

## AFFORDABLE ROOM SERVICE ROBOT NAVIGATION USING IR TECHNIQUE

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## AFFORDABLE ROOM SERVICE ROBOT NAVIGATION USING IR TECHNIQUE

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This project is submitted in partial fulfillment of the requirements for the degree of Bachelor of Computer Science and Information Technology

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## ABSTRACT

The room service robot navigation is a mobile machine that can detect and follow the line drawn on the floor. Generally, the path is predefined and can be either visible like a black line on a white surface with a high contrasting color or it can be invisible like a magnetic field. Therefore, this robot should sense the line with its Infrared Ray (IR) sensors installed under the robot. After that, the data is transmitted to the processor by specific transition buses. Hence, the processor is going to decide the proper commands and then it sends them to the driver and thus the path will be followed by the line follower robot.

## ABSTRAK

Navigasi robot perkhidmatan bilik ialah mesin mudah alih yang dapat mengesan dan mengikuti garis yang dilukis di atas lantai. Secara amnya, jalan itu telah dipratentukan dan boleh kelihatan seperti garis hitam di atas permukaan putih dengan warna kontras yang tinggi atau ia tidak kelihatan seperti medan magnet. Oleh itu, robot ini harus mengesan garis tersebut dengan sensor sinar Inframerah yang dipasang di bawah robot. Selepas itu, data dihantar ke prosessor khusus oleh bas peralihan. Oleh itu, prosessor akan menentukan arah yang betul dan kemudian menghantarnya kepada pemandu dan jalan itu akan diikuti oleh robot pengikut baris.

### **CHAPTER 1: INTRODUCTION**

### 1.1 Project title

Affordable Room Service Robot Navigation using IR Technique

#### **1.2 Introduction/Background**

A robot is a machine that resembles a living creature in being capable of moving independently and performing complex actions. It is typically designed to reduce the appropriate amount of human work. Usually, it is designed to reduce the risk factor for human work and increase the comfort of any worker. In developed countries, robotics has made great strides. High performance, high precision, lower labor costs, and the ability to work in hazardous locations put robotics in an advantageous position over many other technologies of this kind. In an era where robotics and automation are developing so fast, this project intends to combine both the aforementioned fields to develop and automated serving system for a hotel. In my project, I will invent a hotel room service robot navigation using the IR technique. IR is an infrared sensor is an electronic device that emits some aspects of the environment to be sensed. An IR sensor can monitor an object's heat and sense movement. Some types of detectors only measure infrared radiation instead of emitting it as a passive IR sensor. This is our target to use robots for greater efficiency and saving human time and efforts. A line tracer has been presented which will trace a white line on a black surface or vice-versa. The line will be placed in front of the hotel rooms so that the robot can follow the line from a door to a door. Then, the robot will bring the item that has ordered by the customer such as toiletries, and food to their doors. The special features of this proposed system are when the waiter press the customer room number by remote control, the robot will bring the item that has been ordered and stop at the room that has been press by the waiter. Then, the robot will stop at the starting point and wait for the next order item.

## **1.3 Problem Statement**

Nowadays, many small-to-medium enterprises (SME) such as in hotel fields, cannot afford the usage of the waiter robot to replace human work. Currently, many waiter robots are very expensive and complicated to use. Since it required a specialist to service and do the maintenance part for the service. Thus, there is a need to build a robot which able to replace the waiter in the hotel. The robot can replace human work such as bringing the customer's needs. For example, it ables to carry parcels, food, or even the customer toiletries. This proposed project uses robots with IR sensors for greater efficiency and saving human time and effort. It will able to identify and design the requirement of navigation technique for room service robots using affordable solutions. Then, it can identify the product function and features of the room service robot.

### **1.4 Objectives**

- To identify and design the requirement of navigation technique for room service robots using affordable solutions.
- To identify the product function and features of the room service robot.
- To design and propose a framework for the implementation of room service robots.
- To develop a robot prototype with IR sensors.

#### **1.5 Procedures/Methodologies**

The type of methodologies used in this project is the Rapid Development of Applications (RAD). RAD methodology is a methodology that focuses on rapid prototyping and application development to ensure faster product delivery. It focuses on the iterative development process. RAD is more stable and faster. RAD consists of 4 main phases that are analysis and quick design, prototype cycles, testing, and implementation.



Figure 1. 1 Rapid Application Development (RAD) Diagram

### 1.5.1 Analysis and quick design phase

In this phase, the goal and expected outcome for this project need to be determined. The breakdown of this stage involves researching the current problem, define the project objective, and finalizing all the requirements needed.

#### **1.5.2** Prototype cycle phase

By using RAD, after the first phase is done, it is time to build out the user design through various prototype iterations. After the build, it needs to demonstrate and refine. In the build phase, all hardware modules of the microcontroller and sensor need to be set up. There are one sensor and actuators that will be used. All the hardware can be got at Shopee or electrical shops.

### 1.5.3 Testing phase

For this phase, the prototypes from the prototype cycle phases are converted into a working model. Then, it will be tested based on-line the following robot. Testing also involving testing all the individual units either the software or hardware to make sure it is functioning well. Also, more details about the testing phases will be described in Chapter 4.

#### **1.5.4** Implementation phase

This is the implementation phase where the finished model will be done. It also needs to be testing to ensure all the requirement is being achieved. In this final phase, the final prototype will be finished to be used in the hotel.

### 1.6 Scope

Affordable room service robot navigation using the IR technique is a simulation of a robot in the hotel. It would be used for the hotel's employees. A room will be set up with the track of the hotel room, to test the robot before it implements in the hotel. A black line will be used as a path of the robot to move according to the track. Therefore, a set of IR sensors is used to sense the path of the track which is the black line, and capture the data and sent it to the microcontroller which is Arduino Uno. The proposed project is designed is a car robot that acts as a waiter in the hotel. It can bring the need of the customer such as toiletries and send to their room.

### **1.7 Significant of project**

This project offers some insights which can help the hotel employee to ease their works so that they can focus on other work. The advantages of this project are they will be used for sending things from one place to another. Next, there is no need for human operators. The robot can perform repetitive tasks by following the path on its own by using the IR sensors. It also can be used for domestic purposes. Lastly, it is used in the hotel to carry parcels, food, or toiletries.

#### **1.8 Project Schedule**

The project schedule is used as a guideline and reminder to develop this Room Service Robot Navigation using IR Technique. Gantt chart has been used to represent the project schedule with the help of Microsoft Excel to ensure the time of completion of the project punctually. The Gantt chart is developed based on important dates and tasks according to Final Year Project 1 and Final Year Project. All the important dates and tasks are illustrated in the Gantt chart as shown in Figure 1.2.



Figure 1. 2 Gantt charts of FYP

### **1.9 Expected Outcome**

Upon project completion, a Room Service Robot Navigation using IR Technique will be developed which has the features of an IR sensor that can send the item for hotel customers. Next, it will help the hotel not to expend more money to hire a worker. Other than that, the robot will follow the path using IR sensors. Then, the robot will capable of taking various degrees of turns.

## 1.10 Conclusion

This project will be using RAD methodology for the development of the IoT project. It will help the waiter in the hotel to deliver the needs of the customers so that they can focus on other works. This line following robot based on IoTs is acting as a waiter robot that fulfills the customer's needs such as toiletries, food, and more.

### **CHAPTER 2: LITERATURE REVIEW**

### 2.1 Introduction

In reviewing the literature, existing systems with similar functions and processes to the proposed system will be discussed in more detail. A comprehensive analysis will be carried out to inspect the strengths, weaknesses, and features of those systems. Four existing systems chosen for this literature review are Waiter Robot-Solution to Restaurant Automation, Remote Controlled Waiter Robot for Restaurant Automation, Smart Food Serving Robot in Restaurant, and lastly, Simple Ordering Waiter Line Follower Robot using Arduino. All the system reviewed is related to the line following robot that uses the IR sensor. Based on the analysis, a comparison between the existing application and the proposed application will be made. This is to adapt to the strengths and to avoid the weaknesses of the existing systems to improve the proposed application. Apart from that, this chapter also discusses the tools and technology used in the development of the proposed application which can help to find suitable tools and technology in the process to develop this proposed application.

#### 2.2 Review on existing system/application

The criteria of the waiter line following robot are it can follow the track using the IR sensors, Arduino, remote control, wheels, and other hardware. My project criteria are the robot can follow the line on its track and can make a degree of turns while using the remote control.

#### 2.2.1 Waiter Robot-Solution to Restaurant Automation

The robot waiter works as a line following robot for which four sensors are used. The project has two important parts namely the menu bar and robot itself. The menu bar is based on the LCD, keypad, and the Bluetooth module. The LCD is used to display the order menu bar, while the keypad is used to select the order. The robot waiter will work on the phenomenon of the line following. It used four IR sensors. The two sensors in the center are used for line following and set the robot waiter on the line while the other two sensors installed on sides are used for table counting. The command to stop at the table number is sent to the robot wirelessly from the kitchen using the WLAN wireless transmitter. This is because the range of WLAN is higher as compared to Bluetooth. The components used in the circuit are as followed:

- a) Atmega328p
- b) 2 DC motors
- c) Motor driver
- d) 4 IR Sensor
- e) 2 wheels
- f) 5V battery
- g) Bluetooth module
- h) Wifi module
- i) Keypad

Figure 2.1 below shows how is the implementation of the Waiter Robot-solution to the Restaurant Automation.



Figure 2. 1 Shows Waiter Robot-solution to Restaurant Automation

#### 2.2.2 Remote Controlled Waiter Robot for Restaurant Automation

This proposed work is based on wireless communication with the help of the TSOP 1738 module (Infrared Receiver Module). This proposed work includes AVR ROBOT, TSOP IR receiver, Remote, buzzer, RC-5 Decoder. TSOP sensor is designed to receive the coded infrared pulses from the transmitter and directs the function of the device. Here Coded Infrared pulses are the commands from the operator then internally these commands are served as various activities of Robot. Here we are using Robots for mankind's operations in big restaurants as a waiter or as an employee. This Robot can able to do functions like taking orders from each table, passing to the operator, and sweep out and make clean an area after the table is empty. The robot waiter works as a line following robot for which sensors are used. The components used in the circuit are as followed:

- a) Arduino Uno
- b) Keypad
- c) Infrared sensors
- d) Tsop 1738
- e) LCD
- f) Motor Driver
- g) Bluetooth module

Figure 2.2 below shows how is the implementation of the Remote Controlled solution for Restaurant Automation.



Figure 2. 2 Remote Controlled Waiter Robot for Restaurant Automation