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Report on

‘Camouflage Multifunctional Army Robot’

Submitted by

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under the guidance of

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CERTIFICATE

This is to certify that the Report entitled

‘Camouflage Multifunctional Army Robot’

is a bonafide work carried out by

Preksha Nagesh(PES1201700827)

In partial fulfillment for the completion of 5th semester course work in the Program of Study B.Tech in Electronics and Communication Engineering under rules and regulations of PES University, Bengaluru during the period Aug – Dec. 2019. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report. The report has been approved as it satisfies the 5th semester academic requirements in respect of project work.

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DECLARATION

I, **Preksha Nagesh**, hereby declare that the report entitled, '*Camouflage Multifunctional Army Robot*', is an original work done by us under the guidance of **Prof. Prajeesha Emmanuel**, Asst. Professor, Dept. of ECE, and is being submitted in partial fulfillment of the requirements for completion of 5th Semester 2 credit Course / Hands on Course on Automation using Electronic Components, in the Program of Study B.Tech in Electronics and Communication Engineering.

PLACE:Bangalore

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Contents

Chapter 1-Introduction

1.1 Problem Statement

1.2 Proposed Method

Chapter 2-Literature Survey

Chapter 3-Methodology

3.1 Components Used

3.2 Block Diagram and Working

Result

Conclusion

Future Scope

References

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Abstract

Nowadays, many expenses are made in the field of defense in adopting primitive security measures to protect the border from the trespassers. Some military organizations take the help of robots in risk prone areas which are not that effective when done by army men. These army robots are confining with the camera, sensors, metal detector and video screen. The main objective of our system is to get camouflaged including an Ultrasonic sensor to trace the intruders, Gas and Metal sensors to detect gas and metal respectively and also a spy camera which provides live video footage.

Chapter 1 - Introduction

A robot is a machine which is programmed by a computer and is capable of carrying out a complex series of actions automatically. In this modern era of technology we know use machines, especially robots to perform repetitive and dangerous tasks. Lots of research and resources go into the making of these robots and still there is a lot left to learn about these complex machines and their abilities. What many years ago seemed like fiction, now is slowly changing to reality due to these machines.

Every day our soldiers put their lives on the line for the people of India. They give us an immense sense of safety by putting themselves in a constant state of danger. We have designed a robot to make their lives a bit easier. Our robot aims at tackling risk prone areas which are more effectively done by robots than humans.

Basically our Army Robot is capable of performing tasks such as locomotion, sensing of harmful gas, sensing metal beneath the surface, obstacle and human detection. The robot also consists of a camera which provides live footage and also our robot can move in stealth as it can camouflage itself with the surroundings which it makes it hard for the enemies to spot it.

This army robot is more efficient when compared to the soldiers. Excellency of this robot is in being operated wireless from a remote which offers no risk to the soldier lives. Robots are enhanced to be robust and sturdier giving the guarantee of success in the risk prone environment. The main aim of the paper is to implement a Camouflaged technology based Wireless multifunctional Army Robot which can be controlled through a smartphone using WiFi.

1.1 Problem Statement

Design and building of a “Camouflage Multifunctional Surveillance Robot”. This robot is extensively made to be used by the military for risk free surveillance.

1.2 Proposed Method

The aim of the project is to design, manufacture and operate a robot via a Smartphone, used as remote control device. We have used a LED (RGB) strip which can diffuse uniform colors, coupled to sensors that can precisely identify ground colors. This robot is designed in such a way that it can reproduce the color independently at various areas on which it moves on and hence produce a uniform light source of the same color and hence blend in with the outside world without being noticeable. On the other hand, we also created a system which can receive and decipher information received from the Smart phone using IOT to further pilot motors which in turn drives the robot in any required direction. It also comprises of a Wifi camera which provides live video footage which is used for spying. Furthermore, we have used four sensors to provide necessary information about the surroundings, namely,

1. Gas Sensor-To detect gas
2. Metal Sensor-To detect metal
3. Ultrasonic Sensor-To detect objects
4. Color Sensor-To detect the color of the ground for camouflaging.

Chapter 2 - Literature Survey

Traditionally a robot or a rover is a metal chassis with few sensors attached to it and is driven with the help of wheels and DC motors. For achieving movement in a desired direction the motors are either made to rotate clockwise or anticlockwise.

Typically when the term Surveillance is used it means gathering information about the surrounding area and to achieve this goal a robot uses various types of sensors.

For a robot to achieve stealth in an environment it needs to blend in.

To execute this idea we will need to gather a lot of information about every component used and also learn how to use them.

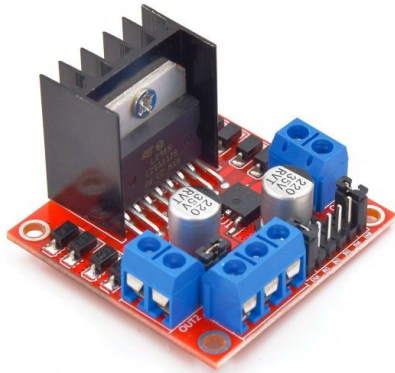
The working of the robot is divided into certain subsections or steps for which individual research was done.

1. Movement - For moving the robot wirelessly using a smartphone the Rootsaid Wifi Command app was used which provided the necessary information to perform the task.
2. Camera - For live surveillance using the picamera we learnt how to use the picamera from the Raspberry Pi website and for live surveillance we browsed the internet and found a webpage which provided the necessary information to finish this task whose link is given at the end of the document.
3. Sensors- For the various sensors used in the project necessary information about each sensor was obtained from various sources and their basic respective codes was also received in the same fashion.
4. LED Strip-For the bot to blend in we are using an LED strip to glow in accordance to the color of surface which is received from the color sensor attached to the robot.

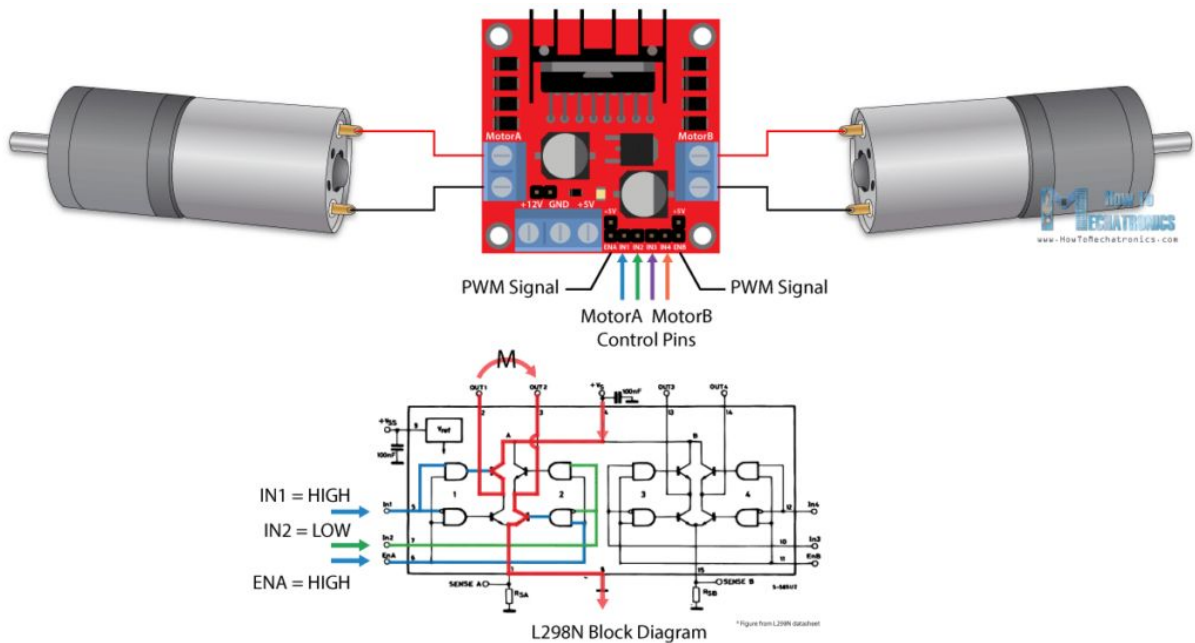
Chapter 3-Methodology

3.1 Components Used

1. H-BRIDGE L298N:



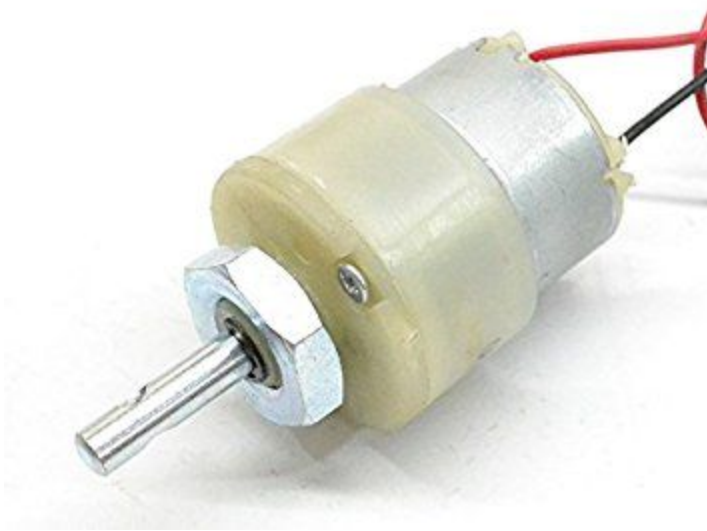
Using this, we can control DC motors using the Arduino. The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.



2. **DC Motors:**

These are used to run the whole setup. A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy.

A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.



3. **Raspberry Pi:**

We are using Raspberry Pi 3 in our bot. The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. In our project, we use the raspberry pi for the purpose of movement, controlling the dc motors and for the pi-cam.



4. **Arduino UNO:**

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE, via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. We use Arduino UNO for the gas sensor, metal sensor and colour sensor.



5. **Gas Sensor:**

Gas Sensor(MQ2) module is useful for gas leakage detection (home and industry). It is suitable for detecting H₂, LPG, CH₄, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer.



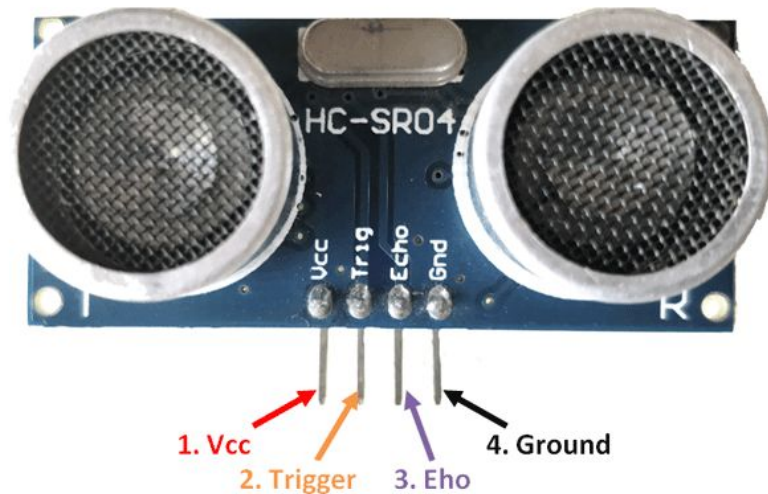
6. **Metal Sensor:**

Metal detector is an electronic instrument that detects the presence of metal nearby.

Inductive inductive proximity sensors can only detect metal targets. They do not detect non-metal targets such as plastic, wood, paper, and ceramic. Unlike photoelectric sensors, this allows an inductive proximity sensor to detect a metal object through opaque plastic.



7. **Ultrasonic Sensor:**



This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. For our project we use the ultrasonic sensor to help in detecting objects and warn us beforehand.

Ultrasonic Sensor Pin Configuration

Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

8. **Colour Sensor:**

This is used to configure the LED strip so as to make it the same colour as its surroundings thereby inducing a camouflage effect. The color sensor detects the color of the surface, usually in the RGB scale. Color sensors have a variety of applications including detection of environment, choosing the right product and sorting.



9. **LED strip:**

An LED strip light (also known as an LED tape or ribbon light) is a flexible circuit board populated by surface mounted light-emitting diodes (SMD LEDs) and other components that usually comes with an adhesive backing. The LED strips glow in accordance of RGB values loaded into them which is provided by the color sensor.



10. **Pi-Cam:**

Using the pi-cam, we send back real time visual data from the bot to the system. It is a camera which is controlled using the Raspberry Pi. The Pi camera provides us with a live video footage which is shown on the webpage of the IP address it is connected to.



11. **Chassis:**

A chassis is the load-bearing framework of an artificial object, which structurally supports the object in its construction and function. All the above components are placed on the chassis. The wheels are screwed on and the system operates accordingly.



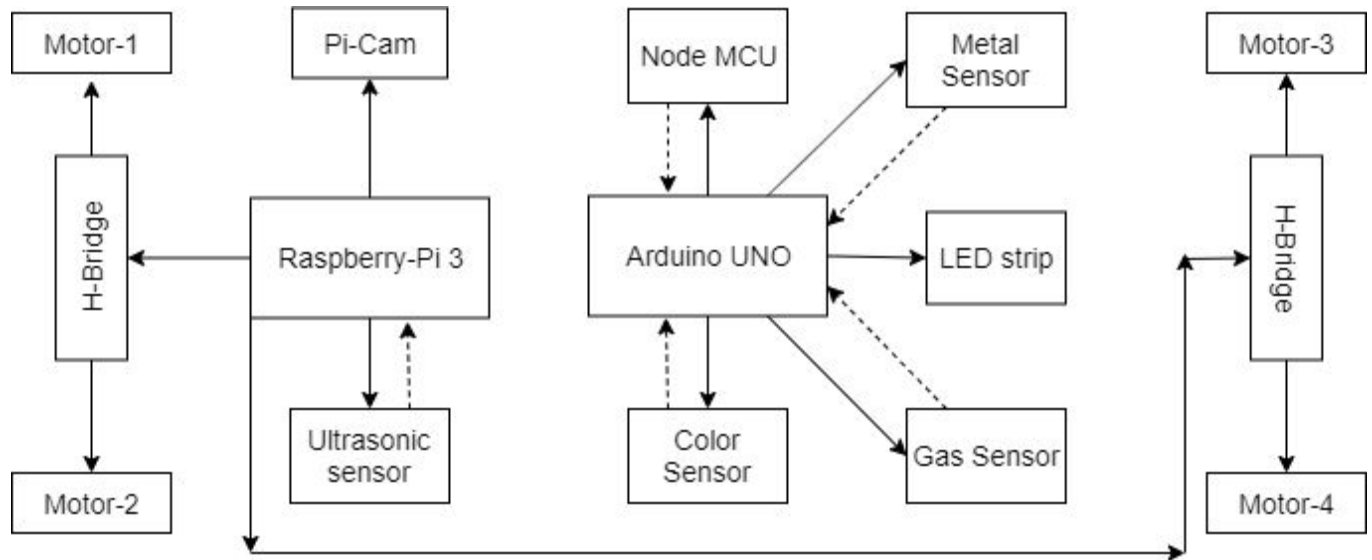
12. **Node MCU:**

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. It is used for wireless communication between the Arduino and the system. It is done using the Blynk App.



3.2 Block Diagram and Working

Flow of the working of the robot is shown by the block diagram below:-



The robot consists of two processors namely the Raspberry Pi and Arduino Uno, both of them have their own properties and have been used to perform various tasks to complete the project.

The flow of the project is explained in the points below:-

1. **Movement of the Robot** - Four DC motors have been used to help in movement of the robot. A DC motor requires a minimum of 12V supply and so to make sure of this condition a H-Bridge is used. One H-bridge is used for 2 motors. The H-Bridge is also used to control the motors depending on the code dumped in the Raspberry Pi. As explained previously in the report the H-Bridge consists of control pins which are connected to the Raspberry Pi. Two pins for each motor is assigned wherein one pin controls the clockwise motion of the motor and the other controls the anticlockwise

motion. A python code is written and dumped in the Raspberry Pi and the GPIO pins are connected to the respective control pins of the H-Bridge.

Using the Rootsaid WiFi commander, we can control the movement of the robot using a phone over a local hotspot(WiFi). The Rootsaid app on the device sends data to the Raspberry Pi when a button is pressed via WiFi. The Raspberry Pi checks the received data and performs the respective action.

2. **Surveillance Camera** - For live surveillance the robot uses a camera which provides live footage of the outside world. In this project a Pi-Camera is used which is connected to the Raspberry Pi. To achieve this task a code is written in Python and dumped on the Raspberry Pi. In the code we use HTML to create our own webpage where the footage will be shown. The webpage will have the same address as the IP address of the Raspberry Pi and for a system connected to the same IP address on browsing to the webpage will be able to view the live footage received from the camera.
3. **Gas Sensor** - A Gas Sensor is a sensor which is used to detect certain gases like LPG, methane etc. For our project we are using the MQ-2 Gas Sensor. The Gas Sensor is connected to the Arduino Uno wherein a code is written in Arduino IDE and then uploaded to the Arduino. Whenever the Gas Sensor detects a gas nearby, an LED on the sensor gets switched on and the sensor sends some data to the Arduino. In the Arduino IDE we can see the graph spiking up when gas is detected.
4. **Metal Sensor** - A metal sensor is a sensor which is used to detect metals in close vicinity. The metal sensor is connected to the Arduino UNO wherein a code is written and then uploaded to the Arduino. On executing the code the metal sensor starts to work and whenever it detects a metal object it sends data to the Arduino which upon receiving gives a message which states that a metal is detected.
5. **Ultrasonic Sensor** - A Ultrasonic Sensor is a sensor which measures the distance between itself and an object using ultrasonic waves. This property of the sensor can be used to detect objects or people over a long distance. The sensor is connected to the Raspberry Pi wherein a code is written and uploaded to it. On executing the code the sensor immediately starts calculating the distance and on reaching a certain distance a warning message is received from the Raspberry Pi.
6. **Color Sensor** - The Color Sensor is used to detect which color is present on the surface it is placed on. The sensor sends different RGB values depending on the color it detects.

The sensor is connected to the Arduino UNO wherein a code is written and is then uploaded to it. On executing the code the sensor starts to detect color and sends its respective RGB values to the Arduino.

7. **LED Strip** - An LED strip is a flexible circuit board consisting of LED lights. The lights glow in different colors depending on the RGB values present in it. For our project we use the LED strip to provide the camouflage part. The color sensor detects the color of the ground and sends corresponding RGB values which is loaded into the LED strip which then glows accordingly.
8. **Wifi Module(Node MCU)** - A WiFi module is used to receive data from the Arduino wirelessly when the robot is on the move. The Node MCU is connected to the arduino via the Blynk app in which data received from the sensor can be monitored.

All these steps are critical in the making of the robot and also it's working. The data received from the sensors and the live camera footage received from the respective sensors and camera we can truly perform surveillance of the terrain without physically being out there and LED strip provides the stealth element for the robot to blend it and make it hard to spot it by enemies.

Result

The robot works in accordance with the instructions given to it. On browsing to the webpage Live video footage from the Picamera can be seen and in accordance to that the robot can be moved in any direction using the smartphone connected to it. Data from the sensors is received in the device and the values can tell us about the surroundings. The color sensor is able to detect the color of the surface and accordingly the LED strip is glowing in order to stay hidden.

Conclusion

The army bot has proven to be working and ready to use. The project's aim was to reduce the workload of a soldier by acting as an alternative solution in gathering information from an enemy base camp without the soldier risking his/her life. The robot not only spies on an enemy base camp but due to the sensors present on it additional information about the layout is also provided which helps the army in planning strategies.

As discussed in the beginning of this paper that in this modern era robots are being used to perform dangerous activities, this army robot has now proven this fact by performing a dangerous activity such as Surveillance by actually not risking anybody's life and providing fruitful and additional information about the area which is being surveyed.

Future Scopes

The robot can be further improved by making the camera movement independent i.e. with the help of some motors the height and angle of the camera can be adjusted wirelessly using the smartphone hence providing a larger field of view.

This concept of a surveillance robot isn't restricted only for military purposes. Many risk prone areas such as Chemical factories, Nuclear Power Points can use this robot to help in surveillance. This robot is quite useful for covering a lot of ground in a small amount of time.

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