

BILL OF MATERIAL

Component Name	Purpose in Project	Quantity
ESP 32	Main microcontroller: controls the LEDs and robot manually via Wi-Fi, letting the user override automatic mode and steer the robot using a phone app	1
Arduino Nano BLE 33 Sense	Secondary microcontroller: handles the robot's motors and automatic mode – it uses Bluetooth to track and follow the phone while processing sensor data to avoid obstacles.	1
L298N Motor Driver	Controls motor speed and direction, allowing two DC motors to be driven from the microcontroller	1
12V DC geared motors	The robot driver, encoders allow measurement of distance and speed for precise movement	2
Li-ion 18650 battery cells	The main power source supplies energy for motors and electronics	4
18650 Battery Holder	Holds batteries safely and connects them electrically	1
5V DC-DC step-down regulator	Converts battery voltage to stable 5V for ESP32, Arduino, and sensors	1
On/Off Rocker Switch	Turns the system on and off safely	1
USB cable	Used for programming microcontrollers and debugging	1
Breadboard	For temporary prototyping of circuits and wiring sensors	1
0.1 μ F ceramic capacitors	Reduce high-frequency noise on the microcontroller and motor driver logic	2
220 μ F electrolytic capacitor	Absorbs voltage spikes from motors; stabilizes power supply	1

10 μ F electrolytic/tantalum capacitor	Additional smoothing/stabilization for sensors or regulator output.	1
Ultrasonic distance sensors	Detect obstacles and measure distance to follow the user	2
Caster wheel	Supports stable 3-wheel chassis (two drive wheels + caster)	1
T-Slot Aluminium Extrusion	Structural frame for mounting motors, batteries, and electronics	3

Extras		
LED	Used as an indicator to show the status of the robot, such as power on, signals during testing, or error/debug feedback	6
Connecting wires	Provide electrical connections between the microcontrollers, sensors, motor driver, and other components to complete the circuit.	NA
3d Printing	Custom fabrication of brackets and supportive parts that hold components in place, ensuring the robot is structurally stable.	
Laser-cut frames	Provide precise and sturdy wooden framework pieces for the robot's body and chassis, giving it shape and durability.	
Nuts and bolts	Used to fasten different structural parts together securely, ensuring the chassis and mounted components remain stable.	
Heat inserts	Provide strong, reusable threaded holes in the 3D-printed parts, improving durability when screws are repeatedly tightened or removed.	
Zip Ties	Used to reinforce and hold components in place	

