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## **Camouflage Based Robot for Multipurpose Military Applications**

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### **ABSTRACT**

*In modern times, a lot of money is spent on implementing old-fashioned security techniques to keep trespassers away from the border. In risky locations where army troops might not be as successful, several military organizations use robot assistance. These military robots are concealed and equipped with a camera, sensors, metal detector, and Camouflage. The primary objective of our system is to blend in with the environment, but it also includes a few extra functions, such as an IR sensor to track intruders and WIFI for real-time data processing with the camera at the video screen. As a result, the suggested WIFI system reduces mistakes made during defence and keeps the nation secure from the intruder.*

**Keywords:** *Trespassers, camouflaged, intruders, IR (Infrared), WI-FI (wireless fidelity)*

### **INTRODUCTION**

The Camouflage Robot is an advanced robotic creation designed for military applications. It possesses the ability to blend seamlessly into any environment, mimicking its surroundings and remaining virtually invisible to adversaries. With its intelligence-gathering capabilities and tactical advantages, it provides enhanced stealth, reconnaissance, and decision-making support on the battlefield. Equipped with various sensors and autonomous navigation, it can gather critical intelligence and perform covert operations. The Camouflage Robot represents a significant innovation in military technology, demonstrating the military's commitment to leveraging cutting-edge robotics for strategic advantage.

Robots are automatic mechanical devices that frequently resemble people or animals. Typically, a computer software or electronic circuitry directs modern robots. Robots have replaced humans in performing repetitive and dangerous tasks. Basically, Army Robot is capable of performing tasks such as Face detection, missile detection, and camouflage. If any obstacle is detected, that will be notified and robot will stop moving. So, in all the proposed system provides a helping hand to our security forces in detection of intruders. Robots are enhanced to be robust and sturdier giving the guarantee of success in the risk prone environment.

This project aims to contribute to the ongoing efforts in modernizing military operations by introducing a game-changing

technology capable of transforming the way soldiers navigate and operate in hostile environments. The Camouflage robot for military applications holds the potential to greatly reduce casualties, enhance operational effectiveness, and ultimately increase mission success rates.

In the realm of modern warfare, technological advancements have played a pivotal role in enhancing the capabilities of armed forces. Among the cutting-edge innovations, the development of camouflage robots has emerged as a remarkable stride in military applications. These sophisticated machines combine advanced robotics, artificial intelligence, and state-of-the-art camouflage technologies to revolutionize the concept of stealth operations on the battlefield.

The primary objective of camouflage robots is to mimic their surroundings, effectively blending into the environment and providing invaluable tactical advantages to military forces.[1-3]

#### **LITERATURE SURVEY[4-6]**

- Paper Title: Moving Object Detection using Adaptive Blind Update and RGB-D Camera, Authors: Navid Dorudian; Stanislao Lauria, Stephen Swift: - With this initialization technique, a model is built to contain background pixels, and background pixels are identified by comparing each of the pixels of the newly constructed frame with the model at the same place. The background-model update reported in this study uses blind and regular updates and differs from prior techniques in that it applies a different criterion.
- Paper Title: Camouflage modelling for moving object detection, Authors: Xiang Zhang, Ce Zhu: -They proposed a new strategy, camouflage modelling (CM), to detect camouflaged moving objects.
- Paper Title: A Bayesian Approach for Camouflaged Moving Object Detection, Authors: Xiang Zhang, Ce Zhu, Shuai Wang, Yipeng Liu, Mao Ye: - To locate foreground pixels that were masked, they recommended the use of camouflage modeling (CM). Given that foreground and background are both involved in camouflage, we must model both the foreground and backdrop and compare them in a well-planned manner in order to detect camouflage.
- Paper Title: Camouflage moving object detection, Authors: Archana Rajesh, Sanjeevani Kiran Shah: - It was investigated how to detect moving objects that is concealed using various ways.
- Paper Title: Design of security robot in night vision using a wireless video camera and ultrasonic sensor, Author: Dr. Shaik. Mahaboob Basha: - They have planned a mechanical vehicle in light of RF innovation for far off activity associated with the remote camera mounted on the robot for the purpose of observing. The robot is implanted with a 8051 series microcontroller for the ideal activity and is by and large utilized for the end goal of spying.
- Paper Title: Implementation of Spy Robot for A Surveillance System using Internet Protocol of Raspberry Pi,

Author: Ghanem Osman Elhaj Abdalla, T. Veeramanikandasamy: - The authors created a platform based on the Raspbian operating system with Internet of Things (IoT) algorithms for remote monitoring and control. The pi camera concurrently captures moving items that are posted inside the webpage while the PIR sensor detects living objects and sends them to the viewers via the web server. With or without human interaction, intelligent robots can complete desired tasks in unstructured circumstances.

### **PROPOSED SYSTEM**

A camouflage system that uses a color sensor that can detect the surrounding color and blend with a present environment by enabling camouflage mode, also using metal detector to detect metal objects like mines and bombs from the ground and report and using gas sensor to detect harmful gases and PIR sensor to detect and intruders. Soldiers are stationed close to sensitive sites to continuously watch for changes in order to conduct human surveillance. Additionally, there is a greater chance of dying if one is captured by the enemy. However, with advancements in technology, it is now possible to remotely monitor important locations by using ROBOT instead of people, sparing their lives. The backbone of this entire system is IOT technologies include cellular, Wi-Fi and ethernet.

Our project basically consists comprises a microcontroller and Wi-Fi module integrated ESP32. The camouflage system consists of a colour sensor which captures the surrounding colour and after

processing, the signals are send to ESP32 module which decides which LED array to glow by actuating a relay module, there by matching the surrounding environment. There are numerous sensors, including Smoke Sensor: detects for toxic gases, IR Sensor: Detects motion, Proximity sensor: For detection of underground mines and bombs, L293D: For driving the dc motors for motion control. These sensors' data are collected by the ESP32 module and transmitted to TCP/UDP app in your smartphone. Through the TCP/UDP app the robot's movement can be controlled. When the IR sensor is triggered, the ESP32 cam takes a picture and provides live streaming, which can be accessed through internet.[7,8]

### **Hard-Wired Surveillance Systems**

These systems use wires to connect the cameras, motion detectors, power supply.

### **Remote Access Systems**

These systems possess the ability to monitor and control a security system from a location away from the surveillance area through android device.

In the below block diagram of Camouflage robot there is use of various sensors, description of the sensors is as follows

### **Colour sensor**

The primary function of a colour sensor is to measure the intensity of light reflected from an object and determine its colour. It typically includes a light source, a sensor, and a signal processing unit. Light from the light source is directed onto the object, and the sensor measures the

reflected light. The sensor can be designed to detect specific wavelengths of light or a broad spectrum of colours.

#### **IR sensor**

An IR (infrared) sensor, also known as an infrared detector or IR receiver, is a device that detects and responds to infrared radiation. The human eye cannot see infrared radiation because it consists of a longer wavelength than visible light.

#### **MQ6 smoke sensor**

The MQ6 sensor module utilizes a tin oxide (SnO<sub>2</sub>) semiconductor to find the intended gases. The sensor experiences a chemical reaction that alters its electrical conductivity when it comes into touch with the gas. The module includes a heating element that maintains the sensor at an elevated temperature to improve its sensitivity and response time.

#### **Proximity sensor**

This is a type of device that detects the presence or absence of an object within its sensing range without physical contact. Here it is used as metal detector that is an instrument used to find metallic objects in diverse materials or the environment. It operates by generating a magnetic field and then sensing changes in that field caused by the presence of metal.

#### **WI-FI**

Wi-Fi (Wireless Fidelity) is a technology that allows devices to wirelessly connect to local area networks (LANs) and access the internet; it makes it possible for devices to communicate with each other using radio waves, doing away with the

requirement for actual connected connections

#### **ESP32**

The ESP32 is an extremely well-liked and adaptable microcontroller module made for embedded systems and Internet of Things (IoT) applications. It is a replacement for the ESP8266 module that is being developed by Espressif Systems and is based on the Xtensa LX6 CPU. A system on chip featuring Wi-Fi and Bluetooth capabilities for a variety of uses, it is inexpensive and low-power.

#### **Relay**

A relay is an electrical switch that is operated by an electromagnet. Its contacts are opened or closed according to an electromagnetic signal to regulate the amount of electric current flowing through a circuit.

#### **ESP32 cam**

The ESP32-CAM is a development board that combines an ESP32 microcontroller and a camera module. It provides a platform for building projects that involve capturing images or streaming video over a network.

#### **RGB led array**

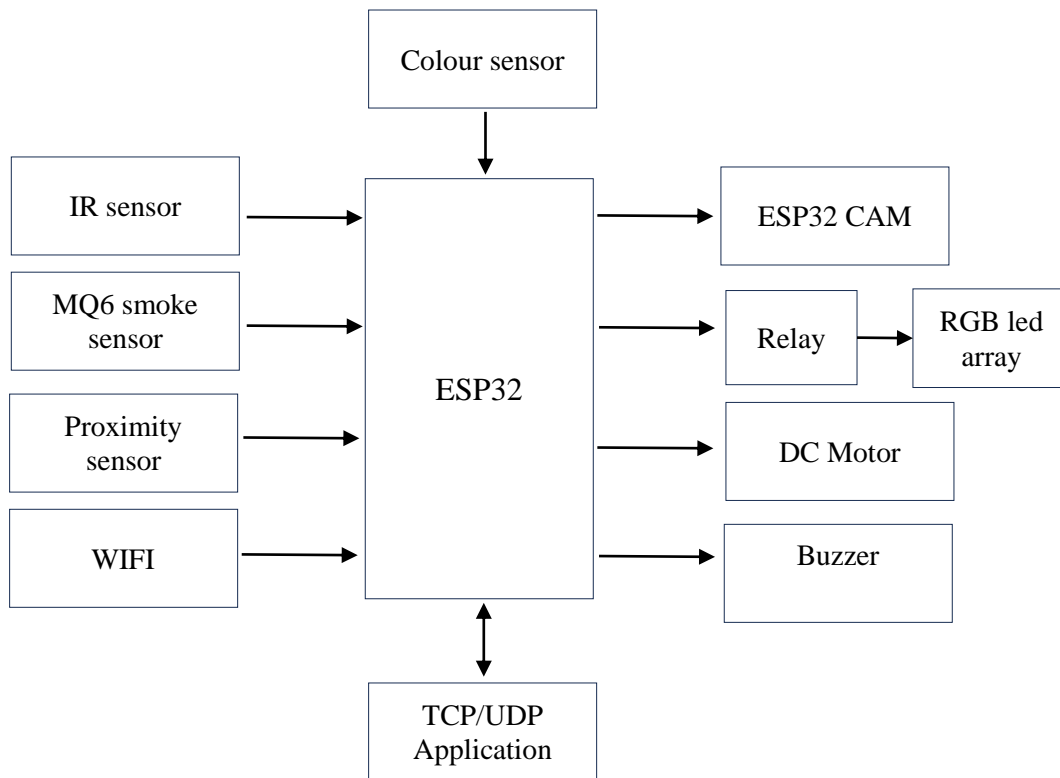
An RGB LED array is a collection of RGB (Red, Green, Blue) LEDs arranged in a matrix or an array format. It allows for individual control of each LED's colour and brightness, providing a wide range of colour possibilities.

#### **Buzzer**

When an electrical current is applied to electronic equipment, the buzzer emits

sound or an audible tone. It is commonly used in various applications, including

alarms, notifications, electronic games, and communication devices



**Fig.1:** Block Diagram of Proposed System

**FUNCTIONALITIES**

- To capture and identify an unidentified foe or enemy, then to fire an automated gun or laser at the foe.
- To mix with a current climate by empowering disguise mode.
- To recognize metal articles like mines and bombs from the beginning report.
- To identify the friendlies or adversaries by the camera and PIR sensor.
- To control the development of the robot by the cell phone.

- ESP32 Wi-Fi & Micro controller module
- ESP32 Cam
- Smoke sensor
- IR sensor
- Colour sensor
- LED array
- Motor Driver & DC motors
- Proximity sensor
- Buzzer
- Relay
- L293D H-Bridge

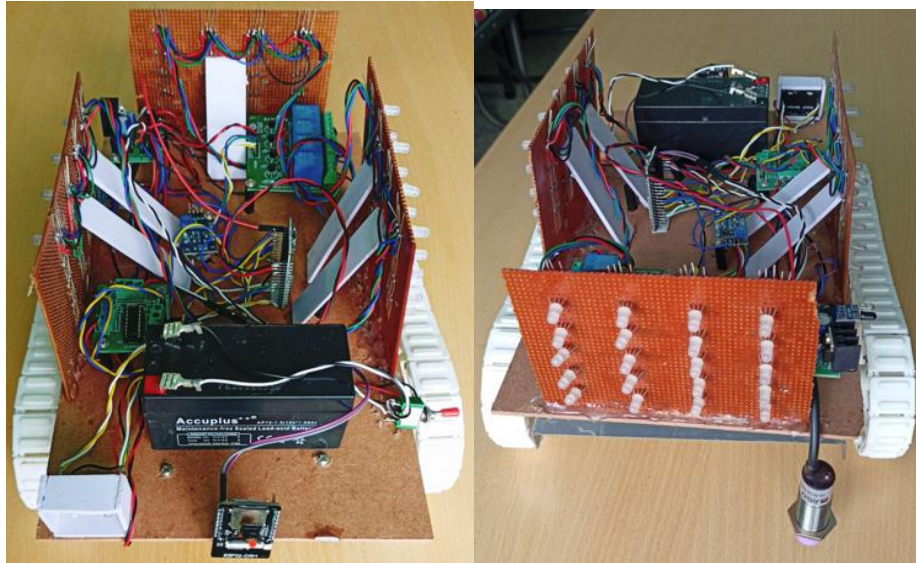
**SYSTEM REQUIREMENTS**

**Hardware Requirement**

**Software Requirements**

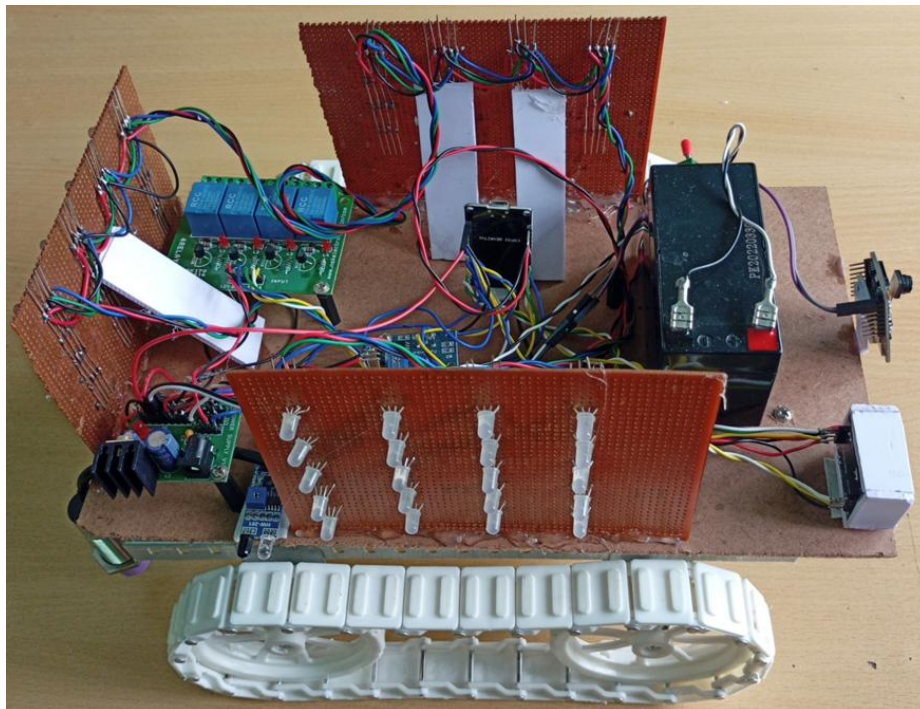
- Arduino IDE
- TCP/UDP application
- Embedded C

**PROTOTYPE**

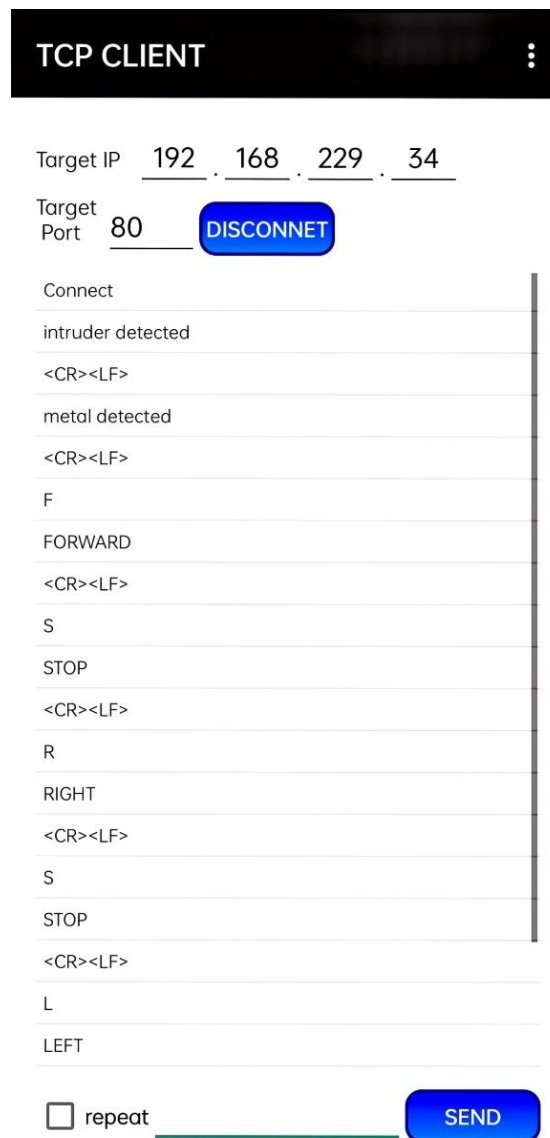


**(a)**

**(b)**



**(c)**



**(d)**

**Fig. 2:** (a) Front view of robot (b) Back view of robot (c) Side view of robot (d) TCP/UDP app interface.

- (a) Image that is showing the front view of the robot in which there is presence of camera beside a colour sensor of white colour followed by a battery of black colour and led array.
- (b) In this image it is showing the back view of the robot in which a proximity sensor has been installed by which the detection of land mines, bombs is possible and led array is as followed
- (c) This is the side view in which we can observe the relay of blue colour through which the action of the RGB led array takes place through the microcontroller ESP32, which powered through the supply of power from the battery.
- (d) This is the app interface of TCP/UDP app in which we should on the hotspot and configure the device IP address and then the robot gets connected as shown, if and object or person gets though the

IR sensor then Intruder detected message is shown, and if and metal object is detected by proximity sensor then metal detected message is shown, and the movement of the robot is controlled by giving commands like F:for forward movement, B:for backward movement, R:for right movement, L:for left movement and S:to stop.

### **APPLICATIONS**

- In military applications to identify human presence.
- During a rescue effort where human access is impractical.
- To pilot an unmanned aerial vehicle in combat zones.
- Tracking device.

### **ADVANTAGES**

- This technique provides a reliable and secure way to guarantee that no people are left behind during a rescue effort.
- The system employs WIFI, which makes it accurate and dependable.
- The system is safe even for the user because it uses robotics and requires no manual work.
- This can be utilized in hazardous areas where people cannot access.
- The robot is difficult to distinguish from the adversaries due to the colour-changing effect.

### **CONCLUSION AND FUTURE SCOPE**

The proposed system serves as a replacement for human life, which is always given priority. The proposed robot also serves as a life-saving security system. When it is hard for humans to access or monitor an area, the camouflage army robot

is a great option. It performs and serves a crucial function in keeping an eye on the battleground regions and capturing the surroundings. The robot conceals itself from enemy sight by changing color in accordance with the environment since it is based on the chameleon's ability to change color.

Our system's implementation is solely driven by the use of IR sensors, smoke sensors, DC motors, cameras, etc. Overall, this robot is a versatile tool that eases the stress on people during disasters. Our security officers receive assistance from the camouflage robot system in the detection of trespassers and attackers. It is challenging to see the robot with the unaided human eye due to its camouflaging feature. As our developed system only uses RGB scale camouflaging, there is room to improve the system by setting it with multi-color camouflaging.

Our project's primary goal is to control a robot with a cell phone. The system stops and sounds an alert if it detects any metallic objects or human presence. It also detects any metallic objects and human presence using a PIR sensor.

The microcontroller is set up so that depending on the key that is pressed the Robot will move intelligently, detecting the presence of metallic items in mines with the aid of a metal detection sensor, and alerting through a buzzer warning system. The project's flaw is that it is unknown what is happening with the robot. A GSM module, which indicates if a robot is operating, can eliminate this. Additionally, a GSM module that provides



the necessary information can be added along with an ultrasonic module that is utilized to identify obstacles.

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