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# IoT Based War Field Surveillance Robot With Night Vision Camera

Thorat B. Mayuri[1], Lone R. Sakshi[2], Nagare G. Rupali[3], Prof. Dr. R.K.Kanhe[4]

(Electrical Engineering, BAMU University,Maharashtra Institute Of Technology College -[MIT Autonomous Institute]Aurangabad, Maharashtra, India[1]
Email: mayurithorat337@gmail.com)

(Electrical Engineering, BAMU University, Maharashtra Institute Of Technology College -[MIT Autonomous Institute] Aurangabad, Maharashtra, India[2]
Email: sakshishitalrajkamal777@gmail.com)

(Electrical Engineering, BAMU University, Maharashtra Institute Of Technology College -[MIT Autonomous Institute] Aurangabad, Maharashtra, India[3]
Email: rupalinagare290@gmail.com)

(Electrical Engineering, BAMU University, Maharashtra Institute Of Technology College -[MIT Autonomous Institute] Aurangabad, Maharashtra, India[3]
Email:ram.kanhe@mit.asia)

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## Abstract:

The main goal of this paper is to develop a robot that will perform surveillance. This paper aims to develop a multi-purpose surveillance robot to perform surveillance activities in industrial areas, militarized war zones or radioactive field areas to analyze, control and protect the areas from unwanted threats. Nowadays, robot plays a vital role in our daily activities, reducing human labor and human error. The purpose of this robot is to move and provide audio and video information, sense temperature, humidity, distance, presence of an object, can track the bot using gps tracker from the given environment and send the obtained information to the user. In this project, the robot can be controlled using a Blynk mobile phone or laptop application via Internet of Things (IoT) and also get live video streaming both day and night using the camera from the robot. Along with the obtained live streaming video output, the user can also detect the presence of metal bombs using metal detector, measure the distance using an ultrasonic sensor, etc. In this way the surveillance activities can be carried out.

*Keywords* **—Ultrasonic Sensor, PIR Sensor, Temperature Detector, GPS Tracer, ESP8266 Module, Metal Detector, Camera.**

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## I. INTRODUCTION

Technology has brought about a dynamic and massive change in the field of robotics and automation, reaching all kinds of fields. Surveillance is the process of close systematic observation or surveillance of a person, group, etc., especially a person in custody or a suspect. Thus, surveillance is mainly required in areas such as border areas, public places, offices, shops and industries, etc. It is mainly used for monitoring activities. The act of surveillance can be performed both indoors and outdoors by humans or by embedded systems such as robots and other

automation devices. A robot is nothing but an automatic electronic machine that is capable of performing programmed activities, replacing human labor, providing highly accurate results and easily overcoming the limitations of human beings. So replacing humans in tracking fields is one of the great advances in robotics. The robot consists of an ESP2866 module, which is the heart of the robot. This robot is further composed of DC motors, wheel, li-battery, ESP8266 Wi-Fi module and various types of sensors such as ultrasonic sensor, metal detection, PIR sensor, gps tracker, temperature detector for detection purpose. The user end communicates with the robot by implementing the Internet of Things concept i.e IoT.

In our project we have used two PCB board. On 1st board we have connected ESP8266 GPS Tracker and metal detector. And in 2nd PCB board we have connected ESP8266, ultrasonic sensor, DHT11 sensor, PIR sensor and motor driver.

## II. LITERATURE REVIEW

### A. ESP8266 Wifi Module

The Electronics ESP8266 Node MCU WiFi Development Board, a versatile and powerful tool for your IoT (Internet of Things) projects. This development board is based on the ESP8266 microcontroller, offering built-in Wi-Fi connectivity and a range of features to streamline your development process. It provides a user-friendly platform for creating connected devices and applications. It combines the capabilities of a microcontroller with the convenience of Wi-Fi connectivity, allowing you to connect and control your devices remotely. Whether you're building smart home systems, environmental monitoring devices, or industrial automation solutions, this board offers the flexibility and functionality you need.

The ESP8266 microcontroller at the heart of this development board is known for its reliability and ease of use. It features a 32-bit RISC architecture and offers ample computing power for your projects. With its integrated Wi-Fi module, you can

easily connect your device to a local network or the internet, enabling seamless communication and data transfer. It supports a range of programming options, including the popular Arduino IDE. This makes it accessible to both beginners and advanced users, allowing you to write code and upload it to the board with ease. Additionally, it offers a wide array of libraries and examples to accelerate your development process. This development board provides a variety of input and output pins, including digital and analog pins, as well as support for I2C and SPI communication protocols. This enables you to connect sensors, actuators, and other electronic components to create interactive and responsive projects. The board also has an onboard USB interface for easy programming and power supply.



Fig.1 ESP8266 Wifi Module

### B. Metal Detector

Metal Detector is a high performance metal detector designed for security. Working Voltage is DC3-5V, Detecting Distance is <60mm. It can apply to game entertainment, car detection, Elevator floor control, equipment position detection, metal proximity switch, traffic statistics, etc.. Simple circuits are easy to assemble and train your welding skills during assembly. For welding beginners is really an interesting welding practice. Buzzer start to ring and the redlight indicator is on when the metal is close to the metal detector. This is a DIY kit for the Metal Detector project. The kit have all the necessary components and a PCB with a built-in detector coil. The PCB is made from good quality material and has all the necessary information about the component values printed on it.



Fig.2 Metal Detector

### C. Ultrasonic Sensor

Ultrasonic sensors are electronic devices that calculate the distance of a target by emitting ultrasonic sound waves and convert these waves into electrical signals. The propagation speed of ultrasonic waves is faster than audible sound. These are mainly two basic elements, which are the transmitter and the receiver. Using piezoelectric crystals, the transmitter generates sound and from there it travels to the target and back to the receiving component. To know the distance between the target and the sensor, the sensor calculates the time it takes for the sound emission to travel from the transmitter to the receiver.

Fig.3 Ultrasonic Sensor

### D. PIR Sensor

The PIR sensor detects human movement within a distance of approximately 10 m from the sensor. PIRs are basically made of a pyroelectric sensor that can detect infrared radiation levels. When any person, animal or any object comes within range of the sensor then the automatic lighting turned on. This can also be used in automatic room lighting, when any person enters the room, then the light will turn on automatically. The PIR sensor can detect animal/human movement in the desired range. The detector itself does not emit any energy, but passively receives it. Detects infrared radiation from the environment. When the infrared radiation from the human body particle with temperature occurs, focusing on the optical system causes the pyroelectric device to generate a sudden electrical signal.

Fig.4 PIR Sensor

### E. DHT11 Sensor

The DHT11 is a Digital Temperature and Humidity Sensor. It is an low cost digital temperature and humidity sensor. This sensor can be easily interfaced with any microcontroller like Arduino, Raspberry Pi, etc. to measure humidity and temperature instantly. The DHT11 sensor is available as a sensor and as a module. The difference between this sensor and the module is the pull up resistor and the power on LED. It is a relative humidity sensor. This sensor uses a thermistor and a capacitive humidity sensor to measure the ambient air. They use various technologies such as thermocouples, thermistors and integrated circuit temperature sensors to accurately detect changes in temperature. This data is vital in industries such as HVAC i.e heating, ventilation and air conditioning to regulate indoor climate, in manufacturing processes to meet specific temperature requirements, and in weather forecasting to monitor atmospheric changes. Humidity sensors, on the other hand, measure the moisture content or relative humidity in the air. This information is key to maintaining proper humidity levels in spaces such as greenhouses, museums, warehouses and data centers. It is a combination of temperature and humidity sensors provides a comprehensive view of environmental conditions.
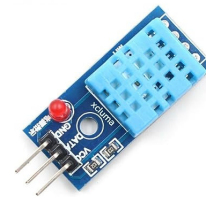
Fig.5 DHT11 Sensor

### F. GPS Tracker

The GPS receiver modem is based on SIM COM Sim28M/Sim28 ML GPS module. The SIM 28 ML is a stand-alone or a GPS receiver with a built-in LNA. The SIM 28M can delay antenna requirements and does not need an external LNA. Sim 28ML can monitor the signal up to -165 dbi even without the help of a network. The SIM 28ML has excellent low power consumption characteristics (17mA acquisition, 16mA

monitoring). Sim 28ML supports various localization and navigation applications including autonomous GPS, QZSS, SBAS ranges (WASS, EGNOS, GAGAN, MSAS). DGPS and A-GPS. SIM Com introduces the small, high-performance and reliable GPS-SIM28ML module. It is a self-contained SMT type L1 frequency GPS module and is designed with a highly sensitive MTK navigation system that allows you to achieve the highest level of sensitivity, accuracy and time to first fix i.e TTFF with the lowest power consumption.



Fig.6 GPS Tracker

### G. Camera

We have used Imou Ranger 2-D Camera in this bot. It has AI Human Detection & Intruder Alarm System, Sound Detection, Motion Detection & Motion and Human Tracking, 1080P & Two-way Talk, Night Vision Up to 10M, Privacy Mode, Best Solutions, 2.4GHz Wi-Fi & LAN, 24x7 Continuous Recording. This camera is 360° rotational.



Fig.7 Camera

This camera will capture HD videos and images. It has cloud and SD card both facilities.

### H. Motor Driver

A motor driver is an electronic device that helps convert electrical energy into mechanical energy. It is an integrated circuit chip that controls motors in autonomous robots and embedded circuits. L298N motor driver module consists of L298 motor driver IC, 78M05 voltage regulator, resistors, capacitor, Power LED, 5V jumper in integrated circuit. 78M05voltage regulator will only be activated when the jumper is placed. When the supply voltage is less than or equal to 12V, then the internal circuit will be powered by the voltage regulator, and the 5V pin can be used as an output pin to power the microcontroller. The jumper should not be placed when the supply is greater than 12V, and a separate 5V should be supplied through the 5V terminal to power the internal circuits. L298N motor driver module is a highperformance motor driver module for controlling DC and stepper motors. This module consists of L298 motor driver IC and 78M05 5V regulator. The L298N module can control up to four DC motors or two DC motors with direction and speed control.
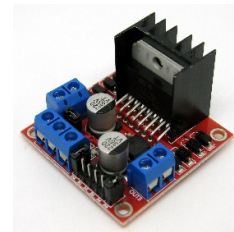


Fig.8 Motor Driver

## III. HARDWARE USED

### A. CompositeAluminumMaterial

Aluminum Composite Material i.e ACM. It is a three-layer sandwich panel consisting of two pre-painted aluminum sheets bonded to a polyethylene i.e PE core. Aluminum Composite Material panels are an excellent material for indoor or outdoor applications that require good dimensional stability, light weight and an elegant, brilliant appearance. Eye-catching, durable and only half the weight of aluminum, Aluminum Composite Material metal panels are attractive and practical for use in visual merchandising, framing, archival, commercial interior and exterior, construction and fine art applications.
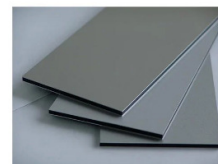


Fig.1. Composite Aluminum Material

Fig.4 Wheels

### B. PVC Foam Sheet

Foam PVC board is a light rigid material used mainly in the production of signs and displays. PVC foam sheet is a firm or rigid compressed foam sheet and is easy to clean. Foamed PVC consists of an extremely light core sandwiched between two hard glossy surfaces. Foamed PVC can be processed in a large number of ways. It can be cut, filed, nailed, drilled, punched, sheared, painted, riveted. Its incredible versatility as well as its lightness, strength and clean finish make it an ideal material for a wide range of applications.



*Fig.2. PVC Foam Sheet*

### C. Motor

The motor shaft has a hole for a better connection. The motor will run smoothly on a voltage range of 6 to 18 V DC and will give you 60 rpm on 12 V supply. It provides a torque of 7.5 kg-cm at 60 rpm.



*Fig.3 Motor*

### D. Wheels

Robot Wheels are used to move around the ground using their motorized wheels to propel themselves. This design is preferred because it is simpler than the legged design. The design, manufacturing, and programming processes for moving on flat terrain are simpler, and wheeled robots are easier to control than other types of robots. We have used two types of wheels second one is 360 degree for smooth and fast rotation of the bot.



## IV.    SOFTWARE USED

Blynk is a comprehensive software suite that enables prototyping, deployment and remote management of connected electronic devices at any scale.

Whether personal IoT projects or commercial connected products in the millions, Blynk enables users to connect their hardware to the cloud and create iOS, Android and web applications, analyze real-time and historical data from devices, remotely control them from anywhere, receive important alerts and much more. Blynk application controls our project from anywhere at any time.
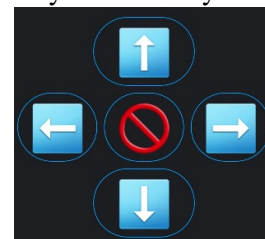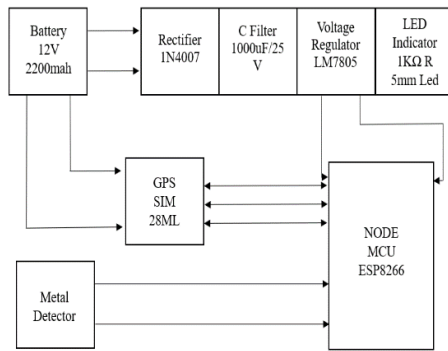


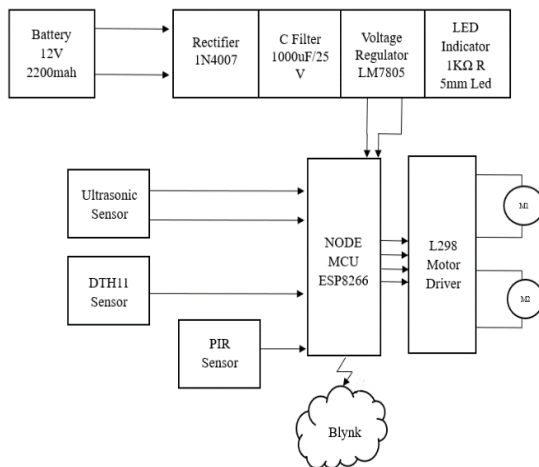This image shows the bot control on Blynk application.



This image shows the sensors control on Blynk application.

## V. SYSTEM MOELING

### A. Block Diagram

*Block Diagram 1*



*Block Diagram 2*

**B. Result**



Final Model

## VI. CONCLUSIONS

We have successfully made a IoT Based War Field Surveillance Robot With Night Vision Camera. For surveillance of war area, agricultural area, industries, shops etc. In this bot we have use different sensors like metal detector, PIR sensor, ultrasonic sensor, DHT11 sensor and GPS tracker. We have also used a 360° rotational HD camera for capturing HD videos and images. We are controlling this bot by using Blynk application. We can control the bot and also we can get alert of ultrasonic sensor, PIR sensor, DHT11 sensor on the Blynk application.

## ACKNOWLEDGMENT

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