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# Wireless Multifunctional Robot with Camouflage for Military Applications

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**ABSTRACT:** A modern approach for surveillance at remote and border areas using multifunctional robot based on current IOT technology used in defense and military applications. This robotic vehicle has ability to substitute the solider at border areas to provide surveillance. The robotic vehicle works both as autonomous and manually controlled vehicle using internet as communication medium. This multisensory robot used to detect human, bombs, harmful gases, and fire at remote and war field areas. Conventionally, wireless security robot is obsolete due to limited frequency range and limited manual control. These limitations are surmounted by using IOT technology which has limitless range. It can eliminate the need of deploying humans at hostile conditions at all the times. Moreover, in case if something suspicious is detected by the system, it must be able to take the necessary decisions and hence actions along with issuing alert messages for the human controllers. This robotic vehicle is designed for reconnaissance as well as surveillance under certain circumstances.

**KEYWORDS:** CNN algorithm, Multifunctional, Reconnaissance and Surveillance.

## I. INTRODUCTION

The main objective of our project is Ensuring security across border region is considered as an important aspect for any country. It provides protection to the country at the same time it incurs huge expenses for a country. Many systems are developed by researchers to provide a solution for efficient monitoring of borders. A mechanized robot controlled by embedded system is reported. This system employs a group of sensors and a web camera; data from these sensors transmitted wirelessly to a mobile application. The robot consists of a laser machine gun and camera to facilitate determination of targets and use Wi-Fi enabled communication between the robot and the user. Metal, smoke and fire sensors transmit the information. A camouflage system that uses a web camera that can detect the surrounding colors and change the color of the robot is also discussed in this section. The mobile application is responsible for controlling the motion of the robot and also to control the laser gun. The location of the robot is also sent to the mobile app.

## II. LITERATURE SURVEY

This section presents the existing methods and relevant approaches which are surveyed as follows.

D Arjun; P K Indukala ; K A UnnikrishnaMenon [1] The performance of various WSN nodes is compared and tabulated. Also, different WSN based human intruder detection systems have been discussed. Different scenarios for detecting human intrusion occurring on the flat border areas, dry leaves, and river/pond crossings are considered.

Ekra Bin Syed Mojib ; A.K.M. BahalulHaque ; Md. NafisRaihan ; Mahbubur Rahman ; Fahad Bin Alam [2] Proposed an idea to make border security more vigilant and active. As quadcopters fly in the sky and record everything with a wide-angle, it becomes easy to watch an extensive area with one drone. Along with the help of machine learning, we can easily detect the intrusion (human & another animal) from the video captured by the drone.

Ross S. Eaton; Stan German; ArjunaBalasuriya [3] Described the SPUDDS concept for enhancing maritime situational awareness and security through the persistent visual monitoring of our maritime borders. Given the expected detection range of each SPUDDS buoy, the entire U.S. coast could be monitored with just a few hundred buoys, and each buoy automatically performs ship detection locally, eliminating the need for large teams to monitor mostly uneventful video feeds.

S. Ren, K. He, R. Girshick, and J. Sun [4] Presented RPNs for efficient and accurate region proposal generation. Enables a unified, deep- learning-based object detection system to run at 5-17fps.
Arunpreet Kaur, Dilip Kumar [5] This paper presents a modern approach for surveillance at remote and border areas using multifunctional robot based on current 3G technology used in defense and military applications. This paper also illustrates the

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experimental results of tilt angle selection of solar panel and power consumption in automatic and manual mode. This robotic vehicle is designed for reconnaissance as well as surveillance under certain circumstances.

E Amareswar, G Shiva Sai Kumar Goud, K R Maheshwari, E Akhil, S Aashraya, T Naveen [6] It has proven to allow for meaningful two-way communication between the Android phone and the robot. The Multi-Purpose Military Service Robot has been designed in such a way that it can fulfill the needs of the military, the police and armed forces. It has countless applications and can be used in different environments and scenarios. For instance, at one place it can be used by the armed forces, military purposes, while at another instance it can be used for spy purposes.

Minal S. Ghute, Kanchan P.Kamble, Mridul Korde[7] Robot was built by keeping military applications in mind. So it comes with basic video surveillance and metal detection so that it can detect underground landmines etc. Further extensions can be made in the same projects such as home automation, telemedicine system.

Dr. Shreedhar A Joshi.[8] Employing the embedded technology and based on microcontroller interface using Wireless Sensor Network paradigm the proposed HAS design has been successfully implemented. The proposed work is a perfect example of low cost, rugged, flexible, reliable and wireless solution to the home/office automation. The prime objective of this design is to use the Smartphone to control the home appliances effectively. The intruder motion data, light and door lock data is continuously monitored. The user will get the alerts about the appliance's conditions and any kind of home intrusion detection.

Rakshana Mohamed Ismail, Senthil Muthukumaraswamy, A. Sasikala [9] The prototype is a semi-autonomous, battery-operated military support and rescue robot, developed to eliminate all the key weaknesses in the existing models and to build an all-in-one robot developed to work with maximum efficiency. From the results and discussion, the proposed system overcomes the weakness of the existing systems and proves to aid better in military operations.

R. M. Ismail, S. Muthukumaraswamy and A. Sasikala [10] The proposed work is a perfect example of low cost, rugged, flexible, reliable and wireless solution to the home/office automation. The prime objective of this design is to use the Smartphone to control the home appliances effectively.

## III. SYSTEM ARCHITECTURE AND DESIGN

*A. System Design*

In this section, we will discuss the Architectural System design of our proposed system and Description of the various modules involved. Module and their descriptions are listed below:

1. *Face Detection Module*- This module detects the presence of the user, crops their face, converts to grayscale, and saves the image to the dataset. We use the classifier using CNN built into Arduino ide to perform this operation.
2. *Training and Classification Module*- We use images to train a generalized model for emotion detection. We split the obtained dataset into training and classification sets.
3. *Emotion Detection Module*- Our customized model is now deployed to identify the emotion of the user through the real time camera feed. The user's facial expression is determined by the emotion detection module.

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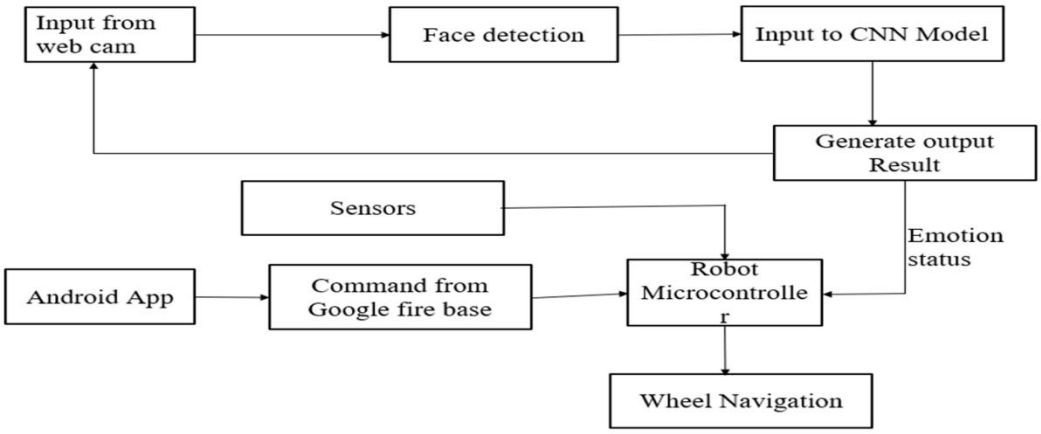


4. ESP32 Microcontroller -The ESP32 has both Wi-Fi and Bluetooth capabilities, which make it an all-rounded chip for the development of IoT projects and embedded systems in general. The ESP32 works with the Arduino IDE with the installation of the ESP32-Arduino Core and the integration between these two is remarkable.
5. Sensor Module – Metal detector Inductive proximity sensors can only detect metal targets. This Flame Sensor Module is used to detect fire/flame source or other light sources of the wavelength in the range of 760nm – 1100 nm. Smoke Gas Sensor Detector Module is useful for gas leakage detection. Due to its high sensitivity and fast response time, measurements can be taken as soon as possible.

## IV. PROPOSED ALGORITHMS

As we have discussed earlier our system includes various modules and functionalities. For the efficient working of the system, a tight integration is required between the different functional modules. This section presents the algorithms used within each module to achieve the respective specific subtask.

*a. CNN Algorithm*

PURPOSE: Prediction of Suspicious Behavior INPUT: Image obtained from Har Cascade dataset
OUTPUT: Classifies whether he is suspicious or normal behavior.

Below is the sequence of steps used to build CNN Model

*start*
Step1: Import Libraries
Step2: Create the model
Step3: Train the model
Step4: Start the web cam feed
Step5: Identify the face using the Har Cascade
Step6: Resize the face into 48x48 and is passed as input to the CNN
Step7: The network outputs as list of soft max scores

Step8: The emotion with maximum score is displayed.
*End*

## V. APPLICATIONS

The applications of the proposed system are as follows:

1. Can be used as low range mobile surveillance devices.
2. Can be used in Military applications (no human intervention).
3. Can be used in home automation, Human detection.

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4. Can be used in accessing remote places which are inaccessible for humans.
5. Can be used in spy robot, border security.

## VI. RESULTS

The results chapter or section simply and objectively reports what you found, without speculating on why you found these results. The discussion interprets the meaning of the results, puts them in context, and explains why they matter. In qualitative research, results and discussion are sometimes combined. The results and snapshots help in easily understand the working of the model and the user interfaces in detail.

A test report is an organized summary of testing objectives, activities, and results. Once our deep learning model is built (with your training data), we need unseen data to test our model. This data is called testing data, and we can use it to evaluate the performance and progress of our algorithms' training and adjust or optimize it for improved results.

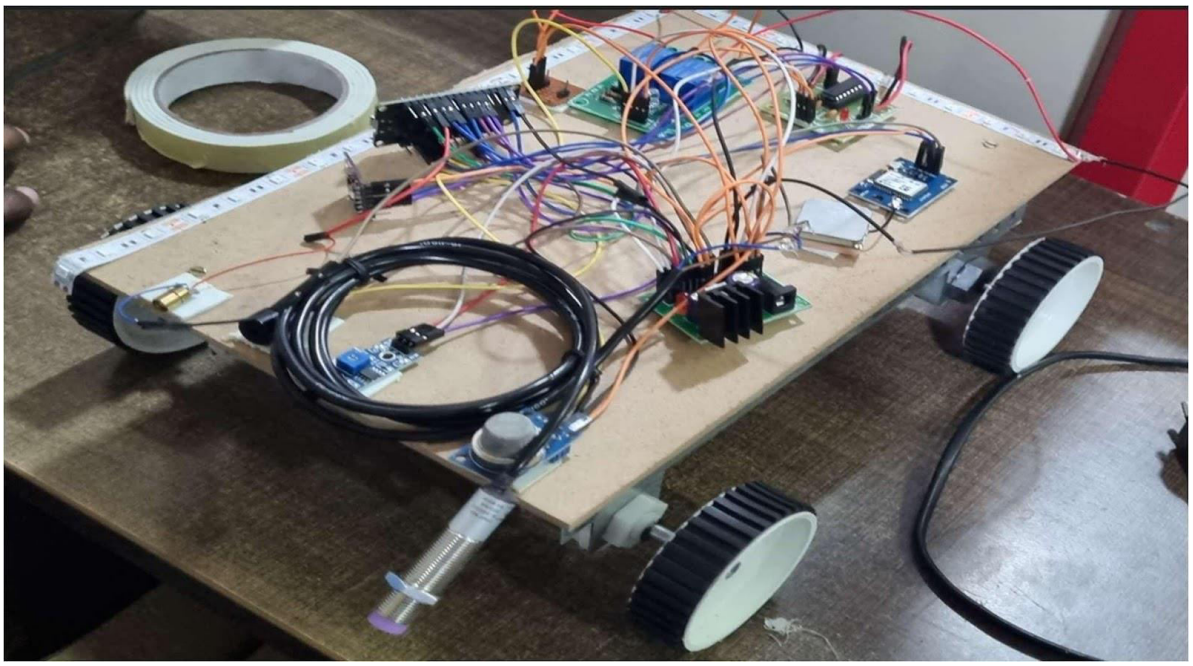

**Fig 1. Robot Model**

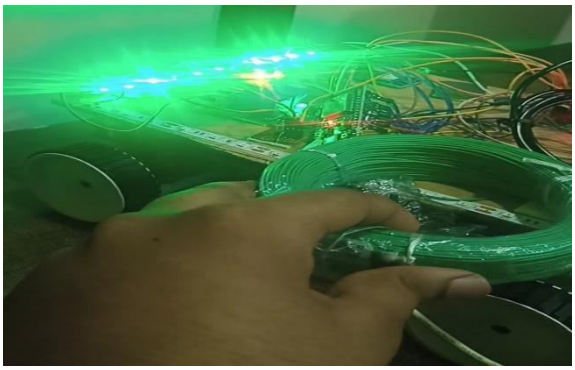

**Fig 2. Camouflage Robot**

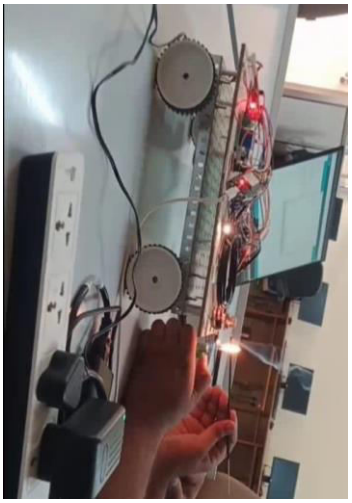

**Fig 3. Smoke and fire detection**

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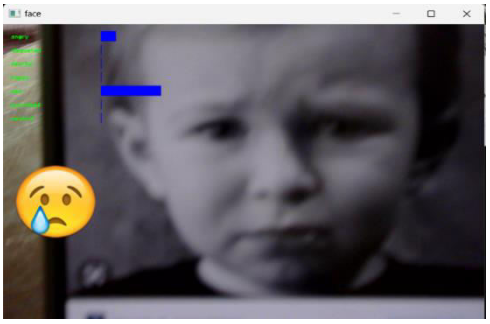

Fig 4. Sad face detection

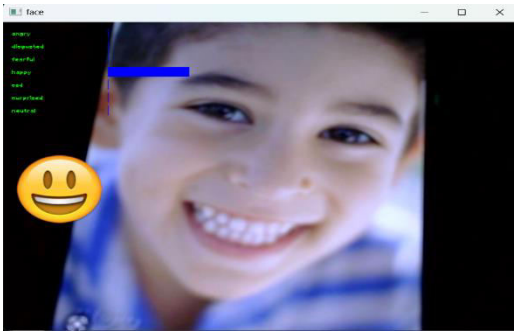

Fig 5. Happy face detection

Fig 6. Surprised face detection

## VII. CONCLUSION AND FUTURE WORK

Camouflage Robot plays a vital role in saving human loses as well as the damages that occur during disasters. Thus, it will gain more importance in the upcoming era. The robot basically consists of a vehicle mounted with camera which captures the images and detects color accordingly as part of camouflaging feature. One of the most emergent research is suspicious behavior monitoring in video surveillance. Facial expressions play a significant role in social communication since they convey a lot of information about people, such as moods, emotions, and other things.

Future implementation would be Implementation of the real time camouflage feature to the proposed robot design and to give a feature of autonomy to the proposed design of the robot. Target is acquired in better accuracy using finer quality and more precise position sensing devices. Observation and firing platforms are enabled by wireless data transfer to and from the control station and needs to be separated by greater distances.

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