

raf

TJ211 J84 2012.



0000099234

Robot simulation for human behaviour (in term of attitude and discipline) / Juliana Mohd Salleh.

A

99234

KI

**ROBOT SIMULATION FOR HUMAN BEHAVIOUR
(IN TERM OF ATTITUDE AND DISCIPLINE)**

**Juliana Binti Mohd Salleh
B010910184**

**Bachelor of Mechatronic Engineering with Honour
June 2012**

DEVELOPMENT OF ROBOT SIMULATION FOR HUMAN BEHAVIOUR

JULIANA BINTI MOHD SALLEH


Thesis is submitted in fulfilment of the requirements for the awards of the degree of
Bachelor of Mechatronic Engineering with Honour

Faculty of Electrical Engineering


UNIVERSITI TEKNIKAL MALAYSIA MELAKA (UTeM)

JUNE 2012

I hereby declare that this thesis entitled "*Robot Simulation for Human Behaviour (in Term of Attitude and Discipline)*" is the result of my own research except as cited in the references. This project is adequate in terms of scope and quality for the award of the degree of **Bachelor of Mechatronic Engineering with Honour**.

Signature : 
Name : JULIANA BINTI MOHD SALLEH
ID Number : B010910184
Date : 26 JUNE 2012

I hereby declare that I have checked this project and in my opinion, this project is adequate in terms of scope and quality for the awards of the Degree of **Bachelor of Mechatronic Engineering with Honour.**

Signature : 

Name : CIK NUR ILYANA BINTI ANWAR APANDI

Position : Lecturer

Date : 26 JUNE 2012

ACKNOWLEDGEMENT

In the name of the Almighty ALLAH, the most gracious and merciful, with His gracing and blessing has led to success be upon this project. I would like to take this opportunity to express my sincere thanks and appreciation to the following persons who have directly or indirectly given generous contributions towards the success of this academic study.

First and foremost, I would like to express my greatest gratitude to my respectful supervisor, MISS NUR ILYANA BINTI ANWAR APANDI for her constructive criticism on this project and most of all her comment and advice. Not forgetting her understanding and kindness in spending a time to help me during implement this project for Final Year Project.

My sincere appreciation extends to all my fellow friends especially my classmates for giving their support, help and kindness in sharing knowledge with me. Special thanks to post-graduate student who were willing to cooperate in the contribution of idea and information.

Lastly, I am deeply indebted to everyone who involved directly and indirectly in this project. The contribution and commitment given towards me earning my bachelor's degree are indescribable and without them, this FYP would have been impossible. I really hope that this project may guide and help people in the future

Thank you so much to all.

ABSTRACT

Analysis on human character involving attitude and discipline is hard to implement and durable to monitor directly. These projects take initiative to study human behaviour using the implementation of robot simulation. The simulation differentiates two groups of robots with different character in term of attitude and discipline. Each robot simulation is generating using same algorithm with varies condition is applied. The simulation is done using Matlab programming. Final result shows that Robot A have a sequence during charging where the first robot has a battery less than 7 it will lead to the charging point meanwhile the next robot with battery level less than 7 will queue and take turn. On the other side, Robot B is freely to charge make the charge point become crowded. The clear result will be shown in the graph attain.

ABSTRAK

Analisa mengenai sifat manusia yang berkaitan dengan disiplin adalah sukar untuk dilaksanakan dan sukar juga untuk dipantau secara langsung. Projek ini mengambil inisiatif untuk mengkaji tingkah laku manusia menggunakan pelaksanaan simulasi robot. Simulasi yang membezakan dua kumpulan robot dengan watak yang berbeza dari segi sikap dan disiplin. Setiap simulasi robot menggunakan algoritma yang sama tetapi berbeza syarat dikenakan. Simulasi ini dilakukan dengan menggunakan pengaturcaraan Matlab. Keputusan akhir menunjukkan bahawa Robot A mempunyai turutan semasa pengecasan di mana robot pertama mempunyai bateri yang kurang dari 7 ia akan membawa kepada titik cas manakala robot yang akan datang dengan paras bateri kurang daripada 7 beratur akan dan mengambil giliran. Di sisi lain, Robot B adalah bebas untuk mengenakan membuat titik caj menjadi sesak. Hasil yang jelas akan ditunjukkan dalam graf mencapai.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	ACKNOWLEDGEMENT	i
	ABSTRACT	ii
	ABSTRAK	iii
	TABLE OF CONTENTS	iv
	LIST OF TABLES	vi
	LIST OF FIGURES	vii
	LIST OF APPENDICES	viii
1	INTRODUCTION	
	1.1 Project Background	1
	1.2 Problem Statement	2
	1.3 Objective of the Project	3
	1.4 Project Scope and Limitation	3
2	LITERATURE REVIEW	
	2.1 Introduction	5
	2.2 Habituation Robot	6
	2.3 Summary	14
3	METHODOLOGY	
	3.1 Introduction	15
	3.2 Research Methodology	15
	3.3 Preliminary Method	17
4	RESULT, ANALYSIS AND DISCUSSION	
	4.1 Introduction	22
	4.2 Result	22

4.3	Analysis and Discussion	27
4.4	Summary	29
5	CONCLUSION AND RECOMMENDATION	
5.1	Conclusion	30
5.2	Recommendation	30
	REFERENCE	32
	APPENDIX	33

LIST OF TABLES

TABLE	TITLE	PAGE
2.1	Emotions, stimuli and responses table	9
4.1	Description of Battery Level	23

LIST OF FIGURES

FIGURE	TITLE	PAGE
2.1	ADAM robot and EDEN environment	7
2.2	The route taken by the robot with emotion is disable	10
2.3	The route taken by the robot with emotion is enable	10
2.4	The environment used for foraging experiment	12
3.1	Simulation of robot A	16
3.2	Simulation of robot B	17
3.3	The construction of the circle	18
3.4	Triangle concept	18
3.5	Box	19
3.6	Suitable function for charge and discharge	20
4.1	Graph for Robot A Simulation	23
4.2	Battery level graph to the time of Robot1, Robot2 and Robot3 (A)	25
4.3	Graph for Robot B Simulation	25
4.4	Battery level graph to the time of Robot1, Robot2 and Robot3 (B)	27
4.5	Theory of Graph Log	28

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	K-chart for the project to be develops	33
B	The comparison table for journal that related to the project	34
C	Flowchart of the project to develops	37
D	Coding to draw the circle and result attain	38
E	Coding to draw a box and result attain	39
F	Coding to make the circle growth and shrink (size) and result attain	40
G	The coding of movement of the circle and result attain	42
H	Slide presentation	45

CHAPTER 1

INTRODUCTION

1.2 Project Background

Usually robotic project will use a supervised robot that will conduct the robotic system to find its target or to do a task but for unsupervised robot learning, it is a term for independent robot that can control its motion and movement itself without need a backup from other source. Although the project is only the simulation development it still can be produce either with supervised or unsupervised learning.

For this project, the system used is unsupervised robot learning that will be implementing toward the project. Unsupervised Learning uses no external teacher and is based upon only local information. It is also referred to as self-organisation, in the sense that it self-organises data presented to the network and detects their emergent collective properties. Usually, supervised learning is performed off-line, whereas unsupervised learning is performed on-line. This project is about the robot that will respond or react as a human. The robot will automatically learn what should to do in the simulation boundary base on the environment given. Final aim for the project is to develop an unsupervised robot that will learn and adapt with the environment in order to analyse the human nature of attitude and discipline.

1.5 Problem Statement

This project is a study of robot simulation that learns and adapt with the selected environment. Since the project of robot that imitate human behaviour is never been done before, therefore this is the main reason to develop this project in order to create and design a new technology of robotic system not only in Malaysia but for worldwide user. There is several problem encounters in order to make the project successfully. Human is the best creatures in this world and to make a robot that exactly same like human is too impossible but in this project the development of human being is able to implement but in term of attitude and discipline only, also limited to the specific environment and situation.

The problem that encourages developing this kind of project is to investigation the developments of social behaviour for unsupervised robot. Similar to human that can control his action by self, this project also implementing the same method that called unsupervised. The robot simulation will generate it behaviour without any supervising and then learns and adapt with the environment in the boundary. Therefore, the main issues to be highlight in the project are to design the unsupervised robot simulation and to make the robot learn and adapt with the environment.

Purpose to develop this kind of project is to bring, create, design and develop a new type of robotic technology of unsupervised robot simulation. Although there is an established project that play around with human emotion such as happy, sad and angry but this project to being discover is to analyze the human character of discipline and attitude that never been explore by other. Furthermore, with those issues being highlighted there is a benefit to robotic group where the development of unsupervised robot that learn and adapt with the environment will give a positive impact in the real world. If this project is successful, there is a possibility to create another unsupervised human behaviour robot but this time is about the real robot and not the simulation.

Each project to be explored and develop supposed to have issues to be solved. Based on the second paragraphs the development of the project can solve the issues completely since the project is want to develop the unsupervised robot learning that can adapt with the environment. In order to make the robot to have those intelligent, the design of the robot simulation will be consist of artificial intelligent of neural network that can

produce unsupervised robot simulation with a self-learning and adaptation with the environment. Therefore the project is managed to solve the issues earlier.

Lastly in the end of the project, the new technology of robotic system is produced and established where there is a robot that can imitate human behaviour then learns and adapt with the environment. This will give an impact and affect the nation of robotic group as well.

1.6 Objective of the Project

There are several objectives that related to this project, including:

1. To study and investigate the suitable environment and model which has relationship of social robot that related to human behaviour.
2. To study the best system to produce unsupervised robot and to create a new algorithm using Matlab software.
3. To observe the difference between two groups of robot simulation that has a different attitude and discipline.

1.7 Project Scope and Limitation

For this project, the scope is to analyse the attitude and discipline between a two groups of robot which is represented by Robot A and Robot B where this two group of robot have a different behaviour. Robot A will be set to be a good robot that has discipline meanwhile Robot B is vice versa Robot A. Each group of robot contain with three (3) circles that represent the robot. The robot is moves only in the boundary that have been set and there is an environment contain the source of food. Each robot will have a different

level of energy. The project is implementing only on the software so that the analysis is being made from the simulation only.

CHAPTER 2

LITERATURE REVIEW

2.4 Introduction

Literature review is the path or process that done with an analysis, reading, evaluating and summarizing the material in order to review the importance and critical point of current knowledge about a specific topic. Then, the result of a literature review may be compiled in a report or use as a part of a research article, thesis or grant proposal.

Since this project is the first time attempt, there is a limited journal or paper that related to it so that there is difficult to comply with literature review. Studies on robot that learn and adapt from it environment already established however, as far as this study concern, there are none involving a robot with human behaviour. There are several studies about unsupervised robot and also a robot that learn and adapt with the environment, with verify method usage. So that the comparison of what method that been choose by those journal in order to get and achieve the goal can be done.

2.5 Habituation Robot

Habituation robot is rarely heard in robotic field but there is some project that being done before like a work by S. Marsland [11]. In frankly understanding, habituation robot is a combination of adaptation and learning of the robot due to the surrounding matter. Since the root word of habituation is habitat that bring a meanings of home or residence or habitation and etc.

Habituation bring a definition of a mechanism that experience some situation to make the brain learns to ignore the repeated stimulus [11]. In history this has been investigated toward a different type of animals by the biologist in order to understanding the concept of habituation. The research also implement the habituation method using neural model into the mobile robot in order to analyse either the robot will response same as animal or not as mention at [11]. Therefore, habituation robot for this project is to analyse if the robot is be able to understand the situation and to adapt with the suitable environment that robot experienced.

As one part in this project, habituation robot is being implemented with mechanism of unsupervised control so that to achieve the goal, neural network intelligent is used. Habituations in this project mean that the robot simulation is ignoring the environment but it not blankly ignoring the environment, it actually learns something where the robot is observing the environment. Then, robot simulations will self learning and self adaptation to the environment. The general study for this project is involving robotic world with full references as shown in **APPENDIX A**.

There are a lot of methods to produce an unsupervised robot. A part from the method is artificial intelligent which is an intelligent system that making computers copy the intelligent of human behaviour. This project needs a self learning and adaptive to environment so that the using of artificial intelligent is most suitable due to the techniques under artificial intelligent contains fuzzy logic, neural network and others technique. According to the animal behaviour perspective by Scott [8] that explains about the learning definition into:

“The most general definition of learning is therefore the

modification of behaviour by previous experience.”[8]

This definition of learning is perfectly matches and suitable for this project where the robot simulation will learn something after observing and experience the situation once. Such as in reference [2] the project is implementing a self-contained environment and perhaps that the robot will be able to improve its performance since the environment that constructed is an ecological niche for a mobile robot. There are similar situation and objective where the robot then will learn and adapt with the environment even though it is hardware development.



Figure 2.1: ADAM robot and EDEN environment [2]

Figure 2.1 is a construction of the robot ADAM (the ADaptive Mobile robot) and environment EDEN (an Educational Environment) where the robot ADAM is train with a neural network controller since the goal for the project is to develop a system of unsupervised learning that make the robot follow an observation of the performance by the innate controller of the robot itself. The robot is being operated the observation via its sensor that will gather the information of the environment. The neural network controllers that implement into ADAM then bring a basic competence to respond with the environment.

Fuzzy logic is suitable for supervised robot meanwhile neural network is for an unsupervised robot that is performs as a biological brain to perform a particular task. Therefore, there is a project that uses ANN (Artificial Neural Network) as a main system of the product. As in [1], the project is hardware development but the system used is a technique from artificial intelligent. The system used is same in [4] and [5] but the different is both [4] and [5] are simulation design. Since [1] use machine learning in real hardware is a bit challenging due to the hardware that involve a noise from sensor, not accurate actions and uncontrollable changes in the environment. Therefore the usage of ANN is a well-known technique of artificial intelligent in order to implement for machine learning in noise environment in [1].

On the other hand some analyses on the artificial emotion of human and animal is done in [4]. The development of hybrid reactive or deliberative architecture being done in order to incorporates with the artificial emotions to improve and modify the general adaptive performance of the robot. According to the project, the idea is to make the robot simulation that imitate human behaviour so that using this method in [4] could make the project more beautiful and attractive since the robot got a feeling and emotion like human such as the robot will happy once can get enough food and getting angry and sad if do not have a chance to get the food by implementing the hybrid reactive or deliberative architecture into the system.

Artificial emotions that experienced by the robot are not a real emotions or not fully similar to the real emotion of human. Then, this intelligent system also not a superficial external response that responsible to mimic human emotions. Besides, the technology is software mechanism that inspired by biological emotions theory in order to enable a robot to respond with the environments that arise during its interaction with a task. According to this project (robot learning and adaptation with environment) there is a part that can use to implement the artificial emotion like in reference [4]. Since the robot is stimulated to get a food, there is an emotion that can be play during that time. There is a happy emotion can be implement to the robot that can eat the food but for those robot who failed to get the food, it will get angry and sad by applying the technologies that already being approached in [4]. Besides that, surprise emotion also can during the robot come out from the boundary and without any sign the food is given and make the robot surprise, excitedly and immediately run over the food.

Table 2.1: Emotions, stimuli and responses table [4]

EMOTION	STIMULUS	RESPONSE
Fear	Physical damage is incurred	Avoid danger, reducing current goal's importance
Anger	Progress towards current goal is obstructed	Achieve current goal at any cost
Surprise	Perceived reality contradicts predictions	Explore environment to improve world knowledge
Happiness	Current goal is achieved	Provide positive reinforcement to successful behaviour
Sadness	Current goal is not achieved	Provide negative reinforcement to unsuccessful behaviour

Table 2.1 represent several emotion of human that can be implementing into the robot. Since human is a special creature that have a lot of emotion, sentiment and expression which is make human is different with other creation in the world. Concern with this, it is impossible to implement all these human character into the robot. Therefore there will be a limitation for those emotions that suitable to be implementing according to [4].

The artificial emotions can be useful to a model that helps the interaction between human and machine. Rather than that, the artificial emotions can motivate a robot to reprioritize the targets, change the performance parameters and provide a learning reward [4]. Meaning that, using this method the project can perform a robot simulation that can adapt the emotion due to the situation of the environment.

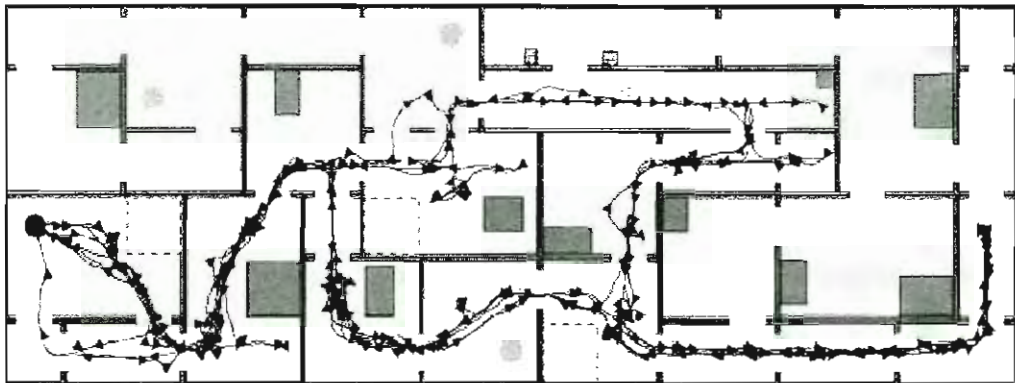


Figure 2.2: The route taken by the robot with emotion is disable [4]

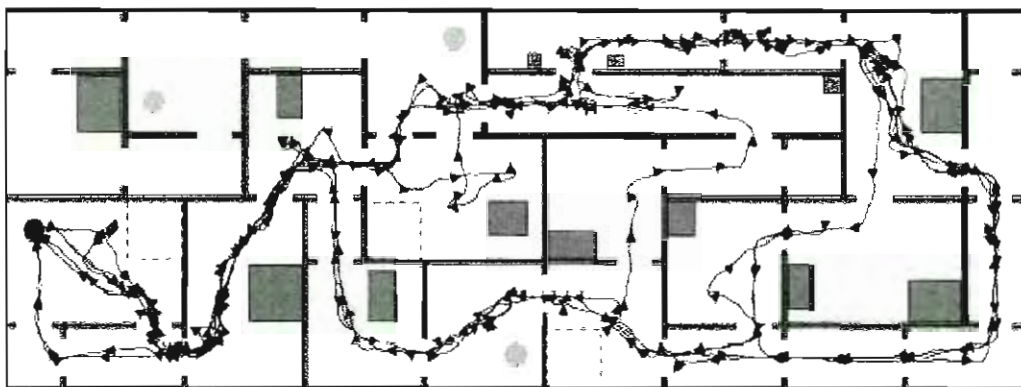


Figure 2.3: The route taken by the robot with emotion is enable [4]

Figure 2.2 and Figure 2.3 show the example environment and path that been through by the robot in order to avoid the obstacle that contains with several emotions. From the example (Figure 2.2 and Figure 2.3) shows that there is a different during through the obstacle with or without the emotion. The robot that through the obstacle without any emotion available will select all the routes that possible by referring to the algorithm only without take any emotion signal that fluent the algorithm as long as the robot can reach the targeted point. But the robot with emotion will take a different routes depend on the emotion that activate during that time. Therefore the idea from this study can be implementing into project where the robot is simulate to move everywhere according to the environment. It is expected that from the environment given the suitable emotion can be implementing together.

In addition, the project is using a neural network to make the robot can learning and adapt to the environment. The robot should experience the environment and make the observation then learn and adapt with the environment. There is another method that under neural network which is can use to conduct the unsupervised robot learning and adaptation. The method is neural endocrine. The advantage of this method is it can control a multi robot since other method usually available to single robot.

There is an example project that use neural-endocrine as the interface for the project that is done by J. Timmis. Neural endocrine is a relationship between a standard perceptron of artificial neural networks and an artificial endocrine system that has the capability to affect the weights of the neural networks but that is depending on the external and internal factors [5].

According to J. Timmis [5], the analysis was done with eleven different behaviours that can be categorised into the three different groups (taxes, reflexes and fixed action pattern). Swarm robotic is being use to do a task of the cleanup the harmful waste, search and rescue operations at disaster sites which is dangerous for human to involves directly or the large area (like ocean) that need a monitoring. But for this experiment, the robot is given a task to collect the rubbish at the pond.

In that case, the technology use is a glands and hormones as a main component of artificial endocrine system where artificial glands will produce artificial hormones during the simulation which is cause by both the internal state of the system and external stimuli. Therefore, to perform the habituation robot of human being in term of discipline and attitude those have a feeling, the method use in reference [5] can be implement in this project.

Environment is the main aspect for this project. Therefore Jon Timmis [5] run a test for the project in order to get the desire result. The test is run by a different environment in order to test the robot performance due to adaptability of the system. The environment were designed with all the required aspect including the capabilities of the robot mind since the robot is build with two sonar sensor at front. This make the robot trying hard to find its way to collect the rubbish since there is an obstacle in the environment. There also other difficulties in the environment where the bin is located at the centre of the environment and surrounding with the obstacle. The robot will collect the rubbish and need

to put it in the bin that is in difficult location, so that the robot would cooperate together by signalling and flocking [5].

Therefore the design of the environment will take a big impact to the unsupervised robot learning and adaptation so that Figure 2.4 is the example of environment that being construct by Jon Timmis [5]. There is a group of robot that responsible to collect the rubbish that float everywhere in the pond. The environment is constructing together with another difficulty that is an obstacles that block the robot from move fluently in order to collect the rubbish and put it into the bin that located at the center of the environment and being surrounding by the obstacles.

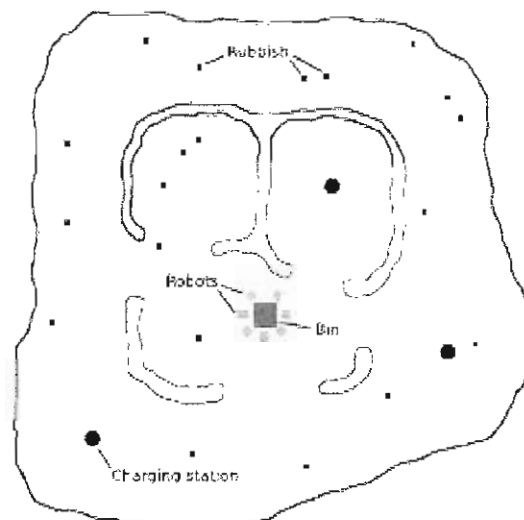


Figure 2.4 The environment used for foraging experiment [5]

Since real world learning required a rapid performing, one-layer linear function approximation ANNs (Adalines) can solve and offer all the weakness of the ANN itself where in real application, ANN learning perhaps becomes too slow and this could cause any damage on the robot. Adalines is use to apply a faster adaptation especially for a robot that need to explore the environment and collect the data by itself. Besides, in [1], reinforcement learning (RL) also is implementing due to the learning by autonomous exploration for light seeking robot that could perform the limited memory and computing