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ijirset@gmail.com

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Military Surveillance Robot

**Nilam Ramesh Gadekar, Pratiksha Pandurang Salunkhe, Rushikesh Narayan Gade,
Prof. R.S.Nipanikar**

Department of Electronics & Telecommunication, Shri. Chhatrapati Sambhajiiraje College of Engineering,
Dhangawadi, India

ABSTRACT:-- The study discusses the utilization of robotic surveillance systems in various scenarios, such as border monitoring and war zones. These systems serve as substitutes for human border guards responsible for surveillance. The robotic vehicle has the ability to autonomously detect human presence and transmit relevant information to the control station. This technology caters to both surveillance and reconnaissance situations. The necessity for security applies to every individual, and as the population has increased, so has the demand for adequate security measures. However, financial constraints often hinder the establishment of sufficient security measures. The aim of the research was to develop an intelligent robot that can provide high-quality security as a long-term solution to this issue. The objective was to create and implement a rover that utilizes modern technology, allowing it to travel under the control of a remote control room, explore the area, and promptly notify the control centre in the event of any abnormalities. When a person is detected, the information is transmitted to the control room. Additionally, the robot is equipped with a smart camera that can capture live videos and images of intruders when necessary. Surveillance plays a significant role, particularly in border areas, where the robot employs a metal sensor to identify landmines in the surrounding vicinity.

KEYWORDS: - DC Motor, Robot, Sensor , IoT base , ESP 32 CAM and Ultrasonic sensor, Wi-fi

I. INTRODUCTION

Surveillance encompasses real-time data collection, analysis, and efficient dissemination of information to operators. It holds immense importance in defence applications as it enables the detection of potential threats, allowing prompt actions to safeguard citizens. The primary objective of surveillance is to monitor various scenarios, regions, or individuals, typically in military contexts where observing enemy territories, hostage situations, or conflict zones is vital for national security. In proximity to sensitive areas, skilled personnel engage in human surveillance to maintain constant vigilance for any changes. However, this method carries the risk of losing personnel if discovered by the enemy.

With recent advancements in technology, remote monitoring of critical locations can now be achieved using robots instead of human operatives. These physical and sophisticated robots possess the capability to identify subtle details that may elude human observation. Furthermore, the use of robots eliminates the risk of losing human resources, as mentioned previously. Equipping these robots with high-resolution cameras and various types of sensors enables remote acquisition of data about the targeted location. A surveillance robot operates as a semi-automated machine, following instructions, gathering essential data, navigating towards its objective, and streaming or capturing images that can be reviewed by the operator, all while navigating obstacles.

The objective of this paper is to present a wireless-controlled robot vehicle as a solution or example. This robot vehicle can detect objects, estimate the distance between itself and a human, and wirelessly transmit video footage of its surroundings to the operator.

II. EXISTING SYSTEM

The majority of surveillance systems commonly used today operate autonomously, utilizing DTMF (Dual Tone Multi-Frequency) and RF (Radio Frequency) communication for data transmission [1][4]. However, RF communication has limited range compared to other modern communication technologies, which restricts the operational range of these

systems. Additionally, RF communication relies on line of sight, making it less suitable for environments with obstacles or dense vegetation like forests.

To address these limitations, human intervention is often required to makeover the robots, making them semi-autonomous when DTMF is used to control their movement. However, incorporating mobile phones into robotic systems for data collection and transmission purposes increases the overall system cost. High-quality mobile devices can be expensive, and such systems may not be practical or realistic for widespread implementation.

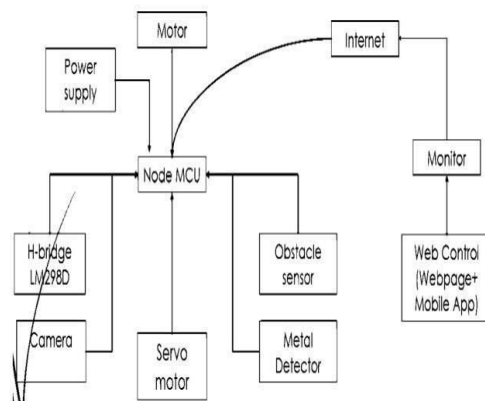
[1] Reference for DTMF communication method. [4] Reference for RF-based communication method.

III. SYSTEM ARCHITECTURE AND IMPLEMENTATION

In our proposed system, the robotic vehicle plays a crucial role in assessing the area during hostage situations and providing precise data to the operator. This allows the operator to take proactive measures to prevent any loss of life or property. The vehicle is equipped with two types of sensors: metal sensors and ultrasonic sensors.

The ultrasonic sensor is responsible for detecting the presence of humans or barriers that could potentially pose a risk to the robot. It helps the vehicle navigate around obstacles and ensures the safety of the robot during its operation. On the other hand, the metal sensor is utilized for detecting and locating land mines in the vicinity, enhancing the overall security of the area.

To control the robotic vehicle, a website is employed, serving as an interface for the operator to send instructions wirelessly from any location. The operator can issue commands such as moving the vehicle in the FORWARD, BACKWARD, LEFT, and RIGHT directions, enabling precise control over the vehicle's movement and exploration of the area



System Description:-



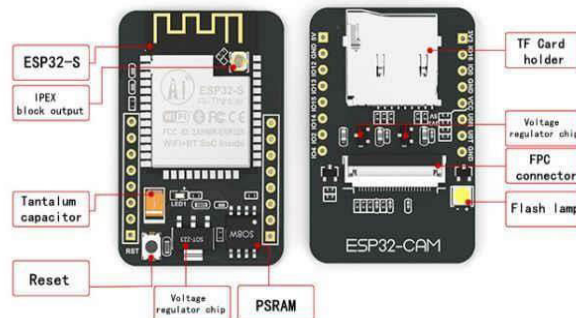
1. NodeMCU

An open-source firmware called NodeMCU was developed specifically for the ESP8266 wifi chip. It is bundled with the ESP8266 Development board, also known as the Node MCU Development board, to harness the capabilities of the ESP8266 chip. Node MCU is built on the LUA programming language and offers the flexibility for users to modify, customize, or even manufacture their own hardware based on the platform.

The Node MCU Development board features serial communication protocols, digital and analog pins, as well as built-in wifi functionality. It provides an accessible means to obtain Node MCU firmware through readily available web custom builds.

[2] In addition to LUA scripting, Node MCU can also be programmed using the Arduino IDE, a popular integrated development environment. This allows Arduino developers to leverage their existing knowledge of the Arduino platform and programming language, making it more convenient to create NodeMCU projects without the need to learn a new language or IDE specifically for NodeMCU.

II. ESP32-Camera:



The ESP32-CAM is a versatile module that finds applications in various IoT scenarios. It is well-suited for IoT applications such as wireless positioning system signals, industrial wireless control, wireless monitoring, QR wireless identification, and smart home devices. Its capabilities make it an ideal solution for a wide range of IoT applications.

Additionally, open source firmware like NodeMCU offers prototype board designs that are compatible with the ESP32-CAM. These open source designs provide flexibility and convenience for developers who want to work with the ESP32-CAM and leverage the features and capabilities of the NodeMCU firmware.

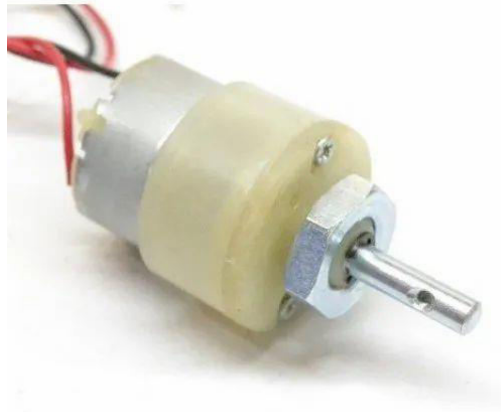
❖ Features

- Onboard ESP32-S module, supports WiFi+Bluetooth
- OV2640 camera with flash
- Onboard TF card slot, supports up to 4GB TF card for data storage
- Supports WiFi video monitoring and WiFi image upload
- Supports multiple sleep modes, deep sleep current as low as 6mA
- Control interface is accessible via pin header, easily embedded into user product.

❖ Specifications

- WiFi module: ESP-32S
- Processor: ESP32-D0WD
- Built-in Flash: 32Mbit
- RAM: Internal 512KB + External 4MB PSRAM
- Antenna: Onboard PCB antenna
- WiFi protocol: IEEE 802.11b/g/n/e/i
- Bluetooth: Bluetooth 4.2 BR/EDR and BLE
- WiFi mode: Station/SoftAP /SoftAP+Station
- Security: WPA/WPA2/WPA2-Enterprise/WPS
- Output image format: JPEG (OV2640 support only), BMP, GRAYSCALE
- Supported TF card: up to 4GB
- Peripheral interface: UART/SPI/I2C/PWM
- IO port: 9
- UART baudrate: default 115200bps
- Power supply: 5V
- Transmitting power:
 - 11b: 17±2dBm (@11Mbps)
 - 11g: 14±2dBm (@54Mbps)
 - 11n: 13 ±2dBm (@HT20, MCS7)
- Power consumption:
 - Flash off: 180mA @5V
 - Flash on and brightness max: 310mA @5V
 - Deep-Sleep: as low as 6mA @5V
 - Modern-Sleep: as low as 20mA @5V
 - Light-Sleep: as low as 6.7mA @5V
- Operating temperature: -20°C ~ 85°C
- Storage environment: -40°C ~ 90°C, <90%RH
- Dimensions: 40.5mm x 27mm x 4.5mm

III. 200 RPM DC GEAR MOTOR:



A gear motor combines a motor and gearbox into a single unit. The gearbox reduces the speed of the motor while increasing its torque output. Key parameters for gear motors include speed (rpm), torque (lb-in), and efficiency (%). To choose the appropriate gear motor for your specific application, it is essential to calculate the load, speed, and torque requirements. ISL Products offers a range of small and miniature gear motors, including Spur Gear Motors, Planetary Gear Motors, and Worm Gear Motors, to fulfill various application needs. Our DC motors can be paired with our unique gearboxes, resulting in highly efficient gear motor solutions. It is crucial to carefully match the motor and gearbox reduction ratio when incorporating a gear motor into your design.

IV. RELAY:-



A relay is an electrical switch that operates using an electrical signal. It consists of input terminals to receive control signals and output terminals for operating contacts. The switch can have various contact forms, including make contacts, break contacts, or a combination of both.

Relays are utilized when there is a need to control a circuit using a separate low-power signal or when multiple circuits need to be controlled by a single signal. Initially, relays were employed as signal repeaters in long-distance telegraph circuits, where they refreshed the incoming signal by transmitting it on another circuit. They were extensively used in telephone exchanges and early computers to perform logical operations.

Result :-

This bot can be controlled by using our website or our application, it gives the user complete access to control it. The website and application have an option of live feed where you can watch the live streaming of the bot. There is an alarm feedback associated with the website and application where if any metal or object detected will generate a pop up stating that metal has been detected or an object is in front of it. The website overlook is as shown underneath.



IV. CONCLUSION

To develop a highly reliable security system that minimizes human errors, this research project incorporates a combination of cutting-edge technologies, including wireless communication, neural networks, and hardware controllers. The resulting robot possesses autonomous capabilities, enabling it to navigate independently, avoid obstacles, and promptly alert the control room of any anomalies. By reducing human labour and eliminating the potential for human errors, this robot offers an advanced and cost-effective solution compared to similar products available in the market.

To enhance its practicality, the robot will implement efficient charging techniques and innovative strategies to extend battery life, enabling longer patrolling periods. A protective polycarbonate shell will enclose the camera, ensuring its accuracy and functionality while safeguarding it from external elements. The robot's controls will be designed for user-friendly operation, making it accessible to a wider range of individuals. Tracking and management of the robot's activities will be facilitated through a dedicated mobile application.

To ensure operational versatility, the robot will be weatherproofed, enabling it to function effectively in adverse weather conditions that are challenging for human operators. Additionally, integration with drones will enhance the security system by enabling aerial surveillance of intruders from heights inaccessible to the robot's camera, thus providing a comprehensive surveillance solution.

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