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Wireless Material Handling Pick and Place Robotic Arm Implementation Using Arduino

Mr. P. Pradeep Kumar[1], P.Amrunda[2], U.Jaya Prakash Narayana[3], P. Sreekanth [4], P.Padmaja[5]
Assistant Professor[1], UG Student[2, 3, 4, 5], Department of Electronics & Communication Engineering,
Sai Rajeswari Institute of Technology, Proddatur, Andhra Pradesh,516360.
palajipradeep83@gmail.com[1],pallaammu2226@gmail.com[2],jayaprakashnarayana10@gmail.com[3],
chandusreekanth004@gmail.com[4], padmajareddy465@gmail.com[5]

ABSTRACT

The design analysis of an Android Controlled "Pick and Place" Robotic vehicle has been presented in this paper. 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. It is a micro controller based control system which works in alliance with Android Application. It can be accessed by android application and the application can control the movement of vehicle as well as its robotic arms. This system comprises of a Bluetooth module which work as the receiver for vehicle. This sends commands to the micro controller which execute according to the signals received by Bluetooth. In this work, the design of a robot is presented which will move around in four directions and is equipped with gripper for pick and place operation. These operations will be controlled by a user friendly interface present on operator's mobile phone. Depending upon the button clicked on the application, proper motional commands are given to robot by micro controller. This project is in aimed to design and develop a mobile robot which can move according to the button pressed on App.

This prototype can be employed in chemical industry for handling of chemical materials of hazardous nature, or for movement of heavy objects in any industry

KEYWORDS

Pick and place robotic arm,Bluetooth control android app,soft catching gripper.

I. INTRODUCTION

Automation and robotics have revolutionized industries by increasing efficiency, precision, and reducing human effort. One such innovation is the Pick and Place Robot, a robotic arm designed to lift objects from one position and place them in another with high accuracy.

This paper focuses on designing and implementing a Pick and Place Robot controlled via Bluetooth using the HC-05 module.The robot can be wirelessly operated through a smart phone or any Bluetooth-enabled device, making it an efficient and cost-effective solution for various industrial and domestic applications.

The Pick and Place Robot consists of a robotic arm with servo motors to control movement.

The HC-05 Bluetooth module enables wireless communication between the robot and a mobile application or micro-controller-based interface. A micro controller (such as Arduino) processes the received commands and actuates the motors accordingly.

II. PROBLEM STATEMENT

In modern industrial automation, material handling is a crucial process that impacts efficiency, accuracy, and safety. Traditional manual handling of objects can be time-consuming, labor-intensive, and prone to human errors. Automated robotic arms provide a solution to these challenges by enhancing precision, speed, and flexibility in handling materials**.**

This project aims to design and implement a wireless pick and place robotic arm controlled using Arduino and a remote control interface. The robotic arm will be capable of lifting, moving, and placing objects with precision in predefined locations. The system will be wirelessly controlled using Bluetooth, RF, or Wi-Fi

communication, eliminating the need for wired connections and enhancing mobility.

III. METHODOLOGY

Present project is the implementation of the wireless material handling pick-and-place robotic arm involves a systematic approach to design, development, and testing. Initially, the mechanical structure of the robotic arm will be designed using lightweight materials and servo motors to ensure precise movement and payload capacity. The Arduino micro controller will serve as the central control unit, interfaced with an HC-05 Bluetooth module for wireless communication. A custom control application will be developed for a smart-phone or PC to transmit commands wireless to the robotic arm.

The methodology includes programming the Arduino to interpret received signals and control the servo motors for accurate pick-and-place operations. Sensors, such as ultrasonic or infrared, will be integrated to detect object positions and ensure safe handling. The system will undergo iterative testing to optimize performance, including range, accuracy, and response time. Power supply design will prioritize efficiency and portability, using a rechargeable battery pack. Finally, the robotic arm will be evaluated in real-world material handling scenarios to validate its functionality and reliability.

IV. BLOCK DIAGRAM

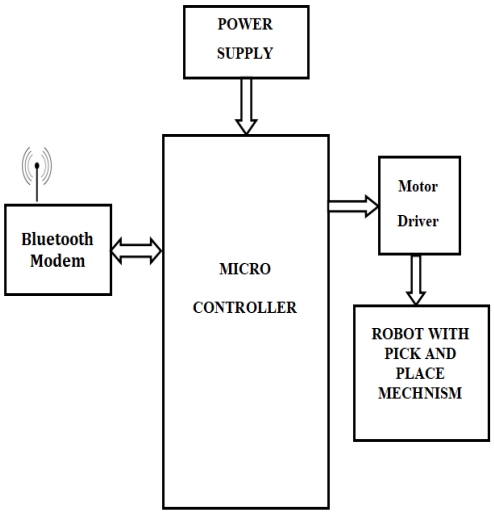


Fig: BLOCK DIAGRAM

V. COMPONENTS USED

1. ARDUINO UNO

The Arduino UNO is a widely used open-source micro controller board based on the Microchip ATmega328P micro controller and developed by Arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

The board features 14 Digital pins and 6 Analog pins. It is programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

Fig: ARDUINO UNO

2.BLUETOOTH

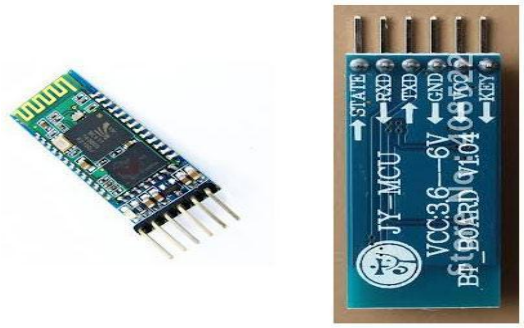


Fig: BLUETOOTH DEVICE

Bluetooth is an open wireless technology standard for exchanging data over short distances (using short wavelength radio transmissions) from fixed and mobile devices, creating personal area networks (PANs) with high levels of security. Created by telecoms vendor Ericsson in 1994 it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization.

3. DC MOTTOR

Fig:: DC MOTOR

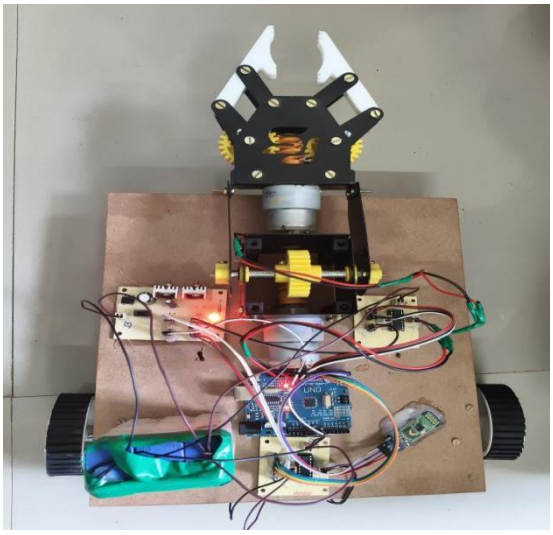
A dc motor uses electrical energy to produce mechanical energy, very generally through the interaction of magnetic fields and current-containing conductors. The reverse process, producing electrical energy from mechanical energy, is carried out by an alternator, source or dynamo. Many types of electric motors can be run as sources, and vice verse. The input of a DC motor is current/voltage and its output is torque (speed).

4. MOTOR DRIVE IC

Fig: MOTOR DEVICE IC

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to allow for bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is planned to provide bidirectional drive currents of up to 600-mA at voltages of 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar maltreating motors, as well as other high-current/high up-voltage loads in positive-supply applications.

RESULT



CONCLUSION

Although this research is still in an early stage of development, it has already proven to succeed in several of its goals. The operating system of smart phone is android which can develop effective remote control program. At the same time, this program uses blue-tooth connection to communicate with robot. It has proven to allow for meaningful two-way communication between the Android phone and the robot which would allow a non-expert to interact with and adjust the functionality of a system.

ATmega328 controller, a single board micro-controller intended to make the application of interactive objects or environments more accessible.

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