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DESIGN OF LOC AREA PROTECTED ROBOT

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Abstract: This paper presents the design and implementation of a robot specifically engineered to operate within a Line of Control (LOC) area, enhancing security and operational efficiency in high-risk zones. The robot is equipped with advanced sensory systems, autonomous navigation capabilities, and robust protective features to withstand harsh environmental conditions and potential threats. Key design considerations include real- time obstacle detection and avoidance, secure communication protocols for remote control and data transmission, and an adaptive system. The integration of cutting- edge technologies such as machine learning, computer vision, and resilient materials ensures the robot's reliability and effectiveness in maintaining security and performing surveillance tasks along the LOC. The research addresses the challenges of mobility in rugged terrains, the necessity of sustained operational autonomy, and the importance of safeguarding sensitive data against cyber threats. Through rigorous testing and simulations, the proposed design demonstrates significant potential in augmenting traditional security measures, providing a robust solution for military and border control applications.

Keywords: EmbeddedC,ESP32 Compiler, IFTTT, Blynk.

I. INTRODUCTION

The Kargil War also known as the Kargil conflict, was an armed conflict between India and Pakistan that took place between May and July 1999 in the Kargil district of Kashmir and elsewhere along the Line of Control (LOC). The conflict is also referred to as Operation Vijay (Victory in Hindi) which was the name of the Indian operation to clear the Kargil sector. The cause of the war was the infiltration of Pakistani soldiers and Kashmiri militants into positions on the Indian side of the LOC, which serves as the de facto border between the two states. During the initial stages of the war, Pakistan blamed the fighting entirely on independent Kashmiri insurgents, but documents left behind by casualties and later statements by Pakistan's Prime Minister and Chief of Army Staff showed involvement of Pakistani paramilitary forces, led by General Ashraf Rashid. The Indian Army, later on supported by the Indian Air Force, recaptured a majority of the positions on the Indian side of the LOC infiltrated by the Pakistani troops and militants. With international diplomatic opposition, the Pakistani forces withdrew from the remaining Indian positions along the LOC.The war is one of the most recent examples of high-altitude warfare in mountainous terrain, which posed significant logistical problems for the combating sides. INDIAN government had to face huge loss because of this war. Human loss, machine loss, aircrafts, tankers. Indian economy decreased by 38%, cost of all commodities increased, taxes increased altogether we had to face tremendous loss.

II. LITERATURE SURVEY

1 A Multipurpose Intelligent Robotic solution for Maximizing Crop Yields in Large Agricultural Projects- International Conference on Sustainable Engineering Development Md. Robiul Islam, Sohel Rana, Mohammod Abul Kashem, Maisha Islam, MS. Atia Tamanna, Md Oli Ulla (2023).

In this research, an efficient multifunctional intelligent agricultural robot is proposed to ease the operations of sowing, pesticide spraying, and weather-based watering in to optimize crop production The proposed approach is considered to be especially beneficial to farmers and rural workers who engage in hot weather, rough terrain, and high humidity levels. Our testing shows that the proposed robotic solution is capable of performing these tasks and has the potential to revolutionize modern agriculture. These robots are intended to do a wide range of tasks, including planting, weeding, harvesting, and spraying crops, all while lowering labour costs and increasing efficiency. The primary goal of this research was to develop a low-cost agricultural robot capable of performing basic functions in agricultural fields. More robots are needed in developing countries to meet the ever- increasing demand for food. The agribot prototype created for this research will respond to the commands of an operator.

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2 IOT BASED SMART NIGHT PATROLLING ROBOT-P. ANBUMANI, K. FELOOMI - V.S.B ENGINEERING COLLEGE, KARUR, TAMILNADU, INDIA (2023).

The implementation of an IoT-based smart night patrolling robot is presented in this paper, utilizing an Arduino Uno, camera module, sound sensor, ultrasonic sensor, motor driver, motors, Node mcu, and buzzer. The proposed robot is designed to autonomously patrol a designated area and capture images and videos of the area using the camera module. The proposed system is controlled using a web-based interface, allowing users to monitor and control the system from anywhere. the IoT-based smart night patrolling robot is a significant advancement in the field of surveillance and security. The system has the potential to reduce the reliance on manual labour in night patrolling operations, reducing the risk of human error and improving the efficiency and effectiveness of the process.

Advances and perspectives in collaborative robotics: a review of key technologies and emerging trends-Swapnil Patil, V. Vasu-(2023). This review paper provides a literature survey of collaborative robots, or cobots, and their use in various industries. Cobots have gained popularity due to their ability to work with humans in a safe manner. The paper covers different aspects of cobots, including their design, control strategies, safety features, and human–robot interaction.

The paper starts with a brief history and evolution of cobots, followed by a review of different control strategies and Safety features such as collision detection and avoidance, and safety-rated sensors are also examined. Collaborative robots, commonly known as cobots, are transforming the way humans and robots collaborate in shared workspaces. The need for enhanced productivity and efficiency in industries, including manufacturing, logistics, and healthcare, has fuelled the development of cobots. This study did a thorough analysis of the literature and developed a tentative classification system, classifying and sub classifying significant works and new research in this field. This study's main goal was to identify and evaluate the burgeoning topics and research problems in safety and ergonomics in industrial collaborative robotics.

3 SMART SURVEILLANCE ROBOT FOR MILITARY APPLICATIONS USING IoT
Dr. B. Swapna Rani-International Journal of Creative Research Thoughts-(2023).
Surveillance plays a major role in National security. This paper presents a new approach for surveillance at remote and border areas, using multifunctional robot based on IoT used in defence and military applications. This Smart surveillance robotic machine has the ability to substitute the soldier at border areas to provide surveillance in critical situations.

In this project design and development of the robot is done which will move from one place to another, it has capability of capturing real-time images and videos required for the surveillance. The main constraint in surveillance is the mobility of the robot. The proposed system shows the date and time on the screen and is interactive. According to the requirements, the display can be modified. Military uses were taken into consideration when creating this robot. So, it comes with basic video surveillance and human detection so that it can detect underground persons etc.

Further extensions can be made to the same models such as home automation, telemedicine system. The robot can be equipped with interactive voice feedback. The system can be further developed by including Receptor-free nano sensors that are based on detecting physical properties of explosives. These sensors may provide extra information and help face recognition systems to identify face images in both static images and video sequences.

Embedded System Hardware
As with any electronic system, an embedded system requires a hardware platform on which it performs the operation. Embedded system hardware is built with a microprocessor or microcontroller. The embedded system hardware has elements like input output (I/O) interfaces, user interface, memory and the display. Usually, an embedded system consists of:

- Power Supply
- Processor
- Memory
- Timers
- Serial communication ports
- Output/Output circuits
- System application specific circuits

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Embedded System Software

The embedded system software is written to perform a specific function. It is typically written in a high- level format and then compiled down to provide code that can be lodged within a non- volatile memory within the hardware. An embedded system software is designed to keep in view of the three limits:

- Availability of system memory
- Availability of processor's speed
- When the system runs continuously, there is a need to limit power dissipation for events like stop, run and wake up.

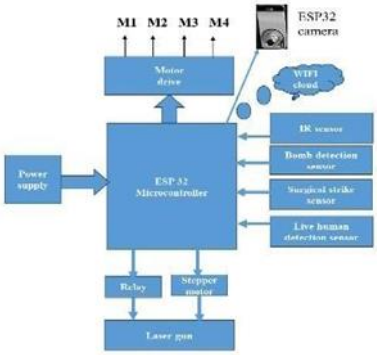
III. EXISTING SYSTEM

- VERY HUGE POPULATION TO SECURE APPROX 140 CRORES
- VERY LARGE AREA TO GIVE SECURITY APPROX 10,000 KM
- HORRIBLE CLIMATIC CONDITION ALONG THE BORDER i.e., EXTREME HOT, EXTREME COLD, ALWAYS RAINING, FOGGY CLIMATE MAKES VERY DIFFICULT TO GIVE SECURITY
- LOSS OF HUMAN LIVES
- HUGE HUMAR RESOURCE IS REQUIRED APPROX 20K CRORE PER MONTH
- NO PROTECTION FROM SURGICAL STIKE
- NO 360 DEGREE, 24/7 SURVELLIANCE SYSTEM
- NO MERCILESS SHOOTING FACILITY
- NO PROTECTION FROM MINES & BOMBS
- NO LIVE HUMAN DETECTION
- NO ARTIFICAL INTILLEGIENCE PHOTO GRAPHY SYSTEM
- NO IOT BASED NOTIFICATION SYSTEM
- NO SOLUTION FOR DRUGS (COCAINE, OPIUM ETC) PENETRATION INTO THE COUNTRY
- NO SOLUTION FOR SOLDIERS WITHOUT LIMBS

IV. PROPOSED SYSTEM

To design & implement a cost-effective PAC BOT which is based on the 360-degree surveillance and shooting techniques and to resolve all the mentioned problems in the existing system. The aim of the project is to design, manufacture and operate via a Smart phone, used as remote-control device can SHOOT INTRUDERS accordingly with the ground surface where INTRUDER IS moving, coupled to sensors that can precisely identify ground movements. 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 drive the robot in any required direction. Furthermore.

1 Camera is attached to show the real time data wireless through RF,
2 Gas sensor to detect toxic gas,
3 Metal sensor to detect metal arm and weapons if any,
4 PIR sensor to detect human intruders or soldiers beneath the earth.
5 IR sensor is used for the obstacle detection and also
6 GAS sensor is used to detect the gas particular gases with the air all these values or updated in the website for every predefined time.



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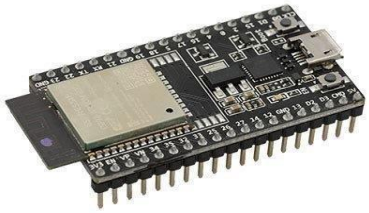
DESCRIPTION OF THE COMPONENTS

ESP32 MICROCONTROLLER



The ESP32 microcontroller is a versatile and powerful component used in various electronic devices. It's compact in size, making it suitable for applications where space is limited. Despite its small form factor, the ESP32 packs a punch with its dual- core processor, Wi-Fi and Bluetooth connectivity, ample GPIO pins for interfacing with sensors and actuators, and support for various communication protocols like SPI, I2C, and UART. Additionally, its low power consumption makes it ideal for battery- powered devices. With its capabilities and compact size, the ESP32 is a popular choice for IoT projects, wearable gadgets, and other embedded systems where both performance and size matter.

EEPROM

EEPROM MEMORY EEPROM, or Electrically Erasable Programmable Read Only Memory, is a non-volatile memory type commonly used in microcontrollers and other electronic devices. Unlike traditional ROM, EEPROM can be reprogrammed multiple times electrically, without requiring removal from the circuit. This makes it ideal for storing small amounts of data that need to be retained even when the power is turned off, such as device settings, calibration data, or user preferences. EEPROM is slower than RAM and has a limited number of write cycles, typically around 100,000 to 1 million cycles, depending on the specific EEPROM type. Despite its limitations, EEPROM provides a convenient and reliable solution for storing critical data in embedded systems.

L298 H BRIDGE DRIVER

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The L298 is a popular H-bridge motor driver integrated circuit (IC) commonly used in robotics and other projects involving motor control. It's designed to drive inductive loads like DC motors and stepper motors bidirectionally, meaning it can control their speed and direction of rotation. The L298 typically consists of two Hbridge circuits, each capable of driving one motor. It can handle a wide range of voltages and currents, making it suitable for various motor applications. The IC requires external diodes to protect against back EMF generated by the motors. With its straightforward interface and robust design, the L298 H-bridge driver is a go-to choice for hobbyists and professionals alike in motor control projects.

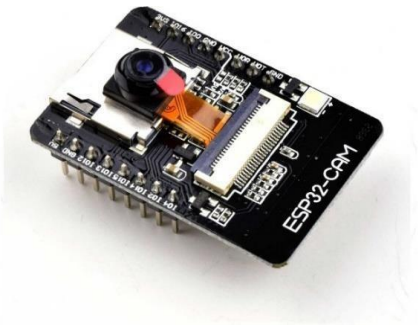
REAL TIME CLOCK DS1307

The DS1307 is a widely-used real-time clock (RTC) module that provides accurate timekeeping in electronic projects. It includes a built-in crystal oscillator, battery backup, and I2C interface for communication with microcontrollers. The DS1307 can keep track of seconds, minutes, hours, day, date, month, and year, and it compensates for leap years. With its low power consumption and battery backup, it maintains time even when the main power source is off. The module is easy to use and integrates seamlessly into various applications requiring precise timekeeping, such as data logging, alarm systems, and IoT devices.

ULNDRIVER

The ULN2003 or similar ULNxxxx series are high- voltage, high-current Darlington transistor arrays. These ICs are commonly used to drive inductive loads such as relays, stepper motors, and solenoids from low-power microcontroller outputs. The ULN series simplifies interfacing between low-level logic circuitry (such as microcontrollers) and higher-power loads by providing multiple Darlington pairs within a single package. Each pair can handle significant current loads and has built-in flyback diodes to protect against voltage spikes generated by inductive loads.
This makes the ULN series ideal for applications where driving high- power loads is required without risking damage to the controlling circuitry.

ESP32 CAMERA



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The ESP32-CAM is a variant of the ESP32 microcontroller with an integrated camera module. It combines the power of the ESP32 with a small camera sensor, allowing for IoT projects that require image capture and processing capabilities. With built-in WIFI and Bluetooth connectivity, the ESP32-CAM can transmit images wirelessly, making it suitable for applications such as surveillance cameras, video streaming, and facial recognition systems. Its compact size and ease of use make it popular for DIY projects and prototyping in the field of computer vision and IoT design, to "plug and play.

SOFTWARE REQUIREMENTS

EMBEDED C

Embedded C is a specialized programming language used for developing software for embedded systems, which are small computers typically designed to perform specific tasks. Unlike regular C programming, Embedded C is optimized for resource-constrained environments, such as microcontrollers, where memory and processing power are limited. It focuses on efficient use of hardware resources and direct interaction with peripherals like sensors, actuators, and memory- mapped registers. Embedded C programs are typically written to control devices and perform specific functions, such as controlling motors, reading sensor data, or implementing communication protocols. Overall, Embedded C is essential for programming embedded systems, enabling developers to create efficient and reliable software for a wide range of applications, from consumer electronics to industrial automation.

ESP32-COMPILER

The ESP32-COMPILER is a crucial tool for developing software for ESP32 microcontrollers. It's essentially a software program that translates human-readable code written in programming languages like C or C++ into machine code that the ESP32 microcontroller can understand and execute. This process is called compilation. The ESP32- COMPILER ensures that the code is optimized for the ESP32 architecture, taking into account its specific features and capabilities. Additionally, it checks for errors and helps developers debug their code, ensuring that it runs smoothly on the ESP32 platform. Overall, the ESP32-COMPILER is a fundamental component of the software development process for ESP32-based projects enabling developers to create efficient and reliable firmware for a wide range of application.

IFTTT

IFTTT is a user-friendly software platform that automates tasks and connects various online services and devices together. Its name reflects its core functionality: users can create simple conditional statements called applets, where one action triggers another action. For instance, "If it rains (this), then send me a notification (that)." IFTTT supports a wide range of services,

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BLYNK

Blynk is a user-friendly software platform tailored for IoT (Internet of Things) projects, offering a streamlined approach to creating mobile apps to control and monitor connected devices remotely. It's designed with simplicity in mind, featuring a drag- and-drop interface that allows users to effortlessly build custom interfaces for their IoT applications. With a rich library of pre-built widgets and code snippets, users can quickly prototype and deploy their projects without the need for extensive coding knowledge. Blynk supports a wide array of hardware devices and communication protocols, making it versatile for diverse applications ranging from home automation to industrial monitoring. Additionally, Blynk provides robust cloud connectivity, secure communication channels, and built-in data logging capabilities, empowering users to gather and analyse data from their IoT devices with ease. Overall, Blynk streamlines the development process for IoT projects, making it accessible and practical for hobbyists, makers, and professionals alike.

Result

Here are some of the works that has performed by the LOC area protected robot and it detect the various sensors which are included in the project and also detects the live human, the camera will give live video streaming and the Gps will detect the live location.

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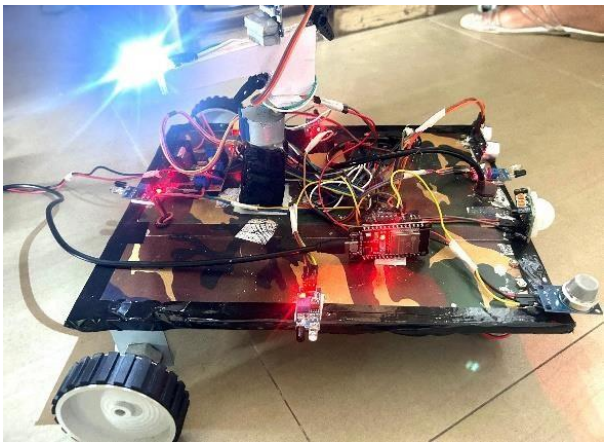

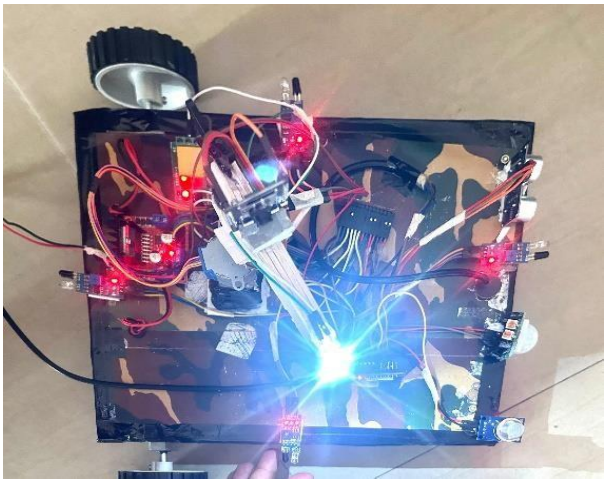

Figure : IR sensor detection by laser gun

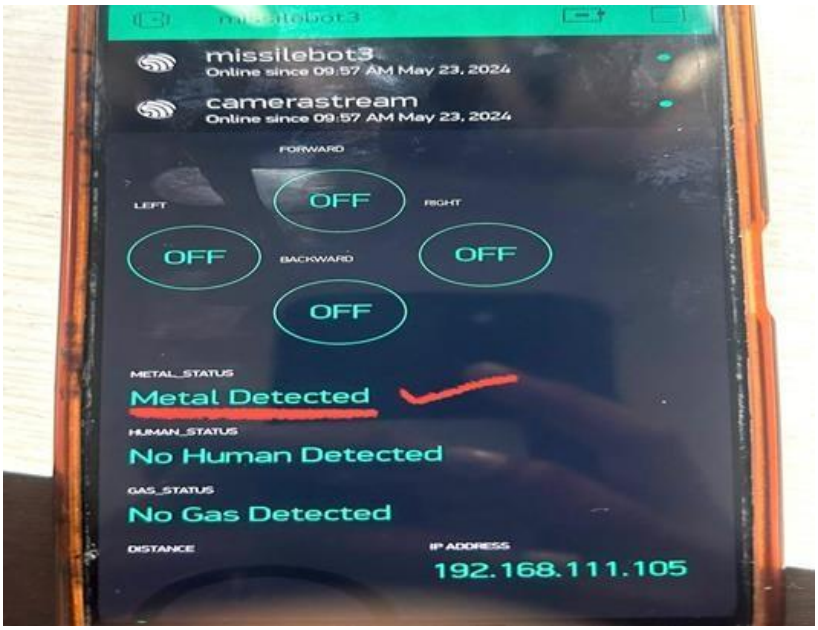

Figure: Metal detection

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Figure: Alive human detection

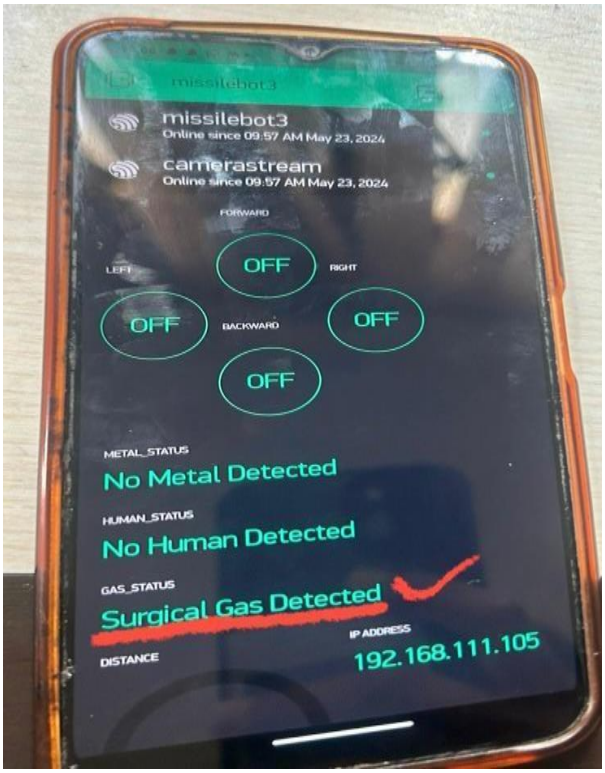

Figure: Surgical gas detection

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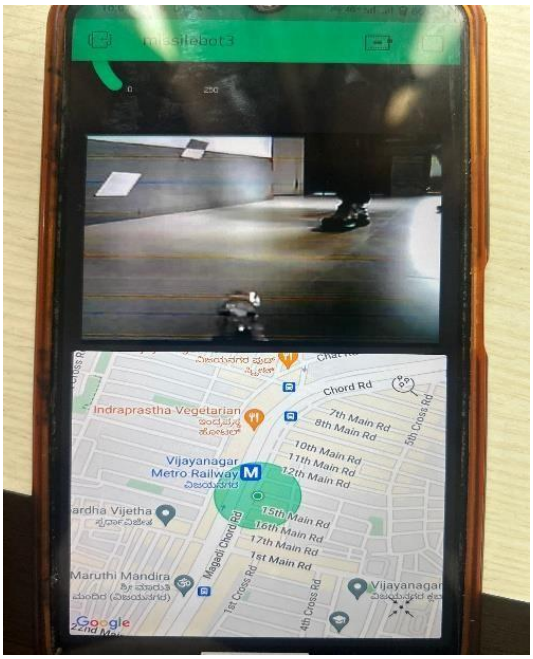

Figure: Live video streaming and Gps

V. CONCLUSION

Merciless bsf is the current area of research where lots of scope exists. Currently this particular security technique is required by several countries .one such enhancement we are trying to do. The type of communication technique enhance operation, where the user can control the m from any part of world by getting live video feedback, compared to earlier robots work like WIFI with constraints have limited, iot and s video camera makes it cost effectives combat robot. This robotic vehicle with different widely be used as surveillance robot for emergency rescue operations where human and user will be able to alert prior to intruder. The proposed system gives an exposure to design a multifunctional defense robot. This robot has a widespread industrial, defense applications. The laser gun attached to the robot is an excellent substitute for the weapons carried by the soldiers. The laser gun can be triggered with the help of wireless camera. Another application is border security system to sense movement of intruder through pir sensor. The current range of operations is up to 10m and can be made more sophisticated. Laser gun found to be very accurate in pointing to the target.

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