

# An intelligent Espionage Robot Controlled by Mobile Wireless System

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**Abstract**— The field of robotics has grown exponentially as a result of the integration of several domains. With advances in technology, a drone, also known as an unmanned aerial vehicle (UAV), can be controlled from 20,000 miles away. Such technologies either use artificial intelligence or radio communication to control their process. Creating one such autonomous robot is the main task. More than a thousand kilometers away, in a distant place, this must be managed. Currently available technologies can only control robots up to 500 yards away. Our communication way is WIFI. These Wi-Fi-connected computers send serial data, and they also communicate with a system using a microcontroller to direct how it operates. The robot senses as well in order to avoid obstacles and determine its location.

**Keywords**- Robotics, Unmanned Aerial Vehicle, Wi-Fi.

## I. INTRODUCTION

Engineering areas like structural, pneumatics, electronics and mechanical are all included in the realm of robotics. In the structural component, beams, frames, axles, linkages, etc. are used. The mechanical components include several kinds of gears (such as crowns, spurs, worms, bevels, and splitter gear systems), pulleys and belts, drive systems like differentials, wheels, castors, and steering, and more. The creation of

accurate pushing and pulling movements, such as those that simulate arm or leg movement, depends heavily on pneumatics. Because of their ease of use and low cost, pneumatic grippers are also advantageous in robotics. DC and Stepper motors, electrical grips, actuators, clutches, and their control are among the electrical objects [1]. The electronic components include a microprocessor for general control purposes, interface circuitry, a remote control, sensors, touch sensors, light sensors, collision sensors, etc., and interface

circuitry. The Wi-Fi enabled robot's operation is simple; all the operations is based on dragging or slide the joystick in the direction to move the robot. Through Wi-Fi, the Blynk App transmits values from a two-axis joystick to an Arduino board. The values are received by Arduino, who then compares them to predetermined values and moves the robot. Robot controlled devices, new drives, creates faster, accurate, intelligent robots which results in technical advancement demanding high performance robots. Different sophisticated robot applications can use robotic control system. The remote receiver commands through RF transmitter were received by the Arduino and controlled fully through this spy and bomb detection robot. Therefore, this spy and bomb detecting robot is suitable for military use [2]. The majority of military organizations now use robots to complete many dangerous tasks that soldiers are unable to complete. These military spy robots are typically used with an integrated system that includes a gripper and cameras, video screens, and sensors. The shapes of the military robots vary depending on each robot's intended use. As a result, the suggested system, an intelligent robot using an RF module, saves human lives and lowers manual error in the defense side. This specially developed robot system for spy and bomb detection was created to save human lives and defend the nation from enemies. The capacity of these robots to conduct field missions remotely without really endangering human lives is one of their most crucial features. Robotics is one of the factors contributing to the rapid global advancement. A combination of programming, interfaces, motors, and integrated circuits, robotics is a branch of computer, electrical, and mechanical engineering.

1. The first of Asimov's Laws is that no robot is allowed to harm people and that no person is allowed to put themselves in danger by remaining motionless.
2. A robot is supposed to comply with and carry out every instruction given by a human, provided that it doesn't clash with the first law.
3. A robot must project itself, otherwise it won't be able to defend itself.

## II. RELATED WORKS

A robot is often device that is operated by computer and electronic programming. Robots designed for manufacturing are widely used in industries around the globe. Creating a contemporary robot that an Android phone can control. The movements of the robot can be controlled by the remote buttons in the android app development. Android Bluetooth facilitates communication between Bluetooth devices and between phones [3] and the Bluetooth module HC-06 by Sathya Moorthy et al (2022). Smart living will eventually become a reality, allowing consumers to wirelessly and remotely operate their homes. Robot motion can be managed using commands sent from an android device. The interface for IP web cameras will also use wireless communication, eliminating the requirement for a receiver to be installed on a mobile device. So, utilizing a Bluetooth link, the computer can observe the camera and navigate the camera at the same time.

In the military, robots are taking on a crucial role. The great bulk of military job is dangerous for people. As a result,

the trooper is replaced by a robot. The goal of the study is to create a spy robot variation that allows to watch the location with edge. The robot's size also makes it useful for use as a hidden agent robot. All of the processes are under the supervision of PIC 16F628A and PIC 16F877 [4, 5] by Chitra et al (2022). To capture real-time footage of the field, a CCD camera is employed. Thus, it will function in the manner in which the robot is programmed. The robot has a transmitter that is attached to it so that it can be watched as it moves. The robot is controlled manually so that it won't be lost due to a lack of human participation, which is the justification. In addition to long-range applications, it is very likely to be used as a government worker robot over short distances.

Das et al (2022) opted the design and characterization of a wireless charging and controlling surveillance robot. The suggested system consists of a wireless control station, a surveillance robot, and a wireless charge transmitter. The surveillance robot has three wheels and is rectangular in design [6]. Through a wireless medium like Bluetooth, it communicates with the device. Robots have sensors for temperature, humidity, ultrasonic, and PIR. The robot's humidity is detected via a humidity sensor. The climate changes are detected by temperature sensors depending on numerical value. This sensor detects any objects in the path that the robot must travel. The robot's PIR sensor detects the presence of people nearby. Using a GSM module, the mobile device may receive these sensor notations and the information. Each and every change is perceptible, and it is possible to see the changes in a mobile device through a message. The robot's battery is charged by the wireless charging system, which also supplies power to all the other components.

Navare et al. (2022) designed a wireless robot that can disarm bombs, enhancing nation's defense against terrorist attacks, suicide bombers, and other similar actions [7]. In this project, surveillance and bomb detection are two applications that will be combined. A little robot with a night vision camera is called a spy robot. Relays will power the motors, and the relays will be controlled by a remote via RF module. A war field robot with 24 bomb and land mine detection capabilities and wireless RF control is proposed. User input is transferred by the sensor to the receiver, which receives it, recognizes it, and passes it along to the proper module (Robot) for action. The Robot is made up of a Base, a robotic Arm, and a camera that is wireless. DC motors were employed to move the robotic arm. Thus, the safest method of explosive disposal was developed to protect commoners' lives.

Robots having cameras that can be remotely controlled and communicate video footage to the intervention force are called spy robots was developed by Rahman et al. (2022). They are built to be transportable sizes and are compact. This paper's project makes use of the PIC 16F628A and PIC 16F877 to create a mobile espionage robot with a remote controller [8]. A wireless camera, an antenna, batteries, and four moving wheels make up the spy robot. The two distinct PICs are utilized to control the spy robot and a wireless system remotely. A CCD camera is used to record data about the area around the robot. On the remote controller is a 4 bits LCD display for viewing user commands. The LED

with CCD that are connected by a lighting circuit to allow the spy robot to be used in low-light conditions at night. In wireless remote-control systems, radio frequency module signals are utilized to broadcast and receive wireless logic signals that spy robot uses for controlling system.

A robot is essentially a human replacement that is operated by humans. Robots can be employed in situations where humans cannot be sent or if human life is in danger. The robots are assigned to meet at the locations in various military applications and for security purposes. A spy robot is built on an embedded system that includes an obstacle detector and other cutting-edge characteristics. Second, the robot is more improvised in that it has a self-defense system built into it, such as an obstacle detector to help it avoid hurting itself. Thirdly, LCD display that can be used to show the robot's present direction as well as to convey various messages in an encrypted fashion. Additionally, it includes a few improvements that make use of the most recent Android technologies.

A. Advantages of Smart Spy Robot System

- Video streaming without apparent light.
- Greater area coverage.
- The video was captured using an SD card.
- Monitoring at the border.
- Rescue and search effort.
- Application in industry.

The suggested task would be carried out with the aid of a spy robot, which would be employed to watch over and monitor locations that are inaccessible to humans. Surveillance is the process of keeping a watch on something else. It is frequently employed in military contexts when sustaining national security necessitates keeping borderlines [9–11]. Workers are stationed close to sensitive areas to keep an eye out for developments during human surveillance. The following sections explain how the paper is organized: In Section 3, a potential methodology is presented. Section 4 presents the project. The performance values for research are evaluated in Section 5, and the paper is concluded in Section 6.

III. RESEARCH WORK PROPOSED

The purpose of the research is to build a robot that can be operated using an Android smartphone. The Robot may be wirelessly controlled by an Android smartphone's Bluetooth feature. A remote control for an Android smartphone is utilized to control the robot. A flowchart of the research process is shown in Figure 1. Just a handful of the connectivity options that Android provides include Wi-Fi, Bluetooth, and wireless communication over a cellular network. Android provides access to a wide range of useful frameworks and tools that may be used to build sophisticated applications. Additionally, Android provides developers with a complete set of tools that were built specifically to operate with the platform, increasing their efficiency and deepening their applications. The RF-based short-range networking open standard specification known as Bluetooth has the power to alter computers and wireless communication.

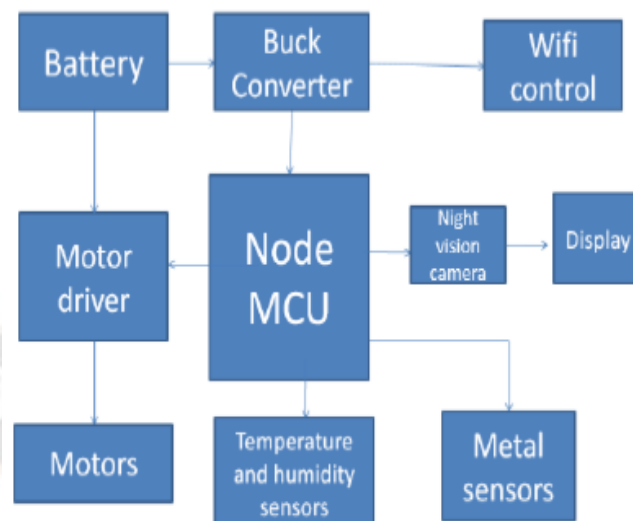


Fig. 1. Block diagram of smart spy robot system

It supports inexpensive wireless connections with a wide range of portable devices, including computers, PDAs, and mobile phones. In addition, desktop computers will be able to connect wirelessly, doing away with the need for cords to connect screens, printers, keyboards, and the CPU. The primary controlling element of the system is a microcontroller. A blue tooth module and DC motors are attached to the microcontroller. Data from an Android smartphone is provided to the controller as input using the Bluetooth module. The Robot's motors are controlled in accordance by the controller. Using an Android phone, the project's robot can be made to move in all four directions. Robot system LED indicators are used to show the robot's direction. These systems are preloaded with programmer in "C" to complete task. The suggested task would be carried out with the aid of a spy robot, which would be employed to watch over and monitor locations that are inaccessible to humans. Surveillance is the process of keeping a watch on someone, somewhere, or something else. It is frequently applied in a military context when sustaining national security necessitates with borderlines. Workers are stationed close to sensitive areas to keep an eye out for developments during human surveillance.

A. Wi-Fi ESP8266

The ESP8266 Wi-Fi Module, a self-contained SOC with a TCP/IP protocol stack, can be used by any microcontroller to provide Wi-Fi networking. The ESP8266 can take over all Wi-Fi networking responsibilities from another chip. as the firmware is pre-programmed into every ESP8266 module. An Arduino device can connect to it and acquire Wi-Fi functionality similar to that of a Wi-Fi Shield. The ESP8266 module has a community inexpensive board. With strong on-board processing and storage capabilities, this module's GPIOs enable connection to with loading.



Fig. 2. Performance Evaluation

No extra RF components are required for the ESP8266 to operate in any operating scenario. It also supports APSD and Bluetooth co-existence interfaces for VoIP applications. The Wi-Fi unit performs IOT operations by sending energy meter data to a website through IP address. Pins 7 and 8 of the Arduino microcontrollers are linked to the TX and RX pins.

#### B. Motor Driver

DC motors can operate in either direction thanks to an everyday integrated circuit (IC), the L293D. The 16-pin IC L293D can drive two DC motors concurrently and in either direction. A single L293D IC manages the control of two DC motors [12]. Dual H-bridge connected in either direction to an H-bridge circuit. To drive a DC motor, H-bridge IC are ideal. Two h-Bridge circuits on a single L293D chip enable the independent spinning of two dc motors.



Fig. 3. Motor driver

#### C. DC Motor

To produce a torque on wires, the conductors under each pole of a motor must carry current in direction [13]. The brush gear and commutator of a dc motor are there to make the current in a conductor reverse as it travels from one brush side to the other.



Fig. 4. DC motor

#### D. Temperature and Humidity Sensor

Each DHT11 component is thoroughly calibrated in an exceptionally precise humidity calibration lab. The OTP

memory has the calibration coefficients as programmers along with a signal detecting algorithm. System integration is made simple by single-wire serial interface. It offers a variety of applications due to its small size, low power consumption, and up to 20-meter signal transmission.



Fig. 5. Sensor

The component's packaging is made up of a row of four pins. Specific packages can be requested by users, and connecting is simple. For the temperature and humidity sensor complex, the DF Robot humidity sensor outputs a calibrated digital signal. It provides extremely high dependability and outstanding long-term stability by utilizing temperature sensor technologies. This sensor connects to an 8-bit microcontroller with a humidity component on an NTC temperature measurement component, and it offers outstanding quality, quick resistance, and efficacy.

#### E. Node MCU

An IoT device called Lua code makes use of the Node MCU development kit and open-source firmware.



Fig. 6. MCU node

Based on the ESP8266 SDK, the Arduino Wi-Fi Shield library were adopted for the development of the ESP8266WiFi library. Over time, the Wi-Fi functionality from the ESP8266 SDK to this library outgrown its APIs.

#### F. Buck Converter

The SMPS topology is the buck converter. The industry frequently uses it to transform a higher input voltage into a output voltage [14]. Galvanic isolation is not provided by the buck converter because it is an open converter.



Fig. 7. Buck converter

A filter component with active switch gets controlled by an IC make up the converter itself. This outstanding simplicity makes it possible to distribute electricity in the application in a way that is both affordable and extremely effective. The load receives a smooth, output from the buck converter's filter. This might be seen as a qualitative gain, but it calls for extra care with regard to significant load transients. The input is visible to the switch S1. The effect is that the input waveform is highly dynamic.

#### G. Metal Sensor

A filter with switch gets the transmit electronics generate a coil with a current that serves as the magnetic transmitter. The receiver consists of a receive coil connected to hardware. The same coil is used for transmit and receive. The coils are housed connected to the coil and is known as the "control box."



Fig. 8. Metal sensor

The switch with metal objects, causes current to flow. Eddy currents are a descriptive term for these electric currents. Eddy currents produce a weak magnetic field that is distinct from the transmitted signals representing both strength and structure. Metal detectors employ the modified shape to identify metallic targets. The switch with distinct "shape" can resemble a time delay. The regenerated magnetic field of the eddy currents produces voltage signal at the receiver coil. Since the signals are weaker such electronics must amplify them.

### IV. SPECIFICATIONS AND RESULTS

#### A. Specifications

- Soft-AP for P2P
- Current: 10uA–170mA
- Flash memory: up to 16MB
- TCP/IP integration
- Tensilica L106 32-bit processor
- Processor MHz range: 80-160
- RAM: 32K
- 17 GPIOs
- In 802.11b, +19.5dBm

- B/G/N 802.11 support

#### B. System Operation

The way the system operates is as follows: first, commands are sent via the remote control to the receiver, which processes and transmits them to the driver circuits that move the motors. The motors for the camera and unusual wheel are then given the appropriate instructions and move in accordance. The camera's capture card receives real-time transmissions of the footage it has captured, which are subsequently displayed on the screen.

Both continuous conduction mode and intermittent conduction mode are operational modes for the buck converter. Switch with ability to block negative current flow, D1 operates in DCM mode at a fixed frequency. Synchronous switch called a MOSFET, the CCM can even be obtained at zero output current at the same specified frequency. Current has a negative IVA as a consequence. Low currents PFM is widely used for efficiency-related reasons. This DCM technique uses a set pulse to reduce the number of switching events and hence dynamic loss. The components are most stressed to high. The converter now operates in CCM.

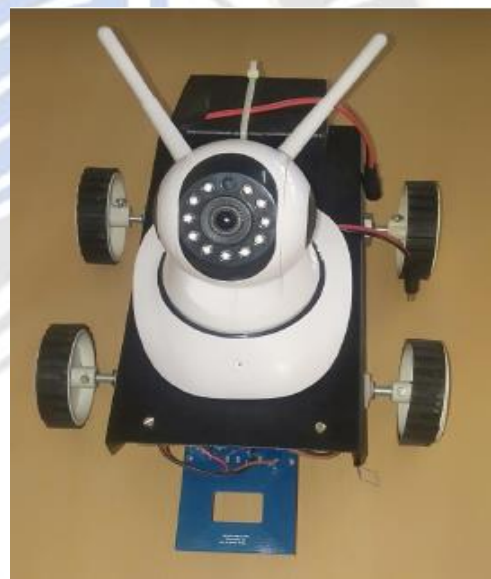


Fig. 9. Designed robotic system

The input pins need to have logic 0 and 1.

- In a clockwise manner, Pin 2 is Logic 1 and Pin 7 is Logic 0.
- Pins 2 and 7 in an anticlockwise direction, with logic values of 0 and 1, respectively.

Logic 0 - no rotation is present on pins 2 and 7. In a high-impedance situation

- Logic 1 - idle no rotation is the current setting for pins 2 and 7.

The mobile robot's communication module uses an RF communication module to carry out the data transmission function. The ATX-ARX receiver and transmitter modules used in this module communicate via the 433 MHz band.

The ATX-34S and ARX-34S depicted in Fig. 7 are used in the proposed RF receiver and transmitter modules. mobile robot for use in communication.

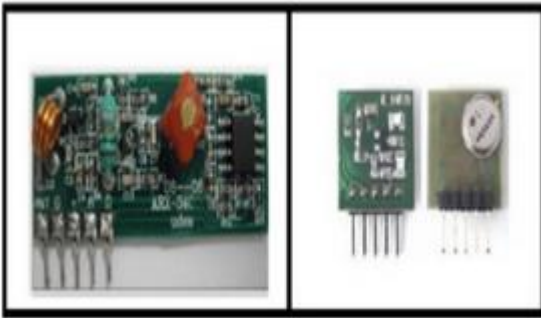


Figure 10. ARX-34 wireless receiver and ATX-34 transmitter modules.

The fourth level includes visualising. The robot arm's mounted camera can move around a lot. It makes use of a wireless, rechargeable CMOS-type gadget that can transmit colour video and audio up to 100 yards away via RF signals. It also communicates via wireless RF communication technology. This study's primary objective is to design a vehicle that can be used in environments that are dangerous to people's lives. A potent laser LED is therefore mounted on the vehicle because it is thought that it can enter any area. Using LEDs, a camera may capture a clear image in dimly lit areas. (Fig. 11)



Figure 11. Laser LED on the mobile robot arm. The user runs two test trails for the mobile robot, and the outcomes are shown in Fig. 11.

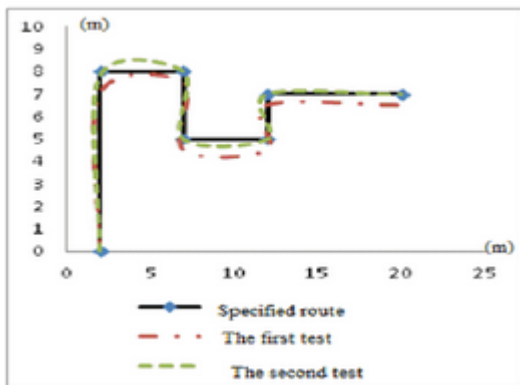


Figure 12. The test of the mobile robot

## V. CONCLUSION

An interface between a microcontroller and a robot is built using the assembled hardware. An Android applet and a

website can be used to successfully control the robot's movement. As a result, the two robot operating modules underwent successful testing and demonstrations. A Bluetooth remote is novel and practical way to control a robot, despite its constrained communication range. Guiding the motion of a robot by means of the internet, which merely enables access to the required webpage. By placing a sensor on it, this instrument is used to find bombs and landmines in battle zones. Additionally, the device's size can be reduced depending on its intended purpose. This type of robot can complete difficult, repetitive jobs that people find uninteresting. A small espionage robot might be able to do the very dangerous duty that it might have to execute. Investigating and locating any sites that may contain toxic gases is crucial. Using spy robots, people who reside in earthquake-damaged structures can also be identified. The spy robots' wireless cameras enable remote access to hazardous regions that humans are unable to enter or escape. The user can remotely control the spy robot to move to the spot of their choice and snap spy pictures. The user can confirm and make suggestions from a computer using the remote controller. The spy robot has a lightning LED attached to it, which acts as a hiding place for a tool for rescue. The robot is made to be portable and is not extremely huge. The entire system is powered by lead acid batteries that are connected to the voltage regulator. The robot controller then parses the byte stream into robot control instructions in accordance with the communication protocol after receiving the remote control data. The robot movement is regulated once the inverse kinematics analysis is converted into robot joint angle data. The robot's terminal trajectory inaccuracy.

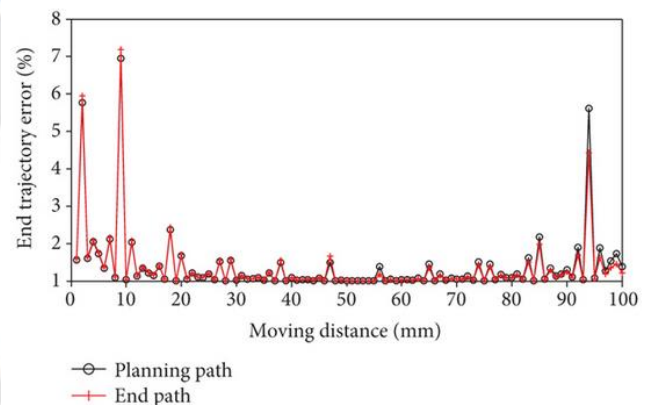


Fig 13: The trajectory error of the remote-control robot end.

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