



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF ROBOT FOLLOWING HUMAN USING
ARDUINO**

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

by

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DECLARATION

I hereby, declared this report entitled
“Development of Robot Following Human Using ARDUINO”
is the result of my own research except as cited in references.

Signature : _____

Author's Name : _____

Date : _____

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor Degree of Engineering Technology (Electrical Engineering in Robotics and Automation) (Hons.). The member of the supervisory is as follow:

.....

(Project Supervisor)

ABSTRAK

kertas kerja ini berkaitan dengan peningkatkan penggunaan teknologi di sekeliling kita seperti telefon pintar, tablet, kereta pintar dan drone. Tetapi bagi pembangunan robot tidak mendapat sambutan. Pertama sekali untuk membangunkan robot ia memerlukan kos yang tinggi dan memerlukan pemahaman yang mendalam tentang bagaimana robot berfungsi. Kedua, Bersama-sama dengan pembangunan yang meningkat pada hari ini oleh pengilang dan permintaan perniagaan, robot adalah asas dalam beberapa industri dan mempunyai daya tarikan kepada inovasi ini. Sehingga kini, inovasi robot telah mencapai kemajuan yang bagus. Oleh sebab itu, robot biasa digunakan untuk kegunaan moden sebagai sebahagian daripada beberapa tempat, termasuk kilang pembuatan, tetapi robot pintar untuk kegunaan harian kepada orang ramai, kita masih belum dapat dicapainya lagi (Morioka et al. 2004).

Kata kunci: Robot, Pemprosesan Imej dan Arduino

ABSTRACT

This paper is related to the increasing the use of technology around us such as smart phone, tablet, smart cars and drone. But yet the development of robots is not that explosive. First of all to developed a robot is quite costing and need a deep understanding of how to the robot. Secondly, Together with the blast of enhancing day by day life administrations and businesses requests, robot is fundamental and some industry have popularity on this innovation. As of late, robot innovation has progressed altogether. Be that as it may, ordinary robots are utilized for modern use as a part of some limited spots, including manufacturing plants, and clever robots for our general everyday use have yet to be accomplished(Morioka et al. 2004).

Keyword: Robot, Image Processing and ARDUINO

DEDICATION

To my beloved mother, Puan Haslinda binti Muhamad and my father Noor Azizi bin Ismail, my sibling Noor Syazweena, Noor Syaza Iwanie and my fellow UTEM friends that supported me in completion of my project proposal for my Final Year Project.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Together with the blast of enhancing day by day life administrations and businesses requests, robot is fundamental and some industry have popularity on this innovation. As of late, robot innovation has progressed altogether. Be that as it may, ordinary robots are utilized for modern use as a part of some limited spots, including manufacturing plants, and clever robots for our general everyday use have yet to be accomplished(Morioka et al. 2004). Robot has a lot type of purposes, such as the following robot that can follow as basic as line and as complicated as fast moving object. This type of robot is so much use in the industries, for example in the car manufacturing industries there are robot use to carry a component or a part of a car such as an engine to a work station that are too heavy for a normal human to carry it. This type of robot also can be used as personal butler to follow a human such as in supermarket, the trolley cart is a human following robot that can move itself and helps carry the groceries wherever the human go.

The use of robot can increase the productivity of an industry to maintain the quality of the product produce by the company. Besides that, the labour cost can be reduce due to the use of robot that does not need to pay them and they do not ask for a raise. Human workers that work for a company need to be paid. After a long period of time work in the company, they intent to ask for a raise in the salary. Human need a minimum sleep of 6 hours a day but robot does not need a sleep they can operates

24/7. Hence, the use of robot is has high demands in the manufacturing industries can bring high profit to them.

This type of robot used in the industry has a lot of variation to navigate in the workspace of a manufacturing building. The often used is the line following robot, this line following robot is cheap and easy to maintain. Line following robot commonly use an infrared (IR) sensor that program to follow the line on the floor of the workspace area. The other kind of robot is use an image processing to follow the path of a targeted object, this is not the commonly use in the industries but it can be use in the shopping markets, airports, hospital and office. Some of the robot is equipped with laser range-finder and omnidirectional camera. The first method is based on visual tracking only and while it works well at slow speeds and controlled conditions(Kroh 2011). Some has robot following with Vision Based Target Detection(Sonoura & Yoshimi 2008)

The focus of this paper is the image processing by using matlab for tracking a human target that implement for a robot. The use of image processing can reduces the use of other device such as sonar receiver, IR sensor and other device that can detect and receive information. When the use of image processing the robot can move on think on its own by the programming in matlab, as people called artificial intelligent (AI). This AI can make the robot to move according to the person that targeted in the setting. Since its origin, which can be dated back to 1956, AI research has been strongly inspired and motivated by human intelligence (Dautenhahn 2007)

Image processing is really a breakthrough in science to a big step in innovative purposes. Because human intent to use their eye to making a decision such as when walking the human use their eyes to judge the condition of the road it is safe to walk or not. Besides that, human use their eyes to judge distance, size, and a lot of thing, there are a saying „seeing is believing“. The eyes can capture images and instantaneously sent the image to the brain to process and sent signal to all parts of the body. This is remarkable the power of the nature.

We as human always want to replicate the nature, to build something that resemble the creation of the nature, because the creation of nature is the best human creates all sorts of sensor to replace the use of human interaction senses but the best

senses is the senses of sight. This is why the image processing is made. When put a camera on a robot that can move and the camera can process image for the robot to think and make decision that just replicated something alive.

With this technology it can be use to help in our daily life. For example, this human following robot combine with shopping trolley cart, there is no need to push the heavy trolley cart to the car or the counter and let all the heavy lifting done by the robot. This also can be use in the hospital area that the bed of the patient before going to the operation room, as we know that the bed in the hospital quite heavy with all the mechanism to lower or raise the bed. With the use of this robot following human there no need the use of people to move the bed but the bed just follow one person to a destination.

For my project I will be develop a human following human by using a MATLAB and ARDUINO. Besides that, the use of matlab Graphical User Interface (GUI), With GUI the robot can be control the speed, target to follow and so much more. In the GUI we also can see what the camera that mounted on the robot following human can see. This can make it easier to monitor the movement of the robot and also can monitor who the robot following.

1.2 Problem Statement

The use of robot in various parts in our daily life just got even bigger such as in the industries of manufacturing cars and even in our daily life. There is a type of robot called the robot following human but the robot following human is not automated, the robot usually need a human assist. For example, the robot needs to be control by a remote control of the robot already pre-program to do a certain task. Robot following human have a lot of possibilities to be apply to. With my project, the robot following human will be intergraded with the image processing. With the image processing, the robot will have the capabilities to be automated hence, the robot has the image processing to help itself to follow a human.

1.3 Objective

1. To develop a robot following human by using ARDUINO.
2. To control and analyse the motion perform of the robot following human.
3. To integrate the image processing technique for robot following human.

1.4 Work Scope

For the work scope of this project is using matlab software as the medium to input the programming. After the programming is completed the programming is inserts in the ARDUINO Uno as the brain or the processer to give signal to other parts of the robot to move or to stop. Besides that, the arduino Uno also will process the image processing that make the importance component of this robot to perform. The graphical user interface (GUI) also helps to make this robot following human is user friendly.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In the late years the improvement in innovation turns out to be exponentially blossom. This innovation is applied from the agribusiness to industry occasion in our day by day life. The introduction of innovation is 2 million years BC(Dosoudil 2007). Two million years BC ago the first technology is for hunting, it is the tools for survival. Fast forward to the 20th century new technology is discover it called „robot“ (Edward 2011). Besides that, robot is not the only one invention that takes the world by storm. For example rocket for aerospace(Liu et al. 2014) , train(Albrecht et al. 2013) and mobile phone(Yang et al. 2012). One of the big achievement from the late 90th to the 21th century is the ASIMO(Mutlu et al. 2006) humanoid robot that created by Honda(Kanagal et al. 2011).

2.1 Type of Robot Following

The main title of my research paper is the robot following human. There is other type robot following such as line following robot. There are lines following robot that join with the ability to adjust by utilizing two wheels. Much the same as an altered pendulum that been parity to not tumble down (Ghani et al. 2011). Besides that, there is robot that use for agriculture purposes. This type of robot use the four wheel system for follow path in the agriculture are(Cariou et al. 2009). It is easier to

navigate through the farm with four wheels compare to two wheels that stated in the research paper.

2.2 Image Processing

In my project, the use of image processing is essential to the robot design. The image processing help the robot to identified the target for following. There are a robot already have the system of moving by depending on the image processing. The robot experiment called RHINO and MINERVA robots(Trautman et al. 2013). The system of image processing helps the robot to navigate through a crowded place. The robot can execute its own path to get through as in Figure 2.0 the camera is install on the shilling of the compound.



Figure 2.0: Images processing targeting path(Trautman et al. 2013)

Besides that, there is research paper that the robot also use camera for the navigation. The robot can follow a certain target and also have the capability as the image processing robot. The robot use an implements multisensor data fusion techniques(Bellotto & Huosheng 2009). The robot use laser base algorithm and use the laser for navigate the robot and make it more accurate to follow.

Some of the robot is equipped with laser range-finder and omnidirectional camera. The first method is based on visual tracking only and while it works well at slow speeds and controlled conditions (P. Batavia 2006). All of this technology can

make the robot having artificial intelligent (AI). This AI can make the robot to move according to the person that targeted in the setting. Since its origin, which can be dated back to 1956, AI research has been strongly inspired and motivated by human intelligence (Dautenhahn 2007).

2.3 Software

The programming of the image processing(Parker 2010) is suggested to use the software MATLAB(Kong 2010). The uses of MATLAB can speedups for the functions in the data-independent or data-sharing. This is essential for a fast data transfer in the robot following human. Moreover, the use ARDUINO with this project the MATLAB must use MATLAB- ARDUINO to make the programming compatible from MATLAB to ARDUINO. This can control parameter for the controller and the ARDUINO in order to generate the pulse width modulation (PWM)(Zulkifli et al. 2015). This is really importance because the PWM is important to control the speed of motor. Without the speed control of the motor, the dc motor is hard to control and make the robot have unstable speed.

2.4 Graphical User Interface (GUI)

Graphical User Interface (GUI) also helps to assist user to control the robot. There are a research that use this method to make the use of this system is easy. The human machine interaction interface is to make the robot manipulator (RM) can perform all active and passive exercises as well as learn specific exercise motions and perform them without the physiotherapist (PT) through the Human–Machine Interface(Adli 2011). As in figure 2.1 how the GUI is operates to this system.

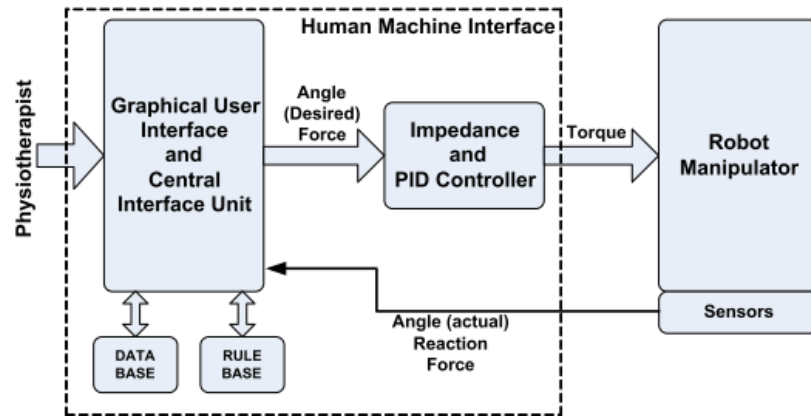


Figure 2.1:GUI methodology overview(Akdoğan & Adli 2011)

2.5 Processor

Execution of image processing toll frameworks is just restricted in some spots. Remembering these issues we have built up this anticipate where raspberry pi(Grout & Houlden 2014) will be utilized as host. This minicomputer has the capacity of picture handling and control a complete toll framework. A camera will be utilized to take photo of the vehicle's name plate to sort the toll charge as per vehicles classification. Alongside numerous programmed tolls taking corner there will be a manual stall with administrator additionally who will handle those vehicles which encounter issues with any of the programmed toll taking corner(Raihan 2013).

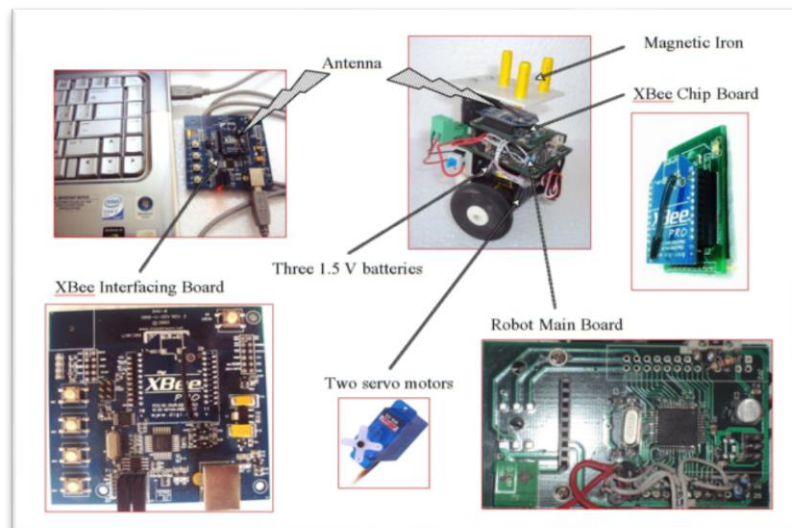


Figure 2.2-Component of ZigBee(Qian et al. 2013)

A remote(Qian et al. 2013) submerged versatile robot framework is planned keeping in mind the end goal to contemplate the conduct of Artemia gathering. Another thought has been exhibited for submerged versatile robot framework which is comprises of two sections, first is the submerged mechanical robot and the second is ZigBee remote based portable robot which controls and moves the initial segment(Rashid et al. 2012)

2.6 Robot Development

There is various type robot that involve in the development of robotic for example the field of Tactile Human–Robot Interactions (Tactile HRI) (Argall & Billard 2010). Where physical contact from a human is identified by a robot amid the execution or advancement of robot practices. Methodologies are introduced from two perspectives: the sorts of physical cooperation that happen between the human and robot, and the sorts of sensors used to identify these connections. We contribute a structure for the classification of Tactile HRI research inside every perspective. Material detecting procedures are assembled into three classifications, as per what covers the sensors: (i) a hard shell, (ii) an adaptable substrate or (iii) no covering.

Three classifications of physical HRI in like manner are recognized, comprising of contact that (i) meddles with robot conduct execution, (ii) adds to conduct execution and (iii) adds to conduct advancement.

Besides that, there is a development in multi-agent system (MAS). MAS are the other type of approach utilizing the itemized procedure gave by Pro-metheus strategy to the configuration of a moving robot application for the detection and following human. (Gascueña & Fernández-Caballero 2011). But the system is unpredictable self-governing automated frameworks must be completely demonstrated in their underlying outline stages by method for specialist based innovation. The application has been totally displayed with the Prometheus Design Tool (PDT)

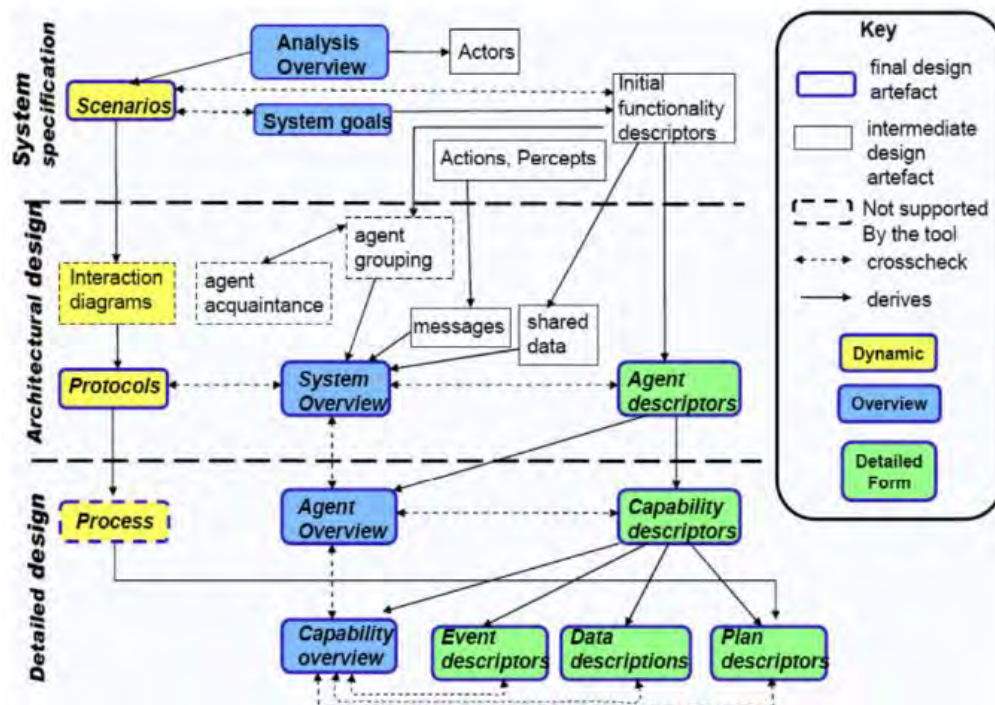


Figure 2.3-Prometheus methodology overviews.

CHAPTER 3

METHODOLOGY

3.0 Introductions

In this chapter it is the method that I will use to make the project works and running smoothly. This chapter is importance because it can keep track to my work for this project. In the making of robot following human the steps to be implement to the robot is essential because it is not a robot that can buy of a store. The objective of this project must be fulfilling because the objective is already a step by step to make the robot following human works.

3.1 Flowchart

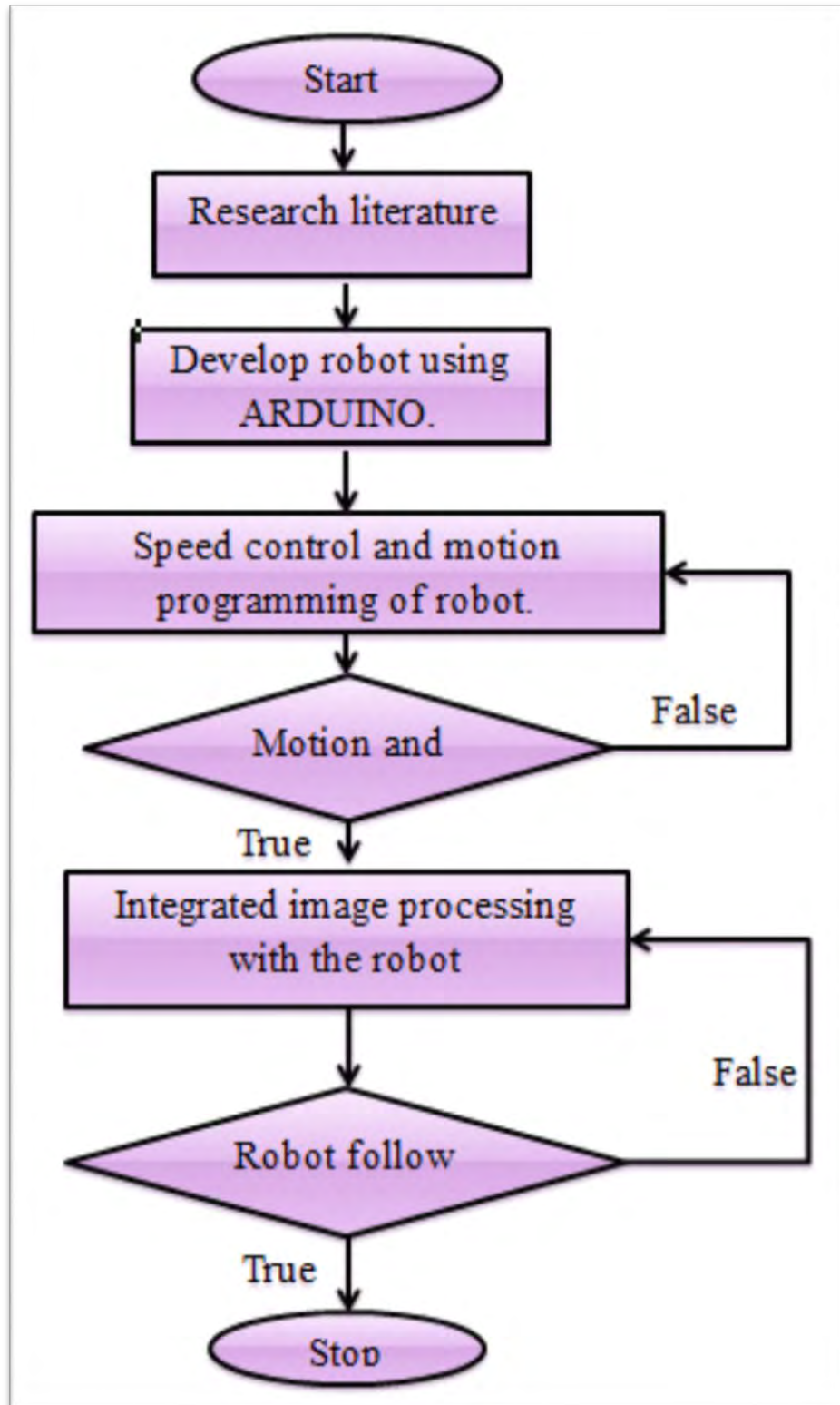


Figure 3.0-Flow Chart

At the beginning of my flowchart is the literature review, past research must be reviews as a reference to make the project better and can be as guidance. After all the reviews the robot can be develop according to the guidance of the literature reviews. With the review, the best design can be finalise. This is importance because with the best design the robot can perform as required. After the robot had been develop, the programming of the robot come to place.

The programming of the robot is the command to the robot to make a motion and move. Without the programming the robot only has the brain but do not have the mind to move. The programming always corresponding to the motion and movement required, if the movement and motion is not the right one, the programming need to be troubleshoot. When the motion and movement of the robot is correct according to the required, the integration of image processing to the robot takes place. The image processing is to make the robot follow a human. The process of following a human is always the hard thing to do, so image processing system is always need to be improve if the robot not following a human accordingly. Finally when the robot follows a human and performs to all the required movement and motion, the project is a success. The project can be stop at the end of the flowchart.

3.2 List of Component

3.2.1 ARDUINO Uno

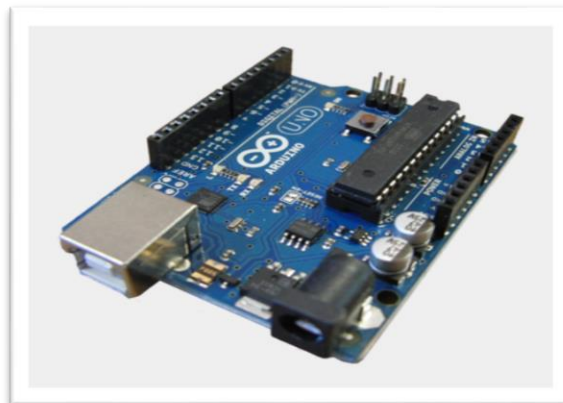


Figure 3.1: ARDUINO Uno