IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, March 2026
Impact Factor: 8.2

Gestobot: Smartphone and Gesture Controlled Robotic System

Manthan Nandanwar[1], Sarvesh Sune[2], Om Mokhadkar[3], Sanskar Chiddarwar[4], Sarthak Mangale[5], Hrutuja Badhe[6], Ashlesha Kurhade[7], Prof. Rahul Sharma[8]
Students, Department of Electronics and Telecommunication Engineering[1-7],
Professor, Department of Electronics and Telecommunication Engineering[8],
Dr. Rajendra Gode Institute of Technology and Research Amravati, Maharashtra, India.

Abstract: *This paper presents the development of GESTOBOT, a smartphone and gesture-controlled robotic system designed to provide an intuitive and wireless human robot interaction platform. The system integrates a robotic arm with a mobile base, enabling both object manipulation and directional movement within a single framework. Hand gestures are captured using flex sensors and inertial sensors such as accelerometers and gyroscopes embedded in a wearable glove or smartphone interface. The acquired signals are processed and transmitted wirelessly via Bluetooth or RF communication to a microcontroller-based receiver mounted on the robot.*
Upon reception, the control unit interprets the signals and drives DC motors and servo motors through an H-bridge motor driver to execute the desired actions. The mobile platform performs movements such as forward, backward, left, right, and stop, while the robotic arm replicates finger motions for grasping and handling objects. The proposed system eliminates conventional joystick-based control, enhancing portability, flexibility, and user convenience. This approach demonstrates significant potential for applications in surveillance, hazardous environment operations, assistive systems, and educational robotics..

Keywords*:* Gesture-controlled Robotics, Smartphone-Based Control System, Assistive Device, Flex Sensor, Wireless Communication

I. INTRODUCTION

In the rapidly evolving field of robotics, the way humans interact with machines plays a critical role. Traditionally, this interaction relied on wired controls, basic joysticks, buttons or computer interfaces. Although functional, these methods often created a disconnect between human intent and robotic action. As automation became increasingly integrated into daily life and industry, the demand grew for more intuitive, natural, and accessible control systems-especially for individuals unable to use conventional input devices or in situations where environmental or safety constraints require remote operation.

GESTOBOT-a portmanteau of “gesture” and “robot” addresses this need by introducing a robotic system that responds to human gestures and smartphone commands. Its core philosophy is to make robot control as natural as moving one’s own body: a simple tilt of the hand, a swipe on a screen, or an intuitive physical motion becomes a direct command to the machine. With the widespread availability of inertial sensors, affordable microcontrollers, and smartphones, GESTOBOT offers an interface that is accessible to both hobbyists and professionals with minimal hardware investment.

Gesture recognition in GESTOBOT utilizes sensors such as accelerometers and gyroscopes to capture motion and orientation. These sensors continuously monitor the position and angle of the hand or sensing device, converting physical movement into voltage signals or digital data that a microcontroller can interpret. A significant advancement in recent years has been the wireless transmission of these commands through technologies such as Bluetooth or dedicated RF modules, freeing the operator from wired constraints. This capability expands potential applications to hazardous

DOI: 10.48175/IJARSCT-31515

ISSN 2581-9429 IJARSCT

industrial environments, rescue operations, laboratories, and assistive technologies for individuals with physical disabilities.

Smartphone integration further enhances the system's functionality. Acting as a powerful, sensor-rich, and always-connected platform, the smartphone enables GESTOBOT to incorporate touchscreen gestures, accelerometer and gyroscope inputs, and even voice commands. By combining physical gestures with smartphone-based controls, the system becomes highly adaptable, allowing customization based on user preferences and the specific robot being controlled.

The significance of GESTOBOT extends beyond the immediate convenience of controlling robots with a simple wave or tilt of the hand. It represents a broader shift toward inclusive, context-aware interfaces that reduce reliance on technical expertise. This transformation helps democratize robotics, making the technology more accessible for education, rehabilitation, industrial automation, research, and entertainment. From its origins as a hobbyist and classroom project, gesture-controlled robotics has evolved through international research efforts, strong open-source communities, and the widespread sharing of technical knowledge. GESTOBOT stands at the forefront of this movement, offering a glimpse into a future where humans and machines interact seamlessly, naturally, and safely.

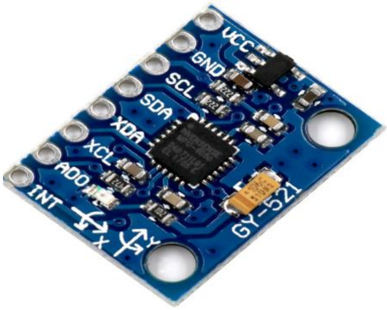
II. COMPONENTS REQUIRED

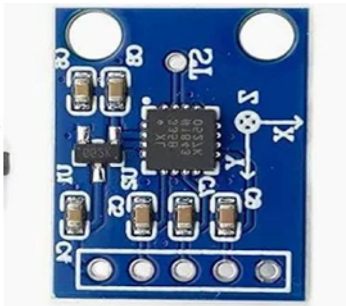
1. Sensor

These detect the hand motion.

MPU6050(Accelerometer +Gyroscope) – Detect hand tilt and movements in X, Y, Z axes.

ADXL335 Accelerometer – Alternative motion sensor for gesture detection.

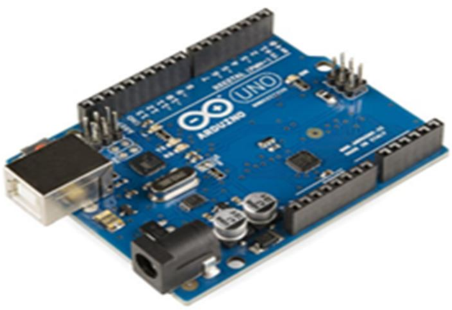




2. Microcontroller

Controls the whole system and processes sensor data.

Arduino Mega/ Arduino UNO (ATmega328P based) – Reads sensor values, interprets gestures, and controls the robot.



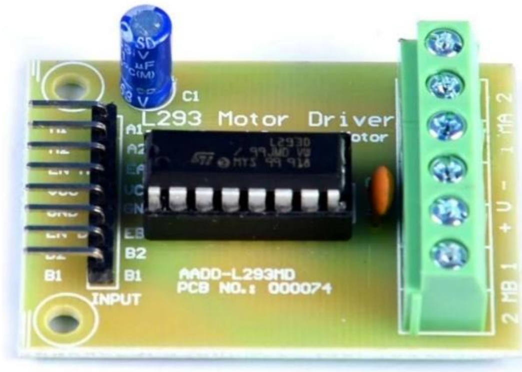
3. Wireless Communication Modules

Used to send gesture commands from the controller to the robot.

Bluetooth Module (HC-05 /BLE) – Used when controlling via smartphone.

nRF24l01 Wireless Module – Alternative wireless communication.

4. Motor Driver
Interfaces the microcontroller with motors.
L293D Motor Driver IC
These allow forward and reverse movement of DC motors.



5. Actuators
Actual movement components of the robot.
DC Motors (2-wheel or 4 wheel)

6. Power Supply
Provides power to transmitter and Robot.
9V/12V battery

III. SOFTWARE REQUIRED

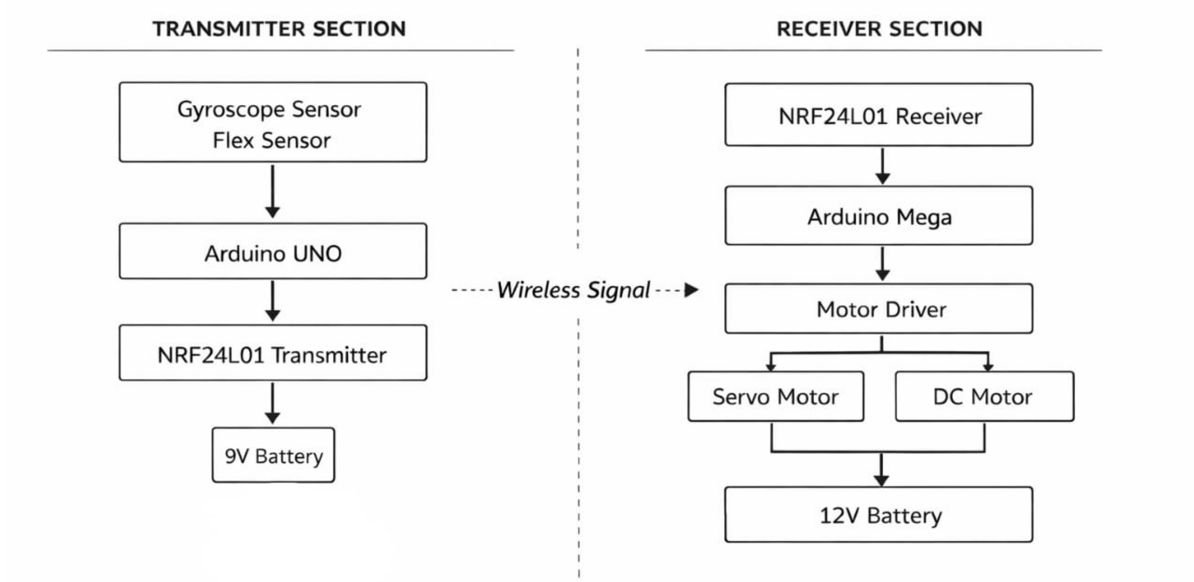
Arduino IDE:
In this project, the Arduino IDE is used to write, compile, and upload the program required to control the robot system. The code for reading sensor inputs, processing hand gesture signals, and controlling the motors is developed using the Arduino IDE with a C/C++-based programming language. After writing the program, it is compiled and uploaded to the Arduino Uno microcontroller board through a USB connection. The Serial Monitor feature in the Arduino IDE is also used to observe sensor values and debug the system during testing. Therefore, the Arduino IDE plays an important role in programming, testing, and implementing the gesture-controlled robot system.

Proteus Design Suite:
Proteus is used for circuit simulation and schematic design. It allows researchers to design and test electronic circuits virtually before implementing them in hardware. In robotics projects, Proteus helps stimulate microcontroller circuits, sensors and motor driver connections, which reduces hardware errors during the development stage.

MIT App Inventor:
MIT App Inventor is a web-based application development platform developed by the **Massachusetts Institute of Technology** that allows users to create Android mobile applications using a visual drag-and-drop programming environment. Instead of traditional coding, it uses block-based programming to design app logic and user interfaces easily. In this project, MIT App Inventor is used to develop the smartphone application that sends control commands to the robot through the Bluetooth module, enabling wireless control of the robotic system.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, March 2026
Impact Factor: 8.2

IV. BLOCK DIAGRAM



V. DESIGN

DOI: 10.48175/IJARSCT-31515

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, March 2026
Impact Factor: 8.2

VI. WORKING

The Gestobot operates based on the principle of gesture recognition and wireless communication to control the motion of a robotic vehicle. The system interprets human hand movements and converts them into control commands that determine the robot's direction and movement. The control logic and processing algorithms used for the system are programmed using the Arduino IDE and implemented on the microcontroller platform such as the Arduino Uno.

The operation of the system begins when the user performs a hand gesture through the controller unit. The motion sensing mechanism detects the orientation and acceleration of the hand in different directions. These physical movements produce corresponding electrical signals that represent the direction and magnitude of the gesture. The microcontroller reads these signals and processes them through predefined threshold values and programmed logic to determine the intended

After identifying the gesture, the system converts the detected motion into digital command signals such as forward, backward, left, right, or stop. These commands are then transmitted wirelessly from the transmitter unit to the receiver unit mounted on the robotic platform. The wireless communication module ensures that the gesture commands are sent continuously and in real time so that the robot can respond immediately to the user's movements.

At the receiver side, the incoming signals are captured and decoded by the microcontroller. The decoded commands are then interpreted by the control algorithm, which determines the appropriate motion action required for the robot. Based on the received instruction, the microcontroller generates suitable control signals for the motor driving circuitry responsible for controlling the rotation and direction of the robot's wheels.

The motor control mechanism activates the motors in different configurations to achieve the desired movement. When the forward gesture is detected, the motors rotate in such a way that the robot moves straight ahead. Similarly, backward gestures cause reverse rotation of the motors, while left and right gestures control differential wheel movement to change the robot's direction. The stop gesture halts the motor operation, bringing the robot to a stationary position.

Through this integrated process of gesture detection, signal processing, wireless transmission, and motor control, the Gestobot enables intuitive human–robot interaction. The robot responds directly to natural hand movements without the need for traditional manual controllers. This method improves user convenience, enhances control efficiency, and demonstrates the practical implementation of gesture-based robotic systems in modern automation and human–machine interface applications.

VII. APPLICATION

Assistive Technology – Helps physically challenged or elderly people control robotic devices or wheelchairs using simple hand gestures.

Industrial Automation – Used to control robots remotely for material handling, assembly, and inspection tasks in industries.

Defense and Military Operations – Useful for bomb disposal, surveillance, and exploring dangerous or restricted areas.

Hazardous Environment Operations – Can be used in nuclear plants, chemical industries, and disaster zones where human entry is risky.

Healthcare Sector – Robots can assist in hospitals for medicine delivery, patient assistance, and contactless operations.

Education and Research – Used by students and researchers to study robotics, embedded systems, and human-machine interaction.

Surveillance and Security – Can patrol areas and monitor environments using gesture-controlled robotic systems.

Entertainment and Gaming – Used in interactive robotic toys and gaming systems controlled by gestures or smartphones.

Smart Home Automation – Can control household robots or devices through gestures or mobile applications.

Search and Rescue Operations – Robots can enter collapsed buildings or disaster areas to locate victims.

Agriculture – Used to monitor crops, inspect farms, or perform small automated farming tasks.

Space Exploration – Gesture-controlled robots can assist astronauts in handling equipment in space missions.

Warehouse Management – Helps in moving goods, inventory inspection, and automated material transport.

Firefighting Assistance – Robots can be sent into fire-affected areas to inspect conditions and reduce risk to firefighters.
Construction Industry – Robots can inspect building sites and assist in hazardous construction tasks.
Home Service Robots – Can help in daily household activities like carrying objects or cleaning tasks.
Museum and Exhibition Guides – Gesture-controlled robots can guide visitors and provide information.
Traffic Monitoring and Control – Used for monitoring traffic conditions or assisting in traffic management systems.
Robotics Training Platforms – Used for training students and engineers in advanced robotic control techniques.

REFERENCES

[1]. J. A. Gonzalez-Aguirre et al., "Service robots: Trends and technology," *Applied Sciences*, vol. 11, no. 22, p. 10702, 2021.
[2]. H. Oliff, Y. Liu, M. Kumar, and M. Williams, "Improving Human Robot Interaction Utilizing Learning and Intelligence: A Human Factors-Based Approach," *IEEE Transactions on Automation Science and Engineering*, vol. 17, no. 3, pp. 1597-1610, 2020.
[3]. L. H. Jhang, C. Santiago, and C. S. Chiu, "Multi-sensor based glove control of an industrial mobile robot arm," in *2017 International Automatic Control Conference*, CACS 2017, vol. 2017, pp. 1-6, 2017.
[4]. J. Ryu, Y. Kim, H. O. Wang, and D. H. Kim, "Wireless control of a board robot using a sensing glove," in *2014 11th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI)*, pp. 423-428, 2014.
[5]. Vrushab Sakpal, Omkar Patil, Sagar Bhagat, "Hand Gesture Controlled Robot Using Arduino" in *International Journal of Recent Trends in Engineering and Research 2018,* Volume 04, Issue 04; April- 2018.
[6]. K. Roy, D. P. Idiwal, A. Agrawal, and B. Hazra, "Flex sensor based wearable gloves for Robotic gripper control," in *ACM International Conference Proceeding Series*, vol. 2, 2015.
[7]. Sumir Broota, Dr. Sanjesh Pawale, " Building of Inmove Robotic Arm for Performing Various Operations" in *International Journal For Research In Applied Science And Engineering Technology 2022*, vol. 10.
[8]. Sharath Surati, Nishigandha Patel, "Pick and Place Robotic Arm: A review Paper" in *International Research Journal For Engineering And Technology* 2021, vol. 8.
[9]. "ROBOTICS: Fundamental Concepts and Analysis" book by Ashitava Ghosal.
[10]. Khan, S.A., & Mundhada, V. (2025). Arduino-Based Gesture-Controlled Robot. International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), 5(4).
[11]. Wang, Mei, et al. "Hand Gesture Recognition Using Valley Circle Feature and Hu's Moments Technique for Robot Movement Control." Measurement, 94, 2016.