Study on Bio-Mimetic Portable Robotic Arm

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ABSTRACT

The purpose of the project is to encourage automation in almost every activities which require much labor for the completion of the job. Many industries spend a lot of money and time in hiring the labors to carry out their day to day physical activities like transportation of goods, assembly of delicate components in electronics industry, packaging of products etc. Moreover, a variant of this robot model can be employed in areas which risks the human life for example, in Coal Mines, Deep tunnels within the surface of the earth, Defusing bombs, In other defense works etc. The main purpose of the gripper is to hold the items and place them as per the user requirement. For control system, the model constitutes of a microcontroller whose responsibility is to control the motions of the model, DC motor, Motor Drivers, Servo motors, Potentiometers, Joystick controls.

The advanced version of the model can be implemented to perform complex human activities performing a surgery also can be used in various fields like Automobile industry, Instrumentation industries, military applications etc. This models holds the promise to re-define the meaning of automation in the evolving digital era.

KEYWORDS: ARDUINO, servo motor, potentiometer and Joystick

INTRODUCTION
What is the first thing that comes to mind when you think of a robot?
For many people it is a machine that imitates a human—like the androids in Star Wars, Terminator and Star Trek: The Next Generation. However much these robots capture our imagination, such robots still only inhabit Science Fiction. People still haven't been able to give a robot enough 'common sense' to reliably interact with a dynamic world. However, Rodney Brooks and his team at MIT Artificial Intelligence Lab are working on creating such humanoid robots.

The type of robots that you will encounter most frequently are robots that do work that is too dangerous, boring, onerous, or just plain nasty. Most of the robots in the world are of this type. They can be found in auto, medical, manufacturing and space industries. In fact, there are over a million of these type of robots working for us today.

Some robots like the Mars Rover Sojourner and the upcoming Mars Exploration Rover, or the underwater robot Caribou help us learn about places that are too dangerous for us to go. While other types of robots are just plain fun for kids of all ages. Popular toys such as Teckno, Polly or AIBO ERS-220 seem to hit the store shelves every year around Christmas time.

But what exactly is a robot?
As strange as it might seem, there really is no standard definition for a robot. However, there are some essential characteristics that a robot must have and this might help you to decide what is and what is not a robot. It will also help you to decide what features you will need to build into a machine before it can count as a robot.

A robot has these essential characteristics:
Sensing: First of all your robot would have to be able to sense its surroundings. It would do this in ways that are not un similar to the way that you sense your surroundings.

Giving your robot sensors: light sensors (eyes), touch and pressure sensors (hands), chemical sensors (nose), hearing and sonar sensors (ears), and taste sensors (tongue) will give your robot awareness of its environment.

Movement: A robot needs to be able to move around its environment. Whether rolling on wheels, walking on legs or propelling by thrusters a robot needs to be able to move. To count as a robot either the whole robot moves, like the Sojourner or just parts of the robot moves, like the Canada Arm.

Energy: A robot needs to be able to power itself. A robot might be solar powered, electrically powered, battery powered. The way your robot gets its energy will depend on what your robot needs to do.

Intelligence: A robot needs some kind of "smarts." This is where programming enters the pictures. A programmer is the person who gives the robot its 'smarts.' The robot will have to have some way to receive the program so that it knows what it is to do.

So what is a robot?
Well it 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 robots is a combination of physics, mechanical engineering, electrical engineering, structural engineering, mathematics and computing. In some cases biology, medicine, chemistry might also be involved. A study of robotics means that students are actively engaged with all of these disciplines in a deeply problem-posing problem-solving environment.

BLOCK DIAGRAM
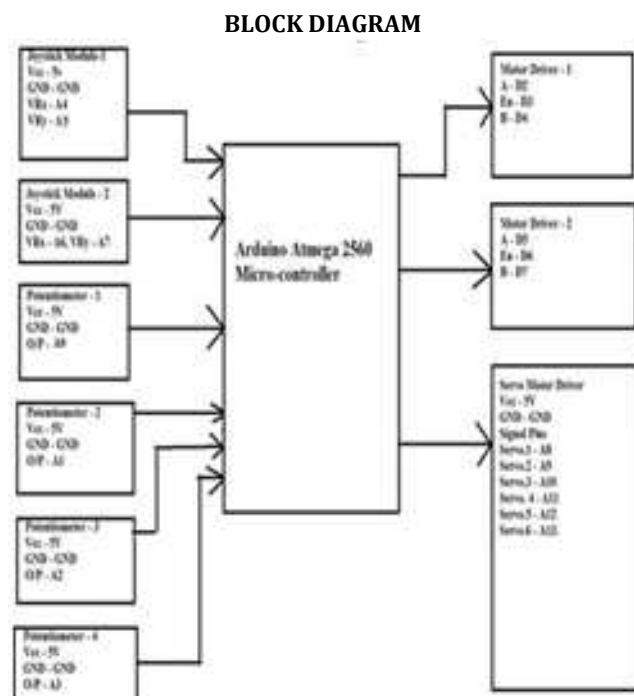
The above figure refers to the circuit diagram and the working of this robot is as follows.

➤ Firstly, the switch of the battery is turned ON to activate the robot and then the program is loaded into the processor.
➤ Then later, when we make any gestures like moving our elbow joints up and down, then by the help of potentiometers
➤ connected to the elbow joints, the slider of the potentiometer rotates and this cause a variation in resistance.
➤ The variations in resistance are sent to arduino atmega 2560 through wires which then rotates the servo motor in particular angle accordingly by using a map function which maps the analog potentiometer values to angle values for servo motor.
➤ Thus when the servo motors rotates, the mechanism is in such a way that it lifts the robotic arms connected to the servo motors.
➤ When we need to lift some heavy objects, we take the help of joystick module which helps us to close and open the grippers which indirectly means rotates the mini

servo motor in particular angle by which the grippers open and close by which holding of objects is done.
➤ While the grippers are holding the objects, we can once again move your elbows by which lifting of arms will be performed and then the objects are lifted.
➤ With the help of joystick module we can drive the motors and the robot can be carried to anywhere we want and can place the objects.
➤ The main application of this robot finds in industries where the lifting of heavy objects can take place. For example in cargo loading and un-loading.
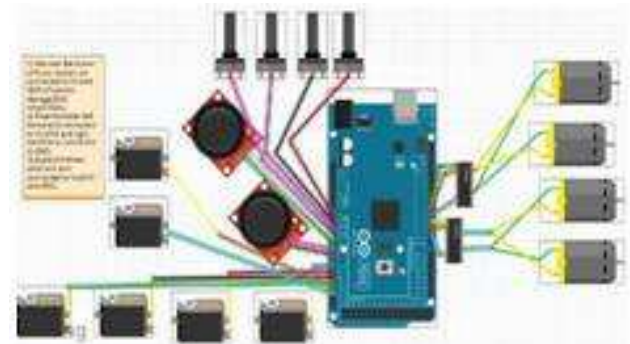

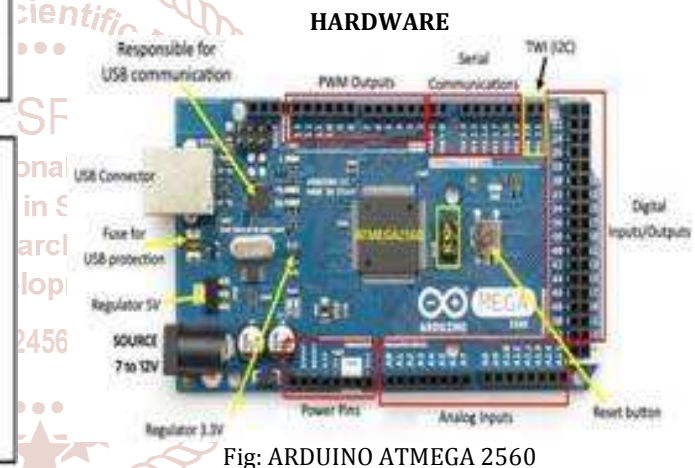Fig: Circuit Diagram

HARDWARE

Fig: ARDUINO ATMEGA 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, 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 Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

SERVO MOTOR
The servo motor is most commonly used for high technology devices in the industrial application like automation technology. It is a self-contained electrical device that rotate parts of a machine with high efficiency and great precision. The output shaft of this motor can be moved to a particular angle. Servo motors are mainly used in home electronics, toys, cars, airplanes, etc. This article discusses about what is a servo motor, servo motor working, servo motor types and its applications
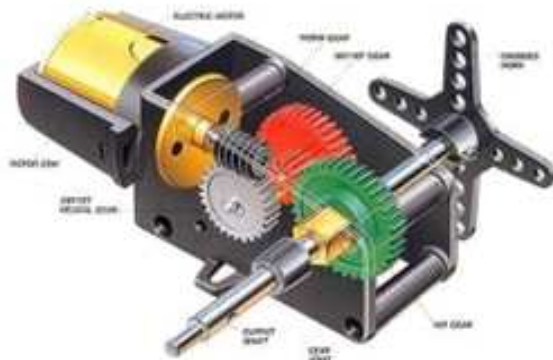
Fig: Servo Motor

POTENTIOMETER

These resistors can be broadly classified as fixed and variable resistors. As their respective names suggest, a fixed resistor has a single fixed value of resistance, whereas a variable resistor has resistance value over a defined range. Out of the numerous linear and Non-linear variable resistors available, the most common is the Potentiometer.

The value of the resistance can be changed from zero to a defined upper limit, by just manually sliding the contact over a resistive strip. As the resistance changes, the current through the circuit changes and hence according to the ohms law, the voltage across the resistive material also changes.

Since its covert's rotary or linear motion by the operator into a change in resistance (hence a change in electric parameter), it can be called an electro-mechanical transducer. They are passive in nature, therefore dissipate power rather than supplying power to the circuit
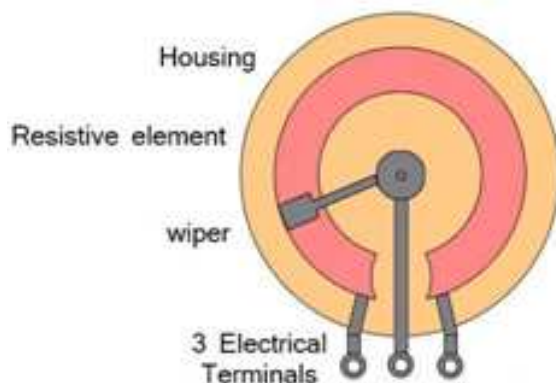

Fig: Potentiometer

JOYSTICK

Joystick is an input device. Analog joystick is sometimes called as Control Stick. It is used to control the pointer movement in 2-dimension axis. The joystick has two potentiometers to read user's input. One potentiometer is used to get the analog output voltage for X-Direction movement and the other potentiometer is used to get the analog output voltage for Y-Direction movement. The potentiometers are connected between +VCC and Ground. They simply behave as Voltage Divider Network.

The joystick has one freewheeling Holder. According to the holder movement, the potentiometer knob changes its position and resistance of the potentiometer.

SOFTWARE DESCRIPTION

A software is a set of instructions and associated documentation that tells a computer what to do or how to perform a task or it mean all the software on a computer, including the applications and the operating system.

Arduino is a prototype platform based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed and ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. The key features are:

➤ Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.
➤ You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE.
➤ Unlike most previous programmable circuit boards, Arduino does not need an extra piece of hardware (called a programmer) in order to load a new code onto the board. You can simply use a USB cable.
➤ Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks the functions of the microcontroller into a more accessible package.

CONCLUSION

Finally, our robot helps to lift the heavy objects which cannot be lifted by normal people by mimicking the actions made by us.

This robot can be easily controlled or driven to where ever required with ease because it is controlled by joystick.

FUTURE SCOPE

This robot can be further extended by adding a GPS sensor by which the robot can go fully wire-less.

By creating algorithms which automatically tells the robot to lift the objects and place them in particular order when a destination or a source is reached.

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