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A Review on Smart Triggering Weapon System for Military Application

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Abstract: *In India, Border security depends completely on the soldiers. This is a task taken up by the military which is important and also necessary. To reduce the burden on the soldiers we use robots which also helps in increasing the security around the border areas. Thecurrent weaponized robotics system which is very useful for border security and surveillance is too expensive, while the demand for their application has been increasing which is why they are taking the help of the existing human teams to solve the dangerous missions. This project aims to solve this problem as we develop a robotic device of low cost that is capable of firing precisely and secured by using a varietyof semi-automatic weapons at the targets. This project consists of 3 steps: detection of the human intruder face, wireless communication, andtriggering of the weapon. For the purpose of this project, we use a microcontroller-based automatic system. The basic idea of this system is to detect the human intruder by using an ultrasonic sensor. By wireless communication, the information will be sent to the military camp, which will trigger the gun to shoot the enemy. The main objective of our paper is to develop a low-cost robotic device to secure the border area, where surveillance is very difficult for soldiers.*

Keywords: Human intruder, wireless communication, ultrasonic sensor, Microcontroller

I. INTRODUCTION

The country's military is a vital part of any country's security. It is in charge of ensuring that its borders are safe and secure from any threats. In a country like India where the tension between the neighbouring countries is high, border security becomes an important part of the military force and plays a big role in country's security. Border forces are assigned for the continuous surveillance to make sure there are no problems and any trespassers be caught. This includes surveillance in rough terrains of the many different landscapes and the weather conditions of the country. This makes the border security completely dependent on the soldiers of the country. In this case, a security system may be devised to relieve some of the soldiers' burden. The security system is a novel concept for intelligently securing our borders without the need for human participation. It protects our country while simultaneously conserving energy and resources. It also regularly monitors the border to safeguard the country from foreign invaders. The existing border surveillance system requires ample amount of funding and resources. The deployment of a smart border monitoring system, in this situation, is critical when considering the relevance of border security. Military robots have been in development for several decades. The development of robots with cameras that can capture real-time actions in the border area gives the border security sector a huge advantage. This can be utilized to stop or capture any trespassers. Along with capturing the image at the site of activity, the combination of face recognition leads to increased accuracy and usability. Wireless communication is used to send the acquired data to the control center. A secured communication protocol is used to carry out this task. The inclusion sensors have helped in taking action when an intrusion is detected. This project will help on the border security activities and ease the burden on the soldiers at costs which are lower while meeting the quality standard.

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II. LITERATURE SURVEY

R. Karthick et.al. [1]

Proposed a design 8for low-energy intrusion detection systems which activate if any unusual event occurs. It consists of a freestanding camera along with embedded video processing capability and wireless communication. For this video processing module, the PIR sensor is integrated so that it triggers the video analysis module based on the absence or presence of an enemy in the field. We can get two benefits from this. The first concern is the effectiveness of the video analysis algorithm as it provides many details also in such a way that it reduces false information due to occlusions or moving objects. The second concern is power consumption. There will be limiting of the all overpower consumption of the system by limiting the activity when it is not required. Now this analyzed video will be sent to required people by using wireless communication.

Zhi Sun et.al. [2]

This paper was based on Border Sense and presented using wireless sensor networks that included multimedia sensors, scalar sensors, and mobile sensor networks. They recommend that this be done to eliminate human participation and improve current border patrol systems. They use camera sensors to provide a wide detection range and accuracy. Sensors for mobile devices gives intruder tracking functionality to monitor intruders once they've been spotted, as well as various other features. The results of the heterogeneous sensors are sent to the administrator. Some of the unmanned stations of aerial vehicles were employed to track the discovery of unlawful border crossings. Because of their tremendous mobility human involvement can be reduced with the use of unmanned aerial vehicles. The weather might also be a factor here and a hindrance to this surveillance.

Jagdish Lal Raheja, et.al. [3]

Proposed this paper to recognize intruder actions in the dark condition by using Kinect for surveillance purpose as differentiating between animals and humans are unable to do by the sensors and because of this, it sends the wrong signal. To overcome this problem a system is proposed which will differentiate the human and animal. For this purpose, depth sensors, Microsoft Kinect are used which has an IR camera that captures the skeleton information and depth image. IR projector will get combined with IR camera to measure depth which is structured light principle-based. The Kinect is placed on pole 8m tall and having a tilt of
-10 degree. The data set is collected for four ways of moving on a hilly region: Walking, standing crawling, and bending. By using this joint feature, we can get accurate information. This proposed system shows 92% accurate detection for recognizing intruder action.

Odysseas Kechagias-Stamatis, et.al. [4]

In this paper, we propose the SPR solution in this study, This is a 3D ATR method that works in real time and is resistant to rigid transformations and disturbances. In addition, the number of database entries required per target is reduced to a bare minimum of one. The scenario in the object has two targets, a T-90 MBT and an anti–air missile battery Trees have partially obscured both targets. In comparison to the templates, have a different scale Both are positively detected and recognized. In 307 milliseconds, the aim is met. Even if there are a few incompatibilities in both scenarios, SPR is still capable of recognizing targets correctly. Because RoPS is scale dependent, we consider the identical experiments as in Section IV.B but limit them to the observation scale. RoPS obtains a recognition rate of 96.4 percent on average, and the processing time per request is just over a minute posture is 118.7 seconds, greatly beyond the time limitations of a missile based on LIDAR. The reason for this is that calculating the local reference frame takes a long time, and there are a lot of them. There are a lot of features that need to be matched. In terms of average recognition capabilities, SPR outperforms RoPS (50001000) by 0.1 percent and, more crucially, it is 253 times faster. RoPS, unlike SPR, is not scale invariant, which is a requirement for a system. ATR is a missiletype ATR. We reduced the number of key points to get a faster RoPS balance between recognition performance and processing time efficiency.

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Khalid El-Darymli, Eric W. Gill et.al. [5]
The aim of this paper is to survey and evaluate the current state of the art in synthetic aperture radar target detection. Using decision level fusion of two observations from distinct look angles, the recognition performance can be significantly improved versions of the intended configuration The MSTAR dataset was used to test the algorithm. The quest for positive evidence is the recognition process. The model improves recognition by the use of model similarity knowledge and the integration of numerous recognizers at various look angles. The target-models' resemblances can be striking. To increase performance, histograms of collisions in feature space were used to quantify performance. The first of these is pulse compression allowed radars to range-resolve targets that were close together. The Linear frequency modulation is the most extensively utilized pulse compression technique gazing from the side Radars that are carried in the air.

P. A. Dhulekar et.al. [6]
Proposed a design for detection of the enemy at the war field, specifically during the night times because most of the attackers will attack at the night time due to the reason that human vision cannot identify the enemy location. So for this reason, they have used Night vision cameras to be useful for monitoring, especially at night, because they require less light intensity. It is connected to the raspberry pi model 3 for image processing applications. The camera is connected to the Raspberry Pi board's CSI connector. If there is the presence of an enemy detected. The camera records video footage of the monitored area and delivers it to a PC for image processing via the Internet of Things in the form of data or video footage. The obtained video will be processed by using MATLAB software. If it detects any movement of a person or an object, the alarm system will activate, and the military will take additional action.

Anurag Singh et.al. [7]
This paper proposes the Inclusive Border Management System for cross-border monitoring. The radar system sends a 360degree view of the area to the control room. In the realm of Human Interaction, they use a Brain Computer Interface to recognize motion in drones as well as displays They record informative collection using P300 signals handled by EEG. Gaussian Mixture Models were employed to represent the background time variations. The P300 also allows the customer to communicate through video frames and update to dangerous situations. The goal is for administrators to cut the rate without having to watch it. It operates on the basis of Border security system.

Naseer M.Nasrabadi et.al. [8]
The aim of this paper is to use the FLIR data set for automatic target recognition employing networks for training and evaluation. These neural networks are designed for 2D inputs, and the discovered targets are supplied to DCNN, which accurately targets and rejects each target. False alarms are common. The Adam optimization approach was utilized to detect the objects in this case. The Image net data set was utilized to create the VGG network. The major task of this network is to localize the potential targets in a FLIR image. During these process, the input chip image and output could be any target. Some uses weather conditions by ROI dataset for different backgrounds. All these predicted patches and objects ends up by detection the images and securing the borders by intruders by networks. This network's main duty is to locate prospective targets in a FLIR image. The input chip picture and output target could be any target during this operation. Some use weather conditions from the ROI dataset for various purposes.

Arjun D et.al. [9]
Proposed this paper on detection of an intruder in the flat border area by using a multisensor to detect the invasion by the enemy by the movement and the footstep signals. After the attacks happened in the Pulwama and Pathankot there is a large demand for a system having a multisensing property that should have less human intervention. It integrates different wireless technologies for monitoring and detecting an invader in the surveillance region and to issue warnings of invasion to the base camp. The wireless sensor network(WSN) is used for surveillance purposes. By using the WSN, the Panchendriya framework is designed. By using this framework, they have proposed a system that consists of an IR sensor by using Infrared signals will detect whether an enemy has crossed the borders. IR sensor has two nodes, one for transmission and another for receiving(LED) the signals. Continuous transmission is seen if an intruder is detected. The framework is developed with an Arduino UNO microcontroller and LED is used to display the results.

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Seunghan Lee et.al. [10]

Proposed this paper to design and to develop the multi-level simulation framework to address all of the issues raised by the employment of various sensors, as well as using detection and classification algorithms to handle real-time data provided by stationary and mobile sensors for continuous monitoring. To manage a variety of sensing data in order to control the devoted system in real-time and dynamically, a Dynamic datadriven application system is introduced. This system mainly focuses on the algorithm which complies with the surveillance system's requirements and validation in the border area. In this proposed framework they make use of 3 levels which are 1) Surface level, in which seismic sensors are used in the ground for the information source 2) Low Altitude Level (LAL), along with the vision sensor Unmanned Aerial Vehicles (UAV) are used by selecting optimal waypoints to monitor an area. 3) High-Altitude Level (HAL), primarily uses aerostats to give a surveillance area perspective, with the satellite transmitting real-time high-level data to the ground control server. After getting all the levels of information the proposed framework will operate which consists of 2 subsystems, which are the planning and control subsystem. The planning includes 3 modules first is the Binary data is generated based on the detected object. The object is classified as a friend or enemy based on human behavior theory and fidelity is found by fidelity algorithm.

Dawoud AL Shukri et.al.[11]

The aim of this paper is to look at the security of border intrusion detection using IoT and embedded systems. They use two types of cameras, a thermal FLIR camera and a night camera, to monitor even in dark, foggy, and damp conditions. In telescope mode, the camera aids in aiming the laser gun in night mode. They also make use of a Raspberry Pi, which is prohibitively expensive. These laser weapons keep hackers at bay and obstruct invader movement. The areas are scanned using a 180-degree motor. These serve as a means of communication and control. It sounds an alarm, and if the burglar ignores the alarm, an electric fence is activated. Using IOT, this border screen will be transferred to the controller side. The area around the boundary is to provide data and communication without interruption, some wired and wireless networks are connected.

Asadullah Butt et.al. [12]

The purpose of this paper is to examine the military's employment of unmanned aerial vehicles (UCAVs) as a defense mechanism to provide security to a specific area. They've created a weapon launcher system. To keep the weight of the pieces in check, aluminium alloy was used. Once the design has been finalized. The loads and stresses were obtained when the forces were arranged. The first design was implemented. However, the force employed here was too great for rotorcraft. The other plan was to use the explosives to provide defense. The UAV is used to detect facial recognition and assess border security. It can be used to detect intruders by pointing them out. In this case, multimedia sensors provide invader video information. The information contained in the database algorithm used to implement and improve various algorithms for prospective targets. They use technology for the performance of the eye in addition to defense mechanisms.

Aditya Prasad et.al. [13]

Proposed paper on Python-based defensive application for auto-target detection with sensor-based automated gun firing system and Arduino-UNO microcontroller. In this system, the image of the enemy gets captured by the camera. The face detection can be done by Haar Cascade Classifier Algorithm. Once it is detected as the enemy. The intruder's image as spotted by the camera, then continuous firing occurs simultaneously image is sent to control station via an E-mail alerting the army personnel. In this system, IR sensors and ultrasonic sensors are used. When the IR sensor detects a signal, the gun fires continuously, with a display of gun fire on the LCD. When the enemy's movement is detected by the Ultrasonic sensor, a single shot is fired along with the LCD.

Ambika M S et.al. [14]

Proposed a design and execution of an automatic multi-tasked military robot to monitor the border area continuously. It has sensing, processing, rotating, and triggering units. The sensing unit consists of an IR sensor and a Raspberry Pi Camera which will sense the object is detected by the sensor, it captures a picture of it. In the processing unit, they are using a Raspberry pi processor. A CSI camera connection on this chip allows you to connect a Raspberry Pi camera. In

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the rotating unit, rotation is actuated by a DC motor. The last one is the triggering unit in this the laser torch is used. The major approach of this system is enemy detection by an Infrared sensor, if the enemy is observed then the image of the enemy gets captured. This captured image uses wireless communication technology and the image will be sent to the control room. The individual in the control unit checks and verifies the image. If the verified image is an enemy, then by using wireless communication a response will be relayed back to the processor for the laser to be directed at the intruder.

Hanaa Mohsin Ahmed et.al. [15]
This paper proposes a surveillance method to monitor international border security in this study. They employ a Raspberry Pi- based robotic system for this type of surveillance, which suggests that it can automatically detect intruders and alert the administrator. Image processing with an open CV an SMS or e-mail alert is provided through means. This system will be activated when the following conditions are met: The camera sensor will be turned on. The sensors are used to detect and avoid various obstructions. Face recognition algorithm and human face When a suspicious incident occurs in the context of the system will generate an alert if it detects surveillance. The algorithms that are used to detect faces are difficult to understand. The items in the field are radiated by the PIR sensors. It emits infrared light. Such radiations have wavelengths that are undetectable to human eyes, but they can cause cancer.

III. OBSERVATION

After a thorough review of a few research works, it was observed that with the growing tensions across borders it is very important to have efficient surveillance systems. The papers reviews make effective use of sensors and microprocessors applied according to their design. There was a vast variety observed in the methods used for surveillance which may be through sensors for motion detection, cameras for face detection, and other methods along with compatible processing algorithms.

VI. CONCLUSION

It can be concluded that there are several methods of intruder detection across the border The main advantage is the detection of intruders through different types of sensors and processors are used but still, certain drawbacks are observed after reading the above papers i.e., they tend to be expensive and use high-priced robots. This drawback can be overcome in our project using low-cost components while also having an efficient method for intruder detection through face detection.

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