International Journal of Multidisciplinary Engineering in Current Research - IJMEC
Volume 9, Issue 5, May-2024, http://ijmec.com/, ISSN: 2456-4265

AN ADVANCED ROBOT FOR MILITARY APPLICATIONS

Ms. Sahaar Arshad [*1], Mr. Abdullah Maaz [*2], Mr. Abdul Hannan Azib [*3],
Mr. H. A. Abdul Samad[*4],
[*1, 2, 3] B. Tech. Student Dept. of ECE, Shadan College of Engineering and Technology
[*4] Associate Professor, Dept. of ECE, Shadan College of Engineering and Technology
sahaararshad281@gmail.com[*1], maazna123@gmail.com [*2], rk2206244@gmail.com *[3],
abdus.samad569@gmail.com [*4],

Abstract: The main aim of the project is to design and develop a robot for military applications which is capable of Picking and placing an object that can be bomb or defuse it. Robot exactly, is a system that contains sensors, control systems, manipulators, power supplies and software all working together to perform a task. Designing, building, programming and testing a robot is a combination of physics, mechanical engineering, electrical engineering, structural engineering, mathematics and computing. The pick and place robot is a microcontroller based mechatronic system that detects the object, picks that object from source location and places at desired location.

INTRODUCTION

The project is designed to develop a pick n place robotic vehicle with a soft catching gripper. The project is aimed to design and develop a pick and place robotic vehicle with a catching gripper. The project will include development of an android app and mobile robot which will be able to move objects from one place to another. Thus, controlling the vehicle remotely. Remote operation is achieved by any smart-phone/Tablet etc., with Android OS; upon a GUI (Graphical User Interface) based touch screen operation. This prototype will pave path for real life models using the same concept. [1] The vehicle will be controlled by the android application device at the transmitting end, which will send signal i.e. ASCII code, to Bluetooth module (HC-05) which is employed as an interface between Mobile and vehicle (robot). The microcontroller is coded using AVR Studio for controlling of the motors, both to move the robotic vehicle and to control the gripping of the objects through the arm. At the transmitting end using android application device, commands are sent to the receiver to control the movement of the robot either to move forward, backward and left or right etc. At the receiving end four motors are interfaced to the microcontroller where two for them are used for arm and gripper movement of the robot while the other two are for the body movement. The android application device transmitter acts as a remote control that has the advantage of adequate range, while the receiver end Bluetooth device is fed to the microcontroller to drive DC motors via motor driver IC for necessary work. Remote operation is achieved by any smart-phone/Tablet etc., with Android OS; upon a GUI (Graphical User Interface) based touch screen operation. The main advantage of this robot is its soft catching arm that is designed to avoid extra pressure on the suspected object for safety reasons.

LITERATURE SURVEY

Robots have their historical past though they came into existences only in 1961 when Unimation Inc, USA introduced the first servo- controlled industrial robots. Early development dating back to 500B.C shows that the

DOI: https://doi-ds.org/doilink/05.2024-87269361

Egyptians, Indians, the Chinese, and the Romans built many automatics puppets which imitate the movement of animals and birds. The Chinese built many amusing devices that depicted sequential motions. Also, the early men discovered many mechanisms and exhibited their innovation skill in building ships and introduced looms to weave. This ushered in the industrial revolution. In the 1940s, remote teleported master- slave manipulators were developed. Later, force feedback and kinesthetic sensory elements were added to them to facilitate better control. Tele-operated devices were used in mars exploration in 1976. In 1948, the transition was invented at Bell laboratories U.S.A. In 1952, IBM‟s first commercial computer IBM 701 was introduced. Then came numerically controlled tools in which various slides of machines were displaced by numerical commands through suitable hardware. The development of NC (numerically controlled) machine tools has, therefore, been a turning point in the development of robotics. The planet corporation in 1959 introduced a pick and place robot. In 1961, the first industrial robot was commercialized by Unimation Inc. Microprocessor technology was brought by INTEL in 1961. The real robot development process continued between 1968 and 1982 when various models of robots were developed by leading robot scientists in different universities, national laboratories and different industrial houses in the USA, Japan, France, UK, and other European countries. Some of the robot models of historical interest are the Versatran by AMF, developed in (1963) and Cincinnati Milacron introduced in (1974), Irb-6 by ASLA in (1978). The Kawasaki and Hitachi groups in Japan have also contributed a lot in developing various sensors to make robots „think‟ intelligently. Various robot institutions propagate the ideas and ideologies of robotics to the profession. Some of the pioneering institutions are the Japan industrial Robot Association (JIRA, 1971), Robot Institute of America (RIA, 1975), British Robot Association (BRA, 1977) and Robotics Interaction / SME, to mention a few .

SYSTEM ANALYSIS

AIM:

The main aim of the project is to design and develop a robot for military applications which is capable of Picking and placing an object that can be bomb or defuse it.

Problem Statement

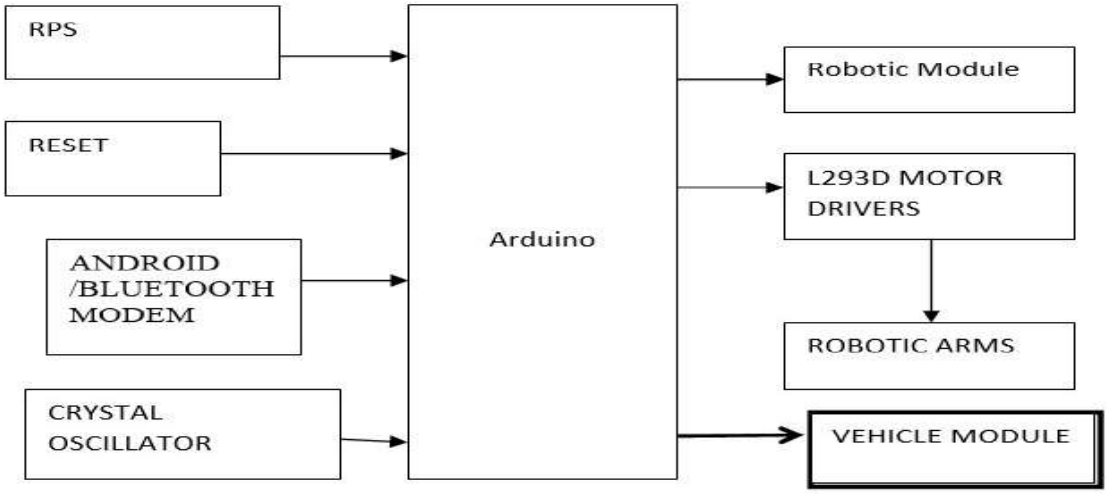
Previously robotic arm movement was controlled by wired applications which is having small range as per the length of their wires.

Proposed Methodology

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 microcontroller. 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

DOI: https://doi-ds.org/doilink/05.2024-87269361

BLOCK DAIGRAM



Monitoring section:

Mobile Application

Hardware Specifications :

- Power Supply
- Arduino UNo
- Bluetooth Module
- Robotic Arm and Gripper
- Robotic Module

Software Specifications :

- Arduino Compiler
- Programming Language: C

DESCRIPTION OF COMPONENTS

Microcontrollers

Microprocessors and microcontrollers are widely used in embedded systems products. Microcontroller is a programmable device. A microcontroller has a CPU in addition to a fixed amount of RAM, ROM, I/O ports and a

DOI: https://doi-ds.org/doilink/05.2024-87269361

timer embedded all on a single chip. The fixed amount of on-chip ROM, RAM and number of I/O ports in microcontrollers makes them ideal for many applications in which cost and space are critical.

ARDUINO

Overview:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. The Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

The board has the following new features:

1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin, that is reserved for future purposes.

- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

Android

Android is an operating system based on the Linux kernel, and designed primarily for touch screen mobile devices such as smart phones and tablet computers. Initially developed by Android, Inc., which Google backed financially and later bought in 2005, Android was unveiled in 2007 along with the founding of the Open Handset Alliance—a consortium of hardware, software, and telecommunication companies devoted to advancing open standards for mobile devices. The first publicly available smart phone running Android, the HTC Dream, was released on October 22, 2008.

The user interface of Android is based on direct manipulation, using touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching and reverse pinching to manipulate on-screen objects. Internal hardware such as accelerometers, gyroscopes and proximity sensors are used by some applications to respond to additional user actions, for example adjusting the screen from portrait to landscape depending on how the device is oriented. Android allows users to customize their home screens with shortcuts to applications and widgets, which

DOI: https://doi-ds.org/doilink/05.2024-87269361

allow users to display live content, such as emails and weather information, directly on the home screen. Applications can further send notifications to the user to inform them of relevant information, such as new emails and text messages.

Android's source code is released by Google under the Apache License; this permissive licensing allows the software to be freely modified and distributed by device manufacturers, wireless carriers and enthusiast developers. Most Android devices ship with a combination of open source and proprietary software. As of July 2013, Android has the largest number of applications ("apps"), available for download in Google Play store which has had over 1 million apps published, and over 50 billion downloads. A developer survey conducted in April–May 2013 found that Android is the most used platform among developers: it is used by 71% of the mobile developers population.

HC-03/05 Embedded Bluetooth Serial Communication Module AT command set

Description: HC-05 is a class-2 **bluetooth module** with Serial Port Profile, which can configure as either Master or slave. a Drop-in replacement for wired serial connections, transparent usage. You can use it simply for a serial port replacement to establish connection between MCU, PC to your embedded project and etc.

HC-05 Specification:

- Bluetooth protocal: Bluetooth Specification v2.0+EDR
- Frequency: 2.4GHz ISM band
- Modulation: GFSK(Gaussian Frequency Shift Keying)
- Emission power: ≤4dBm, Class 2
- Sensitivity: ≤-84dBm at 0.1% BER
- Speed: Asynchronous: 2.1Mbps(Max) / 160 kbps, Synchronous: 1Mbps/1Mbps
- Security: Authentication and encryption
- Profiles: Bluetooth serial port
- Power supply: +3.3VDC 50mA
- Working temperature: -20 ~ +75Centigrade
- Dimension: 26.9mm x 13mm x 2.2 mm

DOI: https://doi-ds.org/doilink/05.2024-87269361

HC-05 embedded Bluetooth serial communication module (can be short for module) has two work modes: order-response work mode and automatic connection work mode. And there are three work roles (Master, Slave and Loopback) at the automatic connection work mode. When the module is at the automatic connection work mode, it will follow the default way set lastly to transmit the data automatically. When the module is at the order-response work mode, user can send the AT command to the module to set the control parameters and sent control order. The work mode of module can be switched by controlling the module PIN (PIO11) input level. Serial module PINs:

1. PIO8 connects with LED. When the module is power on, LED will flicker. And the flicker style will indicate which work mode is in using since different mode has different flicker time interval.

2. PIO9 connects with LED. It indicates whether the connection is built or not. When the Bluetooth serial is paired, the LED will be turned on. It means the connection is built successfully.

3. PIO11 is the work mode switch. When this PIN port is input high level, the work mode will become order-response work mode. While this PIN port is input low level or suspended in air, the work mode will become automatic connection work mode.

4. The module can be reset if it is re-powered since there is a reset circuit at the module.

L293D

- 600mA OUTPUT CURRENT CAPABILITY PER CHANNEL
- 1.2A PEAK OUTPUT CURRENT (non repetitive) PER CHANNEL
- ENABLE FACILITY
- OVERTEMPERATURE PROTECTION
- LOGICAL "0" INPUT VOLTAGE UP TO 1.5 V
- (HIGH NOISE IMMUNITY)
- INTERNAL CLAMP DIODES

5.1 DESCRIPTION

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors.

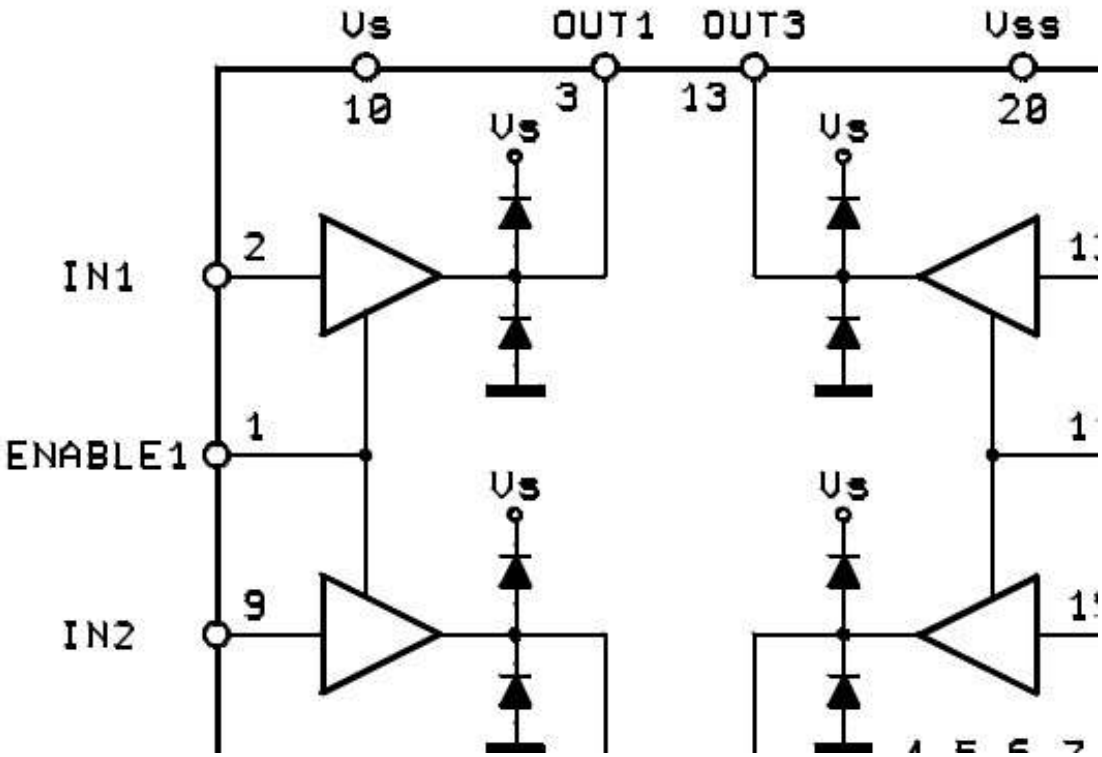
To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included.

This device is suitable for use in switching applications at frequencies up to 5 kHz. The L293D is assembled in a 16 lead plastic package which has 4 center pins connected together and used for heat sinking. The

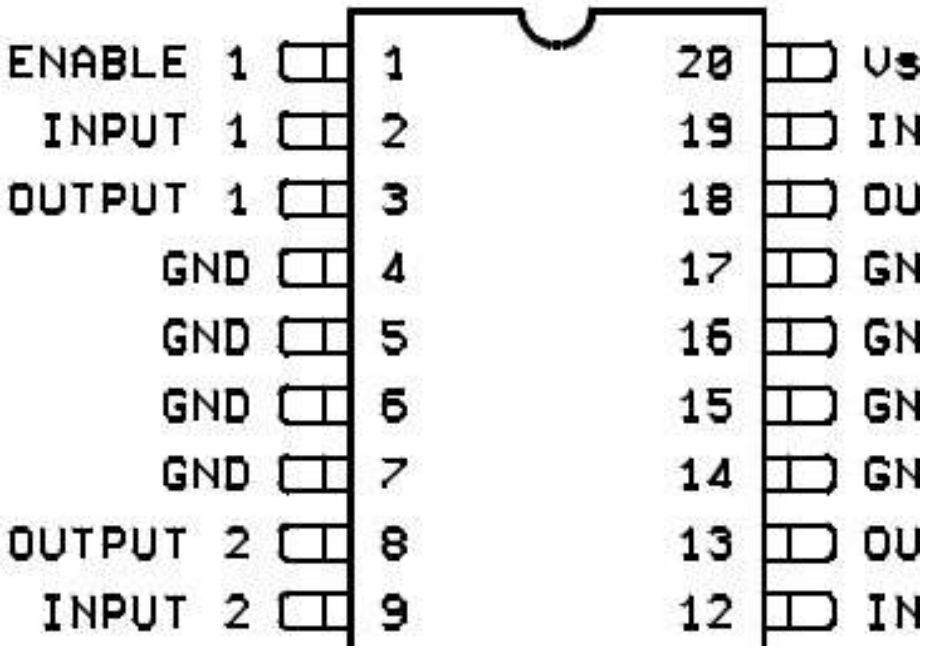
DOI: https://doi-ds.org/doilink/05.2024-87269361

L293DD is assembled in a 20 lead surface mount which has 8 center pins connected together and used for heat sinking.

BLOCK DIAGRAM



PIN CONNECTIONS



ASSEMBLY INSTRU

- Check the components supplied in the Kit against the Component list and identify all the components.
- It is generally best to solder the lowest height components first. Solder the components in the following order:
- Jumpers, resistors, diodes, IC base, transistors and other components.
- Take care of terminals polarity while soldering diodes, LED s and electrolytic capacitors.
- Identify the terminals of transistors and solder them in correct direction.
- Connect the LCD with the help of 16-pin male-female work-strip connector.
- Use flux cored lead to avoid dry solderability.
- Inspect the solder points against dry solder / excess solder
- Now insert the preprogrammed microcontroller in the IC base firmly.
- Adjust the 10K preset (near LCD) to correct contrast display level of LCD.
- Ensure that the ac voltage to the kit is 12V. For this, use 230/12V step down transformer with 500mA or more current rating.
- Use heat sink for voltage regulator, if required.

ADVANTAGES AND DISADVANTAGES OF L293D

ADVANTAGES

- Efficient way of speed control of DC motor.
- Produces more torque.
- Produces less noise.

DC MOTOR

WORKING PRINCIPLE OF A DC MOTOR

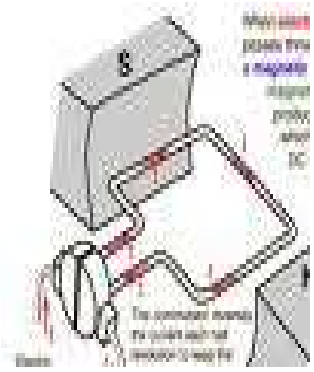
A DC motor is an electric motor that runs on DC electricity. It works on the principle of electromagnetism. A current carrying conductor when placed in an external magnetic field will experience a force proportional to the current in the conductor.

OPERATION OF A DC MOTOR

There are two magnetic fields produced in the motor. One magnetic field is produced by the permanent magnets and the other magnetic field is produced by the electrical current flowing in the motor windings. These two fields result in a torque which tends to rotate the rotor. As the rotor turns, the current in the windings is commutated to produce a continuous

DOI: https://doi-ds.org/doilink/05.2024-87269361

Torque output this makes the motor to run.



SPEED CONTROL METHODS OF DC MOTOR

They are various methods used to control the speed of a DC motor. Some of them are:

1. Armature control method
2. Flux control method
3. Ward Leonard system.

Armature control method: Speed can be controlled by varying the voltage. As speed is directly proportional to the voltage. As voltage increases speed increases and vice-versa. A simple voltage regulation would cause lots of power loss on control circuit. So we are going for PWM. In this method the duty cycle determines the speed of the DC motor. Required speed can be attained by changing the duty cycles. PWM also allows smooth speed variation without reducing the torque. It also eliminates harmonics.

Dc motor is an electric motor converts electrical energy into mechanical motion. The reverse task that of converting mechanical motion into electrical energy, is accomplished by a generator or dynamo. In many cases the two devices are identical except for their application and minor construction details.

DC motors are used when there is positioning requirement and also changes in load and torque. DC motors can be conveniently interfaced to Bipolar DAC, or MPUs can generate PWMs to control them.

SOFTWARE DESCRIPTION

Arduino IDE compiler:

Arduino is an open-deliver electronics platform based mostly on smooth-to-use hardware and software utility. Arduino boards can observe inputs - slight on a sensor, a finger on a button, or a Twitter message - and flip it into an output - activating a motor, turning on an LED, publishing a few components online. You could tell your board what to do by sending a hard and fast of commands to the microcontroller at the board. To do so that you use the Arduino programming language (based totally mostly on Wiring), and the Arduino software (IDE), based on Processing.

Over the years Arduino has been the brain of lots of obligations, from regular gadgets to complex medical gadgets. A worldwide community of makers - college students, hobbyists, artists, programmers, and

DOI: https://doi-ds.org/doilink/05.2024-87269361

specialists - has collected spherical this open-deliver platform, their contributions have brought as much as a terrific amount of available know-how that can be of terrific assist to novices and experts alike.

Arduino has become born on the Ivrea interaction format Institute as a clean tool for instant prototyping, geared towards university college students without a historic past in electronics and programming. As quickly as it reached a miles wider community, the Arduino board started converting to conform to new dreams and traumatic situations, differentiating its provide from smooth eight-bit boards to merchandise for IoT

Programs, wearable, three-d printing, and embedded environments. All Arduino boards are without a doubt open-deliver, empowering clients to assemble them independently and ultimately adapt them to their unique dreams. The software program, too, is open-supply, and its miles growing thru the contributions of customers globally.

The advantages of the Arduino IDE utility are

1. much less steeply-priced
2. The clean smooth programming surroundings
3. Extensible software program application utility and hardware

Conclusion:

We conclude that main objective of this project is to develop an embedded system based application to rotate the robotic arm.

It has been developed by integrating features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit.

The project or the robot been made is a working prototype of the pick and place robotic arm vehicle. The prototype presently cannot handle much weight but after further developments and introduction of high torque motor in the circuit will help in picking up large weights, for e.g. , bombs.

Advantages:

- It reduces the man power
- Accuracy is high.

Applications:

- Can be used for industries.

Future scope & Aspects

Further developments like, introducing a wireless camera to the circuit may also lead to addition of various applications of the pick and place robot like, it can pick a bomb from a crowded place and place it at a place where least damage will occur to human life and property. Even the usage of Bluetooth can be modified by using other connections like GSM or Zigbee which will be advantageous in the respect of range. Since, the range of Bluetooth is limited, it is now the limitation of out project which can be removed by using Zigbee which is efficient in terms of range.

DOI: https://doi-ds.org/doilink/05.2024-87269361

REFERENCES

1. Ankit Gupta, Mridul Gupta, NeelakshiBajpai, Pooja Gupta, Prashant Singh, "Efficient Design and Implementation of 4-Degree of Freedom Robotic Arm", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, June 2013.
2. . B.O. Omijeh, R. Uhunmwangho, M. Ehikhamenle, "Design Analysis of a Remote Controlled Pick and Place Robotic Vehicle", International Journal of Engineering Research and Development, Volume 10, PP.57-68, May 2014.
3. 3Gilgueng Hwang, "Development of a Human-Robot- Shared Controlled Teletweezing system"IEEE transactions control system technology, vol. 15, no. 5, september 2007
4. Guangming Song. [2011] "Automatic Docking System for Recharging Home Surveillance Robots" IEEE Transactions on Consumer Electronics, Vol. 57, No. 2.
5. Mohamed Naufal Bin Omar, "Pick and Place Robotic Arm Controlled By Computer", Faculty of Manufacturing Engineering, April 2007.
6. Sanjay Lakshminarayan, Shweta Patil, "Position Control of Pick and Place Robotic Arm", Department of Electrical Engineering MS Ramaiah Technology, Bangalore, India.

DOI: https://doi-ds.org/doilink/05.2024-87269361