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DESIGN AND IMPLEMENTATION OF WAR FIELD SPY ROBOT USING ANDROID APPLICATION

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ABSTRACT- This paper main objective is to create a wireless surveillance robot that can keep an eye on people's actions in border and war zones. By offering real-time monitoring and intelligent detection characteristics, the system seeks to lower threats to human life and stop hostile incursions. The robot can continuously monitor even in dimly lit or dark situations thanks to its wireless camera that is combined with night vision technology. This makes it possible for military personnel to securely view far-off places without going into hazardous situations. Users may wirelessly monitor and control the robot's movement by utilizing a Bluetooth-based mobile application. The robot's camera improves visual acuity and provides the operator with real-time video footage. Surveillance area, guaranteeing that intruders are discovered early. Furthermore, a smoke sensor keeps an eye on air conditions and warns users of potential risk in the event of fire threats or unusual smoke levels. Since most explosive devices have metallic components, a metal detector sensor is added to further increase security by identifying metallic things that could signal the presence of explosives. The Bluetooth program receives all sensor data in real time, including motion detection, smoke levels, and metal detection. This intelligent surveillance robot enhances situational awareness, reduces human involvement in risky areas, and improves operational safety for defense forces. The system provides a cost-effective, efficient, and reliable solution for modern defense surveillance applications.

Keywords: Wireless Surveillance Robot, Border Security, Bluetooth Control, Night Vision Camera, Ultrasonic Sensor, Smoke Sensor, Metal Detector, Defense Surveillance, Real-Time Monitoring, Intruder Detection

I. INTRODUCTION

The Spy Robot is a cutting-edge surveillance technology made to monitor sensitive regions and battlegrounds in a safe and effective manner. This robot's primary goal is to decrease human casualties

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by collecting data in real time and sending live video footage via a wireless network. This enables military personnel to see and assess hazardous conditions without having to go inside. The HC-05 Bluetooth module allows wireless connection at a range of around 10 meters. The robot is controlled by an Android application with Bluetooth technology. The robot has a wireless camera that records images in real time, enabling it to enter hostile areas covertly and keep an eye on things all the while. Unusual heat levels are detected by a temperature sensor, whereas a metal detector identifies buried explosives by detecting metallic objects. An LED indicator alerts operators when metal is detected, which can be viewed through the camera. Additionally, the robot includes a gripper mechanism to safely handle suspicious objects and a shooting mechanism for combat situations.

This Bluetooth-controlled, self-powered robot can be used in defense operations, shopping malls, hotels, and other high-security areas. By minimizing human involvement in dangerous situations, the spy robot enhances security, prevents terrorist attacks, and ensures safety using modern robotic and wireless communication technologies.

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II. OBJECTIVES

The main objective of the project "Design and Implementation of War Field Spy Robot using Android Application" is to develop a mobile robotic vehicle that can be remotely operated using an Android smartphone for surveillance and environmental monitoring in hazardous or war field areas.

- To create an Android application for a Bluetooth-based robot movement control system.
- To include a 360° Wi-Fi camera for on-the-spot video surveillance.
- To integrate several sensors (temperature, metal, smoke, and ultrasonic) to identify impediments and environmental risks.
- To transmit warnings to the Android app and show sensor values on an LCD.
- To use an L293D motor driver to operate the robot's DC motors for left, right, forward, and backward motion.

To guarantee dependability and safety in combat situations by offering wireless communication, buzzer-based remote surveillance, and prompt alarms.

III. SYSTEM OVERVIEW

The purpose of the War Field Spy Robot Design and Implementation Android Application is to enable remote monitoring and surveillance in critical regions and combat zones. The block diagram illustrates how the system functions as a whole, with the microcontroller serving as the central control unit that synchronizes all sensors, communication modules, and output devices. A battery supply powers the system and gives all of the robot's parts the necessary voltage. The robot and the Android application may communicate wirelessly thanks to the Bluetooth module (HC-05) that is attached to

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the microcontroller. The Android app allows the user to remotely control the robot's movement by sending orders like forward, backward, left, and right.

The microcontroller processes the signals and transmits control instructions to the motor driver, which operates the motors and moves the robot in accordance with the directions received from the Android application. The robot is equipped with a wireless camera to record live footage of the battlefield. Defense personnel may securely watch the surroundings thanks to the transmission of the recorded video to the remote monitoring system. By detecting obstructions or intruders in front of the robot, the ultrasonic sensor helps prevent collisions and improves surveillance capabilities.

Fig.1- Proposed System

HARDWARE COMPONENTS

- **Arduino Uno**

PIC18F4520 Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Arduino Uno is a popular, open-source microcontroller board based on the ATmega328P. It's designed for ease of use and versatility in electronic projects, offering a combination of digital and analog input/output pins, a USB interface for programming, and a power jack for external power. The Uno is a favorite among hobbyists, educators, and professionals for prototyping and developing embedded systems, interactive devices, and more.

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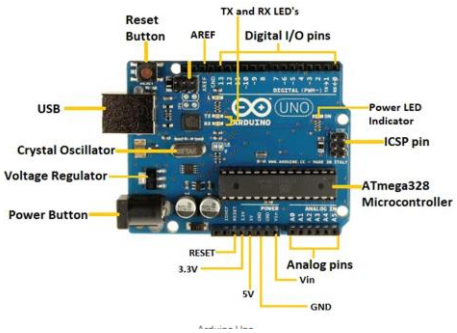

Fig.2- Arduino Uno(Microcontroller)

- **L293D Motor Driver**

The L293D motor driver plays an important role in the Design and Implementation of War Field Spy Robot using Android Application by controlling the movement of DC motors. Since the microcontroller cannot supply sufficient current to drive motors directly, the L293D motor driver acts as an interface between the microcontroller and motors. It receives low-power control signals from the microcontroller and converts them into high-current signals required for motor operation. The L293D is a dual H-bridge motor driver that allows control of two DC motors simultaneously. Based on commands received from the Android application through the Bluetooth module, the microcontroller sends signals to the L293D driver. The driver then controls motor direction such as forward, backward, left, and right by switching the polarity of the motors.

This enables smooth movement and precise control of the spy robot in war field environments. Additionally, the L293D provides protection against back EMF, ensuring safe and reliable motor operation.

Fig.3- L293D Motor Driver

- **Piezoelectric Buzzer**

The Piezoelectric Buzzer is used in the Design and Implementation of War Field Spy Robot using Android Application as an alert and warning device. It produces sound signals whenever the robot detects unusual or dangerous conditions in the surveillance area. The buzzer is connected to the microcontroller, which controls its operation based on input received from various sensors such as the metal detector, smoke sensor, ultrasonic sensor, and temperature sensor. When any sensor detects an

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abnormal condition, such as the presence of an obstacle, smoke, high temperature, or metallic object indicating a possible explosive, the microcontroller activates the piezoelectric buzzer. The buzzer then generates an audible alert to notify the operator or nearby personnel about the potential threat. This feature enhances the safety and reliability of the spy robot by providing immediate warning signals. The piezoelectric buzzer consumes low power, operates efficiently, and is suitable for compact robotic systems used in defense applications.

Fig.4- Piezoelectric Buzzer

- **Metal Sensor**

The Metal Sensor plays a crucial role in the Design and Implementation of War Field Spy Robot using Android Application by detecting metallic objects that may indicate the presence of explosives, weapons, or hidden devices. The metal sensor is mounted at the front of the robot and connected to the microcontroller. It works based on electromagnetic field detection. When the sensor comes near a metallic object, the electromagnetic field changes, and the sensor generates a signal.This signal is sent to the microcontroller, which processes the information and activates alert mechanisms such as a buzzer or LED indicator. The alert is also transmitted to the Android application through the Bluetooth module, informing the operator about the detected metal.This feature helps defense personnel identify potential threats from a safe distance. The metal sensor improves security, enhances surveillance capability, and reduces the risk to human life in war field and hazardous environments.

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Fig 5- .Metal Sensor

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- **Ultrasonic Sensor**

The ultrasonic sensor uses ultrasonic wave technology to measure distance accurately and efficiently. It operates within a voltage range of 3.3V to 5.5V, making it compatible with most common microcontrollers used in embedded systems and robotics projects. The sensor features a simple 4-pin interface consisting of VCC, GND, TRIG, and ECHO pins, which allows easy connectivity and integration into various applications. It offers high accuracy with precise distance measurement capability, often providing millimeter-level resolution. The ultrasonic sensor is compact in size and durable in construction, making it suitable for use in different environments and applications. It is highly versatile and can be used for obstacle detection, object tracking, distance measurement, and liquid level monitoring. Additionally, it is easy to integrate with microcontroller platforms such as Arduino, as libraries and sample codes are widely available. The ultrasonic sensor is also affordable, making it a cost-effective solution for adding distance sensing capabilities in robotics, automation, and smart monitoring systems.

Fig.6- Ultrasonic Sensor

- **DHT11 Humidity Sensor**

The **DHT11 Humidity Sensor** is used in the **Design and Implementation of War Field Spy Robot using Android Application** to monitor environmental humidity and temperature conditions in the surveillance area. The sensor is connected to the microcontroller, which continuously reads humidity and temperature data from the surroundings. The DHT11 sensor detects moisture levels in the air using a capacitive humidity sensing element and a thermistor for temperature measurement. When the robot moves through different environments, the DHT11 sensor collects real-time environmental data and sends it to the microcontroller. The microcontroller processes this information and transmits it to the Android application via the Bluetooth module. This allows the operator to monitor environmental conditions remotely. This feature is useful in war field conditions where sudden changes in humidity and temperature may indicate environmental hazards, fire risk, or abnormal atmospheric conditions, improving safety, surveillance capability, and operational decision-making.

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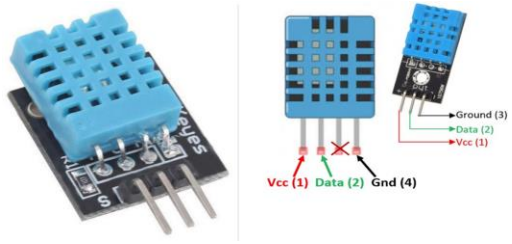

Fig.7- Humidity Sensor

- **360 Degree Wifi Camera**

360° pan & 71° tilt with 3mp full hd clarity – this cp plus smart wi-fi cctv camera offers wide-angle indoor coverage with smooth 360° horizontal and 71° vertical rotation. motion tracking, human detection & sound alerts – this indoor security camera tracks human movement, filters out non-human motion, and detects unusual sounds providing smarter and more accurate alerts than a regular camera cctv for home setup. ctc cyber secure tech for privacy enhanced with cp plus trusted core technology, this indoor wi-fi camera keeps your data and video streams safe from cyber threats. CLOUD & SD card storage for wi-fi cctv camera this cp plus 3mp smart wi-fi camera offers dual storage support with encrypted cloud recording and local backup via microsd card up to 256gb (card not included), giving you flexible and secure cctv footage storage options for your smart home or office.

IR night vision up to 15m – infrared leds capture clear black-and-white video even in complete darkness, ensuring your wi-fi camera for home is effective 24x7. Private mode for peace of mind – instantly disable live view and recording through the app. an essential wi-fi cctv camera feature for privacy in sensitive areas. dual connectivity with LAN & wi-fi – supports both wi-fi and Ethernet lan cable connection for stable and uninterrupted cctv camera for home performance.

Fig.8- 360 Degree Wifi Camera

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IV. WORKING PRINCIPLE

Circuit Diagram:-

The Arduino Uno, which serves as the system's primary controller, is coupled to a number of components in the circuit diagram for the Design and Implementation of War Field Spy Robot utilizing Android Application. A 12V battery, a 7805 voltage regulator, capacitors, a diode, and an LED indication are all part of the power supply unit. The circuit receives input power from a 12V battery, which is transformed into the regulated 5V needed for the Arduino and sensors by the 7805 voltage regulator. The LED shows the availability of power, the diode guards against reverse polarity, and capacitors are employed to filter noise. As the central control unit, the Arduino Uno receives input information from many sensors, including the DHT11 temperature and humidity sensor, metal sensor, smoke sensor, and ultrasonic sensor.

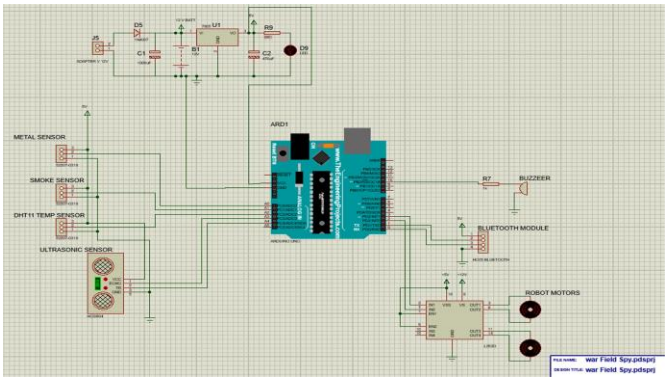

Fig.9- Circuit Diagram of the System

The Bluetooth module HC-05 is connected to the Arduino's RX and TX pins, enabling wireless communication between the robot and Android application. Through the mobile app, the user can control robot movement such as forward, backward, left, and right.The L293D motor driver is used to control the DC motors, as Arduino cannot supply sufficient current directly. The motor driver amplifies control signals and drives two DC motors, allowing directional movement of the robot. The ultrasonic sensor detects obstacles by measuring distance using ultrasonic waves. The metal sensor detects metallic objects, while the smoke sensor identifies smoke or gas in the environment. The DHT11 sensor monitors temperature and humidity levels. The buzzer provides audible alerts during abnormal conditions. Overall, the system enables safe remote surveillance in war field environments.

V. RESULT

The Android application used in the design and implementation of the War Field Spy Robot was successfully built and tested to carry out monitoring and surveillance tasks in sensitive areas and on the battlefield. Through Bluetooth connectivity, the Android application's orders allowed the robot to move in a variety of directions, including forward, backward, left, and right. Effective remote control

of the robot was made possible by the HC-05 Bluetooth module, which offered reliable wireless connection within the designated range.

The robot was able to avoid collisions during mobility thanks to the ultrasonic sensor's successful detection of obstructions in front of it. The metal sensor correctly identified metallic items, suggesting potential explosives or concealed weaponry. While the DHT11 sensor tracked temperature and humidity levels in real time, the smoke sensor successfully detected the presence of smoke and gas. The buzzer alerted the operator whenever it detected abnormal circumstances.

The DC motors were smoothly controlled by the L293D motor driver, guaranteeing the robot's dependable mobility. The Arduino Uno analyzed all of the sensor data before sending it to the Android app for monitoring. The technology worked effectively, enhancing safety, lowering human risk in hazardous situations, and offering real-time observation. The created spy robot turned out to be dependable, affordable, and appropriate for security and defense uses.

VI. CONCLUSION

In this study, a wireless camera operated by an Android application is used to make a robot model. Additionally, the initiative intends to educate people how to create Android apps and control the robot wirelessly using the HC 05 Bluetooth and Android app platforms. For enhanced usefulness, the robot also has smoke and metal detectors. Human labor may be greatly decreased by using this robot. The robot's movement segment was developed with extreme precision, and the project's goals were all met with remarkable accuracy. Although there is always space for improvement in any work, the camera's performance has been judged adequate. Using an Android device, the system permits remote monitoring and control. The robot successfully aids in danger detection, obstacle identification, and real-time data transmission to the control unit thanks to its integrated sensors, wireless control, and live video streaming. This lowers the danger to soldiers and increases military operations' effectiveness. All things considered, the project shows itself to be an affordable, transportable, and dependable method of monitoring and reconnaissance in conflict zones, disaster areas, and other hazardous locations. Future applications might make the system even more sophisticated and self-sufficient with further improvements like GPS tracking, night vision, and AI-based object identification.

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