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Motion Detection Car using WiFi Cam and NodeMCU

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Abstract: *Our project combines a WiFi camera and NodeMCU-controlled car to establish an intelligent surveillance system. The WiFi camera captures and streams real-time video to a server while a NodeMCU-controlled car autonomously responds to detected motion. When motion is identified, the system instructs the car to investigate the source, offering a dynamic approach to surveillance. This innovative solution presents cost-effective and flexible applications across diverse environments, including homes, offices, and outdoor spaces. It harnesses the power of WiFi technology for efficient video streaming and integrates motion-based control for enhanced security and responsiveness. The system's adaptability and real-time monitoring capabilities make it a practical choice for a wide range of surveillance needs, ensuring both convenience and peace of mind for users.*

Keywords: Surveillance, WiFi Camera, NodeMCU, Motion Detection, Autonomous Response, Real-time Monitoring

I. INTRODUCTION

The project, titled "Motion Detection Using WiFi Camera and NodeMCU-Controlled Car," represents an innovative approach to modern surveillance and security systems. In an era where connectivity and automation are paramount, this project merges cutting-edge technology to create a dynamic and cost-effective solution. By integrating a WiFi camera for real-time video streaming and a NodeMCU-controlled car for autonomous response to detected motion, this system addresses the need for adaptable, intelligent surveillance across various environments.In addition to the core functionality of motion detection and autonomous response, the project also provides the option to configure alert systems, such as email notifications or mobile app alerts, to keep users informed in real-time. This added feature enhances the system's utility, ensuring that users can stay connected and take immediate action when security events occur.

This project offers a practical and flexible means of enhancing security in settings such as homes, offices, and outdoor spaces. It harnesses the power of WiFi technology to provide continuous monitoring through live video streaming and leverages motion detection algorithms to trigger autonomous responses. By doing so, it not only increases the efficiency of surveillance but also minimizes human intervention, making it a versatile and convenient choice for a wide range of applications.

II. LITERATURE REVIEW

The development of a "Motion Detection Car Using WiFi Camera and NodeMCU" involves drawing insights from a diverse range of research areas. In the field of motion detection, [1]pioneering work by researchers like Mubarak Shah and David Lowe has advanced the application of computer vision and object recognition algorithms for real-time tracking. [2]Their contributions include the development of key techniques and frameworks, such as the Scale-Invariant Feature Transform (SIFT) and the Viola-Jones object detection framework.

WiFi camera technology has been widely explored in surveillance and robotics.[3] Notable researchers such as David Scaramuzza and Wolfram Burgard have made substantial contributions to visual perception in robotics, specifically in the domain of autonomous vehicle navigation and mapping.[4] Their work has helped establish the foundations for integrating WiFi cameras into mobile robotic systems for advanced motion tracking.[5] NodeMCU, as a versatile platform in IoT and robotics, has garnered attention from researchers like Ryan Teoh and Yong Seng Yeap, who have

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focused on its integration into sensor networks and remote monitoring and control systems. [6]Their research highlights the potential of NodeMCU in enabling real-time data communication and control in IoT applications.

The integration of WiFi cameras, NodeMCU, and motion detection in robotics has been explored in various projects such as "OpenCV," an open-source computer vision library maintained by a global community of researchers and developers. [7]OpenCV provides essential resources for implementing image processing, recognition, and object tracking in real-time, making it a valuable reference for the "Motion Detection Car Using WiFi Camera and NodeMCU" project.[8]Research conducted by experts like Stuart Russell and Peter Norvig in the field of artificial intelligence has introduced foundational concepts related to machine learning, which underpin many aspects of the "Motion Detection Car Using WiFi Camera and NodeMCU" project. [9]The principles of supervised and unsupervised learning, as well as classification and regression, have relevance in designing the intelligence of the motion detection car.

Overall, the interdisciplinary nature of the "Motion Detection Car Using WiFi Camera and NodeMCU" project benefits from insights across various domains, including motion detection, WiFi camera technology, NodeMCU, computer vision, robotics, and machine learning, as contributed by the mentioned researchers and their groundbreaking work in these fields. reflecting the ongoing advancements in the fields of computer vision and artificial intelligence.

III. METHODOLOGY

The methodology for creating a WiFi-controlled robotic platform with integrated CTRZQ wireless CCTV begins with project initiation, defining the objectives of building a versatile robot for remote control and live video surveillance. Key components include the NodeMCU ESP8266 microcontroller, L298N Motor Driver, BO Motors with Wheels, a 2s, 7.4V, 1000mAh, 30C Li-po Battery, and the CTRZQ wireless CCTV spy camera. Hardware integration is meticulously carried out, ensuring secure connections and power supply. Firmware development focuses on motor control and real-time video streaming, allowing remote operation and live video monitoring from the robot. Efficient power management and WiFi connectivity are essential, extending battery life and enabling seamless communication. Testing and calibration validate system responsiveness and video quality. Upon successful testing, the robotic platform with motion control and live video surveillance is deployed in the desired environment for educational, surveillance, or entertainment purposes.

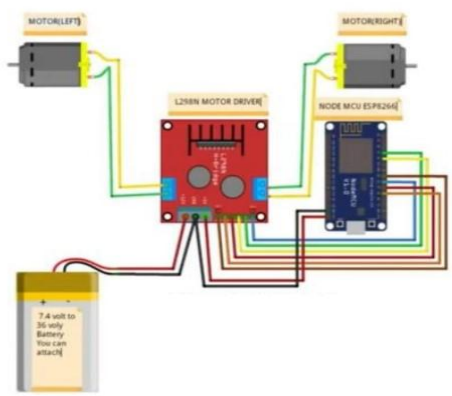

Fig.1 Circuit Diagram

Comprehensive documentation encompasses hardware and software configurations. User manuals and guides facilitate user operation. A project report highlights the methodology, findings, and outcomes, emphasizing the versatile application of a WiFi-controlled robotic platform with integrated CTRZQ wireless CCTV spy camera, offering both mobility and surveillance capabilities in a single system.

The configuration of a WiFi connection is essential for seamless communication between the NodeMCU, controlling device, and the CTRZQ wireless CCTV spy camera. This ensures real-time video surveillance capability from the robot.In addition to motor control, the control interface is expanded to allow users to remotely control the camera's orientation, providing a comprehensive surveillance solution. Thorough testing and calibration verify the system's

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responsiveness to remote control commands and camera movements. These tests also ensure the quality of live video transmission.

Following successful testing, the robotic platform, equipped with both motion control and surveillance capabilities, is deployed in the intended environment, suitable for educational, surveillance, or entertainment purposes. User feedback is actively collected to further enhance the system's performance and usability.

Detailed documentation encompasses hardware and software configurations, including comprehensive schematics. User manuals and guides are generated to assist users in operating the robotic platform and utilizing the CCTV camera effectively. A comprehensive project report captures the methodology, findings, and outcomes of the WiFi-controlled robotic platform project, showcasing its versatility and potential for various applications, including real-time video surveillance with the integrated CTRZQ wireless CCTV spy

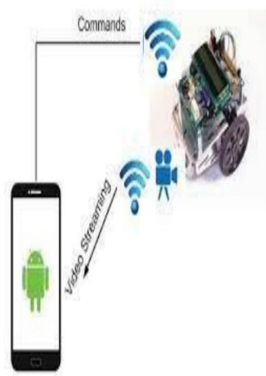

Fig.2 Android Application

IV. FUTURE SCOPE

Enhanced features can be added, such as obstacle detection and avoidance, enabling autonomous navigation. Integration with machine learning and computer vision algorithms can empower the robot to recognize and respond to specific objects or environments. Moreover, the project can serve as a foundation for educational purposes, teaching robotics and IoT concepts.

- **Obstacle Avoidance and Autonomous Navigation**: Incorporating obstacle detection sensors, such as ultrasonic or LiDAR, can enable the robot to navigate autonomously in complex environments. It can avoid obstacles and find the optimal path to its destination, making it suitable for tasks like home cleaning robots or autonomous warehouse transport.
- **Environmental Monitoring**: The robot can be equipped with environmental sensors for tasks like air quality monitoring, temperature and humidity control, or even early detection of environmental hazards such as fires or gas leaks. This makes it valuable for smart home and smart city applications.
- **Security and Surveillance**: For enhanced security, the robot can be equipped with additional sensors, like motion detectors and facial recognition cameras. This makes it suitable for applications such as homesecurity, automated patrolling, or monitoring remote locations.

V. MONITORING

Monitoring the WiFi-controlled robotic platform involves tracking its performance, including responsiveness to commands and video quality. It also includes collecting user interaction data and environmental information from sensors. Error handling and user feedback collection are crucial. Ensuring security, managing battery life, monitoring network stability, and assessing surveillance and object recognition accuracy are essential components of effective monitoring. This oversight guarantees optimal robot performance and user satisfaction.

VI. USE IN THE ARMY

Its ability to navigate various terrains, stream live video, and perform remote inspections makes it valuable for scouting and monitoring in potentially hazardous or challenging environments. It can assist soldiers in assessing situations from a safe distance, gathering critical intelligence, and enhancing situational awareness. Additionally, the robot can be deployed for remote security and perimeter surveillance, aiding military personnel in safeguarding key installations and providing a tactical advantage on the battlefield.

VII. CONCLUSION

The "Motion Detection Car Using WiFi Camera innovative solution with wide-ranging applications. By combining motion detection technology with remote control capabilities, this project offers an efficient and adaptable surveillance tool. It enables real-time monitoring, making it ideal for security and surveillance applications, both in domestic and industrial settings.The project demonstrates the potential of IoT and robotics in enhancing security, offering valuable insights into how technology can be harnessed to address real-world challenges. With further developments, such as obstacle avoidance and autonomous navigation, this system can become even more valuable and versatile. Moreover, its educational and research applications make it a valuable resource for students and enthusiasts interested in the fields of robotics, IoT, and computer vision.

As technology continues to advance, the "Motion Detection Car Using WiFi Camera and NodeMCU" project serves as a testament to the endless possibilities for innovation and practical implementation. Its adaptability and potential for future enhancements highlight its significance in the realm of IoT and robotics.

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Code :

```
#define ENA   14        // Enable/speed motors Right       GPIO14(D5)
#define ENB   12        // Enable/speed motors Left        GPIO12(D6)
#define IN_1  15        // L298N in1 motors Right          GPIO15(D8)
#define IN_2  13        // L298N in2 motors Right          GPIO13(D7)
#define IN_3  2         // L298N in3 motors Left           GPIO2(D4)
#define IN_4  0         // L298N in4 motors Left           GPIO0(D3)

#include <ESP8266WiFi.h>
#include <WiFiClient.h>
#include <ESP8266WebServer.h>

String command;           //String to store app command state.
intspeedCar = 800;        // 400 - 1023.
intspeed_Coeff = 3;

const char* ssid = "NodeMCU Car";
ESP8266WebServer server(80);

void setup() {

pinMode(ENA, OUTPUT);
pinMode(ENB, OUTPUT);
pinMode(IN_1, OUTPUT);
pinMode(IN_2, OUTPUT);
pinMode(IN_3, OUTPUT);
pinMode(IN_4, OUTPUT);

Serial.begin(115200)
// Connecting WiFi
WiFi.mode(WIFI_AP);
WiFi.softAP(ssid)
IPAddressmyIP = WiFi.softAPIP();
Serial.print("AP IP address: ");
Serial.println(myIP);
 // Starting WEB-server
server.on ( "/", HTTP_handleRoot );
server.onNotFound ( HTTP_handleRoot );
server.begin();
}
void goAhead(){

digitalWrite(IN_1, LOW);
digitalWrite(IN_2, HIGH);
analogWrite(ENA, speedCar);
digitalWrite(IN_3, LOW);
digitalWrite(IN_4, HIGH);
analogWrite(ENB, speedCar);
  }
```

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```
void goBack(){
digitalWrite(IN_1, HIGH);
digitalWrite(IN_2, LOW);
analogWrite(ENA, speedCar);

digitalWrite(IN_3, HIGH);
digitalWrite(IN_4, LOW);
analogWrite(ENB, speedCar);
  }
void goRight(){
digitalWrite(IN_1, HIGH);
digitalWrite(IN_2, LOW);
analogWrite(ENA, speedCar);

digitalWrite(IN_3, LOW);
digitalWrite(IN_4, HIGH);
analogWrite(ENB, speedCar);
  }

void goLeft(){
digitalWrite(IN_1, LOW);
digitalWrite(IN_2, HIGH);
analogWrite(ENA, speedCar);

digitalWrite(IN_3, HIGH);
digitalWrite(IN_4, LOW);
analogWrite(ENB, speedCar);
  }

void goAheadRight(){
digitalWrite(IN_1, LOW);
digitalWrite(IN_2, HIGH);
analogWrite(ENA, speedCar/speed_Coeff);

digitalWrite(IN_3, LOW);
digitalWrite(IN_4, HIGH);
analogWrite(ENB, speedCar);
  }
void goAheadLeft(){
digitalWrite(IN_1, LOW);
digitalWrite(IN_2, HIGH);
analogWrite(ENA, speedCar);

digitalWrite(IN_3, LOW);
digitalWrite(IN_4, HIGH);
analogWrite(ENB, speedCar/speed_Coeff);
  }
void goBackRight(){
```

```
digitalWrite(IN_1, HIGH);
digitalWrite(IN_2, LOW);
analogWrite(ENA, speedCar/speed_Coeff);
digitalWrite(IN_3, HIGH);
digitalWrite(IN_4, LOW);
analogWrite(ENB, speedCar);
  }

void goBackLeft(){

digitalWrite(IN_1, HIGH);
digitalWrite(IN_2, LOW);
analogWrite(ENA, speedCar);

digitalWrite(IN_3, HIGH);
digitalWrite(IN_4, LOW);
analogWrite(ENB, speedCar/speed_Coeff);
  }

void stopRobot(){

digitalWrite(IN_1, LOW);
digitalWrite(IN_2, LOW);
analogWrite(ENA, speedCar);

digitalWrite(IN_3, LOW);
digitalWrite(IN_4, LOW);
analogWrite(ENB, speedCar);
 }

void loop() {
server.handleClient();

    command = server.arg("State");
    if (command == "F") goAhead();
    else if (command == "B") goBack();
    else if (command == "L") goLeft();
    else if (command == "R") goRight();
    else if (command == "I") goAheadRight();
    else if (command == "G") goAheadLeft();
    else if (command == "J") goBackRight();
    else if (command == "H") goBackLeft();
    else if (command == "0") speedCar = 400;
    else if (command == "1") speedCar = 470;
    else if (command == "2") speedCar = 540;
    else if (command == "3") speedCar = 610;
    else if (command == "4") speedCar = 680;
    else if (command == "5") speedCar = 750;
    else if (command == "6") speedCar = 820;
```

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```
    else if (command == "7") speedCar = 890;
    else if (command == "8") speedCar = 960;
    else if (command == "9") speedCar = 1023;
    else if (command == "S") stopRobot();
}

void HTTP_handleRoot(void) {

if( server.hasArg("State") ){
Serial.println(server.arg("State"));
  }
server.send ( 200, "text/html", "" );
  delay(1);
}
```