DESIGN AND FABRICATION OF ROBOTIC ARM VEHICLE CONTROLLED BY BLUETOOTH TECHNOLOGY

ABSTRACT

In this new era, robots are used in various areas such as welding, painting, assembly etc. Robotic arms are used in various areas such as military, defense, Medical Surgeries, pick and place function in industrial automation applications. This is due to the vast potential it holds in reducing human effort in performing tasks faster will still maintaining operational accuracy. By sending the robotic vehicle to hazards environment like chemical analysis, firework manufacturing industry, bomb diffusing etc. It can be accessed by android application and the application can control the movement of vehicle as well as its robotic arm.

This system consists of a mechanical based robotic arm comprise of a Bluetooth module which work as the receiver for vehicle by sending commands to the microcontroller. Which executes according to the signals received by Bluetooth technology. This steps require for developing and designing the arm's structure and mechanical components, such as joints, links, and end-effectors. Implementing control algorithms to achieve the desired motion.

In this project work, choosing the right type of electric motors to drive the arm's movement and integrating the sensors with other feedback devices, to improve the arm's accuracy. On successful completion on this project, Precise, Repeatable motions, Increased Efficiency, Increased Dexterity, Improved Interaction, Adaptability, Enhanced Safety and Integration with Other Systems.

INTRODUCTION

Robots are machines that are programmed to perform a specific task autonomously or under human control. They can be used in a variety of settings, from manufacturing and assembly lines to hospitals and households.

A robotic arm is a type of robot that is designed to manipulate objects with precision and accuracy. It typically consists of a series of joints that can be moved in different directions, as well as an end-effector, such as a gripper or tool, that can be used to grasp or manipulate objects.

The flow of a robotic arm depends on its programming and the task it is designed to perform. In general, a robotic arm will first receive instructions from a computer or controller that tells it what task to perform. The arm will then move its joints in a coordinated manner to reach the desired position and orientation. This may involve moving in multiple directions simultaneously to reach the target location.

Once the arm is in position, the end-effector will be used to grasp or manipulate the object. This may involve using a gripper to pick up a part from a conveyor belt, or using a tool to perform a specific task, such as drilling or welding.

After the task is complete, the arm will move back to its starting position or to another position to perform the next task. This may involve reversing the flow of movement and rotating the joints in the opposite direction.

Overall, the flow of a robotic arm is carefully programmed and controlled to ensure precise and accurate movement that can perform a wide variety of tasks.

LITERATURE REVIEW

- **ARDUINO CONTROLLER PICK AND PLACE ROBOTIC ARM VEHICLE**

Kumar Aditya,(2015) This project was a working prototype of the pick and place robotic arm vehicle. The main aim of this review paper is to present the idea of working and principals behind the robotic arm vehicle. This work unravels the fact that man would always want to adhere to safety precautions at workplace and even in its environment, to be able to handle some specific tasks, like sending the robotic vehicle to hazardous environment to obtain samples for chemical analysis.

- **DESIGN OF MOBILE ROBOT WITH ROBOTIC ARM UTILISINGMICRO CONTROLLER AND WIRELESS COMMUNICATION**

Alit Swamardika (2017) The purpose of this study is to design a prototype of a mobile robot equipped witha robotic arm which can be controlled by wireless technology. In this scheme, the mobile robot in the form of 6 Wheel Drive Robot equipped with roboticarm 6 Degree of Freedom and is controlled wirelessly through remote control based on XBee Pro Series 1. XBee pro operates on the IEEE802.15.4 physical radio and operates at 2.4 GHz unlicensed band. X Bee-PRO modules will be loaded by a current of 250 mAwhile ending data (TX) and 50 mA when receiving (Rx).

- **SMART PHONE CONTROLLED ROBOT**

Chaithra.K (2020) In this prototype they proposed design which can pick and place objects safely from one place to another. A robotic arm is designed using Arduino to perform pick and place the objects via Bluetooth commands. The robot gripper is cable of holding the objects in its jaw and safely place from one place to another. The movement of robot is controlled by android based smart phone. The robot receives commands from the application. All the actions or the tasks are controlled by Arduino micro controller with a pair of motor drivers.

PROBLEM IDENTIFICATION

Combining a pick and place robotic arm with a Bluetooth-controlled vehicle can present several challenges, including:

- Coordination and control between the robotic arm and the vehicle
- Navigation and obstacle avoidance
- Payload capacity

- Battery life

OBJECTIVES

The objective for the design and fabrication of a robotic arm vehicle controlled by a Bluetooth module with pick and place function is to create a functional and efficient robot capable of performing complex tasks. Specifically, the objectives include:

- Design a robotic arm vehicle that is capable of being controlled wirelessly via a Bluetooth module.
- Fabricate the robotic arm vehicle using durable and lightweight materials, ensuring that it is capable of withstanding heavy use.
- Develop a user-friendly interface for controlling the robotic arm vehicle, which will make it easy for the user to operate.

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METHODOLOGY

In today's world, there is multiple robotic arm machine which was working in multiple industries on daily bases some of them are used for automobile manufacturing, nuclear industries, army purposes, etc. But there are so the problem comes to operate the robotic arm moving them from one position to another way bare a big loss to the industry.

This prototype is developed for the multipurpose industrial uses and movable robotic arm that can move from one position to another via the android application and it's very reliable and flexible to operate this prototype.

The command whichever is given that is received by the Hc-05 serial pin RX and provide to the micro controller placed in Arduino Uno the program execute and run the respective command and the prototype work as a response.

There are several existing methods for the design and fabrication of robotic arm vehicles controlled by Bluetooth modules with pick and place functions.

Components

- **Arduino Uno**:

It is a microcontroller board based on the ATmega328P, with 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, and a power jack.

- **NodeMCU:**

  It is an open-source development board based on the ESP8266 Wi-Fi chip, with GPIO pins, Wi-Fi connectivity, a USB interface, and Lua scripting capabilities.

- **PLA (Polylactic Acid)**:

  It is a biodegradable thermoplastic filament used for 3D printing, made from renewable resources such as corn starch and sugarcane.

- **Gear motors**:

  These are motors that have a gearbox attached to the output shaft, allowing for increased torque and reduced speed.

- **Acrylic sheet**:

  It is a lightweight, shatter-resistant plastic material often used in DIY projects, with high optical clarity and a variety of color options.

- **HC-05 module**:

  It is a Bluetooth module that enables wireless communication between devices, with a range of up to 10 meters and support for multiple connection modes.

- **L293D motor driver**:

  It is an integrated circuit that allows for the control of DC motors, with features such as direction and speed control, and protection against overcurrent and over temperature.

DESIGN AND FABRICATION

Used Solid Works software to design the mechanical components of the robotic arm, including the base, shoulder, elbow, wrist, and gripper. The design should meet the requirements for payload capacity, range of motion, and precision. Aluminum or acrylic sheets can be used to create the structural components of the arm, gears, and linkages can be used for the joints and movement mechanisms. Use PLA material for fabricating the robotic arm from the designed CAD files. Assemble the components using bolts, nuts, and screws, and use gears to create the joints and movement mechanisms. Fabricate the electronic components, such as the motor driver board and the Bluetooth communication circuit, using soldering and wiring techniques.

Write the code for the micro-controller to control the motors and Bluetooth communication. Use the Arduino IDE and Node MCU to write code inC or a similar programming language. Test the code using a breadboard and jumper wires before final assembly. Assemble the mechanical and electronic components of the robotic arm, including the motors, gears, and Bluetooth module. Use the motor driver board and voltage regulator to power the motors, and connect the Bluetooth module to the microcontroller using jumper wires. Test the robotic arm to ensure it meets the requirements for payload capacity, range of motion, and precision. Test the Bluetooth communication to ensure wireless control is working correctly.

Overall, the design and fabrication of a robotic arm vehicle controlled by a Bluetooth module with pick and place function requires expertise in mechanical design, electronic design, programming, and fabrication. The above steps outline a general process for creating such a system, but there may be variations based on specific requirements and available resources.

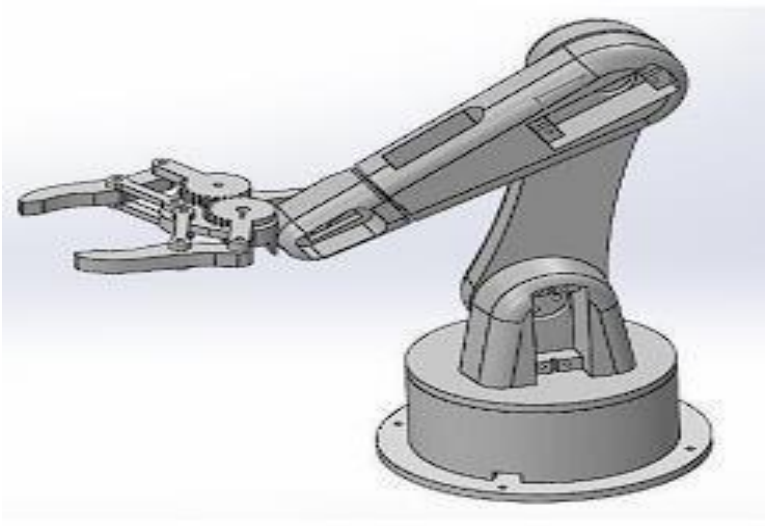

Fig 1: Assembled Robotic Arm Design `

9. Block diagram

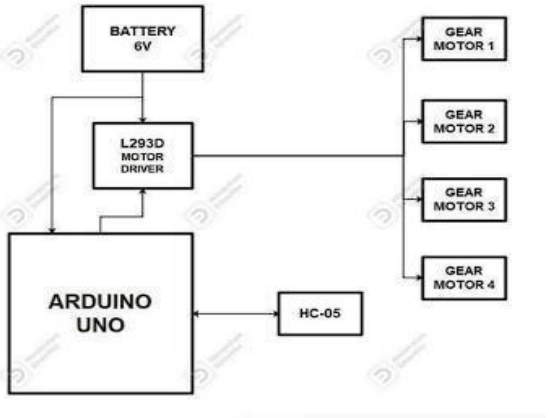

Fig 2 block diagram of robotic vehicle

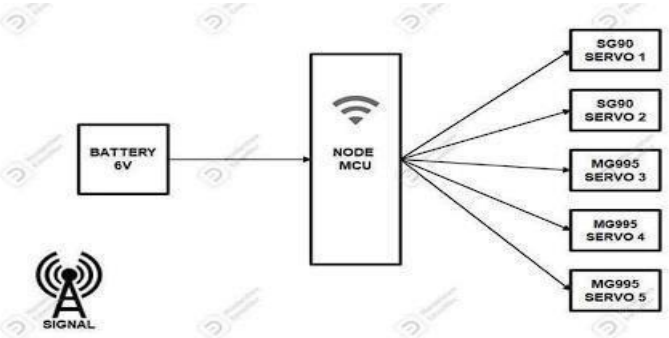

Fig 3 block diagram of robotic arm

CONCLUSION

Upon completion of the robotic arm vehicle with five degrees of freedom. Robotic arm is made up of using PLA material which is biodegradable thermoplastic polymer that is known for its high strength, stiffness, and heat resistance. It is also safe, non-toxic, and environmentally friendly.The use of wireless technology for controlling the system provides ease of use and flexibility for the user, allowing the system to be operated from a distance. The successful implementation in multiple disciplines, including mechanical engineering, robotics, control systems, and software development.The pick and place robot with a movable vehicle controlled by both Wi-Fi and Bluetooth technology has many potential applications in various industries, including manufacturing, logistics, and agriculture.

The system can be used to automate repetitive and labor- intensive tasks, improving productivity and efficiency.Overall, the successful implementation of a pick and place robotic arm along witha movable vehicle requires a multidisciplinary approach, including mechanical, electrical, and software engineering, to design and build a robust and reliable system that meets the specific needs of the application.

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