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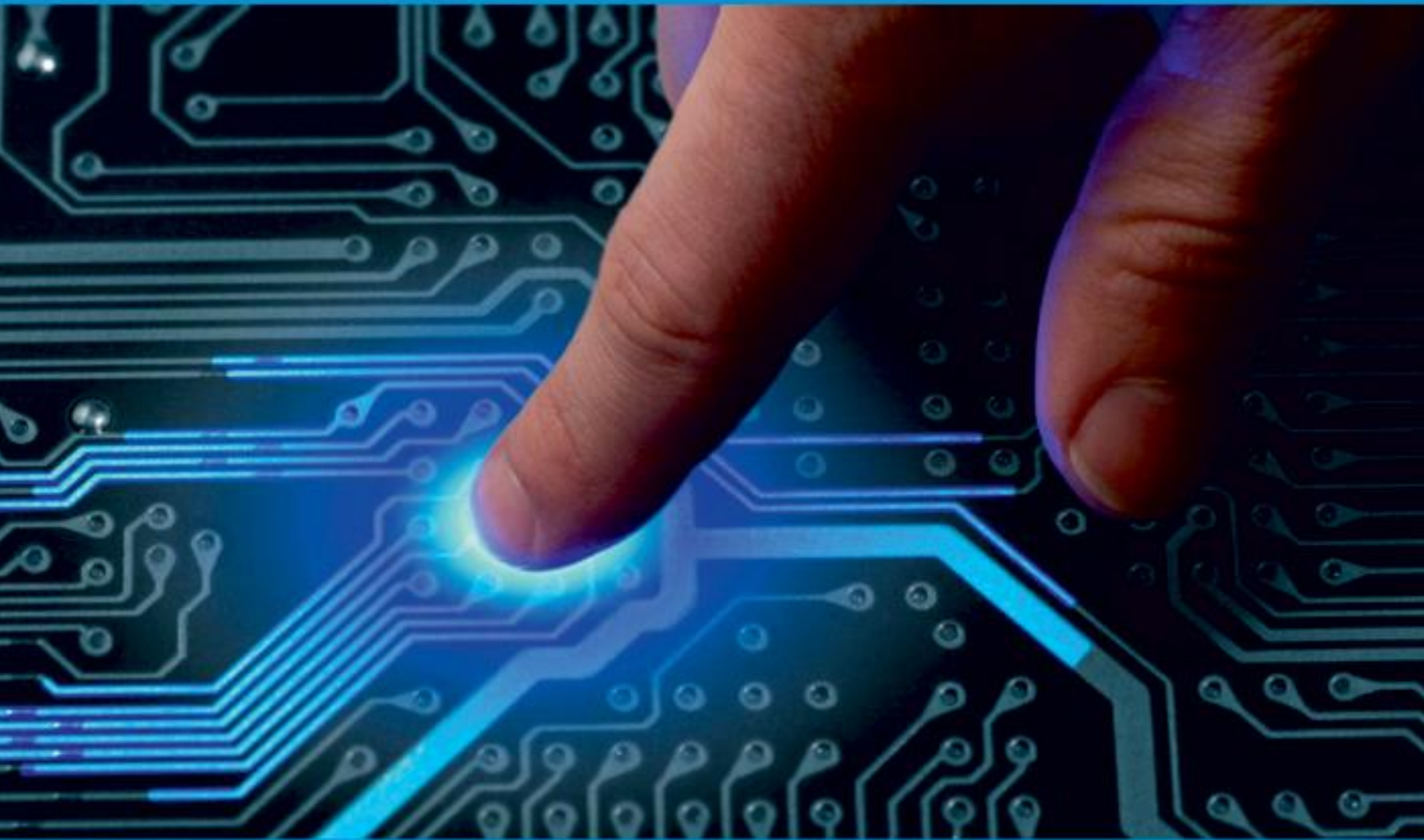

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# Hand Motion Control Robotic Arm System

Sakshi Jadhav, Govind Chaure, Archaana Randive

Department of Electronics and Telecommunication Engineering, AISSMS Institute of Information Technology Pune, Maharashtra

Assistant Professor, Department of Electronics and Telecommunication Engineering, AISSMS Institute of Information Technology, Pune, Maharashtra

**ABSTRACT**: In various automated industries wireless activities are necessary specially in remote locations where its dangerous or hazards areas. In a number of the industries it is necessary to handle few jobs with very heat which isn't possible by human hand in such cases wireless operations are more efficient. This project focuses on design of hand gesture controlled robotic arm using Arduino uno with the assistance of R-F transmitter and receiver there is a line of sight connection between the transmitter and receiver but Communication over Radio Frequency does not have line of sight connection. The range of RF communication is very high when compared to IR communication wireless sensor networks. It consists of two parts which are interconnected by the wireless sensor communication systems. The R-F transmitter is going to be transmit signals and there for the receive are receives the signals. The primary part consisting of gloves.The part of glove is fully occupied by rechargeable battery. and the other part is consists of motors, gripper and other hardware which is arm side where robotics arm will be used . This part consists of motor, microcontroller and robotic fingers through which the mechanical action takes place

**KEYWORDS**: Human Hand robotic interaction, Ardiuno, RF Transreceiver

## INTRODUCTION

In recent years, robotic arms have become increasingly prevalent in various fields, ranging from manufacturing and assembly lines to medical and research applications. One fascinating aspect of robotic arm control is the ability to manipulate them using hand motions. This project introduces a hand motion control robotic arm using Arduino Uno, an accessible and widely used microcontroller platform. The aim of this project is to develop a system that enables users to control a robotic arm effortlessly by mimicking their hand movements. By combining the Arduino Uno's processing power, the flexibility of its programming environment, and the precision of motion sensors, we can create an intuitive and interactive control system. The core of the system lies in capturing hand motions using a sensor, processing the data, and translating it into commands that control the robotic arm's movements. In this project, we will employ an accelerometer and a gyroscope sensor to detect the orientation and movements of the hand.

The Arduino Uno serves as the brain of the system, receiving the sensor data, analyzing it, and generating corresponding commands to control the robotic arm's joints. Its compatibility with a wide range of sensors and its ease of programmingmake it an ideal choice for this application. By developing a user-friendly interface, we can create an intuitive mapping between the hand motions and the desired movements of the robotic arm. Users will be able to grasp, lift, rotate, and release objects using their own hand gestures, providing a more natural and immersive control experience. Throughout this project, we will explore the principles of sensor data processing, servo motor control, and the fundamentals of robotic arm kinematics. By the end, we will have a fully functional hand motion control robotic arm that can be further expanded upon and integrated into various applications.

## II.METHODOLOGY

Design the system by specifying the requirements and selecting sensors and actuators. Integrate the sensors with Arduino Uno and calibrate them for accurate readings. Develop code to interpret sensor data and map hand gestures to robotic arm movements. Control the robotic arm by generating appropriate signals for the servo motors. Design a user-friendly interface to provide feedback and interaction. Test the system, gather user feedback, and make refinements to improve performance and usability.

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## II.LITERATURE REVIEW

[1] This paper implements a real-time hand gesture recognition algorithm based on the low-cost Kinect sensor. It enables real-time 3D hand gesture interaction with a robot for understandinghuman-directed instructions. if the system can withstand background intrusive objects or people. To detect hand gestures in any orientation, and more specifically pointing gestures while extracting the 3D pointing direction, a Haarlet-based hand gesture recognition system is implemented.

[2] The Ardiuno Controlled Gesture Robot is a robotic arm used today for pick-and-place operations in industrial automation applications as well as for defence and medical procedures. The robotic arm moves and completes the task based on the gesture of human hands, and this system imitates the actions of human hands. The arm is very adaptable and can be used in environments where it is unsafe for people to be there, such as the industry that makes fireworks and diffuses bombs, for example.The robotic arm can be controlled in a variety of ways. This study examines the use of the Zig-bee protocol and accelerometer-based gesture recognition to wirelessly control the movements of a robotic arm.

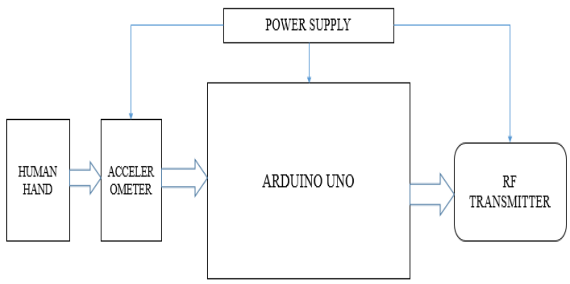
[3] Design and Construction of a Six-Axis Gesture Controlled Robot - This paper describes the construction of a six-axis robot that is gesture controllable. The robot has six degrees of freedom and is simple to use because it does not require more control effort. Flex sensors and transceivers are built into a human hand glove, and the resistance variation of the flex sensor is transmitted to the robot axis. The robot can rotate about its axis either angularly or linearly depending on the variation. The signals sent and received between the robotic arm and the human hand are controlled by a straightforward transceiver. The system is managed by Arduino programming.

[4] The use of MATLAB to control an Arduino-based robotic arm for human hand tracking has gained a lot of attention recently due to its many useful applications. There are numerous ways to implement this method. Here, we demonstrate a straightforward method forusing the robotic arm to track the human hand. This paper demonstrates the use of a robotic arm to interface with a human hand. Using this technique, a human hand can control a robotic hand. Its demonstration involves using image processing to identify various colours at various axes of the human hand. This method is very helpful because it records a live video of the hand and follows it to connect with a robotic arm. The video will be captured by a laptop camera.

[5] A ROBOTIC ARM WITH HAND MOTION CONTROL BASED ON GYROSCOPE, ACCELEROMETER, AND MAGNETOMETER MICRO-ELECTRO-MECHANICAL SYSTEM SENSORS
For many inhuman situations where human interactions are difficult or impossible (i.e., impossible situations), there are high requirements to develop artificial arms. The information, methods, and techniques presented in this paper are crucial for creating a robotic arm called a gesture robotic arm that is controlled by the movements of a typical human arm. Data for this robotic arm is collected using the sensor fusion technique of MEMS, accelerometers, and gyroscopes. An appropriate averaging algorithm is used to smooth the accelerometer output in order to provide an effective control mechanism and to lower the noise level coming from the sensors. The Arduino platform, in which everything is interfaced, served as the foundation for the creation of this arm.

BLOCKDIAGRAM

Hand glove region :




The main heart of the system is that Arduino uno controller which is control the overall working of the system and send or receive response to the different elements of the system to take a action. Also we used Arduino uno IDE software for controlling the arm Working principle of our system is flex sensor power supply and RF transmitter will be interfaced to the Arduino uno processor. Power supply help us to provide DC supply voltage to the Arduino and other component.

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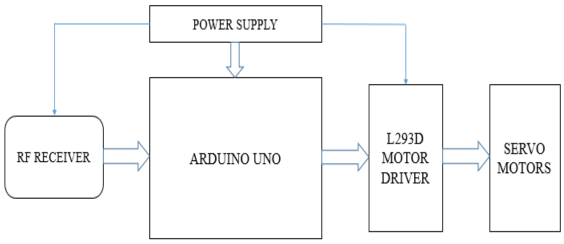
ROBOT ARM REGION :




The controller will hold off on starting the system until it has received data from the sensor. The data is processed by the controller after it is received from any sensor, and it is then given to the RF transmitter to be wirelessly transmitted to the RF receiver on the other part of the project. The Arduino Uno controller located in the arm region processes the data signal as soon as it is received by the RF receiver from the RF transmitter. The processed data signal is then sent to the motor drive to cause the robotic arm to move.

## III.COMPONENT SPECIFICATION

**Accelerometer Sensor :** The MPU6050 gyroscope and a flex sensor are integrated into a hand glove that controls the position of the 3D-printed robotic arm. The gripper servo of the robotic arm is controlled by the Flex sensor, and the MPU6050 is used to move the robotic in the X and Y axes. You can also construct your arm without a printer using plain cardboard, as we did for our Arduino Robotic Arm Project. You can also look at the Record and Play Robotic Arm that we previously constructed for ideas.

**Arduino uno :** A microcontroller board called Arduino UNO is based on the ATmega328P. It has 6 analogue inputs, a 16 MHz ceramic resonator, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes with everything needed to support the microcontroller; to get started, just plug in a USB cable, an AC-to-DC adapter, or a battery.

**RF transmitter and receiver :** In order to transmit data at up to 3KHz from any common CMOS/TTL source, the hybrid RF Transceiver Module offers a complete RF transmitter and receiver module solution. The transmitter module has a low current consumption (typically 11mA) and is very easy to use. Direct data supply from a microprocessor or encoding device can reduce the number of components and guarantee low hardware costs.

**Flex sensor :** A flex sensor is employed in this gesture-controlled robotic arm to regulate the gripper. The gripper opens when the gripper's attached servo motor rotates in response to the hand glove's flex sensor being bent. Since the motion of the finger may be able to produce a continuous range of voltages, the resistance of the 2.2-inch flex sensor will be tested at various bending angles. This test will be done to ensure linearity and adequate sensitivity, which is important because it directly affects accuracy.

**Servo Motor :** Interfacing pastime It's simple to use servo motors like the S90 servo motor with an MCU. Three wires protrude from each servo. One will be used for the signal that the MCU is supposed to send, and the other two will be used for supply (positive and negative). A MG995 Metal Gear Servo Motor, which is typically used for remote-control cars, humanoids, and other devices.

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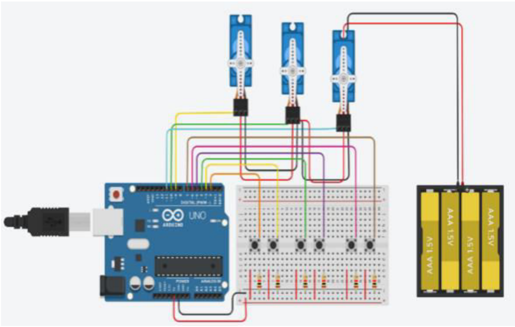
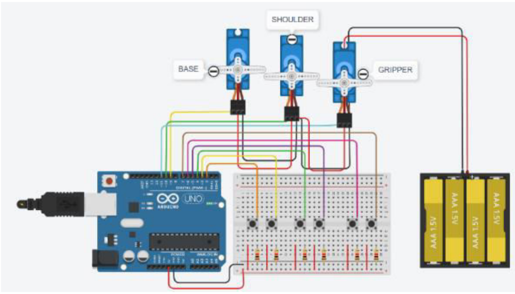
## IV.SOFTWARE DESIGN

### A. CIRCUIT SIMULATION OF THE SYSTEM:



### B. SIMULATIONRESULTOFTHESYSTEM:




## V.RESULT

The robotic arm is intended to perform a specific task that is challenging for humans to complete, which is why we are attempting to implement robotics. The prototype design includes a hand glove where the accelerometer is placed on top of the right hand in order to be able tocapture our hand's movement, process it correctly, convert it into radio waves that are easily readable by the receiver, and then receive it with strength and accuracy.
In comparison to other systems, the developed system is more dependable, economical, user-friendly, environmentally friendly, and simpler to use.

## VI.CONCLUSION AND FUTURE WORK

CONCLUSION : The hand motion control robotic arm systems have emerged as a promising technology within the field of robotics and human-computer interaction. These systems allow for intuitive and natural interaction between humans and robots, enabling precise control and manipulation of robotic arms through hand gestures or motions. The hand motion control robotic arm systems offer a bridge between human intent and robotic actions, opening up new possibilities for intuitive and efficient collaboration between humans and machines in various domains. Continued research and development in this area hold the potential to further advance these systems and unlock their full potential in a wide range of applications.

FUTURE SCOPE :
- Improved Accuracy and Precision
- Enhanced Haptic Feedback
- Increased Adaptability and Customization
- Integration with AI and Automation
- Expanded Applications

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- Human-Robot Collaboration

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