DEVELOPMENT OF PICK AND PLACE ROBOTIC ARM USING ARDUINO

LIN WAI KIT

B071710662

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DEVELOPMENT OF PICK AND PLACE ROBOTIC ARM USING ARDUINO

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours.

by

LIN WAI KIT

B071710662

970810-38-5019

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY

2020

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.....
LIN WAI KIT
Alamat Tetap: NO 702, Jalan Haruan, Taman Bernam, 35900 Tanjong Malim, Perak.

Tarikh: 12/01/2021

Disahkan oleh penyelia:

NURUL KAUSAR BINTI AB MAJID
Jurutera Pengajar
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan
Elektrik dan Elektronik
Universiti Teknologi Malaysia Melaka

....
NURUL KAUSAR BT AB MAJID

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Author: LIN WAI KIT

Date: 12/01/2021

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Industrial Automation & Robotics) with Honours. The member of the supervisory is as follow:

Signature: ……

Supervisor: NURUL KAUSAR BT AB MAJID

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DEDICATION

This thesis is dedicated to my parents and family member who give me moral support and encouragement during completing this report. I also would like to dedicate my friends and supervisor that always possibly help me when I have trouble with this project.

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ABSTRACT

In recent years, people paid more and more attention to industry and daily work, which is also being replaced and automated by robots. A robot is an automatically operated machine that replaces human efforts, although it may not look like a human or perform functions in a human way. Pick and place robot is one of the technologies used to perform picking and placing operations in manufacturing industry. The design of this system can eliminate human error and human intervention and make the work more accurate and efficient. Literature mentions that the pick and place robot is designed and implemented in various field, such as bottle filling industry, packaging industry and also rehabilitation for patients with arm disability or stroke. The purpose of this project is to design and develop a low-cost pick and place 4 DOF robotic arm. In this project, servomotors act as the joints of robotic arm and is controlled by programming of Arduino Uno. The Arduino Uno acts as the microcontroller in this project. There are four potentiometers attached to the Arduino Uno and each servomotor or joint of robotic arm is controlled by potentiometer. By moving the servomotors, the Arduino robotic arm able to rotate 180 degree for picking and placing some objects from one place to another. The servomotor used in this project is low torque and can also be used with high torque servomotor to pick up and place more heavy objects. In addition, the robotic arm also can be controlled via Bluetooth or smartphone applications.

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ABSTRAK

Pada tahun-tahun terakhir, orang-orang memperhatikan industri dan kerja sehari-hari, yang juga diganti dan automatik oleh robot. Robot adalah mesin yang beroperasi secara automatik yang menggantikan usaha manusia, walaupun ia tidak kelihatan seperti manusia atau melakukan fungsi dengan cara manusia. Pilih dan letak robot adalah salah satu teknologi yang digunakan untuk melakukan pilih dan letak operasi dalam industri pembuatan. Rencana sistem ini boleh menghapuskan ralat manusia dan campuran tangan manusia, dan membuat kerja lebih tepat dan efektif. Literatur menyebutkan bahawa robot pilih dan letak dirancang dan dilaksanakan dalam berbagai bidang, seperti industri penuh botol, industri pakej dan juga pemulihan semula untuk pesakit dengan cacat lengan atau stroke. Tujuan projek ini adalah untuk merancang dan mengembangkan pilih dan letak robot dengan biaya rendah. Dalam projek ini, mesin servo bertindak sebagai gabungan lengan robot dan dikawal oleh program Arduino Uno. Arduino Uno bertindak sebagai pengawal mikro dalam projek ini. Terdapat empat potentiometer yang dilampirkan kepada Arduino Uno dan setiap motor servo atau gabungan lengan robot dikawal oleh potentiometer. Dengan menggerakkan motor servo, lengan robot Arduino mampu memutar 180 darjah untuk mengambil dan menempatkan beberapa objek dari satu tempat ke tempat lain. Motor servo digunakan dalam projek ini adalah torque rendah, dan juga boleh digunakan dengan motor servo torque tinggi untuk mengambil dan menempatkan objek lebih berat. Selain itu, lengan robot juga boleh dikawal melalui Bluetooth atau aplikasi melalui telefon pintar.

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LIST OF SYMBLO

ms	millisecond
m	metre
GHz	Giga Hertz
Mbps	Mega bit per second
Gbps	Giga bit per second

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LIST OF ABBREVIATIONS

DOF	degree of freedom
rtfMRI	Real-time functional magnetic resonance imaging
WREX	Wilmington Robotic Exoskeleton
VR	virtual reality
LCD	Liquid Crystal Display
BIO	basic input-output
PRO-M	programmable memory
ADC	analog-to-digital converter
ANN	Artificial Neural Network
ILC	Iterative learning controller
BMI	brain-machine interface
EEG	electroencephalography
EMG	electromyography
OS	operating system
GUI	graphical user interface
IoT	Internet of Things
NFC	Near-Field Communication
IR	Infrared
UHF	Ultra-High Frequency

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BLE	Bluetooth Low Energy
PP	Polypropylene

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The definition of robot is to study, design, and manufacture with robot system. With the rise of manufacturing activities, people invented a kind of robotic arm to help each industry to complete a task or work, rather than using manpower. Robots are often used to perform safe, dangerous, high repetitive and unpleasant tasks. The robot can complete material handling, assembly, arc welding, resistance welding, machine tool loading and unloading, painting and other functions. It is very useful because it has high precision, intelligence and infinite energy levels to do work compared to humans. For example, in the assembly or packaging line, the robotic arm is widely used. It can lift small objects to achieve the repeated action that humans cannot bear for a long time. This is because it is not limited by fatigue or health risks of the robotic arm, the robotic arm can complete the task of lifting light materials efficiently and in time.

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In the second half of the 20th century, the original meaning of the word robot changed. Although in science fiction, robot is still a kind of artificial machine whose performance is similar to or better than that of human. In the real world, robot is used to represent simpler machines. In industry, a controlled joint mechanical system is also called robot. Mobile robot is a kind of intelligence autonomous vehicle. For many people, the term robot has become a general term for any automatic machine. There are many people trying to redefine the word

robot. In industry, robot is a kind of "automatic control and reprogrammable multipurpose manipulator" which is defined by ISO that can be programmed on three or more axes. Related to web search engine, robot is an "automatic program that tracks links to websites on behalf of search engine or directory". According to these definitions. Is the famous robot R2D2 in Star Wars as a robot?

The machines we now call robot recombine some of the capabilities of science fiction robots, such as the ability of industrial robots to operate or the ability of mobile robots to navigate, but there are still many gaps. There are many reasons for these changes in the meaning of the word robot, but the main reason may be marketing. In business marketing, the word robot is used to give products a future and complex connotation, such as "kitchen robot". There is also another way of marketing in the scientific community, where the term robot is overused. For instance, trying to make their funding requirements for Research & Development (R&D) activities more attractive. However, this over marketing has some negative effects on those who are still working on robotics.

In this highly developed society, time and manpower are the key constraints to accomplish tasks on a large scale. In most regular and frequently work, automation plays an important role in saving human resources. One of the main and most frequently performed tasks is the selection and placement from source to destination.

Today's industries are increasingly turning to computer-based automation, mainly because of the need to increase productivity and deliver uniform quality end products. In the past, due to the inflexibility and high cost of the hard-automation system for automated manufacturing tasks, people have a wide range of interests in the use of mechanical arm which can perform various manufacturing functions at a lower cost in a flexible environment. The use of industrial mechanical arm reflects some contemporary trends of

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