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MILITANT INTRUSION DETECTION USING MACHINE LEARNING

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Abstract - *The project is being used for monitoring, and live-tracking. The prototype is used in live-surveillance for monitoring and detecting abnormal events based on real-time image processing techniques. Operations of this project have three processing modules, the first processing module is for object detection using the YOLO-V5 algorithm and the second processing module is for monitoring and alarm operations will be carried out by the third processing module.)*

Key Words: **Live-tracking, Live-surveillance, Object detection, Ultrasonic sensor, YOLO-V5 algorithm.**

1. INTRODUCTION

The Militant Intrusion Detection System is very important for the military. This system detects weapons, grenades, armored vehicles, land mines, and intruders. The real goal of this system is to increase the accuracy of detection of weapons and intruders. The system works based on the YOLO-V5 algorithm, a subtopic of machine learning. The detection robot consists of a Raspberry Pi that contains the detection program. Once the robot detects a weapon or intruder, it sends a message displayed on the LCD screen. Landmine detection is an additional function of the robot, which is performed with a metal sensor. By using this robot, many attacks can be detected in advance [1], [3], [15].

The YOLO-V5 (You Only Look Once) is a neural networkbased algorithm specifically used to classify objects such as weapons, fire, and water drops. It is popular because of its speed and accuracy. The algorithm creates a box for each object and detects parts of the object. When it detects something related to the input, the object in question is detected [16].

A key technique used in YOLO models is non-maximal maximum suppression (NMS). NMS is a post-processing step used to improve the accuracy and efficiency of object detection. Object detection typically creates multiple bounding boxes for a single object in an image. These bounding boxes may overlap or be in different positions, but they all represent the same object.

1.1 Objectives

- This prototype implements the detection of different warship objects using a YOLO(You Only Look Once) algorithm which is the base of CNN layers(Convolutional Neural network).
- It detects guns, grenades, and tankers.
- Once the system detects the objects the detection details are stored & it will send alerts to the admin side (control room).

1.2 Problem statement

Develop a military robot that can perform complex tasks in difficult and dangerous environments, such as battlefield surveillance and threat neutralization.

1.3 Motivation

Nowadays, the protection of borders and personnel areas becomes very important. Video surveillance plays an important role in real-time. Due to these requirements, cameras are installed at every corner and the video surveillance, system detects the scene and automatically detects abnormal activities and entrances.

1.4 Existing System

The existing system does not distinguish between normal and abnormal events, resulting in police arriving at crime scenes less and less frequently unless there is visual verification, either by manned patrols or by electronic images from surveillance cameras [12]. Irregularity or anomaly detection is the identification of irregular, unexpected, unpredictable, unusual events or elements that are not considered normally occurring events or regular elements in a pattern or element in a data set and thus differ from existing patterns [6][10]. An anomaly is a pattern that occurs deviantly from a set of standard patterns [14].

2. LITERATURE SURVEY

I Peng Zhao and Lingren Kong used the YOLO-V3 algorithm, which was slow and less accurate [5], [9].

Gyanendra K. Verma and Anamika then used the RCNN algorithm, which was faster than the YOLO-V3 algorithm but could not match many similar objects [7], [13], [14].

Ankit Kashyap then used SSD from the CNN algorithm which collects the data and converts them into grayscale images. The converted images are then analyzed and separated by parts and analyzed separately [10], [12], [16].

Harsh Jain, Ayush Jain, and Ankit Kashyap used deep learning algorithms and developed a model that only detects objects approaching the camera [1].

Arif Warsi developed a model using only a metal sensor and an ultrasonic sensor to identify the weapons and the rifle, but it was not able to identify the weapons and the intruders[2], [19].

Table -1: Literature survey

SL NO	TITLE	YEAR	PUBLISH	AUTHOR	INFERENCE
1.	YOLO-v3: A Lightweight Network Model for Improving the Performance of Military Targets Detection	2020	IEEE	Peng Zhao, Lingren Kong	YOLO-v5 algorithm is used for extraction, which is faster than the Ghost Net algorithm.
2.	A Handheld Gun Detection using Faster RCNN Deep Learning	2021	IEEE	Gyanendra K. Verma, Anamika	YOLO-v5 has a precision of 87.69%. It is more accurate than Faster RCNN.
3.	Anomaly Detection in Videos for Video surveillance Applications using Neural Networks	2022	IEEE	Mohana, Vidyashree Dabbagol	But in our project, we can detect both weapons and humans, as we have used the YOLO-v5 algorithm.
4.	Weapon Detection using Artificial Intelligence and Deep Learning for Security Applications	2022	IEEE	Harsh Jain, Ayush Jain, Ankit Kashyap	To overcome low time flexibility, we have used the YOLO-v5 algorithm.

3. PROPOSED METHODOLOGY

The model consists of three phases:

1. Capturing
   - The image of the object is captured using a USB camera.
   - The captured video is then divided into frames for analysis[5].
2. Recognition
   - This phase first deals with object detection (guns, grenades, armoured cars, and intruders).
   - Object detection is performed based on the input images[1], [3], [4], [6].
3. Alerting
   - As soon as the objects (guns, grenades, armoured cars) are detected, the RGB light bar turns 'red'[20].
   - When the intruder enters, the laser light ON lights up once and sends a warning message to the soldiers, which is displayed on the screen LCD[2].

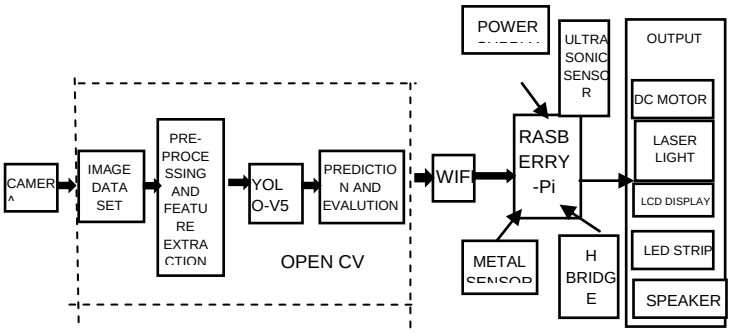

Fig -1: System Architecture

4. REQUIREMENTS

4.1 Hardware requirements

- Camera
- RGB Led strip
- DC Motor
- Motor Driver(H-Bridge)
- LCD Display
- Metal Sensor
- Ultrasonic Sensor
- Raspberry-pi
- Speaker
- WIFI

4.2 Software requirements

- Operating system: Windows 10
- Software Tool: Open CV
- Coding Language: Python
- Tool: Image processing toolbox.

5. IMPLEMENTATION

In this project, solutions are obtained using software and hardware components to achieve the results of Militant Intrusion Detection. Through the YOLO-V5 algorithm intruders and objects like guns, grenades, and takers are detected [2], [5], [7].

Making a real-time application using computer vision is found to be a more efficient and creative task that needs processing accuracy of the system[1], [6], [3]. Open CV is freely available software, which is used to create a computer vision. Open CV is used in programming languages like Python. It supports many interfacing like low-level and high-level peripherals that contain cameras[17], [19].

Objects like grenades, guns, and tankers are detected and sent a message and captured image through the telegram app and the RGB sensor strip turns red[4]. By using the YOLO-V5 algorithm intruder is detected and displayed on the LCD screen, and the Laser light will ON once. It is a Machine Learning approach where the cascade function is trained from a lot of images[7][8].

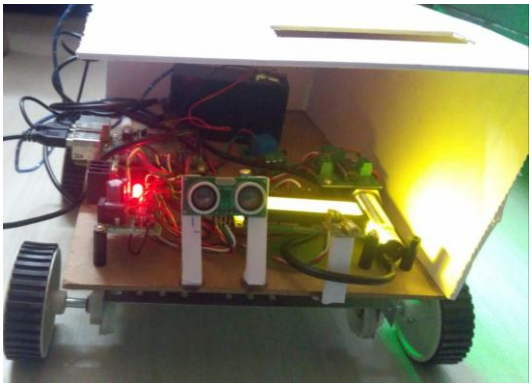

Fig -2: Proposed System

6. SYSTEM OUTCOMES

The proposed system includes three phases which are object-capturing, recognition, and alerting.

1. Object capturing
   - The camera captures the objects that are in front of the robot.
   - Sends them to the open-cv, which detects them.

Fig -3: Tanker, grenade, and gun are captured

2. Recognition
   - The data set is extracted from the image it captured.
   - The data is analyzed by pre-processing and feature extraction.
   - The YOLO-V5 algorithm is applied, which creates the frame on the captured image.
   - Then it is sent to the alerting area[11].

Fig -4: Detection of tanker, grenade, and gun

3. Alerting
   - After detection, the robot announces the number of detected intruders or weapons through the loudspeaker.
   - If the environment is safe, the GREEN LED is lit, otherwise, the RED LED is lit.

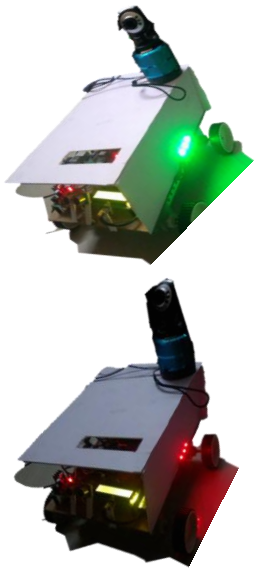

Fig -5: Green LED is lit when there is a safe environment otherwise Red LED is lit.

- Then it is displayed on the 7-segment display LCD.

Fig -6: Results of Miliant Intrusion Detection is displayed on the LCD screen.

6.1 ADVANTAGES

- It has fully automated operations, without any human intervention.
- No one can manipulate the data sent by the device to the soldiers.
- It is Cost Effective.
- Unknown intruders are detected.
- Attacks are prior alerted.

6.2 FUTURE SCOPE

- The system can be further improved by adding an extra feature of human threat detection by identifying the militant from the group of images.
- The robot can be equipped in identifying the weapons concealed and neutralizing the threat.
- The system can be extended to other domains such as mob management to effectively handle man management.

7. CONCLUSION

The proposed project successfully implements a Militant Intrusion Detection System by considering various degrees of threats in the form of automated weapons, Grenades, Tankers, and artillery systems in a seamless way. This project is a new hope in the battlefield where human lives are at stake.

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