

# MECHATRONICS BOOK SERIES

## ROBOTICS AND AUTOMATION

---

Rini Akmeliawati  
Wahju Sediono  
Nahrul Khair Alang Md. Rashid



IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

# **MECHATRONICS BOOK SERIES: ROBOTICS AND AUTOMATION**

---

## **Editors**

Rini Akmeliawati  
Wahju Sediono  
Nahrul Khair Alang Md. Rashid



**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

Rini Akmecliawati, Wahyu Sediono & Nahrul Khair Alang Md. Rashid:  
Mechatronics Book Series Robotics and Automation

ISBN: 978-967-418-152-9

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 CONTENTS

---

<b>Preface</b>	<b>i</b>
<b>Acknowledgement</b>	<b>ii</b>
<b>Editor</b>	<b>iii</b>
<b>Table of Content</b>	<b>v</b>
<b>1. Visual Tracking for Human Face</b> A.A. Shafie, Iqbal and M.R. Khan	<b>1</b>
<b>2. Robot Design : A Case Study of Team Learning Experience and Outcome</b> A.A. Shafie	<b>7</b>
<b>3. Development Neck Support for Humanoid Robot Head</b> A. A. Shafie, M.N. Kasyfi and N. I. Taufik Y	<b>14</b>
<b>4. Development of Cooperative Mini Robot</b> Amir A. Shafie , Siti E.M.Z and Shazeela A	<b>21</b>
<b>5. Humanoid Robot Arm</b> Amir A. Shafie and Mohd N. Y.	<b>26</b>
<b>6. Designing Human Robot Interaction for Emotionally Expressive Robotic Hear AMIR-III</b> A. Iqbal, A. A. Shafie, and M. R. Khan	<b>32</b>
<b>7. An Overview of Fuzzy Based Person Following Robot</b> T. Alamgir, I. J. Alfar and M. M. Rashid	<b>38</b>
<b>8. Mechanical Design of a Person Following Robot</b> Tarik Bin Alamgir, Ibrahim Jawad Alfar and Muhammad Mahbubur Rashid	<b>43</b>

<b>9. Development of Fuzzy Based Person Following Robot part 2</b>	<b>49</b>
Tarik Bin Alamgir, Ibrahim Jawad Alfar and Muhammad Mahbubur Rashid	
<b>10. Mobile Robot for Fined Tube Inspection</b>	<b>56</b>
Muhammad Mahbubur Rashid	
<b>11. Robot Aided Upper Limb Rehabilitation System: Mechanical Design</b>	<b>64</b>
Shahrul Na'im Sidek, Hidayatullah Mohamed Nawi	
<b>12. Robot Aided Upper Limb Rehabilitation System: Electronics for Sensors and Actuators</b>	<b>69</b>
Shahrul Na'im Sidek, Khairul Anwar Khalid	
<b>13. Robot Aided Upper Limb Rehabilitation System: Results and Analysis</b>	<b>73</b>
Shahrul Na'im Sidek	
<b>14. Snake Robot Locomation in Narrow Space: A Review</b>	<b>79</b>
Raisuddin Khan, Mitsuru Watanabe and Masum Billah	
<b>15. Multiple Hexapod Robot and Collaborative communication</b>	<b>86</b>
Raisuddin Khan, Masum Billah and Mohiuddin Ahmed	
<b>16. Autonomous Unicycle Robot Using Reaction Wheel Pendulum: Mechanical Design</b>	<b>94</b>
Atika Adrina Teepol, Nur Fadhilah Mohd Fauzey, Shahrul Na'im Sidek, Yasir Mohd Mustafah	
<b>17. Autonomous Unicycle Robot Using Reaction Wheel Pendulum: Controller Design</b>	<b>103</b>
Nur Fadhilah Mohd Fauzey, Atika Adrina Teepol, Shahrul Na'im Sidek, Yasir Mohd Mustafah	

HISTORICAL BACKGROUND AND EDUCATION

<b>19. Develop an Algorithm for Goal Finding Robot using Reinforcement Learning</b>	<b>118</b>
M. Kamal, R. Khan, S. Bazuhair and M. Billah	
<b>20. Design and Development of 2 Fingers Robotic Hand Actuated by Active Grasping Data</b>	<b>126</b>
MdMozasser Rahman <sup>1</sup> ,MohdZoolfadli B MdSalleh	
<b>21. Design and Development of Interactive Fish Robot</b>	<b>144</b>
MdMozasser Rahman <sup>1</sup> ,RizaMuhida and Mohammad Zukhair b MohdNazmi	
<b>22. Design and Development of A Digger Robot</b>	<b>154</b>
MdMozasser Rahman,MohdRuzaini Bin AbdRalim and Others	
<b>23. Glass Wall Cleaning Robot: A Review</b>	<b>170</b>
Md Mozasser Rahman, Ahmed Murgab Mohammed Mahil, Norsofiana Bt Umar and Nurul Izzati Bt Samsuddin	
<b>24. Glass Wall Cleaning Robot: -Electrical design and control</b>	<b>177</b>
Md Mozasser Rahman, Ahmed Murgab Mohammed Mahil, Norsofiana Bt Umar and Nurul Izzati Bt Samsuddin	
<b>25. Glass Wall Cleaning Robot: -Electrical design and control</b>	<b>187</b>
M. M. Rahman, M. R. b A. Ralim	
<b>26. Development of Robotic Manipulator to assist human using brain Signal</b>	<b>198</b>
Mahbuba Hossain, Raisuddin Khan, and Masum Billah	
<b>27. Glass Wall Cleaning Robot: Mechanical Design</b>	<b>204</b>
Mahbuba Hossain Raisuddin Khan, and Masum Billah	

<b>28. Intelligent SCADA Based Monitoring Scheme for Low Voltage Distribution System</b>	<b>210</b>
M. J. E. Salami, A. M. Aibinua, Mohd Shafie Bin Sani and Nurfaizal Bin Wah	
<b>29. Intelligent SCADA Based Monitoring Scheme for Low Voltage Distribution System</b>	<b>218</b>
Abdullateef Ayodele Isqeel and Momoh Jimoh Eyiomika Salami.	
<b>30. Autonomous Goal Finding Robot</b>	<b>227</b>
M. Kamal, Md. R. Khan, Faisal and M. Billah	
<b>31. Intelligent SCADA Based Pipe Monitoring System</b>	<b>236</b>
M. J. E. Salami, A. M. Aibinua, Mohd Shafie Bin Sani and Nurfaizal Bin Wah	
<b>32. Path Tracking of Car Like Mobile Robot</b>	<b>250</b>
A. A. Isqeela and M. J. E. Salami	
<b>33. A New Energy Efficient Building System</b>	<b>255</b>
M. J. E. Salami, Md. R. Khan, O. A. Abdulquadric	
<b>34. Automatic Car Parking System</b>	<b>262</b>
M. J. E. Salami, Md. R. Khan and O. A. Abdulquadria	
<b>35. Anthropomorphic biped robot</b>	<b>267</b>
A. A. Shafie, M. F. Baharudin	

## CHAPTER 34

### Automatic Car Parking System

Raisuddin Khan<sup>a</sup>, Nur Hanani<sup>b</sup> and Masum Billah<sup>c</sup>

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

<sup>a</sup>raisuddin@iiium.edu.my, <sup>b</sup>nurhanani@yahoo.com, <sup>c</sup>masum.uia@gmail.com

#### 34.1 Introduction

Automatic parking is an autonomous car maneuvering from a line of traffic into a parking slot to perform parallel, perpendicular or angle parking. The purpose of automatic parking is to enhance the driving comfort and safety in constrained situations where much attention and experience is essential to steer the car. The parking maneuver is performed by means of coordinated run of the steering angle and speed. During the maneuver the actual situation in the environment is always considered to ensure collision-free motion within the existing space.

An automatic car parking system can be understood as an automatic storage and retrieval systems (AS/RS) which are computer controlled to automatically store and retrieve cars with high throughput [1-2]. Current development of automatic car parking technology can be divided into four stages, namely - manual, mechanical, automatic (automation) and intelligent [3-4]. The effective management of cars in an automatic car park is a challenge, especially finding the locations of the car. It has been reported in the literature that more than 70% of Malaysians commute in private cars to their work place and other destinations [4-7]. As a result the parking spaces in various organizations become inadequate leading to low productivity.

#### 34.2 System Development

**Functional Design.** In designing the system, we consider a system that consists of nine spaces with eight platforms for the car park. The platforms are free to move horizontally or vertically like a puzzle. The system is developed so that people just leave their car on the platform outside the parking area, the system automatically finds the empty space and the platform with the car moves to occupy the empty spaces. For retrieval of the car, the driver just wait outside the parking area, key in the identification of their car and wait for the system to trace and bring out the car.

**Electrical and Mechanical Elements.** Microcontroller is utilized as the controller device for the project. In this project, we decide to use Programmable Intelligent Computer (PIC) as the microcontroller. The lot consists of nine spaces of parking with eight parking lots and an empty space for the car movement. The parking lots consist of the platform and the base. Spaces are efficiently used in this design as there are no spaces required for people entering and exiting the car.

Torque can be transformed to linear force by a rack and pinion. The pinion is nothing else than spur gear. It meshes with a toothed bar or rod. The rack and pinion is used to convert a rotary motion of the gears into the linear motion of the platforms. The speed of the rack is determined by the diameter of the gears as it turns. The gear is driven