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Android Integrated Smart Dining Robot

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ABSTRACT

The integration of IoT (Internet of Things) and Android platforms into smart dining robots represents a transformative shift from traditional dining systems. which often rely on manual operations, static automation, or limited-interaction devices. In contrast, The proposed system integrated IoT real-time communication between robots, kitchen systems, and customers, while the Android platform provides an intuitive mobile app for menu customization and remote control. This system comprises two robots one is ordering robot and another is serving robot. An ordering robot collects orders from table counters, relays them to the reception list, and transmits data to the kitchen using Iot applications. The serving robot delivers prepared orders to the designated tables controlled by the Bluetooth. The proposed IoT-Android smart dining robot leverages interconnected sensors, cloud-based data analytics, and a user- friendly Android interface to enable autonomous navigation, dynamic order processing, and personalized customer interactions.

Keywords: Smart Dining, Smart Restaurant Solutions, Service Robot, Smart Ordering System, Robotic Waiter

1. INTRODUCTION

The use of Internet of Things (IoT) and Android technology in restaurants changes how dining works. Traditional dining mostly depends on people doing tasks like taking orders, sending them to the kitchen, and serving food. This can lead to problems likes low service ,mistakes ,and uneven quality. The new IoT-Android smart dining robot system, on the other hand, makes the whole process automatic and faster. It helps reduce the need for human workers, speeds up service,and gives customers a better experience. By using IoT and Android, this system solves common problems that restaurants face, making things run more smoothly and keeping customers happier. The IoT Android-integrated smart dining robot is a system that uses robots to take orders and deliver food in restaurants. It connects the robots, kitchen, and customers through IoT technology to make everything work smoothly in real-time. This system helps reduce mistakes, speed up service, and offer personalized experiences for customers. It also allows restaurants to track orders and improve how they operate. Overall, it makes dining faster, easier, and more fun. The IoT-Android smart dining system has two main robots: the ordering robot and the serving robot. These robots work together to make dining easier and more automated. The system also uses sensors, cloud data, and an Android interface to help with communication, managing orders, and providing real-time updates. The ordering robot is the first robot customers interact with. It moves around the restaurant and takes orders from tables, counters, or the reception area. The robot uses sensors and communication tools to collect the order and send it directly to the kitchen. This reduces human error and makes sure the order is accurate. The ordering robot uses IoT technology to send the order to the kitchen right away, so the chefs can start preparing the food immediately.

2. LITERATURE SURVEY

Iyanda, et al(2024) proposed the ESP32 acted as a web server, processing requests and communicating with an Arduino Mega to control the robot's actions. The system's performance was evaluated by testing accuracy, efficiency, and its ability to handle multilingual customer requests. Real-world scenarios were simulated, including order handling in multiple languages, obstacle avoidance , and food delivery. Feedback was gathered to assess performance and identify improvements. This work highlights the potential impact of multilingual restaurant serving robots in enhancing customer experiences, streamlining operations, and promoting cultural inclusivity in the restaurant industry**.[1] Srilekha, et al2024)** adopted robotic systems for tasks like taking orders, delivering food, and processing bills to enhance the dining experience. This project focused on a smart delivery robot designed to efficiently deliver food. It addressed challenges in traditional restaurants, such as service inconsistency and human errors. The robot, equipped with an Arduino module and advanced algorithms, uses RFID for precise table identification and navigation. A Gaussian Regression model predicted the robot's distance traveled and error percentage to improve delivery accuracy. **[2] Sultana, et al2024)** proposed an IoT-based automated order-handling system to enhance the dining experience in restaurants, particularly in developing countries. The system addressed challenges like operational inefficiency and customer satisfaction. It demonstrated significant potential in improving food order validity, quality, and privacy. By using advanced technology, it provided a sustainable solution for the dining sector, offering both economic and operational benefits in developing countries. **[3] Srinivasan, et al(2024)** experimented the integrating robot waiters and cloud-based systems to improve customer service. Robots, using cloud-enabled collaborative filtering, can personalize dining experiences by analyzing customer preferences and streamlining order suggestions. This technology has been shown to improve service efficiency, reduce wait times, and enhance customer satisfaction. For example, some Asian restaurants use robots to take orders and deliver food, while cloud systems help personalize the experience. While challenges like cost and customer acceptance remain, the combination of robotics and cloud computing continues to offer exciting possibilities for transforming the restaurant industry.**[4] Rajule, et al(2024)** developed Intelligent Restaurant to improve service byaddressing common mistakes made by wait staff during busy times. By placing QR codes on dining tables, customers can directly place their orders, reducing errors and enhancing the dining experience. A smart restaurant system integrates a database that not only improves service quality but also analyzes customer reviews and predicts daily order trends. This technology helps restaurants optimize inventory management and better understand customer sentiment**.[5] Ramadevi, et al(2024)** designed a "Wireless Communication-Based Menu Ordering System" enhances the dining experience by integrating technology with restaurant services. Using Arduino Uno, Bluetooth, an LCD display, a 4x4 keypad, and a buzzer, the system allows customers to browse and order from the menu via a mobile app. Once connected, customers can view item details and place orders, which are sent directly to the chef for real-time updates. This system streamlines the kitchen's workflow, reduces order processing times, and offers greater convenience for diners**.[6] Qaisar, et al(2024)** introduced a cost-effective IoT-based waiter robot designed to improve customer service and restaurant efficiency. Equipped with an RPLidar sensor and encoded DC motors for navigation, the robot can carry heavier loads and navigate to specific tables. Using the Robot Operating System (ROS) and herbal lidar maps, it autonomously plans paths and successfully reaches target tables. Initial tests confirm its ability to navigate and perform tasks, showcasing a promising step forward in service robotics for the hospitality industry**.[7] Moshayedi, et al(2024)** developed the FOODIEBOT, an advanced food delivery robot using image processing, mobile apps, and web

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interfaces for efficient navigation in dining halls. PID controller calibration and MATLAB simulations were used to optimize its movement across variouspaths. The Beetle Antennae Search (BAS)method proved mostefficient, outperforming others in execution time, while Particle Swarm Optimization (PSO) achieved the highest speeds oncertain paths. The study confirms the effectiveness of optimization method sand the accuracy of simulations in improving the robot's performance.**[8].** . **Singh, et al(2023)** presented an IoT-based smart restaurant management system designed to address common operational challenges like customer orders, staff management, and fire safety. The system integrates an efficient food ordering system with a reliable fire management system that works even without internet connectivity. It has been tested for responsiveness, with a responsetimeof0.5seconds forfire management, and is fault-tolerant to hard ware and network errors. Additionally, it offers low setup and maintenance costs, providing a comprehensive solution for restaurants**.[9] Akhund, et al(2021)** designed to collect data from remote and potentially virus-affected areas. The robot is controlled via a smartphone app using Bluetooth communication, enabling users to operate it from a distance. The collected data is sent to a cloud server, allowing global monitoring of the information. Two apps are used: one for controlling the robot's movement and another for viewing the data collected by the robot. This system has significant potential in helping virus- affected areas by safely gathering and monitoring crucial data without putting people at risk**.[10] Jintao, et al(2025)** presents a multimodal human-robot interaction platform using ChatGPT to enable more natural conversations with robots, implemented on the Pepper humanoid robot.The goal is to improve communication, enhance robot performance, and reduce negative attitudes toward robots. Experiments measuring participants' attitudes and anxiety before and after robot interaction showed significant improvements, suggesting the system's potential to foster positive human-robot relationships**.[11] Jadhav,etal(2024)** presented the digital menu card with ordering and recommendation system is revolutionizing the restaurant industry. Customers can digitally access menus, place orders directly to the kitchen, and receive personalized recommendations based on preferences. This system reduces wait times, improves order accuracy, and enhances the dining experience. Restaurants benefit from increased efficiency, real-time menu updates, reduced printing costs, and fewer staff requirements during peak hours. Overall, this innovation streamlines operations while providing a seamless, personalized experience for customers**.[12] Nugraha, et al(2025)** examines two Indonesian short stories, Andina Dwi Fatma's Linus Damono (2018) and Erwin Setia's Cerita Dua Robot dan Pemuda Penyendiri (2019), to explore posthumanism in the context of growing robotics and AI use in Indonesia. Through close reading, it reveals narratives featuring non-human subjects that highlight humans' control over them. The stories present contrasting views on the future of humanity: utopia and dystopia. These works are crucial for raising awareness of the potential benefits and risks of robotic and AI technologies and can serve as material for developing critical literacy on posthuman issues.

3. PROPOSED SYSTEM

The IoT Android Integrated Smart Dining Robot is an automated system designed to enhance food service in restaurants and homes. It uses an Arduino Uno as the main controller, with Bluetooth for wireless communication via an Android app. Equipped with infrared sensors for navigation, an LCD display for menu interactions, and a keypad for manual input, the robot efficiently delivers food with minimal human intervention. IoT integration enables real-time monitoring ,improving service speed and efficiency, making it a smart solution form odern dining automation.

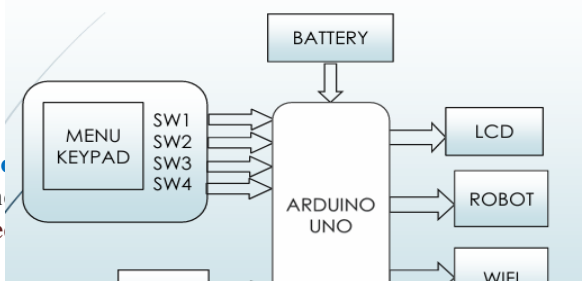

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Fig 1: Block Diagram of Transmitting Section

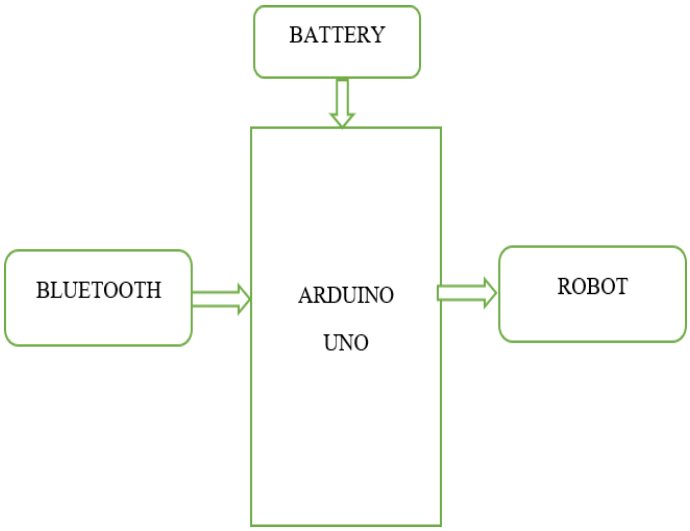

Fig 2: Block diagram of receiving station

Based on the block diagram, the IoT Android-integrated smart dining robot operates using an Arduino Uno as the main controller. A battery powers the system, while Bluetooth enables communication with an Android device for remote operation. The robot receives commands from the Android app via Bluetooth, which the Arduino processes to control its movement and functions. The system may include additional components such as an LCD for displaying information, a keypad for menu selection, and infrared sensors for navigation and obstacle detection. This setup enhances automation in dining services by allowing users to interact with and control the robot seamlessly.

4. Result analysis

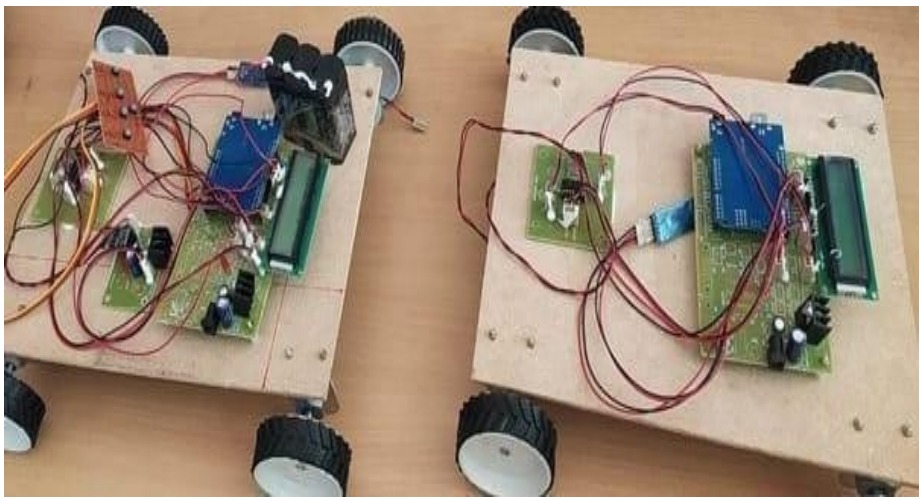

Fig 3: Final view consisting the both ordering Robot and serving robot.

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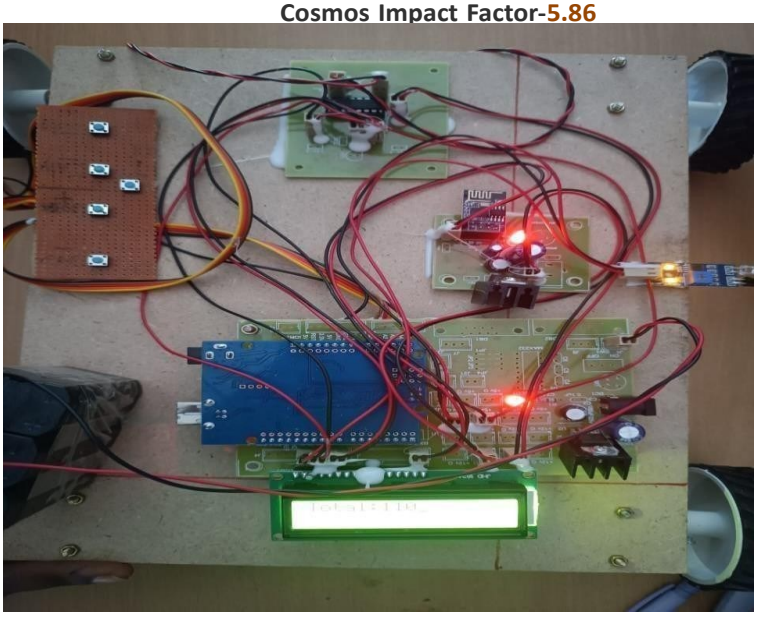

Fig 4: Ordering section that displays the total amount for ordered items in 16*2 LCD display

Fig 5: ordered items displayed in TCPT elnet Terminal by using wifi module

5. CONCLUSION

The integration of IoT and Android platforms in the smart dining robots marks a significant advancement in modernizing the dining experience. Unlike traditional systems, which rely on manual laboror limited automation, this system enhances efficiency and customer interaction. By connecting the ordering robot, serving robot, and kitchen systems through IoT, real-time communication is achieved, ensuring smooth order processing and timely deliveries. The Android platform allows for easy menu customization and remote control, offering a user- friendly experience for both customers and staff. With two distinct robots – one for taking orders and the other for serving – the system operates seamlessly to improve both customer service and operational efficiency. The use of interconnected sensors, cloud-based data analytics, and Bluetooth-controlled navigation makes the system adaptable, autonomous, and responsive to real-time needs. In conclusion, the IoT-Android smart dining robot system transforms the traditional dining model, providing a more streamlined, personalized, and efficient dining experience that benefits both customers and restaurant operations.

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