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Smart Restaurant and Humanoid Robot

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I. INTRODUCTION

Robots are used to serve humanity. The branch of robotics that plays such a vital role is called "social robotics" [1]. Social robots in today's scenario are now communicating with human, interacting and relating to society in all aspect and are capable of understanding social terms[2]. Due to the modernization in robotic technologies, many new designs and mechanisms are being implemented which are able to read human thoughts and understand actions. Such robots find vast applications in assistive robotics e.g. to help out injured, sick and elder people [3]. Theses robots are adaptive, i.e. they can be used in multi-mode as per scenario [4]. So far, the robots are those who learn from us, but that time will not be so far when the teacher will then be learner. There is an ever rising trend in using robots in restaurants for automation [5]. These robots can welcome guests, take orders, serve food to customers [6]. Designing such robots can be effective to learn advance concepts in human-robot interaction, develop new models and protocols for communication as well as use new architectures for real time path planning, guidance and control.

This paper describes about a Smart restaurant and Humanoid Robot which uses ,ATMEGA 328, IR sensor and L293D Motor Driver IC which is used for the automating the robot. The robot works on the principle of Line following robot. Which uses IR sensors to detect the path and reach up to the table as instructed by the Chef of the restaurant. The orders can be given using the customer's respective smart phone. The menu is sent to the Gmail ID of the chef . When the food is prepared the chef will instruct robot to carry the food to the table over a designated path. The robot is highly accurate and waits for 20 seconds before returning back to the chef via return path. The programming algorithm is original and uses table no. and counter value comparison results to detect if the table is reached or not. The robot is completely covered from base but the battery charging port remains outside the robot to charge it in case of low battery problems.

II. COMPONENTS REQUIRED

A. Atmega 328P- It is the microcontroller used to control the robot and take the decision while moving along the path.
B. Active Infrared Sensor- I.R. sensors are used to track the dark and light stripes. Thus the robot is able to turn along the curves and reach the table
C. Printed Circuit Board- 0-level PCB is to mount the components such as microcontroller, voltage regulator IC, motor driver IC and buttons.
D. Jumper Wires – Used to connect the components and sensors.
E. Dc Gear Motor- Used in maneuvering the robot to the desired location.
F. Motor Driver I.C. (L293D)- Used to drive the DC motor as motors operate at 9V-12V D.C.
G. Li-on Battery- used as power source for the motors, sensors and the microcontroller.
H. Voltage Regulator I.C.(7805) – used to regulate voltage at 5V as the sensors and IC's operate at 5 V D.C.

III. DESIGN OF THE ROBOT

The Robot works on the principle of line following and path detection using infrared sensor. The infrared sensors are attached in the front of the robot. Four DC motors are fixed to the base of the robot which is used for maneuvering along the path. The path is T-shaped closed loop. All the components such as motor driver IC, microcontroller, voltage regulator IC are mounted on the 0- level PCB. This robot is a general purpose robot and it can be used in various other places such as hospitals, restaurant, hotels etc.



Fig.1 Design of the robot

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IV. CIRCUIT DIAGRAM

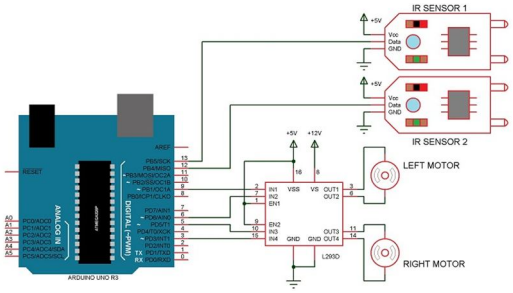


Fig. 2. Circuit Diagram of line following robot

V. WORKING OF THE ROBOT

In this robot the pair of IR sensors and 'flag' variable's value is used to switch between the condition and status of the robot. The various conditions are as follows:-

A. Initially the flag =0 and two IR sensors are in off condition since both are at black stripes near the chef. Here the Robot waits for the Table no. Initialization and placement of the dish.
B. When the button is pressed the table number is initialized. Each button corresponds to the particular table. For example Button 1=Table 1, Button 2 = Table 2 etc.
C. The robot starts to move along the path. When Left IR sensor= Off and Right IR sensor=On, the robot turns to the left. While, Left IR sensor=On and Right IR sensor = Off, the robot turns to the right.
D. . When it reaches a table, both IR sensor = Off and thus the value of 'Count' variable is incremented by '1'. i.e. count=count+1.
E. This count value is compared with the table number. i.e. Table==count.
F. If 'count' is not equal to 'table' then the Robot continues to move to the next table. If ''count' is equal to 'table' then the Robot stops at the table for 20 second and waits for the customer to pick up the dish.
G. After 20 second the robot starts to move further on the circular path and return to the chef's table.
H. Once it reaches the chef's table all the values are initialized with the initial values. i.e. count=0 , table =0 and flag=0.
I. Here it again waits for the entry of the table number and the robot is ready to serve the next customer.

TABLE 1. Algorithm of line following robot

Left IR sensor	Right IR sensor	Movement
Off	Off	Stop and wait
Off	On	Turn left
On	Off	Turn right
On	On	Move forward

TABLE 2. Algorithm of the serving robot

Flag Value	Operation
0	Wait for table number entry Table =0, count=0.
1	Move to the designated table and check if 'count' equals 'table'.
2	Wait for 20 seconds (if reached)
3	Move to the chefs table after serving the customers

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VI. WORKING OF THE ANDROID APP

The app is used to show digital menu card and to build the communication between the customer and the chef of the kitchen. This makes the restaurant smarter and digitally equipped. The app is used has following stages:-

A. The App used has the home page which contains menu card.
B. The customers can use the menu card to order the food digitally via mobile phone
C. The next page which appears is the order confirmation page, where the customer can confirm their respective order.
D. The customer can book either 'DINE IN' or ' TAKE AWAY' service as per his/ her choice
E. Then the customer needs to share the order to via WhatsApp or Gmail Id mentioned.
F. The customer get the invoice saved in his account mentioned.
G. The order is received by the chef on the Gmail or WhatsApp.

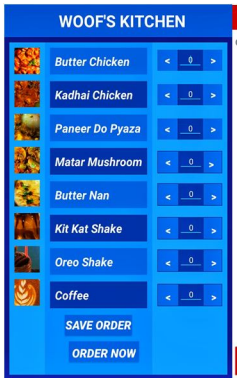


Fig.3. Home screen

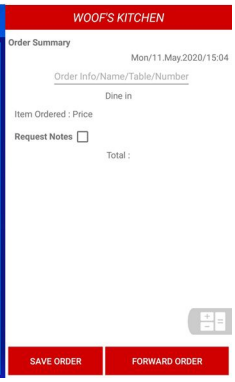


fig.4. Confirmation page



Fig.5. Received Order

VII. ACKNOWLEDGMENT

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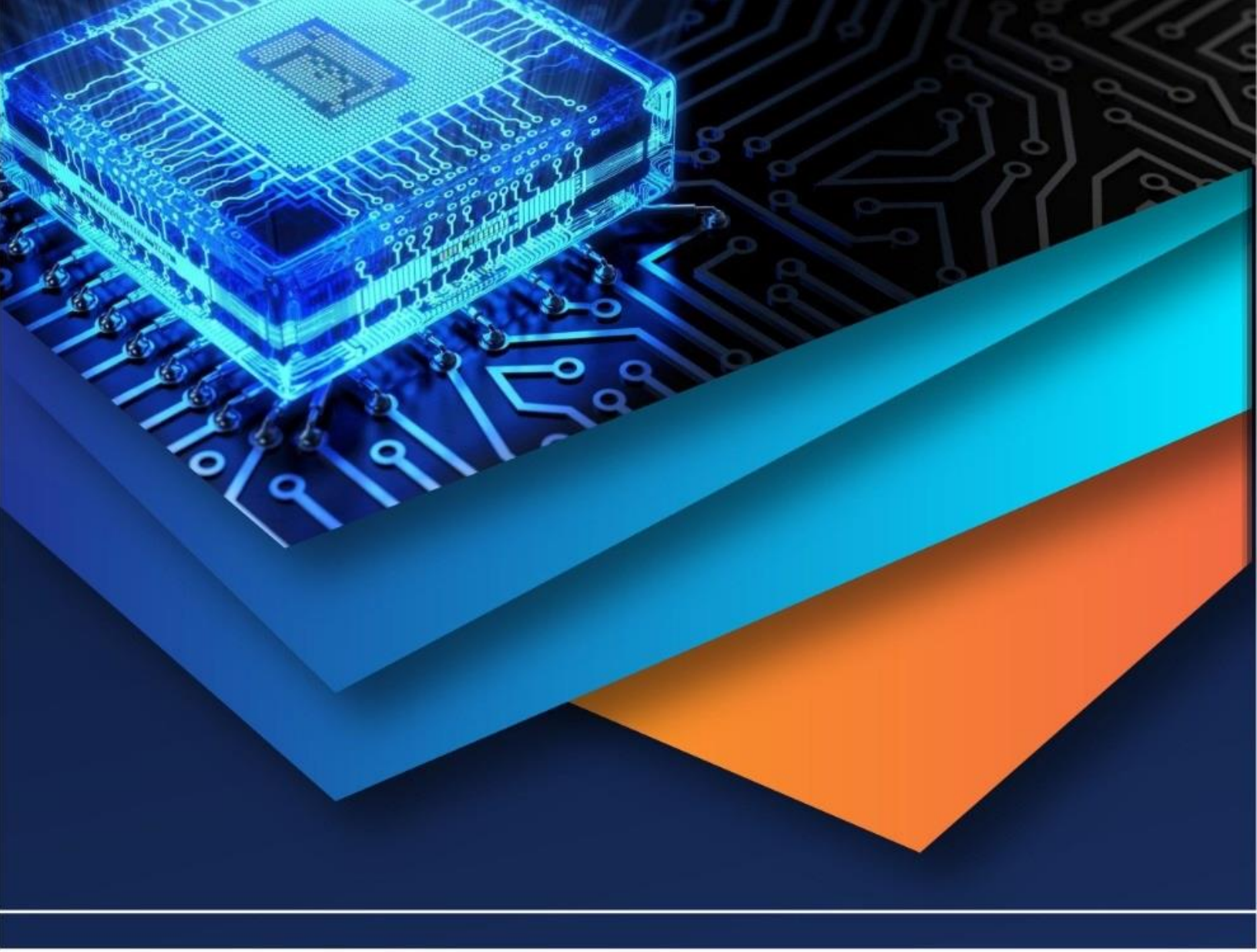
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