Multifunctional Robotic Arm with Movable Base

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❖ ABSTRACT

This report introduces a groundbreaking development in robotics. a multifunctional robotic arm mounted on a movable base, designed to overcome the limitations of traditional fixed-base robotic arms. Inspired by the International Federation of Robotics' definition of industrial robots, this innovative design integrates a series of linked segments with joints for rotational and linear movement, along with a versatile end effector incorporating gripping and drilling functionalities. The addition of a movable base enables the robotic arm to navigate its environment, significantly enhancing its reach and adaptability. The report explores the design specifics, functionalities, and advantages of this system, highlighting its potential to revolutionize automation in various sectors, from manufacturing to hazardous material handling.

❖ INTRODUCTION

Industrial robots have become a cornerstone of automation, their programmable arms mimicking human movement with remarkable precision.However, many traditional robotic arms are limited by a fixed base, restricting their reach and hindering their application in complex environments. This report introduces a revolutionary development – a multifunctional robotic arm mounted on a movable base.

This innovative design builds upon the core principles of a robotic arm, utilizing a series of linked segments connected by joints that allow for rotational and linear movement. The "end effector," analogous to the human hand, is where the magic happens. In this case, the end effector boasts a multi-functional design, incorporating both a gripping mechanism and a drilling function. The gripping mechanism allows the robot to grasp and manipulate objects of various shapes and sizes, while the drilling function empowers it to handle tasks requiring precise material manipulation.

This multifunctional robotic arm with a mobile base holds immense potential to revolutionize automation across various sectors. From streamlining complex manufacturing processes to tackling hazardousmaterial handling situations, the possibilities are endless. The concluding section of this report will explore these potential applications and delve into the exciting possibilities for future development of this versatile robotic system.

❖ LITERATURE REVIEW

1) A survey on Arduino Controlled Robotic Arm byAnkur Bhargava.

In this paper, a 5 Degree of Freedom (DOF) robotic arm has been developed. It is controlled by the Arduino Uno microcontroller which accepts input signals from a user a set of potentiometers. The Robotic Manipulator is made from four rotary joints and an end effector, where rotary motion is provided by a servomotor. Each link has been first designed using Solid works Sheet Metal Working Toolbox and then fabricated using a 2mm thick Aluminum sheet. The servomotors and links thus produced assemble

2) Review on development of industrialrobotic Manipulator by Rahul Gautam.

The research paper "Review on Development of Industrial Robots and Their Impact on Society" provides an overview of the development of industrial robots and their impact on society. The paper discusses the history of industrial robots, their types, and their applications in various industries. The authors describe the technical aspects of industrial robots, including their kinematics, control systems, sensors, and end-effectors. The paper also highlights the advantages and challenges associated with the use of industrial robots in manufacturing, such as increased productivity, cost- effectiveness, and safety concerns. Furthermore, the authors explore the impact of industrial robots on the workforce, including the potential for job displacement and the need for retraining and upskilling of workers. The paper concludes by suggesting possible solutions to address the challenges associated with the use of industrial robots and their impact on society. Overall, this paper provides a comprehensive review of the development of industrial robots and their impact on various aspects of society.

3) Internet Controlled Robotic Arm byWan Muhamad Hanif Wan Kadir.

In this research paper the information is given about a development of internet controlled robotic arm. The robotic arm can be controlled through a computer using the internet. The robotic arm can be used for daily house old usage. The Robotic Arm is controlled by using an Arduino uno that interfaced with using Arduino Ethernet Shield. The analysis that was done for this project was servo motor analysis and accuracy test.

Survey on Design and Development of competitive low-cost Robot Arm with Four Degrees of Freedom by Ashraf Elsassian.

The research paper "Industrial Robots: Their Role and Contribution to Future Manufacturing" discusses the role and contribution of industrial robots in the manufacturing industry. The paper provides a brief history of industrial robots, their development, and their current state. The authors describe the various types of industrial robots available, along with their functions and applications in different manufacturing processes. The paper also highlights the benefits of using industrial robots, such as increased productivity, improved product quality, and reduced production costs. Furthermore, the authors discuss the challenges associated with the use of industrial robots, such as safety concerns, limited flexibility, and high initial costs. The paper concludes by suggesting future directions for research and development in the field of industrial robotics, including the need for developing more intelligent and adaptable robots that can work alongside human workers. Overall, this paper provides a useful overview of the role and contribution of industrial robots in the manufacturing industry and highlights the potential for continued growth and development in this area.

❖ PROBLEMS IN CURRENT SCENARIO

Traditional robotic arms have played a vital role in automating industrial processes, but they face limitations that hinder their broader application.Let's explore some key challenges:

1) Limited Workspace: Fixed-base robots are confined to a specific work area defined by their reach. This restricts their ability to handle tasks across a larger workspace or navigate complex environments.

2) Lack of Versatility: Single-function robots can only perform a specific task, often requiring dedicated robots for different operations within a single process. This inflexibility leads to increased complexity and cost.

3) Safety Concerns: In situations involving hazardous materials or requiring close human-robot interaction, fixed-base robots pose safety risks due to their limited maneuverability.

4) Redeployment Challenges: Adapting a fixed-base robot to a new task or production line often requires significant reprogramming and potentially even physical modifications. This hinders their adaptability to changing production needs.

❖ SOLUTION

The proposed multifunctional robotic arm with a movable base addresses the limitations outlined above by offering several key advantages:

- Enhanced Reach and Mobility: The mobile base grants the robot the freedom to navigate its environment, significantly expanding its reach and operational area. This allows for tackling tasks across a larger workspace and adapting to dynamic environments.

- Multifunctionality: The gripping and drilling functionalities within a single end effector empower the robot to perform a wider range of tasks. This eliminates the need for multiple dedicated robots, streamlining methods and decreasing typical expenses.

- Improved Safety: The mobile base allows the robot to be positioned strategically, minimizing human exposure to hazardous materials or situations.

- Increased Adaptability: The multifunctional design and mobile platform make the robot adaptable to changing needs. With reprogramming, the robot can switch between tasks or be redeployed in different production lines with greater ease.

- By combining mobility with multifunctional capabilities, this design offers a future-proof solution for automation challenges. The ability to perform varied tasks, navigate its environment, and adapt to changing needs positions the multifunctional mobile robotic arm as a transformative force in various industries.

❖ METHODOLOGY

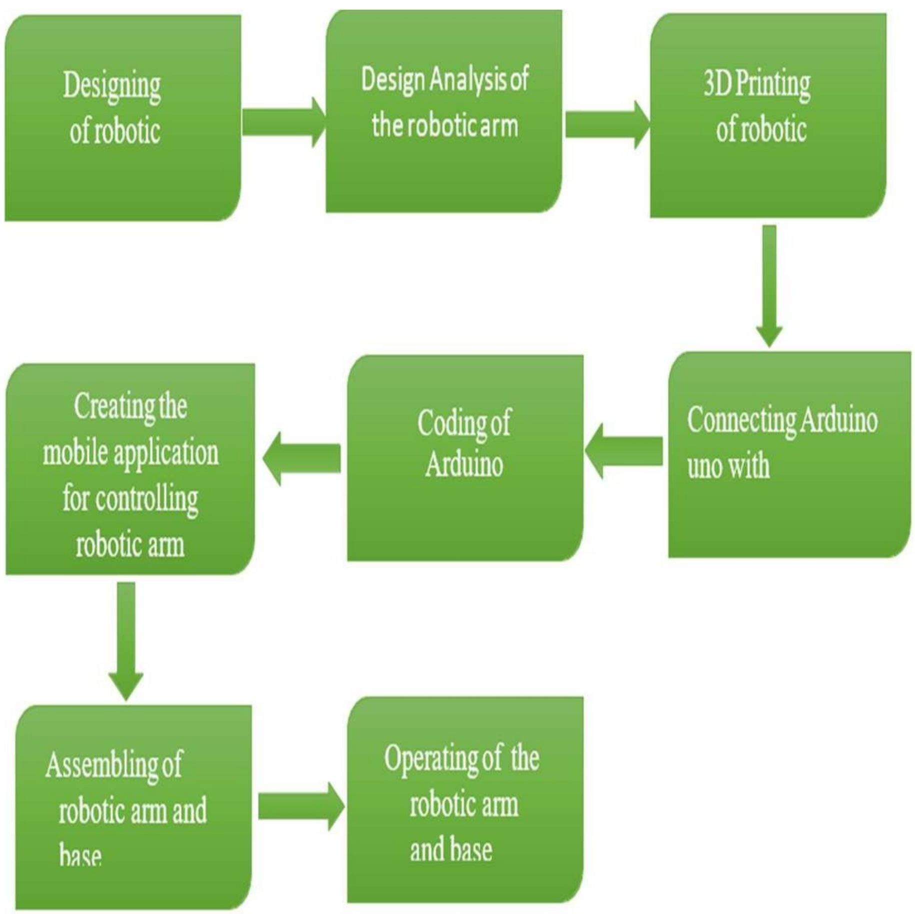


Fig 1. Block diagram of the Methodology ofrobotic arm and base

❖ WORKING

1) Start : You'll need to prepare the robotic arm and establish a connection between it and the mobile app.

2) Mobile Application : A user-friendly mobile app acts as your remote control. It provides a clear interface for you to input commands and data to control the arm'smovements.

3) Bluetooth Connection : A Bluetooth module acts as the bridge between the mobile app and the robotic arm. This module connects to the Arduino Uno, enabling wireless communication with the app.

4) User Input Deta : The mobile app allows you to enter specific instructions,such as the desired angles or speed for the arm's movements. This data is then sent to the Arduino Uno via the Bluetooth connection.

5) Data Validity : Before sending instructions to the arm, the app performs data validation checks. This ensures the commands are within safe and acceptable ranges to prevent malfunctions.

6) Moves Servo Motor : The Arduino Uno receives the validated data from the mobile app. It interprets this data and controls the servomotors accordingly, enabling the arm to perform the desiredmovements.

7) Gear Moter : In some cases, the system might utilize gear motors alongside servomotors. These gear motors receive power from a battery based on the commands issued through the app. The commands travel from the app to the controller, then to the Bluetooth module, and finally to the Arduino, which ultimately powers the gear motors according to the instructions.

8) End : Once you're done controlling the arm, you can end the session by closing the mobile app or turning off the Bluetooth connection.

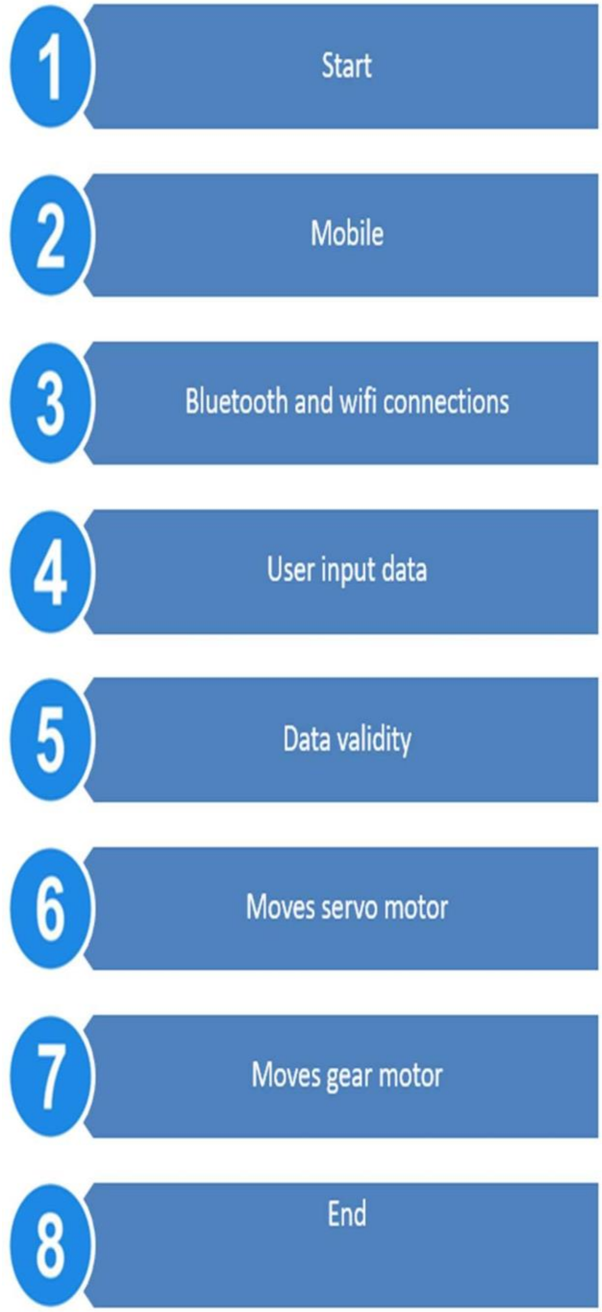
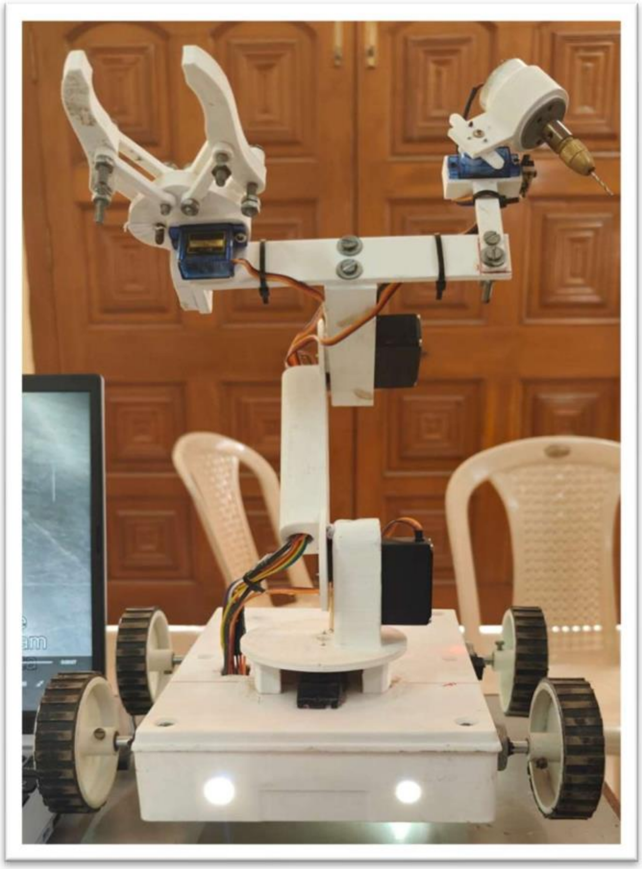
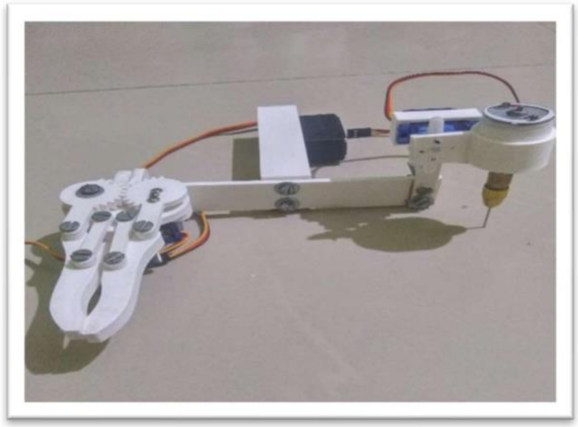


Fig 2. Working of robotic arm and bas

❖ ACTUAL PROJECT

Robotic arm in ideal condition:-





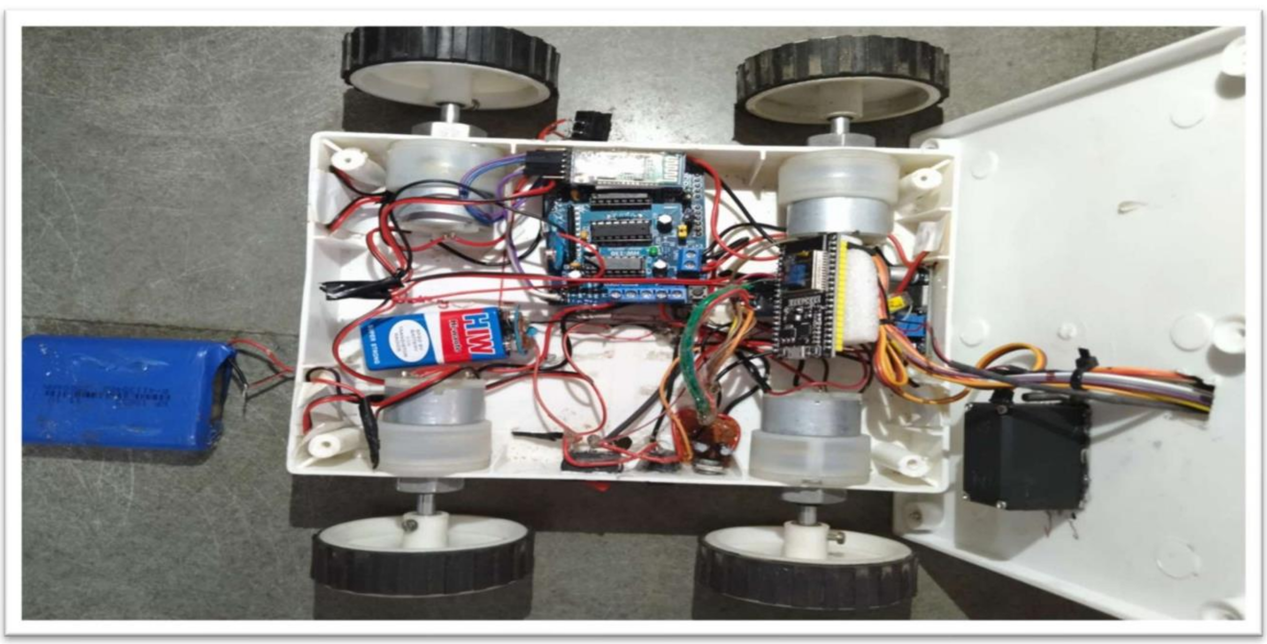


Fig 3. Circuit of robotic arm and base

❖ CONCLUSION

The report describes a functional prototype of a 4-DOF robotic arm built for light material handling tasks. It is constructed from PLA Filament and uses servo motors for movement. This designminimizes risk by automating the handling of potentially hazardous objects and improves efficiency by completing complex tasks faster and more precisely.

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