Restaurant Waiter Assistant Line Follower Robot

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DECLARATION

I declare that this thesis entitled “Restaurant Waiter Assistant Line Follower Robot is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : Jackson Lee

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Date : 3/07/2021

APPROVAL

I hereby declare that I have checked this report entitled “Restaurant Waiter Assistant Line Follower Robot” and in my opinion, this thesis it complies the partial fulfillment for awarding the award of the degree of Bachelor of Electrical Engineering with Honours

Signature : .....

Supervisor Name : ASSOC. PROF. Ir. Ts. DR. ABDUL RAHIM BIN ABDULLAH

Date : 5 July 2021

DEDICATIONS

To my beloved mother and father

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ABSTRACT

This project is dealing with the development of the Restaurant Waiter Assistant Line Follower Robot where it provides a better way of service in serving the customer and improves the work efficiency in the restaurant. In this era of technological advancement, there many kinds of design and function of the line following robot have been implemented, equipped, and used in the restaurant at the oversea country such as China modern automation restaurant, Japan restaurant, and others countries. Line Follower Robot is a robot that uses the line (a black tape line) as the main path to send the food from the kitchen to the table to serve the customer a better way. In this project, the main microcontroller that has been used is Arduino Mega in controlling the whole robot, receiving input from the sensor and module, and sending the signal to the output module. The Arduino controller is receiving the signal from the input of the sensor such as keypad to set the movement of the robot and Mifare rc522 RFID to locate the table for serving and another input sensor. There are several simulation tests and hardware development tests on each part of the robot carry out before the complete prototype of the robot is developed. The robot will go through several load test which is from 0 g to 1700 g based on the food's weight setting, also the average speed of the robot will be generated. Then, the battery consumption of the robot is in 1 hour and 8 minutes. In general, the overall function of the robot is sending the food to the targeted table after the number of the targeted table is inserted and it will return to the kitchen (original position) to standby for another task.

ABSTRAK

Projek ini berurusan dengan pengembangan Robot Pengikut Line Waiter Assistant Waiter di mana ia menyediakan cara perkhidmatan yang lebih baik dalam melayani pelanggan dan meningkatkan kecekapan kerja di restoran. Di era kemajuan teknologi ini, terdapat banyak jenis reka bentuk dan fungsi robot berikut yang telah dilaksanakan, dilengkapi, dan digunakan di restoran di negara luar seperti restoran automasi moden China, restoran Jepang, dan negara-negara lain. Line Follower Robot adalah robot yang menggunakan garis (garis pita hitam) sebagai jalan utama untuk menghantar makanan dari dapur ke meja untuk melayani pelanggan dengan cara yang lebih baik. Dalam projek ini, mikrokontroler utama yang telah digunakan adalah Arduino Mega dalam mengendalikan keseluruhan robot, menerima input dari sensor dan modul, dan mengirim isyarat ke modul output. Pengawal Arduino menerima isyarat dari input sensor seperti papan kekunci untuk mengatur pergerakan robot dan Mifare rc522 RFID untuk mencari meja untuk diservis dan sensor input lain. Terdapat beberapa ujian simulasi dan ujian pengembangan perkakasan pada setiap bahagian robot yang dilakukan sebelum prototaip lengkap robot dikembangkan. Robot akan melalui beberapa ujian beban iaitu dari 0 g hingga 1700 g berdasarkan tetapan berat makanan, juga kelajuan rata-rata robot akan dihasilkan. Kemudian, penggunaan bateri robot adalah dalam 1 jam 8 minit. Secara umum, fungsi keseluruhan robot menghantar makanan ke meja sasaran setelah jumlah meja yang disasarkan dimasukkan dan ia akan kembali ke dapur (kedudukan asal) untuk bersiap sedia untuk tugas lain.

TABLES OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

ISO - International Organization for Standardization

LCD - Liquid Crystal Display

RFID - Radio Frequency Identification

LED - Light Emitting Diode

IR - Infrared

DC - Direct Current

IDE - Integrated Development Environment

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Overview

This chapter will be discussed about the background of the definition of the robot, the term of the robot, what is restaurant waiter assistant line follower robot, the motivation for conduct this research, the problem statement, the objectives that want to achieve, and the scope that used in this research.

1.2 Research Background

1.2.1 Definition of Robot

The robot is one of the machines which are using the combination of electronics and mechanical knowledge in the development of the robot while it also one of machine that can be programmable based on the human need by a computer**[1].** It is also capable of handling or carrying the complex task where the human cannot be reached. There are two types of control on to this robot which is first it can be controlled by using external control device and second ones is the controller are equipped within the robot itself where the robot can run automatically by following the program that has set by a human without a human manually control **[2][3].**

1.2.2 The term of the Robot

The history of robots is one of the terms that have used and always mentioned out by a fancy world that has been come up with innovation to transform fancy into reality. The world organization for Standardization (ISO) clarifies that a robot is " an automatically controlled, reprogrammable, multipurpose with three or more axes." Besides, the Robot Institute of America assigns a robot as " a reprogrammable, multifunctional manipulator designed to maneuver material, parts, tools, or specialized devices through various programmed motions for the performance of a spread of task." Also, another more attractive definition which presented by Meriam-Webster, where it stated that a robot is " a machine that looks like a human being and performs various complex act (as walking or talking) of a person's being."[3]

1.2.3 What is Restaurant Waiter Assistant Line Follower Robot?

Restaurant Waiter Assistant Line Follower Robot is an electromechanical machine that can be programmable easily by the human with using the computer and it normally used in the restaurant where it can help the waiter to serve the customer a better way during the peak hour moment or holiday season. Also, this robot is very economical friendly and low cost that can be affordable for the restaurant. When talking about this robot, this robot is using the 'Line' as the main path or predefined path in the restaurant to send the food or meal for the customer and the path can be a black electronics tape or black stripe on the white background surface**[7]**. The robot is using the Infrared sensor called an IR sensor to track or follow the predefined line path to serve the customer. There are several similar research paper that relates to this project that has stated which are Smart Food Serving Robot in Restaurant where this robot is provided user interface with the robot because this robot is using the LCD touch screen to display the electronic menu bar for ease customer to place the order and the order that placed will transfer through wireless communication into the kitchen **[4**].

This project is to develop the line follower robot where is mainly uses in the restaurant application to serve the customer in another way. The general purpose for this robot is to send the food or meal and beverages to the located table for the customer and go back to the own position (kitchen) to standby for another task by the line follow or line tracking method.

1.3 Motivation

In this era of technological advancement, robotics technology has become widely used in many types of fields of applications throughout the world such as in industry, hotels, restaurants, Café, and other applications. Due to the fastest-growing rate of the development of robotics technology, there are many kinds of robotics application that have been used and increased available in the nowadays public, besides, the robot also equipped with many and different types of enhanced sensor, microcontroller, and others intelligent technology to serve people such as the application of robot to serve the customer at the restaurant or Café.

As we know that as the waiter, serve the customer is one of the regular tasks at the restaurant every day. When the customer arrives at the restaurant, the waiter will ready and go to serve and take orders from them, after done taking orders, the waiter sends them into the kitchen for preparing the food. After the meal or food is prepared, the waiter also will take the meal to serve the customer again so the task as a waiter will always be repeated daily, weekly, and also yearly. While during the festival and holiday season and also the peak hour, the waiter will become more and more panicked and busy with taking many orders from the customer, sending the meal or food to serve people and others waiter's services.

In this project, the Restaurant Waiter Assistant Line Follower Robot will be addressed in this situation to help and reduce the workload of the waiter and also the improving the level of satisfaction of the customer during waiting for the services and food. Besides, the robot will use the line follow as a path method to serve the customer table to table. When the robot doesn't any task, it will return to the kitchen to standby and receive the task and continue serving customers.

1.4 Problem Statement

Restaurant or as known an eatery, it is a place that prepares and serves various kind of foods and drinks or beverages for customers. During the peak hour, festive season, or the holiday season, there are many kinds of customers are flown into the restaurant, at this moment, it will be a time of panic and stress for the waiter during serving customer. As a waiter at the restaurant, the waiter will take a lot of orders from table to table, send the orders to the kitchen and also make a meal from the kitchen to the table to serve customers. Besides there are some problems that have faced by the restaurant during this moment, which are unavailability of waiter, the capability of a waiter in carrying the food, time waiting of customer is limited due to the congestion peak hour or season and others problems**[4][8].** Besides the cost of a restaurant robot in using the line approach is very high cost due to the use of intelligent technology such the use of high accuracy sensor, several algorithms, artificial intelligence and others technologies.

To serve the customer in a better way, a Restaurant Waiter Assistant Line Follower Robot is developed where the robot is programmed by using Arduino IDE to serve the customer better, to reduce the time taken for serving the customers, and to reduce the workload of the waiter. This robot is using the predefined line to follow as a path to send the food to serve the customer and after several tasks done by the robot, the robot will go back to its position (kitchen) to standby and receive another orders or services and serve the customer continuously.

1.5 Objective

The objective of this project was to:

-To design a Restaurant Waiter Assistant Line Follower Robot that is used for restaurant waiters based on Arduino.

-To develop an automated robot that can assist restaurant based on line follower using infrared.

- To analyze the performance of the robot in the restaurant.

1.6 Scopes

This project will be more focused on the design and development of the Restaurant Waiter Assistant Line Follower Robot to reduce the workload of the waiter, increase the availability of waiter and improve the level of the satisfaction of the customer in the restaurant. This robot is programmed by using the Arduino IDE software, C++ programming language, and Arduino Microprocessor Language. The test of every electronics component in this project is carried out. The final code will be written, edited, tested, and ran by the Arduino microprocessor. In this project, the Arduino will be acted as the main controller, the motor driver MDD3A and the DC geared motor, SPG30-270k will be used in driving the movement of the robot. The cell membrane keypad 4 by 4 will be used for the chef to select the number of tables to serve and making confirmation or command for the robot to do the task, while the use of the Mifare rc522 RFID sensor is to locate the position of the table and the line array sensor is a 5 array IR sensor module has been used is for line tracking accurately and make the movement of robot go smoothly during sending food to prevent food fall out from the robot, then, the buzzer will inform the customer when the food arrives, while it also alert customer or another person when standing in front of it. Then, the robot will go back kitchen after completed the task.

1.7 Summary

In this chapter, an introduction about the project research background, motivation, problem statement, objectives, and scope of the project is mentioned. It is the detail and task that need to be complete in this project.