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SURVEY ON BLUETOOTH CONTROLLED PICK AND PLACE ROBOTS

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Abstract: Pick and place robots are revolutionizing industrial operations by automating repetitive tasks with precision and speed. These robots, equipped with advanced sensors and control systems, adeptly handle diverse objects, optimizing manufacturing processes in industries such as automotive, electronics, and logistics. Their ability to swiftly and accurately position components enhances productivity while ensuring consistent quality. Beyond efficiency gains, these robots contribute to workplace safety by mitigating human exposure to hazardous tasks. Integrating seamlessly into Industry 4.0 frameworks, they leverage connectivity and data-driven insights for adaptive production and predictive maintenance. Pick and place robots stand as pivotal tools in reshaping manufacturing landscapes, offering unparalleled efficiency, precision, and safety in industrial applications.

Index Terms **- Bluetooth controlled, Pick and place robots, Precision, Workplace safety, Adaptability.**

I. INTRODUCTION

In the dynamic landscape of industrial automation, pick and place robots have emerged as game-changers, redefining traditional manufacturing methodologies. These robots, characterized by their precision, agility, and adaptability, have revolutionized production processes across diverse industries. By seamlessly maneuvering through assembly lines, they efficiently handle tasks involving object recognition, grasping, and placement with unparalleled accuracy. From automotive to electronics, pharmaceuticals to logistics, the integration of pick and place robots has unleashed a wave of operational enhancements. Their seamless integration into existing workflows has not only elevated productivity but also upheld stringent quality standards. By minimizing errors and optimizing processes, these robots have become indispensable contributors to resource conservation and cost-effective manufacturing.

II. LITERATURE SURVEY

[1]. This paper discusses the design and implementation of a pick and place robot prototype. The aim is to develop a robot that can assist disabled people to perform tasks. The prototype consists of an XLR8 development board based on FPGA, a Bluetooth module, DC motors, motor drivers and a battery source. An Android app called "Arduino Bluetooth controller" is used to send commands to the robot over Bluetooth to control its movements and arm actions. The robot can move forward, backward, left, right and the arm can pick and place objects. The XLR8 board receives commands from the Bluetooth module and provides inputs to the motor drivers to control the DC motors. The robot uses logic tables to decide which motor movements to perform based on the received command. The prototype is able to pick up and place cylindrical objects as a proof of concept. The paper discusses some advantages of the prototype like speed, performance and

scalability. Some limitations and potential applications like an industrial robot or bomb defuse robot are also mentioned.

[2]. This text discusses various aspects of designing and developing pick and place robotic arms. A pick and place robotic arm can automate repetitive tasks, reduce labor costs, and achieve quality control. The basic requirements are high speed, reliability, and a simple and cheap gripper design. The basic operations include gripping, lifting, moving, placing, and releasing. Forward and inverse kinematics are used to determine the arm's position and orientation.
Pneumatic cylinders and direction control valves are commonly used to power and control the arm's movements. Grippers are used to pick up and release objects. Modern lightweight materials like cellular titanium and nano crystalline aluminium can be used to build advanced lightweight robotic arms. Energy consumption and trajectory optimization methods can be implemented to reduce the robotic arm's energy usage. Wireless and flexible robotic arms have also been developed. the text discusses various aspects related to designing pneumatic and lightweight robotic arms for pick and place operations. The focus is on components, control methods, materials, and techniques to optimize performance and reduce energy consumption.

[3]. This paper discusses the design and development of a robotic arm for pick and place applications using a NodeMCU controller. The objective was to build a compact, affordable and usable robotic arm for educational purposes. The robotic arm has four degrees of freedom and consists of a base, three links, and a gripper. The base supports the entire assembly and is made of aluminum. It is rotated by a motor. Links 1 and 2 transmit force to the next link and gripper. They are also made of aluminum and connected using screws. DC servo motors control the movement of the links. The gripper is designed to pick up objects up to 200 grams using a 1.8Kg/cm capacity servo motor. The NodeMCU is used as the control system to control all the activities of the robotic arm. It receives input signals from an Android application and responds accordingly by turning ON or OFF servo motors. The paper discusses the design of each component in detail along with their specifications. The robotic arm combines electrical and electronic engineering knowledge and can be reprogrammed for different applications.

[4]. The paper proposes a method to separate degradable and non-degradable waste using a pick and place robot. A simple image processing technique is used for object detection using an Android mobile. An Android app is developed to detect degradable objects (vegetables) and non-degradable objects (plastic covers) using image processing. When an object is detected, the app sends a signal (0 or 1) to the microcontroller via Bluetooth. The microcontroller controls the robotic arm to pick up degradable objects and place them in one box and non-degradable objects in another box, based on the signal received. Infrared sensors are installed on the robot to detect the presence of objects. Various technologies and algorithms are used for the machine vision system, from image capture to final robot decisions. The system aims to reduce human intervention in waste separation, reducing exposure to diseases. In summary, the proposed system uses a simple robotic arm, an Android app for image processing, and a microcontroller to separate degradable and non-degradable waste automatically.

[5] The paper discusses the design and implementation of a pick and place robotic arm using gesture and voice recognition. The proposed robotic arm consists of accelerometer sensors to capture the operator's hand gestures and movements. The robotic arm and gripper movements are controlled wirelessly based on the accelerometer readings. The robotic arm can perform tasks like picking up objects, dropping objects, and rotating the gripper. Voice commands are also used to control the robotic arm. The text mentions various gesture recognition techniques like vision-based, accelerometer-based, and finger gesture recognition. It also discusses different existing robotic arm designs and control methods. Overall, the key points are the design of a robotic arm that can pick and place objects based on the operator's hand gestures and voice commands. The accelerometer sensors play an important role in capturing the gestures and movements to control the robotic arm.

[6]. This paper proposes an extended look-ahead approach for combined lateral and longitudinal control of vehicle platooning. The conventional look-ahead approach suffers from cutting-corner behavior where follower vehicles turn earlier than the leading vehicle during cornering maneuvers. The proposed extended look-ahead approach compensates for this by extending the look-ahead point perpendicular to the heading direction of the preceding vehicle, creating a virtual vehicle as the tracking objective for the follower. A

nonlinear controller is designed based on cooperative adaptive cruise control. Simulations and experiments on a unicycle robot platform show that the extended look-ahead approach successfully compensates for the cutting-corner behavior while maintaining a safe inter-vehicle distance. The key contributions are the design of the extended look-ahead approach and the stability analysis of the closed-loop system. The results demonstrate the effectiveness of the approach in simulations and experiments. The approach can improve the cornering performance of vehicle platooning systems.

[7]. This paper discusses the design and implementation of a pick and place robotic arm using Arduino. The proposed robot uses an Arduino Uno board as the controller interfaced with an L239D motor driver shield to drive the DC motors. 60 RPM DC motors along with wheels are used for the robot's movement. An HC-05 Bluetooth module is used to control the robot wirelessly using an MIT Android application. A robotic gripper is used to pick and place objects. The Arduino IDE is used to program the Arduino board while the MIT App Inventor is used to develop the Android application. The hardware setup consists of the Arduino, motor shield, motors, wheels, Bluetooth module and robotic gripper. The robot can pick and place small objects and can be useful for disabled people. It provides a cost-effective and user-friendly solution.

[8]. This paper proposes the design of an automated robotic arm using machine learning for object detection and pick and place operations. The robotic arm is built using a Raspberry Pi controller, servo motors, end effector, camera module and other components. Machine learning algorithms like TensorFlow and OpenCV are used for object detection and localization. The working involves the camera capturing the object to be picked, detecting the object using machine learning models, calculating the distance and angle of the arm with respect to the object, and then converting the angles into duty cycles to control the servo motors for proper grasping and placing of the object. The system demonstrates real-time object detection and pick and place operations and aims to reduce human intervention in industrial automation applications. The usage of machine learning enables the robotic arm to perform tasks efficiently and improves the manufacturing lead time.

[9]. This text discusses various aspects of robotic arm design and development. Several research papers on robotic manipulators are reviewed to gain knowledge that will help in designing a robotic arm. Robotic arms are used in industries to minimize human errors, increase efficiency and precision. They can work in conditions that are risky for humans. Different types of robotic arms are mentioned like Cartesian, cylindrical, and spherical. The key elements of a robotic arm are discussed like links, joints, end effector, kinematic chain, actuators, and controllers. Artificial intelligence and machine learning can provide smartness to robotic arms. Several research papers on designing different types of robotic arms are summarized. The papers focus on topics like modelling and simulation using soft computing techniques, developing low-cost reconfigurable arms, wireless robotic arms using sensors, path planning and control algorithms, object recognition and grasping, and using computer vision for motion control. Challenges like object occlusion and joint friction are also highlighted. In summary, the review covers various design aspects of robotic arms like degrees of freedom, link design, actuator selection, kinematic analysis, object detection, and motion control. The knowledge gained from this review can help in designing efficient and intelligent robotic arms for industrial applications.

[10]. This paper aims to develop a wireless robotic arm that can pick and place objects using Bluetooth technology. The robotic arm can be controlled using an Android app through Bluetooth communication. The main components used are: A power supply to provide power to the circuit, DC motors to actuate the robotic arm and wheels for movement. Bluetooth module to enable wireless communication between the Android app and the microcontroller, An Arduino microcontroller to receive commands from the Android app and control the DC motors accordingly. The system works by sending commands from the Android app to the Arduino microcontroller via Bluetooth. The microcontroller then controls the motor driver circuits which power the motors. This allows the arm and gripper to move and pick up objects wirelessly. The researchers were able to develop a working prototype robotic arm vehicle that can pick up and place components. However, it cannot currently lift heavy objects. Further improvements like adding a high torque motor and wireless camera could enable more uses like removing bombs from dangerous areas.
In summary, the study demonstrates the potential of using Bluetooth technology to enable wireless control of a robotic arm for pick and place applications. The prototype developed serves as a proof-of-concept that could be further improved to handle heavier loads and perform more complex tasks.

[1]. This paper introduces an inventive approach to industrial automation through a Bluetooth-controlled pick and place robot employing a color sensor for object identification and sorting. The system's distinctive elements lie in its utilization of Bluetooth connectivity for remote control, enabling flexibility in operation, and the innovative use of a color sensor to categorize objects based on their colors, streamlining sorting processes. Additionally, the system's focus on efficiency enhancement, error reduction, and improved accuracy stands out, illustrating its potential to minimize human error in comparison to manual pick and place tasks. The robot's ability to handle hazardous tasks in factories, ensuring workplace safety, and its utilization of a soft gripper for safe object handling showcase its commitment to safety and innovative component selection. Moreover, emphasizing the system's potential for industrial automation in handling repetitive tasks across industries underscores its scalability and practicality. This integration of technology, safety considerations, and real-world applicability positions your project as a comprehensive solution in the realm of automated systems for manufacturing and logistics

III. CONCLUSION

In conclusion, our aim is to create an accessible and economical pick and place robot, leveraging the Arduino Uno as the central control unit. By integrating a Bluetooth module, the robot becomes user-friendly, enabling control via the MIT Android application. This amalgamation of affordable hardware and intuitive mobile-based control signifies a cost-effective and user-centric solution poised to democratize the accessibility of pick and place robotics, fostering ease of operation and wider adoption across various applications and user scenarios. Hence, we have successfully reviewed several research papers published by different authors for the better understanding of the development of the Robotic Arm.

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