PAPER NAME

HAND GESTURE-CONTROLLED ROBOT U SING ARDUINO WITH INTEGRATED CLEA NING SYSTEM

AUTHOR

Sandesh Dongare

WORD COUNT

3942 Words

CHARACTER COUNT

23655 Characters

PAGE COUNT

27 Pages

FILE SIZE

1.4MB

SUBMISSION DATE

Apr 12, 2024 1:02 PM GMT+5:30

REPORT DATE

Apr 12, 2024 1:03 PM GMT+5:30

9% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

- 4% Internet database
- 4% Publications database
- Crossref database
- Crossref Posted Content database
- 7% Submitted Works database

Excluded from Similarity Report

- Bibliographic material
- Quoted material
- Manually excluded sources
- Manually excluded text blocks

AISSMS
INSTITUTE OF INFORMATION TECHNOLOGY
(IOIT)
ADDING VALUE TO ENGINEERING
An Autonomous Institute Affiliated to Savitribai Phule Pune University
Approved by AICTE, New Delhi and Recognised by Govt. of Maharashtra
Accredited by NAAC with "A+" Grade | NBA - 5 UG Programmes

A

PROJECT REPORT ON

"HAND GESTURE-CONTROLLED ROBOT USING ARDUINO WITH INTEGRATED CLEANING SYSTEM"

SUBMITTED BY

Seat No.	Name of Students
B190252515	Mr. Shannon Dsouza
B190252514	Mr. Sandesh Dongare
B190252527	Mr. Santwik Khedekar
B190252557	Ms. Disha Raut

Under The Guidance of
DR. A. D. SHIRALKAR

In Partial fulfillment of the requirement for the
Degree of Electrical Engineering

SAVITRIBAI PULE UNIVERSITY, PUNE
(2023-2024)

ALL INDIA SHRI SHIVAJI MEMORIAL SOCIETY'S
INSTITUTE OF INFORMATION TECHNOLOGY, PUNE
ACADEMIC YEAR 2022-2023

AISSMS
INSTITUTE OF INFORMATION TECHNOLOGY
(IOIT)
ADDING VALUE TO ENGINEERING
An Autonomous Institute Affiliated to Savitribai Phule Pune University
Approved by AICTE, New Delhi and Recognised by Govt. of Maharashtra
Accredited by NAAC with "A+" Grade | NBA - 5 UG Programmes

CERTIFICATE

This is to certify that the project report entitled

"HAND GESTURE-CONTROLLED ROBOT USING ARDUINO"

Submitted by

Seat No.	Name of students
B190252557	Ms. Disha Raut

Is a bonafide work carried out by them under the supervision of **Dr. A. D. SHIRALKAR** and it is approved for the partial fulfillment of the requirement of Savitribai Phule Pune University, for the award of the degreesof **Bachelor of Engineering** (Electrical Engineering).

This project report has not been submitted earlier to any other or university for the award of any degree or diploma.

Dr. A. D. SHIRALKAR
Internal Guide
Department of Electrical Engineering

Dr. A. D. SHIRALKAR
Head
Department of Electrical Engineering

External Examiner

Dr. P. B. Mane
Principal
AISSMS Institute of Information Technology, Pune.

Place: PUNE
Date:

ACKNOWLEDGEMENT

We would like to express our heartfelt gratitude to AISSMS IOIT College for providing us with the opportunity, resources, and guidance to undertake the project titled "Hand Gesture-Controlled Robot using Arduino with Integrated Cleaning System." We extend our sincere appreciation to the Dr. A. D. Shiralkar (HOD) for their support and encouragement throughout the duration of this project. The invaluable knowledge and skills we have gained from our professors and mentors have been instrumental in the successful execution of this endeavor.

Last but not least, we acknowledge the unwavering commitment and dedication of our project team members, whose collaborative efforts and enthusiasm have culminated in the creation of this innovative and user-friendly technology.

This project was made possible by the collective efforts of all those mentioned above, and we are immensely grateful for their contributions.

Mr. Sandesh Dongare

Mr. Shannon Dsouza

Mr. Santwik Khedekar

Ms. Disha Raut

ABSTRACT

The motivation behind the Gesture-Controlled Robot with an integrated cleaning system is to simplify household cleaning tasks. Traditional cleaning often requires users to physically move and hold the device, making the cleaning process labor-intensive and time-consuming. This innovation allows users to effortlessly control the robot's movement and cleaning operations through predefined gestures, making the interaction easier. This Gesture-Controlled Robot will be equipped with a soft-bristled cleaning brush, aligning with the growing demand for smart home technologies and promoting energy efficiency and automation in domestic cleaning tasks. This offers a glimpse into the future of intelligent, user-friendly, and autonomous household appliances.

INDEX

LIST OF FIGURES

INDEX

CHAPTER 1: INTRODUCTION

The traditional methods for controlling robots typically involve remote controllers, complex programming. However, these methods can create barriers for user friendly interaction. Addressing this need, the project aims to bridge the gap between humans and robots through the natural language of gestures. The project's main objective is to develop a hand gesture-controlled robot that responds to specific user gestures. The project seeks to provide a user-friendly and engaging method for controlling robots in real-time. It uses Arduino, an open-source electronics platform and integrating sensors capable of recognizing hand gestures. It also provides an integrated brush which is fixed on the robot which makes household chores more interactive and engaging.

In addition to introducing the project's purpose and goals, this report provides an overview of its key components and methodology. It includes a review of relevant literature to explain the project's approach. Method details, such as how the transmission and receiving systems work, along with the cleaning mechanism, are also covered. Furthermore, a detailed list of components is included, explaining what they are and how they function. The report wraps up with a discussion on how the project can be applied practically.

1.1 MOTIVATION

The motivation behind this report lies in the pursuit of creating a more intuitive, user-friendly, and efficient cleaning experience. Hand gestures provide a natural and seamless means of communication, eliminating the need for complex remote controls or direct physical manipulation. This also fulfills the need for people with mobility challenges, making cleaning tasks more accessible to a diverse range of users. Traditional cleaning often requires manual operation and constant monitoring, limiting their efficiency and adaptability. Also, if we compare the vacuum cleaners available now are all automated, which has increased the cost. Having an automated vacuum cleaner at that price has become a luxury. So, the project aims to combine gesture control technology powered by Arduino with the integrated soft bristled brush cleaning system and create a user-friendly experience with simple hand movements and make cleaning fun and interactive and at a low cost.

1.2 PROBLEM STATEMENT

The conventional methods of controlling robots through programming or remote devices lack intuitive and seamless human interaction. This paper aims to address this limitation by designing a hand gesture-controlled robot. The challenge is to develop a system that can accurately recognize and interpret hand gestures, allowing users to control the robot effortlessly and naturally. This technology could potentially transform human-robot interaction and find applications in diverse fields.

1.3 OBJECTIVES

To develop a hand gesture recognition algorithm to interpret different hand movements for controlling the robot's forward, backward, left, right, and stop actions.

To eliminate the errors for smooth functioning.

To implement real-time response, ensuring the hand gesture-controlled robot responds smoothly to user gestures. [6]

To create a user-friendly interface, allowing users of all ages to interact.

.

1.4 THESIS OUTLINE

The project thesis is divided into seven chapters. These seven chapters cover all the chapters in detail.

In the first chapter, we discuss the Introduction of the project, overview, theory, objective, and problem statement.

In the second chapter, we discuss the literature review of literature which helps us during the project.

In the third chapter, we discuss the Research Methodology, in this, we studied the proposed system, flow chart, circuit diagram, and brief working of the proposed system.

In the fourth chapter, we discussed the System Requirements, where we discuss the Hardware and software requirements Regarding the proposed system.

In the fifth chapter, we discussed the Result and Experimental setup of the proposed system.

In the sixth chapter, we discussed the Conclusion and future scope of the project.

The last chapter which is the Seventh chapter we discussed the Reference of the Literature review.

CHAPTER 2: LITURATURE REVIEW

The paper explores the utilization of gesture gadgets with sensors for intuitive communication between users and robots, enabling gesture-based control. Additionally, it delves into the integration of accelerometer sensors facilitating precise control over the robot's movements and throttle, enhancing user interaction and ease of operation. “Gesture Control Robot”, Volume 9 Issue 2 | July 2022

This paper discusses the pivotal role of automation in robotics, particularly in tasks such as job picking and placing. It emphasizes the use of sensor-based systems to automate motion control, enhancing efficiency and reducing human effort in repetitive tasks. “The Gesture Controlled Robot”, ISO 9001:2008 Volume: 08 Issue: 04 | ISSN: 2395-0072, Apr 2021

In this paper it highlights a cutting-edge project merging robotics and computer vision to create a hand gesture-controlled car, enhancing maneuverability and user interaction. By integrating a camera and gesture recognition sensors, the system allows intuitive control through hand gestures “Hand Gesture Recognition Based Robot Using Accelerometer Sensor”,2015

CHAPTER 3: RESEARCH METHODOLOGY OF PROPOSED SYSTEM

The project is divided into 3 sections to make it simple and prevent complexity.

The first section includes the transmitting section which includes-

Accelerometer ADXL335, Arduino Uno Atmega328, RF transmitter TX (433MHz). The ADXL335 is a compact and energy-efficient 3-axis accelerometer sensor, perfectly suited for applications such as hand gesture-controlled robots. It possesses the capability to detect acceleration across the X, Y, and Z axes. The Arduino Uno, based on the ATmega328P chip, interfaces with the ADXL335 accelerometer, which provides three-axis analog outputs corresponding to hand gestures. An RF pair module is a wireless communication device that consists of a transmitter and a receiver module. RF pair modules typically operate in the 433 MHz or 2.4 GHz bands. They are ideal for wireless communication because they are relatively free from interference from other devices.

The second section includes the receiving section which includes-

RF Receiver Module, L293D Motor Driver, DC motors, Arduino Uno Atmega328.

The L293D serves as a dual-channel H-bridge motor driver IC, enabling the management of either two DC motors independently or a single stepper motor.

The third section includes-

This will include the integration of a soft bristled brush which is ideal for removing dust, hair, and other light debris without scratching or damaging the surface for cleaning purposes.

3.1 BLOCK DIAGRAM

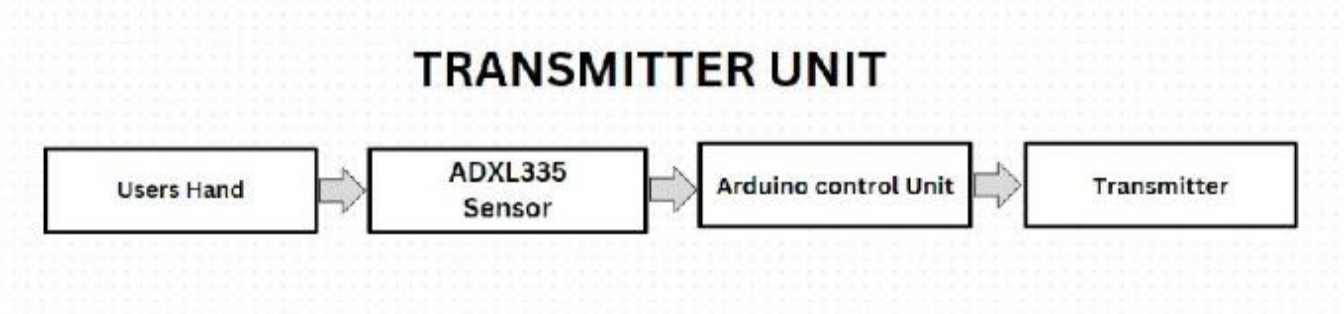


Figure 1: Block diagram of Transmitting Section.

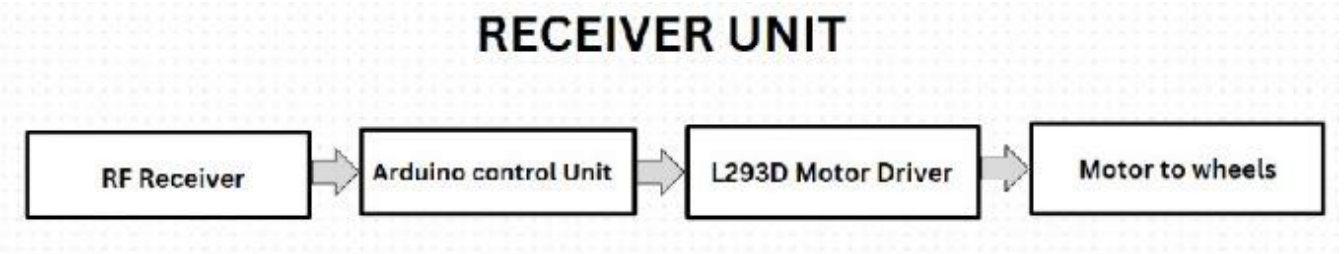


Figure 2: Block diagram of Receiving section.

3.2 CIRCUIT DIAGRAM

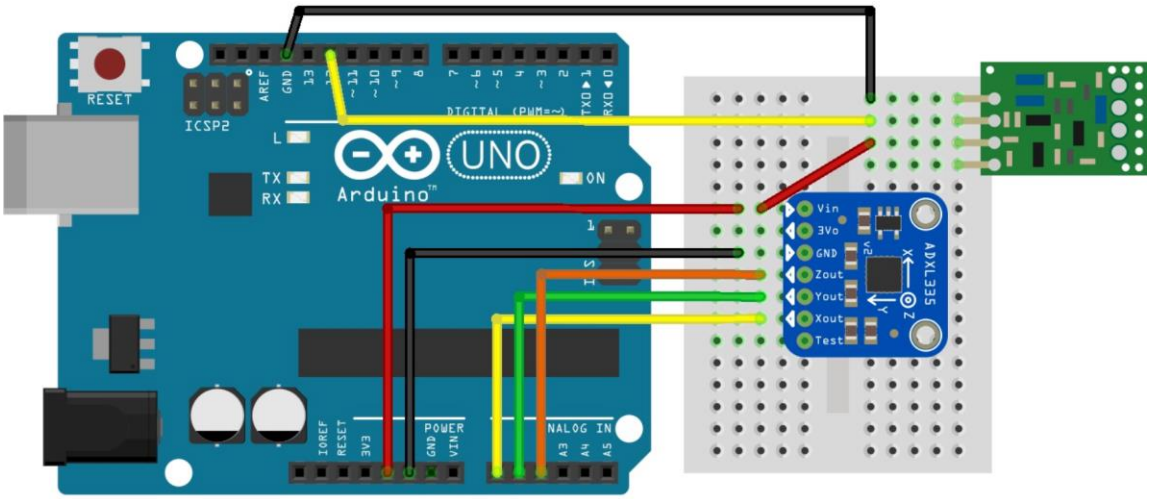


Figure 3:Transmitting unit

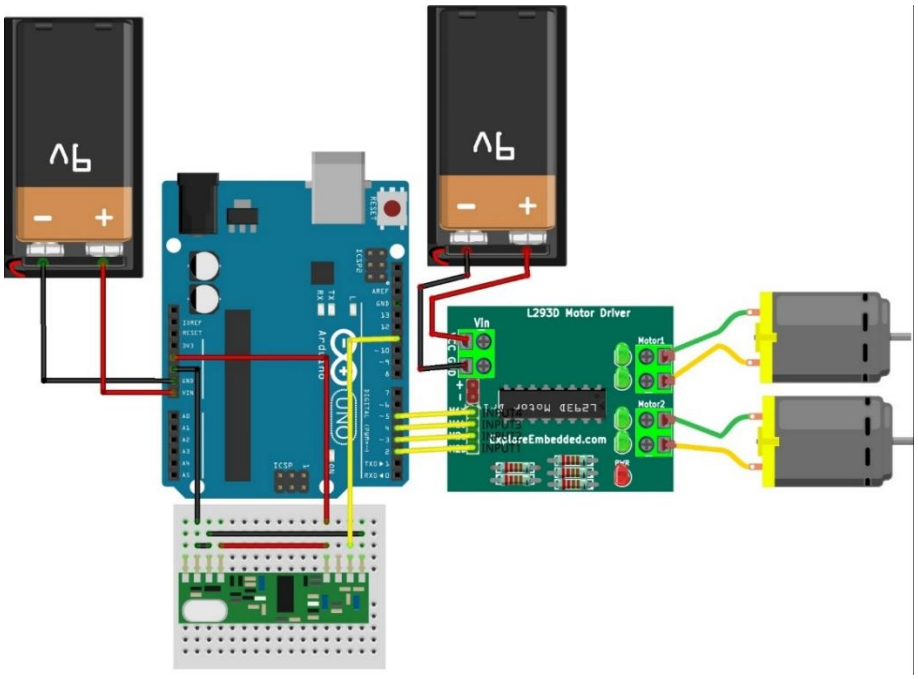


Figure 4:Receiving unit

CHAPTER 4: SYSTEM REQUIREMENT

1) Hardware Requirement

Sr. No.	Name Of Component	Quantity
1	Arduino UNO	2
2	ADXL335 Triple Axis Accelerometer	1
3	2WD Two Wheel Drive Robot Car Chassis	1
4	170 Points Mini Breadboard	3
5	Jumper wires	-
6	RF433 MHz Transmitter Receiver Wireless Module	1
7	L293D Motor Drive Module	1
8	9V Battery	4
9	Battery Snap Connector to DC Barrel Jack Adapter	1

2) Software Requirement

Arduino IDE

4.1 Arduino Uno Atmega328p for Transmitter Receiver Unit

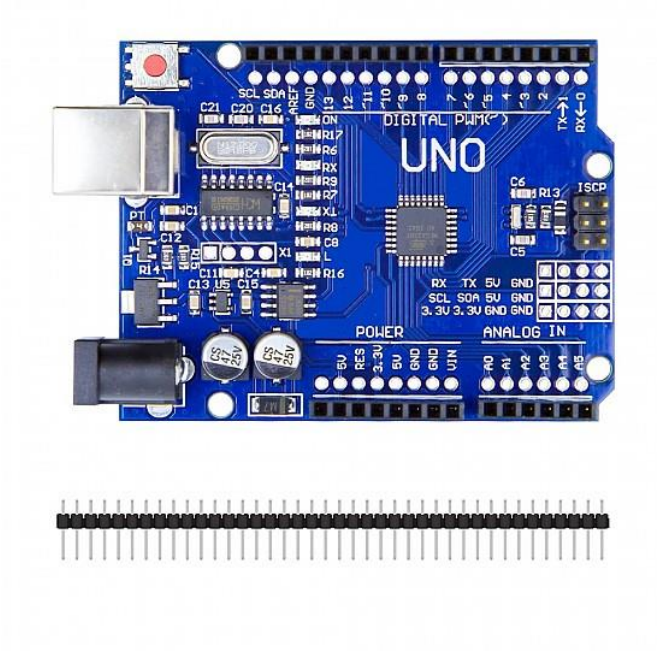


Figure 5:Arduino UNO

The Arduino UNO is a microcontroller board based on the ATmega328P. It is equipped with a 16 MHz ceramic resonator, 6 analog inputs, 14 digital input/output pins (with 6 of them configurable as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes fully equipped to support the microcontroller, requiring only a USB cable to connect to a computer or an AC-to-DC adapter or battery for power. In this paper it is responsible for interpreting the hand gestures and translating them into motor commands for the robot to follow. It serves as the central processing unit for our hand gesture-controlled robot, interpreting commands from the ADXL335 accelerometer and controlling the robot's movements via the L293D motor driver. Communication with the robot is facilitated through the RF pair module.

4.2 ADXL Sensor For Transmitter Unit

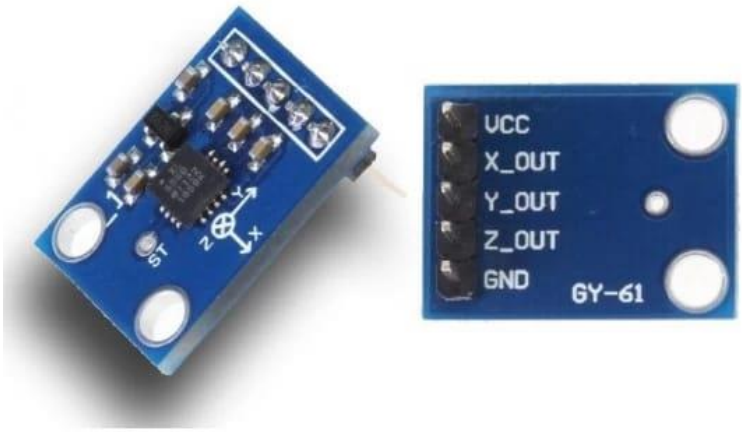


Figure 6:ADXL Sensor

The ADXL335 represents a compact, energy-efficient 3 axis accelerometer sensor, well-suited for integration into hand gesture-controlled robots. It possesses the capability to detect acceleration across all 3 axes - X, Y, and Z, within a range of ±3 g. This means that it can measure acceleration up to 3 times the acceleration of gravity. The ADXL335 sensor is connected to the Arduino board, which reads the sensor data and processes it to identify the desired robot movement. Subsequently, the Arduino board produces PWM signals to manage both the direction and speed of the motors in the robot.[15]

Features:

- It offers 3-axis sensing capabilities. Housed in a compact, low-profile 4 mm × 4 mm × 1.45 mm LFCSP package.
- It operates at low power, typically consuming 350 µA.
- Compatible with single-supply operation ranging from 1.8 V to 3.6 V.
- It withstands shock of up to 10,000 g.

- Demonstrates excellent temperature stability.
- Allows bandwidth adjustment with a single capacitor per axis.
- Compliant with RoHS/WEEE standards, ensuring lead-free composition.

4.3 L293D Motor Driver for Receiver Unit

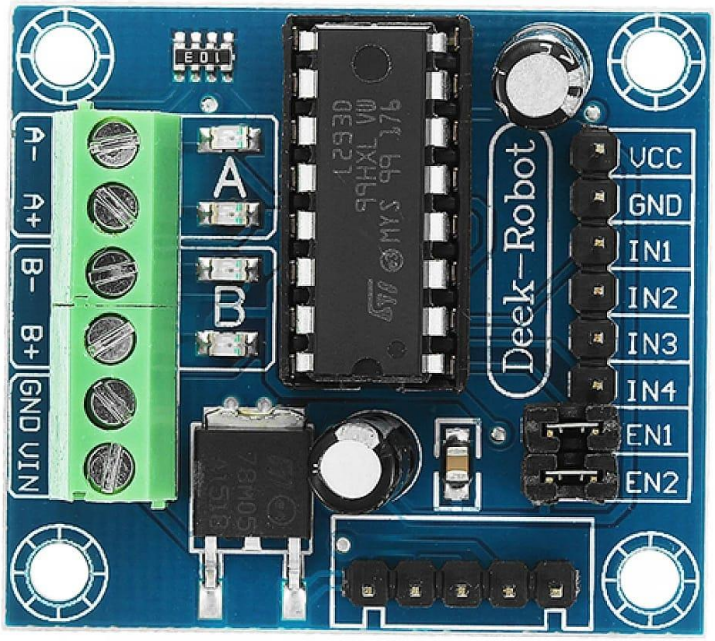


Figure 7:L293D Motor Driver

The L293D functions as a dual-channel H-bridge motor driver IC, facilitating the control of two DC motors. For each motor channel, the L293D provides two inputs, labeled as IN1 and IN2. These inputs dictate the motor's rotational direction. When IN1 is set to a high signal and IN2 to a low signal, the motor rotates in one direction. Conversely, if IN2 is high and IN1 is low, the motor rotates in the opposite direction. When both IN1 and IN2 are low, the motor ceases operation. The L293D also has two outputs for each motor channel: OUT1 and OUT2. These outputs are connected

to the motor itself. The L293D uses a variety of internal circuits to control the current flow to the motor, which enables the regulation of both motor speed and torque.[3]

4.4 Rf Pair Module for Transmitter and Receiver Unit

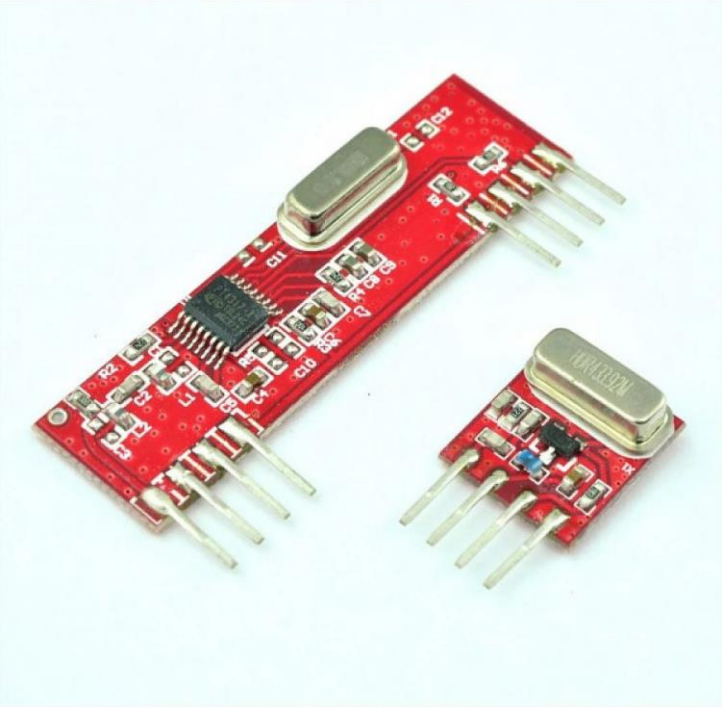


Figure 8:RF pair module

A wireless communication device made up of a transmitter and a receiver module is called an RF pair module.

The frequency ranges in which RF pair modules normally function are 433 MHz and 2.4 GHz. These frequency ranges are comparatively free from other device interference, making them perfect for wireless communication.

Utilizing RF pair modules is quite simple. By connecting the Arduino to the transmitting module, it may communicate the appropriate orders to the transmitter. The commands are then broadcast over the air to the receiving module via the transmitting module. The receiver module is attached to the robot, through which it receives and processes commands. The Arduino controller oversees sending and receiving commands. The intended orders are sent by the Arduino board to the transmitter module, which subsequently sends them to the receiver module via radio

transmission. The robot then carries out the instructions that it receives from the receiving module.

When it comes to hand gesture-controlled robots, RF pair modules offer a flexible and dependable method for wireless communication between the Arduino and the robot. They have a broad communication range and are comparatively simple to use.[3]

Specifications: -

- It provides a range of 100 meters in open space under standard conditions.
- The RX receiver operates at a frequency of 433 MHz with a typical sensitivity of 105 dBm.
- The RX receiver requires a supply current of 3.5 mA and operates at an IF frequency of 1 MHz.
- It operates at an operating voltage of 5V.
- The TX frequency range is 433.92 MHz, with a supply voltage requirement of 3V to 6V.
- The TX module offers an output power range of 4 to 12 dBm.

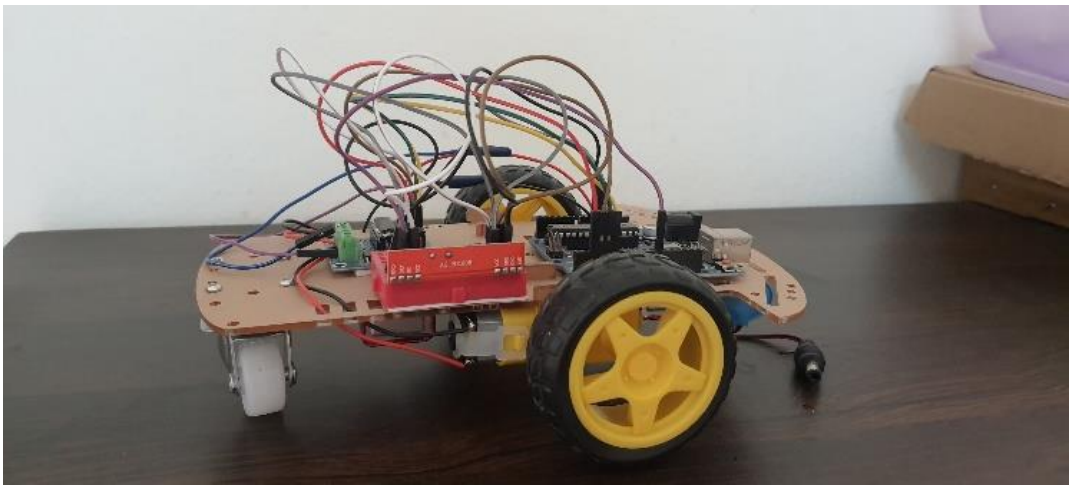
Features: -

- It provides a range of 100 meters in open space under standard condition.
- The RX receiver operates at a frequency of 433 MHz with a typical sensitivity of 105 dBm.
- The RX receiver requires a supply current of 3.5 mA and operates at an IF frequency of 1 MHz.
- It operates at an operating voltage of 5V.
- The TX frequency range is 433.92 MHz, with a supply voltage requirement of 3V to 6V.
- The TX module offers an output power range of 4 to 12 dBm.

4.5 Robot Chassis for Hand Gesture Robots

Robot chassis is lightweight and durable for the robot to move easily. The chassis is flexible enough to allow the robot to move freely in all directions. The chassis is stable enough to prevent the robot from tipping over. The wheels allow the robot to move in any direction, including sideways and backwards. The rubber wheels have good traction to prevent them from slipping on smooth surfaces. List of components is mentioned in Table 1.

As shown in Figure 4, after connecting Arduino along with the ADXL335 and RF transmitter, to the gloves worn on the hand. When the ADXL335 detects a tilt, it will transmit its data to the Arduino. The Arduino, in turn, will send the information via RF transmitter. For instance, if there is a forward tilt, the Arduino will read 'f' (forward), and the RF transmitter will send this to the receiver unit fixed on the robot chassis. The receiver unit as shown in Figure 5, comprises an RF receiver, Arduino, and motor driver. Upon receiving the 'f' signal, the RF receiver will pass it to the Arduino, which will then instruct the motor driver to move the robot forward. This programming logic will be replicated for backward, right, and left directions.



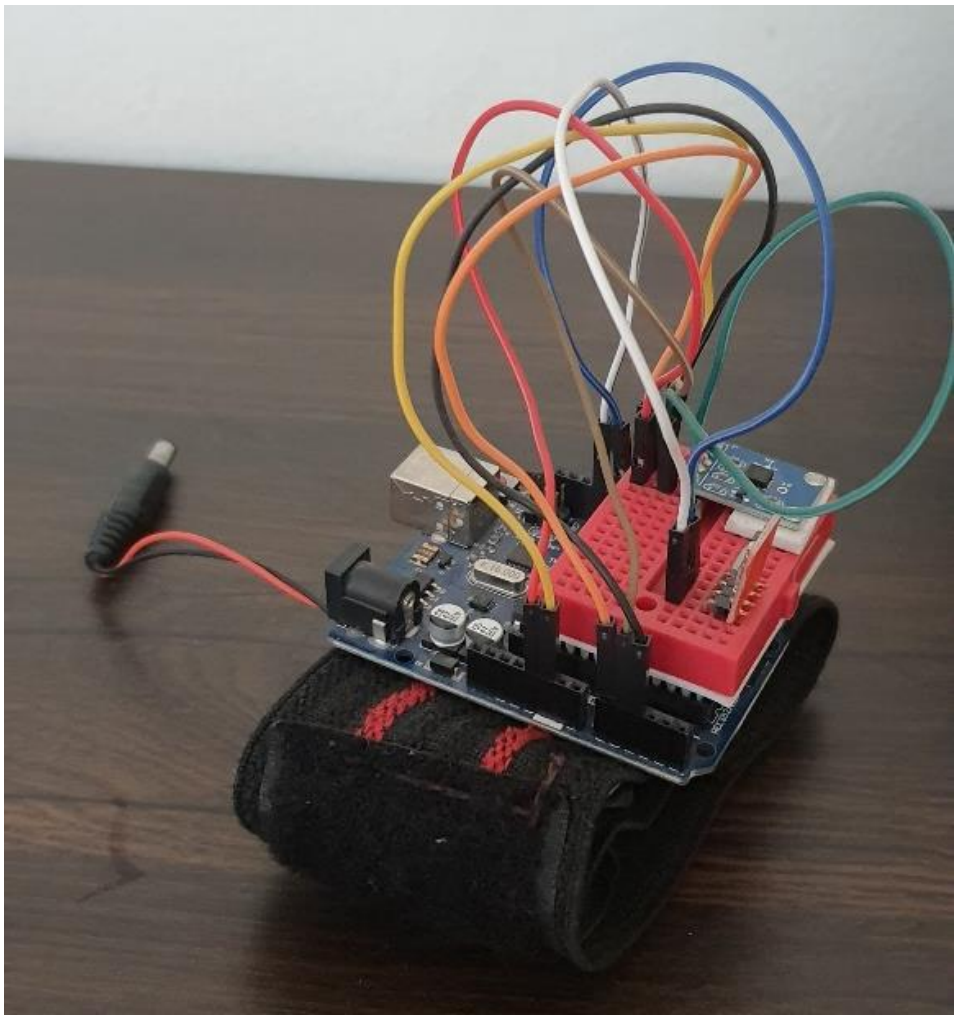


Figure 9:Model image

CHAPTER 5: RESULT

Transmitter Unit:

In our setup, we utilize two Arduinos—one housed on our hand, and the other mounted on the chassis of our robot. The ADXL335 sensor is interfaced with the Arduino situated on our hand, tasked with detecting tilt movements. Additionally, an RF transmitter is linked to the same Arduino. Whenever a tilt is detected by the ADXL335, it relays this data to the Arduino. Subsequently, the Arduino transmits corresponding characters via the RF transmitter. For instance, upon detecting a forward tilt, the Arduino sends the character "f" to the RF transmitter, which in turn transmits it to the receiver unit.

Receiver Unit:

In the receiver unit, another Arduino is interfaced with the robot's chassis, alongside a motor driver responsible for controlling the motor directions. Furthermore, an RF receiver is connected to this Arduino. Upon reception of the transmitted character ("f" for forward movement, for instance), the Arduino interprets this signal. It is programmed to direct the L293D motor driver to execute the appropriate command. For example, upon receiving the "f" character, the motor driver is instructed to propel the robot forward. Similar logic is applied for all other directional commands such as left, right, and backward movements.

CHAPTER 6: CONCLUSION AND FUTURE SCOPE

6.1 Conclusion

In conclusion, the Gesture-Controlled Robot with an integrated cleaning system is a significant step forward. By using simple hand gestures, it offers a hassle-free experience for users. With sensors like ADXL, L293D motor driver, and transmitter and receiver units, along with two Arduino boards for controlling hand gestures and the robot, the report shows a comprehensive approach to robotics. While it's mainly for home cleaning, its potential goes beyond that, promising to make tasks simpler and more efficient in various areas like hospitals, industries etc. The user-friendly design and smart technology will make everyday life easier and more fulfilling.

6.2 Future Scope

Smart Navigation and Mapping: Integrate sensors and mapping algorithms to enable the robot to navigate autonomously while avoiding obstacles and efficiently covering cleaning areas.

IoT Connectivity: Implement IoT connectivity to enable remote monitoring and control of the robot via mobile devices, allowing users to schedule cleaning tasks and receive status updates from anywhere.

Multi-Functional Cleaning Attachments: Develop modular cleaning attachments to expand the robot's capabilities, such as mopping, vacuuming, or disinfecting, catering to diverse cleaning needs.

Integration with Smart Home Ecosystems: Integrate the robot with existing smart home ecosystems to enable seamless interoperability with other smart devices and enhance overall home automation capabilities.

Gesture-Based Game Mechanics: Create innovative game mechanics and challenges that leverage hand gestures for player input. From casting spells to swinging swords, navigating obstacles, or performing sports-related actions such as throwing a ball,

shooting a basketball, or swinging a golf club, hand gestures offer a new dimension of control and engagement in gaming experiences.

CHAPTER 7: REFERENCES

[1] Chanda, Premangshu, Kanti Mukherjee, Pallab, Modak, Subrata, Nath, Asoke, "*Gesture Controlled Robot using Arduino and Android*" International Journal of Advanced Research in Computer Science and Software Engineering (IJIRCSSE), 2016. This paper deals with the design and implementation of a wireless gesture-controlled Robot using Arduino.

[2] Deepak, Soubagya Nayak, Jalumuru Nalin, "*Development of Gesture Controlled Robot Using 3-Axis Accelerometer*", Journal of Control & Instrumentation, 2016. This paper deal with Iot based Hand Gesture Control Robot having car-hardware setup includes a motorized-wheel-equipped chassis, an ESP32 module, a camera module, and sensors.

[3] Prajwal Ashwin Jawalekar, "*Robot Control by Using Human Hand Gestures*", International Research Journal of Engineering and Technology (IRJET), 2018. This paper describes implementation of robot control by using human hand gestures.

[4] Setia, Archika, Mittal, Surbhi, Nigam, Padmini, Singh, Shalini, Gangwar, Surendra, "*Hand Gesture Recognition Based Robot Using Accelerometer Sensor*", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, 2015.

[5] Samanta, Argha, Kumar, Sangharsh, Saraswat, Deepak, Das, Bharnab, Kumar, Vibhuti, Channi, Harpreet Kaur. "Modeling and Designing of Gesture Control Robot", 2017. This paper has given only modeling and designing of gesture control robot idea.

[6] Mounir Bou Hedda, Slimane Mekaoui, Mohamed Guesmi, Abderrahim Douakh, Sofiane Tchoketch Kebir, "Gesture Control of Mobile Robot Based Arduino," in 8th International Conference on Modelling, Identification and Control, Algeria, 2016. In this paper, a simple approach of target detection and localization to control a distant robot mobile in real time is presented.

[7] Joon Yung Heo, Jihoon G. Yoon, Hyungjong Park, Young Dae Kim, Hyo Suk Nam, Ji Hoe Heo,"Stroke prediction in acute stroke",2019.

[8] M. U. Rajkanna, “Hand Gesture Based Mobile Robot Control Using,” in International Conference on Circuit, Power and Computing Technologies, 2014. This system provides 120 gestures and range of communication between mobile robot and user which is 10 m.

[9] Jeena R.S., Dr.Sukesh Kumar “Stroke prediction using SVM”, International Conference on Computing, Communication and Networking Technologies (ICCCNT), IEEE, 2016.

[10] Ji-Won Seo, Woo-Jin Seol, Dong-Soo Kwon, Young-Hoon Nho, “Emotional Interaction with a Mobile Robot using Hand Gestures” in the 11th International Conference on Ubiquitous Robots and Ambient Intelligence, 2014. The goal of this paper was to show that mobile robot could emotionally interact with human by using elaborate hand gesture

[11] Jiangping Hu, Yuping Zhang, Hong Cheng,“Hand Gesture Based Control Strategy for Mobile Robots,” in 29th Chinese Control And Decision Conference, 2017. This paper given designing idea for mobile robots.

[12] A. Parimala, W. Nancy, M. Benisha, N.Nandhagopal, N.Krishnaraj, “*Gesture Control Robot Using Arduino*”, International Journal of Advanced Science and Technology, vol. 29 no. 06, 2020. This paper uses microcontroller with metal detector in the defense field without involving the manpower resources.

[13] Kathiravan Sekar, Ramarajan Thileeban, Vishnuram Rajkumar, “*Hand Gesture Controlled Robot*”, InternationalJournal Of Engineering Research & Technology (IJERT), vol. 09, no. 11, 2020.

[14] Prof. Chetan Bulla, Ranjana Shebani, Bhoomika Balegar, Deepa Nandihalli, Kalagouda Pati, “*Gesture Control Robot*”, International Journal of Research In Electronics And Computer Engineering, vol. 07, no. 02, 2019. This paper is

integrated with webcam and used for street light electricity for hand gesture-controlled robot using Arduino.

[15] M. Jain, M. Sehgal, Y. Kalra, P. Jain, N. Aggarwal, R. Singh, D. Kumar, T. K. Bera and R. Singh, "Object Detection and Gesture Control of Four-Wheel Mobile Robot," in International Conference on Communication and Electronics Systems (ICCES), 2019. The purpose of this research-work was to control the movement of the robotic arm with accelerometer/ gyroscope-based gesture controller.

[16] S. Ikegami, C. Premachandra, B. Sudantha and S. Sumathipala, "Study on Mobile Robot
Control by Hand gesture Detection" in 3rd International Conference on Information Technology Research (ICITR), 2018.

[17] S. C. Narsingoju Adithya, "*Hand Gesture Controlled Robot*", International Journal of
Recent Technology and Engineering (IJRTE), vol. 8, no. 1S4, 2019. This document will show how to create a programmable component that responds to your hand signal.

9% Overall Similarity

Top sources found in the following databases:

- 4% Internet database
- Crossref database
- 7% Submitted Works database
- 4% Publications database
- Crossref Posted Content database

TOP SOURCES

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	**ijirset.com** Internet	1%
2	**Sreenidhi International School on 2023-06-02** Submitted works	<1%
3	**Visvesvaraya National Institute of Technology on 2019-04-18** Submitted works	<1%
4	**Mar Baselios Engineering College on 2023-05-21** Submitted works	<1%
5	**UOW Malaysia KDU University College Sdn. Bhd on 2024-01-18** Submitted works	<1%
6	**K Sakthi, Y Mohamed Sarim Zain, S Manoj Shakthi Raj, M Manickavasa...** Crossref	<1%
7	**Universiti Malaysia Pahang on 2016-12-04** Submitted works	<1%
8	**ir.juit.ac.in:8080** Internet	<1%

9	"Proceedings of the International Conference on Data Engineering and ... Crossref	<1%
10	Satish Thatavarti, L.R. Sudha, Sai Charan Lanka, Arepalli Gopi, B. Venk... Crossref	<1%
11	Higher Education Commission Pakistan on 2023-08-14 Submitted works	<1%
12	Ashish Kumar Dutta, J.Simon Gnanesh Paul, S. Siddharth, K.G. Nitish, J... Crossref	<1%
13	duc.edu.iq Internet	<1%
14	iapatt.org Internet	<1%
15	Middle East College of Information Technology on 2018-06-02 Submitted works	<1%
16	Swinburne University of Technology on 2016-05-29 Submitted works	<1%
17	khazna.ku.ac.ae Internet	<1%
18	engpaper.com Internet	<1%
19	Costas Kyriacou. "Network interface for a data driven network of works... Crossref	<1%
20	October University for Modern Sciences and Arts (MSA) on 2023-01-31 Submitted works	<1%

21	Sunway Education Group on 2023-11-11 Submitted works	<1%
22	Visvesvaraya Technological University on 2014-11-12 Submitted works	<1%
23	Mount Kenya University on 2021-07-26 Submitted works	<1%

Excluded from Similarity Report

- Bibliographic material
- Quoted material
- Manually excluded sources
- Manually excluded text blocks

EXCLUDED SOURCES

aissmsioit on 2024-04-08 — 44%

Submitted works

EXCLUDED TEXT BLOCKS

ALL INDIA SHRI SHIVAJI MEMORIAL SOCIETY'SINSTITUTE OF INFORMATION TEC...

Savitribai Phule Pune University on 2017-11-07

In Partial fulfillment of the

digitalcollection.utem.edu.my

External ExaminerDr. P. B. ManePrincipalAISSMS Institute of InformationTechnolo...

Savitribai Phule Pune University on 2018-06-13

Is a bonafide work carried out by them under the supervision of

iGroup on 2017-06-04

D

Savitribai Phule Pune University on 2018-06-13

We would like to express our

www.coursehero.com

forproviding

Taylor's Education Group on 2018-06-17

the collective efforts of all those mentionedabove, and

Griffith College Dublin on 2023-09-05

LIST OF FIGURESFigure

123dok.com

Block diagram

Middle East College of Information Technology on 2018-06-02

CHAPTER 1: INTRODUCTION .....

khazna.ku.ac.ae

3.1 BLOCK DIAGRAM .....

Kolej Universiti Linton on 2015-04-20

6: CONCLUSION AND FUTURE SCOPE ..... 1...

Nizwa College of Technology on 2019-06-23

CHAPTER 7

Engineers Australia on 2020-03-02

1.2 PROBLEM STATEMENT

UOW Malaysia KDU University College Sdn. Bhd on 2024-01-18

Arduino UNO

UOW Malaysia KDU University College Sdn. Bhd on 2024-03-19

excellent temperature stability

www.coursehero.com

operating voltage

Higher Education Commission Pakistan on 2013-05-28

a range of 100 meters in open space

Deepak B.B.V.L., Soubhagya Nayak, Sandip Kumar Patra. "Development of obstacle- avoiding robots using R...

operating voltage

Higher Education Commission Pakistan on 2013-05-28

CHAPTER 6: CONCLUSION AND FUTURE SCOPE6.1 Conclusion

www.ir.juit.ac.in:8080

a system that can accurately recognize and interpret handgestures

UOW Malaysia KDU University College Sdn. Bhd on 2024-01-18