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Design and Build a 2WD Car Robot Using Arduino UNO with a Wireless Joystick Control System

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Abstract

This research aims to develop and realize a 2WD car robot that uses an Arduino UNO and is controlled by a wireless PS2 joystick. The method used in this research is experimental, which includes system design, hardware assembly, programming, and performance testing. The designed system integrates the joystick as input, Arduino for data processing, and the L298N motor driver to control DC motors. The test results showed that the robot could effectively carry out instructions from the joystick, such as moving forward, backward, turning, and stopping. The system's response time is relatively fast, approximately 1 second, allowing for real-time control. The wireless connection proved stable at distances between 1 and 5 meters, but its performance decreased at longer distances and was disconnected at around 10 meters. Based on these results, it can be concluded that the system has functioned according to the intended design, although it still. although it still has limitations in communication range. Therefore, it is recommended to use a communication module with a wider range and to add sensors to improve the robot's capabilities. This research is expected to serve as a reference in the development of microcontroller-based robotic systems.

Keywords Robotics, Arduino UNO, 2WD Mobile Robot, Wireless PS2 Joystick

INTRODUCTION

The development of robotics technology today shows very significant progress, especially in the application of both automatic and semi-automatic control systems. Robots are no longer limited to their use in large industrial sectors, but have also been widely used as a means of learning in the world of education, especially to learn the basics of electronics, programming, and control systems. One example of the application of robotics that is quite simple but effective is a car robot (robot car) that can be operated remotely (Basri et al., 2025; Saptiadi et al., n.d.). Car robots that use microcontrollers are one of the most popular options because their structure is quite simple, flexible, and easy to develop. The use of microcontrollers such as Arduino UNO allows the incorporation of various electronic components, such as DC motors, motor drivers, and communication modules, into one interoperable system. Thus, car robots become an effective medium for studying control systems and understanding the interaction between hardware and software (Omar, 2024; Putra et al., n.d.). Omar, 2024; Putra et al., n.d.).

In a robotic control system, the control method is one of the most crucial aspects. One commonly used method is manual control using a joystick. The use of joysticks makes it easier for users to adjust the direction and speed of the robot's movement in real-time. When compared to conventional buttons (push buttons), joysticks offer advantages in terms of flexibility and comfort, as they are able to provide smoother control and faster response (Hidayat et al., 2023; Syabana et al., n.d.)., The use of wireless joysticks, such as PS2 controllers, further increases system efficiency because it no longer depends on the use of cables. With the help of a receiver module connected to a microcontroller, the signal from the joystick can be received and processed directly to regulate the robot's movements. This system allows users to control the robot from a certain distance more practically and freely. In addition, wireless communication technology is also an important foundation in the development of modern robotics systems (Komitov & Shopov, 2025; Syahputro et al., 2020)., However, in its application there are still several obstacles that often occur, such as delays, movement direction errors due to improper motor configuration, and unstable communication between joysticks and robots. In addition, the process of integrating components such as Arduino, L298N driver motors, and joystick receivers requires careful design so that the system can function optimally. Therefore, a design and implementation of a car robot that can be controlled using a wireless joystick effectively and efficiently is needed (Agustin, 2025; Pumps & With, n.d.)

In the development of microcontroller-based car robots with wireless joystick control, there are a number of important problems that need to be analyzed in depth. These problems include how to design a car robot system that is able to receive and process input from the PS2 joystick accurately, as well as how to integrate various components such as an Arduino microcontroller, L298N driver motor, and wireless receiver to work in a coordinated manner. In addition, it is necessary to analyze the system's response to user commands, especially related to the speed of response, the accuracy of the direction of motion (forward, backward, and turn), and the stability of communication between the joystick and the robot under actual conditions of use

(Komitov & Shopov, 2025; Kusumah et al., n.d.). [Based on the problems that have been identified, this study aims to design and realize an Arduino-based car robot that can be controlled using PS2 wireless joystick in an integrated system. In addition, this research also aims to implement a control system that is able to convert input from joysticks into motor movements in real-time and responsively. Furthermore, a test of the overall system performance was carried out to determine the success rate in terms of control accuracy, communication stability, and work efficiency of the developed car robot (Firdaus, 2025; Komitov & Shopov, 2025)

The results of this study are expected to make a positive contribution both in terms of theory and practical application. From a theoretical perspective, this research can be used as a reference to understand the basic principles of a robot control system using joysticks and the integration of electronic components. From a practical perspective, this research can be used as a learning tool for students and students in the field of robotics and system control. In addition, the system created can also be the foundation for further development, such as Internet of Things (IoT)-based robots or autonomous robots with the addition of extra sensors to improve their capabilities and intelligence levels (Galihetal., n.d.; Yudhaetal., 2023

METHODS

This research is a type of experimental research that aims to design, compile, and test the performance of an Arduino-based mobile robot with PS2 wireless joystick control. This approach was chosen because the research includes the direct application of the system along with the evaluation of the robot's response and performance. The research design consists of the system design stage, the creation of the hardware circuit, the development of the program, and the testing of the entire system. The test results data are then analyzed to assess the success rate of the system in responding to joystick instructions, including aspects of speed, movement accuracy, and communication reliability (E-issn, 2024; Komitov & Shopov, 2025).

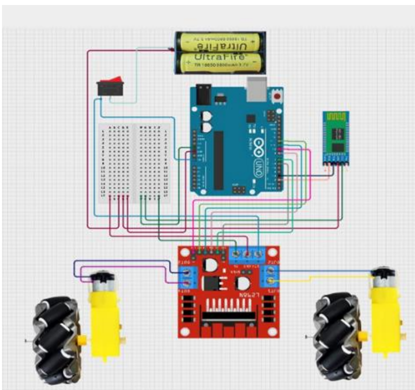

Figure 1. Block Diagram of 2WD Car Robot Control System Using Arduino UNO with Wireless Joystick Control Syste

Tools and materials

Arduino One

Arduino UNO is an ATmega328P-based microcontroller that acts as the main control center on a mobile robot system. The Arduino receives input from the PS2 wireless controller through the receiver module, processes the information, and then passes the setting signal to the motor driver. This board is equipped with a variety of digital and analog input/output pins that are used to interact with other devices. Not only that, Arduino is also easy to program through the Arduino IDE, making it ideal for the development of robotics projects (Of et al., 2022; Pandjaitan, 2023).

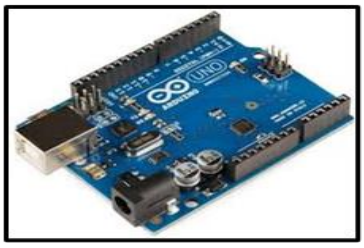

Figure 2 Arduino One.

L298N Driver Motor

The L298N Driver Motor is a drive module used to control the DC motor. This component acts as an intermediary between the Arduino and the motor, because the Arduino cannot provide high current directly to the motor. The L298N facilitates the adjustment of the direction of rotation of the motor (forward and backward) as well as the speed of the motor via PWM (Pulse Width Modulation) signals. This driver is essential for the motor to operate according to instructions from Arduino (Nugroho, 2025; Ramadhany et al., 1945).

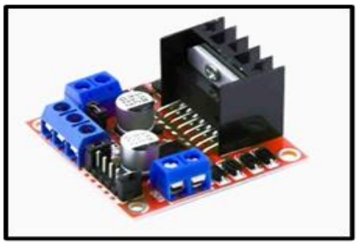

Figure 3 L298N Driver Motor.

Robot Car Kit 2WD

The 2WD Robot Car Kit is a basic frame (chassis) of a robot that is equipped with two drive wheels and one balancing wheel. This kit serves as the main structure to assemble all the components, such as the motor, Arduino, batteries, and drivers.

This 2WD system makes the robot easier to control, but can still move forward, backward, and rotate effectively (Abimanyu et al., 2023; Sitompul et al., 2025).

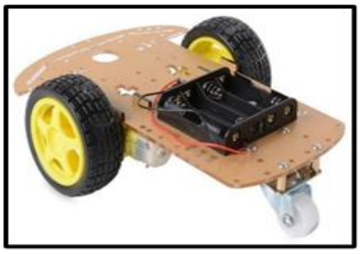

Figure 4 Robot Car Kit 2WD.

PS2 Wireless Controller + Receiver

The PS2 Wireless Controller is a joystick-shaped input device that is used to control the robot manually. This controller is equipped with various buttons and two analog joysticks that can adjust the direction and speed of the robot's movement. The signal from the controller is transmitted wirelessly to the receiver, and then forwarded to the Arduino for further processing. This wireless system offers freedom and comfort in operating the robot without being tied to a cable (Putro & Muda, 2025; Rangkuti & Fitriyadi, 2024).

Figure 5 PS2 Wireless Controller + Receiver.

18650 Battery

The 18650 battery is the main power source used to supply energy to the car's robotic system. This battery has a nominal voltage of 3.7V with a large enough capacity to provide stable power to operate components such as Arduino, driver motors, and DC motors. The use of 18650 batteries provides advantages in the form of a relatively small size, rechargeable, and has good efficiency for robotics applications. With this battery, the robot can operate independently without having to be directly connected to an external power source (Pi, n.d.; Serineka et al., 2024).

Figure 6 18650 battery.

Jumper Cable

The jumper cable serves as a link between components in an electronic circuit. This cable connects the Arduino to the driver motor, receiver, and other elements. The use of jumper cables simplifies the assembly and testing process because of its flexible nature and is easy to install or remove (Firdaus, 2025; Rulik et al., 2022).

Figure 7 Jumper Cable.

System design

The system design in this study was carried out to ensure that all components integrate well to control the car robot through the PS2 wireless joystick. This system is made by combining interrelated input, processing, and output devices, resulting in robot movements that correspond to the user's instructions (Hidayat et al., 2023; Serineka et al., 2024). Overall, this system is divided into three main components, namely input, process, and output. The input component utilizes the PS2 wireless controller to convey motion instructions such as forward, backward, left turn, and right turn. The signal from the joystick is transmitted wirelessly to the receiving module, and then forwarded to the Arduino UNO microcontroller. In the process section, the Arduino UNO is responsible for reading and processing the data from the receiver. The data is in the form of a digital or analog signal that represents the joystick commands. Arduino further converts those commands into precise control signals to activate the motor. This process includes programming that manages the robot's movement logic according to the joystick input (Agustin, 2025; Yudha et al., 2023).

In the output section, the signal from the Arduino is routed to the L298N driver motor to regulate the direction and speed of the DC motor. The driver motor then activates the motor mounted on the 2WD car kit robot, so the robot moves according to the instructions. The resulting movements include forward, backward, left turn, and right turn. The flow of the system starts from the user moving the joystick, the signal is sent to the receiver, processed by the Arduino, and then passed to the driver motor to drive the motor. Through the design of this system, it is hoped that robots can be controlled in real-time with fast and precise responses (Fadzillah & Setiawan, 2023; Rangkuti & Fitriyadi, 2024).

Block diagram of 2WD Car Robot Using Arduino UNO with Wireless Joystick Control System.

The system block diagram illustrates the workflow of a car robot from input to output. The system starts with the PS2 joystick as an input that relays instructions wirelessly to the receiver, then passes it to the Arduino UNO for processing. Then, Arduino sends a control signal to the L298N driver motor that regulates the direction and speed of the motor. In the final stage, the DC motor as the output moves according to the joystick's commands, so that the robot is able to move forward, backward, or rotate (Sukri et al., 2025).

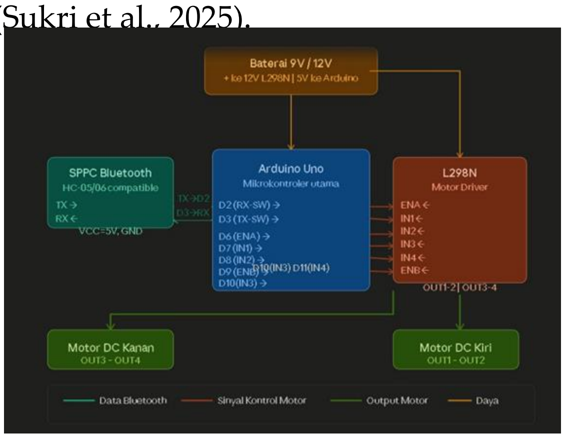

Figure 8 Block diagram.

Research procedure

Robot Chassis Assembly

At this stage, the assembly of the robot skeleton is carried out using a 2WD car kit robot. The process begins with installing the DC motor on the bracket on the chassis, followed by attaching the wheels to the motor shaft. Furthermore, a caster wheel is installed to maintain the robot's balance when moving. All parts are tightened with bolts and nuts so that the frame is strong and does not come off easily when the robot is operated (Saptiadi et al., n.d.).

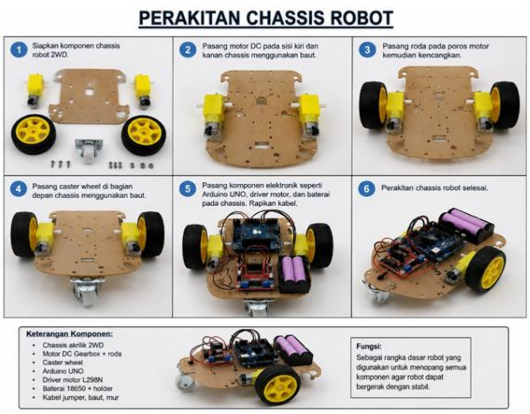

Figure 9 Robot Chassis Assembly.

Installation of Electronic Components

After the frame is assembled, the installation of electronic components such as the Arduino UNO, the L298N driver motor, and the PS2 receiver module is continued. The Arduino is placed on the chassis for easy access for programming. The driver motor is installed close to the motor for easy cable connection, while the receiver is placed in an open location so that the joystick signal is optimally captured. All components are secured with fasteners or brackets so that they do not shift during the robot's movement.

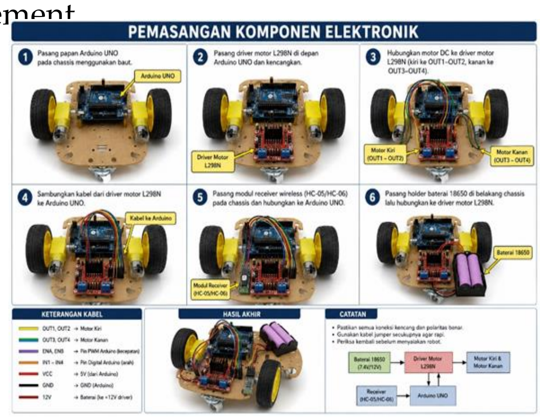

Figure 10 Installation of Electronic Components.

Network-Appropriate Wiring

This stage includes connecting all components using jumper cables. The Arduino is connected to the driver motor via digital pins to control the direction and speed of the motor. In addition, Arduino is also connected to the PS2 receiver through communication pins such as data, command, clock, and attention. The DC motor is connected to the output terminal of the driver motor. Wiring is done carefully following the circuit diagram to prevent connection errors that could interfere with system functioning.

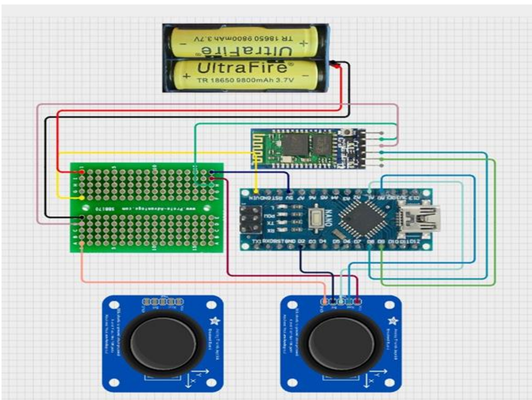

Figure 11 Network-Appropriate Wiring.

Arduino Programming

At the programming stage, Arduino is configured using Arduino IDE software. The program was developed to read the input from the PS2 joystick through the relevant library, then process that data into motor drive instructions. The program logic includes setting the direction of movement (forward, backward, left, right) as well as the speed of the motor according to the joystick input. After the program is completed, the code is uploaded to Arduino and verified whether the system works as desired.

```
// Pin L298N
int ena = 6;
int in1 = 7;
int in2 = 8;
int enb = 9;
int in3 = 10;
int in4 = 11;

// Bluetooth SPPC
SoftwareSerial bluetooth(2, 3); // RX=D2, TX=D3

char command;

void setup() {
  Serial.begin(9600);
  bluetooth.begin(9600);

  pinMode(ena, OUTPUT);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  pinMode(enb, OUTPUT);
  pinMode(in3, OUTPUT);
  pinMode(in4, OUTPUT);
  Serial.println("=== Robot Siap ===");
}

void loop() {
  if (bluetooth.available()) {
    command = bluetooth.read();
    Serial.print("Perintah: ");
    Serial.println(command);

    if (command == 'L') {       // Maju
      analogWrite(ena, 180);
      digitalWrite(in1, HIGH);
      digitalWrite(in2, LOW);
      analogWrite(enb, 180);
      digitalWrite(in3, HIGH);
      digitalWrite(in4, LOW);
    }
    else if (command == 'B') {  // Mundur
      analogWrite(ena, 180);
      digitalWrite(in1, LOW);
      digitalWrite(in2, HIGH);
      analogWrite(enb, 180);
      digitalWrite(in3, LOW);
      digitalWrite(in4, HIGH);
    }
    else if (command == 'R') {  // Belok kanan
      analogWrite(ena, 180);
      digitalWrite(in1, HIGH);
      digitalWrite(in2, LOW);
      analogWrite(enb, 0);
      digitalWrite(in3, LOW);
      digitalWrite(in4, LOW);
    }
    else if (command == 'F') {  // Belok kiri
      analogWrite(ena, 0);
      digitalWrite(in1, LOW);
      digitalWrite(in2, LOW);
      analogWrite(enb, 180);
      digitalWrite(in3, HIGH);
      digitalWrite(in4, LOW);
    }
    else if (command == 'S') {  // Stop
      analogWrite(ena, 0);
      digitalWrite(in1, LOW);
      digitalWrite(in2, LOW);
      analogWrite(enb, 0);
      digitalWrite(in3, LOW);
      digitalWrite(in4, LOW);
    }
  }
}
```

Figure 12 Arduino Programming.

System Testing

The testing phase is carried out to verify that the entire system is operating optimally. The test begins with moving the joystick to observe the robot's response to each instruction. The aspects evaluated included the direction of movement of the robot, the speed of response, as well as the reliability of the relationship between the joystick and the robot. If there is a problem, improvements are made to the series or program. The results of this test are used as a reference to assess the overall performance of the system.

No	Joystick input	Commands	Robot Response	Remarks
1	Forward	Forward	Advanced robots	Conform
2	Forward	Back to the drawing board	Backward robot	Conform
3	Skin	Turn Left	Turn left	Conform
4	Right	Turn right	Turn right	Conform
5	Silence	Stop	Robot stop	Conform

Table 1 System Testing.

FINDINGS AND DISCUSSION

FINDINGS

Robot Assembly Results

The Arduino-based car robot with PS2 wireless joystick control was successfully assembled using a 2WD chassis. All components such as Arduino UNO, L298N driver motor, DC motor, battery, and receiver are neatly installed. The robot has a fairly strong skeleton and the entire system is integrated according to the original design.

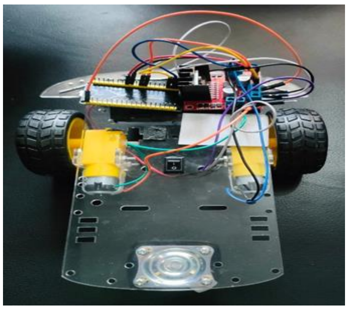

Figure 13 Robot Image.

Robot Motion Test Results

The test was carried out to determine the robot's response to the joystick input. The test results are shown in the table below:

No.	Commands	Response time (seconds)	Remarks
1	Forward	1	Fast
2	Retreat	1	Fast
3	Skin	1	Fast
4	Right	1	Fast

5	Stop	1	Fast

Table 2 Robotic Motion Direction Testing.

Robot Motion Test Results

This test aims to determine the speed of the robot's response to the joystick input. The test results can be seen based on the table below:

No	Joystick Commands	Robot Movements	Test Results	Remarks
1	Forward	Robots move forward	Successful	Stable moving robot
2	Retreat	Robot moves backwards	Successful	Stable moving robot
3	Turn left	Robot turns left	Successful	Faster right wheel
4	Turn right	Robot turns right	Successful	Faster left wheel
5	Stop	Robot stop	Successful	Motor stop perfectly
6	Turn left	Robot spinning forward	Successful	Stable rotation
7	Turn right	Robot spinning forward	Successful	No obstacles

Table 3 System Response Testing.

Wireless Connection Test Results

The test is carried out to determine the stability of the connection between the joystick and the robot at a certain distance. The test results are shown based on the table below:

No	Distanc	Connection	Communication conditions	Success (%)
1	1	Very powerful	Very stable	100%
2	5	Strong	Stable	100%
3	10	Medium	Stable	95%
4	15	Medium	Quite stable	90%
5	20	weak	Less stable	75%

Table 4 Connection Distance Testing.

System Performance Evaluation

Based on the results of the tests carried out, the car's robotic system functions optimally in responding to joystick instructions. The robot is able to move in the expected direction with a fairly fast response time. Wireless connections are also stable at short to medium distances.

However, over longer distances, there is a decrease in signal quality resulting in delays or even disconnections. In addition, program adjustments are needed to increase control sensitivity so that the robot's movement is smoother.

DISCUSSION

Based on the results of the research that has been previously explained, an analysis can be carried out on the performance of the Arduino-based car robot system with the control of the PS2 wireless joystick. This discussion includes analysis of robot movements, system response, and the reliability of wireless communication. Based on Table 3.1, the car robot successfully responds to every basic instruction from the joystick correctly, namely forward, backward, left turn, right turn, and stop. All commands given result in correct responses without any misdirection. This indicates that the designed control system has functioned optimally in converting the joystick input into motor movement. This match between the instructions and the response also indicates that the programming process as well as the wiring has been done accurately.

Furthermore, based on Table 3.2 on response time, the system displays adequate performance with an average response time of between 0.4 to 0.6 seconds. This fairly fast response time illustrates that communication between the joystick, receiver, and Arduino takes place in real-time. Although there is a slight variation in response time to turning movements, it is still within the tolerance threshold and does not significantly interfere with the overall performance of the robot. The variation may be due to signal processing that is somewhat more complicated than straight forward or backward movements. In Table 3.3, the results of the wireless connection test indicate good stability at short to medium distances, namely 1 to 5 meters. In that distance range, the robot can still be controlled normally even though there is a slight delay at 5 meters. However, above 7 meters, the connection begins to be disrupted, causing a delay in response, and at 10 meters the connection breaks completely. This indicates that the limited signal range is one of the shortcomings of the system used.

Overall, the car robot system has achieved the research goal, which is that it can be controlled wirelessly with a fairly fast and precise response. However, there are still some obstacles to be aware of, such as control distance limitations and possible delays in certain situations. Therefore, for further development, the system can be improved with a longer-range communication module or the addition of an automatic control feature to improve the performance of the robot.

CONCLUSION

Based on the results of design, manufacture, and testing that have been carried out, the Arduino UNO-based 2WD car robot with PS2 wireless joystick control has been successfully made and operates properly according to the research targets. This system is able to capture input from the joystick and convert it into robot movements such as forward, backward, left turn, right turn, and stop with fairly fast responses. The test results showed that the robot's response time was in a satisfactory range, which was under one second, so that the robot could be controlled in real-time. In addition, the wireless connection between the joystick and the robot is also stable at short to medium distances, although at longer distances there is a decrease in signal quality resulting in delays or disconnections. Even though the system is functioning well, there are still several aspects that can be developed to improve the performance of the robot. The use of communication modules with a longer and stable range can be a way to overcome the limitation of control distance. In addition, the addition of sensors such as ultrasonic can add to the robot's capabilities, for example avoiding obstacles automatically. Program improvements are also needed to make the robot's movements smoother and sensitive to each instruction. More regular arrangement of components and the use of more efficient power sources are also able to improve overall system performance and durability.

For further development, there are several recommendations that can be implemented to improve system performance. First, the use of a longer and stable communication module can solve the problem of controlling distance limitations. Second, the system can be expanded with the addition of sensors, such as ultrasonic, so that the robot is able to avoid obstacles automatically. In addition, the control program can be refined to produce smoother and more sensitive movements. The use of more efficient power sources and more organized component arrangements are also able to improve the performance and durability of the robot. Through this development, it is hoped that robots will have more advanced functions and can be used in a wider variety of applications.

REFERENCES

Abimanyu, A., Wijaya, R. N., Mechanics, S. E., Technology, P., & Indonesia, N. (2023). Integrasi Sistem Kendali Lengan Robot pada Preparasi Mikrokapsul Brachytherapy Integration of Robot Arm Control System in Brachytherapy Microcapsules Preparation. 15(2), 82–96.

Agustin, I. P. (2025). Design and Construction of an Electric Wheelchair with Joystick-Based DC Motor Control and YOLO Object Detection. 1(1), 1–8.

Basri, M., Syafar, A. M., Elekro, T., & Parepare, U. M. (2025). JITE (Journal of Informatics and Telecommunication Engineering) Arm Robot 5-DOF using Matlab GUI Text Commands. 8(January), 313–324.

E-issn, V. N. P. (2024). Reslaj : Religion Education Social Laa Roiba Journal Reslaj : Religion Education Social Laa Roiba Journal. 6, 2201–2211. https://doi.org/10.47476/reslaj.v6i3.6102

Fadzillah, H., & Setiawan, I. (2023). DESIGN OF A 6-DOF SURGICAL ROBOT MANIPULATOR WITH INVERSE KINEMATICS-BASED MECHANICAL REMOTE CENTER OF MOTION. 12(3), 102–108.

Firdaus, N. (2025). TNI's Intervention Strategy in Education at the Border. 1(1), 1–7.

Galih, M. I., Novrianto, Y., Saputra, J., To, B., Station, B., & Frequency, U. (n.d.). THE CONTROL AND TELEMETRY SYSTEM OF THE CQB MK1 (CLOSE QUARTER BATTLE) ROBOT TO THE BASE STATION USES THE CONTROL AND TELEMETRY SYSTEM OF THE CQB MK1 ROBOT (CLOSE QUARTER. 1, 1–12.

Hidayat, D., Janan, A., & Muhammad, G. F. (2023). THE DESIGN OF WHEELED ROBOTS WITH IOT AND GUI-BASED CONTROL SYSTEMS USING. 14(2), 701–711. https://doi.org/10.21776/jrm.v14i2.1450

Komitov, N., & Shopov, E. (2025). Joystick Control of a 3D Printed Robotic Manipulator for Student Learning. 2, 213–216.

Kusumah, A. A., Wibisono, P. G., Wiyanto, S., Raya, J., Desa, A., Kecamatan, P., Kodiklatad, E. P., Poltekad, K. D., Electronics, J., & Arms, S. (n.d.). MODIFICATION OF THE CONTROLLING SYSTEM ON THE CQB MK1

(CLOSE QUARTER BATTLE) ROBOT BASED ON ARDUINO MEGA 2560. 1.

Nugroho, A. (2025). Integrative Model of Culture , Leadership , Trust , and Motivation for Enhancing Performance and HRD in Defense Organizations. 13(6), 5327–5340. https://doi.org/10.37641/jimkes.v13i6.4128

Of, I., Processing, I., Real, F. O. R., & Data, T. (2022). IMPLEMENTATION OF IMAGE PROCESSING FOR REAL TIME DATA CAPTURE ON A 6-LEGGED ROBOT (HEXAPOD). 3, 3–8.

Omar, S. (2024). Optimizing the Personnel Position Monitoring System Using the Global Positioning System in Hostage Release. 8(1), 94–110.

Pandjaitan, M. B. (2023). ENHANCING INDONESIA'S NATIONAL DEFENSE : SOLDIER SUPERVISION AND DISCIPLINE IN THE INDONESIAN NATIONAL ARMY IMPROVING INDONESIA'S NATIONAL DEFENSE : SUPERVISION. 13, 242–257.

Pi, R. (n.d.). SIGNAL TO NOISE RATIO ESTIMATION SYSTEM FOR DATA COMMUNICATION FROM ROBOTS (OMNIWEEL) TO ANDROID.

Pump, S., & With, P. (n.d.). Android-based Portable Fuel Transfers Pump Control System for the Effectiveness of Filling Fuel Helicopter Penerbad Jalan Raya Anggrek Pendem Village, Junrejo Batu District, Department of Electrical Engineering, D4 Engineering Study Program, Elkasista Poltekad Kodiklatad 2) Polteka Lecturer Group. 1–9.

Putra, Z. N., Yulisusianto, G., Usuluddin, F., Elektro, J. T., Engineering, P., System, E., Kodiklatad, P., & Batu, K. (n.d.). IMPLEMENTATION OF INERTIAL MEASUREMENT UNIT ENEMY SURVEILLANCE OMNIWHEEL ROBOT AUTONOMOUS BASED INERTIAL MEASUREMENT UNIT ENEMY SURVEILLANCE OMNIWHEEL ROBOT AUTONOMOUS BASED. 1–12.

Putro, K. Z., & Young, G. (2025). Realizing awareness of defending the country for the younger generation in increasing national resilience. 2025, 1–9.

Ramadhany, M. D., Hartayu, R., & Setyadjit, K. (1945). Development of ARM 4 DOF Robot Control Based on Robot Operating System (ROS). 310–314.

Rangkuti, S., & Fitriyadi, A. (2024). DESIGN AND BUILD AN INTERNET OF THINGS 6 DEGREE FREEDOM ARM ROBOTIC CONTROL SYSTEM. 12(1), 80–90.

Rulik, I., Sunny, S. H., Dario, J., Caro, S. De, Zarif, I. I., Brahmi, B., Ahamed, S. I., Schultz, K., & Wang, I. (2022). Control of a Wheelchair-Mounted 6DOF Assistive Robot With Chin and Finger Joysticks. 9(July), 1–13. https://doi.org/10.3389/frobt.2022.885610

Saptiadi, I., Minggu, D., & Darmawan, Y. (n.d.). Rancang Bangun Sistem Kendali pada Robot Tempur Menggunakan Joystick Berbasis Arduino The Design and Implementation Control Systems on Combat Robots Using Joysticks Based on Arduino. 6(1).

Serineka, I. G. P., Piarsa, I. N., & Raharja, I. M. S. (2024). Design and build a robot arm based on Arduino Nano. 5(11), 4526–4532.

Sitompul, E., Teguh, M., Yaqin, I., Tarigan, H. J., Tampubolon, G. M., Samsuri, F., & Galina, M. (2025). Integration of Pixy2 Camera Sensor and Coordinate Transformation for Automatic Color-Based Implementation of a Pick-and-Place Arm Robot. 11(1), 92–109. https://doi.org/10.26555/jiteki.v11i1.30717

Sukri, H., Ibadillah, A. F., Thinakaran, R., Umam, F., Dafid, A., & Kurniawan, A. (2025). Enhanced Precision Control of a 4-DOF Robotic Arm Using Numerical Code Recognition for Automated Object Handling. 6(1). https://doi.org/10.18196/jrc.v6i1.24349

Syabana, B. U., Yulisusianto, G., & Setiawan, R. B. (n.d.). Telemetry Control System on Omniwheel Enemy Reconnaissance Robot Based on Internet of Things (IoT). 1–9.

Syahputro, P. A., Saputra, J., & Sridaryono, A. (2020). IN THE DESIGN AND CONSTRUCTION OF THE RECONNAISSANCE ROBOT CONTROL SYSTEM USING THE ARTIFICIAL NEURAL NETWORK METHOD The Artificial Neural Network method is to help the work of the reconnaissance force so that the data processor received from the Arduino Ide is the software used for me.

Yudha, A., Pratama, P., & Is, N. P. (2023). Prototype of Automatic Waste Object Picking Robotic Arm in the Working Room. 20(2), 779–785.