

# AI based Armed Surveillance Robot

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**Abstract:** This paperwork focuses on robots which perform functions such as Target Firing, Surveillance and Metal Detection. Around the border areas where regular conflicts take place, there is a need for an automated mechanism to take immediate actions in case of invasion from the intruders and to reduce the human loss. In such areas, equipped autonomous robots with AI vision as well manually controlled firing robot helps in monitoring the conditions in border areas.

**Keywords:** AI vision, OpenCV, Face Detection, Firing, Metal Detection, GSM, GPS, Surveillance.

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## 1. INTRODUCTION

Governments of numerous nations are striving to provide good support for border security. Still, border security continues to account for challenges to governments around the world. Other countries have already started to replace the soldiers with automated robots, the system is necessary for self-defence and other contextual factors. In order to reduce the human loss in the war fields, there is a need to develop an automated system. This paper is based on an AI based armed robot, which performs spying and surveillance and then makes decisions based on real-time conditions. The data received from the surveillance operations are transmitted to the base stations through the Wi-Fi signal and any anomaly detected will be notified through GSM. The one who is monitoring from the base station, takes the further decisions. Advancing the current warfare technologies in the future, these robots ensure proper security at the border areas and also reduces the human threats.

## 2. LITERATURE SURVEY

[1] Sentry Gun is conceptualized based on the latest research, in which it uses a high resolution camera to scan the target area and movement can be detected by using software. Compared to humans, it shall perform better while operating in autonomous mode, it will bring a significant fall in the death toll and if installed outside every check post, law enforcement agencies and borders, it can be used to its full potential.

[2] Robotics and Automation are led in different divisions in everyday life. It is effectively used to meet the requirements of varying and enduring requirements. The task is intended to build a mechanical vehicle utilizing the cell phone as a control device, connected with a camera and a firearm. The robot alongside the weapon is made to fire consequently in a particular district by identifying the obscure picture of a person and different uncertainties through the assistance of a camera with night vision capabilities. This robot is useful to the Armed Forces for security framework.

[3] The objective is to bring out a new defence mechanism incorporating automation, which will seek to provide a viable solution to improve the security around the border areas and simultaneously reduce the pressure on soldiers. The

automation system in this defence mechanism majorly comprises face detection of a human intruder, which is supported by Ultrasonic and IR Sensors. This system is implemented using an Arduino microcontroller, which will be complemented with NodeMCU to provide required wireless communication for sending intruder detection and location information to the cloud, which will trigger the gun to shoot down the enemy. The use of wireless communication over GSM is preferred, because the control stations receive Wi-Fi signals directly from the satellite, which is very reliable and fast. The main objective of our research work is to ensure safeguarding the border region around remote areas, where patrolling is difficult for army personnel and will be implemented by the armed forces.

[4] The main objective of this paperwork was to implement a multi-functional army robot consisting of different sensors. The proposed system consists of a wireless camera for serving the purpose of live video streaming surveillance and a colour sensor which is used as a part of camouflaging feature. In the proposed model, cloud based IoT interface with the Blynk app and Wi-Fi module are used for retrieving, storing and recovering information to increase and improve the range of communication.

[5] This project implements the design and construction of a land mine detector that can detect metals, a gas sensor which can detect toxic gas attacks is used and the robot can be controlled wireless mode through an Android phone. A metal detector circuit interfaced to the control unit, alarms lets the user know about the suspected metal ahead. The metal detector circuit is placed on a robotic vehicle and its operation is to detect metals underneath automatically.

[6] Fire accidents are a disaster that can cause the loss of life, damage of property and permanent disability to the affected victim. They can also suffer from prolonged psychological imbalances and remain in the state of trauma. Therefore, this paper presents the development of a firefighting robot dubbed QRob that can extinguish fire, without the need for the firefighters to be exposed to unnecessary danger. QRob is designed to be compact in size than other conventional firefighting robots in order to ease small location entry for in depth reach of extinguishing fire in narrow space. QRob is also equipped with an ultrasonic sensor to avoid hitting any

obstacle and surrounding objects, while a flame sensor is interfaced for fire detection. This resulted in QRob, demonstrating capabilities of identifying the fire locations automatically and ability to extinguish fire remotely at a particular distance. QRob is programmed to find the location of fire and stop at a maximum distance of 40 cm from the fire. A human operator can monitor the actions of the robot by using a camera which connects to an Android phone or remote devices.

[7] This paper has designed the firefighting robot which searches for a fire in a small floor plan or house of specific dimension. There are two dc motors used for motions. There are three sensors used: Temperature for detecting the increase in fire, Smoke (gas) for detection of smoke and IR for detection of obstacles. Apart from increase in temperature the fire is also detected with the assistance of Smoke sensor. The fire is detected with the help of a Smoke sensor present in the system. After detecting fire by the sensor, the firefighting robot will automatically turn on the pump in order to extinguish fire catches. The IR sensor is used for detecting the obstacle in the path of the robot. So that robot can change its direction accordingly after detection. The robot is closely monitored and operated using a web server.

[8] Rescue robots are designed to help humans in search and rescue operations. Rescue robots that are controlled by an operator from a secure distance are called teleoperated robots. In this case, the operator sends command signals to the robot through a communication channel. The robot follows the commands to securely move toward the target locations and, for instance, to manipulate objects or to displace rubbles.

[9] The main objective of this paper is to design a firefighting robot which is capable of detecting the fire outbreak and extinguishes fire using an efficient water spraying system. With the advancement of technology especially in Robotics and incorporating flame sensors it is considerably possible to replace humans with robots for fighting the fire. This would improve the efficiency of firefighters and would also prevent them from risking their lives.

[10] Robots like humanoid, wheeled and armed robots are developed to perform operations such as move and place, object detection, surveillance operation, search and rescue operations. This paper proposed a manually controlled spherical robot system which is implemented using Arduino uno, Camera and Bluetooth. This spherical spy robot can be utilized in the attack and rescue operation to receive the information from the human unreachable areas while doing military services.

### 3. OVERVIEW OF THE MODEL

As per the previous references, the following are the obtained inferences:

- The sentry gun is developed in both autonomous as well as manual mode. Incorporating the servo motors, the triggering operation is performed.
- In Automation of robots, the implementation of the high resolution night vision cameras are being used, and the mechanical vehicle comprises the robotic firearm, controlled by an Android device.
- The ultrasonic sensor and the IR sensors are interfaced to the Arduino microcontroller and the NodeMCU is used to facilitate uploading the obtained data to the cloud. The control stations

receive Wi-Fi signals directly from the satellite, which is very reliable and fast.

- Cloud based IoT interface with Blynk app and Wi-Fi module are used for retrieving, storing and recovering information to increase and improve the range of communication. This serves the purposes like, real time surveillance and colour sensors are used to camouflage with the environment.
- In order to detect the land mines, the metal detectors are used, and the gas detectors are used to detect the toxic gases which are produced after an explosion. These can be controlled by an Android device.

Analyzing the above technicalities, we put forward our methodology wherein, the application of OpenCV is used as an input to take a decision to fire an intruder using Haar cascade classifiers for accurate face detection. In addition to this, we use different sensors to be in sync with actions visioned through the ESP32 camera. In order to detect the landmines, we use the metal detector. We can also incorporate sensors like gas and sound sensors in different parts of the warfield in order to know if any explosions have occurred, based on which the rescue operations can be performed.

## 4. PROPOSED METHODOLOGY

This project work is about the implementation of Computer Vision using the controls Arduino UNO board. The robot mainly focuses on Surveillance, Automated/Manual firing, Metal detection.

### 4.1 Surveillance

The robot provides the Surveillance of the war-field using the camera interfaced with the Arduino UNO which is the ESP32 camera module. This operation of Surveillance is done by the robot until it detects a face. The real time data obtained from the surveillance will be seen and be monitored from the base station.

### 4.2 Firing Action

#### 4.2.1 Manual Firing Action

- The camera does the surveillance operation until it detects any face in its range. When it detects the face, it compares with the pre-trained dataset, to determine whether the person is an invader or not. If the person is found to be an invader, the gun will be pointed at them with the help of servo motors.
- The triggering operation is done manually done from the base station. After the firing of an intruder, the servos will return back to their home position and continue with the surveillance aspect.

#### 4.2.2 Autonomous Firing Action

- When it comes to Autonomous firing, the accuracy to detect the face must be of great concern, as it can bring a threat to the human life.
- The coding related to the rotation of the gun by the servo motors must be altered.
- The servo motor performs the triggering operation.

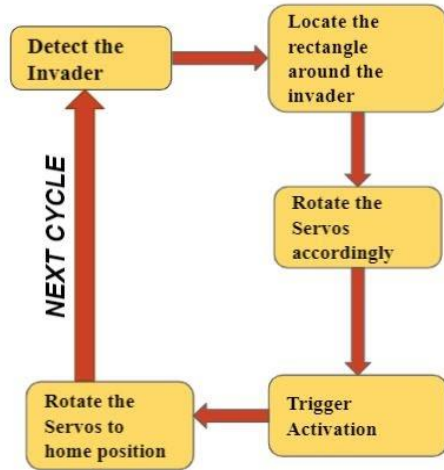


Figure 1: Functional Diagram of Firing Action

### 4.3 Metal Detection

The robot also performs the operation of metal detection, while on surveillance, if it encounters a land mine, it will notify the base station through GSM, and the location will be tracked with the help of a GPS, so that the hazardous explosions can be avoided without risking a human life.

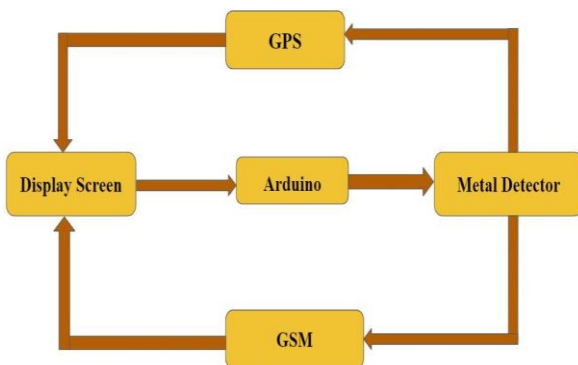


Figure 2: Functional Diagram of Metal Detection

## 5. CONCLUSION

From the above proposed methodology, an AI vision robot with the advanced capabilities of surveillance, firing, detecting landmines. The advancement of technology in the military field is increasing exponentially. The need for fully automated robots with good accuracy which performs all the actions of the soldiers is in demand. Most of the countries have initiated research on this particular domain. The implementation of new age weaponry now comes with AI embedded technologies. Defense sectors are implementing machine learning to predict and protect from intrusions. From the above factors, it can be observed that the fulfillment of automated robots with good accuracy which performs all the actions of the soldiers will be the future scope.

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