ABSTRACT

In today's fast-evolving world of technology, the integration of robotics with wireless communication has opened new doors in the fields of automation, remote operations, and intelligent control systems.
This project, titled "**KAIRO – The WiFi Robo Using NodeMCU and Motor Driver**," explores the development of a simple yet powerful WiFi-controlled robot that demonstrates the practical application of embedded systems and Internet of Things (IoT) technology.

The primary objective of the project is to design a mobile robotic platform that can be controlled wirelessly through any smart device (smartphone, tablet, or computer) connected to the same WiFi network. The core of the system is the NodeMCU ESP8266 microcontroller, which not only serves as the robot's brain but also acts as a server that hosts a web interface. This interface consists of control buttons for movement directions such as forward, backward, left, right, and stop, allowing the user to guide the robot in real-time with ease.

The L298N motor driver module is used to manage the movement of the robot by controlling four DC motors. The NodeMCU sends appropriate HIGH and LOW signals to the driver's input pins based on user commands, and the motors respond by rotating accordingly. The power supply is provided by batteries, making the system compact and mobile.
This project emphasizes simplicity, cost-effectiveness, and accessibility. It does not require additional mobile apps or Bluetooth pairing, as all the control is performed over a standard web browser via IPbased access. This enhances flexibility and range, compared to traditional remote-controlled systems. Furthermore, the system supports real-time control with minimal latency, offering smooth and responsive operation.

KAIRO is designed with educational and experimental use in mind. It provides a platform for students and beginners to learn about key concepts such as microcontroller programming, motor control, WiFi networking, and real-time web communication. It also demonstrates how IoT principles can be applied in practical robotics, making it highly relevant to modern engineering education and DIY projects. Potential applications of such a system include home automation, remote surveillance, smart agriculture monitoring, and exploration in hazardous areas where human presence is risky. Due to its modular nature, the system can be easily upgraded by integrating additional sensors like ultrasonic sensors for obstacle detection, a camera for video streaming, or GPS for location tracking.In conclusion, the project presents a lightweight and adaptable model of a wireless robotic system. It showcases the possibilities of combining open-source platforms with wireless technologies to create innovative and functional solutions. KAIRO stands as a proof of concept for how embedded and IoT systems can revolutionize the way robots are controlled and deployed, especially in educational, experimental, and basic automation environments.

KEY BENIFITS OF SYSTEM INCLUDING:

- Wireless Control via Wi-Fi:
  Allows real-time control of the robot from any device connected to the same network—no need for Bluetooth or physical connection.

- Low-Cost & Open-Source:
  Built using affordable components like Node MCU and L298N, with open-source code and hardware that encourage learning and customization.

- Easy Integration with Sensors:
  The system can easily be extended with sensors (like ultrasonic, IR) for obstacle detection, line-following, or automation.

- Cross-Platform Compatibility:
  Can be controlled using any device (Android/iOS phones, laptops, tablets) with a browser—no special app needed.

- Efficient Motor Control:
  Motor driver ensures stable and safe operation of DC motors by isolating them from the microcontroller, and allows bi-directional motion.

- Portable & Rechargeable:
  Powered by a compact battery pack, making the robot wireless, mobile, and suitable for field or indoor experiments.

- DIY Friendly & Educational:
  A great learning platform for beginners and students to understand embedded systems, IoT, and robotics.

- IoT Ready:
  Lays the foundation for advanced IoT applications, such as remote surveillance, smart automation, and home security robots.

- Fast Response Time:
  Wi-Fi communication ensures low latency, giving quick responses to user commands.