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REVOLUTIONIZING BATTLEFIELD INTELLIGENCE BY QUAD ROBOT: A SURVEY

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Abstract: This survey paper explores the integration of diverse technologies in the development of a Quad Robot for Revolutionizing Battlefield Intelligence in limited zones. In modern warfare, obtaining accurate and timely intelligence is crucial for strategic decision-making and operational success. Quad robots, equipped with advanced sensing technologies are poised to revolutionize battlefield intelligence gathering. These autonomous or remotely controlled machines have the capability to infiltrate enemy territory, gather data on enemy positions, movements, and intentions, and relay real-time information to military commanders. This paper examines the technological advancements like Wireless Communication, operational implications by using real-time footages, and ethical considerations associated with the integration of quad robots into military intelligence operations, highlighting their potential to demonstrate future of warfare. We shall review recent research in this paper.

***Keywords* - Quad Robot, Revolutionize battlefield, Wireless communication, Real-time footages**.

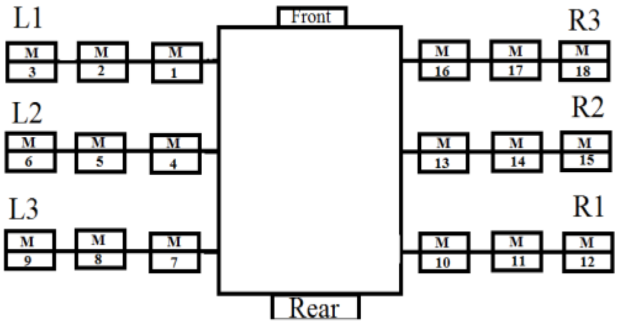
I. INTRODUCTION

In the constantly changing environment of warfare, the quest for superior intelligence has remained paramount. From ancient scouts to modern reconnaissance aircraft, the gathering of battlefield information has been instrumental in shaping military strategies and outcomes. Today, amidst the technological revolution of the 21st century, a new frontier emerges the integration of spy robots into the theater of war. In the evolving landscape of science and technology, robots have emerged as versatile entities able to carry out preprogrammed or independent tasks. Robotics are being used in more and more industrial and daily applications because of their speed and cost effectiveness. A robot is an electromechanical device that can do activities on its own or according to a preprogramme. In addition to operating autonomously, robots can also be controlled by a computer program, such as by an operator [3]. "Revolutionizing battlefield intelligence by Quad robot" stands at the forefront of this paradigm shift, promising unprecedented levels of situational awareness, agility, and precision. These autonomous machines, equipped with modern sensors, emerging artificial intelligence algorithms, and cutting-edge communication systems, are poised to reframe the dynamics of modern warfare. Bidirectional Communication Control Architecture that makes it possible to create a two-way communication between human and robot, in order to ensure greater efficiency during the demonstration of HRC tasks [4]. The commands that are sent to control different appliances and devices of a robot that are connected to the platform can be controlled with the help of GSM module. The entire control system works on GSM technology that can control the device effectively from remote location to desired location [5]. The operative robot depends on DTMF innovation to cover long reach. In recent days remote cameras are playing a very significant part in security issues. the obtained images, and identification is been done. We can use two feature extraction algorithms, principal component analysis (PCA) and convolutional neural network(CNN) [8]. We shall review recent research in this paper.

II. RELATED WORKS

[1] From the 3rd paper, we can get to know about Gait Recognition Algorithm which gives usknowledge about locomotion of the Spider robot.

Here they have used TKSPIDER1 spider robot which has 6 legs and they have performed few motion by using Gait Recognition Algorithm. A Gait walking algorithm is a computational method used to analyze and interpret human or animal locomotion patterns. These algorithms typically involve the detection and tracking of key points or features on the body, such as joints or limbs, to understand the biomechanics of walking or running as shown in **Figure 1**. Four distinct TKSPIDER1 robot coded gaits are used in this. These algorithms, which include the explorer, tripod, biped, and wave gaits, were created in response to shifting



environmental conditions. The robot has moved in four directions: forward, backward, right, and left.

Fig 1: Leg Scheme of TKSPIDER1

Here, in this robot they have used 3 Servo motor for each leg, and the motion is supported by the motors. Walking algorithm's gait patterns are depicted in the **Figure 2a**. TKSPIDER1's movements are described in brief black lines.

Wave gait: five legs are in the stance phase and only one leg is in the swing phase at a time. Robotic locomotion involves the sequential movement of the legs to the next phase and simultaneous propulsion of the main body. Until the next following command, the cycle is continued as shown in **Figure 2b**.

Tripod gait: a group of three legs that alternate between the swing and stance phases while moving in opposition to the other three legs. Three legs alternate between the swing and stance stages in the tripod, locating all four legs through double motions at the subsequent phase. Tripod gait is, therefore, the quick and simple algorithm among pre-built algorithms. The tripod's capacity allows it to be utilized on any surface.

Biped gait: It is similar to three step gait as respectively legs move to serial next states. Biped leg coordination is described as progressing of pair of legs. First moving of robot is occurred in three moves. When stance of any leg, the other legs propel the body forward. The purpose of location of this algorithm in this section is providing more variety about gaits. In velocity status, biped gait is exist between tripod and explorer gait.

Explorer gait: Here where each leg is located repeatedly after motion of other leg. The gait of an explorer is more like to a wave about running succession of legs. Sequence motions are utilized to manage both gaits. Because every leg moved in unison according to this algorithm, the robot moved more slowly and sensitively. Concurrently, as the robot advances, its body is always driven by its five legs. Thus, on more rugged terrain, this gait ought to be chosen.

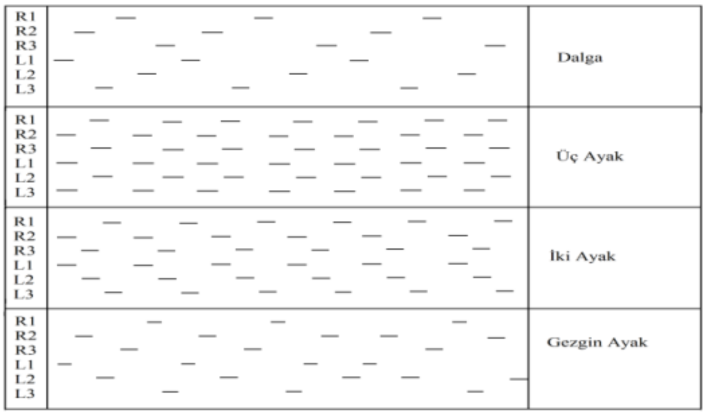


Fig 2a: Walking Algorithm of Gait pattern

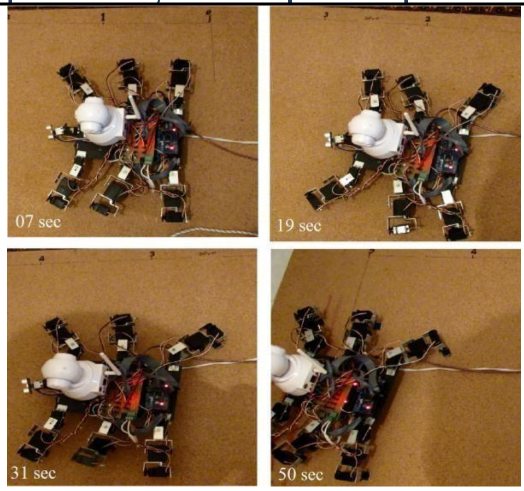


Fig 2b: Movement of TKSPIDER1

[2] In paper [8], the authors in this paper uses these following methods for human recognition for the data which were taken from CCTV footages.

The proposed method consists of four significant steps: (i) image acquisition, (ii) image enhancement, (iii) face detection, and (iv) face recognition. Among these for preprocessing of image for human face recognition the following methods are used.

Pre-processing is a step that comes after picture acquisition and gets the image ready for additional handling. Edge detection methods and grayscale conversion are the two primary pre-processing procedures.

Grayscale Conversion: We obtain the RGB image (R for red, G for green, and B for blue) from the camera. One red pixel paired with blue and green pixels makes up an RGB pixel. One pixel in an RGB image is equivalent to eight bits, hence computing was made possible by the use of large numbers. Since every pixel is a scalar, the image will have eight bits. Thus, the formula for converting RGB to grayscale is

$$\text{Grayscale} = 0.3 * R + 0.59 * G + 0.11 * B.$$

Here, the corresponding pixels for red, green, and blue are denoted by R, G, and B.

Canny Edge Detection: The Canny filter uses sudden colour shifts in images to identify edges. This is what we're utilizing to sharpen the image edges. We can recognize facial emotions with more precision the more the benefits are enhanced. Gaussian and Sobel filters make up the filter. Initially, grayscale images are subjected to a Gaussian filter with a preset value of σ in order to facilitate edge finding.

The camera like Night vision camera can be utilized. It can catch picture and video data through the camera during both day and night also, send it to the beneficiary unit. Along with this image acquisition from Camera, image preprocessing, face detection, localization, extraction from the footages.

$$G = \frac{1}{\left(2\pi\sigma^2\right)} e^{-\left(x^2+y^2\right)/2\sigma^2}.$$

The Sobel filter is used in the second phase to identify the edges in the pictures.The horizontal boundaries are located using the filter that is

$$G_x = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}.$$

The filter for horizontal edges is,

$$G_y = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}.$$

To locate every edge in the filter, the horizontal and vertical edges are computed

$$A = x = \sqrt{G_x^2 + G_y^2}.$$

Pictures with edges are subjected to the hysteresis threshold, the final and third stage of the clever edge detector. The threshold is stated as

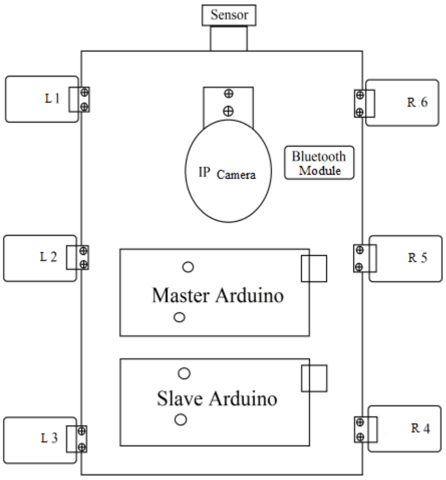
$$H = \frac{1}{1 + e^{-x}}.$$

First, the lowest and maximum thresholds are chosen.

A value of one is assigned to the pixel if its value above the threshold; otherwise, it is set to zero. Another scenario is when the value stays constant and is equal to the threshold. In order to obtain the final improved image, the edges are applied to the original image. As a result, facial feature extraction and detection become simple, improving system efficiency.

III. METHODOLOGY

[1] From the 3rd paper the author has developed spider robot. The developed robot isTKSPIDER1 which is named after the author.



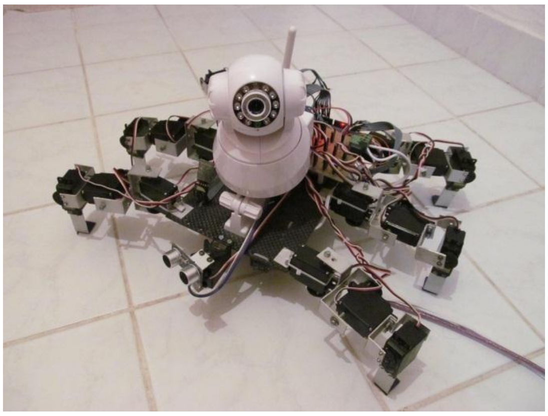


Fig 3a: TKSPIDER1 **Fig 3b:** General Structure of TKSPIDER1

The mechanical structure of TKSPIDER1 was made of stiff material and had six legs that were positioned symmetrically. TKSPIDER1, with its six symmetrically distributed legs, is a light- weight composite body developed for terrain exploration. The primary body is made of a single, lightweight composite piece. It is inexpensive and processable in terms of comfort. The robots measure 26 cm in length, 16 cm in width, and 0.3 cm in thickness. To maintain the center of gravitynear the midway of the body, the legs are attached at opposite angles to the body. Because of this, the robot had to constantly balance itself while in motion. On the front of the body are inserted an ultrasonic sensor, a battery, and a power switch. On the left side are two control circuits, a camera, and a Bluetooth module.

With three degrees of freedom for each leg, simple motion algorithms are used for efficiency and stability. The robot has an ultrasonic sensor to identify impediments and modify its trajectory. The construction as a whole measures 46 cm by 35 cm and is 26 cm tall.

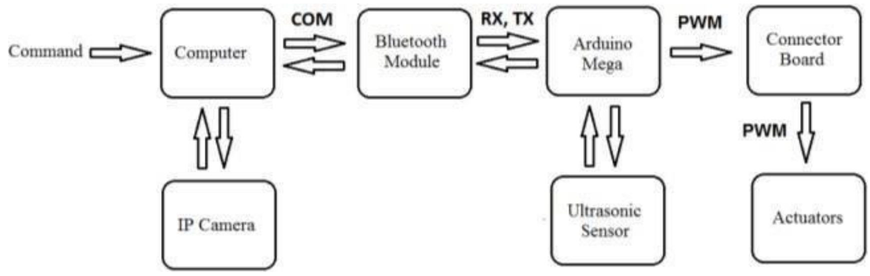


Fig 4: TKSPIDER1 Block Diagram

The control unit of TKSPIDER1 is built using Arduino technology. A microcontroller was used to control each leg. Servo motors get a PWM signal from the Arduino board's outputs via a connector board. The robot has 19 actuators in total. Of these, 18 are for the legs and the remaining ones are for the ultrasonic sensor's motion. The system's block diagram can be expressed as it is depicted in the above graphic. By giving the computer commands, one can moveabout. The microcontroller received the command over a Bluetooth link, after which the mechanism operates. Furthermore, a real-time image captured by a camera can be used to track theregion that the robot presents. This camera functions as an IP camera and has its own dedicated data channel for robot control.

Result:

Table 1a : Leg Segments Of Gait Algorithm

Gaits	**Leg Segments**		
	Coxa degree	***Femur degree***	***Tibia degree***
Explorer	40	50	45
Tripod	60	50	40
Wave	40	60	45
Biped	60	40	40

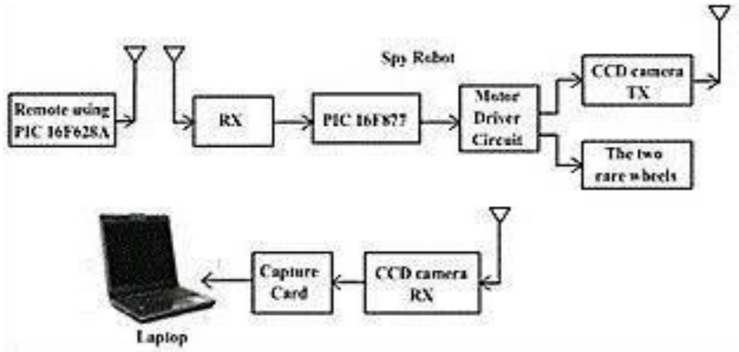
Table 1b: Parameters Obtained of Walking Algorithm

Gaits	Parameters			
	p Length m	*stance m*	*Time sec*	*Velocit y m/sec*
Explorer	0,08	1,50	51	0,029
Tripod	0,06	1,50	23	0,065
Wave	0,07	1,50	50	0,030
Biped	0,14	1,50	40	0,038

The TKSPIDER1 robot, created for this research, is capable of operating on both smooth and uneven surfaces. A robot that is developed with features that may be used for a variety of purposes does not take up a bigger field; instead, it is more widely used in different fields. An Arduino Mega board is utilized for remote control, and a Bluetooth module was added to the robot to allow computer-to-machine communication. The robot received the command via the Bluetooth connection. Real-time wireless transfer of records from the IP camera on TKSPIDER1 to a PC is possible. The above Table 1a and 1b shows the results of the walking algorithm and was found out with following output when made to work on flat ground along with few minor advantages and disadvantages.

[2] In the [1] paper a Military Spying Robot has been designed. A small number of spying robots are meant to be operated by remote controls. Spying robots can also be equipped with cameras, allowing them to communicate information or videos to the mediation or spying group. These robots can move more quickly because they are often smaller in size. In this instance, RF technology has been employed to transmit data between the user and the robot. We will be ableto collect real-time videos of the robot's movements thanks to the CCD camera. The PIC microcontroller serves as the system's brain in this instance, directing all of the duties and movements carried out by the robot.

The main part to focus on is to operate a movable military mediator or espionage robot that can be commanded by a remote. PIC 16F628A and PIC 16F877 were employed in this design. These covertly operated robots feature a camera that can be operated by a remote control, batteries, and an antenna. Two distinct PICs have been implemented to enable remote control of the robot and entire system. The CCD



camera, also known as a charged couple device, is utilized in this to latch all data or information to the robot.

Fig 5: Block Diagram of Military Spying Robot

To monitor the user's direction, a 4-bit LCD that is operated by a remote is mounted on top of it. They have installed an LED light on the CCD camera with all the lightning circuits in case the robot needs to move through dimly lit places or at night. Radio frequency modules, or RF modules, are also utilized in this robot to receive and transmit signals from a remote to an agent robot. This allows the user to regulate the robot's speed and, in essence, to turn it on and off. In their military agent robot, we employed three brushed DC motors with two motor drivers(L2989) to provide good speed and turning control.

The way the system operates is that the remote is used to first provide commands to the receiver,which then processes and transmits those commands to the driver circuits, which control the motors. The motors of the camera and the unusual wheel get commands after which they move in accordance. The CCD camera records video, which is then instantly transferred to the camera's capture card and shown on the screen. The modified PIC microcontroller uses basic special coding. Pins A and B on the PLC are utilized as input and output pins, respectively. The PLC 6F628's PORT A pins are only connected to the LCD that is fastened to the remote controller. The L2980 motor driver is attached to the pins of PLC 6F877's PORT B. The RB 7 has a 9600 baud rate and is used as input and output pins for serial communication. Additionally, this application can carry out commands for sending and receiving.

Result:

In the military, the developed Military Spying Robot has proven effective. Every effort has been made to the best of ability. They can view precisely what was happening with the assistance of this robot. To the best of their knowledge, their structure has not produced anyunsettling influences. The robot travels in accordance with the information they gave via the remote control, which is determined by the engine's direction. They have also been able to see events in the area where the robot is hiding thanks to the camera. The battle robot was designed to withstand attacks of this ferocious nature. This robot is remote-controlled, RF-based, and equipped with all the controls found in a typical vehicle. You were shown a remote camera that can be used to remotely screen opponents if necessary. With its tiny camera eyes, it can stealthily enter an enemy zone and transmit all the data to us. This is a simple robot covert agent to utilize.

[3] In the [7] we can see how Human recognition via Image processing has been developed. The author claims that the visual feature from the photos and the main edges of theretrieved movies are the first steps towards human recognition. The suggested system willuse a shot boundary detection technique to identify critical edges in order to maximizecomputing productivity. The video is first used as the input, after which the features areextracted as pictures, mixed with the video features, and then sent to a classifier. Theoutput is then produced using classification algorithms, as seen in the **Figure 6** flow chart below.

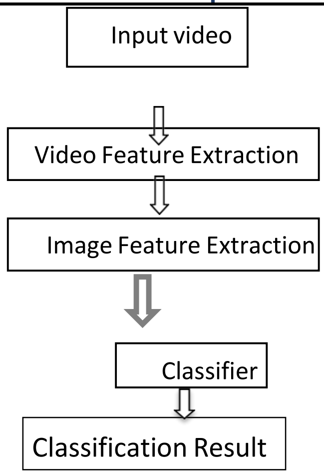


Fig 6: Flow Chart of the proposed work

The video reader receives the video as input and converts it to a number of frames. After that, the frames are computed as histograms and smoothed using the Laplace smoothing transform. Every five-frame color histogram is calculated and subtracted from the frame before it. The frame will be shot boundary if the removed value exceeds the empirically determined threshold value. Only at the moment the shot is taken is the frame in the center of the image regarded as a key frame. Preprocessing, often known as filtering, is the process of removing noise from the frames. The frames will be in the form of 3D images, which must be transformed using the bi-linear interpolation technique into 2D images in order to improve the output of the input video. The Laplace smoothening transform can be used to clearly extract the frames from both the image and video characteristics when employing the feature extraction approach. This system's utilization of the quantized trained dataset will result in less storage space being needed. By applying the procedure to compare the extracted value of the input test video frames with the quantized dataset values, the output can be categorized.

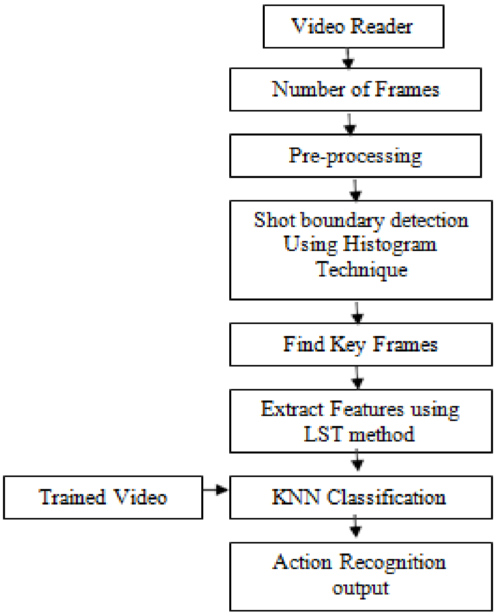


Fig 7: Flow Chart of the hand recognition system

When it comes to classifying human actions like clapping, boxing, walking, jogging, and hand waving, the KNN classifier performs the best.

Histogram

It depicts the various pixel frequencies in the image, which are necessary to comprehend itsaspects.

Bi-linear interpolation

This resampling technique estimates a new pixel value by taking the distance weighted average of the four nearest neighbor pixel values. Here, it's utilized to resize the picture.

Laplace smoothening transforms (LST)

It is suggested to use the LST transform to extract the image's low frequency features the Laplacian function.

K Nearest Neighbor classifier (KNN)

When tackling classification problems, the KNN classifier is increasingly frequently utilized. Based on the Euclidien distance formula, the algorithm operates. Typically, 5 is selected as the k value across all applications.

Result:

Matlab is used in the development of the suggested technique. Only one person's action can be generated using the suggested method. Using the shot boundary method, a key frame in a video is determined by taking a sample of five frames. The following graphics illustrate how the suggested method extracts and classifies the main frame attributes through continuous process repetition.

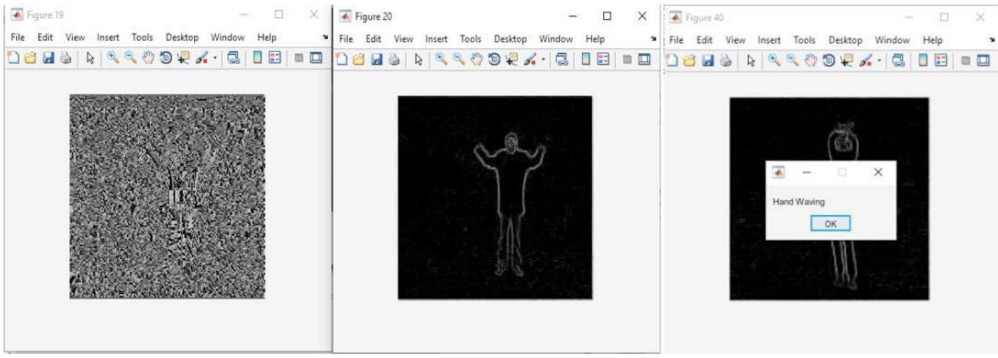


Fig 8: Test output result for hand waving

Figure 8 shows the noise-free output in the first image, followed by feature extraction in thesecond, and finally, the classification of the test output of a hand wave motion in the last image.

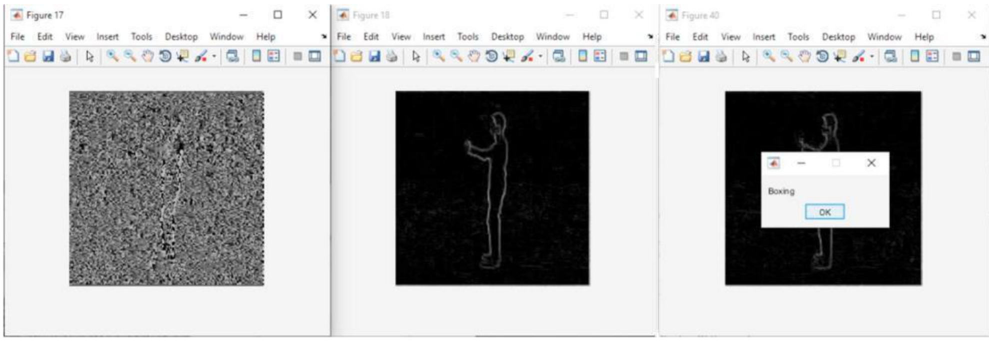


Fig 9: Test output result for boxing

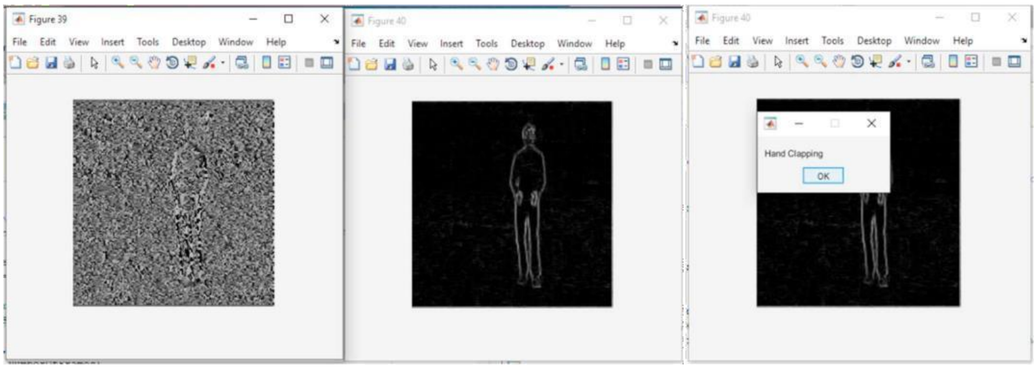


Fig 10: Test output result for hand clapping

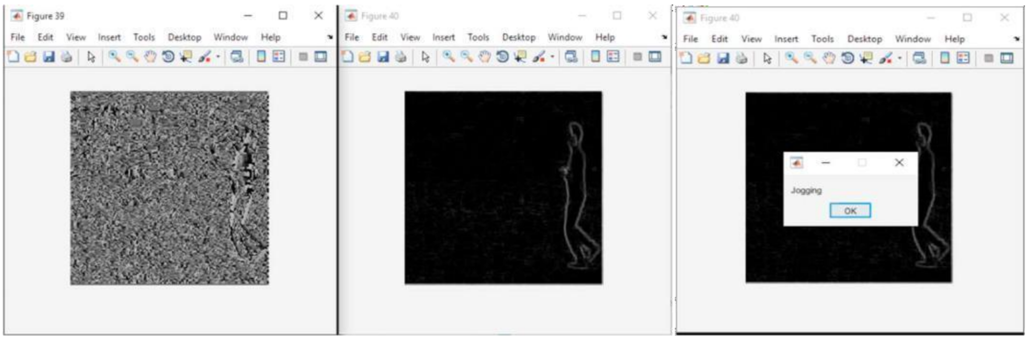


Fig 11: Test output result for jogging

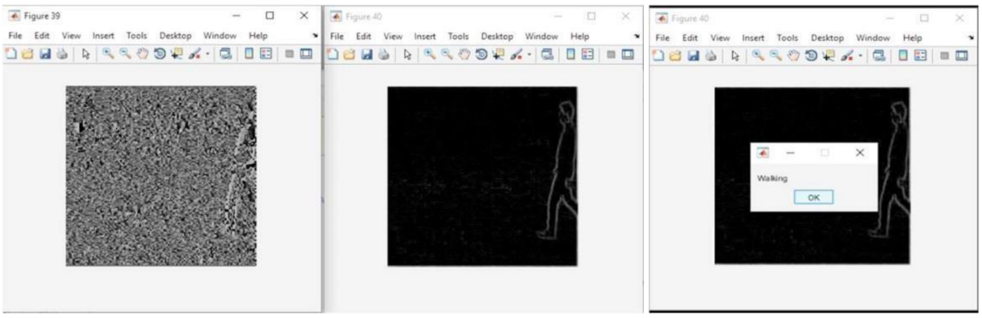


Fig 12: Test output result for walking

All other human movements were performed in a manner similar to figure 3, and the outcomes are shown in **Figures 9** (boxing), **10** (hand clapping), **11** (jogging), and **12** (walking). With reduced storage space needed for the training data set, the suggested strategy produces more efficient results for the human action recognition problem.

As a result, it is evident that a video action detection system is suggested for five distinct hand posters, and its outcomes are carried out. Test findings demonstrate that, in comparison to outdated methods, the proposed system performs video action recognition more effectively. Only one person's action can be generated using the suggested method.

[4] The has created a robot for long-range detection with a night vision camera, as reported in the [6] paper. The first idea for a long-range spy robot with metal and obstacle detection will essentially be utilized in the development process of a military robot that can be employed in distant areas, as the use of metal objects would have been used in battle fields. Studies have indicated constraints in current technology, spurring us to surmount these obstacles. To improve functionality, a keypad and DTMF decoder were included. In order to make them mobile, DC motors and wheels were attached and connected to an Arduino in the practical implementation. An Atmega328 microcontroller was used to control an ultrasonic sensor and metal detector for obstacle and metal detection. A DTMF decoder translated commands from a mobile phone or GSM module to control the movement of the robot as part of its communication system. Comprehensive testing was done in the last phase to confirm the system's functionality.

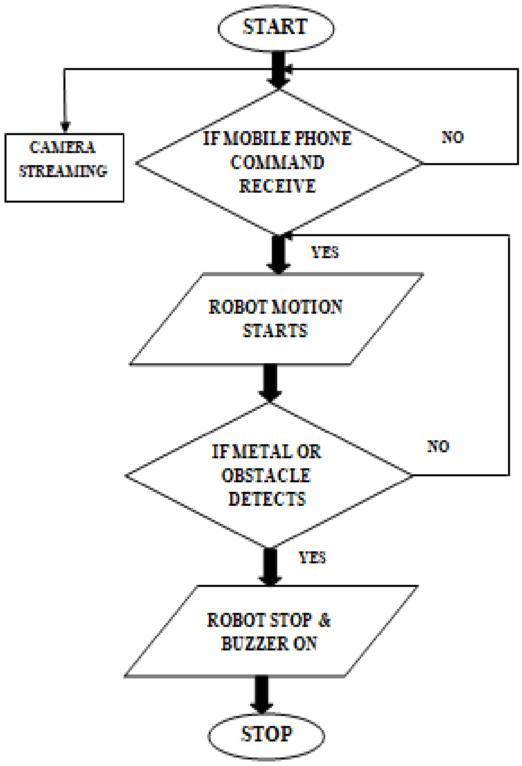


Fig 13: Flow chart of Spy Robot

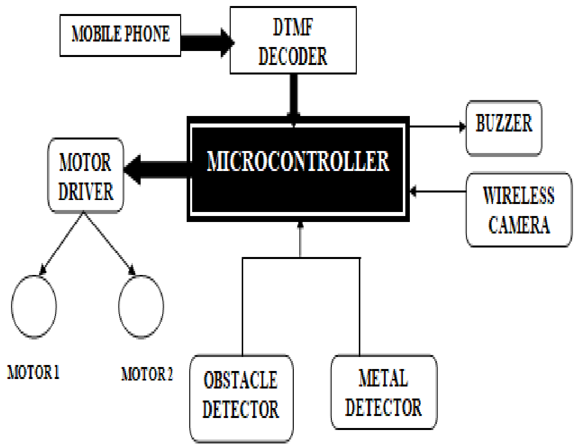


Fig 14: Block diagram of Spy Robot

At that time, haggles are connected to DC engines. Because the engine driver is connected to the Arduino, it will have a lot of power. This configuration is intended to make our robot portable. Here, we've used an Atmega 328 microcontroller to enable communication between all of the equipment involved in handling the information received between the two partiesafter the DTMF Decoder has been connected to the microcontroller. A metal object is placed in front of the robot; if it detects metal, it sends a message to the microcontroller, which then halts motion and sends a message to the signal. Additionally, the signal is connected to a microcontroller.

The Atmega328 Microcontroller is linked to the equivalent of an ultrasonic locator, so that any obstruction will cause the movement to stop. Via the Arduino UNO, the code for every action taken by and from the microcontroller is run. Following this arrangement, they used a cell phone to interface with a DTMF decoder, but they forgot to send the order by remote portable phone (or GSM model). The cell phone interpreted the organization to produce a parallel 4-bit number, which was then sent to a microcontroller for robot manufacturing. After interacting and associating, testing is finally carried out at the conclusion, and the outcomes are recorded.

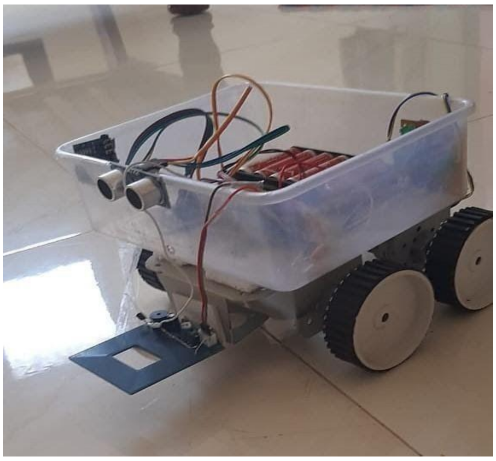


Fig 15: Spy Robot

Result:

A remote cell phone keypad is used by a DTMF controlled robot to determine where the order is being transmitted. They have used two cell phones in this. One is linked to the customer, while the other is connected to the robot. The order transmitter unit is the phone with the client, and the collector unit is the second phone on the robot. The author states that in order to begin a call, we must first initiate one from the client's phone to the recipient's phone. The call is then received by means of the answer mode function of the client's phone. At that moment, the customer can control the robot's movement by pressing unique buttons on the phone's keypad. Every time a key is squeezed, a distinct sound is produced from each key; the DTMF decoder records and interprets this sound.

After the data has been decoded, it is delivered to the microcontroller, which measures it and relays the processed information to the engine driver IC. The engine driver IC then initiates the robot's movement as necessary. At the moment, these are the keys to maneuver a robot:

- When we press 6 from the client telephone, the robot will turn right.
- When we press 4 from the client telephone, the robot will turn left.
- And when we press *, the robot will stop robot movement.

Separate metal identifier and hindrance finder sensors are used in this framework. When the metal detector detects the presence of metal, it transmits the generated data to the microcontroller, which then transmits a high signal over the port connected to the engine and ringer. As a result, the ringer activates and the robot immediately stops moving

IV. CONCLUSION

Our survey paper extensively explored the landscape of existing research in the realm of Spy Robots designed for human detection and scouting. The focus of our project, incorporating features such as walking on various terrain surfaces, live video feedback capture, human recognition, and GSM communication, aligns with the evolving demands of surveillance and reconnaissance technologies.

The integration Arduino and Night vision camera underscores the commitment to utilizing cutting-edge hardware for enhanced functionality. The Arduino platform, with its versatility and computational power, serves as a robust foundation for our Spy Robot, enabling real-time video capture and processing.

The amalgamation of walking capability expands the operational scope of the Spy Robot, allowing it to navigate through diverse environments with agility. The emphasis on human recognition adds a crucial layer of intelligence, contributing to the adaptability and contextual awareness of the robot in dynamic scenarios.

The usage of a GSM module for communication further extends the reach of the proposed Spy Robot, enabling seamless data exchange and control over extended distances. This feature enhances the potential applications in remote or challenging terrains where traditional communication methods may be limited.

Incorporating insights from our survey and leveraging the advancements presented in the literature, we have taken few ideas and implemented in our project which strives to contribute to the field by addressing key challenges and pushing the boundaries of what Spy Robots can achieve in the domains of human detection and scouting. As the technology continues to evolve, our Spy Robot stands poised as a versatile and capable solution, showcasing the integration of state-of-the-art components for efficient and intelligent operation.

REFERENCES:

[1] Military Spying Robot. Sarmad Hameed, Muhammad Hamza Khan, Naqi Jafri, Adeel Azfar Khan, Muhammad Bilal Taak. International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075,Volume-8, Issue-7C2, May 2019

[2] Adaptive Intelligent Spider Robot. Rozita Teymourzadeh, CEng, Member IEEE/IET, Rahim Nakhli Mahal, Ng Keng Shen, and KokWa

[3] Design of Six Legged Spider Robot and Evolving Walking Algorithms. Tolga Karakurt, Akif Durdu, and Nihat Yilmaz. International Journal of Machine Learning andComputing, Vol. 5, No. 2, April 2015.

[4] Bidirectional Communication Control for Human-Robot Collaboration. Davide Ferrari, Federico Benzi and Cristian Secchi. 10 Jun 2022

[5] Design Of GSM Based Wireless Controlled Robot. B.Sai Prashanti, P.Shaily Vineetha, Neha Krishna.D, Dr.Radhika Sajja, D.Swapna. Proceedings of the 1st International and 18th ISME Conference ISME 18, Februar 27th, 2017

[6] Long Range Spy Robot With Night Vision. Pousia S, Bharani N, Preethi D, Balachandar P, Amar V, Kaushik M International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056, Volume: 0 8 ,05 |May 2021

[7] Robust Human Action Recognition System via Image Processing U. Anithaa, R.Narmadhab, D. Raja Sumanthc, D.Naveen Kumarc International Conference on Computational Intelligence and Data Science (ICCIDS 2019)

[8] A Real-Time Framework for Human Face Detection and Recognition in CCTV Images. Rehmat Ullah ,Hassan Hayat, Afsah Abid Siddiqui, Uzma Abid Siddiqui, Jebran Khan, Farman Ullah, Shoaib Hassan,Laiq Hasan, Waleed Albattah, Muhammad Islam, and Ghulam Mohammad Karami. Hindawi Mathematical Problems in Engineering Volume 2022, Article ID 3276704

[9] U. Saranli, M. Buehler, and D. E. Koditschek, "Rhex-A simple and highly mobile hexapod robot," *Int. J. Robot.Res.*, vol. 20, pp. 616-631, 2001.

[10] War Field Spying Robot Using Wireless Camera, KunjGudhka, AishwaryaKadam, Devika Kale, ManilRupani,Prof. TilottamaDhake, International Journal of Electrical and Electronics Research ISSN 2348-6988 (online) Vol. 4, Issue 1, pp: (85-92), Month: January - March 2016

[11] SMART PHONE BASED ROBOTIC CONTROL FOR SURVEILLANCE APPLICATIONS, M.Selvam, IJRET: International Journal of Research in Engineering and Technology, Volume: 03 Issue: 03 | Mar-2014

[12] Military Spying and Bomb Disposal Robot Using IOT, 1CHAITRALI JADHAV, 2SHAMLI GIBILE, 3SNEHAL. GAIKWAD, 4NEELUM DAVE, International Research Journal of Engineering and Technology (IRJET) e-ISSN:2395-005 Volume: 05 Issue: 04 | Apr-2018

[13] DESIGN AND IMPLEMENTATION OF REMOTE OPERATED SPY ROBOT CONTROL SYSTEM, International Journal of Science, Engineering and Technology Research (IJSETR), Volume 3, Issue 7, July 2014

[14] Design of an Intelligent Combat Robot for war, Dr.S.Bhargavi, S.Manjunath, (IJACSA) InternationalJournal of Advanced Computer Science and Applications, Vol. 2, No. 8, 2011

[15] Robot Assisted Emergency Search and Rescue System With a Wireless Sensor Network, International Journal of Advanced Science and Technology Vol. 3, February, 2009

[16] Ramanathan S; Akash V; Arun Prasad R; Venkat Rahul M. "Pick and Place Robot for Surface Mounting Devices". International Research Journal on Advanced Science Hub, 2, 8, 2020, 75-81. doi: 10.47392/irjash.2020.97

[17] Dhiraj Singh Patel. Mobile operated spy robot. International Journal of Emerging Technology and Advanced Engineering (IJETAE); 2013.