Intelligent Surveillance Robot For Military Applications

Venkata Vamsi. K[1], Kavin. S[2], Surya. K[3], Mrs. D.Shanthichelliah[4], Mrs. M. R. Mahalakshmi[5]
[1, 2, 3, 4, 5] Dept of ECE
[1, 2, 3, 4, 5] Sri Muthukumaran Institute Of Technology,

Abstract- *Current defense applications are changing day by day using advanced technology and in future,it is expected that soldiers are able to trace the enemy in the battle field using remote technology. A sophisticated military robot is a robot that is needed by the military because it can be deployed to the battlefield in a remote or autonomous manner to destroy the enemies without involving the soldiers. In this project, a prototype of a surveillance military robot is designed to detect the intrusion of enemies and to take appropriate action for enemy attacks. It is implemented using image processing techniques which is interfaced with the surveillance robot. The robot is controlled with the assistance of Arduino mega micro controller which is interfaced with IOT module and various sensors to control the robot movement. Thus, a cost-efficient surveillance robot using IOT is developed for military applications to locate the enemies and to attack them.*

Keywords- Robotics, IOT, Surveillance, Arduino.

I. INTRODUCTION

The highway lane following system developed in this example steers the ego vehicle to travel within a marked lane. The system tests the lane following capability in the presence of other non-ego vehicles, which are the target vehicles. For regression testing, it is often sufficient for the target vehicles to follow a predefined trajectory. To randomize the behavior and identify edge cases like aggressive lane change in front of the ego vehicle, it is beneficial to add intelligence to the target vehicles.

In the existing model soldiers have to risk their lives in locating the enemies. There is no such robot to implement it in replace to a soldier.

Disadvantages of the existing system:

- It requires lot of work to move soldiers in the battle field and there is an uncertainty to the lives of the soldiers.
- Lot of casualties may report.

The project is Local path planning plays an important role in the navigation of the autonomous vehicle, because it collects the information from sensors, and decides next move of the vehicle. In most conditions, autonomous vehicle should drive follow the road line and overtake an obstacle. Different methods of local path planning have been developed for meeting the requirements of lane following and collision avoiding.

In the proposed system the intelligent robot is designed which is used as moving vehicle in the battle field to detect the people other than soldiers.Enemies are detected and appropriate action is taken against them.The robot can be controlled through IOT.The enemies are identified using image processing and movement of robot is controlled using ZigBee.

Advantages**:**

1. Casualties are zero as the robots are sent in replacement to the soldiers.
2. It can be deployed to any remote location as it is controlled through IoT.

II. LITERATURE REVIEW

In the title [1] Development of Design Tool for Hybrid Power Systems of Hybrid Electric Military Combat Vehicles byDong Hwan Choi/ Samsung TechLink, Seung Jun Lee/ Seoul National Univ, said that this paper introduces a developed hybrid power modeling and simulation tool for series hybrid electric military combat vehicles. A simulation tool for determining optimal hybrid power in hybrid components such as motor, engine, generator, and storages and for evaluating designed driving control strategy and energy management strategy is essential in designing a hybrid system. The developed tool is based on the MATLAB/Simulink with simple GUI interface. It supports various series hybrid structures of military vehicles, driving cycles, and driving control strategies. It supports two types of analysis methods: a forward-facing method and a backward facing method. In this research, in order to determine the motor's power and spec, the developed tool is incorporated

with the commercial multibody dynamic's software, Virtual Lab/Motion developed by LMS International. The objectives of the iterative works between design of optimal hybrid power systems and optimal driving control strategy include reducing the overall fuel consumption and optimizing the mobility performance to cost, mass and volume space claims of the vehicles' power systems, and enabling those vehicles with enhanced electrical power generation and storage capabilities useful for field operations, too. A 20ton 8x8 series hybrid electric vehicle is considered as design example. This paper shows the results of determined hybrid components' power and shows the SOC variation and fuel efficiency for various driving strategies.

In this title [2] Dynamic Load Allowance for Military Tracked and Wheeled Vehicles by Anthony Everitt, Gordon Wight and Marc-AndreAgenaissaid that the ability of tracked fighting vehicles (e.g., tanks) to cross bridges is a critical aspect of military operations. Military vehicles, specifically tanks, are continuously increasing in mass, while bridge infrastructure capacity remains relatively unchanged. This can significantly affect mobility on military operations. The North Atlantic Treaty Organization (NATO) utilizes a Military Load Classification (MLC) system that provides a method to compare the load effects of vehicles to the capacity of bridges in order to determine the feasibility of crossing. Tracked vehicles exhibit significantly different behavior than wheeled vehicles; yet frequently the MLC system is applied using the same vehicle-related factors when determining the capacity for both wheeled and tracked vehicles. One of these factors, Dynamic Load Allowance (DLA), is not based on recent research for modern tracked vehicles. Bridge load testing was carried out with one tracked vehicle and three wheeled vehicles. Results of the dynamic effects generated on a smooth surface are presented and indicate that a lower DLA for tracked vehicles, than wheeled vehicles, is likely appropriate. A lower DLA for tracked vehicles would result in increased bridge capacity for tanks.

In the title [3]Study on Military Vehicle Equipment Grading Method Based on Clustering Analysis and Fisher Discriminant Analysis by ZHANG Dapeng, WANG Feng Zhong, WANG Liang, ZHU Feng said that the performance of military vehicle equipment is a straightforward expression of their quality evaluation. In connection with the characteristics of undefined classification about military vehicle equipment in the present situation, laying no stress on the key points and uneasy to master, itutilizes clustering analysis and discriminant analysis to solve the problem of classification about military vehicle equipment. The effectiveness of the method in military vehicle equipment clustering and grading is proved by using 21 equipment samples which are marked by general logistic department specialist.

In this title [4] Design of Small Mobile Robot Remotely Controlled by an Android Operating System via Bluetooth and NFC Communication byKyung-RoKim Seok-Hwan Jeon, Woo-Yong Kim, YoungjunJeon1, Kyung-Soo Kim and JeHonHong said that in this paper, the small mobile robot for use in block type IOT (Internet of things) education robot aimed for children and infants is designed. As the robot moves on real world structure built by blocks, the virtual robot on the augmented reality displayed on the screen moves at the same time. Since the real world and virtual world should match precisely, accurate position and velocity estimation is important. The algorithm using two RGB sensors is applied for low-cost design. In addition, NFC module built inside some blocks are used to adjust the cumulative position error between the real robot position and position of robot on the augmented reality.

In this title [5] Design and Analysis of IoT-Based Intelligent Robot for Real-Time Monitoring and Controlby Mona Kumari,AjiteshKumar, Rita Singhal said that Nowadays development of IoT applications with robotics is an ongoing revaluation. This paper mainly focuses on the security, remote surveillance, and monitoring of our homes done by the surveillance robots. Remote surveillance has become the most important research topic over the past decade. Through this paper we put forward a surveillance robot that can be used in domestic areas and many other places. Robots are becoming important in our day-to-day life activities as they reduce the human labor and probability of error. We can control robots manually or they can be automatic based on the need of people. This paper focuses on design and implementation of mobile robot for obstacle detection and avoidance in a real-time basis.

III. METHODOLOGY

The proposed project develops an intelligent vehicle for military purpose using MATLAB for face detection and surveillance logistic and rescue operation.

Objectives:

- To detect the enemies.
- To destroy the enemies at military locations.

In this system, we use ARDUINO MEGA microcontroller which acts as brain of the system as it controls the entire system and the programs are stored in it. Here we use 12V Battery for the supply of the entire system. The

robotic chase consists of a motor driver and two dc motor for the movement of the robot. All the information's are displayed through the LCD display. Zigbee is used as the communication device. The entire system is controlled by the IOT module. An ultrasonic sensor is used to detect the object and detection is processed with MATLAB to find the enemies. The servomotor is triggered and the laser is used to accurately locate the enemies and destroy them.

TRANSMITTER

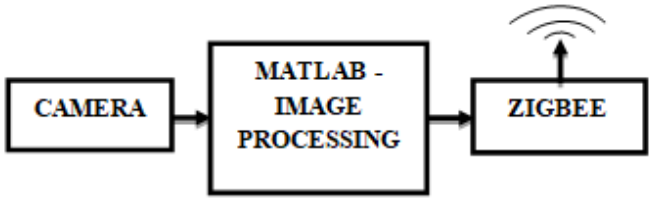

Fig.1., Transmitter Block diagram

In this project our main motive is to identify the enemy using image processing. In the transmitter section the MATLAB is used for image processing to detect the face and identify the enemies and transmits the information.

RECEIVER

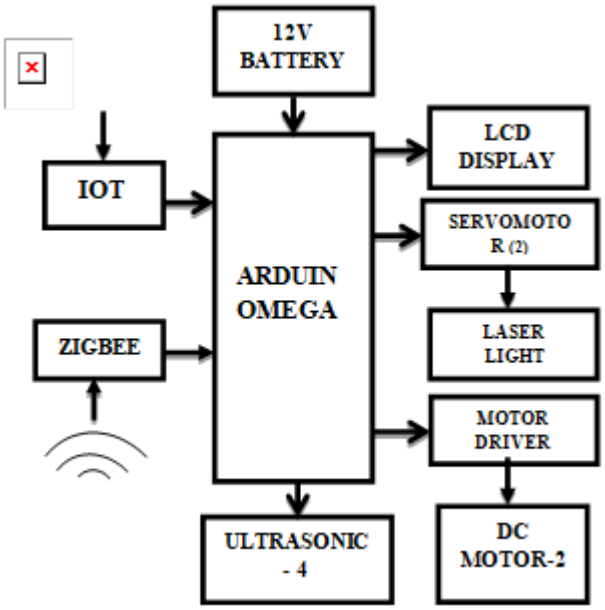

Fig.2., Receiver Block diagram

In this section Robotic chase is designed using Arduino mega microcontroller. Ultrasonic sensor, laser light, servo motor, DC motor, lcd, 12v battery and ZigBee receiver is interfaced with microcontroller. Ultrasonic sensoris used for two purpose to detect the object and to detect the enemy's range. In this section laser light act as a gun. DC motor control the chase. IOT update the all information to IOT. LCD display the all the information.

System requirements:

Hardware Requirements Software Requirements

Arduino MEGA Embedded C
12 V Battery MATLAB
LCD Display
Ultrasonic sensor
Laser light
Servo motor
IOT
Zigbee TX & RX
Camera
Motor driver
DC motor
Robotic chase

IV. HARDWARE DESCRIPTION

ARDUINO MEGA**:**

The MEGA 2560 is designed for more complex projects. With 54 digital I/O pins, 16 analog inputs and a larger space for your sketch it is the recommended board for robotics projects. This gives your projects plenty of room and opportunities.

It is used to interface hardware and software and to connect sensors and motors.

Fig.3., Arduino mega

12V BATTERY**:**

A **battery** is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices such as flashlights, mobile phones, and electric cars.

It is used to supply the power to the motors and board for the movement of robot.

IOT**:**

The **internet of things** (**IoT**) is the network of physical devices, vehicles, buildings and other items embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data.

IoT module is used to manage the connectivity and, in this project, it is used send and receive data about the status in battlefield through online.

SERVO MOTOR**:**

servo motors are used to control the position of objects, rotate objects, move legs, arms or hands of robots, move sensors etc.

It is used to control position of shaft in the motor 180 degree to control the laser direction.

ZIGBEE**:**

ZigBee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power, wireless sensor networks.

In this project ZigBee transmitter and receiver is used to transmit the information from system to robot.

LCD**:**

LCD screen is an electronic display module and find a wide range of applications.

It is used to display the updates of the robot and movement of robot.

LASER LIGHT**:**

A laser is created when the electrons are in the atoms of optical materials like glass, crystal, or gas absorb the energy from an electrical current or a light.

Here, laser light used as a destroying tool in the robot, when enemy is identified it will flash a light on that person.

ULTRASONIC SENSOR**:**

The ultrasonic sensor is used to detect any kind of obstacles the obstruct the robot.An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e., the sound that humans can hear).

It is used to measure distance and identify the obstacles of the robot.

MOTOR DRIVER**:**

When the motor is directly connected to the o/p of the above ICs then, they might damage. To overcome this problem, a motor control circuit is required, which can act as a bridge between the above motors and ICs (integrated circuits). Motor driver is used to control the flow of current to the dc motor and ICs. When the power flow is increased the driver will control it and supply the power they needed.

DC MOTOR**:**

A DC motor is an electric motor that runs on direct current power. It is a device which converts electrical energy to mechanical energy. It works on the fact that a current carrying conductor placed in a magnetic field experiences a force which causes it to rotate with respect to its original position.

In this project, DC motor used for the movement of the robot in 360-degree rotation.

WEB CAMERA**:**

A webcam is a video camera that feeds or streams its image in real time through a computer to computer's network. It is used to capture images for the face detection.

V. SOFTWARE DESCRIPTION

EMBEDDED C**:**

Embedded C programming plays a key role in performing specific function by the processor. In day-to-day life we used many electronic devices such as mobile phone, washing machine, digital camera, etc. These devices working is based on microcontroller that are programmed by embedded C.

It is used to interface all sensors and other components with Arduino and embedded c program is written to control the robot.

MATLAB:

MATLAB is a programming platform designed specifically for engineers and scientists to analyze and design systems and products that transform our world. MATLAB lets you take your ideas from research to production by deploying enterprise application and embedded devices, as well as integrating with Simulink and model-based design.

MATLAB is used for face detection and program is written to detect the peoples other than enemies and take appropriate action against them.

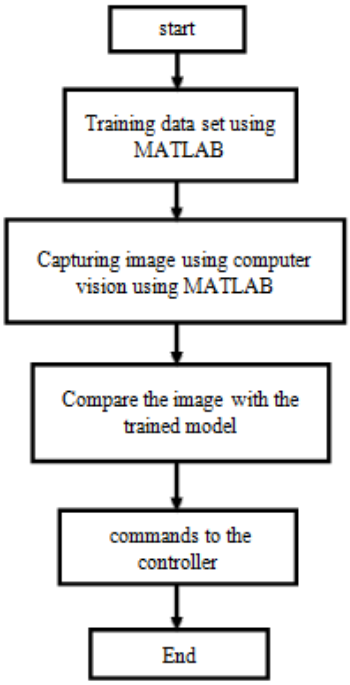

Fig.4.,Face detection flowchart

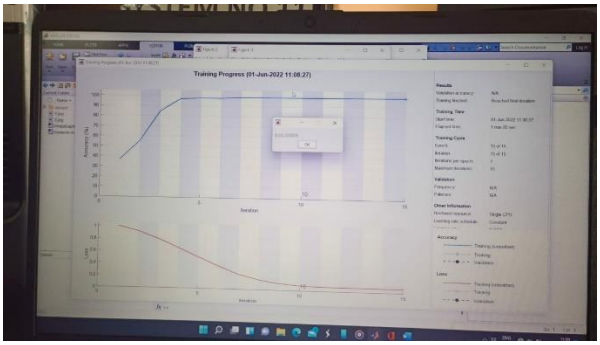

Fig.5., simulation output of face detection

VI. VERIFICATION&RESULTS

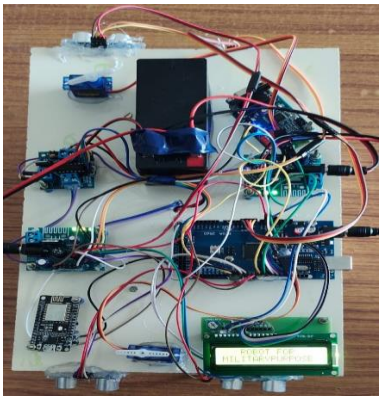

Fig.7., Transimitter prototype

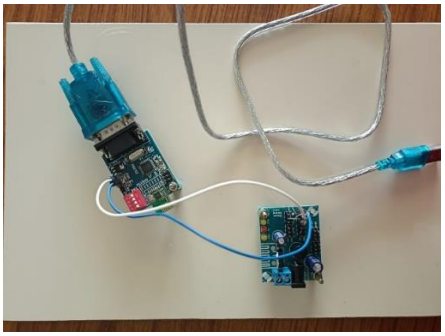

Fig.8., Receiver prototype

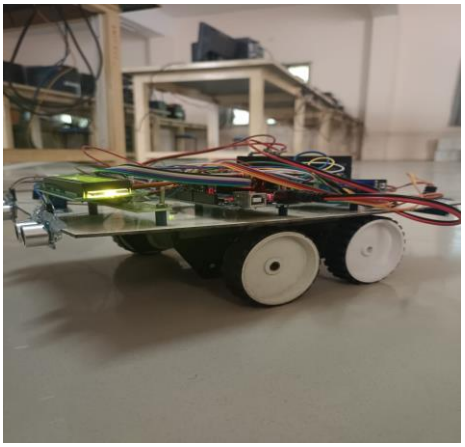

Fig.9., Robotic chase

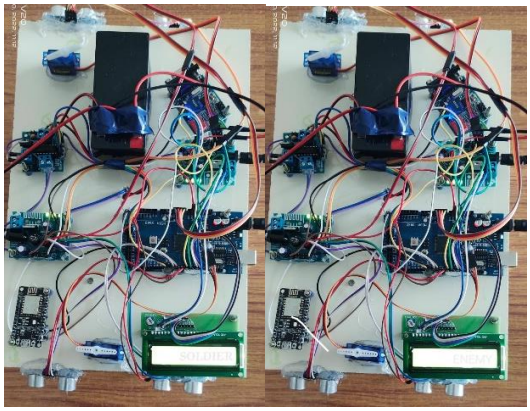

Fig.10., Outputof LCD display

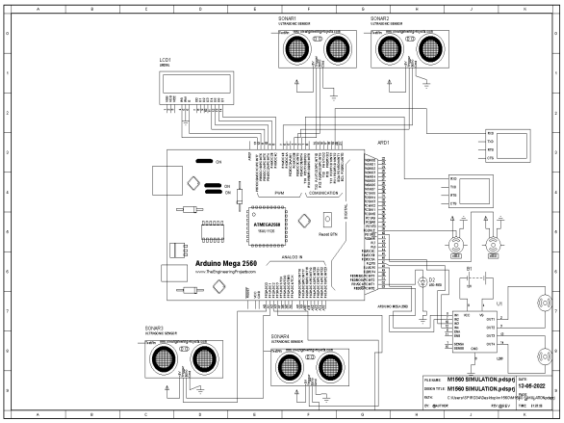

Fig.11., Robotic chase circuit diagram

VII. CONCLUSION

The design of An Intelligent surveillance vehicle for Military Applications - version 1.0" is to Improve the use of technologies of our armed forces that can be monitor the car wirelessly at remote locations also it would be very useful in the border surveillance. various movements of the hand are predefined for each and every direction. It is usedto detect the enemies in the war field even at all time in absence of human being. This system using advanced technology to detect the enemies and sensor devices will make it cheaper, scalable and more efficient to the next generation. Also, the use of Artificial Intelligence opens up a lot of options for improvement in defense application.

VIII. FUTURE ENHANCEMENT

In future the accuracy of face detecting will be increased and movement of the robot is improved to be fast.In future we can use raspberry pi as a controller of the project and it will make easy to connect the sensors and Ics.The development of autonomous vehicles becomes a hot topic due to the demand of intelligent surveillance robot for military applications. In future the robot can be developed as a drone.

REFERENCES

[1] Development of Design Tool for Hybrid Power Systems of Hybrid Electric Military Combat Vehicles byDong Hwan Choi/ Samsung Techwin, Seung Jun Lee/ Seoul National Univ,2018.

[2] Dynamic Load Allowance for Military Tracked and Wheeled Vehicles by Anthony Everitt, Gordon Wight and Marc-Andre Dagenais,2019.

[3] Study on Military Vehicle Equipment Grading Method Based on Clustering Analysis and Fisher Discriminant Analysis by ZHANG Daeng, WANG Feng Zhong, WANG Liang, ZHU Feng,2012.

[4] Design of Small Mobile Robot Remotely Controlled by an Android Operating System via Bluetooth and NFC Communication byKyung-Ro Kim Seok-Hwan Jeon, Woo-Yong Kim, YoungjunJeon1, Kyung-Soo Kim and Je Hon Hong,2017.

[5] Design and Analysis of IoT-Based Intelligent Robot for Real-Time Monitoring and Controlby Mona Kumari, Ajitesh Kumar, Rita Singhal,2020.

[6] Z. Li, Y. Hu, R. He, and Z. Sun, "Learning disentangling and fusing networks for face completion under structured occlusions," Pattern Recognin., vol. 99, Mar. 2020.

[7] H. Zhang, Q. Li, and Z. Sun, "Adversarial learning semantic volume for 2D/3D face shape regression in the wild," IEEE Trans. Image Process, Sep. 2019.

[8] Y. Li, L. Song, X. Wu, R. He, and T. Tan, "Anti-makeup: Learning a bi-level adversarial network for makeup-invariant face verification," in Proc. 32nd AAAI Conf. Atif. Intel., 2018.

[9] J. Liang, R. He, Z. Sun, and T. Tan, "Distant supervised centroid shift: A simple and efficient approach to visual domain adaptation," in Proc. IEEE/CVF Conf. Compute. Vis. Pattern Recognin. (CVPR), Jun. 2019.

[10] P. Li, X. Wu, Y. Hu, R. He, and Z. Sun, "M2FPA: A multi-yaw multi-pitch high-quality dataset and benchmark for facial pose analysis," in Proc. IEEE/CVF Int. Conf. Compute. Vis. (ICCV), Oct. 2019.