

IoT based Multipurpose Surveillance Robot

Divakar U¹, Ningaraju A.M², Sudarshana Chakravarthy³, Suraj Sharma S⁴,
Harish S.V⁵, Pawan Bharadwaj⁶

^{1,2,3,4} UG Scholar, Department of Electronics and Communication Engineering,
NIE Institute of Technology, Mysuru

^{5,6} Assistant Professor, Department of Electronics and Communication Engineering,
NIE Institute of Technology, Mysuru

Abstract - The main goal of IoT based Multipurpose Surveillance Robot is to design and develop a surveillance robot that is capable of being used for rescue and spying in military operations. It is known that humans cannot venture into hazardous/disaster-affected places as it can be life-threatening and hence robots are required where human intervention is nearly impossible. Wireless surveillance robots can help to prevent the endangerment of humans or animals. The robot acts as a surveillance device to capture the intruder's surrounding information before the intruder attacks the soldiers. The issues related to short-range communication to control the movement of the robot are overcome by using IoT technology and therefore real-time video can be transmitted to the intended recipient. An android phone can control the robot's movement from a distance. This project comprises the following phases: controlling the robot in manual mode using IoT technology via android application, Phone acting as a camera for live video streaming, IR, Gas and Metal detection sensors, and rechargeable batteries. The work aims to reduce loss of lives during military operations, ensure safety on the war field and help provide footage of disaster-struck regions. This robot can perform multiple operations. When bombs are planted in a land mine-affected area, the robot can be made to act as a bomb detector robot using the metal detector sensor. The robot can also be used by rescue teams to detect human beings quickly during natural disasters like earthquakes if any human beings are trapped under debris.

Key Words: IoT, Surveillance, Robot, Live stream, Node MCU (esp8266), Blynk, Phone camera, IR sensor, Gas sensor, Metal detector

1. INTRODUCTION

With the various and fast advancements in the field of Automation and Robotics, robots are playing a vital role in simplifying the lives of human beings by reducing human errors and human labor. A surveillance robot is a robot used for spying/monitoring purposes. Any remote/inaccessible areas can be monitored using surveillance robots.

Surveillance is the method of systematic close observation of a person or area of suspicion. Surveillance is mainly required

in the area of defense, intelligence gathering, disaster-affected areas and in public places.

Nowadays, tracing, tracking and attacking enemy troops in different areas proves to be a tedious task for army personnel. There is always a chance of loss of the lives of soldiers on the battlefield and during emergencies. To develop a technology that serves the high speed and advanced capacity to control the robots and to devise new methods of control theory. To realize the above standards, some technical improvements along with the need for high-performance systems are required to create a faster, reliable, accurate and more intelligent robot. This can be devised by advanced control algorithms, robot control devices and new drivers. To meet the requirements, we can use multimedia to control the user-friendly robot.

Earlier, the robots were being controlled through wired networks. But now, to make robots more user-friendly, they are framed to make user commanded work. The design of our project i.e., IOT based Multipurpose Surveillance robot encourages the development of a robotic vehicle based on Wi-Fi technology for remote operations connected with the phone that acts a camera mounted on the robot for monitoring/surveillance purposes. This IoT based Multipurpose Surveillance robot has or is embedded with a Node MCU (ESP8266) microcontroller for the desired operation and is generally used for monitoring purposes. The transmitting module on PC consists of push buttons that send commands to the receiving module for controlling the movement of the robot either to right, left, forward or backward. In the receiving module of this Surveillance robot, 2 DC motors are interfaced with the Node MCU(ESP8266) microcontroller to control its movement via motor driver IC(L298N). The Wi-Fi control transmits the signals to the receiver and has a range of up to 400m. The receiver collects and decodes the received signal's before feeding them to the Node MCU (ESP8266) microcontroller to drive the DC motors via motor drivers(L298N). Interfacing is done between the device and the Wi-Fi module. Wi-Fi module device receives the signals or commands from the ESP8266 microcontroller.

2. LITERATURE SURVEY

J. Gao, X. Gao, W. Zhu, J. Zhu and B. Wei ^[1], have proposed a new snake robot with all body drive system based on rope system. This is a disaster management device and can climb into ruins to detect people and controlling it is simple compared to other kinds of snake robots. Snake robot has 11 bodies and 10 joints. Head and tail bodies have a main CPU, camera and communicator. The middle body has 9 tubes and all tubes have rope drive system on surface. Joints are used to sway and raise the body.

Sushant Kumar and Dr S. S. Solanki ^[2], 2016, discuss a system developed for remote surveillance of homes using an Arduino, IP camera and Team Viewer to monitor the system. A DTMF controlled remote is used to switch on the PC, camera and robot. Once the mobile phone is called and a particular set of keys are pressed, corresponding relay switches activate all the components required in the remote surveillance.

Mohammad Shoeb Shah, P.B. Barole ^[3], 2016 represents a low-cost, cost-effective robot using microcontroller Arduino UNO which can perform the act of tracking as well as rescue act. The robot is equipped with a passive infrared sensor, ultrasonic range module, temperature and humidity DHT11 sensor, air quality sensor MQ-135, accelerometer sensor, gyro sensor, magnetometer sensor, GPS sensor, Bluetooth and WIFI module, motor controller and robotic arm. The robotic arm is a type of articulated arm and consists of gripper for easy grasping of objects. It is controlled remotely by the end user via the Internet. It is connected with a solar panel to provide a device for charging the battery with solar energy.

G. Anandravisekar, A. Anto Clinton, T. Mukesh Raj, L. Naveen, M. Mahendran ^[4], designed a robot that perform the act of continuous surveillance in the household areas. The robot is controlled by a mobile phone or laptop via IoT using Cayenne software. Used to send instructions for a robotic system. Arduino connected with Wi-Fi module ESP-8266 for an unlimited range of operation accepts these commands. DC motors, ultrasonic sensor to detect any obstacle, IR sensors and a wireless camera that provides audio and video streaming data to the user used in this project.

S. Jagadesh et al ^[5], designed this robotic vehicle using Wi-Fi technology for remote control of a wireless camera mounted on the robot. This robot uses a Node MCU ESP8266 microcontroller for the desired operation. Interfacing is done between the device and the Wi-Fi module. The Wi-Fi module device receives the commands from the ESP8266 microcontroller. This robot can be used for longer-range surveillance and capturing images during live streaming. Night vision camera makes surveillance easier during low lighting conditions. Lack of GPS, so the robot's location cannot be determined.

Telkar, Aishwarya K and Baswaraj Gadgay ^[6], 2020, has proposed a robot with a Wireless Night Vision camera that gives the live streaming of the robot surrounding area even during the night. Using an Android or PC, a controller unit controls the robot wheels via the Internet of Things. The GSM technology provides the notification to the control unit once the robot stops upon detection from sensors. The GPS receiver is used to track the robot and also to notify the user of the landmine or bomb's exact location.

M. Sunitha et al ^[7], 2020, propose a security robot that uses IoT to monitor key points in a home or workplace for the presence of intruders. With a live-stream camera attached to the robot, the picture of the intruder can be seen. As soon as the PIR sensor on the robot detects a human, the NodeMCU attached to the GSM module triggers sound, alerting the user about the intruder. The Raspberry Pi board controls, monitors, and supervises all of these.

3. ISSUES IN EXISTING SYSTEMS

The existing models such as Radio Frequency (RF), Bluetooth & GSM (Global System for Mobile communication) have various cons/disadvantages, few are that it works only for a short-range of distance or coverage area making it a bit difficult for surveillance or spying for a long range of distance, limited data transfer and lag in bandwidth.

4. BLOCK DIAGRAM

This IoT based Multipurpose Surveillance Robot Block Diagram is as follows shown in Fig - 1

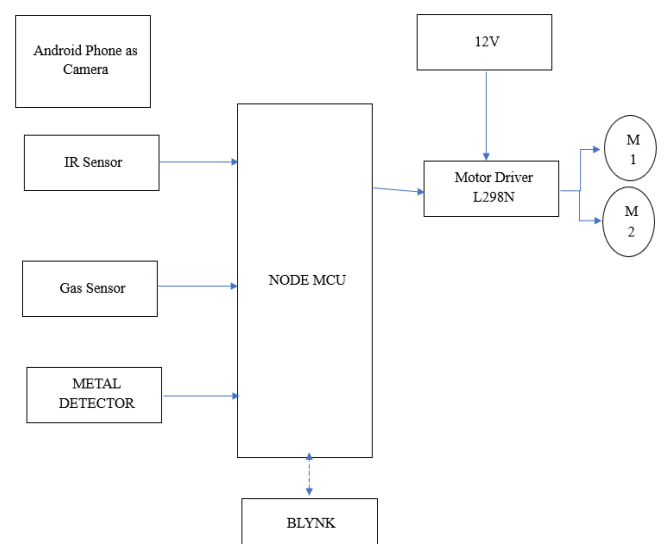


Fig - 1: Block Diagram

The main components of our block diagram are Node MCU (ESP8266), Metal Detector, Motor Driver(L298N), Battery(12V), Gas sensor (MQ2), IR sensor, 2 DC Motors and

phone as camera as shown in Fig - 1. DC motors are used for controlling robot's direction. Metal detector is used for detecting land mines which are placed on the ground. Gas sensor is used for detecting hazardous gases during rescue operations. IR sensor is used to determine if the robot is near to an object. BLYNK app is used to control our robot.

4. HARDWARE AND SOFTWARE REQUIREMENTS

Hardware requirements are as follows,

ESP8266 (Node MCU): - The ESP8266 is a Wi-Fi module which is used to provide internet access to the microcontroller. The commands are provided to the microcontroller via Blynk App to control and monitor the motion of the robot.

Motor driver (L298N): - As the name suggests, it is mainly used to drive motors. A single L298N is capable of running two DC motors at the same time; Also, the direction of the two motors can be controlled independently. The motor driver is used as an amplifier, to amplify the voltage supply to the motors. The motors operate at 12V, but the microcontroller provides only 3.3V to 5V at its output pins.

DC Geared Motors (30 RPM): - A DC motor is an electrical machine that converts electrical energy into mechanical energy. In a DC Geared Motors, the i/p electrical energy is the direct current (DC) which is transformed into the mechanical rotation.

Robot Chassis & Wheels: - It's a simple accessory that particularly supports the making of a robot. Chassis is a very essential component not only in constructing robots but also for many mechanical devices. The components that are interfaced are handled by a chassis for connecting components and accessories on it.

IR sensor: - IR Sensor Module is an electronic device, that emits the light in order to sense some object of the surroundings. Infrared (IR) sensors are also capable of measuring/computing the heat being emitted by an object and detecting the motion.

Metal Detector Sensor: - A metal detector is an instrument/device that detects the presence of metal nearby. It is also known as Proximity sensor. Proximity sensor means – if any object/target comes into its vicinity, it senses that object. A proximity sensor (metal detector) is a sensor able to detect the presence of nearby objects(target) without any physical contact. The metal detector is used to detect landmines or bombs underneath the robot.

Gas Sensor (MQ2): - A gas sensor is a device which detects the concentration or presence of gases in the atmosphere. Based on the concentration/presence of the gas, the MQ2 gas sensor produces a corresponding potential difference by

changing the resistance of the material inside this gas sensor, which can be measured as o/p voltage. Based on this voltage value the type and concentration of the gas can be found or estimated.

Power Supply: - Batteries are used as power supply (12-volt battery).

Software requirements are as follows,

Arduino IDE: - Arduino IDE is an open-source software. It makes it easy to write the code and upload it to the board. This Arduino IDE software can be used with any Arduino board.

BLYNK: - Blynk is a platform with IOS and Android apps to control Arduino via the internet. It's a digital dashboard where we can build a graphic interface for projects by dragging and dropping widgets.

5. FLOWCHART

The following Fig - 2 shows the flow chart of the working of IOT based Multipurpose Surveillance Robot. The battery is connected and the robot is initialized or made ready to perform the action according to the code loaded into the robot.

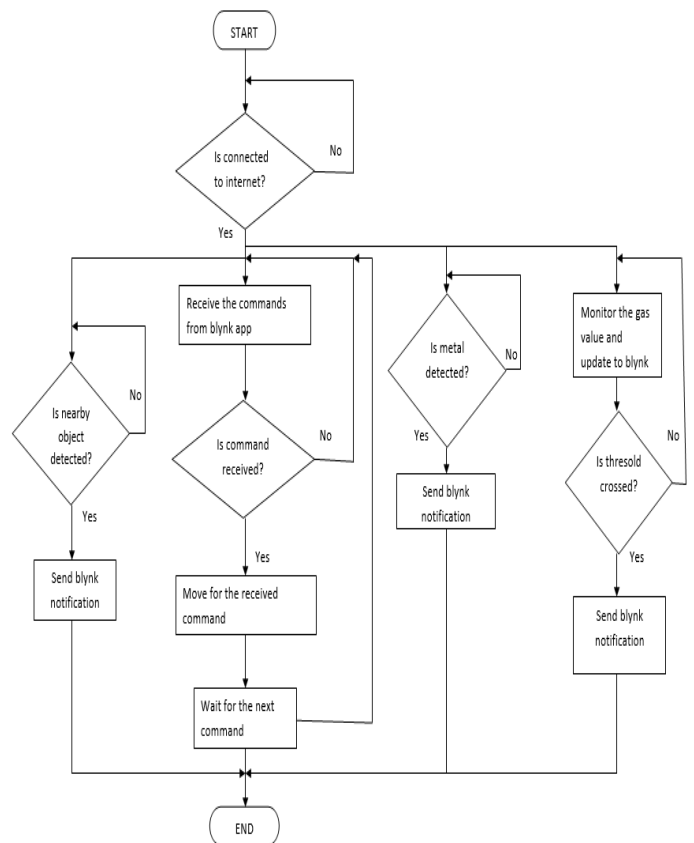


Fig - 2: Flowchart

6. CONCLUSION

This paper presents a multipurpose surveillance robot that can be used in military applications for both spying and detecting landmines. We can also use this robot for detecting hazardous gases during rescue operations where humans cannot get inside due to tight spaces.

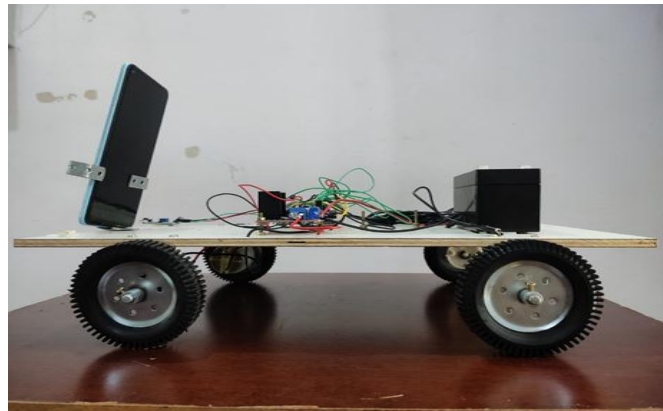


Fig - 3: Final robot assembly

- [7] Sunitha, M., et al. "IP Based Surveillance Robot Using IOT." 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC). IEEE, 2020.

REFERENCES

- [1] J. Gao, X. Gao, W. Zhu, J. Zhu and B. Wei, "Design and research of a new structure rescue snake robot with all body drive system," *2008 IEEE International Conference on Mechatronics and Automation*, 2008.
- [2] Sushant Kumar and Dr. S. S. Solanki, "Remote Home Surveillance System", *2016 International Conference on Advances in Computing, Communication, & Automation (ICACCA)*, 29 September 2016.
- [3] Shah, Mohammad Shoeb, and P. B. Borole. "Surveillance and rescue robot using Android smartphone and the Internet." *2016 International Conference on Communication and Signal Processing (ICCSP)*. IEEE, 2016.
- [4] G. Anandravisekar, A. Anto Clinton, T. Mukesh Raj, L. Naveen, M. Mahendran, "IOT based Surveillance Robot". Department of Electronics and Communication Engineering Saranathan College of Engineering Trichy, Tamilnadu, India. "International Journal of Engineering Research & Technology (IJERT)", 2018.
- [5] S. Jagadesh, R. Karthikeyan, R. Manoj Prabhakaran, R. Ramesh and C. Shanmugam. "Surveillance Robot Using Microcontroller ESP8266". *IJAREEIE* Vol. 8, Issue 3, March 2019
- [6] Telkar, Aishwarya K., and Baswaraj Gadgay. "IoT Based Smart Multi Application Surveillance Robot." *2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA)*. IEEE, 2020.