
DEFENCE UNMANNED VEHICLE(DUV)

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Abstract— *The goal of the Defence Unmanned Vehicle (DUV) project is to create a cutting-edge autonomous rover with military and surveillance uses. To improve its operating capabilities, the DUV incorporates a range of sensors and modules using Arduino Mega and Arduino Uno microcontrollers. The rover is equipped with modules for obstacle recognition, dynamic action facilitation, live video streaming, Bluetooth connectivity, and accurate movement control. The DUV is designed to seem like a tank-like rover that is outfitted with a laser activation mechanism, a siren, and a radar system that allows it to react to threats that are identified. Through the use of sensors, the DUV is able to identify possible dangers and impediments. The radar and laser system are then activated to neutralize the threat and sound the alarm. The real-time video feed provided by the live video streaming module enables operators to see the rover's.*

This research shows how combining several technologies may result in an efficient unmanned defence vehicle that can function on its own in dangerous situations. The DUV's usefulness in contemporary defensive scenarios is highlighted by its powerful control mechanisms, GPS tracking, obstacle recognition, and live video streaming capabilities.

Index Terms: *Arduino, Ultrasonic Radar, Remote Control, Live Streaming*

INTRODUCTION

The defence and surveillance industries are undergoing tremendous innovation in a time when technology is revolutionizing many other industries. One innovative approach to addressing the intricate problems encountered in contemporary defence operations is the Defence Unmanned Vehicle (DUV) project. By creating an autonomous rover that can carry out vital defence and surveillance duties with little assistance from humans, this project hopes to improve operational safety and efficiency. The DUV project is motivated by the need for durable, adaptable, and dependable unmanned systems that can function well in a variety of challenging and frequently hostile conditions. Conventional military operations frequently necessitate human presence in hazardous environments, which presents serious hazards to people. The DUV offers a remote-controlled, autonomous system that can maneuver, observe, and reduce these dangers.

Precision navigation over difficult terrain is made possible by the DUV's advanced motor driver system, which manages the movement of the rover using four separate motors. In order to ensure that the rover can reach and operate in locations that might not be accessible to other vehicles, its tank-like mobility is essential for operations in both urban and rural situations. An assortment of sensors that continuously scan the environment enable the DUV's essential function of obstacle detection. The integrated radar system, siren, and laser mechanism are activated by the rover's ability to detect possible threats and barriers through the use of these sensors. As a proactive defensive mechanism, this feature guarantees that the DUV can react quickly to any threat.

LITERATURE SURVEY

Vedant Chikhale [1] and others created a robotic vehicle algorithm that follows commands from an android device by integrating Arduino into the system. Any smart phone with an Android OS can serve as the controlling device. The sender utilizes a mandatory android app for sending the information. The commands are read by the receiver end and then translated into actions to control the robotic vehicle. The android device instructs the vehicle to move in four different directions: forward, backward, right, and left.

Brahmandaberi Saketh [2] and others suggested that the main idea behind robotic vehicles is to follow user voice commands to complete tasks without the need for human presence in the area, allowing users to control the robot through their voice. The robot can be controlled using user voice commands by utilizing an Android application to connect through the Bluetooth HC-05 module. Afterwards, the automated car can detect objects using the Ultrasonic sensor module. Customized Arduino will provide control over the motors used to drive the robotic vehicle in terms of hardware. Ultrasonic sensors connected to the Arduino assist in the automatic braking of a vehicle when a sudden obstacle is detected. The obstacle avoidance robots are being used in high-risk areas that are inaccessible to humans. Recognizing the voice is simple for it.

Nasik, Arudchelvam T, [3] stated that control of the robot could be done through voice commands as well as Android smartphones. Having Bluetooth capability in an Android smartphone is clearly necessary. By utilizing the android phone, specific keys could be utilized to control the robot's movements. Similarly, the robot's motion could also be managed through voice commands. It is important to mention that this robot has the ability to alter its route in case it encounters a barrier in its way. In order to steer clear of the obstruction, the robot could also be manipulated through voice commands or a smartphone. Hence, the unique characteristics of this robot include the ability to automatically navigate around obstacles, being operable through both voice commands and smartphones simultaneously, and being very affordable.

Yilmaz [4] and others who have researched the creation and operation of a robotic vehicle have discussed hardware, software, and communication setups, focusing on real-time obstacle detection and avoidance. The system was implemented using Arduino platform, an android application, and Bluetooth technology. This paper discusses the presentation of robotic car design and application through sensor programming on a platform. This robotic device was created in collaboration with an Android-based device. The robot's brain is Arduino Uno.

Sri Vaishna, [5] has developed a project involving a robot car as one of its outputs. The primary goal of this design is to enable the vehicle to move around in unfamiliar surroundings while preventing crashes and being controlled manually through a Bluetooth app on a mobile device. A robot is a device capable of carrying out tasks either autonomously or with assistance. The project suggests a smart robotic vehicle that is equipped with built-in intelligence to autonomously navigate obstacles in its path. Additionally, steering can be manually controlled using a mobile phone.

Anmol Raizad [6] and others have all collaborated on projects involving Arduino, motor driver, and Bluetooth module. Arduino is a prototyping platform that is open source and relies on user-friendly hardware and software. Arduino utilizes a microcontroller known as ATmega328. As robotics has increasingly integrated into our everyday lives and the field of engineering, it plays a crucial role in the advancement of new technology. This remote control car is a basic and user-friendly model, with Arduino replacing the typical micro-controller and a Bluetooth module replacing the IR sensors. The remote can be any cell phone, whether android or IOS. This project has the potential to be expanded on a larger scale to be used with real-time vehicles.

Shubh Srivastava [7] has focused on a project outlining a Voice Control Robot Car. The operation relies on an Arduino micro-controller, motor drivers, and a Bluetooth module. Arduino, a platform for creating digital devices, consists of open-source hardware such as single-board microcontrollers and kits. The plan involves creating the Robot Car's Hardware first and then programming its functioning based on our existing programming knowledge. Next, the code will be tested on software (IDE) before being connected to the hardware. The control unit is coordinated with the Bluetooth device by using a Bluetooth module to capture and interpret voice commands. The smart android device with Bluetooth Application is the remote that controls the system.

Saikat Patra [8] along with others detailed the setup of a voice-operated robotic vehicle utilizing Arduino. In this project, the robot receives specific voice commands from the user through an Android app on their smartphone. The Bluetooth transceiver module on the receiving end gets the commands and then sends them to the Arduino on the robotic vehicle.

Anjali Verma, Deepak Kumar, [9] and others developed a system to regulate vehicles using voice commands from humans through a Bluetooth module. Voice Control Robot is utilized to carry out particular instructions such as moving forward, moving backward, halting, turning left, turning right, and performing dance moves (or rotating) etc. It relies on Speech Recognition. The robot receives instructions through an Android app. The AMR - Voice Android app is linked to the HC-05 Bluetooth module, which is directly linked to the Arduino Uno R3. We instruct the robot and it carries out tasks based on our instructions. Voice Control Robot is highly beneficial in areas inaccessible to humans.

M Saravanan [10] and others collaborated to create a robot that can be controlled using voice commands. A mobile app with a microcontroller is utilized for necessary assignments. Bluetooth technology facilitates the link between the vehicle and the android app. The user can control the robot either by using buttons on the app or by giving spoken commands. The robot's motion is made easier by the four dc servo motors linked to a microcontroller on the receiving end.

Arthi, [11] et al. authored "Smart Spy Surveillance Robot System" for the International Journal Research & Technology (IJERT) with ISSN: 2278-0181 in the Special Issue of 2018. This article explains the design of a mobile surveillance device utilizing ESP32-CAM and a robot chassis.

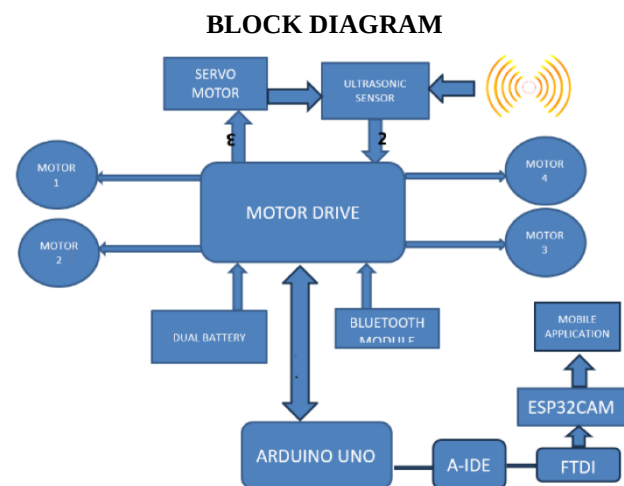


Figure: Block Diagram

The Arduino Software (IDE) includes a text editor, message area, text console, toolbar, and menus for coding. It links to the Arduino device for uploading programs and interacting with them.

METHODOLOGY

CIRCUIT DIAGRAM

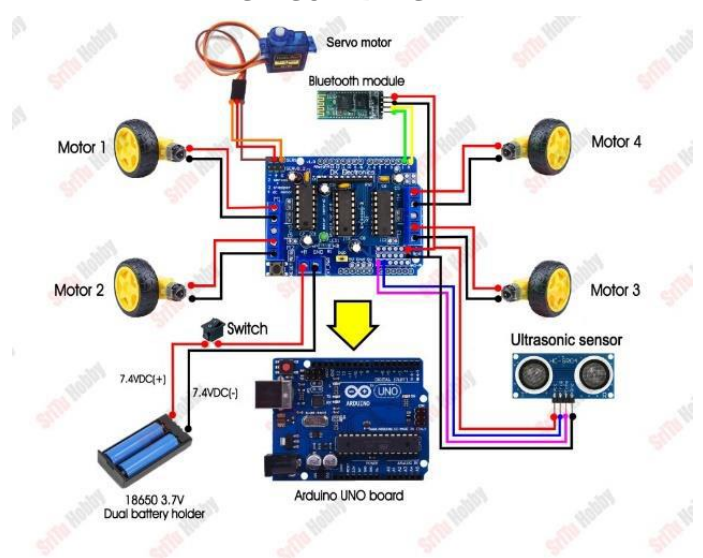


Figure: Circuit Diagram

STEPS TO BE IMPLEMENTED TO BUILD THE PROJECT

Step 1: Join the circuit as illustrated in the circuit diagram.

Step 2: Transfer the program to the Arduino board.
<https://drive.google.com/file/d/17ahxSLHEPD3sru3nF1v1UmitbDk3XQMk/view?usp=sharing>

Step 3: Link this robot car to the computer. Next, delete the two slashes before the "obstacle" function. Afterwards, disconnect the RX and TX jumper wires that are currently attached to the Bluetooth module. Next, transfer the code to the Arduino and then reconnect the RX and TX jumper cables.

Step 4: Link the robot car to the computer. Afterward, disconnect the Bluetooth module by removing the RX and TX jumper wires. Next, transfer the program to the Arduino and then reattach the RX and TX jumper wires.

Step 5: involves linking the ESP32 CAM to the FTDI programmer following the circuit diagram and uploading the code using the Arduino IDE.

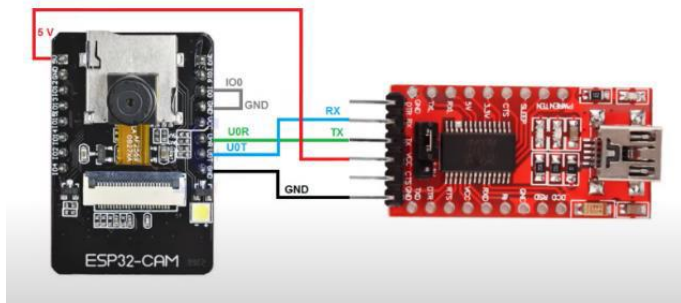


Figure: ESP32 CAM

ESP32-CAM	FTDI Programmer
GND	GND
5V	VCC(5V)
U0R	TX
U0T	RX
GPIO 0	GND

Table: Pin Connections

RESULT

The Defence Unmanned Vehicle (DUV) project has shown tremendous progress in developing an autonomous and functional rover that can carry out difficult military and surveillance missions. The four-motor driving system of the DUV allowed for smooth operation over a variety of terrains, and its mobility and navigational capabilities were strong. By integrating cutting-edge sensors, obstacles might be detected and avoided with greater efficiency, guaranteeing

uninterrupted motion free from collisions. When the rover sensed barriers or possible threats, its threat response mechanisms such as the radar, siren, and laser activation worked flawlessly, demonstrating the system's dependability in real-time situations. Furthermore, the DUV and the control program were able to establish a reliable connection thanks to the Bluetooth communication module, which improved operator safety and enabled remote operation. The DUV's location tracking and real-time monitoring were its main advantages. The module ESP32-CAM.



Figure: Original DUV

ADVANTAGE

- 1.DUV can be managed using different methods, offering flexibility and adjustability for various situations. Users have the option to select from obstacle avoidance or voice control.
- 2.This project utilizes Arduino, a popular open-source platform for electronics and robotics. It can function as a great educational resource for studying robotics, programming, and electronics.
- 3.It has the potential to be incorporated into other projects or systems. As an example, individuals involved in smart home automation or IoT projects have the option to integrate the robot as a mobile part with voice-controlled features.
- 4.The DUV is a budget-friendly option for creating a flexible robot, as it commonly utilizes inexpensive and readily available components found in Arduino-based projects.
- 5.Constructing and testing the DUV offers beneficial hands-on educational opportunities, pushing users to grasp the complexities of robotics, programming, and electronics
- 6.This bot is suitable for use in situations where human interaction is challenging and in various isolated regions.

DISADVANTAGE

1. Adding various functionalities, such as voice command, might lead to a rise in energy usage. This could result in a decreased battery life or the necessity of larger and pricier power sources, which could impede the practicality and usability of the robot car.
2. Accurate face recognition is essential for detection but it can be difficult to achieve, especially in noisy settings or with multiple users. Incorrect face recognition could result in unintentional behaviors or dissatisfied individuals.

3. Arduino boards possess restricted computational capabilities and storage capacity. Employing intricate obstacle avoidance algorithms in conjunction with voice recognition could overload the board, resulting in possible performance problems or slower response times.

4. As Esp32 cam relies on a robust WiFi connection, a strong internet connection is necessary for optimal performance, which can be challenging.

FUTURE SCOPE

1. Integration of Advanced AI and Machine Learning: By combining machine learning and advanced artificial intelligence (AI), the DUV's capacity for autonomous decision-making may be greatly improved. The rover may be able to anticipate possible hazards, learn from its surroundings, and improve its navigation and reaction plans thanks to these technologies, which are based on real-time analysis and previous data.

2. Enhanced Sensor Suite: With the addition of thermal imaging, infrared sensors, and sophisticated radar systems, the DUV's capacity to identify and detect a broader variety of threats—including ones that are invisible to conventional optical sensors—may be increased. The DUV would function better in a variety of conditions with this improvement, such as limited visibility and nighttime operations.

3. Better Communication networks: 5G and satellite communication would be added to the communication networks to enable quicker and more dependable data transfer, even in highly interfered urban or distant locations. This would improve the DUV's real-time control and monitoring capabilities, increasing its effectiveness and responsiveness in mission-critical scenarios.

4. The development of autonomous swarm capabilities among numerous DUVs has the potential to greatly improve operational efficacy. Complex operations involving several units collaborating to cover greater ground, carry out coordinated moves, and carry out more advanced surveillance and defense tactics would be made possible by swarm intelligence.

5. Integration of the DUV into IoT ecosystems allows it to be part of a broader interconnected network, engaging with other smart devices and systems for more intricate tasks. Integration of the DUV into IoT ecosystems allows it to be part of a broader interconnected network, engaging with other smart devices and systems for more intricate tasks.

CONCLUSION

The military Unmanned Vehicle (DUV) project effectively demonstrates the possibility of combining cutting-edge technology into a unified, functional system that can handle contemporary military and surveillance concerns. The project created a robust and adaptable autonomous rover with high-definition video streaming, precise GPS tracking, efficient

obstacle recognition, and threat response mechanisms by utilizing the capabilities of Arduino Mega and Uno microcontrollers. Operational safety and efficiency are greatly improved by the DUV's capacity to function in dangerous conditions without the need for direct human interaction. The system's dependability and efficacy in real-world situations are demonstrated by the successful integration of real-time monitoring, autonomous navigation, and exact position tracking. Moreover, the project's flexible and scalable architecture opens the door for future developments, enabling the DUV to fulfill changing military requirements and integrate extra feature.

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