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Auto Triggerring Weapon System for Border Security using Internet of Things

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Abstract: *Border surveillance is the utmost essential responsibility in the realm of national defense and security. It is imperative to maintain constant vigilance over a nation's borders to uphold tranquility and ensure the safety of its populace. Safeguarding border areas rigorously from such activities is particularly critical in the present climate, where terrorist infiltrations and illicit movements of both animate and inanimate entities have become commonplace due to technological advancements. Offering uninterrupted surveillance is the minimum action required to prevent such incidents in border regions. At present, the manual monitoring of borders is carried out by the border security forces responsible for this task.Due to the vast distances between the borders and the harsh terrain and climate, it requires a lot of people and resources. Designing it is therefore analytically critical to create an automatic weapon system that could also complete even without monitoring task requirement for human involvement. Implementing this system eliminates the need to continuously deploy personnel in hazardous situations. Moreover, the system should possess the ability to make appropriate decisions and take necessary actions while also notifying human controllers when suspicious activities are detected. Central control rooms can be located away from the border region. Once an alert is sent, humans must determine the subsequent course of action. When implemented effectively, this approach helps conserve resources and reduces risks to human life. Full automation of border monitoring is not currently viable due to safety concerns, but such technologies can certainly assist and work in conjunction with armed forces to protect a nation's borders.*

Keywords: Boundary surveillance cameras, unauthorized detection, wireless communication, Microcontroller, ultrasonic sensor

I. INTRODUCTION

For a very long time, border security has been a top priority for the whole globe, not just India. It means guarding the nation's borders against the unlawful flow of people, goods, narcotics, and weapons. It plays a crucial role in preserving international trade, allowing people to travel legally, and offering security against terrorists.

This contributes to preserving a economic growth, safeness, and independence of the country. Systems for border monitoring are used to keep an eye on what goes on near the border and determine whether any suspicious activity is taking place. A series of predetermined tasks are carried out if something that raises suspicion happens. It can entail notifying the appropriate authorities or other systems, such as a warning or battle system, to respond by triggering. Auto Triggering weapon System includes Intruder Detection Systems (IDS) in its core functions. They are made to function in dangerous environments so that they can continuously watch for, find, and pursue intruders (moving targets). Terrorists, drug dealers, human traffickers, and spies might all be invaders in this specific research. An IDS that can send out automated alerts can be quite helpful because it can be very taxing for people to pay close attention and watch the 24x7 live video streaming. Wireless sensor network (WSN) technology is used in the proposed Auto Triggering weapon System, a border infiltration detection method. The video security camera is fixed to the top of a motor and microcontroller set-up. For the purpose of detecting intrusions, infrared sensors positioned on the border fence send signals to the microcontroller. The signal directs the security camera to look in the direction where the intruder has been seen. Three possible outcomes are possible depending on the intruder's location in relation to the border fence's sensors.

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When the microcontroller issues orders to the motors, the camera location may be moved both horizontally and vertically. The two motors function as actuators and are in charge of the surveillance camera's precise placement, vertical movement, and horizontal movement. The camera is placed such that it may capture the movements and activities of the intruder in its range of vision. It's important to find out if it is a animal or human life. As soon as it's established that the unauthorized user is a human, alert signals are sent to the main control center.These notifications force the controller to watch the video material more carefully and determine whether or not the action calls for a response. The controller is then in charge of deciding what should be the best course of action given the circumstance. He or she can communicate the details to higher-ups and turn on some type of automatic mechanism to deal with the invader. Pyroelectric infrared (PIR) sensors, which are inexpensive, low power-consuming, and work in low light, are used to track movement in the area that is being watched. Step motors are also highly dependable and inexpensive. In order to regulate their forward and backward movements as well as precise placement, they are connected to Arduino.
C++ was chosen for the system's design because it is simple to develop, clear to grasp, and adapt to tackle complicated jobs. The data collected just by the controlsystem is stored locally and may also be wirelessly transmitted over a shared Wi-Fi network. Laptops, desktop PCs, and other portable electronics could be the devices. The suggested strategy could help the security agencies in their border region security efforts. It can provide ongoing surveillance in regions with severe weather which help human deployment challenging. The system for border surveillance is moving closer to automation with this action.

II. LITERATURE REVIEW

A sensor network study for boundary monitoring and intruder detection is presented by Arjun et al. in [1]. For a variety of border circumstances, the aim is to develop a multi-sensing system that incorporates a number of monitoring and intrusion detection techniques. such as movement of a water body or a flat surface. This article describes how to detect human intruders using a variety of sensors, including security cameras, infrared, passive sonar, geophones, and hydrophones. Palgati as well as others
[2] provide a model for studying videos taken by security cameras and extracting characteristics from them when video is converted to shots. An object tracking approach based on ROI is used to extract the basic characteristics. Finally, the recognition of the intrusion without any erroneous matches is achieved via semantic content extraction.
Bhaskar [3] provides a framework for military surveillance that incorporates face-recognition based human identification, tracking, and human object detection and tracking. To locate moving items, the background removal approach is applied. Identification of the target's face is necessary for the face recognition procedure. If face detection fails, the aim is being monitored.
Jisha et al[4] .'s proposal for an intruder detection system makes use of a wireless sensor network and an object detection approach. The MICAz sensor node is further coupled to PIR (Passive Infrared) sensors that are employed. The proposed system is expected to identify the unauthorized persons, follow it, and transmit data on its location, velocity, and way of travel to a central base station for assessment.
Sagar et al. [5] construct a robotic smart home security system using image processing techniques. The device has the ability to recognize faces and signboards and alert the user if an intruder is found. The robot's movement is managed by Arduino using Arduino, and all of the sensors are wirelessly connected to it.
A system for intelligent border observation and automated fighting is put out by Singh and Khushwaha [6]. It uses characteristics that were taken from the scene's optical flow data. Depending on the intruder's relative proximity to the border fence when the intruder is automatically detected, the appropriate action is then conducted. Simple tracking is used if the burglar is discovered to be behind the barrier. An alarm is sounded if the burglar is trying to cross the fence while above it. When the burglar has really passed the fence, the auto-firing feature can be used.
Border Sense is a combination wireless sensor network framework that Sun et al. [7] suggest for border patrol systems. There are three levels to it. The first layer is composed of ground and subsurface sensors. Multimedia sensors that transfer visual data are present in the second layer. Unmanned aerial vehicles, which increase coverage and adaptability, are included in the third tier.

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Using seismic and PIR sensors, Jin et al. [8] offer a technique for locating and categorizing a target. One of the three categories—vehicle, animal, or human—can apply to the target. The feature extraction from the sensor inputs uses a wavelet technique known as symbolic dynamic filtering (SDF).

Zhang and Liang [9] provide a method to identify moving people by taking a backdrop picture.

Ye et al. [10] offer an approach that uses background reduction and shadow removal to detect moving targets. The RGB colour space is used to implement the approach. The mean as well as mean absolute deviation are the estimators that are used for background reduction. Brightness difference and chromacity difference are the approximators for darkness removal.

Mishra et al. [11] developed and tested a system to detect boundary infiltration using a sensor network. Data is sent from the dispersed sensor motes to the base station, which features an ANN that use the backpropagation algorithm to recognize patterns and develop itself. Depending on the change in ambient conditions, experimental findings are provided for a variety of instances.

The effectiveness of boundary security simulation utilizing WSN arrays is examined by Alkhathami et al. [12]. Utilizing wireless sensor ZigBee nodes, they provide experimental findings for the OPNET (Optimized Network Engineering Tools). The two topologies used in the experiment are mesh and tree cluster, and the outcomes are contrasted.

Shivani and Kaur [13] provide a technique for border intrusion detection using CCTV cameras. ROI (regions of interest) of the scene may be used to extract several events from a surveillance film. The work that has already been done on border security monitoring is briefly examined. I et al.

[14] provides review of experimentation and study in the two fields of monitoring and unauthorized detection. The major goal is to deploy a large number of small, low-cost nodes using WSN technology in border zones to deliver location- and time-specific information. There is discussion of the difficulties and technical needs for such systems.

According to Essendorfer et al. [15], SOBCAH (Surveillance of Borders, Coastlines, and Harbors) project's design incorporates data from several sensors. First, every piece of data is transformed into a single, industry-standard data format. The data from all the sensors is stored in the SOBCAH Shared Dataset (SSD).

An infraredsensor that detects distances based on the intensity of light backscattered from the items described by Benet et al. [16]. The sole parameter employed by the provided model is the reflection coefficient. The experiment's findings are then displayed.

For the purpose of creating a wireless sensor network Ferdoush and Li [17] explain their work using the Raspberry Pi and Arduino. The hardware on both is open. The system architecture as well as the necessary hardware and software are thoroughly covered. Finally, examples of experiments and their outcomes are shown. It is stated that the technology is both scalable and affordable.

Kulkari et al. [18] has enabled file sharing across different devices over a network. This outlines the system's architecture and implementation. A system for intruder detection that can determine if an invader is a person, an animal, or both is described by Alkhathami et al. [19].or anything. Dynamic Mechanical Analysis (DMA), the method considered to be the most effective, is discussed. Along with barriers and sensor coverage, WSNs are explored.

Agrawal et al. [20] provides monitoring and inspection which recognizes moving objects even low -resolution photos also.

III. AN EVALUATION OF COMPARISON PROPOSED AUTO TRIGERRING WEAPON SYSTEM

S. no.	Authors & Year	Name	Key Features	Limitations
1	Palagati et al.(2014)	Intruder Detection by Extracting Semantic Content from Surveillance Videos	prevents a false match with the invader	Accuracy increases with the number of concepts and the amount of training data, and it is generalizable over a wide range of data domains. Use of structured metadata and uncontrolled material together effectively

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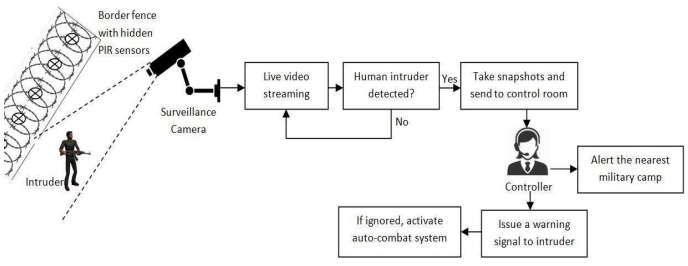
2	Bhaskar(2012)	Integrated Human Target Detection, Identification and Tracking for Surveillance Applications	A special art of reorganization of face recognition by different representation	The computational demands the face recognition phase and need for different contrast augmentation methods and the challenges creating high quality film.
3	Jisha et al.(2010)	Intruder tracking using WSN	Integration of PIR sensor with MICAz allows for the recognition of the human intruder's route, average speed, and direction.	If many people enter the sensing range, the program may not notice them or may perceive them as a single invader.
4	Sagar et al.(2017)	Smart Home Intruder Detection System	may be utilized for remote data transmission and real-time monitoring ability to be controlled by any Android phone. portable and capable of traveling in any way	Data transmission involves an internet connection where incase the connection is lost then the transmission is not possible. Power use has increased.
5	Sun et al.(2011)	Border Sense: Border patrol through advanced wireless sensor networks	Broad detection range and precision detection The diverse sensors cooperate to detect the incursion and provide the results to a remote administrator. The ground sensors provide further information.	The flexible detection method for sensors in the ground and underground The synchronization of numerous neighboring sensors Camera sensors are necessary to identify and track intruders who are not visible from the outside.
6	Essendorferetal .(2009)	An Integrated System for Border Surveillance	better situational awareness; monitoring of large areas with less personnel	The shared database has restricted access. massive volume of data collected by vast sensor networks

IV. METHODOLOGY

In order to operate the Smart Triggering Weapon System for Military Application, precise hardware and software components are essential, in addition to setting up the weapon base. The project methodology involves providing a 12V power supply for the entire circuit. The primary component of the circuit is the Atmega328 microcontroller, which serves as the brain and is loaded with a program to control other components using Arduino IDE software. The microcontroller handles all the components.



Auto Triggering weapon system architecture

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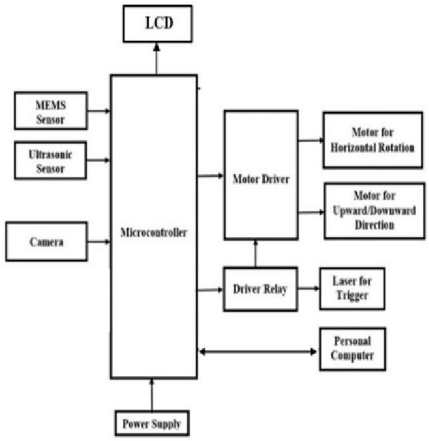
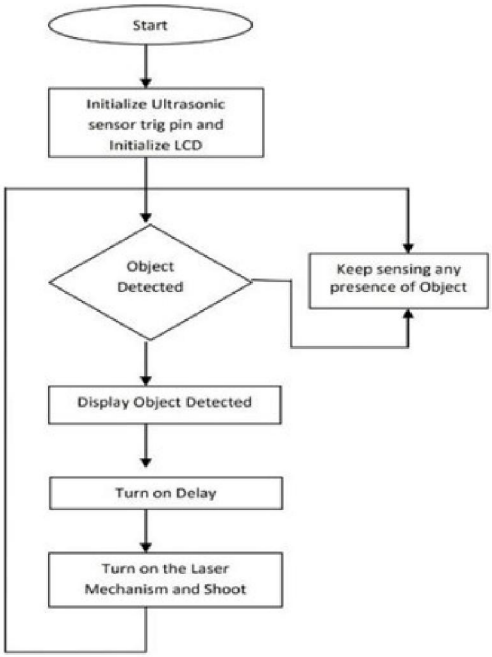
The surveillance system utilizes two DC motors with two terminals each (positive and negative). One motor enables up and down motion of the weapon arm, while the other facilitates right to left motion. These motors are controlled by a 4-terminal relay. Since the microcontroller operates at 5V and the DC motor requires 12V, the relay acts as an electrical switch to adjust the voltage levels accordingly (from 5V to 12V and vice versa). In addition to driving the relays, the microcontroller triggers the laser of the weapon arm, which serves to indicate the weapon's triggering status.

For the movement of the weapon arm, a MEMS sensor, an analog sensor, is used to manipulate its axis. This sensor is responsible for the head movement of the weapon system. When the weapon is triggered, the laser turns on, and when the weapon system is not triggered, the laser is turned off.



Block Diagram of the proposed methodology

To detect authorized and unauthorized individuals, a PC with a camera is installed at the surveillance area. The Viola Jones algorithm, implemented using MATLAB software, is employed for face recognition. When an intruder's face is captured by the camera, it is compared with a pre-defined dataset containing face images of the soldiers. The captured face is then checked against the data file to determine if it matches. If the face is not recognized, a signal is sent to take action, and the laser is triggered.



Flowchart of the proposed methodology

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An ultrasonic sensor is also utilized to determine the distance at which the intruder is approaching. The measured distance is displayed on an LCD screen, along with the arm movement and triggering status of the laser upon face recognition. A threshold limit (e.g., 5 meters) is set, beyond which the laser is activated and a trigger is given to the weapon arm when the intruder crosses the threshold distance. The weapon arm is automatically controlled based on this input.

The data obtained from the Arduino is stored in MATLAB, a programming platform used for human face detection and display of whether the recognized face belongs to an authorized or unauthorized person, using the Viola Jones algorithm. The laser is automatically triggered when the face is unauthorized, and this triggering status is displayed on the LCD screen.

V. IMPLEMENTATION

The system as a whole isn't brand new. Various parts of the system, such as motion tracking and a gun-based system to execute impending targets, were implemented for various purposes. These are distinct and innovative technologies that, when combined, will aid in the development of our automated imaging system. The impact of present technologies has expanded the possibilities for developing various prototypes for future solutions. Previous project failures and triumphs are studied so that the design for this project will aid in the improvement of our system. The creators of this system plan to incorporate multiple current similar technologies into a specific design after evaluating all of the existing similar technologies that have been effectively implemented in the past. body.

The system will have numerous roles, the most important of which is to hold guns defensively. The system can be optimized for use, however it can first be employed for local security by businesses or homeowners. It can even be employed on the battlefield to defend military bases from approaching enemy, and it can detect and intercept approaching planes, helicopters, and missiles. The concept of system can be applied in a variety of ways, depending on the needs of the individual. Internet of things based high security border surveillance strategy Proposed a design for 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. 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.

Surveillance system for detection of suspicious human activities at war field 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.

Design and Implementation of Automatic Multifunctional Military Robot 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. Survey of intelligent surveillance system for monitoring international border security.

VI. HARDWARE AND SOFTWARE OUTPUT

As this system works in two mode. By using switch it changes it state from automatic to manual mode and vice versa based on user input. In automatic mode it will detect the intruder using object detector component like ultrasonic sensor, IR sensor. Then it will trigger the object by pointing a laser light and display a message in LCD stating that object is detected. It also measures the distance of the objects and throw a message. When it detects the objects RASPBERY PI signal is passed by buzzer sound.

In Manual mode based on movement of the MEMS sensor, gun rotates and detects the object. Then it triggers the object by pointing laser light. It also detects the fire and send RASPBERY PI signal by making a buzzer sound and displays a message in LCD stating that fire detected. It also detects RASPBERY PI ful gases and sends an RASPBERY PI signal

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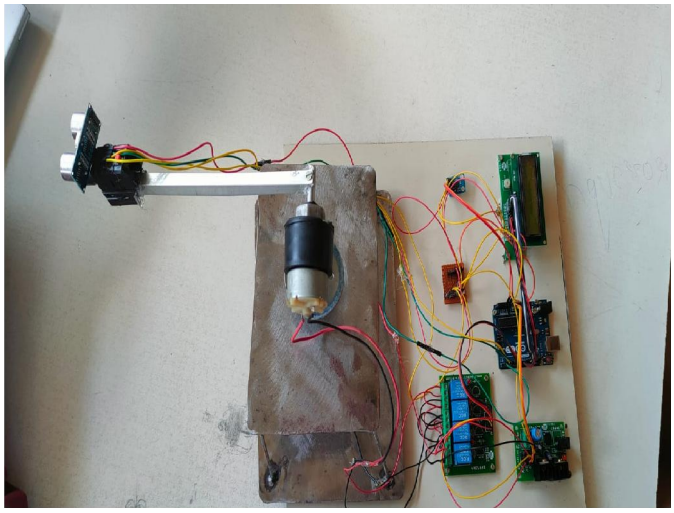
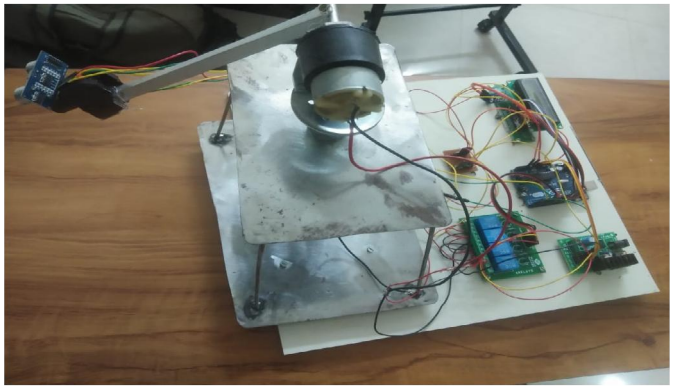
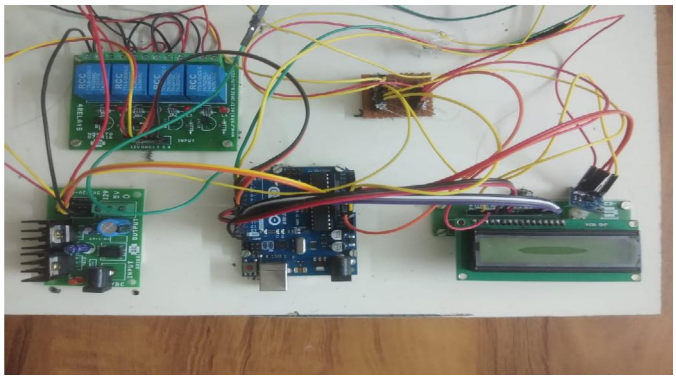
by making buzzer sound and throws a message in LCD stating that RASPBERY PI ful gases detected. The data obtained from the Arduino is stored in the MATLAB. MATLAB is a programming platform and we are usingthis software for human face detection and display if the face is authorized or unauthorized person using Viola Jonesalgorithm. Laser automatically gets triggered when the face is unauthorized and this triggering status is displayed onLCD.



Auto triggering model design



Top View of the Model



Board arrangement of the model

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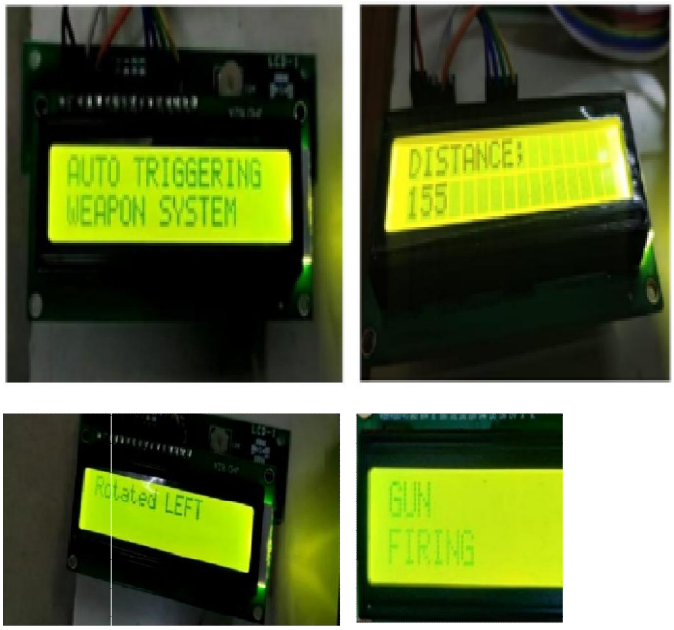

Displaying results

VII. CONCLUSIONS

The recommended approach may be very helpful in increasing the security of in out border areas, especially those with challenging topographical or climatic conditions where human deployment poses a significant danger. The technology can provide a limited-scale border security monitoring system even if it cannot provide advanced border protection. When to a system spots an intruder, it sends out an alarm message and sends intruder's photo main system. The necessary actions are made to eliminate the threat because it is recognized where the signal was produced.

Security personnel may strengthen border enforcement with the aid of the intelligent border monitoring system while also saving a sizable amount of labor and resources. With of a aim immediately communicating any invasion discovered at line of control and necessitating a relocation, it involves use contemporary technology while keeping economic effectiveness system's component modules in mind. If it is deployed appropriately, the technology might aid our border security officials in controlling such illegal and suspicious activities more accurately and efficiently.

REFERENCES

[1] A brief evaluation of border surveillance and intruder detection using wireless sensor networks by D. Arjun, P. K. Indukala, and K. A. U. Menon at the International Conference on Communications and Signal Processing (ICCSP) in 2017, Chennai.

[2] Utilizing semantic information extracted from surveillance films for intruder identification discussed in the paper by Harish, Palagati, Subhashini, R., and Priya, K. at the 2014 International Conference on Green Computing, Communication, and Electrical Engineering (ICGCCEE).

[3] Integrated human target recognition, identification, and tracking for surveillance applications presented by Harish Bhaskar at the 6th IEEE International Conference Intelligent Systems in Sofia, 2012.

[4] Intruder tracking using wireless sensor networks explored by R. C. Jisha, Maneesha V. Ramesh, and G. S. Lekshmi at the 2010 IEEE International Conference on Computational and Computing Research (ICCIC).

[5] The Smart Home Intruder Detection System described by Sagar, R N, Sharmila, S P, and Suma, B V in the International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) in 2017.

[[6] A pathway to smart border surveillance through the Automatic Intruder Combat System proposed by Singh, Dushyant, and DharmenderKushwaha in the Defence Science Journal in 2016.

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[7] BorderSense: Border patrol with sophisticated wireless sensor networks, a study by Sun, Zhi, Wang, Pu, Vuran, Mehmet C., Al-Rodhaan, Mznah A., Al-Dhelaan, Abdullah M., and Ian F. Akyildiz published in Ad Hoc Networks in 2011.
[8] Target identification and categorization using seismic and PIR sensors examined in the research article by Jin, Xin, Sarkar, Soumalya, Ray, Asok, Gupta, Shalabh, and ThyagarajuDamarla in the IEEE Sensors Journal in 2012.
[9] Motion person detection based on background subtraction discussed in the paper by Zhang, Lijing, and Yingli Liang at the Second International Workshop on Education Technology and Computer Science in 2010.
[10] Detecting moving objects using shadow removal and background removal presented by Jianhua Ye, Tao Gao, and Jun Zhang at the 9th International Conference on Fuzzy Systems and Knowledge Discovery in 2012.
[11] Detecting border infiltration using wireless sensor networks and artificial neural network techniques investigated by A. Mishra, K. Sudan, and H. Soliman at the IEEE 6th International Conference on Distributed Computing in Sensor Systems Workshops (DCOSSW) in 2010.
[6] A pathway to smart border surveillance through the Automatic Intruder Combat System proposed by Singh, Dushyant, and DharmenderKushwaha in the Defence Science Journal in 2016.
[7] BorderSense: Border patrol with sophisticated wireless sensor networks, a study by Sun, Zhi, Wang, Pu, Vuran, Mehmet C., Al-Rodhaan, Mznah A., Al-Dhelaan, Abdullah M., and Ian F. Akyildiz published in Ad Hoc Networks in 2011.
[8] Target identification and categorization using seismic and PIR sensors examined in the research article by Jin, Xin, Sarkar, Soumalya, Ray, Asok, Gupta, Shalabh, and ThyagarajuDamarla in the IEEE Sensors Journal in 2012.
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[11] An Integrated Border Surveillance System presented by Barbara Essendorfer, Eduardo Monari, and Heiko Wanning at the Fourth International Conference on Systems in 2009.