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Arm Based Pick and Place Robot Vehicle Using Iot

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Robotics Automation is a sector that is rapidly expanding. Their popularity is growing every day as a result of their increased production, appropriateness, and profitability. In the industrial sector, robotics has ushered in a revolution. As a result, we should keep an eye on what's coming next, because the robotics sector is wide, every day robots contribute to the advancement of engineering around the globe. It reduces human work and can be used in a variety of domains, including military, surveillance, andindustrial pick and place. A surveillance robot using ESP32-CAM is a system that utilizes the ESP32-CAM board and a robot chassis to create a mobile surveillance device. Pick andplace applications are one of the most common places within the assembly process where automation and robots are utilized. While this means factories can easily source suitable pick and place robot models, choosing the right one for a specific application takes some investigation. The web interface allows the user to control the robot's movement, view livevideo streams. The surveillance robot using ESP32-CAM has potential applications in home security, monitoring of remote locations, and industrial surveillance. With its low cost and easy-to-use interface, it provides a convenient solution for anyone who needs to monitor their surroundings remotely the goal of this aim is to create a prototype of a smartphone-controlled robot vehicle that can perform a variety of tasks to create a robot that is both powerful and adaptable while using as little technology as possible. The ESP32controller is employed as the key component, with which all of the other components are interfaced. With the help of a Wi-Fi module, the developed car may be controlled wirelessly via a smartphone.

I. INTRODUCTION

A pick and place robotic arm designed which consumes less power using specialized hardware. This model proposes the control of this robotic arm via internet of things by the system operator. This proposed system can also be used for monitoring via wireless cam and warn the system operator during emergency situations such as leakage of harmful gases with air quality measuring system. The monitoring of data services can be processed with the design of underground server system. Based upon the instruction given by the system operator, coal can also be picked from one place to another. This robot system is attached with robotic vehicle powered by using solar tracking system on the top of same vehicle. This paper discusses solar tracking system and controlling robotic mechanism which ismainly controlled by using authorized person with the help of pc or laptop. To develop a robotic manipulator that takes a piece of an object from one position to another records its movements and replays the action, the work devolved into two parts: the mechanical chassis and the embedded control. The mechanical wrist, and the gripper. The development of a control circuit for a robotic arm has been. The that it responds with the required angles and orientation. The robotic arm takes an object from one point to the other, saves the movement in memory, and repeats the action for as long as desired by the user. The control is built around the rugged, cheap and readily available ESP32. It can easily be programmed in the Arduino IDE. This work is applicable in areas where a high level of accuracy is demanded: like automobile industries for coupling of cars, welding of parts, and lifting of

heavy equipment. Commands are sent to the robotic car through the transmitter, and the robotic vehicle responds by moving forward, backward, left, and right. Four dc motors are utilised to move the vehicle according to the instructions supplied by the motor direction.Berscheid L, et .al(1) Flexible pick-and- place is a fundamental yet challenging task within robotics, in particular due to the need of an object model for a simple target pose definition. In this work, the robot instead learns to pick-and-place objects using planar manipulation according to a single, demonstrated goal state. Our primary contribution lies within combining robot learning of primitives, commonly estimated by fully- convolutional neural networks, with one-shot imitation learning. Therefore, we define the place reward as a contrastive loss between real-world measurements and a task-specific noise distribution. Furthermore, we design our system to learn in a self- supervised manner, enabling real-world experiments with up to 25000 pick-and-place actions. Dewi T, et.al(2) The arm robot manipulator is the most suitable type of robots to be applied in plantation and agriculture for harvesting and packaging. The arm can be customized to imitate the human's arm motion from one point to others during harvesting. Robot motions can be designed using an inverse kinematics method to generate the desired trajectory, and the robot follows the generated trajectory. The inverse kinematics output is the ideal parameters and angles of robot links to ensure the smooth motion during harvesting time . The suitable end-effector of robot applied as a harvesting robot is a gripper. Moreover, in order to achieve gripper's smooth motion, artificial intelligence (AI) is applied to utilize the input from the attached sensors at a robot's system. The chassis consists of the shoulder, the elbow, the presented to the robotic embedded programmed for circuit is designed to send appropriate signals to selected servomotors such lifting, pick and place commonly used AI is the fuzzy logic controller (FLC) and the neural network (NN). Many kinds of research have applied inverse kinematics to generate a robot trajectory. Kadam AL and Hwang M(3) Cloud computing is able of supplying unrestricted sources of computation and storage as services via the internet provide to [1]. Cloud computing distinguish a very important point in computing by provides common computational energy of the demanded resources. It has changed the way of introducing the services of IT with lower demands of infrastructural due to depending on the essential idea of virtualization [2]. The virtual global include the different technological models to supply infrastructure of devices, progression program, and applications as services of on-demand which depend on n a pay-as-you-go type [3]. Cloud computing (CC) and the internet of things (IoT) appeared the revolution in information and communications technologies (ICT) the twenty-first century by new platforms . It is rapidly grown by 2018 and this year is an adventure year for IoT industry. Latif AA ,et.al(4) Robots are now a days being used in wide areas of application such as for nuclear power plant inspection [1-3], for bomb disposal, even for disinfecting hospitals and providing meals to contiguous patients. These robots can be controlled manually or automatically. In manual control a good level of precision is required (for bomb disposal operations, surgical procedures etc.) and it can be done through force feedback methods or using remote joysticks. In a search a rescue scenario or even in a scenario where touching a contaminated surface might affect operator a gesture based approach is more natural and intuitive. In this work our aim is to design and develop an intelligent mobile robot supported with a manipulator arm for search and rescueusing gesture based control. Kumar et.al 2016 (5) has been numerically studied about, the spherical shape dimpled tube through the Triple concentric tube heat exchanger and compared with plain tube via CFD Simulation. Perumal, S et al. 2017 (6) Studied about different heat transfer enhancement techniques by using different types of nanofluids such as AL2O3, CUO2...etc and studied about various thermal behaviours like heat transfer rate, pressure drop, friction factor, pressure drop, effectiveness and heat transfer coefficient. K.Senthilkumar et al. 2014 (7) has been numerically studied on dimpled concentric double tube heat exchanger with AL2O3 nanofluid and compared with smooth tube. Perumal saravanan and Mohan raman 2020 (8) numerically and experimentally studied about, the waste heat recovery from diesel engine exhaust gas through triple concentric tube heat exchanger with plain tube for various engine load conditions.Abdulkareem A,et.al (9) A robot is a machine that can carry out a series of functions automatically and is guided or controlled using programming and electronic circuitry. An alternative definition of a robot is that it is a mechanical or electromechanical device that is programmable and can interact with the environment, carry out tasks and perform various functions without human intervention. Ghadge K, et.al (10) Robotics is the interdisciplinary branch of engineering and science that includes mechanical engineering, electronic &electrical engineering,

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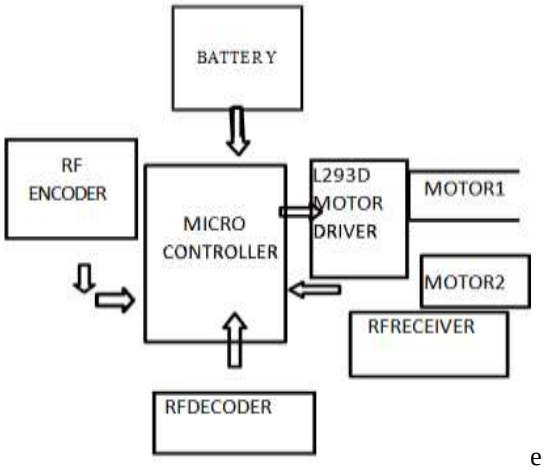
computer science, and others. Robotics deals with the design, construction, operation, and use of robots, as well as computer systems for their control, sensory feedback, and information processing. These technologies are used to develop machines that can substitute for humans. Robots can be used in any situation and for any purpose, but today many are used in dangerous environments (including bomb detection and de-activation), manufacturing processes, or where humans cannot survive. Ongaro F, et.al (11) The ability of untethered small-scale robots to handle nontrivial tasks has been demonstrated in a broad variety of applications, such as manipulation, assembly and micro actuation.

EXPLANATION OF EXISTING SYSTEM

The existing system is based on Microcontroller. A 5V supply is given to the microcontroller. The existing system consist of one L293D motor driver, 2 DC motor, RF encoder and decoder. Two motors for move on vehicle forward and reverse direction. A robotic vehicle is equipped with a night vision camera. Commands are delivered by RF encode, which is communicated to the car via the antenna. The encoder sends orders to the RF decoder. The microcontroller will provide an output that is insufficient to operate the motor based on those commands. As a result, the DC motor is driven by the motor driver L293D. The motor will spin in response to that order, and the camera will observe the surrounding surroundings. The microcontroller controller controls all the circuits and processing the operation correctly. The collected data transfer through wireless for few distances.

BLOCK DIAGRAM OF EXISTING SYSTEM
MOTOR1

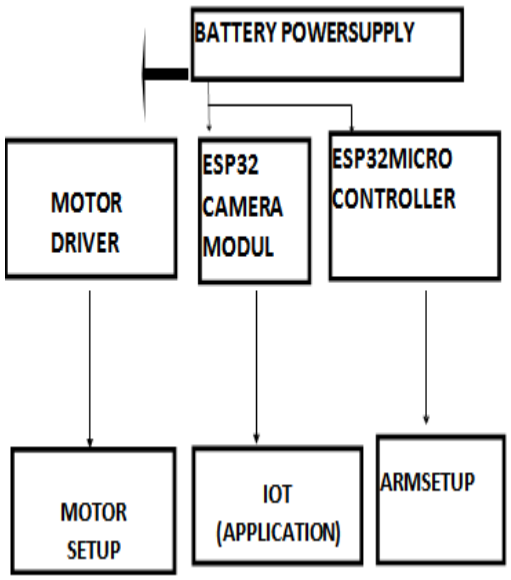


e

EXPLANATION OF PROPOSED SYSTEM

To design a robotic arm suitable to work with four degree of freedom and which is not too bulky and also compatible to use. This arm should be re-programmable according to the applications to be used for. The number of Degree of Freedom that a manipulator possesses is the number of independent position variables that would have to be specified in order to locate all parts of the mechanism; it refers to the number of different ways in which a robot arm can move in the particular direction. A manipulator is usually an open kinematic chain because each joint position is usually defined with a single variable so the number of joints equal to the number of degrees of freedom. A pick-and-place robotic arm is a mechanical system designed to perform the task of picking up objects from one location and placing them in another. It consists of multiple segments connected, similar to a human arm, and is equipped with motors, sensors, and grippers. The basic function of a pick and place robot is done by its joints. Joints are analogous to human joints and are used to join the two consecutive rigid bodies in the robot. They can be rotary joint or linear joint. To add a joint to any link of a robot, we need to know about the degrees of freedom and degrees of movement for that body part. Degrees of freedom implement the linear and rotational movement of the body and Degrees of movement imply the number of axis the body can move.

BLOCK DIAGRAM PROPOSED SYSTEM



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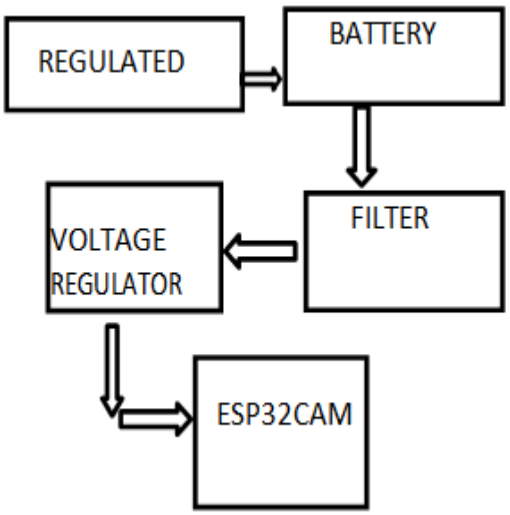
POWER SUPPLY

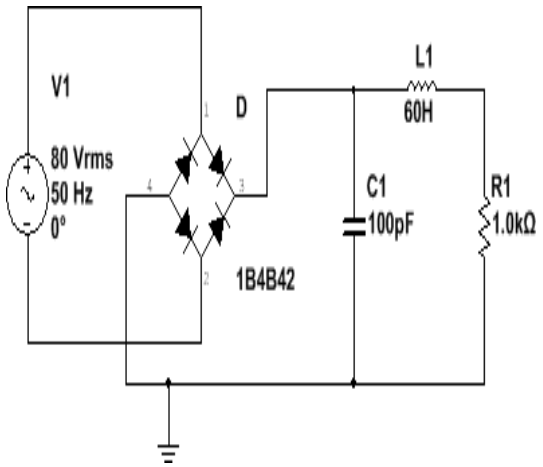
A power supply is an electrical device that supplies electric power to an electrical load.The main purpose of a power supply is to convert electric current from a source to the correctvoltage, current, and frequency to power the load.

BLOCK DIAGRAM OF POWER SUPPLY



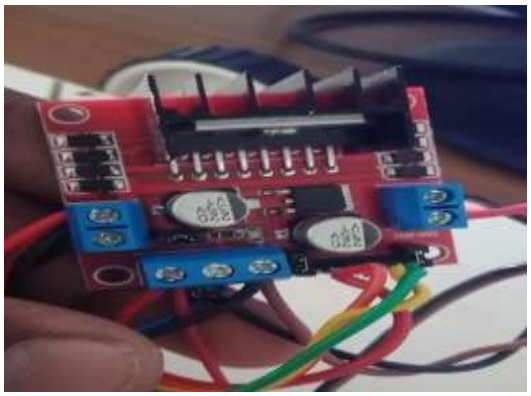
VOLTAGE REGULATOR

A voltage regulator is a device that maintains a steady voltage automatically. Negative feedback or a basic feed-forward architecture can be used in a voltage regulator. An electromechanical mechanism or lectrical components might be used.



MOTOR DRIVER L293D

The L293D H-bridge driver is the most often used driver for bidirectional motor driving applications. A DC motor can be driven in either direction using the L293D IC. The L293D is a 16-pin IC that can simultaneously control two DC motors in either direction. It means that a single L293D IC may control two DC motors at the same time. Because it is equipped with two H-Bridge Circuits. The L293D can also operate tiny and silent large motors. An H-bridge motor control circuit may be built in a variety of methods, including using relays, transistors, and the L293D/L298. Previously we go into the details, let's define the H-Bridge circuit.



WORKING OF MOTOR DRIVER

The concept is based on the H-bridge. The H-bridge is a circuit that allows current to flow both ways. H-bridge ICs are ideal for controlling a DC motor since the voltage must change direction to rotate the motor clockwise or counter clockwise.

There are two h-Bridge circuits in a single L293D chip that can independently rotate two dc motors. Because of its compactness, it is frequently used in robotic applications to operate DC motors.

As illustrated in the pin diagram, the l293d has four input pins, numbered 2,7 on the left and 15,10 on the right. The left input pins control the rotation of the left-hand motor, while the right input pins control the rotation of the right-hand motor. The motors rotate in response to LOGIC 0 or LOGIC 1 inputs sent through the input pins. Simply put, to rotate the motor, logic 0 or 1 must be passed across the input pins.

L293D IC

In most cases, the L293D IC is packed in a 16-pin DIP package (dual-in line package). This motor driver IC uses only four microcontroller pins to control two tiny motors in any direction: forward or backward (if you do not use enable pins).

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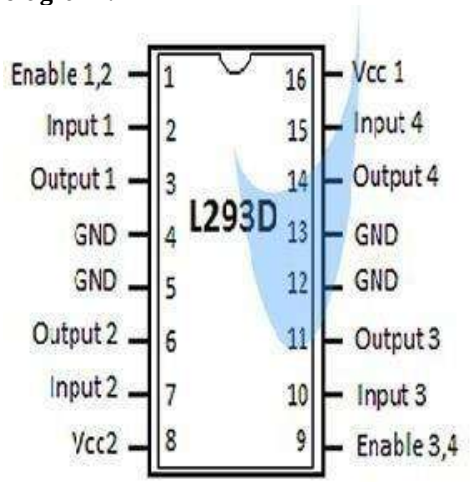
Pin diagram :



FEATURES

- Two DC motors are run at same IC make as possible
- To control the direction and speed of the vehicle is possible.
- Maximum Peak Motor Current:1.2A
- Supply Voltage to Vcc1(vss):4.5 to 7V
- Automatic thermal shutdown

APPLICATIONS

- Digital Circuits can be utilized to control high-current motors
- Stepper motor can be driven
- High-current LEDs can be driven
- Module for Relay Driver

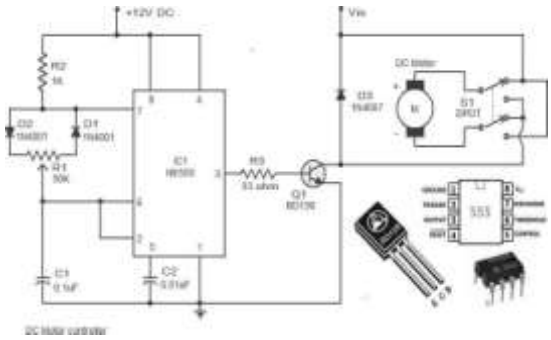
DC GEAR MOTOR

A direct current motor (DC motor) is a type of electric motor that converts electrical energy into mechanical energy. A DC motor receives direct current as its electrical input and converts it to mechanical revolution

DC Geared motor

PRINCIPLE OF DC MOTOR

A current-carrying conductor suffers torque and has a tendency to move when it is put in a magnetic field. In other words, a mechanical force is created when a magnetic field and an electric field interact. The motoring action of a DC motor or direct current motor is based on this idea.



DC Motor circuit diagram

WORKING OF DC MOTOR

A DC motor's stator and armature are key components. The stator is the part of a motorthat doesn't move while the armature spins. A revolving magnetic field is generated by the stator of a DC motor, which causes the armature to rotate.Using a fixed set of magnets in the stator and a coil of wire with a current running through it, a basic DC motor generates an electromagnetic field aligned with the center of the coil. One or more windings of insulated wire are wrapped around the motor's core to focus the magnetic field.Windings of insulated wire are connected to a commutator (a rotary electrical switch) that supplies current to the windings. Each armature coil is energized one at a time by the commutator, resulting in a constant spinning force (known as torque).A rotating magnetic field is created when the coils are turned on and off in a specific order, which interacts with the various fields of the stator's stationary magnets to produce torque, which causes it to rotate. These basic operating principles are used by DC motors to convert electrical energy from direct current to mechanical energy via rotating movement, used for object propulsion. Geared motors have a tendency to lower the motor's speed while increasing the torque. This attribute is useful because DC motors can revolve at rates that are far too rapid for an electrical device to operate. A DC brush motor and a gearbox coupled to the shaft are the most frequent components of a geared motor. Two interconnected components identify geared motors. It has a wide range of applications because to its low cost of design, reduced complexity, and ease of construction, including industrial equipment, actuators, medical devices, and robots.

ADVANTAGES

Without gears, no good robot can be made. All things considered, having a clear

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knowledge of how gears effect torque and velocity is critical.

The concept of mechanical advantage governs the operation of gears. This means that we may switch between rotational velocity and torque by employing different gear sizes. The speed-to-torque ratio of robots is unsatisfactory.

Torque is more important in robots than speed. It is feasible to swap high velocity for greater torque using gears. The decrease in speed is inversely proportional to the increase in torque.

SWITCH

A switch is an electrical component that can disconnect or connect the conducting path in an electrical circuit, interrupting the electric current or diverting it from one conductor to another. The most common type of switch is an electromechanical device consisting of one or more sets of movable electrical contacts connected to external circuits.

TECHNICAL SPECIFICATIONS

Mode of Operation: Tactile feedback

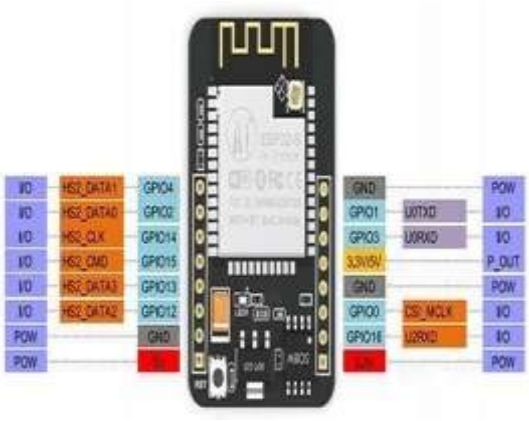
- Power Rating: MAX 50mA 24V DC
- Insulation Resistance: 100Mohm at 100v
- Operating Force: 2.55±0.69 N
- Contact Resistance: MAX 100mOhm
- Operating Temperature Range: -20 to +70℃
- Storage Temperature Range: -20 to +70 ℃

ESP 32 CAM

The ESP32-CAM is a very small camera module that uses the ESP32-S microprocessor. It contains a microSD card slot for storing Photographs taken by the camera or data to offer to clients, in addition to the OV2640 camera and different GPIOs for attaching peripherals.

ESP32 CAM

ESP32-CAM Pin out



- There are three GND pins and two power pins (3.3V or 5V).
- The serial pins are GPIO 1 and GPIO 3. The purpose of these pins is to upload code to your board.
- Furthermore, GPIO 0 is critical since it decides whether the ESP32 is in flashing mode or not.
- When GPIO 0 is connected to the ground ESP 32 going to flashing mode

The following pins are internally connected to the microSD card reader:

- GPIO 14: CLK
- GPIO 15: CMD
- GPIO 2: Data 0
- GPIO 4: Data 1 (also connected to the on-board LED)
- GPIO 12: Data 2
- GPIO 13: Data 3

FEATURES

- The world's smallest 802.11b/g/n Wi-Fi BT SoC module
- Low-power 32-bit CPU that can also function as an application processor
- The clock speed is Up to 160MHz, 600 DMIPS total processing power
- 520 KB internal SRAM, 4 MB external SRAM
- Supports SPI/ UART/I2C/PWM/DAC/ADC
- Built-in flash bulb, support for OV2640 and OV7670 cameras
- Allows for picture upload through Wi-Fi
- Multiple sleep modes are supported
- STA/AP/STA+AP operation modes are supported.

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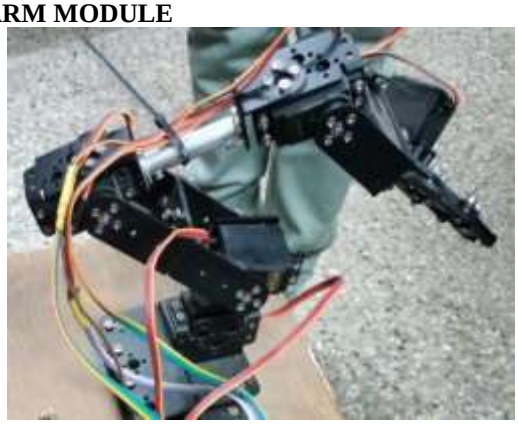
ARM MODULE



They use advanced vision systems to identify, grasp and move objects from one place to another. With a variety of design options available, pick and place robots can be configured with various end-of-arm tooling options for use in different applications, such as assembly, packaging or bin picking. Traditionally, static robotic arms are referred to as pick & place robots, but Robotic is a pioneer in autonomous mobile manipulation: it is a mobile platform that integrates a robotic arm. This means that the robot arm is no longer bound to a fixed, specific space, but can perform pick and place tasks in as many locations as required. The advantages of Pick & Place robots for production processes are diverse, and derive, fundamentally, in two benefits: the reduction of production times and increase in the profitability of the same.

SOFTWARE REQUIREMENTS ARDUINO IDE

The software of Arduino is developed in Arduino IDE (Integrated Development Environment).It's a text editor that works like a notepad and has a lot of features. It's used to write code, compile it to check for errors, and then upload it to an Arduino. It is a cross- platform application that runs on Windows, Linux, and Mac OS X. The C/C++ programming language is supported. It's open-source software, which means users can do whatever they want with it. It works with all Arduino boards, including the Arduino Mega, Arduino Leonardo, Arduino Ethernet, and others. They can design and upload their own modules and functionalities to the application

WORKING OF ARDUINO

The IDE generates a Hex file when a user writes code and compiles it. (A Hex file is a Hexa Decimal file that Arduino can interpret) and then uploaded to the device via USB. Every Arduino board includes a microcontroller, which receives the hex file and executes the code exactly as written.

FUNCTIONS OF ARDUINO IDE

- Window Bar
- Menu Bar
- Shortcut Button
- Text Editor
- Output Panel

The Arduino Integrated Development Environment (IDE), sometimes known as the Arduino Software (IDE), has a code editor, a message box, a text terminal, a toolbar with basic operations buttons, and a menu system. It establishes a connection with the Arduino hardware, allowing it to upload and interact with programs.

Arduino sketches are programs made with the Arduino software (IDE). These sketches were made in a text editor and saved as ino files. The editor allows you to cut/paste, as well as search for and replace text. While storing and exporting, the message section shows errors and provides feedback. The Arduino Software (IDE) sends text to the console, including comprehensive error warnings and other data. In the window's bottom righthand corner, the configured board and serial port are displayed. Using the toolbar buttons, you may validate and upload programs, make, save, and save drawings, and open the serial monitor.

FILE

- New Creates a new instance of the editor, complete with the very minimal structure of a sketch.
- Open Allows you to search for a sketch file on your computer's CDs and folders.
- Open Recent Shows a list of the most recent drawings, all of which are available for viewing.
- Sketchbook Selecting a name from the list of current drawings in the sketchbook

Folder structure opens the relevant sketch in a new editor instance.

- Any example provided by the Arduino Software (IDE) or library is displayed under this menu option. All of the examples are arranged in a tree, making it easy to find what you need by topic or library.
- Closes the Arduino Software instance from which it was selected.
- Save saves the drawing with the name it has right now. If the file hasn't been given a name yet, one will be suggested in the "Save as." box.

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- Save the document as. This option allows you to rename the current drawing.
- Page Design The printing Page Setup window appears.
- Print sends the current design to the printer based on the Page Setup settings.
- Preferences Opens the Preferences window, which lets you change some of the IDE's settings including the interface language.
- Quit: Closes all IDE windows with this command. When you exit the IDE.

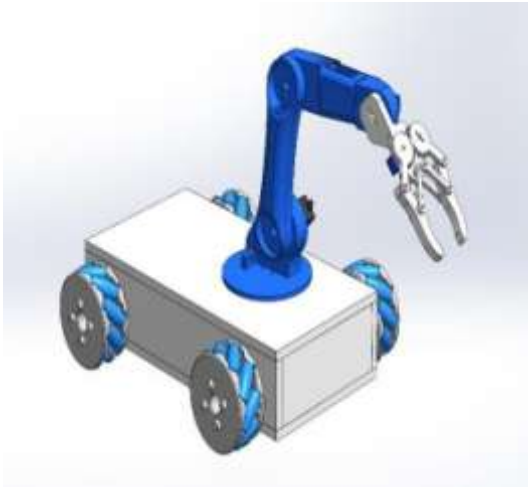
SKETCH

- Verify/Compile Verifies your sketch for errors and displays memory use for code and variables in the terminal window.
- Upload The binary file is compiled and loaded onto the specified board via the provided Port.
- Uploading with a Programmer This will overwrite the board's bootloader, which must be restored using Tools > Burn Bootloader before you can use the USB serial port again. However, it does enable you to use the entire Flash memory for your sketch. Please note that the fuses will not be blown as a result of this order. Use the Tools -> Burn Bootloader command to accomplish this.
- Binary Export (Compiled) Saves a.hex file that can be archived or supplied to the board using other software.
- Go to the Sketch Folder and open it. It's time to open the current drawing folder.
- Take advantage of the library. Adds #include statements to the beginning of your code in order to incorporate a library in your artwork. For more information, see the libraries listed below. You may also use this menu item to access the Library Manager and import new libraries from.zip files.
- Adding a File... to the drawing creates a new file (it will be copied from its current location). The file is saved under the sketch's data subdirectory, which is used to store assets like documentation.

TOOLS

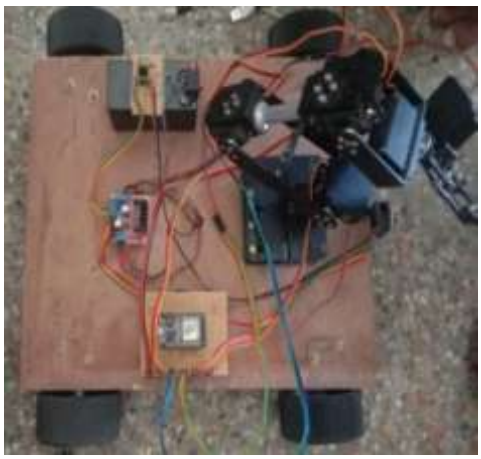
- Auto-formatting This indents your code so that the opening and closing curly braces are aligned, and the statements within the curly braces are indented even more.
- Archive Sketch creates a.zip file that contains a copy of the current sketch. The archive is saved in the same folder as the drawing. Reload the page and correct the encoding. Fixes any discrepancies between the editor's char map encoding and various operating systems' char maps.
- Keep an eye out for serial data. Data is exchanged with any connected board on the currently defined Port via the serial monitor window. This generally resets the board if the board permits Reset via serial port opening.
- Board Select the board you'd want to utilise. The following are descriptions of the various boards.
- Port This menu displays a list of all serial devices on your machine, including real and virtual. It should automatically refresh when you enter the top-level tools menu.
- Programmer You'll need to utilise a hardware programmer if you're not using the onboard USB-serial connection to program board or chip. This isn't usually required, but it is if you're programming a new microcontroller with a bootloader.
- The bootloader must be burnt. You can burn a bootloader into an Arduino board's microcontroller.

DESIGN OF ARM BASED PICK AND PLACE ROBOT VEHICLE



II. RESULT AND DISCUSSION

The assembling of an arm-based pick and placed robot controlled using the ESP 32 controller with rechargeable battery supplied to the overall setup. The directions, pick, and place of the materials are controlled using the IOT platform and mobile application. The overall architecture is shown in



Overall assembling of Arm based pick and place robot

III. CONCLUSION

Robotic arm is a reprogrammable and multifunctional manipulator design to assist human in various surroundings. It is able to overcome human inefficiency in performing repetitive task such as pick and place operation. Thus, industrial in assembly and manufacturing have widely integrated robotic arm into their assembling line to overcome the problem of human inefficiency. Internet of things (IoT) allow data to be exchange between devices through the connection of many devices. The integration of internet of things with robotic arm allows smart industry to be realized. The purpose of this research is to design and build a three degree of freedom robotic arm with a mechanical gripper. Robotic arm is a reprogrammable and multifunctional manipulator design to assist human in various surroundings. Robotic arm is able to overcome human inefficiency in performing repetitive task such as pick and place. Thus, industry such as assembly and manufacturing have widely integrated robotic arm into their assembling line to overcome the problem of human inefficiency. Pick and place robots automates the pick the place operation by picking an object and placing it in other different areas. Computerizing this procedure assists with expanding production rates. Pick and place robots handle dull assignments while opening up human laborers to concentrate on increasingly complex work. Many industries started using pick and place robots for moving operations. But small industries still use laborers for pick and place operation.

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