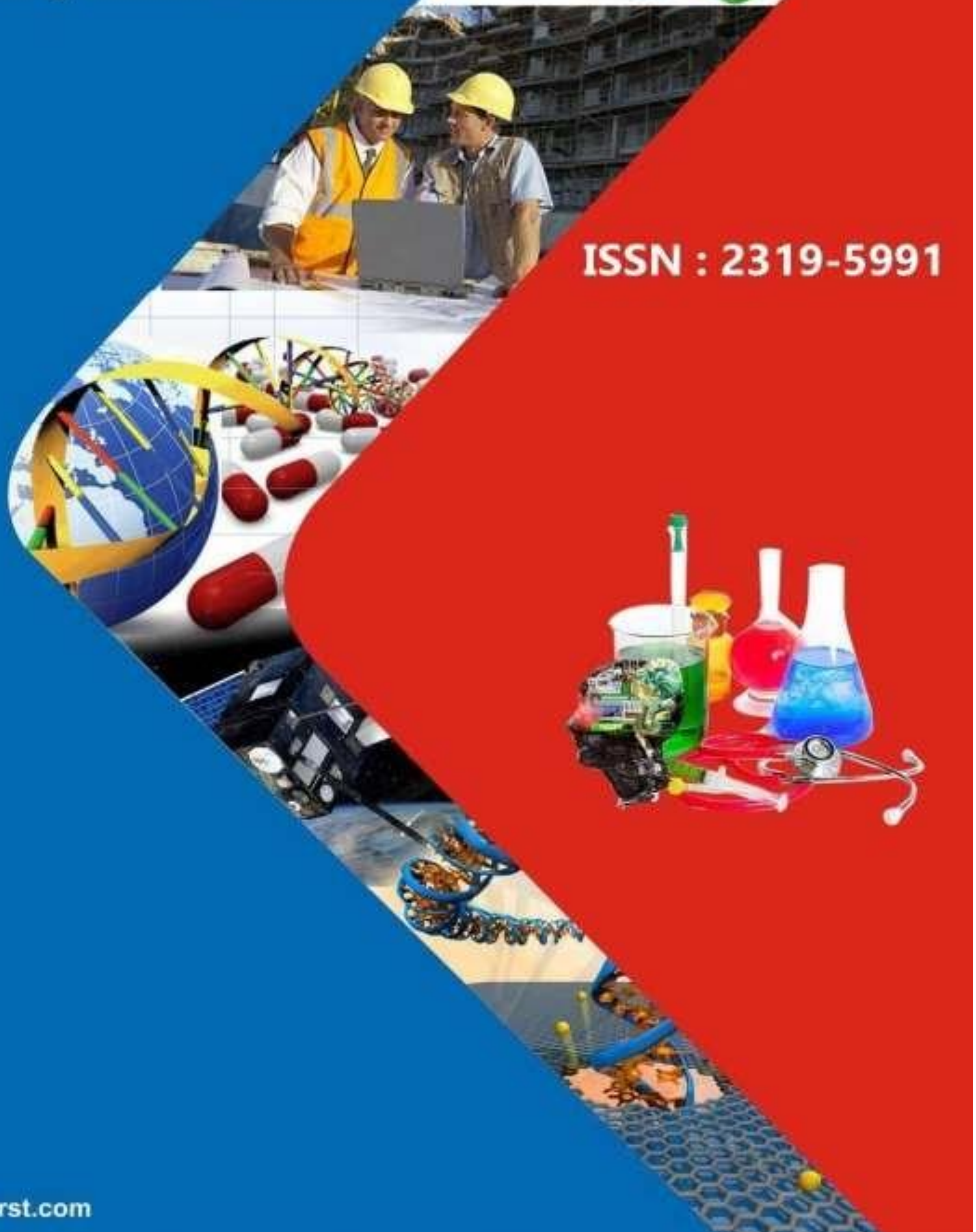
International Journal of Engineering Research and Science & Technology

IJERST

ISSN : 2319-5991



www.ijerst.com

Email: editor@ijerst.com or editor.ijerst@gmail.com

ISSN 2319-5991 www.ijerst.com
Vol. 17, Issue.2, April 2024

ROBOTIC HUMANHAND MODEL WITH WHEELED MOVEMENT

V .SRAVANI[1] , M.V.V.S NAGA CHINMAI[2] , JAKKALA SRIKANTH[3], G.ADARSH[4], MEDI RAMA KRISHNA[5]

[1]Assistant Professor , Department of Electronics and Communication Engineering, TEEGALA KRISHNA REDDY ENGINEERING COLLEGE, Meerpet , Hyderabad , 500097

[2345]UG Students, Department of Electronics and Communication Engineering, TEEGALA KRISHNA REDDY ENGINEERING COLLEGE, Meerpet , Hyderabad , 500097

ABSTRACT

Robotic human hand systems have gained significant attention for their potential applications in prosthetics, human-machine interaction, and teleoperation. This paper presents the design and implementation of a versatile robotic human hand with wheeled movement, leveraging Arduino Uno microcontroller technology, flex sensors, servo motors, DC motors, and a gyroscope sensor.

The proposed system integrates flex sensors to mimic human hand gestures, enabling intuitive control of the robotic hand's movements. Arduino Uno serves as the central control unit, processing sensor inputs and generating control signals for actuation. Servo motors actuate individual finger joints, providing precise and coordinated movement similar to human fingers.

In addition to hand articulation, the robotic hand incorporates wheeled movement for enhanced mobility. DC motors coupled with wheels enable the hand to traverse flat surfaces, allowing it to perform tasks in various environments efficiently. The integration of a gyroscope sensor provides orientation feedback, facilitating stability and orientation control during movement.

The system's modular design and open-source nature enable flexibility and scalability for diverse applications. Potential applications include assistive robotics, teleoperation systems, educational platforms, and human-machine interfaces. Furthermore, the utilization of Arduino Uno and readily available components ensures accessibility and affordability, making the system accessible to a wide range of users and developers.

ISSN 2319-5991 www.ijerst.com
Vol. 17, Issue.2, April 2024

INTRODUCTION

The aim is to build a robotic hand for which a high level of dexterity for the hand is desired. The goal is to be able to hold objects using the robotic hand. The control of the robotic hand will be perfectly maintained through a separate controller glove. A robotic hand is a type of mechanical arm that is programmed to execute given and finger movements instructions accurately. It is usually consisting of motors and includes a flex sensors and servo motors that work together to closely resemble the action and functionality of a human hand . The arm may be the complex mechanism and is the critical part of a complex robot.

To reflect the exact movements of fingers a combination of flex sensors , servo motors and wires are applied. It was agreed that the scope of this project is that we can control wheeled movement and hand movement with more precision. The concept of a robotic hand has various applications. It is therefore thought that the project has potential usage in diverse industries such as the medical industry, in laboratory settings and the defense industry, if it were to be developed. In particular for the medical industry, a well-designed robotic hand with appropriate degrees of freedom would be suitable for use as a prosthetic. Similarly, a well-functioning, robotic hand can be used in harsh environments to humans such as handling the toxic substances and dismantling of bombs

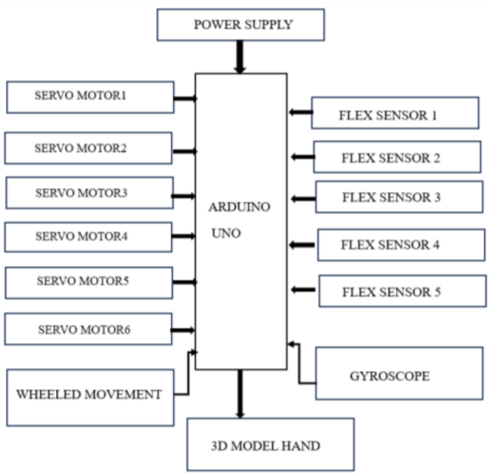


Figure.1 Block diagram

LITERATURE SURVEY

In [1] it is described that development of a human-Artificialmachine communication between the Motion controller and the robotic hand. An algorithm was developed to allow an adequate

ISSN 2319-5991 www.ijerst.com
Vol. 17, Issue.2, April 2024

mapping between the user's hand movement, tracked by the Motion controller. The system should allow for a more human-computer interaction's and a manipulation of the robotic hand . The applications of this interaction discussed in relation with the Ambient Assisted Living, where some can use case scenarios were introduced. To build a robotic hand controlled by human hand movements where data is acquired from the use of accelerometers

In [2] been proposed for development of this hand was based on ATmega32 and ATmega640 along with a computer for signal processing. Finally, this prototype of the hand expected that should be overcoming the problem such as placing or picking objects objects that were far away from the user.

In [3] to design and development of a microcontroller (ATmega) robotic human hand is described. The robotic arm reflects to the action as well as it can be programmed to go along a definite path. The system understands the movement of user's finger and robotic arm reflects the given input action .The action is sensed potentiometers which are on a glove. The movement of potentiometer regulates the position for the servo motors driving the parts of the hand.

In [4] it is presented that developed natural interface for robotic arm that is remote controlling. That was built with concept inertial motion trackers. There are two types of motion trackers. The first is Xsens Xbus Kit tracker and the second one is Razer Hydra Controller. Hydra controller used for determining robotic arm position in 3D space. One of the most complex problem which was resolved in sufficient manner and presented in this article that is processing acceleration data to estimate linear position of the robotic hand to operator's motion. The results of this concept algorithms' parameter values selections and results of practical evaluation of the interface.

In [5] this a proposed system of an accelerometer-based system to control an industrial robot. The accelerometers have been attached to the human arms, recording and understanding its behavior (gestures and postures). An Artificial Neural Network (ANN) has been schooled with a backpropagation algorithm was used to recognize and reflect arm gestures and postures. As the user starts to perform a gesture or posture, the robot starts the movement almost at the same time.

ISSN 2319-5991 www.ijerst.com
Vol. 17, Issue.2, April 2024

PROPOSED SYSTEM

The proposed system integrates flex sensors to mimic human hand gestures, enabling intuitive control of the robotic hand's movements. Arduino Uno serves as the central control unit, processing sensor inputs and generating control signals for actuation. Servo motors actuate individual finger joints, providing precise and coordinated movement similar to human fingers.

In addition to hand articulation, the robotic hand incorporates wheeled movement for enhanced mobility. DC motors coupled with wheels enable the hand to traverse flat surfaces, allowing it to perform tasks in various environments efficiently. The integration of a gyroscope sensor provides orientation feedback, facilitating stability and orientation control during movement.

The system's modular design and open-source nature enable flexibility and scalability for diverse applications. Potential applications include assistive robotics, teleoperation systems, educational platforms, and human-machine interfaces. Furthermore, the utilization of Arduino Uno and readily available components ensures accessibility and affordability, making the system accessible to a wide range of users and developers.

RESULT

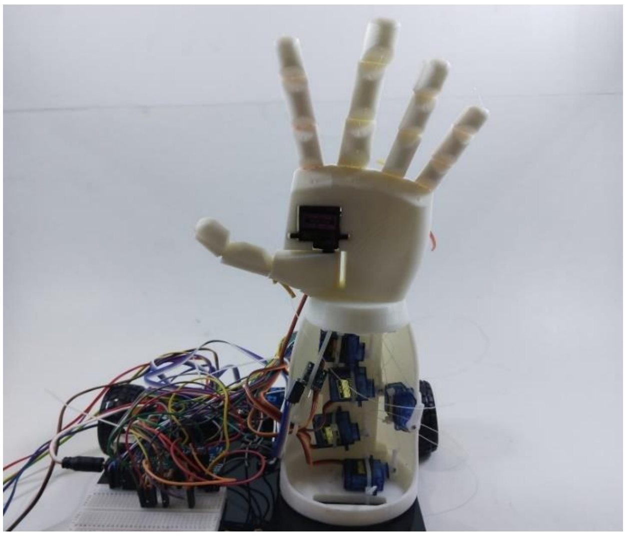


Figure.2 ROBOTIC HAND

ISSN 2319-5991 www.ijerst.com
Vol. 17, Issue.2, April 2024

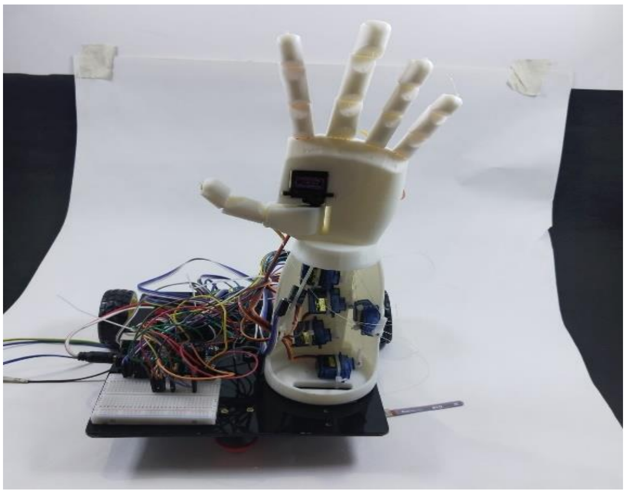


Figure.3 RESULT

ADVANTAGES

Educational Value: Building a robotic hand with these components provides hands-on experience in electronics, programming, and robotics, making it an excellent educational project for students and hobbyists.

Integration of Sensors and Actuators: The project allows for the integration of flex sensors to detect physical input (finger bending) and servo motors to actuate mechanical output (finger movement). This integration showcases the connection between sensors and actuators in a robotic system.

Realistic Movement Simulation: By using flex sensors to mimic human finger bending and servo motors to actuate the fingers, the robotic hand can simulate realistic hand movements. This can be visually impressive and applicable in scenarios like prosthetics or animatronics.

Low-Cost Components: he components used in this project (flex sensors, servo motors, Arduino Uno) are relatively low-cost and widely available. This makes the project accessible to a broad audience with budget constraints.

Open Source and Community Support: The Arduino platform is open source, and there is a large community of developers and hobbyists. This means access to a wealth of online resources, tutorials, and forums for troubleshooting and improvement.

ISSN 2319-5991 www.ijerst.com
Vol. 17, Issue.2, April 2024

APPLICATIONS

Educational Demonstrations: The project serves as an excellent educational tool to demonstrate principles of robotics, mechatronics, and programming. It can be used in classrooms to teach students about sensor integration, motor control, and the basics of robotic systems.

Prosthetics Research and Development: The technology used in the robotic hand can be a starting point for the development of prosthetic hands. By incorporating more advanced materials, sensors, and actuators, the technology could contribute to the creation of functional and affordable prosthetic devices.

Rehabilitation Devices: The robotic hand can be adapted for use in rehabilitation devices to aid patients in recovering hand movement after injuries or surgeries. The flex sensors can be used to monitor and guide rehabilitation exercises.

Human-Machine Interaction Research: Researchers in human-machine interaction can use the robotic hand as a testbed for studying how humans interact with robotic systems. It can be a platform for exploring gesture recognition, user feedback, and control interfaces.

Entertainment and Animatronics: The robotic hand can be incorporated into entertainment systems, such as animatronics for theme parks or interactive exhibits. Its realistic finger movements can contribute to creating lifelike characters and engaging displays.

CONCLUSION

In conclusion, the development of a robotic hand incorporating flex sensors, servo motors, a power supply, and an Arduino Uno opens up a realm of possibilities in various fields. This project seamlessly blends the disciplines of electronics, mechanics, and programming, making it an invaluable educational tool and a platform for innovation.The project provides an engaging and hands-on educational experience for students and enthusiasts, fostering learning in robotics, mechatronics, and programming. It serves as a practical demonstration of the integration of sensors and actuators in a robotic system.

The robotic hand has diverse applications, ranging from educational demonstrations and research in human-machine interaction to potential use in prosthetics, rehabilitation devices, entertainment, and beyond. Its adaptability makes it a versatile tool for exploration and

ISSN 2319-5991 www.ijerst.com
Vol. 17, Issue.2, April 2024

innovation. The use of low-cost components, such as flex sensors, servo motors, and Arduino Uno, enhances accessibility, making the project feasible for a wide audience with budget constraints. This accessibility encourages participation and experimentation in the field of robotics.

FUTURE SCOPE

Enhanced Sensing Technology: Future iterations could incorporate more advanced sensing technologies beyond flex sensors, such as pressure sensors, accelerometers, or even tactile sensors. This would enable the robotic hand to provide more detailed and nuanced feedback about its interaction with the environment.

Integration of AI and Machine Learning: Incorporating artificial intelligence (AI) and machine learning (ML) algorithms could enhance the capabilities of the robotic hand. The hand could learn and adapt its movements based on user behavior, making it more intuitive and responsive.

Wireless Connectivity: Integrating wireless communication modules, such as Bluetooth or Wi-Fi, would enable the robotic hand to be controlled remotely or to interact with other devices in a network. This could open up possibilities for teleoperation and collaborative robotic systems.

Advanced Materials and Lightweight Design: Research into advanced materials could result in a lighter and more durable robotic hand. This is particularly relevant for applications in prosthetics, where comfort and wearability are critical factors.

Biomechanical Modeling: Incorporating biomechanical modeling and simulation techniques could lead to more accurate replication of human hand movements. This could improve the naturalness and efficiency of the robotic hand's actions.

REFERENCES

1. R. Kumar, S. Singh, and A. Kumar (2021) "Design and Development of Robotic Human Hand Model with Wheeled Movement."

2. S. Sharma, A. Verma, and N. Gupta (2020) "A Wheeled Robotic Human Hand Model for Enhanced Mobility."

International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com

Vol. 17, Issue.2, April 2024

3. P. Singh, S. Yadav, and A. Kumar (2019) "Development of a Robotic Human Hand Model with Integrated Wheels for Versatile Movement."

4. A. Patel, R. Gupta, and S. Kumar (2018) "Robotic Human Hand Model with Wheeled Movement for Agile Navigation."

5. M. Gupta, S. Sharma, and R. Singh (2017) "Design and Implementation of a Wheeled Robotic Human Hand Model for Flexible Maneuvering."

6. N. Jain, A. Sharma, and S. Agarwal (2016) "A Mobile Robotic Human Hand Model with Integrated Wheels for Dynamic Locomotion."

7. S. Verma, R. Kumar, and A. Gupta (2015) "Development of a Wheeled Robotic Human Hand Model for Enhanced Mobility and Dexterity."

8. A. Singh, P. Kumar, and S. Jain (2014) "Robotic Human Hand Model with Integrated Wheels for Efficient Movement."

9. S. Yadav, A. Verma, and M. Sharma (2013) "Design and Implementation of a Mobile Robotic Human Hand Model for Agile Navigation.