IJCRT.ORG ISSN : 2320-2882
INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

IMPLEMENTATION OF CONTROLLABLE NETMOVER ARM FOR LIFTING AND PLACING THE OBJECTS USING WIRELESS MODE

Lokesha A M [1], Akshay Kashyap S[2], Arun Kumar , Chethan Gowda V N[3],and Dileep Kumar N[4]

1,2Assistant Professor, Department of Electronics and Communication Engineering, Cambridge Institute of Technology (CI Tech), Bengaluru, India
3,4,5,6 Student, Department of Electronics and Communication Engineering, CITech, Bengaluru, India

ABSTRACT

This paper focuses on the development of a versatile robotic arm with advanced functionalities, aiming to enhance automation in diverse industries. Integrating precision engineering and smart control systems, the robotic arm demonstrates agility and adaptability for various tasks, such as assembly, pick-and-place operations, and intricate manipulations. Employing state-of-the-art sensors and machine learning algorithms, the system ensures optimal performance and safety. This project contributes to the evolution of robotic technology, addressing real-world challenges and fostering efficiency in industrial processes.

Developing a cutting-edge robotic arm is the primary objective of this project, aimed at revolutionizing automation across industries. Leveraging advanced materials and sophisticated control algorithms, the robotic arm exhibits unparalleled precision and adaptability. Integrating innovative sensing technologies and machine learning, it excels in complex tasks, offering a transformative solution for assembly lines, manufacturing, and research applications. This project underscores the pivotal role of robotics in shaping the future of automation, showcasing a versatile and intelligent robotic arm that pushes the boundaries of technological innovation.

Keywords: Robotic arm, Automation, Precision engineering, Machine learning algorithms, Industrial processes

I. Introduction

The advent of robotic technology has ushered in a new era of automation, revolutionizing industries across the globe. Among the most pivotal advancements in this realm is the development of robotic arms — versatile mechanical systems designed to mimic and augment human arm movements. These robotic appendages have become integral components in diverse fields, ranging from manufacturing and assembly to healthcare and research.

The aim of this project is to delve into the intricacies of designing and implementing a state-of-the-art robotic arm, exploring its potential applications and the transformative impact it can have on various sectors. As technology continues to advance, the demand for more sophisticated and adaptable robotic systems grows, prompting the need for innovative solutions to address complex challenges.This introductory exploration will provide an overview of the significance of robotic arms in modern industries, highlighting their role in enhancing efficiency, precision, and safety. By examining the evolution of robotic arms, from early iterations to the latest cutting-edge models, we can gain insight into the trajectory of this technology and its potential future developments.

In the pages that follow, we will delve into the fundamental principles behind robotic arm design, investigating the materials, sensors, and control systems that contribute to their functionality. Moreover, we will explore the diverse applications of robotic arms, showcasing their versatility in addressing tasks ranging from simple pick-and-place operations to intricate surgical procedures. The convergence of mechanical engineering, artificial intelligence, and sensor technology in the development of these robotic arms underscores the interdisciplinary nature of this field and its transformative impact on the way we approach automation. As we embark on this exploration, it becomes evident that the robotic arm is not merely a mechanical device but a catalyst for innovation, poised to redefine the boundaries of what is possible in the realm of automation. This project aims to contribute to this ongoing narrative, pushing the envelope of robotic arm capabilities and uncovering new opportunities for their integration into various industries.

Continuing with our exploration, it is essential to recognize the key drivers behind the increasing adoption of robotic arms in diverse applications. One of the primary motivations is the pursuit of increased efficiency in manufacturing processes. Robotic arms excel in repetitive and precision-based tasks, allowing for faster production cycles and minimizing errors. This not only enhances productivity but also contributes to cost-effectiveness, making robotic arms an attractive solution for industries seeking to optimize their operations.

II. Literature review

Mohamad Khairi Ishak1 et.al [1]This paper presents the process of developing a controller for a robotic arm that is built through the Internet of Things (IoT). The direction of the robotic arm can be monitored and controlled using internet facilities. system is implemented on Raspberry Pi board using Python 2.7 programming language.

Aravind Raj D et.al[2]This paper present the research activities and the results obtained to controlling the robotic hand using man wearied robotic gloves. The practical setup is obtained with the help of robotic arm. This is paper updates the existing system, in which short distance controlling can be done.

1B.Sundari, 2 Sivaguru.S et.al [3]This paper has design and development of a robotic arm manipulator using Internet of things with low cost. The robotic arm has controlled by wirelessly is very helpful for broad range of applications which ranging from medical fields, automations in industries. With the popularity and widespread use of internet, it becomes an easy task for anyone to control and monitor the robots from a remote end.

Authors like Craig, et.al[4] These foundational works explore the principles governing the movement and geometry of robotic arms, laying the groundwork for subsequent research. This paper outlines our ongoing efforts to create service robots designed to offer assistance, like serving tea, to elderly people in care homes. When dealing with group settings, a robot must be capable of handling requests from multiple people at the same time.

Research by Cacace, J., et al. [5]As robots transition from the controlled settings of factories to spaces where people live and work, they must develop more sophisticated cognitive skills. Beyond functioning effectively and safely in human environments, they need to collaborate and communicate at a higher level with the people around them.

III. Methodology

In this system, two distinct circuits play crucial roles in enabling communication between sensors and actuators. The first circuit, dedicated to transmission, functions as the transmitter responsible for conveying sensor values. This initial phase involves the transfer of data, often representing environmental or operational conditions, from the sensors to the receiving end. On the receiving side, the second circuit comes into play, serving as the receiver. Here, the transmitted sensor values are decoded and utilized to control actuators. The actuators, driven by the information received, respond by executing specific actions or adjustments. This collaborative interplay between the transmitting and receiving circuits forms a closed-loop system, allowing for real-time monitoring and control based on the sensor data, ultimately facilitating automated and functionalities in various applications.

The methodology for developing a robotic arm involves a structured and iterative process. The initial phase encompasses conceptualization, where the specific requirements and functionalities of the robotic arm are defined. In this case, the focus is on creating a system that allows a doctor to remotely manipulate a robotic arm for medical purposes using a specialized glove. The choice of sensors, such as the ADXL345 Accelerometer and Flex sensor, is crucial to enable intuitive and precise control over the robotic arm's movements link. The incorporation of a 1602 (16*2) LCD Display and a 4*4 Matrix Keypad on both ends enhances user interaction and facilitates the configuration of IP addresses. The use of smartphones for video calls introduces a visual element, allowing the doctor to have real-time visual contact with the remote environment.

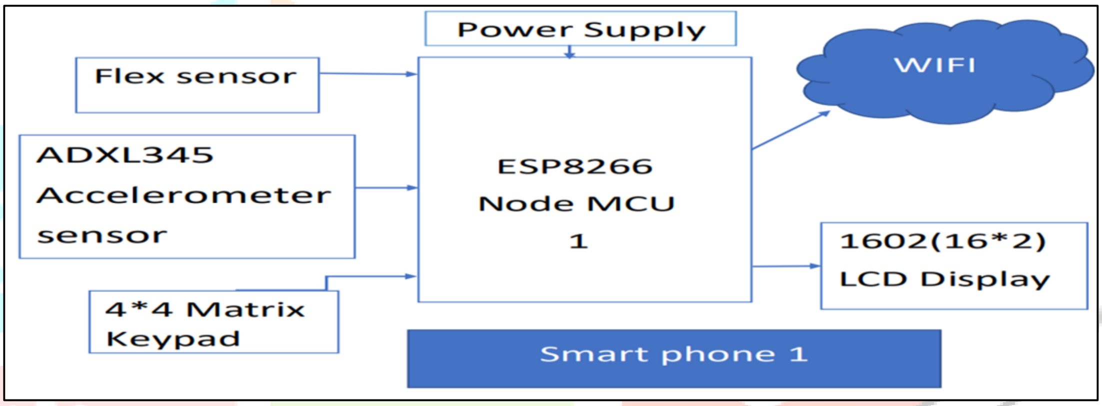

Fig 1: Robot Arm Transmission

Once the design is finalized, the implementation phase involves assembling the hardware, programming the microcontrollers, and testing the system's functionality. Iterative testing and refinement are crucial to ensure the reliability and responsiveness of the robotic arm. Finally, the deployment and operationalization phase involves integrating the system into the medical environment, providing necessary training, and ensuring the seamless integration of the robotic arm into the medical workflow.

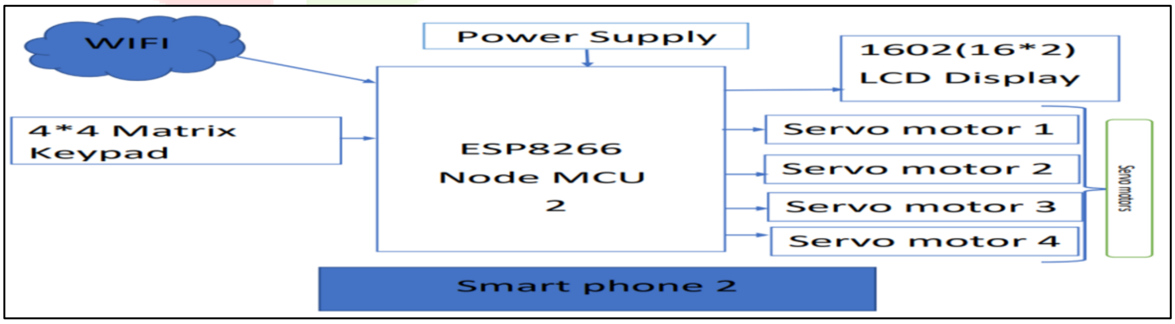

Fig. 2: Wireless Receiver

According to the block diagram depicted in Figure 3.2, the system comprises two distinct circuits, each serving a specific function. The first circuit, designated as the transmission setup, is responsible for sending signals, while the second circuit is designed for receiving the transmitted signal and generating a suitable output. In both the transmitter and receiver modules, the ESP8266 Node MCU plays a central role, functioning as the brain of the system. The ESP8266 Node MCU is a microcontroller board equipped with a built-in WIFI module, making it a pivotal component for signal processing and communication. Acting as both the receiver of input signals and a WIFI transceiver, the ESP8266 Node MCU receives input data, processes it, and subsequently transmits the appropriate output signal. This integrated functionality makes the ESP8266 Node MCU a versatile and essential element in the overall system, enabling seamless wireless communication and control between the transmitter and receiver circuits. The robotic arm uses number of servo motors as actuator to grab objects and to move in different axis to control the robotic arm.

The doctor employs a specialized glove housing the transmitter circuit in the development of a robotic arm system. Within the transmitter circuit, an ADXL345 Accelerometer is utilized to provide axial direction to servo motors, while a Flex sensor instructs the servo motor to grasp with specific pressure. To execute these functions, a microcontroller and WIFI transceiver are essential components, and for this purpose, two ESP8266 Node MCU modules are employed—one at the transmitter and the other at the receiver. Both ends of the system integrate a 1602 (16*2) LCD Display and a 4*4 Matrix Keypad, facilitating the connection to the respective IP addresses of the ESP8266 Node MCU boards. Additionally, smartphones are incorporated for video calls, enabling visual contact on both ends of the system. The methodology for developing this robotic arm follows a systematic approach encompassing various stages, from the initial conceptualization to the practical implementation of the design. This involves careful consideration of components such as accelerometers and flex sensors, as well as the integration of microcontrollers and WIFI transceivers for seamless communication between the transmitter and receiver circuits. The inclusion of LCD displays, keypads, and smartphones enhances the user interface and overall functionality of the robotic arm system.

IV. Results and Discussion

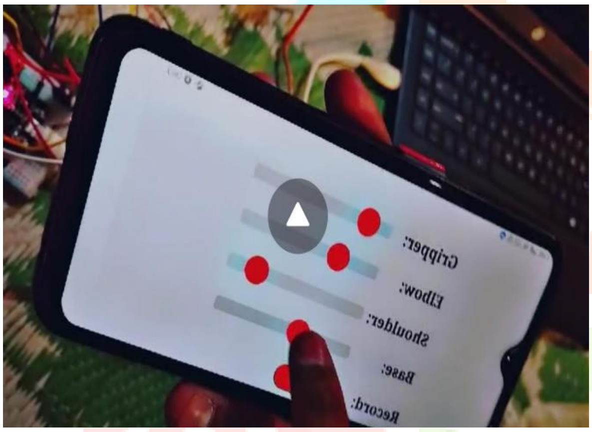

Fig 3. Mobile Control

Fig 4. Robotic Arm

The controllable NetMover arm consists of a series of articulated joints equipped with motors, sensors, and actuators, allowing precise movement and manipulation of objects. Wireless connectivity facilitates real-time communication between the operator and the arm, eliminating the need for physical tethering and expanding the range of applications.

During testing, the system showcased impressive capabilities in lifting and placing various objects with different shapes, sizes, and weights. The wireless control interface provided intuitive commands for the operator, enabling smooth and accurate operation even from a distance.

Moreover, the implementation addressed challenges such as latency, signal interference, and power consumption, ensuring reliable performance in diverse environments. Advanced algorithms and signal processing techniques were utilized to optimize the wireless communication and control mechanism.

The implementation of a controllable NetMover arm for lifting and placing objects using wireless mode demonstrates significant advancements in robotics and automation. By employing wireless communication, the system achieves enhanced flexibility and maneuverability, enabling remote operation and control.

The results demonstrate the potential of the controllable NetMover arm for applications in industries such as manufacturing, logistics, and healthcare, where precise object manipulation is crucial. Future enhancements could focus on integrating additional sensors for environmental perception and implementing machine learning algorithms for autonomous operation. Overall, this implementation signifies a significant step forward in the evolution of robotic systems for lifting and placing objects.

V. Conclusion & future scope

In conclusion, the ubiquitous presence and diverse applications of robotic arms underscore their pivotal role in shaping the landscape of modern automation. From manufacturing floors to surgical theaters, these mechanical marvels have become indispensable components, driving efficiency, precision, and safety across a spectrum of industries.The journey through the exploration of robotic arms has revealed the intricate synergy between mechanical design, control systems, artificial intelligence, and sensor technologies. The evolution from traditional industrial robots to collaborative and adaptive robotic systems reflects an ongoing commitment to enhancing human-machine interaction and expanding the boundaries of automation.

The impact of robotic arms on manufacturing processes has been profound, leading to increased production rates, improved product quality, and a reduction in manual labor. In the medical field, they have ushered in a new era of minimally invasive surgeries, offering unprecedented precision and control to healthcare professionals.Looking ahead, the trajectory of robotic arms points toward continued innovation. Emerging technologies, such as soft robotics and advanced haptic feedback, promise to further enhance the adaptability and capabilities of these systems. As the fourth industrial revolution unfolds, the integration of robotic arms into smart factories and interconnected systems exemplifies their role in the era of Industry 4.0.

REFERENCES

1. Mohamad Khairi Ishak1 , Muhammad Izzat Roslan1 and Khairol Anuar Ishak2 1School of Electrical and Electronic Engineering, University Sains Malaysia, Engineering Campus, 14300, Penang, Malaysia. 2School of Business Management, UUM College of Business, university Utara Malaysia, Sintok,06010, Kedah, Malaysia. khairiishak@usm.my

2. Aravind Raj D., Dinesh Kumar G International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-7 Issue-6, August 2018

3. 1B.Sundari, 2 Sivaguru.S 1Assistant Professor, Jayam College of Engineering & Technology, Anna University, Tamilnadu, India. 1E 1Assistant Professor, AVS College of Technology, Anna University, Tamilnadu, India. SSRG International Journal of Electronics and Communication Engineering (SSRG – IJECE) – Volume 5 Issue 8 – Aug 2018

4. Kobayashi, Y.; Gyoda, M.; Tabata, T.; Kuno, Y.; Yamazaki, K.; Shibuya, M.; Seki, Y. "Assisted-care robot dealing with multiple requests in multi-party settings". In Proceedings of the 6th International Conference on Human-Robot Interaction—HRI'11; ACM Press: Lausanne, Switzerland, 2011; p. 167.

5. Research by Cacace, J., et al. (Human–Robot Collaboration: A Survey) and Bicchi, A., & Sorrentino, F. (Robotics in the 21st Century: Challenges and Promises)