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ChatGPT Based Interactive Robot

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Abstract

This project presents a Wi-Fi-controllable AI robot intended for interactive interaction through integration with ChatGPT. The robot is constructed using an ESP32 microcontroller, which provides Wi-Fi communication, and an Arduino Nano, which accommodates further processing. The robot can be controlled easily by users via a mobile app, which was developed using MIT App Inventor, allowing wireless movement commands. The design incorporates DC motors, an L298N motor driver, and an LED matrix display for real-time movement and system feedback. In contrast to conventional autonomous robots that use sensors to navigate, the design is fully user-command-driven, running over Wi-Fi without collision detection. With the incorporation of ChatGPT, the robot is able to extend beyond simple motion—enabling users to chat, pose questions, and be answered by AI-generated answers, increasing interaction. This cutting-edge system can store a vast array of applications, such as remote-controlled robots, interactive intelligent assistants, and learning tools for studying AI and robotics. Improvements in the tool might add AI-based decision-making, increasing the robot's capabilities and making it even more dynamic and intelligent.

Keywords: Wi-Fi Controlled Robot, IoT and AI Integration, User Command-Based Navigation.

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1. Introduction

The combination of artificial intelligence (AI) and wireless communication in robots is transforming the operation of robots to make them more intelligent, interactive, and wirelessly controlled. This project demonstrates a Wi-Fi-driven AI-based robot which can be controlled through a mobile app and includes ChatGPT integration to enable real-time user interaction. In contrast to conventional robots that use sensors for detecting obstacles or autonomous movement, the system is fully user-command-based and thus enables accurate and remote operation through a mobile app. This merging of AI and robotics elevates the ability of the robot, turning it into an interactive AI assistant, which can respond to the questions of users and also remains fully under user control.

At the center of this system is the ESP32 microcontroller, which also acts as the Wi-Fi communications module, facilitating smooth communication between the robot and the mobile app. There is an Arduino Nano that operates in tandem with it, taking care of certain control functions for motor movement and system functionality. The mobility of the robot is driven by DC motors powered through an L298N motor driver, providing efficient and smooth movement according to user commands. For added user convenience, an LED matrix display makes available real-

time status information such as direction of movement, system connection, and AI-based responses.

One of the most prominent aspects of this project is its ChatGPT interface, enabling the robot to communicate with users more than mere movement control. Through a mobile app created using MIT App Inventor, users are able to provide commands, respond to AI-computed messages, and have actual conversations. This greatly enhances the interaction of users, making the robot dynamic and interactive instead of a mechanical system.

Arduino IDE is employed for programming and connecting all hardware devices to ensure proper communication between ESP32, Arduino Nano, motor driver, and LED matrix display. In contrast to traditional robots that depend on Bluetooth connectivity or physical controllers, this project incorporates Wi-Fi for extended-range control, which is more flexible and convenient.

The inclusion of ChatGPT provides another level of intelligence to the robot, allowing it to process queries from users, provide text-based responses, and enable human-robot interaction. This functionality makes the system applicable in various areas like education, industrial automation, and personal support.

This AI-driven robot controlled by Wi-Fi has a number of real-world applications:

- Educational robotics – Helping students and researchers learn about AI-integrated robotics.
- Interactive AI assistants – Used as conversational AI in domestic and business environments.
- Remote-controlled robotics – Used for flexible control in industrial and automation applications.
- AI-based experimentation – Providing a platform to experiment with AI and robotics integration.
- In the future, some of the following improvements can enhance this system:
- Voice control integration – Enabling users to operate the robot through voice commands.
- IoT-based monitoring – Integrating the robot with cloud systems for remote monitoring and data analysis.
- Camera integration – Incorporating real-time video feedback for enhanced control and monitoring.
- AI-driven automation – Utilizing semi-autonomous or fully autonomous decision-making.

This project presents a cost-efficient, scalable, and user-friendly method of fusing AI with remotely operated robotics. With Wi-Fi-based mobile control, AI interaction using ChatGPT, and real-time status notifications, the system behaves as a robotic assistant with multi-functionality. With further advancements, it could develop into a more independent and intelligent robotic system, further integrating AI, IoT, and human-robot interaction.

2. Literature Review and Objective

The robotics field has advanced with the developments in artificial intelligence (AI), wireless communication, and remote control. The older robots were mainly based on sensors for navigation and collision detection, and hence they were best suited for autonomous operations. With the incorporation of AI, user-operated robots have become more popular, providing improved interaction and command implementation. A number of investigations have discussed WiFi-controlled robot systems, with microcontrollers such as ESP32 supporting wireless connectivity between a user interface, for instance, a smartphone app, and a robot. In comparison with

Bluetooth or cabled control mechanisms, WiFi allows for extensive communication range and transparent remote operation. Research has further emphasized the efficacy of Arduino-based controllers such as the Arduino Nano, supporting instant motor control and task fulfillment.

One of the significant advancements in robotics is the use of AI models such as ChatGPT for interactive communication. Studies have proven that conversational systems based on AI can enhance human-robot interaction by delivering informative feedback and increasing user interaction. AI-based assistants are becoming more common in educational aids, smart automation, and human-computer interaction. In contrast to conventional sensor-based robots, this project presents a novel approach through the integration of WiFi-based mobility control with AI-based responses. Rather than depending on obstacle avoidance or autonomous operation, the robot is operated through direct user instructions via a mobile application. With the incorporation of ChatGPT, the robot can have productive conversations, which makes it more than a machine. This review of literature indicates the increasing popularity of AI-based interactive robots and underscores the need for the creation of user-friendly, real-time, remotely operated robotic systems.

The main goal of this project is to create an AI-powered robot that is controlled via WiFi and can be remotely commanded through a mobile app. The project intends to implement ChatGPT AI in the robot to facilitate real-time user engagement and response generation. To meet this, a wireless communication capability is implemented using an ESP32 microcontroller to provide long-range and stable connectivity for controlling the robot. Arduino Nano is used as a processing system for motor control and system function execution in an efficient manner. The user interface is a mobile app, implemented through MIT App Inventor, facilitating easy execution of commands and interaction through AI-based technology. LED matrix display is integrated in the system for instant feedback in terms of movement status, commands issued by users, and AI-generate outputs.

This project is centered on improving human-robot interaction through the facilitation of AI-based conversations via ChatGPT integration. This is in contrast to the conventional robots that are either completely autonomous or centrally controlled with limited responses. This project closes the difference between AI and robotics by delivering a responsive and engaging experience. The project further seeks to develop a low-cost and scalable robotic platform with applications in educational institutions, interactive AI solutions, and automation-based activities. Also, future developments like voice command, IoT-based monitoring, and AI-based decision-making can be investigated to enhance its functionality. The overall objective of this project is to provide a smart, interactive, and remotely controlled robotic system that can be utilized for real-world applications in different fields.

3. Materials and Methods

The construction of this WiFi-based AI-driven robot incorporates a combination of hardware units, software components, and communication protocols to optimize operation and interaction with the user. The project materials include an ESP32 microcontroller, the main communication unit, which allows for WiFi capability for remote access. An Arduino Nano is also employed as an extra processing device to control motors and carry out user commands optimally. The movement of the robot is ensured with DC motors, which are driven by an L298N motor driver module

in order to control speed and direction. A voltage regulator module provides a safe power supply to the components. For purposes of extending user interaction, an LED matrix display is incorporated to offer real-time feedback of the system status and command execution. The body of the robot is made up of Forex sheet, which provides a light and strong framework to accommodate all devices safely.

Software implementation includes the use of the Arduino IDE for programming the ESP32 and Arduino Nano to provide suitable communication among parts. The MIT App Inventor is employed to create a mobile app, which will act as the interface through which control of the robot is provided by users. Users are able to provide movement commands and control the AI system coupled with ChatGPT using this application. The text-based inputs are processed by the AI model, and intelligent outputs are generated, thus making the robot more interactive and user-friendly. The mobile app interacts with the ESP32 via a WiFi network, and real-time execution of commands without physical proximity restrictions is enabled.

The operating method adopts a systematic process. Upon startup of the system, the ESP32 initiates a WiFi connection and communicates with the mobile app. The user initiates movement commands via the application, which are relayed to the ESP32 and processed by the Arduino Nano to drive the DC motors using the L298N motor driver. At the same time, ChatGPT processes text-based questions and responds accordingly, which are shown on the LED matrix or returned to the mobile app. The system functions completely on user commands for directions.

This methodology allows the robot to perform in an optimal way while its design remains economical and scalable. This synergy between AI interaction, WiFi remote control, and feedback ensures that the project is universal for several sectors such as education, automation, and AI experiments. Its capacity can be augmented along with the level of use through future upgradations such as voice and IoT-based monitoring.

3.1 Circuit Diagram

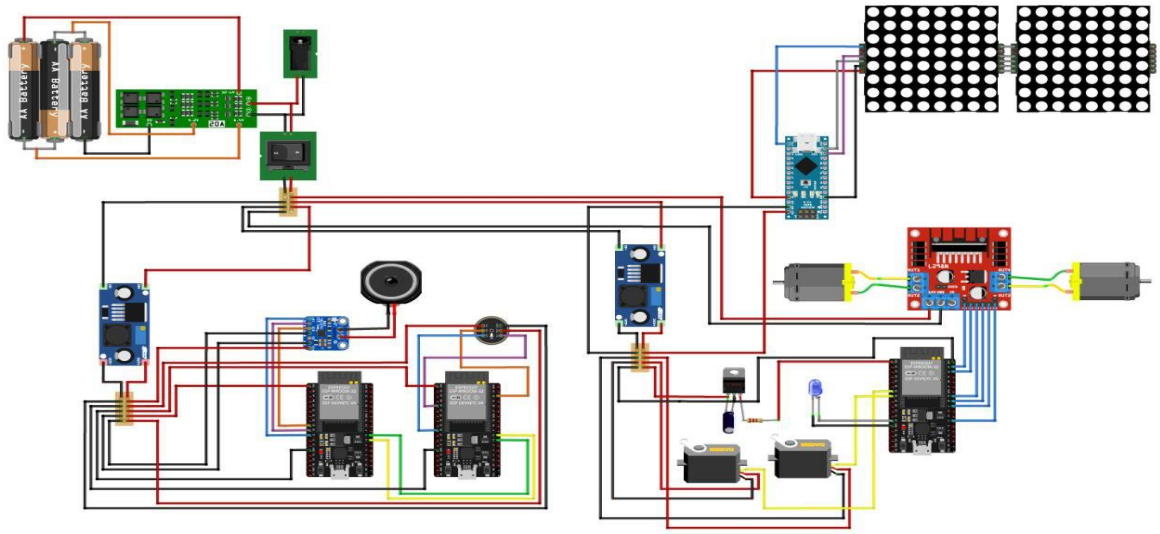

Figure 1: Circuit Diagram

This WiFi-controlled AI robot circuit diagram illustrates the hardware components interconnected in a manner that allows the robot to move, communicate, and interact based on AI. The circuit system is composed mainly of an ESP32 microcontroller, an Arduino Nano, an L298N motor driver module, DC motors, a voltage regulator module, an LED matrix display, and a rechargeable battery power supply. The hardware components are wired in a manner that facilitates easy movement and effective communication between the hardware and software units.

The ESP32 microcontroller is the central unit that creates a WiFi connection with the mobile app. The module is controlled by control signals from the app, and it processes AI-driven responses based on ChatGPT integration. It also communicates with other units to carry out user commands. Because ESP32 has support for WiFi-based communication, it makes the robot remotely controllable with a long range as opposed to Bluetooth-based control systems.

For motor control, the Arduino Nano is employed as a secondary processing unit to process movement commands. The ESP32 communicates movement commands to the Arduino Nano through serial communication, which in turn processes the commands and sends them to the L298N motor driver module. This motor driver plays a crucial role in managing the speed and rotation of the DC motors, including forward, reverse, left, and right travel depending on inputs from the mobile application. The L298N module works by utilizing pulse width modulation (PWM) signals in order to efficiently control motor speeds.

In order to supply a constant power supply, a voltage regulator module is incorporated into the system. As various components have different voltage levels (ESP32 at 3.3V, Arduino Nano at 5V, and motors needing 9V-12V), the voltage regulator provides each module with the proper voltage, avoiding damage from overvoltage or voltage fluctuations. The rechargeable battery powers the whole system, and the robot becomes portable and not dependent on a direct power source.

Key Features of the Circuit Design:

- WiFi-Based Remote Control: Unlike traditional wired or Bluetooth-based robots, this system provides long-range remote control using WiFi.
- ChatGPT Integration: The ability to interact with AI makes the robot more than just a mechanical device; it can respond to user queries intelligently.
- Efficient Motor Control: The L298N motor driver module ensures precise speed and direction control, allowing smooth movements.
- Power Supply Stability: The voltage regulator module provides every component with the voltage levels necessary, avoiding power fluctuation.
- Modular Expansion: The design of the circuit supports future adaptations, including voice recognition, further AI features, or IoT capabilities.

This elaborate explanation of the circuit diagram offers proper comprehension of the interaction of its components in coming up with an AI-interactive, WiFi-controllable robot. ESP32 integration, Arduino Nano, motor driver, and incorporation of ChatGPT make it efficient, intuitive, and viable for diverse usage in education, automation, and robotics research applications.

4. Result and Discussion

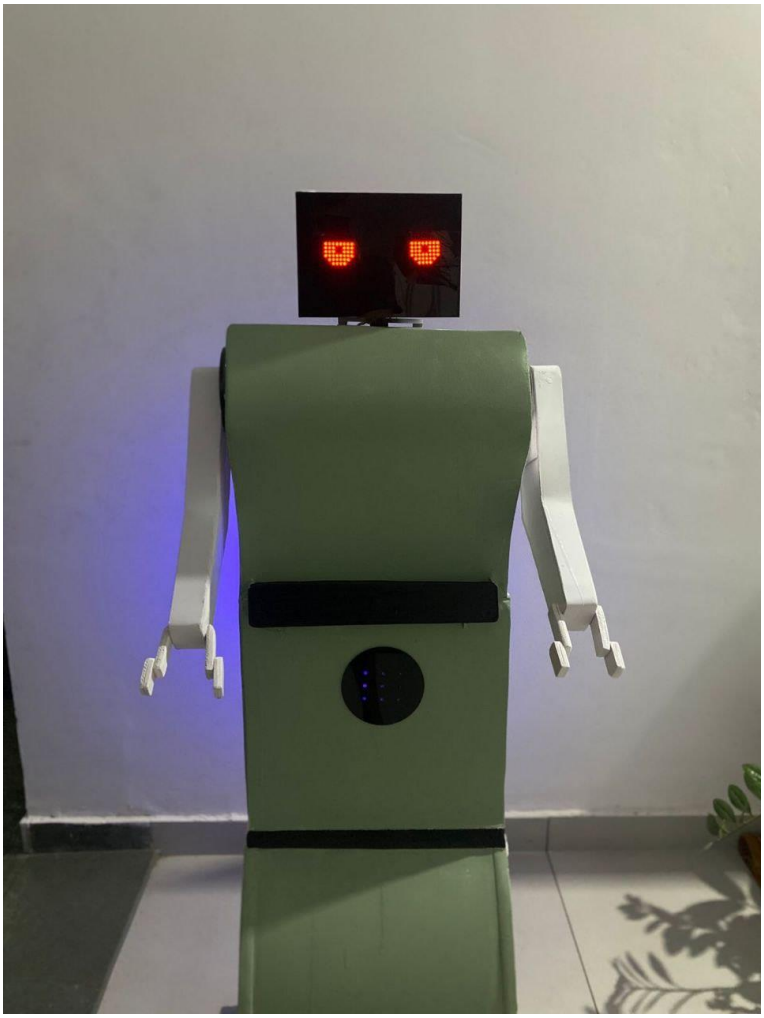

Figure 2: ChatGPT Based Interactive Robot

The AI-driven robot controlled by WiFi was successfully implemented and tested, proving its capability to be remotely operated through a mobile app while incorporating ChatGPT-based AI interaction. The system effectively responded to user input, carried out motor control operations smoothly, and rendered real-time feedback through an LED matrix display. The use of ESP32, Arduino Nano, and an L298N motor driver made it easy to facilitate communication among hardware components, assuring precise motion and control.Under testing, the ESP32 microcontroller provided a reliable WiFi connection with the MIT App Inventor-based application. The link between the ESP32 and the Arduino Nano was stable, which facilitated real-time processing of commands. The DC motors, regulated through the L298N

motor driver module, were responsive to movement commands, making the robot move in various directions. Yet, since the system lacks obstacle detectors, the robot relies solely on human control, and this needs cautious navigation by the user.The incorporation of ChatGPT AI offered an interactive component by which users could interact with the robot via text-based interaction.

5. Conclusion

The WiFi-controlled AI robot is successfully able to integrate wireless remote control and AI-based interaction into a single robot system. The use of ESP32 for WiFi, Arduino Nano for motor control, and ChatGPT for AI response integration enables the project to seamlessly bring together robotics and artificial intelligence to form an interactive and intelligent system. The application created with MIT App Inventor offers a simple and user-friendly interface for robot control, making it easy to use and access. The system effectively implements movement commands, answers AI-based questions, and offers real-time response through an LED matrix screen. The use of L298N motor drivers guarantees accurate control of the motor, enabling smooth movement. But since the robot does not have obstacle-detection sensors, it needs manual guidance, which can be improved in subsequent models. The use of WiFi-based communication allows long-distance control and is more efficient than Bluetooth-based robots.

Although the project adequately fulfills its requirements, some of the issues like WiFi reliance, battery limitations, and lack of autonomous navigation point towards potential areas of improvement. Future developments may involve voice command functionality, IoT-based tracking, and sensor-based obstacle avoidance to enhance autonomy and user-friendliness. In general, this project offers a solid platform for AI-enabled robotics, proving its worth in applications like education, automation, and intelligent robotics research. The convergence of mobility remote-controllability and AI-supported dialogue renders it an adaptable, expandable, and interactive robotic platform with promise for future upgrades.

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