IMPLEMENTATION ON VIDEO SURVEILLANCE BASED DEFENSE MULTIFUNCTIONAL SPY ROBOT USING IOT

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Abstract— This research introduces a groundbreaking paradigm in military robotics an autonomous, multifunctional army robot endowed with state-of-the-art camouflage technology. The innovation lies in adaptive camouflage integration, utilizing cutting-edge materials and environmental sensors to dynamically alter the robot's appearance, ensuring seamless blending with diverse surroundings. Designed for versatile deployment, the robot combines mobility across various terrains, advanced surveillance capabilities, and autonomous decision-making through artificial intelligence. Its modular design facilitates mission-specific configurations, allowing rapid adaptation to dynamic battlefield requirements. The inclusion of weapon systems with precision targeting, secure communication protocols, and electronic warfare capabilities ensures a comprehensive and effective tool for modern warfare. Furthermore, ethical considerations and safety protocols underscore the commitment to responsible and humane use. This abstract outline a transformative advancement in military robotics, offering a synergistic fusion of technology and tactical prowess.

Keywords— Video Surveillance, IoT, Camouflage, Metal Detectors, Landmine Detection, Laser Gun, Moving Object Detection

I. INTRODUCTION

In the ever-evolving landscape of military technology the Camouflage-Based Multifunctional Army Robot. This cutting-edge robotic system represents a fusion of advanced robotics, artificial intelligence, and materials science, aiming to redefine the capabilities of autonomous machines on the modern battlefield. With a primary focus on adaptive camouflage, this robot sets out to revolutionize stealth and situational awareness, offering a dynamic and responsive result for challenges faced by military forces in diverse operational environments. The multifunctional nature of this robot encompasses a spectrum of capabilities, ranging from autonomous navigation and integration surveillance for sophisticated weapon systems. By leveraging state-of-the-art technology, including environmental sensors, AI-driven decision-making, and modular design, the robot stands as a testament to the relentless pursuit of enhancing military effectiveness and adaptability. As conflicts become increasingly complex, the need for autonomous systems capable of swift and intelligent responses has never been more critical and the profound impact it promises to have on the future of military operations.

A. Face Detection:
Face Detection is been done by the skin color identification through color images. The input image is typically in the RGB format, so that color components in the color space use these techniques usually. This is because RGB components are majorly used in lighting conditions.

B. Image Processing:
Vision of camera is important for spotting things like human movement and gun detection. With the better machine vision mechanism, robot will identify each and every movement or change accurately.

C. Moving Object Detection:
In video surveillance, detection of moving objects from a video is important for object detection, target tracking, and behavior understanding.

D. Metal Detectors:
Detector of metal is a device used to detect the visibility of metals at the nearby places. The detector, is used for fetching the devices that are hidden the surroundings or the objects that are present in underground surface.

E. Landmine Detection:
Detection of Landmines, especially anti-tank mines, bombs, and unexploded substances, is the main challenge of facing humanity. Robot will detect the landmines by sweeping the ground which in turn shows the existence of mine. Some sensors are utilized to detect an unknown obstacles.

F. Camouflage Color Sensor:
The RGB's are mounted on the robot chassis. Based on 8- bit value the color of the RGB received is changed and the color of robot is adjusted to the surrounding.

II. LITERATURE SURVEY

Many research as for have been conducted based on overview of relevant research works. The table encompasses crucial details such as the name of the study, author(s), publication year, research objectives, and key advantages and disadvantages identified in each work.

Title	Authors	Year	Objectives	Advantages	Disadvantages
Military Robot for Reconnaissance and Surveillance using Image Processing [1]	Zubair Ghouse, Nishika Hiwrale, Nihar Ranjan	2017	1. System mainly focuses on the development of a robot capable of detecting landmines, toxic gases, fire and positions of heat radiating life forms.	1. The robot recognizes every face which had been already updated in the database. 2. This could be utilized on the battlefield, retrieving stolen objects, surveillance in areas with gas leaks or radiation, to detect landmines and various applications.	1. Disadvantage is the risk of leaking secret images and poor robustness against degraded container images in cover-based methods. 2. Disadvantage is the challenge of achieving high embedding capacity, good imperceptibility, and high security simultaneously, as enhancing one factor may undermine others.
IOT based Automated Intrusion Detection System [2]	Md. Yousuf Hossain, Fabian Parsia George, Mita Halder	2018	1. Very much significant for home security framework that can't disprove in the present crime-ridden society. 2. Protection from burglary, leakage of crude gases and fire are the most vital prerequisites of home guard systems for individuals.	1. Very easily operatable, so that anybody whether rich or comfortable, young or old can utilize this system. 2. Security system intelligent is affordable and can be used in various areas such as swimming-pools, school premises.	1. Constructing the trainer dataset required significant amount of time and attention. 2. The traditional guard systems such as the CCTV camera are quite expensive and require constant supervision.
Military Spying Robot [3]	Sarmad Hameed, Muhammad Hamza Khan, Naqi Jafri, Adeel Azfar Khan, Muhammad Bilal Taak	2019	1. An Army spy Bot for Military surveillance is built, which runs on brushed DC motors for wheels, using a PIC 16F877 microcontroller. 2. CCD camera is been used as spying which works under 12V producing picture resolutions.	1. Usage a CCD camera for spying which works under 12V producing picture resolution of about 1024x800. 2. Remote of the camera have ability of sending live sound and visual recording to a PC or a TV through a tuner card to the station of remote controller.	1. CCD camera cost is more. 2. Camera won't work with U-turn proficiency when it contacts with the limit switch.

Title	Authors	Year	Objectives	Advantages	Disadvantages
Wireless Landmine Detection [4]	Vrishali Patil, Uttam Bombale	2019	1. Wireless locomotion mechanism is achieved using remote control unit and control unit. 2. The main idea is to design and implement a prototype of an efficient low cost automated mine detector that will change the present employed human detector's in mission of searching and bring out mines in a expected area.	1. The robot is equipped with special wheels controlled by H-Bridge module, allowing it to move in all possible directions. 2. The robot is equipped with special range sensors that help in avoiding the obstacles in the field by specifically detecting the position of obstacles.	1. Landmine detection requires the access to two opposite sides of an object, which is difficult to obtain in case of landmines. 2. Short Pulse, wide band low energy radars are in use to probe into the earth, but this method has a problem that the dielectric discontinues at the places other than the mine.
Sensor Controlled defense purpose robot for land mine detection [5]	A. Kunaraj, J. Joy Mathavan, M. Mathushan, G.M. Kamalesan	2020	1. Modification of sensors to work based on radio controller or IOT controller instead of Bluetooth controller. Analyze of an image processing system is included.	1. Metal detector arm is projected in front of the robot so that the land mine detection can be performed effectively without damaging the robot. 2. It alerts the operator if a land mine is detected showing the location of land mine.	1. The land mine detection robots are very rarely used in military because of poor knowledge of operation, high cost of development and difficult to operate in improper surfaces. 2. Excess effort, extra time, huge cost is one of the drawbacks of this robot.
Camouflage Technique Based Multifunctional Army Robot [6]	Rashmi Hegde, G. T. Raju	2020	1. The principle goal of the framework is to ask covered including some extra parameters such as Wi-Fi connection for continuous information given by the camera to the display screen and PIR sensors will follow the intruders..	1. Camouflage robot furthermore can be utilized in star lodgings, strip malls, enhancements showrooms, movement aides, and rescue bunches during catastrophes.	1. Army robots are restricting with the camera, sensors, locator and video screen. 2. Manual Boarder security can't screen definite movement without IR sensor.

Title	Authors	Year	Objectives	Advantages	Disadvantages
A Survey On Camouflage Surveillance Robots [7]	Anshika Manral, Immanuel D A, Monika Murthy, Rakshith S , Kavyashree B	2021	1. This includes real time object classification, camouflaging using Color Detection sensor, behind the wall human detection using Doppler technology and adaption of Inverse Kinematics for locomotion. 2. The Bot contains additional sensors like PIR, Metal detection, Gas-Flammable and CO_2 Sensor whose values are monitored using a web/mobile application through IoT.	1. Perform hazardous tasks which could be fatal to soldiers or humans in general. 2. It is economic and physically lighter than most of the present available surveillance bots which makes it more efficient. 3. Bot have ability of detecting Human who are hidden behind the wall which is also a added advantage.	1. Short range communication is been used such as Bluetooth or ZigBee will not help to control the bot in remote areas. 2. The CCD camera would cost more, also the camera pixels interacts with the limit switch it will stop moving.
Robotic Land Mine Detector for Mine Detection [8]	Mrs. Shital Deshmukh , Saurabh Kanase, Sayali Maske, Pankaj Nalawade, Shyam Laishetty	2021	1. An automatic system used for vision sensors and pattern recognition techniques to perform the same operation and discover the landmines. 2. Shows that a robotic solution to the matter of landmine detection and removal may be a practical alternative to current solutions.	1. Landmine signature is a general term which can be used both in the case of manual and automated landmine detection. 2. Mine clearance is exhausting, dangerous, repetitive work, poorly fitted to humans, but perfect for a robotic solution	1. Most cases landmines rest in the ground for many years after which there may be no visible characteristics available. 2. Landmines sensors should not rely on the visual information.

| Face Detection and Recognition System [9] | Dr. Pardeep Kumar, Shivam Bhargava | 2021 | 1. Capable of uniquely identifying or verifying a person by comparing and analyzing patterns based on the person's facial contours. 2. Implementation by means of recognizing faces with more accuracy and reducing the error rates while recognition. | 1. This database is used to produce CG (computer graphics) computer animation for movies, games, or real time avatars. 2. It is also used in video surveillance, human computer interface and image database management. | 1. Extensive data storage is required for creating, training and maintaining big face databases which is not always feasible. 2. The requirement of computational power also increases with increase in the size of the database. This becomes financially out of bounds for smaller organizations. 3. The relative angle of the target's face by the camera pixels impacts the recognition rate drastically. This may not be suitable for some conditions, therefore creating a major drawback. |

Title	Authors	Year	Objectives	Advantages	Disadvantages
IoT Based Vehicle Robot for Military Services [10]	Supriya P Kurlekarr, Sahil R Shaikh, Prasad D Zadbuke, Akanksha S Yadav, Hamid J Shaikh	2021	1. Create a smart robot that can gather information about the surroundings and effectively transmit it to an operator. 2. To display transferred real-time environmental information on the operator's base station computer as a radar. 3. Provide full remote control of the unmanned ground vehicle's movements to the operator.	1. For hazardous weather conditions and fire at restricted areas, Temperature Sensor LM35 integrated with Flame sensor R2 686 used. 2. Gas Sensor detects sundry deleterious gases like LPG, Propane and iso-butane when the gases exceed their voltage level.	1. The obstacle avoidance IR sensors on board are exceedingly directed; they perform inefficiently in sunlight and fail to identify black substance. 2. The batteries can only power the system for a certain amount of time.
IoT based Autonomous Robot Design Implementation for Military Applications [11]	P. A. H. Vardhini, K. M. C. Babu	2022	1. Implementation of microcontroller is interfaced with other components like metal finder sensor, spy camera, temperature sensor. 2. Various military operations like mine detection, communications, surveillance and fire detection.	1. The good quality camera is in use for surveillance and transmitted using Wi-Fi module. 2. Various applications like mines detection, spying and rescue operations adds advantage.	1. Killer robots challenge human control over the use of force, and where they target people, they dehumanise us – reducing us to data points.
Moving Object Prediction and Grasping System of Robot Manipulator [12]	Ching-Chang Wong , Ming-Yi Chien, Ren-Jie Chen , Hisayuki Aoyama, Kai-Vi Wong	2022	1. Implemented a moving object prediction and grasping system that enables a robot manipulator using a two-finger gripper to grasp moving objects on a conveyor and a circular rotating platform.	1. An automatic data generation method based on the LabelMe tool is proposed to reduce the manpower and time required to collect a large amount of training data. 2. An object numbering system is proposed to ensure that the order of these consecutively recognized moving objects is consistent.	1. The proposed system cannot predict moving objects without regular moving paths. 2. The system cannot grasp unknown objects. 3. Object moving paths considered in this research are regular moving path, so a random moving path is across the field of this research.

Title	Authors	Year	Objectives	Advantages	Disadvantages
Spy Robot for Military Surveillance [13]	Lekha R, Manju Ravi, Sushma M Hegde, Anand HD	2023	1. The primary objective of the war spying robot was to prioritize user-friendliness. 2. Robot excels in mobility, image capturing, and wireless transmission, providing soldiers with real-time information about the dangers and conditions on the battlefield.	1. Through the integration of night vision cameras, flame sensors, gas sensors, and metal finders, the robot would enhance situational awareness and contribute to improved security measures. 2. Robot serves as an efficient spy robot within shorter distances, enhancing operational effectiveness. 3. Gas sensors provide early detection of hazardous gases, ensuring the safety measures.	1. Not suitable for long-range applications. 2. This is applicable only for shorter distances.
Military Surveillance Robot Using IOT [14]	Dr. S.M. Girirajkumar, A. Yaamini, R.S. Sanchhali, G.Nivashni Devi	2023	1. Implementation of smart surveilling system can record and transmitt the video to any portable device.	1. It provide rapid transmission of the video through Internet of Things (IOT).	1. PIR sensor and proximity sensors are activated depend on external stimuli.
An Image-Processing-Based System for Object Detection [15]	SruthyVidiyala, SwathiKadari, SushmaThippani, AnikeTejaswi, ArrabairuVeena, B. Sony	2023	1. Concept is employed for surveillance, allowing us to keep tabs on the military installation, manage traffic, and coordinate with submerged devices to save lives.	1. Underwater computer vision can collect important data can use in a wide variety of practical applications.	1. Can be more computationally intensive than face detection is need to analyze a larger portion of theimage. 2. May be less accurate than face detection in certain scenarios.

III. CONCLUSION

We conclude, that camouflage robot uses the chameleon color changing technique which helps in changing the color by using color sensor. It also detects the gases that are present in the surroundings. The model have been focused mainly on criminal activities like hostage situation. To know more about the inter situation of the hostage building, all- terrains tracked robot have been developed with track arm and established. A more advanced communication system is very helpful and also can be installed in any system. Some multiple camera vision has been incorporated into the system for live visualization and processing purpose. this approach enables these types of robots to provide fast and accurate clearing with no missing areas without any fatigue around the clock. It reduces labor costs, expensive training of manual deminers and improves their working conditions and safety. It reduces risks of injury and losing life and hence reduces direct medical costs, costs of being a way from the work for long time, rehabilitation and insurance. Rapid landmines clearance can help several parties to get access to resources that are important for the local development and creating new jobs and opportunities for local communities. And a night vision camera adds on an better picture visualization of mines. The components include Shock absorber, self-balance system and adjusters should be mounted on wheels to increase the robot fastness. in future it is used as lift saver in disasters like burning building , etc.

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