Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF AGRICULTURE ROBOTIC (AGRIBOT) IN SMART FARMING

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Bachelor of Electrical Engineering Technology (Industrial Automation and Robotics) with Honours

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DEVELOPMENT OF AGRICULTURE ROBOTIC (AGRIBOT) IN SMART FARMING

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DEDICATION

I dedicate this project to my beloved mother and father for always being there for me.

ABSTRACT

Agriculture is one of the farming practices that regards to the cultivating including the development of growing and raising crops to supply the food and other necessity to sustain life. The increasing of the human population will increase the tropical developing nations. Thus, the increasing of agriculture sector will contribute to the higher amount of human labor required by using traditional method. The time-consuming production step also increase and will reduced the productivity of the agriculture sector. One way to address these issues and increase the quality and quantity of agricultural production is using sensing technology to make farms more intelligent and more connected through the smart farming. This study focuses to design the agriculture robotic in smart farming for tomatoes picking. The development of the agriculture robot arm (Agribot) in smart farming for tomatoes picking is design by using Arduino. Furthermore, this design also required several main components to make sure the robot arm is function properly. The performance of the agriculture robot arm (Agribot) will be analyze at the end of this project.

ABSTRAK

Pertanian adalah satu aktiviti yang berkaitan dengan pemelihraaan tumbuhan dan pertumbuhan tanaman dalam pembangunan dapat digunakan sebagai bekalan makanan dan keperluan lain dalam kehidupan seharian. Peningkatan populasi manusia dalam pembangunan sesebuah negara akan meningkatkan keperluan dalam sumber tropika. Oleh itu, peningkatan sektor pertanian dalam menggunakan kaedah tradisional akan menyumbang kepada peningkatan jumlah buruh manusia yang diperlukan. Masa pengeluaran yang diambil juga meningkat dan akan mengurangkan produktiviti aktiviti pertanian. Salah satu cara untuk menangani isu-isu ini dan untuk meningkatkan kualiti dan kuantiti pengeluaran pertanian dengan menggunakan teknologi untuk membuat pertanian lebih maju menerusi pertanian pintar. Kajian ini lebih fokus kepada reka bentuk robot pertanian di lading pintar untuk memilih tomato. Pembangunan lengan robot pertanian (Agribot) dalam pertanian pintar untuk memilih tomato adalah reka bentuk dengan menggunakan Arduino. Selain itu, reka bentuk ini juga memerlukan beberapa komponen utama untuk memastikan lengan robot berfungsi dengan baik. Prestasi lengan robot pertanian (Agribot) akan dianalisis pada akhir projek ini.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

In this chapter, the background study of the agriculture robotic in smart farming is discussed. The problem identification of the project was identified. Then, the objective and scope of the project were stated based on the problem statement to solve the problem occurred. Moreover, the expected result from this project is also discussed based on the scope requirement. The thesis structure of the project is constructed to shows the process flow for each chapter in this report.

1.1 Background Study

Agriculture is one of the farming practices that regards to the cultivating including the development of growing and raising crops to supply the food and other necessity to sustain life. The increasing of the human population will increase the tropical developing nations. The growth of human population will contribute to increasing the requirement of food and biofuel production (Laurance et al., 2013). Even though agriculture activity is seen as uninteresting, low income and productivity of economic activity, but the contribution from this activity had attributed to the concerning of food security. Moreover, the agricultural sector is also playing a role as a major economic contributor in several countries. The development process of many population employed in agriculture, a high percentage of the national income is derived from that sector.

Tomatoes is one of the plants and the world's most fruit crop in the agricultural sector. The tomato is rich in vitamins and minerals that were evaluated by different stages which are immature stages (green colored), physiologically mature (breaker), and harvesting which is the tomato is in red colored (Olivera et al., 2013). The design of agriculture robot is used as the application method to prevent this problem. An autonomous robot is used in measuring the agriculture parameters which is applied the system and method of agriculture robot in harvesting, seeding, plucking and collecting. The agricultural product picking robots are important in the technology of applying robots to agricultural production (Chiu et al., 2013). Wouter et al., (2013) developed the robot for harvesting purpose with regard to hardware design decision, design process technique used, production environment, algorithm characteristics and performance indicators.

Chiu et al., (2013) determined the four major components of autonomous picking robot system that includes the end-effector, machine vision, control system and robot carrier. The autonomous picking robot system acts as the robot arm used to pluck the tomatoes from a tree. Due to the high market demand for tomatoes, the improvement of time and efficiency of picking tomatoes will attribute to the increase of production by only plucking the suitable amount of tomatoes. This can prevent the serious post-harvest problem for traders (Krishna et al., 2012).

1.2 Problem Statement

The picking of fresh tomatoes by using traditional method have increases the amount of human labor and time-consuming production step (Feng et al., 2015). However, the problem of sorting tomatoes caused by the sheer volumes handled and the delicate nature of the fruit are the effects that faced by producers and seller (Rokunuzzaman et al., 2013). In

addition, there is an effect will affect the tomato during storage and transportation which is the tomatoes will deteriorate rapidly (Krishna et al., 2012). Therefore, there is a method such as tomatoes harvesting robot is used for plucking tomatoes from the tree.

The labor intensity will be reduced while the productivity of labor will increase due to the effectiveness of picking robot. Besides that, by using robot harvesting system the amount of human labor and time-consuming production will also decrease (Feng et al., 2015). Thus, the design of the agriculture robot arm is developed for the purpose of tomatoes picking by using gyro sensor as a control system.

1.3 Objectives

The objectives of conducts these studies are:

1. To investigate the harvesting robot in the agriculture fields.
2. To develop the agriculture robot arm (Agribot) for picking tomatoes by using Arduino.
3. To analysis the robot performances for picking tomatoes.

1.4 Scope

This research is conduct to develop the design of harvesting robot arm for plucking tomatoes fruit. Furthermore, this design required several main components to make sure the robot arm is function properly. The components used for robot arm design include Arduino Uno, Servo Motor, and IC7806.

1.4.1 Arduino Uno

Arduino Uno is open source microcontroller board, using C++ language. It is also using ATMEGA as the processor. Arduino Uno board is programmed to control servo motors.

1.4.2 Servo Motor

Servo motor is a rotary actuator that allows for precise of angular position with feedback. The servos for a robotic arm is controlled by Arduino Uno programmer. The motor function to move the joints of an arm so that the robotic arm is able to pluck tomatoes fruit from the tree. This project involves include servo motor acts as a joint.

1.4.3 IC 7806

IC 7806 is a linear voltage for regulator integrated circuits. It is a member of 78xx series of fixed linear voltage regulator ICS and commonly used in electronic circuits requiring a regulated power supply due to their ease-of-use and low cost. The 7806 indicated the output voltage of IC which is 6-volt output. The 7806 is produce positive voltage regulators relative to a common ground. These devices provide 1 or 1.5 amperes of current, however, for smaller and larger package could have a lower or higher current rating. Moreover, the voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The output voltage is maintained at a constant value by the voltage regulator IC.

1.5 Chapter Organization

There are five chapter in this project report included the introduction of the project, literature review in which the studies of related works with the project title from the previous study of the various authors, the methodology that had been used to implement the knowledge, result and discussion of the project and conclusion and recommendation of the project in the future.

a) Chapter 1:

This chapter introduces the brief idea of the project. It focused on the overview of the project, background study, the problems statement, detailing the objectives and scope, and the expected result outcome from the project.

b) Chapter 2:

This chapter concentrate on the literature review that will describe all the information that was referred as a reference in order to complete the research project. Generally, literature review consists of facts and theoretical identification from a previous research that provides a guideline for the project to build up.

c) Chapter 3:

The methodology used is discussed in this chapter. The schedule that needs to be completed and the detailed reports of studies that were done to achieve the aim of the project are presented. The methodology is the important aspect of it as the beginning process of planning. If the methodology is not organized only then will encounter the problem involved in the project.

d) Chapter 4:

This chapter shows the result and discussion of the project. All the data collection and the process involved in selection processes will be discussed in detail. The results will be compared with the objectives outlined in order to arrive at some hypothesis and conclusion.

e) Chapter 5:

This is the last chapter that proved the success achieved by the objective stated in the earlier chapter. This project can be concluded and explain the detail in this chapter. Other than that, a future recommendation for this project also includes improving this project for the future improvement.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Smart farming is the modern application of Information and Communication Technology (ICT) that used in agriculture. This is the way to improve the quality and quantity of agriculture industries by using technology. The advantages of implementing sensor in the agriculture industry are to transmit the real-time data for allowing cost effectiveness and accuracy in order to predict and protect the growth of an agricultural crop. In this chapter, the development of smart farming in agriculture industry has been discussed based on the different type of crop, planting method and effecting of smart farming in industries. Moreover, the study on previous research of development smart farming for tomatoes is conducted to differentiate and improve the process quality in the future work. On the other hand, the component of agriculture robot is defined to justify the function of each component in order to increase the performance of agriculture robot for tomatoes harvesting and picking.

2.1 Development of Smart Farming in Agriculture

Agriculture is the largest economic sectors and plays an important role in the overall economic development of a nation. The growth of technological development in the area of agriculture will increase the competence of certain farming activities. Thus, the study on a smart farming system using sensors for agricultural task automation was conducted through