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Military Aircraft and Landmine Detection Using Multifunctional Robot with Det-Yolo

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Abstract: This project presents a multifunctional robotic system designed to support defense and emergency missions by using Raspberry Pi, AI, and DET-YOLO algorithms. The robot integrates a surveillance camera, PIR sensor, metal detector, and voice module for effective detection and communication. It can identify and track aircraft or landmines, providing real time feedback for safer operations. The system uses DC motors for smooth mobility and can navigate rough terrains autonomously. By combining intelligent image detection and terrain sensing, the robot minimizes human risk in combat zones and hazardous areas. Its adaptable design also makes it suitable for civilian uses such as disaster management and search-and rescue operations. The goal of this work is to create a cost-effective, AI-enabled robot that enhances safety and efficiency in high-threat environments.

Keywords: Pir sensor, Laser gun, Camera, DC Motors, H-Bridge, Proximity Sensor, Color sensor, Zigbee, Dispenser kit, Raspberry pi, Ultrasonic sensor, Battery.

I. INTRODUCTION

Robotics has become one of the most significant areas of modern engineering, combining electronics, mechanical design, and computer intelligence. A robot is a machine capable of performing specific tasks automatically or semi-automatically based on instructions or programmed logic. In recent years, the use of robots has expanded from industries and healthcare to defense, where they help in completing missions that may be too dangerous for humans. The integration of robotics with artificial intelligence (AI) allows machines to think, adapt, and respond to their surroundings effectively. In military applications, robots can perform many vital tasks such as surveillance, detection, and rescue operations. Soldiers working in combat areas often face threats like hidden landmines, hostile attacks, and environmental hazards. Using robotic systems reduces human risk and enhances the accuracy and speed of mission execution. Robots can continuously monitor areas, detect threats, and transmit real-time information, which helps commanders make quick and informed decisions. The proposed project titled “Military Aircraft and Landmine Detection Using Multifunctional Robot with DET-YOLO” aims to develop an intelligent robotic system capable of identifying both aerial and ground-level threats.

II. METHODOLOGY

The multifunctional robot designed for military aircraft and landmine detection integrates several key components to perform real-time threat identification using advanced artificial intelligence. At the core of the system is a microcontroller or an embedded processor, such as a Raspberry Pi or Arduino, which coordinates all operations. The robot is equipped with a high-resolution camera module that continuously captures images of the surroundings. These images are processed by a deep learning model, DETYOLO (Detection with You Only Look Once), which is trained to detect and classify objects like aircraft in the sky or landmines on the ground. To enhance detection capabilities, the robot also incorporates a metal detector or ground sensor that scans the terrain for underground metallic objects, aiding in the identification of buried landmines. The robot moves autonomously or semi-autonomously using motor drivers connected to wheels or tracks, enabling it to navigate various terrains. A power supply unit ensures stable power distribution to all components, while a wireless communication module (such as Wi-Fi, Bluetooth, or GSM) enables real-time data transmission to a remote operator. Additionally, a GPS module can be integrated to log the precise locations of detected threats. Detection results are displayed or alerted to the user through visual or audio signals, such as an LCD display, LEDs, or buzzers. This approach not only enhances the reliability of the robot but also allows flexibility for future expansions such as machine-learning-based detection or advanced navigation algorithms.

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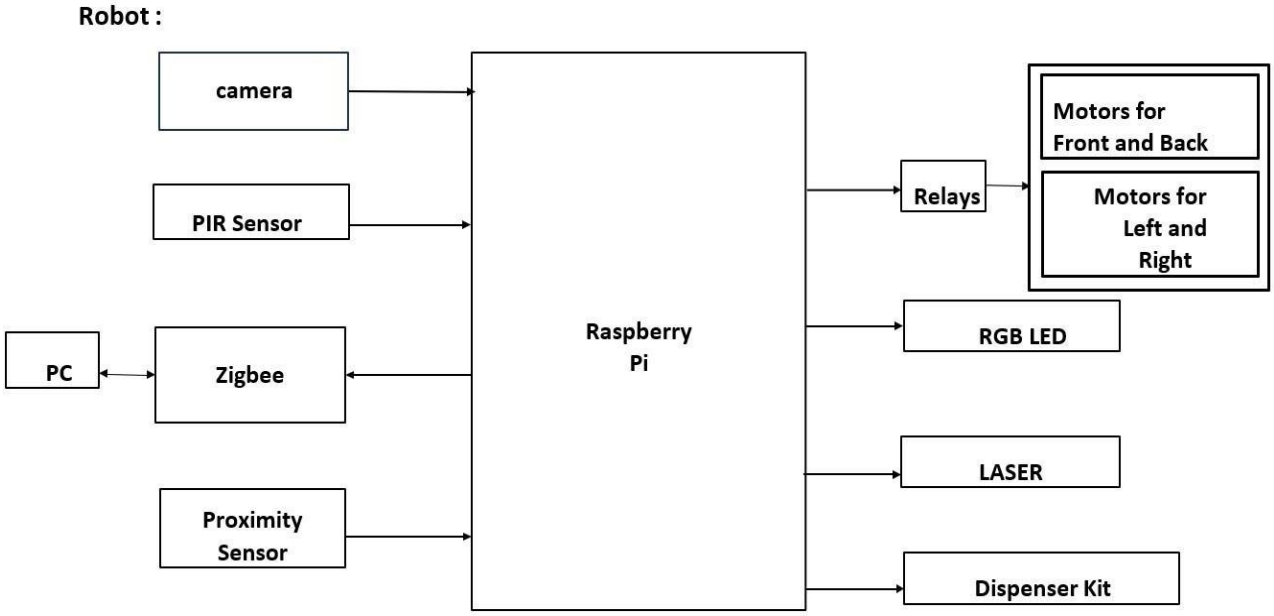

Fig 1: Block Diagram of Robot

III. RESULT

The implementation of the multifunctional robot demonstrated successful integration of the sensing, communication, and actuation modules controlled by the Raspberry Pi. The camera module provided clear real-time video input, allowing the system to process visual data effectively. The PIR sensor and proximity sensor responded accurately to motion and obstacle detection, maintaining consistent performance across multiple test scenarios.

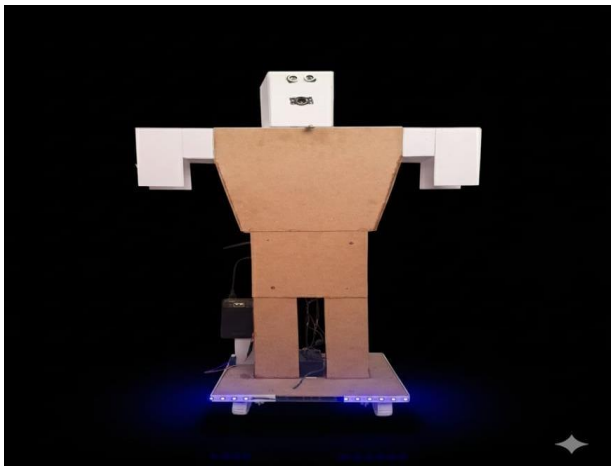

Fig 2: Working Model

The missile-detection system successfully identified the missile object within the test image and marked it with a clearly defined bounding box. Using the DET-YOLO model, the system classified the object as a missile and assigned a confidence score, indicating the model's certainty in its prediction. The detection was performed in real time, demonstrating proper functioning of the camera module, preprocessing pipeline, and inference model.

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Fig 3: Missile Detection

Health monitoring system using some sensors are used to detect vital signs like heart rate, blood pressure, temperature, humidity etc. A dispenser kit refers to a compact mechanical and electronic assembly designed to automatically release or dispense materials such as liquids, powders, grains, or small solid items in a controlled manner. In mini projects or DIY applications, dispenser kits are often used in automated sanitizers, food dispensers, medicine dispensers, or vending systems. The camera module converts light into electrical signals and sends image data to a processor or microcontroller for further processing

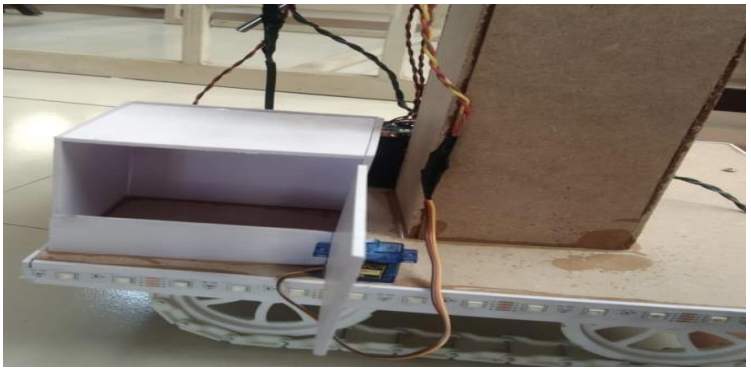

Fig 4: Health Monitoring Kit

The system accurately detected faces in the input frame and classified them as either “known” or “unknown” based on the trained dataset. Known faces were correctly matched with stored feature embeddings, confirming proper recognition functionality. Faces not present in the database were reliably labeled as “unknown,” demonstrating effective discrimination capability. Overall, the model performed stable real-time detection and recognition, validating the system’s accuracy and robustness.

Fig 5: Face Detection

Enable the robot to process data on-site and relay information about detected aircraft and landmines to central command units, improving decision-making speed and operational response. main motive behind Camouflage Robot is to reduce

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human losses in military operations or terrorist attacks. Enable the robot to process data on-site and relay information about detected aircraft and landmines to central command units, improving decision-making speed and operational response These visual inputs are fed into the DET-YOLO object detection model, which is pre-trained to recognize and classify military aircraft flying overhead and potential landmines on or near the ground surface.

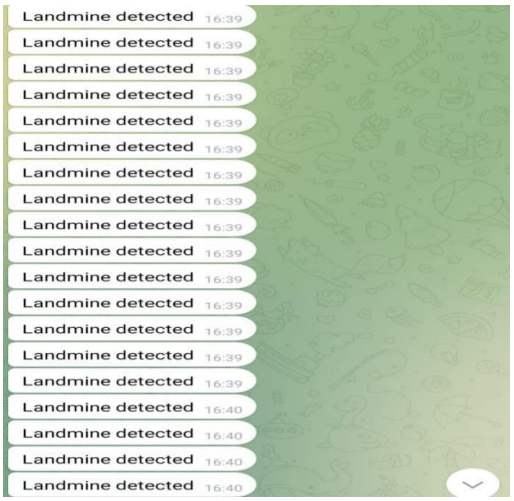

Fig 6: Landmine Detection

IV. CONCLUSION

The multifunctional robot designed for military aircraft and landmine detection integrates several key components to perform real-time threat identification using advanced artificial intelligence. These robots act as the assistant of a soldier. Today, many military organizations take the help of military robots to perform risky jobs due to their accuracy of performing the jobs. These robots used in military are usually employed with the integrated system, including video screens, sensors, gripper and cameras. The main motive behind Camouflage Robot is to reduce human losses in military operations or terrorist attacks. Enable the robot to process data on-site and relay information about detected aircraft and landmines to central command units, improving decision-making speed and operational response.

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