e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

ROBOTICS ARM VEHICLE USING ESP32 AND PS3 CONTROLLER

Prof. Aanand Labade[*1], Harshal Telangre[*2], Trupti Supekar[*3], Vaishnavi Jadhav[*4]

[*1,2,3,4]Dept. Electronics And Telecommunications, Sinhgad Institute Of Technology, Lonavala, Maharashtra, India.

ABSTRACT

In this project, a flexible robotic arm vehicle that can be remotely operated using a PlayStation 3 (PS3) controller is demonstrated. The ESP32 microcontroller, which directs the servo motors of the robotic arm after receiving input data from the PS3 controller, is the central component of the system. Since the robotic arm can pick up and move objects, among other things, it may be used for a wide range of educational, scientific, and hobbyist purposes.

Wi-Fi and Bluetooth connection are two of the ESP32 microcontroller's outstanding features that are used in this project to allow wireless communication with the PS3 controller. Users may easily manipulate the robotic arm's movements with a PS3 controller, making for an entertaining and easy experience. With servo motor integration, it is possible to.

Keywords: Robotics, Robotic Arm, ESP32, PS3 Controller, Wireless Control, Servo Motors, Microcontroller, Automation, Remote Control, IoT.

I. INTRODUCTION

The convergence of technology and robotics has fostered the emergence of ground breaking solutions that are transforming multiple sectors. In recent times, the availability of sophisticated microcontrollers and user-friendly control interfaces has enabled enthusiasts to undertake ambitious robotics initiatives. This paper offers an in-depth examination of a robotic arm vehicle that operates wirelessly via a PlayStation 3 (PS3) controller and is driven by an ESP32 microcontroller.

At the heart of this system lies the ESP32, a powerful microcontroller that processes input from the PS3 controller and converts it into accurate commands for the servo motors of the robotic arm. This integration facilitates intuitive and precise manipulation of the arm's movements, allowing for diverse applications ranging from educational demonstrations to industrial operations. The PS3 controller, a well-known gaming accessory, provides an accessible interface that simplifies the control of the robotic arm. By utilizing the controller's analog sticks and buttons, users can easily adjust the arm's joints, making it suitable for individuals with varying degrees of technical knowledge.

This project investigates the design, implementation, and performance assessment of the robotic arm vehicle, addressing the challenges and solutions encountered in the integration of the ESP32 microcontroller, PS3 controller, and servo motors into a unified system. Furthermore, the paper highlights the potential applications of this technology, including its relevance in educational environments, research facilities, and industrial automation. Through this analysis, we aim to demonstrate the capabilities of cost-effective and widely available components in the creation of advanced robotic systems. By merging the functionality of the ESP32 microcontroller with the user-friendly control offered by the PS3 controller, we have established a versatile platform that can be tailored to a variety of tasks and settings.

II. LITERATURE SURVEY

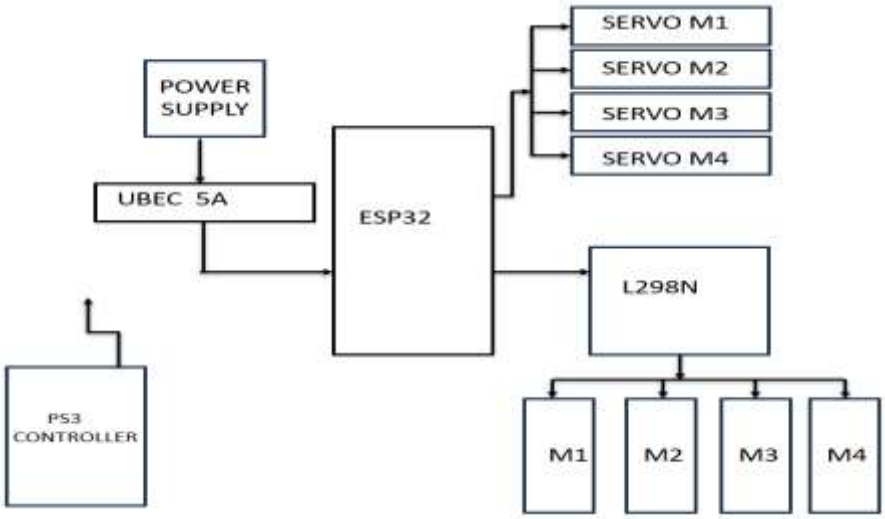
1. **Arduino Controller Pick And Place Robotic Arm Vehicle:** Kumar Aditya, (2015) This project was a working prototype of the pick and place robotic arm vehicle. The main aim of this review paper is to present the idea of working and principals behind the robotic arm vehicle. This work unravels the fact that man would always want to adhere to safety precautions at workplace and even in its environment, to be able to handle some specific tasks, like sending the robotic vehicle to hazardous environment to obtain samples for chemical analysis.
2. **Design and Fabrication of a Low-Cost Robotic Arm with Wireless Control:** A. K. Singh, S. K. Singh, and A. K. Singh International Journal of Innovative Research in Science, Engineering and Technology (2017) This paper discusses the design and implementation of a low-cost robotic arm controlled by a Bluetooth module.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

While it doesn't specifically use an ESP32 or a PS3 controller, it provides valuable insights into the design and control of robotic arms.

3. **A Review on Design and Fabrication of Robotic Arm:** K. Surya Varman, R. Balamurugan, and K. Premkumar international Journal of Scientific Research and Engineering Technology (2016) This paper provides a comprehensive review of various robotic arm designs and fabrication techniques. It discusses the challenges and future trends in robotic arm technology.
4. **Robotic Arm Vehicle:** Dr. Leela G H, Akash A M, Gouthami K S, Madan A, Anusha D H Sep. (2024) Four wheels mobile vehicle with robotic arm is developed which is controlled by joystick based PS3 controller in which ESP32 module is used as a controller board to control the robotic arm vehicle, which can be moved from source point to destination and pick and place the objects without the requirement of driver, by using the commands given by PS3 controller. The movement of the vehicle is controlled by L298N motor driver and action of the arm is controlled by using servomotor connected to ESP32 module which provides the 180-degree arm rotation. The PS3 controller will be connected to ESP32 module, Wireless through the Bluetooth whose maximum range is 100m.

III. HARDWARE DESCRIPTION



Commands are transmitted from the PS3 controller to the ESP32, which interprets them and produces the proper control signals for the L298N motor driver. The four motors are then driven by the L298N, which moves the robotic arm in the appropriate direction and at the required speed.

1. ESP32 Development Board:

- **Microcontroller:** ESP32-S2 or ESP32-C3
- **Power Supply:** 5V DC, 500mA
- **Dimensions:** 2.54 cm x 5.08 cm

2. PS3 Controller:

- **Power Supply:** 5V DC, 300mA (via USB or battery)
- **Dimensions:** Varies by model

3. UBEC 5A:

- **Input Voltage:** 5V-12V DC
- **Output Voltage:** 5V DC
- **Output Current:** 5A continuous, 6A peak
- **Dimensions:** Varies by model

4. L298N Motor Driver:

- **Input Voltage:** 5V-35V DC

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

- **Output Current:** 2A per channel (peak)
- **Dimensions:** 4.2 cm x 4.2 cm

5. Servo Motors:

- **Servo Type:** Standard servo motors (e.g., SG90, MG996R)
- **Power Supply:** 5V DC
- **Stall Torque:** Varies by model (e.g., 1.7 kg-cm for MG996R)
- **Speed:** Varies by model (e.g., 0.12 sec/60° for MG996R)

6. **Power Supply:** The power supply's function is to supply the electrical energy required to run every system component.

IV. SOFTWARE DESCRIPTION

Arduino Integrated Development Environment (IDE) is widely regarded as a preferred platform for programming ESP32 microcontrollers.

ESP32 Wi-Fi and Bluetooth Connectivity: The ESP32's built-in Wi-Fi and Bluetooth capabilities can be easily leveraged using the Arduino IDE. **Sensor Integration:** The IDE supports a wide range of sensors, enabling the creation of IoT devices and automation projects. **Real-Time Clock (RTC):** The ESP32's RTC can be used for time-based tasks and scheduling.

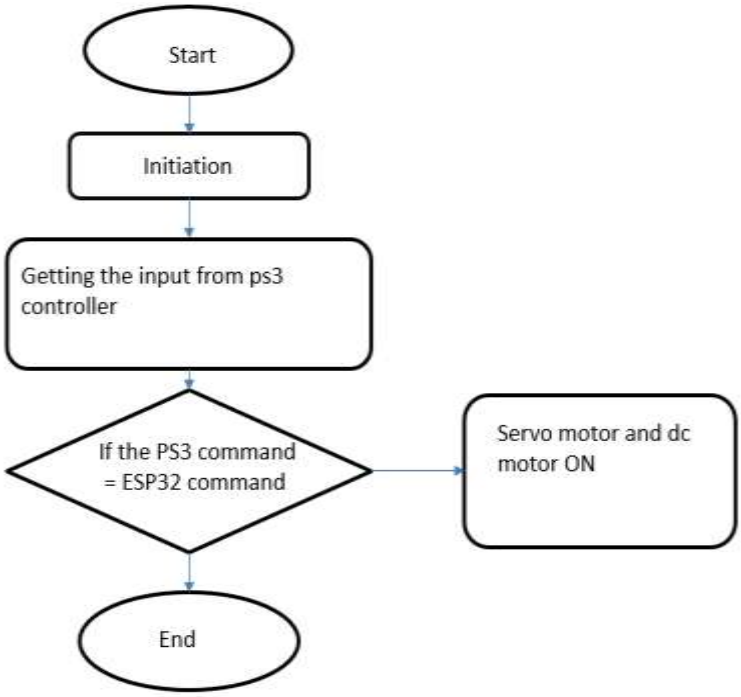
PS3X_lib serves as a specialized library designed for the interaction with PlayStation 3 controllers.

The Servo Library provides essential functions for the operation and control of servo motors.

Motor control libraries including the L298N motor driver library, facilitate the management of direct current (DC) motors.

V. IMPLEMENTATION

This flowchart outlines the basic workflow of a robotic arm vehicle controlled by a PS3 controller using an ESP32 microcontroller. The process starts with initialization, where the ESP32 is set up and a Bluetooth connection is established with the PS3 controller. The ESP32 continuously receives input commands from the controller, including joystick positions and button presses. If the received command is valid and matches the expected format, the ESP32 generates control signals to activate the servo and DC motors, which in turn control the movement of the robotic arm. The process continues in a loop, constantly receiving input and executing commands until the system is powered off.



e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

VI. CONCLUSION

The integration of an ESP32 microcontroller with a PS3 controller offers an effective solution for controlling robotic arm vehicles. The ESP32 enhances processing and wireless communication, allowing for precise and intuitive operation. By utilizing servo and DC motors, the robotic arm can perform a wide range of tasks, from simple object manipulation to complex assembly. Future advancements may include the addition of sensors like cameras and LiDAR, which could enhance environmental perception and navigation. Moreover, incorporating artificial intelligence and machine learning could further improve the system's autonomy and functionality. This combination sets a strong foundation for versatile robotic applications across various sectors, including education, research, and industry.

VII. FUTURE SCOPE

Enhanced Autonomy: Utilize advanced sensors (LiDAR, cameras, ultrasonic) for autonomous navigation and object detection.

Machine Learning: Apply algorithms for object recognition, path planning, and adaptive control.

Human-Robot Interaction: Design intuitive interfaces, including voice commands and gesture recognition.

Collaborative Robotics: Foster teamwork between robotic arms and humans in shared environments.

Remote Operation: Introduce remote control capabilities for teleoperation from afar.

Modular Design: Develop modular systems for customization and scalability.

Power Efficiency: Focus on optimizing power consumption to enhance battery life.

Safety Features: Integrate safety mechanisms to mitigate accidents and ensure user protection.

VIII. REFERENCE

[1] Dr. Leela G H, Akash A M, Gouthami K S, Madan A, Anusha D H (Sep. 2024). International Journal of Advances in Engineering and Management (IJAEM).

[2] Hongli He Rail Transit Institute Engineering Henan College of Transportation Technology Zhengzhou, China Published in 2020 IEEE.

[3] Design of Mobile Robot with Robotic Arm Utilising Microcontroller and Wireless Communication (2017) I.B. Alit Swamardika, I N. Budiastra, I N. Setiawan, N. Indra Er (IJET).

[4] G. V. Nagamani, Dr.A.V.S.Sridhar Kumar, Sk. Mohiddin, M. Sravan Kumar, M. Nikesh Chowdary, P. Rohith Kumar design and fabrication of robotic arm vehicle controlled by Bluetooth technology, (2023) International Journal of Research in Engineering.