

HUMAN ROBOT INTERACTION FOR KINDERGARTEN  
CHILDREN USING HUMANOID ROBOT

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**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**  
**HUMAN ROBOT INTERACTION (HRI) FOR KINDERGARTEN**  
**CHILDREN USING HUMANOID ROBOT**

This report submitted in accordance with requirement of the Universiti Teknikal  
Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering  
(Robotics and Automation) (Hons.)

by

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## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

**TAJUK:** Human-Robot Interaction For Kindergarten Children Using Humanoid Robot

**SESI PENGAJIAN:** 2015/16 Semester 2

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## **APPROVAL**

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirement for the degree of Bachelor of Manufacturing Engineering (Robotics and Automation) (Hons). The member of the supervisory committee is as follow:

.....

(Official Stamp of Supervisor)

## **ABSTRACT**

This report presents the study of human-robot interaction (HRI) using humanoid robot for kindergarten children. The research involved humanoid robot NAO and four children from Taska Aulad Imtiyaz in UTeM. The objectives of this study are to program the humanoid robot NAO in kindergarten setting and to analyse the children's feedback emotions through interview session and Kansei Engineering method. Experiments were conducted in two different sessions. The first session was to introduce the robot to the children and the second session was to obtain children response through interaction with the robot. The second session was carried out 3 weeks after the first session. The results show that the children were happy and showed excitement during the child-robot interaction. They also not scared of the robot.

## **ABSTRAK**

Laporan ini membentangkan penyelidikan mengenai interaksi antara robot dengan manusia menggunakan robot humanoid untuk kanak-kanak tadika. Penyelidikan ini melibatkan robot humanoid NAO dan empat orang kanak-kanak dari Taska Aulad Imtiyaz di UTeM. Objektif kajian ini adalah untuk memprogram robot humanoid NAO, di dalam suasana tadika dan untuk menganalisis maklum balas terhadap emosi kanak-kanak dengan menggunakan sesi temuduga dan kaedah Kejuruteraan Kansei. Eksperimen telah dijalankan dalam dua sesi yang berbeza dan hari yang berbeza. Sesi pertama adalah untuk memperkenalkan NAO kepada kanak-kanak dan sesi kedua adalah untuk mendapatkan tindak balas kanak-kanak melalui interaksi dengan robot. Sesi kedua telah dijalankan 3 minggu selepas sesi pertama. Dua kaedah penilaian telah digunakan untuk menganalisis data yang telah diperolehi daripada kedua-dua eksperimen iaitu dengan menggunakan kaedah soal jawab dan kaedah Kejuruteraan Kansei. Hasil kajian menunjukkan bahawa kanak-kanak gembira dan menunjukkan keseronokan semasa interaksi kanak-kanak robot. Mereka juga tidak lagi takut kepada robot.



## **DEDICATION**

To my beloved parents,

M. Azhar bin Abdul Rahman and Samerah binti Buthirie,

siblings, lecturers and friends.

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First and foremost, all praise to The Almighty, who made this accomplishment possible. I seek his mercy, favor and forgiveness.

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# LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

ALICE	-	Artificial Linguistic Internet Computer Entity
ASD	-	Autism Spectrum Disorder
ASIMO	-	Advanced Step In Innovative Mobiliy
DOF	-	Degree Of Freedom
HRI	-	Human Robot Interaction
IROMEC	-	Interactive Robotic Social Mediators As Companions
KindSAR	-	Kindergarten Social Assistive Robot
MMR	-	Mild Mental Retarded
SAR	-	Socially Assistive Robot
SMI	-	Severe Motor Impair

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

In the early years innovation of computer controlled servomechanism, most robots were created solely as machines that performed repetitive works in industry. On that era, only specially trained individuals or programmer were the person can communicate with robots. Generally, in that time robots can be described as dull machines that performed hazardous work that cannot be performed by human in manufacturing industry. As shown on Figure 1.1, it was prove that robot was invented in 1959 to performed works only with dull image.



Figure 1.1: The first prototype of automotive robot built in 1959- the Unimate #001  
(Royakkers, 2015)

But today, the evolution of robotics technology has recently become significant not only in manufacturing industries, but also in medical, space, and even educational field. Now, robots are no longer confined in manufacturing facilitation. Researchers and robot producers have come out with robot that can exhibits comprehensible behavior and entertaining to interact with. The robot is intended developed as a mediator for interactive companion or social companion to human.

Features of the robot include the capabilities to walk, speak, and even detect emotion of human. Example of social robot invented are Keepon, Pleo, and iCat. By looking at this developing field of robot, researchers tried to implement of robotics tools as a learning platform in education. Begins with preschool education, the feasibility of robotic tools to children will help to broaden their mind about robot besides help to develop their cognitive skill and make them to be more socially interact each other rather than being solitary.

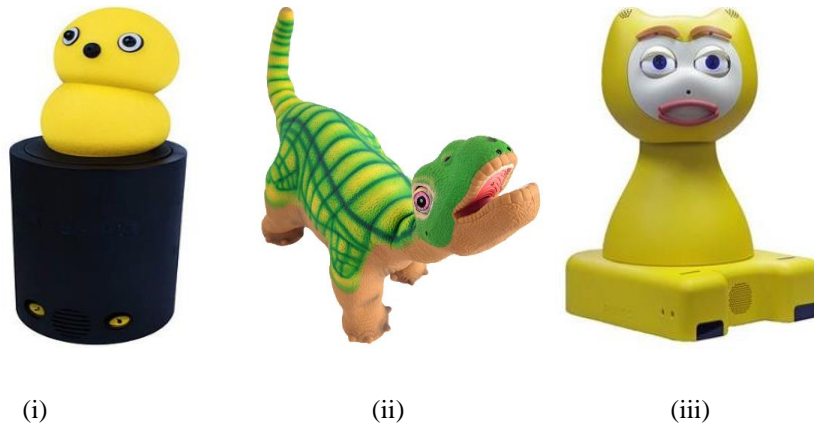


Figure 1.2: The social robot in market (i) Keepon (ii) Pleo (iii) iCat

( Source: <<http://www.robotshop.com/uk>>20/06/16)

Based on the interaction between human and robot, a study on human-robot interaction (HRI) has been created. This field of study focused on understanding work steps between human and robot (Shamsuddin *et al.*, 2012). The existing study of human interaction robot mostly were applied on autistic children and also elderly people from

nursing home. The study on autistic children was to measure the implication of the robot toward their autistic traits. From the result, human robot interaction gave them the positive feedback which when they interact, the robot was able to reduce the autistic traits own by the children. Whereas, study on elderly people was to boost their emotional and spirit in doing their daily routines.

Motivation to carry out this study is to create awareness among children in Malaysia about the existing robotics technology. By implementing robot in their education, hopefully can help them to grow interest to study robotics field in the future. Since this study of HRI is the first in Malaysia, preschool children are selected as the population target to be engaged in a short interaction with NAO robot. The NAO is a small toy like humanoid robot built in the size of two years old kid. NAO is a smart, non-threatening educational tool that creates pleasurable interaction for both the kindergarten staff and children (Fridin, 2014). NAO has 25 degrees of freedom, allowing it to perform various motor action (Fridin, 2014). It will be programmed to do some dancing movement and interact with children in the kindergarten. Children's response toward the robot will be recorded and the result will be analysed. From the analysis, it will show whether the implementation of robot in early education give a positive impact to the children or not.

## **1.2 Problem Statement**

Recently, the research area of HRI continuous grow with most of the target population are elderly, patients with impairment and children with autism. Today's, only several studies are conducted on HRI for normal children to investigate their behavioral. In foreign countries such as Japan, USA, and Turkey the utilization of humanoid robot as learning platform in preschool education is not a new thing anymore. For example Güneysu, 2013 in her study had implemented humanoid robot NAO in kindergarten as learning tool for the children to learn about robots.



Figure 1.3: NAO robot is used as learning platform for children in kindergarten (Güneysu, 2013)

Unlike in Malaysia, the discovery of human-robot interaction especially humanoid robot as a teaching medium to learn in preliminary education is still new. Even though the level of awareness of children in Malaysia towards gadget technology is high, but for robotics technology it is lower. In order to expose the children with robotics technology, a humanoid robot NAO with anthropomorphic shape is suitable introduced to the children in the kindergarten. The respond and behavioral manifest by the children toward the robot will be analysed to obtain the result whether the robot give the positive impact on them or not.

### 1.3 Objectives

The objectives to be achieved in this project are:

- a) To program a humanoid robot NAO to interact with children in a kindergarten setting.
- b) To analyse the emotional feedback of the children towards the robot through interview session and Kansei Engineering.

## 1.4 Scope and limitation

The scope of this study was confined to a certain target audience and the existing facilities in UTeM, as listed below:

- a) Firstly, the target audiences are preschool children at Taska Awlad Imtiyaz UTeM with their age attempt in between 5 and 6 years that have physically and mentally normal condition.
- b) Experiment was performed in the kindergarten classroom because the environment is familiar for the children to adapt themselves. Besides, the location of kindergarten itself is within UTeM main campus area so it was easy to shuttle from campus to the kindergarten.
- c) To utilize the existing robot facility in Faculty of Manufacturing Engineering, humanoid robot NAO was chose as the platform of experimental robot. NAO has a cute and adorable appearance plus has the capabilities to move and speak. This features will help to entice the children to give their focus and attention to the robot.
- d) NAO is easy to program by using Choregraphe.
- e) Other than that, NAO is used because to promote this robot to student of Faculty Manufacturing Engineering so that a widen research area involving NAO will be done in the future.
- f) The only limitation in this study was to program NAO to do certain movement as the movement was imbalance for the robot
- g) As this is a pilot study, the robot was programmed to do some actions, simple dance, and two way interaction.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 What is a Robot?**

In the early existence, robots were invariably hot, smelly and involved jobs that required a great deal of muscle power. But nowadays they have become powerful elements in industry due to its ability to perform different task and operation precisely. Robot attributes that not need the common safety and comfort like human made them undemanding to be handled. According to Robot Institute of American, robot is define as a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through various programmed motion of the performance of a variety tasks.

Historically, robots origin already begins in the ancient world before. As shown in Figure 2.1, similar concept to a robot was started long ago around 4<sup>th</sup> Century BC when a Greek Mathematician Archytas of Terantum postulated a mechanical bird he called ‘The Pigeon’ (Patrizia *et al.*, 2006).