

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

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

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

HISTORICAL BACKGROUND AND EDUCATION

19. **Develop an Algorithm for Goal Finding Robot using Reinforcement Learning** 118
M. Kamal, R. Khan, S. Bazuhair and M. Billah
20. **Design and Development of 2 Fingers Robotic Hand Actuated by Active Grasping Data** 126
MdMozasser Rahman¹,MohdZoolfadli B MdSalleh
21. **Design and Development of Interactive Fish Robot** 144
MdMozasser Rahman¹,RizaMuhida and Mohammad Zukhair b MohdNazmi
22. **Design and Development of A Digger Robot** 154
MdMozasser Rahman,MohdRuzaini Bin AbdRalim and Others
23. **Glass Wall Cleaning Robot: A Review** 170
Md Mozasser Rahman, Ahmed Murgab Mohammed Mahil, Norsofiana Bt Umar and Nurul Izzati Bt Samsuddin
24. **Glass Wall Cleaning Robot: -Electrical design and control** 177
Md Mozasser Rahman, Ahmed Murgab Mohammed Mahil, Norsofiana Bt Umar and Nurul Izzati Bt Samsuddin
25. **Glass Wall Cleaning Robot: -Electrical design and control** 187
M. M. Rahman, M. R. b A. Ralim
- ✓ 26. **Development of Robotic Manipulator to assist human using brain Signal** 198
Mahbuba Hossain, Raisuddin Khan, and Masum Billah
- ↳ 27. **Glass Wall Cleaning Robot: Mechanical Design** 204
Mahbuba Hossain Raisuddin Khan, and Masum Billah

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

CHAPTER 3

Development of Neck Support for Humanoid Robot Head

A. A. Shafie^a, M. N. Kasyfi and N. I. Taufik Y.

Autonomous Agent Research Group,

Department of Mechatronics Engineering, Faculty of Engineering

International Islamic University Malaysia (IIUM), 50728 Kuala Lumpur, Malaysia

^aaashafie@iium.edu.my

3.1 Introduction

Humanoid robot is a term that refers to a robot whose body structure resembles that of a human, other common terms used to describe such a robot are android and gynoid [1]. Humanoids are built to mimic some physical and mental tasks performed by humans in their daily lives. The main idea behind the construction of humanoids is to provide people with more comfort when working with machines. Thus humanoid robots are expected to have the capabilities that are not possessed by conventional industrial robots like self maintenance (recharge itself, swap batteries, etc.) and autonomous learning (learning or gaining new abilities without any further assistance, developing strategies on the basis of current environment and adapting to new conditions). Other important capabilities are e.g. avoiding harmful situations (to people, property and themselves), performing secure interaction with humans and the environment, and the ability to detect, interpret and transmit natural human moods.

Dautenhahn and Billard further proposed the following definition for humanoid social robots: "Social robots are embodied agents that are part of a heterogeneous group: a society of robots or humans. They are able to recognize each other and engage in social interactions, they possess histories (perceive and interpret the world in terms of their own experience), and they explicitly communicate with and learn from each other" [2]. Thus, the important characteristics of humanoids include the ability to express and/or perceive emotions, as well as to communicate with high-level dialogue. Further characteristics are e.g. the ability to learn/recognize models of other objects, to maintain/establish social relationships, to use natural gaze/gestures, to exhibit distinctive or own personality and character, and also to develop social competencies.

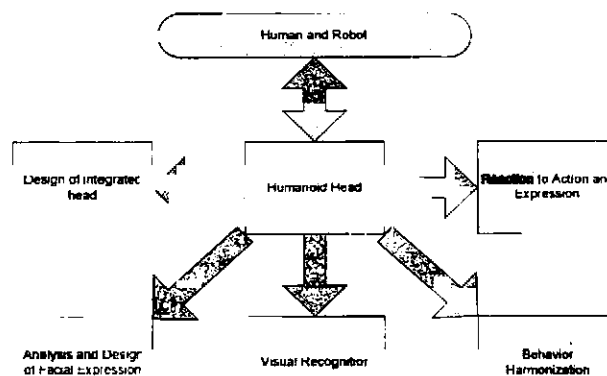


Fig. 1: Humanoid head functionality.

The interaction between humans and robots will play a great role for the success of social robots. Hence, despite the importance of the continuous enhancement of its autonomous capabilities, the human-robot interaction must always be improved. The improvement of human-robot interaction means the improvement of humanness of the robots. The perception of humanness in a social robot is heavily influenced by the form of the head parts such as the presence of certain features (mouth, nose and eyelids), their dimensions and the number of performed facial gestures. Based on the latest