Department of Electronic & Telecommunication Engineering,
University of Moratuwa,
Sri Lanka.

Restaurant Robot

Project proposal

Group Members:

210174X	Gallella MMHHB
210218M	Herath HMSI
210205V	Haputhanthri HLNB
210069F	Basnayake BYN
210629A	Thamirawaran S

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Abstract The "Restaurant Robot: Automated Serving System" project wants to change how restaurants work by introducing a reliable robot to serve food and carry liquid items. The main goals are to make delivering drinks and helping staff with moving food easier. This will make restaurants work better and make customers happier. By looking at what's already out there and designing a good robot, this project hopes to make serving food and drinks in restaurants more automated and efficient.

1 Project Overview

The proposed project, titled "Restaurant Robot: Automated Serving System," aims to develop a more stable and reliable robot for efficiently serving food and liquid-based items in a restaurant environment with precise stability. The primary focus is on automating the process of delivering drinks to customers' tables and assisting restaurant staff in transporting food items within the premises.

Figure 1: Project Objective

2 Problem Overview

The hotel industry faces a significant challenge in optimizing the transportation of food and beverage items within restaurants. Currently, the manual delivery process can be time-consuming and inefficient, leading to potential delays and a decrease in overall customer satisfaction. To address this issue, our project aims to introduce an innovative solution that automates the delivery process of drinks and provides assistance in carrying food items and liquid-based items.

3 Existing Solutions

Many existing projects have been developed for tasks similar to the one proposed in this project. mainly like carrying of food items. What we observed is many of the solutions that are being used in the industry are incapable of carrying liquids and beverages mainly due to their low stability.

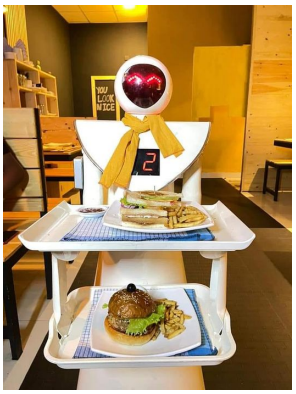

Figure 2: Sri Lankan Retaurant robot

4 Proposed Solution

The device architecture for the Restaurant Robot: Our restaurant robot consists of several integrated components designed to ensure increased stability, reliability, and precision in mainly liquid transportation tasks.

4.1 Robotic Platform

The robotic platform serves as the foundation for the restaurant robot, providing stability and support. It includes:

- **Control circuit:** The robot chassis is encompassed with a PCB circuit at the base for the control of stability of the robot, obstacle avoidance and communication purposes.
- **Chassis:** A stable chassis designed to support considerable amount of weight and smooth navigation across various surfaces within the restaurant.
- **Wheels :** Rubber gripped wheels for precise movement and support.
- **Food compartments :** The food compartments are made utilizing a stacked set of trays on top of the robot chassis.

4.2 Control System

The control system serves as the central hub for coordinating the operation of the restaurant robot, including navigation, proper control of the motors maintaining the stability.

- **Microcontroller:** Microcontroller acts as the brain of the system, processing user commands and generating control signals for the motor drivers. Our plan is to utilize a suitable ATmega Microcontroller for the synchronous activities and a WiFi based-microcontroller for the communication and and information processing workloads.

Figure 3: Microcontrollers

- **Motor Drivers:** To ensure the longevity of the robot, we intend to employ the BTS7960B IC, capable of handling currents up to 43A, as our motors draw a significant amount of current.

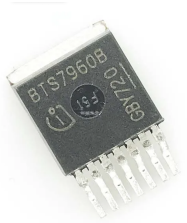

Figure 4: Motor driver IC

- **Motors:** The chosen motors for our application are high RPM motors, complemented by a gear system to enhance torque and reduce speed for improved stability. Additionally, these motors are equipped with odometer encoders.
- **Power Supply:** The currently selected power supply for our system is a 12V source with approximately 40Ah capacity, with a vehicle battery being the preferred option. To meet the voltage requirements for the microcontrollers, we have planned to employ voltage regulation by stepping down the voltage provided by the power supply.

4.3 Communication Methods

1. **Local Network Communication:**

   The robot communicates with other devices on the same WiFi network. It gets commands from a central control point using internet programming concepts like HTTP requests. This helps the robot follow instructions quickly and reliably without using a powerful processing unit inside the robot itself.

2. **Swarm Technology Compatibility:**

   Our design is ready for the future of swarm technology. It means we can control many robots at once. They work together using the local network to coordinate actions. This teamwork makes the robots more efficient and helps them collaborate well in a group, improving overall operations.

3. **Microcontroller-to-Microcontroller Communication (UART):**

   Inside the robot, there are two microcontrollers that need to communicate with each other. We use UART, a communication protocol, to make them exchange important information. This helps the robot follow commands it gets from the local network and perform tasks smoothly and quickly.

5 Research and Literature Review

- Vo Nhu Thanh's research, "Development of Restaurant Serving Robot Using Line Following Approach," addresses the limited use of robots in Vietnam's service industry. The study presents a restaurant serving robot designed with a line-following approach, utilizing a PIC18F4550 microcontroller and ultrasonic sensors. The robot navigates tables, avoids obstacles, and communicates with customers in multiple languages. The work contributes to the application of robotics in the hospitality sector, emphasizing practicality and efficiency.
- Faruk and Ivanov explore the robotic restaurant experience among global travelers, employing a multiple case

study method. Analyzing user-generated content, they identify six key themes shaping this experience: attraction for kids, robotic system, memorable experience, ambience-related attributes, food-related attributes, and deficiencies. This pioneering research contributes to understanding and modeling the components of the emerging robotic restaurant phenomenon in the context of customer experience.

References

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