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Solar powered robotic arm

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ABSTRACT

Robotic technologies deal with automated machines that can take the place of humans, hazardous or manufacturing processes, or simply just resemble humans. A robotic arm is a type of mechanical arm usually programmable with similar functions to a human arm; the arm may be sum of the mechanism or may be a part of more complex robot. Solar energy is a radiant light and heat from the sun has been harnessed by humans since ancient times using a range of ever-evolving technologies. This paper aims to design and construct a robotic vehicle which is powered by solar energy with robotic arms to pick and place an object. In existing method, the solar powered robotic vehicle was designed and is used for increasing the vehicles power by means of solar energy. The proposed system introduces a robotic arm to the vehicle to pick and place an object. There are two ways to charge the vehicle. One method of charging is through direct power supply and alternative method is tracking solar energy. Thus the complete solar energy is utilized by the robotic vehicle to perform pick and place operation using robotic arm was fulfilled.

Keywords: robotic arm

INTRODUCTION

Robots are indispensable in many factoring industries. The reason is that the cost per hour to operate a robot is a fraction of the cost per hour to operate a robot is a fraction of the cost human labor needed to perform the same function. More than this, once programmed, robots repeatedly perform function with a high accuracy that surpasses that of the most experienced human operator. Human operators are, however, are more versatile. Humans canswitch job tasks easily. Robots are built and programmed to be job specific.

Robots are in the infantry stage of their evolution. As robots evolve, they will become more versatile, emulating the human capacity and ability to switch job tasks easily. Robots require a combination of elements to be effective sophistication of intelligence, movement, mobility, navigation and purpose Robotic Arm

The simplest arm is the pick-and-place type. In this case the parts are moved from one location to another without caring how the part is picked up or down. However, these days robot arms are designed to manipulate objects having complicated shapes and fragile in nature. These may be used to assemble parts or fit them into clamps and fixture. This is possible due to high accuracy attainable in robot's arm

ESISTING METHOD

The normal industrial selection system in a store is not automated. And and of course some of them use conveyor type models, where the selected products are placed on the conveyor and it will be collected on the output selection

DRAWBACKS

- Time consuming
- Not suitable for all type of products
- The implementation cost is high

BLOCK DIAGRAM

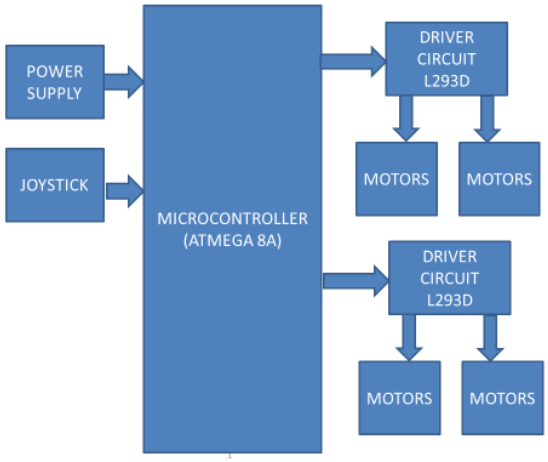


Fig 1: Block Diagram

PC with MATLAB is connected to the Arduino through USB port. The communication between MATLAB and Arduino is done through serial communication. The four channel motor driver circuitry is controlled by programming the microcontroller such that certain movement we need is obtained by switching the respective motor drivers. The DC Motors are connected to the motor driver output, and whenever the motor driver output is high, the motor starts rotating. The robot having two degree of freedom, the arm consists of one DC Motor and at the gripper it employs another DC Motor. Both of the motors are controlled through four channel motor driver circuit.

A simple electromagnetic motor driver consists of a coil of wire wrapped around a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts. The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts. It is held in place by a spring so that when the motor driver is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the motor driver pictured is closed, and the other set is open. Other motor drivers may have more or fewer sets of contacts depending on their function

Motor drivers which are operated both electrically and mechanically. We know that most of the high end industrial application devices have motor drivers for their effective working. Motor drivers consist of an electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. The rated current of motor driver is 7A and 14V DC, for 250V AC the current rating is 7.5A.

A DC motor is an internally commutated electric motor designed to be run from a direct current power source. Brushed motors were the first commercially important application of electric power to driving mechanical energy, and DC distribution systems were used for more than 100 years to operate motors in commercial and industrial buildings. Brushed DC motors can be varied in speed by changing the operating voltage or the strength of the magnetic field.

In the project the movement of the robot is mainly due to the motors with the help of motor drivers. By perfect programming the motor drivers are operated in which the motors rotate to move the robot. In order to get future improvements, each motor is operated by a program. The motors are rated 20mA, 12V DC with a torque of 3kg.

The whole project uses four DC motors in total and six motor drivers, in which four of the motor drivers are connected as four channel motor driver circuit the whole project is given supply through solar energy power generation

WORKING

Power supply being used for the project is generated through solar power generation. power generated from the panel is stored in the battery, a diode circuit is connected between solar panel and battery to prevent the reverse currents flowing from battery to the solar panel. From the battery, supply is given to the V*in* of the Arduino board. The voltage regulator in the board regulates the 12v supply to 5v, which can be used by the micro controller.

- A simple pick and place robot consists of two rigid bodies on a moving base, connected together with rotary joint. A rotary joint is a one which provides rotation in 360 degrees around any one of the axes.
- The bottom or the base is attached with wheels which provide linear movement.
- The 1st rigid body is fixed and supports the second rigid body to which the end effector is provided.
- The 2nd rigid body is provided with movement in all 3 axes and has 3 degrees of freedom. It is connected to the 1st body with a rotational joint.
- The end effector should accommodate all 6 degrees of freedom, in order to reach all sides of the component, to take up position to any height.

Other motor drivers common. When one of the motor driver switches, the DC motor starts rotating in one direction and when the other motor driver switches (and the first one is off) the DC motor starts to rotate in anti-clockwise direction.

Pin 8, pin 9, pin 10, pin 11 are connected to the four inputs of four channel motor driver circuit. Pin 10 and pin 11 control the arm up and down movements and Pin 8, Pin 9 control the gripper operation. When pin 10 is high and pin 11 is low, the

motor 3 rotates in clockwise direction and arm moves upwards and when pin 11 is high and pin 10 is low, the motor 3 rotates in anti-clockwise direction and the arm moves downwards.
When pin 9 is high and pin 8 is low, motor 4 rotates in clock wise direction and the gripper opens when pin 9 is low and pin 8 is high, motor 4 rotates in anti-clockwise direction and the gripper closes.

Hardware Equipment

Type In the hardware design the main components used are:

Motor driver Circuit

The Motor driver Driver Module makes it simple and convenient to drive loads such as 12V motor drivers from simple 5V digital outputs of your Arduino compatible board or other microcontroller. When the input from the microcontroller to the base of the becomes high, the motor1 rotates in clock wise direction. When the input from the microcontroller to the base of becomes high, the motor1 rotates in anti-clock wise direction.

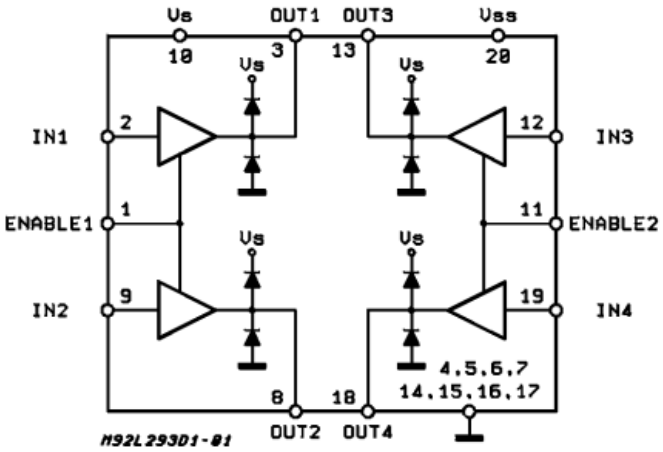


Fig 1: Motor driver Circuit

- Microcontroller ATMEGA 8.
- motor driver circuit.
- Gripper with motor.
- PV Cell Module..
- joystick
- Charge controller.

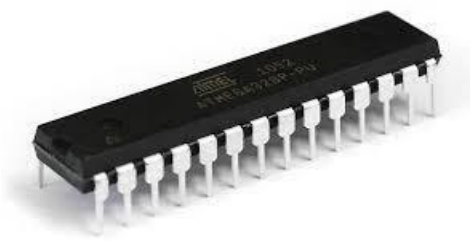
Microcontroller ATMEGA 8

Microchip Pico Power 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed. For both the motors to rotate in clockwise direction, both the inputs at the Q1 and Q3 need to be high. For both the motors to rotate in clockwise direction, both the inputs at the Q2 and Q4 need to be high and the inputs at 1 and 2 bases need to be low

Gripper with motor

Specifications of the DC motor that is being used in the Gripper.

Table 1: Specifications of the DC motor



Voltage	**12V**
Speed	**30 RPM**
Torque	**3 Kg**

When the motor is given supply such that it to rotates in Anti- clockwise direction, it rotates the gears through the shaft making the gripper close.

PV Cell Module

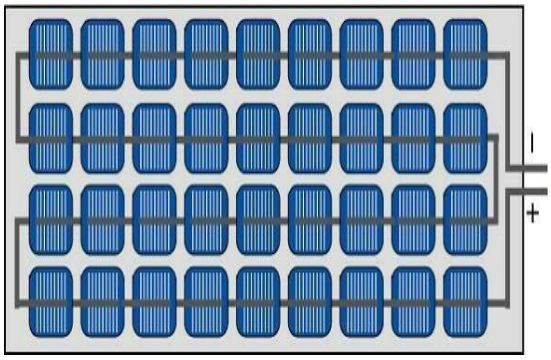


Fig 2: Structure of a PV module with 36 cells in series

For the majority of applications multiple solar cells need to be connected in series or in parallel to produce enough voltage and power. Individual cells are usually connected in series string of cells (typically 36 or 72) to achieve the desired output voltage. The complete assembly is usually referred to as a module and manufacturers basically sell modules. The modules serve another function of protecting individual cells from water, dust, etc. as the solar cells are placed into an encapsulation of single or double at glasses.
Within a module the different cells are connected electrically in series or in parallel although most modules have a series connection. Figure shows a typical connection of how 36 cells are connected of the individual voltages of each cell. It is therefore, very critical for the cells to be well matched in series string so that all cells operate at the maximum power points. When modules are connected in parallel the current will be the sum of the individual currents and the output voltage will equal that of a single cell.

Charge Controller

A charge controller, charge regulator or battery regulator limits the rate at which electric current is added to or drawn from electric batteries. It prevents overcharging and may protect against overvoltage, which can reduce battery performance or lifespan, and may pose a safety risk. It may also prevent completely draining ("deep discharging") a battery, or perform controlled discharges, depending on the battery technology, to protect battery life. The terms "charge controller" or "charge regulator" may refer to either a stand-alone device, or to control circuitry integrated within a battery pack, battery-powered device, or battery charger.
A series charge controller or series regulator disables further current flow into batteries when they are full. A shunt charge controller or shunt regulator diverts excess electricity to an auxiliary or "shunt" load, such as an electric water heater, when batteries are full.

4. RESULTS

When motor 3 moves in clockwise direction then the movement of the arm is downward and when the motor 3 moves in anti clock wise direction then the movement of the arm is upward. The below table the arm movements with respect to the rotation of the motor 3.

Table 2: Movement of Robot according to the rotation of Motors

Motor 1	Motor2	Movement of the Robot
1	**1**	**Forward**
1	**0**	**Right**
0	**1**	**Left**
0	**0**	**No Movement**

Table 3: Arm movements according to motors rotation

Motor 3	Arm Movement
Clock wise	Downward
Anti-Clock wise	Upward

when the motor 4 moves in clock wise direction then the gripper is open and when the motor 4 move in anti clockwise direction, the gripper closes on to the object.

CONCLUSION

This robot is used for pick & place the products from one place another places. Concepts of automobile and robotics are combined in this project. Transmission of power due to meshing of gear is used for lifting purpose. This robot does all those things it mainly reduces the manual work our robot is designed at low cost as well as high efficient one. This project is to give the way for providing bigger effective robot for industrial applications.

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