] the authors reported that for most of the low cost UAV stabilization system is based on the thermal horizon detection using thermopiles. A pair of matched thermopile sensors arranged 180 degrees apart and having their outputs feeding a differential amplifier makes a sensitive horizon detector. When sensors receive equal energy, their axis must be parallel to the horizon and the amplifier output for that channel is zero (the neutral value). Two pairs of sensors arranged laterally and longitudinally make a roll and pitch detector. The use of thermopiles not only to stabilize the aircraft during a levelled flight but also during the aircraft is turning laterally which is by banking a bit the wing of the aircraft and pulling up the pitch. This turning method produce a higher turning rate than using rudder to change the heading the aircraft. For the controllers, there are three microcontrollers from mid range PIC family which are PIC16f877 and PIC16f84a. Each microcontroller has its own dedicated task. PIC1 looks after received data from the ground controller, PIC2 is the master controller at the same time stabilizing the aircraft during flight, and