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IOT BASED CAMOUFLAGE ROBOT

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ABSTRACT
With the evolution of Internet of Things (IoT) and robotics, the idea of camouflage robots has attracted a lot of interest for use in surveillance, defence and wildlife observation. This project outlines the design and development of an IoT-enabled camouflage robot with the ability to change its appearance to match that of its environment. It runs on a microcontroller with wireless communication capabilities (Wi-Fi, Bluetooth) for remote monitoring and control via specialized mobile app or web interface. Other features are obstacle avoidance, motion control, and energy efficient operation. With the use of IoT, there is real time data transmission and the adaptability of the robot in changing environments is increased. This work contributes to creation of autonomous adoptive camouflage technology, which can find potential applications in military reconnaissance, stealth missions, wildlife conservation, and smart environments.

Keywords:
Camouflage, IoT, Surveillance, PIR sensor, Blynk.

INTRODUCTION

A military camouflage robot is the most advanced technology in the current military where it is necessary to be stealthy and at the same time to have diversity and functionality. The robot is supposed to adapt its appearance to the environment, that is why it needs to look like natural things the same way as ground, plants or even cities. The reason behind these features is the use of the newest technologies such as artificial intelligence (AI), computer vision, and adaptive materials. The camouflage robot is capable of modifying not only its appearance but also the way it moves to adapt automatically to the environmental conditions. This makes the robot a reliable tool for reconnaissance, surveillance, and infiltration operations in extreme conditions in military forces. Consequently, the human factor in military operations will lessen while the tactics will be improved through the use of such technology. Consequently, new technologies like military drones and robots AI-based decision-making would let invisible technics like espionage, intelligence gathering and conflict de-escalation work freely. It is the military operations that have moved more towards the use of covert and targeted technology measures, the invention of camouflage robots is the first stride of revolution in defence technology in the future. Human life is exposed to danger in the areas with extreme climatic conditions, high altitudes, battle sites etc. and as a result the main concentration should be to keep the human alive, the robot is a good approach to replace a security. The robot is the product of computer programming and electronic circuits. These robots become the best alternative for humans in the automation of repetitive work and job that could be harmful. The robots have an adjustable mission now, and the main functionalities, which are important, include amongst others, the motion of the robot, interpretation of the environmental data, sensors that are to detect human or animal movement, dangers of toxic gas, metals, taking snapshots. The proposed system survey the area and offers the observer or the user the live footage via the wireless camera. The camouflage spy robots are the special forces that can be deployed into the scheduled or recurrent locations, working in the warfare field thus. The army robot can be maneuvered from a remote location.

LITERATURE SURVEY

NehaBhadwal, VishuMadaan, Prateek Agrawal, Awadesh Shukla and AnujKakran, “Smart border surveillance system using wireless sensor network and computer vision”, and the system is the most significant task in the area of National Defense and security and therefore the system which is available to do the surveil lance task without the need of any human help. It can do away with the necessity of sending humans to hostile conditions at any times. Additionally, if something once the system detects that the intruder is suspicious yes, it shows be able to

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make required decisions and thus take action along with sending alerts messages to the human controllers. The controller is informed to intrusion, it is his decision to do. Such systems if deployed successfully, not only can save resources but also can deserve decrease the risk to human life to a great extent.

Hitesh Shinde, KirtiSonawane, PranitRane, Atharva Pathak, SumitaChandak, "Camouflage Color Changing Robot", According to the survey, the reviewed systems The camouflage robot is the solution for reducing loss of human life by substituting it in operations the system proposed is one camera for surveillance and 1 camera for color sensing purposes the robot detects the color of the environment through this camera and changes its color to in with it. This makes it hard to be detected by the naked enemy eyes. The enemy is remotely operated through a computer and wireless trans receiver is employed to create the link between them systems can stay area around and also gives the life feed to the observer.

Laura Rodríguez Carlos-Roca, Isabelle Hupont Torres and CarlesFernándezTena, "Facial recognition application for border control". This pa per provides an overview of border control processes and how the inclusion of different biometric technologies contributes to its improvement. In particular, facial recognition is one of the latest biometric technologies to have been added to this list of technologies.

COMPONENTS USED

An IoT Based camouflage requires a combination of hardware and software components for sensing, processing, communication, and actuation. Below is a categorized list of essential components:

1) Color sensor:
- Detects surrounding colors by analyzing RGB values, allowing the robot to adapt its camouflage.
- Uses an array of photodiodes with different color filters (Red, Green, Blue) to measure light intensity and generate frequency outputs corresponding to detected colors.

2) Light Dependent Resistor (LDR) :
- Measures ambient light intensity to adjust camouflage brightness or activate night mode.
- Resistance decreases with increasing light intensity, allowing the microcontroller to interpret brightness levels.

3) Ultrasonic sensor:
- Measures distance to obstacles for autonomous movement and collision avoidance.
- Sends ultrasonic waves and calculates distance based on the time taken for the echo to return.

4) DHT11 sensor:
- Measures temperature and humidity for environ mental adaptation.
- Uses a thermistor for temperature sensing and a capacitive humidity sensor to measure moisture levels.

5) Metal Detector:
- Detects the presence of metal objects or landmines, useful for security or military applications
- produces an electromagnetic field, detects metallic object disruptions, and initiates a reaction.

6) Gas sensor:
- Provides safety alarms by detecting dangerous gases such as CO, CO, LPG, methane, or smoke.
- Signals are sent to the microcontroller via a chemically sensitive substance that changes resistance in response to particular gases.

7) PIR sensor:
- Detects human or animal motion based on infrared heat signatures, used for security or automatic activation.
- Senses infrared radiation emitted by living beings and triggers an output when motion is detected.

8) Rain Drop sensor:
- Detects rainfall to initiate defensive mechanisms or weather-based camouflage adjustments.

METHODOLOGY

A Camouflage Army Robot is designed in such a way that it can reproduce the color independently at various areas with specific spots of the ground surface which Fig. 1. Block Diagram of camouflage robot allows the robot to mock up as a checkerboard of multiple colors i.e. the various colors it drives over. In the implemented system the movement of the robot can be controlled in any required direction using IoT platform and smart phone which receives the information from the sensors and camera, the purpose of the project is to design, manufacture and

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operate a robot using a remote controlled device. A small mobile robot is designed which can duplicate its colors similar to the platform it moves on, appearing as camouflaged to the outside world.

ESP 32 microcontroller is the core of the system with an inbuilt Wi-Fi module utilized to get connected to the Internet via which is connected to blink server, the sensor such as ultrasonic sensors utilized to detect the obstacle in the way of robot, color sensor able to detect red, green and blue color utilized to determine the color of the land surface based on this knowledge about the color the matching RGB color will grow in the RGB matrix which is coated on the body of the robot car, As per the enlistment rule of the three essential hues which make different hues in nature, when the estimation of three essential hues is affirmed, the shade of the tried article is known. Knowing the estimation of RGB assists individuals with picking up the shade of the light which is anticipated onto the sensor since each shading compare to just one estimation of RGB. passive infrared (PIR) sensor provides information whenever any heat body like human and animals come close, metal detector is employed to the sense the metallic devices like bombs, guns etc., MQ 7 gas sensor employed to sense the dangerous gases primarily hydrogen gases, DHT11 sensor employed to obtain the details regarding the weather like temperature and humidity, raindrop sensor employed to obtain the details that whether it is raining or not. All of the sensors placed on the robot vehicle. This robot vehicle is equipped with four wheels which are connected with DC motors this DC motors are powered by the motors driver module and a night vision Wi-Fi camera used to record the live shots of the place, as it is having a special capability of night vision it can also take the pictures even in the dark state. Power supply for motor driver module is 12V and for a microcontroller and sensor needs 5V power supply, from the single 12V supply a DC to DC converter is utilized to convert 12V input power supply to 5V output power supply for the sensors and microcontroller. The sensors information are set to the information microcontroller, this microcontroller ESP32 is having a built in Wi-Fi module and it is connected to the preprogrammed router or to the hotspot to obtain the internet connection so that in order to create a communication between blynk server and the robot in the smartphone link application needs to be downloaded and should log into specific user by providing correct username and password. The connection is made between the robot the blynk server and the blynk application in the smartphone the robot movement can be remotely controlled by incorporating appropriate buttons for forward backward, right and left motion of the robot vehicle, and also all sensor values or the data will be uploaded to the server and the same can be accessed on the smart phone.

BLOCK DIAGRAM

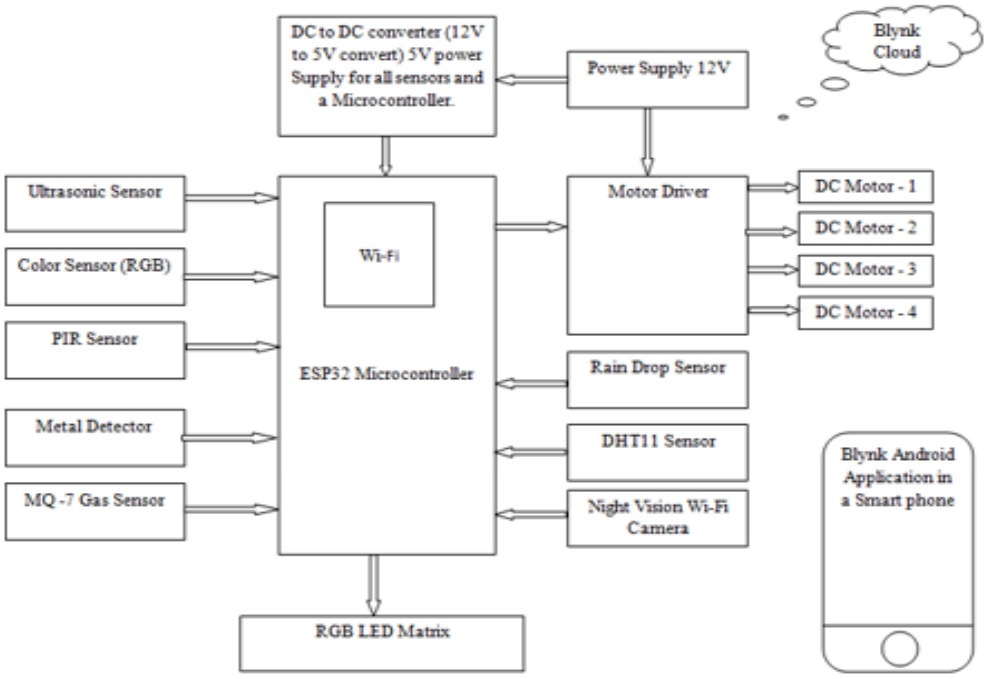

Fig. 1. Block Diagram of camouflage robot

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RESULT

The camouflage robot was successfully designed and proved to have effective environmental adaptation and remote control. The camouflage system of the robot successfully changed its color to blend with the environment, with an average adaptation time of 2.5 to 3 seconds under natural lighting and a bit longer under artificial conditions. IoT integration provided remote control in real-time through cloud platforms such as Blynk, with low latency of less than 500 ms in a stable environment. The ultrasonic sensor-based obstacle detection system provided seamless mobility through the detection of objects between a range of 30 cm to 150 cm, with a response time of about 0.7 seconds. The power consumption of the robot varied between 8W and 12W, with battery life of approximately 4 to 5 hours on a 3000mAh Li-ion battery. The system operated well overall in controlled environments, with some minor issues regarding low-light camouflage accuracy, network stability, and energy efficiency that could be areas of improvement in the future.
The exact figure of resulted Design and implementation of IoT based camouflage robot is shown below:

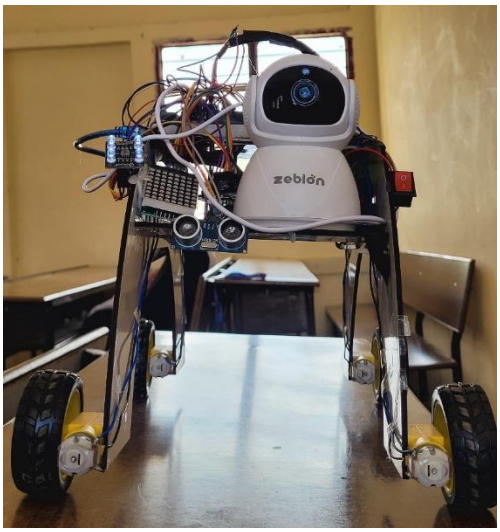

Fig. 2: Camouflage Army Robot

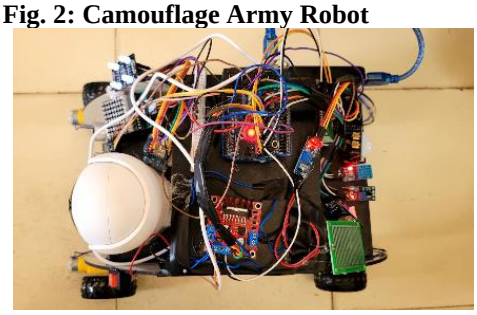

Fig. 3: Working Model

CONCLUSION

The suggested system is a replacement for human life. Since human life is always given the highest priority, this suggested robot assists in serving as a security system and lifesaver. It plays and plays a vital role in keeping an eye on the war field areas and captures the environment. Since it is dependent on the colour changing effect of Chameleons, the robot changes its colour depending on the nearby environment and camouflaged from the opponent's sight. Furthermore, the camouflage feature prevents it from being accessed by the human eye only. The robot is also taking real-time videos from the environs for us to exploit and analyze the battlefield land. Any obstacle that can be sensed, it will alert, and the robot will freeze. Overall, the suggested system gives a supporting hand to our defence forces in the detection of intruders. The robot can be utilized at high altitudes where human beings cannot survive.

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