IOT BASED CAMOUFLAGE ROBOT

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*Abstract :*The most primitive and natural method for avoiding detection is camouflaging, exhibited by many flora and fauna. Implementing this concept in the field of robotics is the main objective of this paper. The use of a multifunctional army robot associated with various sensors is discussed. The use of LEDs and colour sensor plays a vital role for camouflaging. A cloud based IOT interface with Blynk app and WiFi module is used for retrieving, storing and recovering information. Applications of various sensors for detecting parameters are discussed. The usage of wireless camera for live streaming surveillance is also featured in this paper. The various methods discussed are used to design an efficient camouflaged combat robot that serves numerous purposes.

***IndexTerms* -WiFi, AdaBoost,IOT**

I. INTRODUCTION

Over millions of years, natural evolution of living creatures has evident reports with very high adaptive environment blending capability. Some of them being, salamanders, snakes, cockroaches, cuttlefish, golden tortoise, beetle, north pacific giant octopus, chameleons and so on. These gave rise as solutions to traditional problems pertaining locomotion, mechanism design and perception. To accomplish these techniques in real time, camouflage technology can be employed. The camouflage problem is defined as concealing a 2D object located between an observer and a background scene/screen which may be static or dynamic. Active camouflage or adaptive camouflage is a method that adapts, often rapidly, to the surroundings of an object. In theory, active camouflage could provide perfect concealment from visual detection. With the advancement of technology in various domains especially in military, the application of camouflage for infiltration and for primitive security measures to protect the border from the trespassers has played a prominent role. Some organizations working in risky inaccessible areas take the help of robot which are otherwise not feasible by human efforts. The robotic technology has entered into many domains in which they can interact and cooperate closely with human beings; they can incorporate additional features such as autonomy and robustness, through building of a versatile perception and recording various parameters using a multi-sensor platform. The interfacing module is accomplished by using IOT (Internet Of Things) which allows objects to be sensed remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world. The main aim of the paper is to implement a Camouflaged technology based Wireless multifunctional Army Robot which can be controlled through Blynk application using WiFi module.

II. METHODOLOGY

The paper [1] describes about BAE Systems announcing Adaptive infrared camouflage technology. It uses about 1000 hexagonal panels to cover the sides of a tank. The panels are rapidly heated and cooled to match either the temperature of the vehicle's surroundings, or one of the objects in the thermal cloaking system's "library" such as a truck, car or large rock. Stealth technology also termed LO technology (low observable technology) is a sub-discipline of military tactics and passive electronic countermeasures, which cover a range of techniques used with personnel, aircraft, ships, submarines, missiles and satellites to make them less visible (ideally invisible) to radar, infrared, sonar and other detection methods. To achieve the feat of 'cloaking' an object, they have developed a material known as meta materials, some of which can bend electromagnetic radiation, such as light, around an object, giving the appearance that is not there.

The paper [2] proposes bio-inspiration work based on chromatic behavior change with respect to multiple predators. Here the robot exhibits similar concept of showcasing difference in color response on detecting multiple predators. Dwarf chameleons alter their detection ability by encompassing difference in its exposure values with that of the surroundings. The exposure values are said to be maximum detectable on encountering species of their own kind and minimum detectable on encountering its predators. A simple example to this can be noticed by the camouflage feature of a chameleon exhibiting a brighter exposure contrast as stealth in presence of a snake and a lower exposure in presence of a bird respectively. These chromatic behavioral changes are incorporated to our cylindrical based prototype which basically involves many stages as described further. The robot can be controlled automatically or by tele-operation. In the tele-operation the controlling is done mobile device noticing the changes through a visual streaming camera onboard. The robot is initially free to roam; if and only if it encounters a hostile or friendly agents the next phase starts. Here in the next phase on detecting its predators it changes itself to a significant color and also is programmed to remain still in stealth for exhibiting effective camouflaging. If the robot encounters species of its own then it changes to a detectable color. Here the color changing is exhibited based on the visual characteristics of the surrounding terrain.

The paper [3] describes about the basic functionalities that takes place in the following phases- [i] Kinect camera at the back of LCD, captures the BG scene of the camouflage object and then sends the captured images to the computer for real time processing. [ii] Kinect camera mounted on the display, tracks the observer's eyes and his skeleton, and then sends the 3D location of his eyes in real time. [iii] The occluded region behind the object depends on its size and its location with respect to the location of the observer's eyes, i.e. LCD that covers the camouflaged object. [iv] The computer processes the RGB and depth images received from back camera and the tracking information from front camera, which are the tracking status, face features, 2D tracked points, 3D tracked head joint point, and head pose (pitch, roll, and yaw, with working range of 20° ,90°, 45° respectively). [v] The camouflaged image with appropriate scale and location sends to the LCD display.

The paper [4] is concerned with the development of a cognitive robot-ant for inspection of real environments such as riverside, seaside, river/channel orifices, canalization vicinity, etc. The primary task of the robot is to acquire data on the condition of the ecology system and to do some simple cleaning tasks. The robot is provided with on board cameras and a wide array of different specialized sensors. The data and images are sent to the corresponding supervision centre. Here they are processed and connected to geographical information which is collected from a web of sources. Hence initiating the operation of the robot. The robot navigates autonomously, following the high-level instructions obtained from the surveillance centre. It is off-the-shelf, robust wheel-based robot capable of operating on regular as well as irregular terrains. The robot has following modules: (i) versatile perception (ii) artificial brain (intelligence) (iii) locomotion system (iv) arm(s). Heterogeneous system consists of sensors for detection (such as LIDAR, GPS), Visual sensors and non visual perception sensors. TCP/IP communication with the remote surveillance centre enabled over GPRS/EDGE/3G services is used.

The paper [5] deals with a webcam which is used for receiving images and sending them to the notebook or a computer with a central processing unit which is used to display images. A router wireless LAN on the automatic robot is used for transmitting the image data to display on the notebook. Four Motors are utilized for driving four wheels of the automatic robot controlled by relay circuits. They receive signals from infrared sensor circuits which are used for detecting objects and sending signals through the relay circuits to the notebook. Strength of the transmitted signals on the air is measured in terms of distances depending on the received data. Delay time of transmitting and receiving images is considered from the robot to display on the notebook. Distances of the detected signals can be received from four infrared sensors which are displayed on screen. The automatic robot testing will be tested in three patterns of obstacles.

The paper [6] describes about an intelligent detection process which is divided into two phases: Learning phase including in the offline process and Test phase which is a part of the online process. The former includes the preparation of the database files. SIFT and HOG features are the inputs of the AdaBoost algorithm learning and the decision person or not are the output of the network. The second phase of our human detection algorithm identifies if humans exist in the extracted image and where they are in the video sequences. For that AdaBoost is trained to recognize the shape of a human. The trained AdaBoost is then used to identify which of the connected components are human or not. The main advantages of this method are its high speed and performance. It is based on the combination of several weak classifiers which, in average, have a moderate precision and create a strong classifier. The AdaBoost provides both learning and classification operators. In order to implement both algorithms, we have used GML AdaBoost Matlab Toolbox 1 with AdaBoost algorithm implementation. The detection of people is done by sliding a search window through the frame image and checking whether an image region at a certain location is classified as human or non-human. The system can detect standing individuals at different positions, orientations, and with different backgrounds.

The paper [7] describes about the technique for object detection in two sections: (1) Scanning & filtering algorithm (2) Object detection algorithm. The different stages of operation include colour based image thresholding, scanning and filtering, object detection, segmentation and saving to the data base. Image thresholding in an image is converting an RGB scale to binary or BW Scale. The proposed object scanning and filtering algorithm can identify the objects distinctly from each other, irrespective of shape and size. Here the object identification does not affect the system accuracy even when the image background is complex. Window based image scanning is chosen to identify the indexes of non-zero values and the windows having more than 50 percent of non-zero values are only considered for object detection. This condition in scanning, inherently acts as a noise filter. The proposed algorithm for object detection needs no prior information of size or shape of the object. Object detection algorithm figures out the boundaries of the objects by scanning non-zero values.

The paper 8] explains the concept of cloud, which majorly provides interconnection between virtual computers facilitating resources. It also has a private cloud providing IaaS using open stack method. With this it uses Amazon configuration settings for storage at cloud which can be altered in real time. Here Amazon web services are used for different applications to communicate. When the system is turned on, camera starts recording and at real time the data is sent to cloud by using a Wi-Fi adapter, where the communication from the module to the cloud takes place. This can be depicted as a server-client based operational model. Based on the IP address, streaming can be done from any part of the world by operating on the web page.

In paper [9] The segmentation technique used here is motivated by the observation that for most of the domains of interest here changes in illumination lead to small changes in colour value and that these changes are relatively uniform across all colours. So, with modern cameras with automatic shutters and gain control red pixels may vary in colour but will stay in the same region of colour space. The different methods used for colour recognition are: (1) Pixel Classification : To label pixels according to which symbolic class they belong to, we use a soft-labeling scheme followed by a hard decision based on adaptive thresholds. The pixel is assigned to the highest priority colour class for which its likelihood is above the threshold for that colour class. (2) Threshold Adaptation: A histogram based approach is used to adapt the threshold from frame to frame. the key assumption here is that pixels in the image are drawn from two different underlying distributions: pixels that belong to the colour class of interest and pixels that do not. The key assumption translates to a histogram of likelihood values consisting of two, clearly distinguishable Gaussian peaks centered around likelihood values of 1, and 0, respectively. The peak with the highest likelihood value corresponds to the pixels of interest. (3) Region Extraction: Once the image has been segmented, regions of similarly labeled pixels are found using connected component analysis. CM Vision provides fast connected components using a combination of run length encoding and run conglomeration.(4) Object Recognition : Once an image has been segmented and colored regions extracted, high-level vision must attempt to detect and recognize relevant objects in the image if any are present.

In paper [10] SAR is used as imaging radar. SAR is a kind of high-resolution microwave imaging radar. Due to its all-weather, day/night, and penetration capability, airborne and spaceborne SAR is now widely used in target recognition. Passive ground camouflage target which include camouflage tank, camouflage armored vehicle and camouflage aircraft is a simple and effective approach. The different techniques used for target recognition in SAR radar is as follows: (1) Image segmentation. (2) Feature extraction of SAR images. (3) K-means algorithm. In image segmentations there are many sub methods to segment the obtained image. They are: (1) Image binarization. (2) Canny edge detection. There are two ways in feature extraction as well. They are: (1) Gray feature extraction. (2) Texture feature extraction. All the above techniques are used to recognise the target from the images obtained from SAR radars

III. CONCLUSION

The human detecting robot is highly favourable on circumstances where it's impossible for human beings to reach or monitor during unfortunate events. The implementation of this design is purely driven by usage of PIR sensors, IR sensors, Dc motors and cameras etc. Overall, this robot is a highly functional device that reduces the strain on humans during calamities. The camouflage robot system provides a helping hand to our security forces in detection of intruders. The robot can also be used in high altitude areas where human cannot survive. Moreover, the camouflaging feature makes it difficult to detect the robot by naked human eye. There is scope to improve the system by configuring it with multi-colour camouflaging.

REFERENCES

[1] Akash Ravindran, Akshay Premkumar, "CAMOUFLAGE TECHNOLOGY", Department of Electronics & Communication Engineering, IJETCSE, 2014.

[2] K. S. Kumar, M. R. Elara, E. A. Martinez and R. C. Ambrosio, "Designing and experimenting bio-inspired chromatic behaviours in surveillance robot," 2015 10th International Conference on Information, Communications and Signal Processing (ICICS), Singapore, 2015.

[3] A. M. Siddek, "Depth-level based camouflaging using RGB-D sensor," 2017 IEEE International Conference on Systems, Man, and Cybernetics (SMC), Banff, AB, pp. 2349-2354, 2017.

[4] A. Rodic, D. Katie and G. Mester, "Ambient intelligent robot-sensor networks for environmental surveillance and remote sensing," 7th International Symposium on Intelligent Systems and Informatics, Subotica, 2009, pp. 39-44, 2009.

[5] A. Leelasantitham and P. Chaiprapa, "A study of performances on an automatic IEEE 802.11g wireless-standard robot using infrared sensors," 2008 IEEE International Conference on Robotics and Biomimetics, Bangkok, pp. 1556-1560, 2009.

[6] B. Ammar, N. Rokbani and A. M. Alimi, "Learning system for standing human detection," 2011 IEEE International Conference on Computer Science and Automation Engineering, Shanghai, pp. 300-304, 2011.

[7] A. Alexander and M. M. Dharmana, "Object detection algorithm for segregating similar coloured objects and database formation," 2017 International Conference on Circuit, Power and Computing Technologies (ICCPCT), Kollam, pp. 1-5, 2017.

[8] N. Oza and N. B. Gohil, "Implementation of cloud based live streaming for surveillance," 2016 International Conference on Communication and Signal Processing (ICCSP), Melmaruvathur, pp. 0996-0998, 2016.

[9] Brett Browning and Manuela Veloso "Real-Time, Adaptive Colour-based Robot Vision" August 2005, Conf.loc. Edmonton, Alta., Canada, 2005.

[10] Minling Huang, Weiji Xia, Linlin Huang, Ying Zhou, Yanjun Pan, "Passive Ground Camouflage Target Recognition based on Gray Feature and Texture Feature In SAR Images" October 2016 Conf.loc: Guangzhou, China, 2016.

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