‘‘JEEVAN RAKSHA’’ FOR MILITARY GROUND ROBOT USING IOT AND ML

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Deep Learning, Face Recognition, Military Robotics and SOS alert.

Introduction:

The prior concept of this is to detect and target the living object or any movement in highly secured area such as Border by using automation. The automation is sensor base automated laser targeting system that target the living object within the range of sensor . The automatic laser targeting is primary base on PIR sensors, microcontroller and RF transmitting and receiving unit with targeting gun. Until then, border is done by Iron Spike wires, and a watch tower from which a person continuously flashing the light over the border area day and night. Those persons are fully responsible for border security. This will not fully remove the responsibility from their soldiers, but shares the maximum responsibility and will reduce human mistake on the border. The sensors will sense any obstacle within the provide range. The goal is to implement the system (model) for a particular face and distinguish it from a large number of stored faces with some real-time variations as well. This approach is preferred due to its simplicity, speed and learning capability. It gives us efficient way to find the lower dimensional space. A robot is an automatic mechanical device controlled by Raspberry pi microcontroller often resembling a human or animal, Modern robots are usually a guided by a computer program or electronic circuitry. Robots have replaced humans in performing repetitive and dangerous tasks. The use of robots in military raises ethical concerns. The possibilities of robot autonomy and potential repercussions have been addressed

in fiction and may be a realistic concern in the upcoming days. Basically, Army Robot is capable of performing tasks such as locomotion, metal detection and intruder detection. Army Robot is an autonomous robot comprising of wireless camera which can be used as a spy. One such invention of this technology is specialized robots in the field of Artificial Intelligence. The word robot means “A machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer”. These robots used in military are usually employed with the integrated system, including sensors, gripper and cameras. The main motive behind Robot is to reduce human losses in military operations or terrorist attacks.

Objectives:

- Develop a Raspberry Pi-based military robot capable of intruder detection using face recognition and engaging threats through a laser gun.
- Design an autonomous movement system with obstacle detection using UV sensors.
- Integrate landmine detection capabilities using specialized sensors to safely navigate through dangerous terrains.
- Biomedical Sensor and Environmental Sensor along with associated integrated sensors helps in detecting the Soldier’s injury, sends SOS message and opens the door for first aid kit ensuring immediate access to medical supplies.
- Provide real-time data feedback to operators through a secure communication channel.

Methodology:

The techniques used in methodology are:

- **Hardware Setup:** Begin by assembling the hardware components. Attach a Raspberry Pi board to the robot chassis, connect a high-quality camera module for surveillance, and Detects Soldier’s injury, sends SOS message and opens the door for first aid kit ensuring immediate access to medical supplies.

- **Power Supply:** Choose a robust power supply system for the Raspberry Pi robot. Consider using rechargeable batteries that provide sufficient power to support

continuous operation in the field. Implement power management mechanisms to optimize energy consumption.

- **Camera Integration:** Configure the camera module to capture high-resolution images or video feeds. Set up the necessary libraries and software to enable real-time streaming of the surveillance footage to a central processing unit on the Raspberry Pi.

- **Sensor Data Acquisition:** Implement code to read Ultrasonic and IR sensors. Ensure accurate readings and consider calibrating the sensors for optimal performance. Establish a data logging mechanism to store historical health data for each soldier.

- **ML Model Integration:** Develop or employ a pre-trained machine learning model capable for detecting soldier injuries, sends SOS message and automatically opens the door for quick access to medical supplies. Integrate this model into the Raspberry Pi system, ensuring it can process the real-time data from the sensors.

- **Communication Setup:** Implement a communication system to send data to a central server or cloud platform. Utilize protocols such as MQTT or HTTP for secure and efficient data transmission. Set up a reliable network connection to ensure continuous communication, even in challenging environments.

- **Emergency Alert System:** Design an emergency alert system that can be triggered based on predefined health thresholds or manual activation. Include GPS modules to retrieve the robot's location and embed this information in the alert message. Utilize messaging services or satellite communication for reliable transmission of alerts.

The Figure 1 and Figure 2 represented below determines the components used in Military Robot and the Implementation of Military Robot respectively

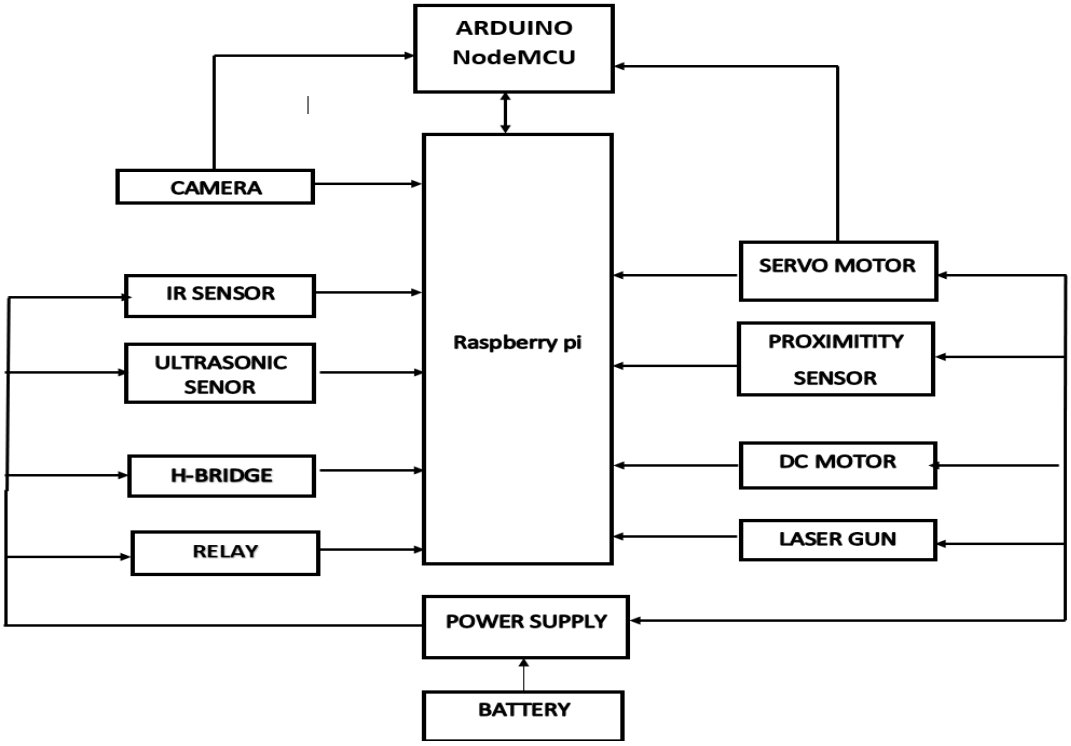

Figure 1: Block Diagram of Military Robot

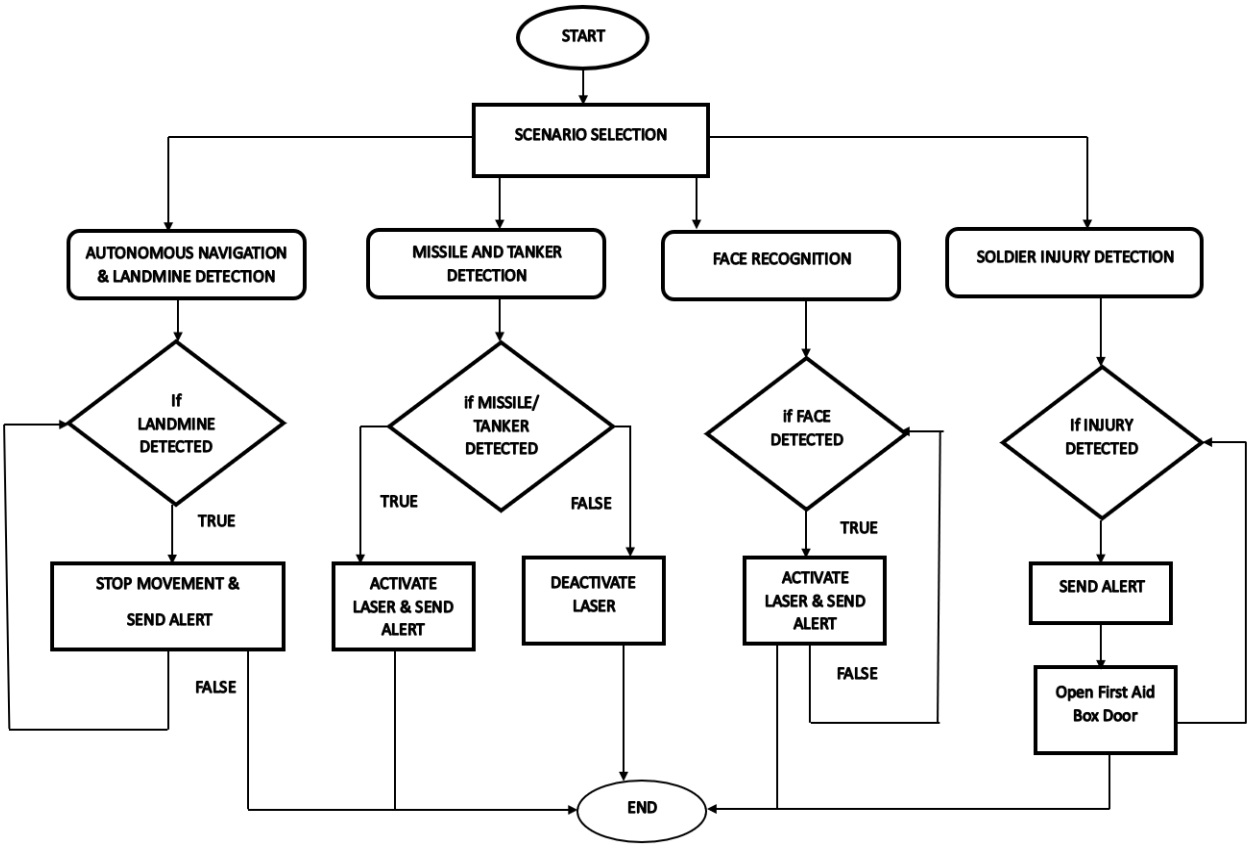

Figure 2: Flow Chart of Military Robot

Results and Conclusion:

- **Model Outcomes:**

Figure 3: Final Model Outlook

- **LANDMINE DETECTION:** When a landmine is detected by the sensor, its location is determined using GPS. An alert message containing the detection details and precise location is immediately sent to the base station for further action.

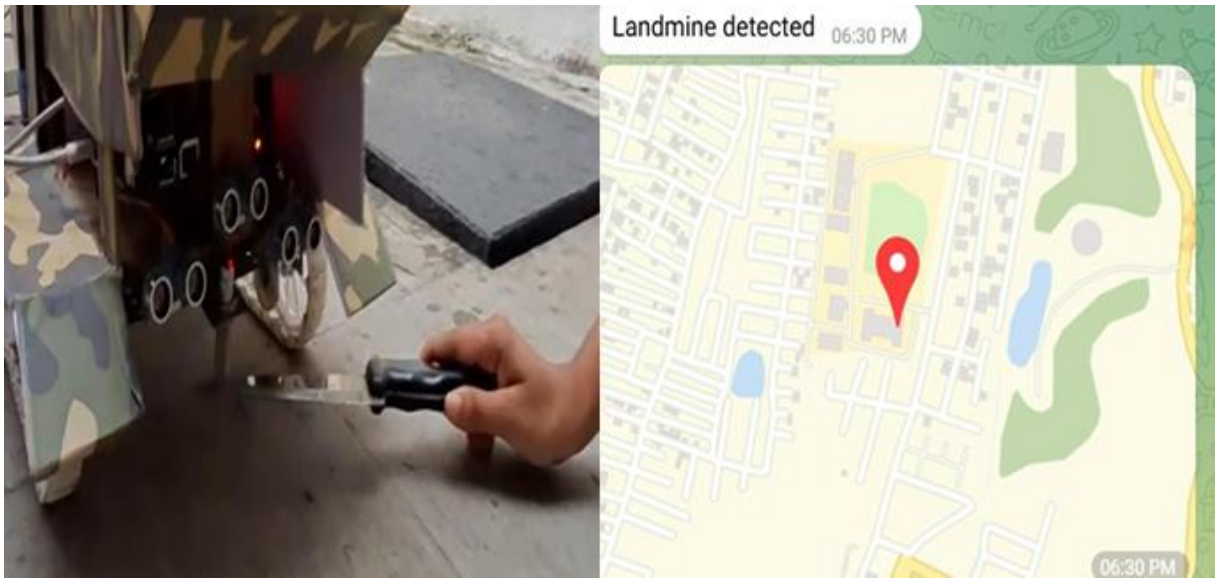

Figure 4: Landmine Detection

- **FACE RECOGNITION:** The robot achieved in detecting and distinguishing between known personnel (authorized soldiers) and intruders (unknown individuals) using a pre-trained face recognition model. On detecting an unknown face, the robot activated its alert system, notifying the command centre in real-time.

- **MISSILE & TANKER DETECTION:** When a missile or tanker is detected by the camera, it processes the image to classify the threat, and the laser gun is precisely aligned to target it. Simultaneously, an alert message with critical details and visual confirmation is sent to the base station for further action.

Figure 5: Tanker and Missile Detection

- **SOLDIER INJURY DETECTION:** Detects the soldier injuries through camera. On detecting an injury, the robot: Sent an SOS alert with the soldier's location to the command centre. Opened its first aid kit compartment, ensuring immediate access to medical supplies.

Figure 6: Soldier Injury Detection

In **conclusion**, a serious problem that has arisen in this century is attacks and smuggling. Due to improper and less security near border area. It is a major challenge on our part to project to detect these smugglers, intruders, terrorists and other illegal activities breaking the security. Since the border area is so large that effective patrolling is not possible and it require a very large amount of manpower, there has to be some kind of security system which can effectively provide more security.

The border area is so large that effective patrolling is not possible and it require a very large amount of manpower, so this kind of security system which can effectively provide more security. In future the system can be implemented using face recognition, so that the system will work more efficiently.

Henceforth, by enhancing the capabilities of these technologies and integrating them, we hope to introduce the 'Motion Detection' system and to contribute to the current security system. This system would be an alternative for expensive security systems being used in the present day. This system does not require any special modifications to the infrastructure where installation is required and can be implemented without any hassle.

Project Outcome & Industry Relevance:

The "Jeevan Raksha" project delivers a multi-functional military ground robot integrating IoT and machine learning to enhance safety and efficiency in military operations. It demonstrates practical applications such as real-time face recognition for intruder detection, autonomous navigation via obstacle and landmine detection, and a health-monitoring system that sends SOS alerts and opens access to medical kits. This robot significantly reduces the risk to soldiers in hazardous environments by automating reconnaissance, threat engagement, and emergency response tasks. It is highly relevant to the defense industry, where unmanned ground vehicles (UGVs) are increasingly used for surveillance, search and rescue, and combat support. The project exemplifies how low-cost, scalable robotics integrated with AI can contribute to border security and battlefield assistance. Furthermore, the use of Raspberry Pi and ML models makes the solution practical for edge computing applications, making it suitable for deployment in remote and resource-constrained areas. This prototype can be extended for use in disaster zones, law enforcement, and hazardous industrial inspections.

Working Model vs. Simulation/Study:

The project involved the development of a physical working model. The team successfully built and tested a functional military robot integrating hardware components such as Raspberry Pi, ultrasonic sensors, laser module, camera, servo motors, and various sensors for navigation and threat detection.

Project Outcomes and Learnings:

The key outcome resulted in the successful integration of IoT and machine learning to build an autonomous ground robot capable of real-time face recognition using CNN and YOLO for authorized personnel detection, effective obstacle and landmine detection through ultrasonic and IR sensors, an SOS alert system triggered by injury detection with GPS-enabled location sharing, and both remote control and autonomous navigation capabilities.

Through this, we gained in-depth knowledge of embedded systems, sensor integration, and power management, along with hands-on experience in deploying machine

learning models on edge devices like Raspberry Pi. We also tackled challenges in hardware-software interfacing and real-time data communication, while developing a deeper understanding of the ethical and practical implications of deploying autonomous military robots. Additionally, the project enhanced skills in team collaboration, project management, and iterative prototyping in a real-world engineering context.

Future Scope:

The future scope of this project includes:

- **Enhanced Features and Functionalities:** Integrate map creation capabilities to allow the robot to navigate back to its source location. Implement night vision mode and enable live video streaming for real-time surveillance. Develop a power management system to activate sleep mode when the robot is idle.

- **Improved Computational Performance:** Upgrade the robot with high-end processors like NVIDIA Jetson and Intel i7/i9 to enable faster and more accurate data processing. These advanced processors will enhance real-time object detection, facial recognition, and complex decision-making tasks, improving the robot's overall efficiency and responsiveness in critical situations.

- **Brain-Machine Integration (BMI):** Evolve the system with non-invasive Brain-Machine Integration, enabling direct communication between the robot and the human brain. This advancement would allow intuitive, real-time control of the robot based on neural signals, enhancing autonomous operations and human-robot interaction.