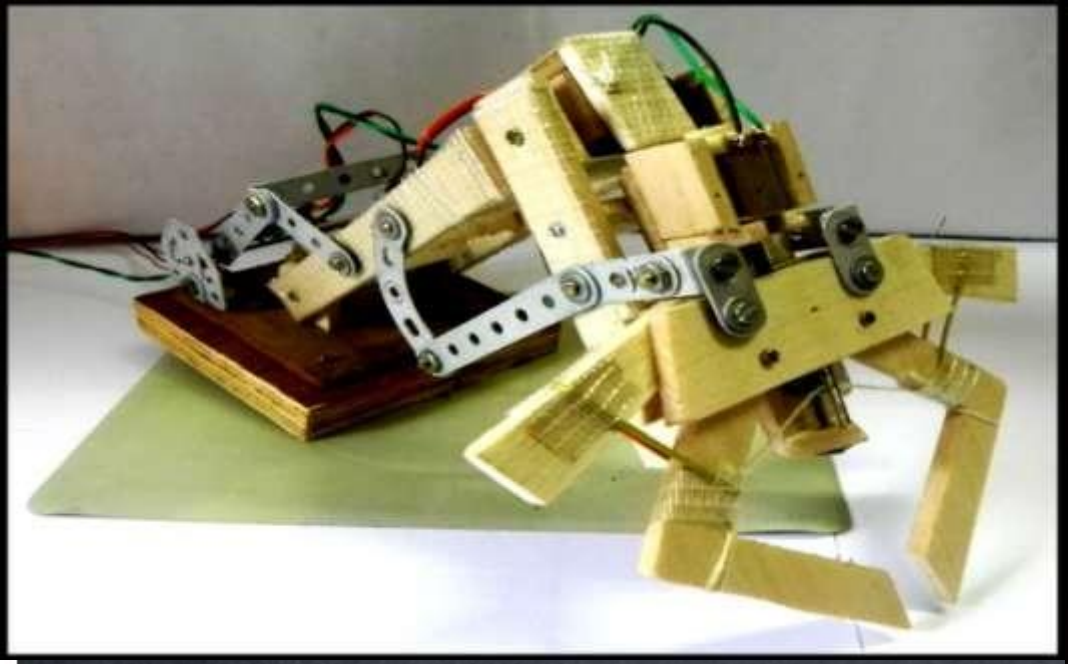
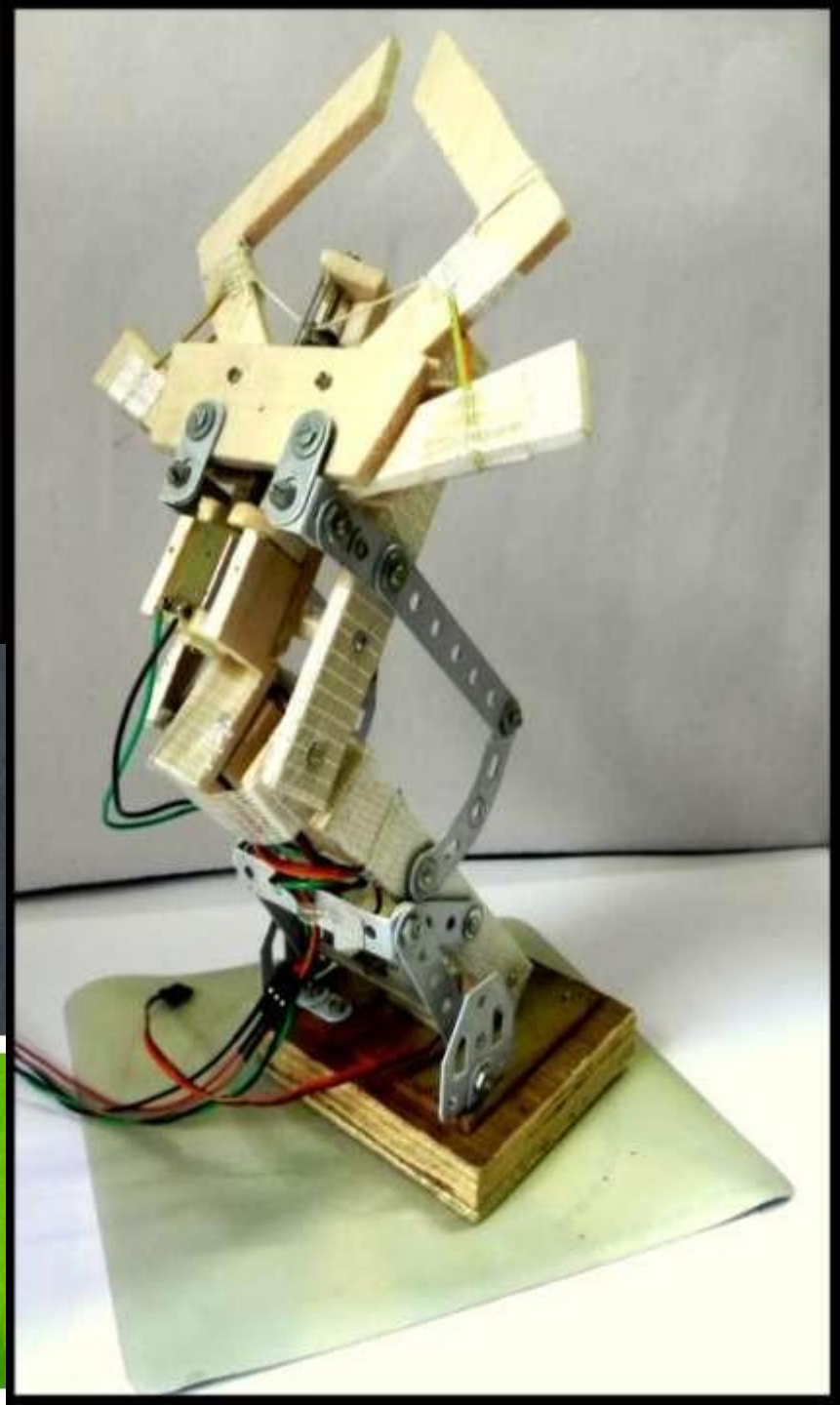


introducing

ROBOTICS ARM



- Prakhar Verma
- Ravindra Faujdar
- Rishabh Mishra
- Udit Nayyar

Aim of the Project

- The main aim of our project is to build a robotic arm that can grip or pick things
- We have implemented the robotic arm that can be controlled using Potentiometer. We have proposed a simple algorithm for hand gesture recognition.

What is a

ROBOTICS ARM???

ROBO ARM & DEGREE OF FREEDOM

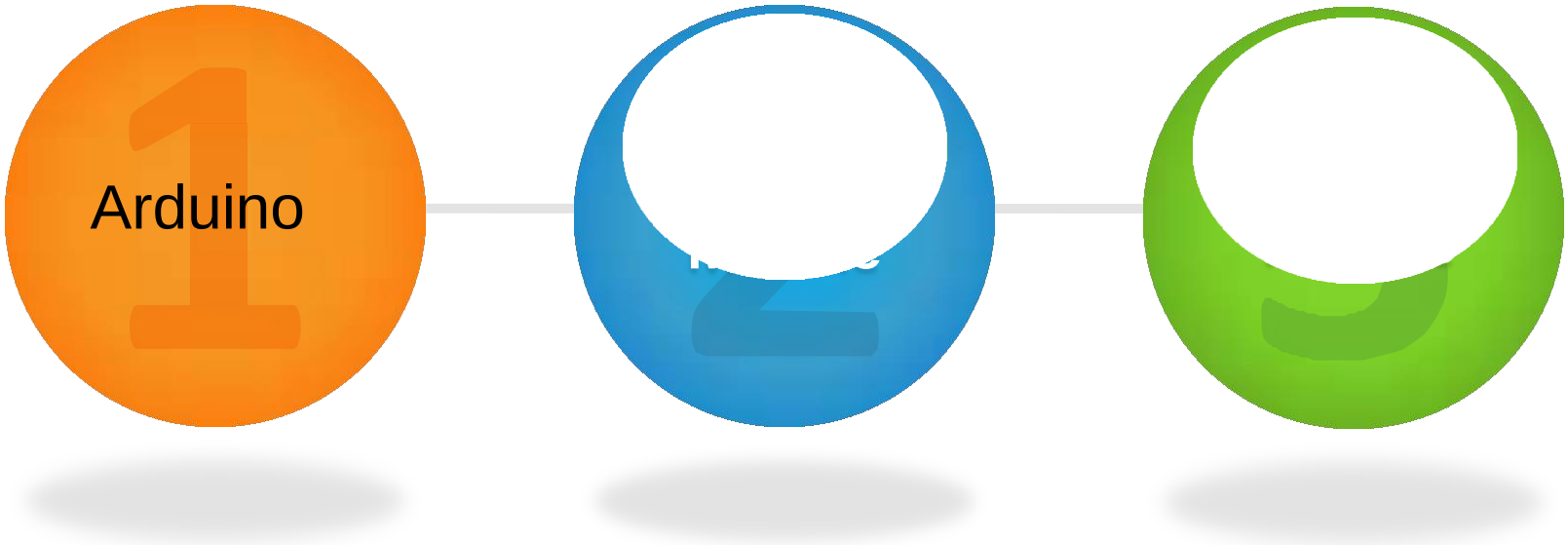
- A robotic arm is a robotic manipulator, usually programmable, with similar functions to a human arm.

- It has about the same number of degree of freedom as in human arm.

MAKING OF ROBOTICS ARM AT A GLANCE

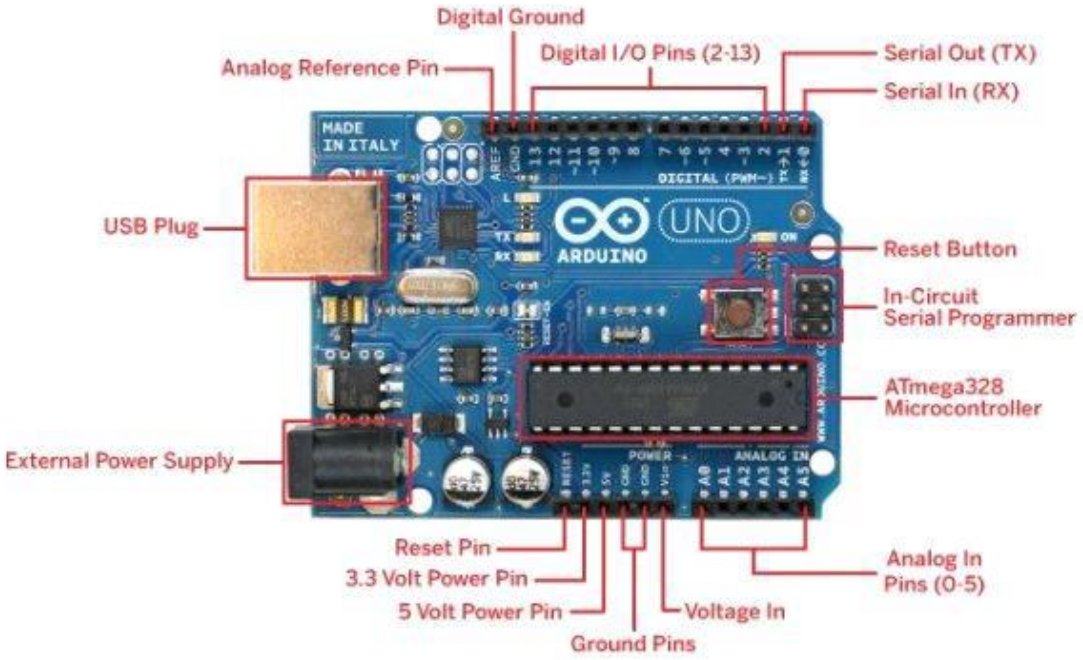
- The movement of the human arm is sensed by Potentiometer
- The Potentiometer generates an analog voltage accordingly.
- The movement of fingers is sensed by Potentiometer which causes a change in the resistance
- An impedance follower is used to convert the resistance to voltage.
- It is then sent to the microcontroller.
- Microcontroller differentiates all data
- These data are used to generate PWM signal for corresponding servo motors.
- The data from Potentiometer are used to drive a servo motor
- This servo motor drives the servomotor of the gripper part

How to Build a Potentiometer Controlled Robotic Arm



We have technical details for every step of the way

Arduino


Digital Ground
Analog Reference Pin
Digital I/O Pins (2-13)
Serial Out (TX)
Serial In (RX)
USB Plug
Reset Button
In-Circuit
Serial Programmer
ATmega328
Microcontroller
External Power Supply
Reset Pin
3.3 Volt Power Pin
5 Volt Power Pin
Ground Pins
Voltage In
Analog In
Pins (0-5)
MADE
IN ITALY
UNO
ARDUINO

ARDUINO

Power USB

Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection

Power (Barrel Jack)

Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack.

Voltage Regulator

The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.

Crystal Oscillator

The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.

Arduino Reset

You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labelled RESET.

Pins (3.3, 5, GND, Vin)

3.3V (6) − Supply 3.3 output volt

5V (7) − Supply 5 output volt

Most of the components used with Arduino board works fine with 3.3 volt and 5 volt. GND (8)(Ground) − There are several GND pins on the Arduino, any of which can be used to ground your circuit.

Vin (9) − This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.

Analog pins

The Arduino UNO board has five analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.

Main microcontroller

Each Arduino board has its own microcontroller (11). You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.

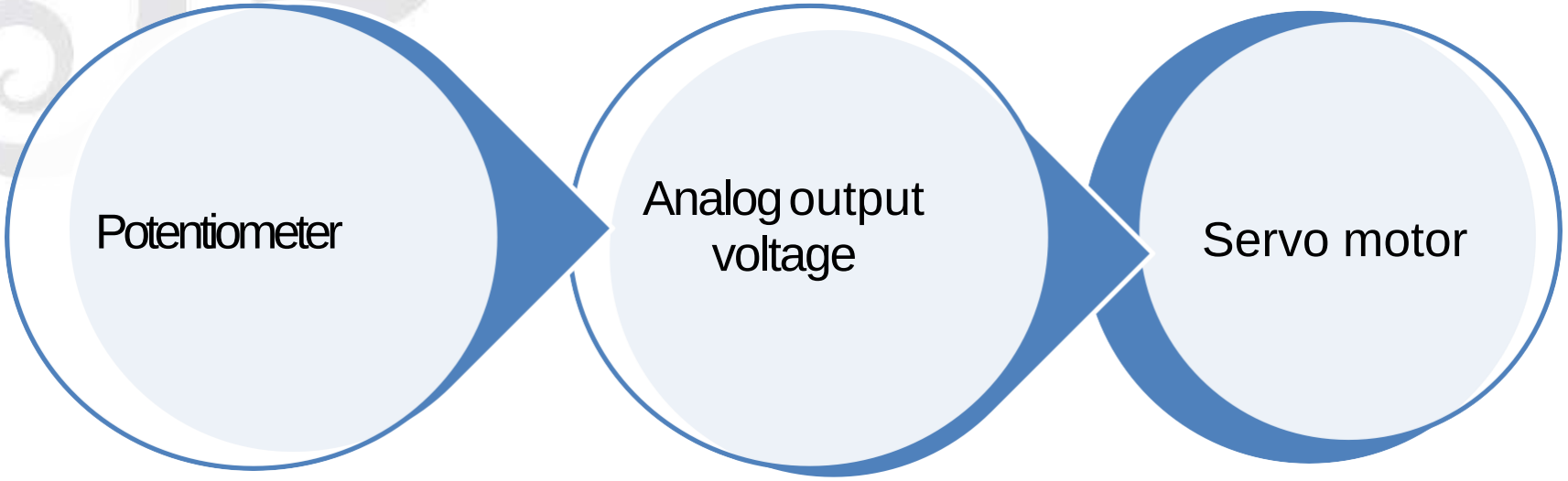
Power LED indicator

This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.

Digital I/O

The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labelled can be used to generate PWM.

How the Commands can be Captured?



Potentiometer

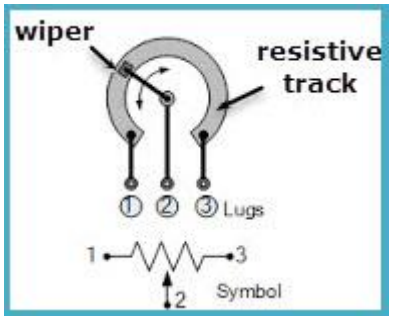
POTENTIOMETER

- The movement of the human arm is sensed by Potentiometer
- The Potentiometer generates an analog voltage accordingly
- Analog voltage passes through a lowpass filter

Working of Potentiometer

A potentiometer is also commonly known as pot. These potentiometers have three terminal connections. One terminal connected to a sliding contact called wiper and the other two terminals are connected to a fixed resistance track. The wiper can be moved along the resistive track either by use of a linear sliding control or a rotary “wiper” contact. Both rotary and linear controls have the same basic operation.

The most common form of the potentiometer is the single turn rotary potentiometer. This type of potentiometer is often used in audio volume control (logarithmic taper) as well as many other applications. Different materials are used to construct potentiometers, including carbon composition, cermet, conductive plastic, and the metal film.



GRIPPING MECHANISM

- For gripping mechanism, Potentiometer are used.
- Potentiometer are sensors that change in resistance depending on the amount of turns
- They convert the change in rotation to electrical resistance-the more the rotation, the more the resistance value

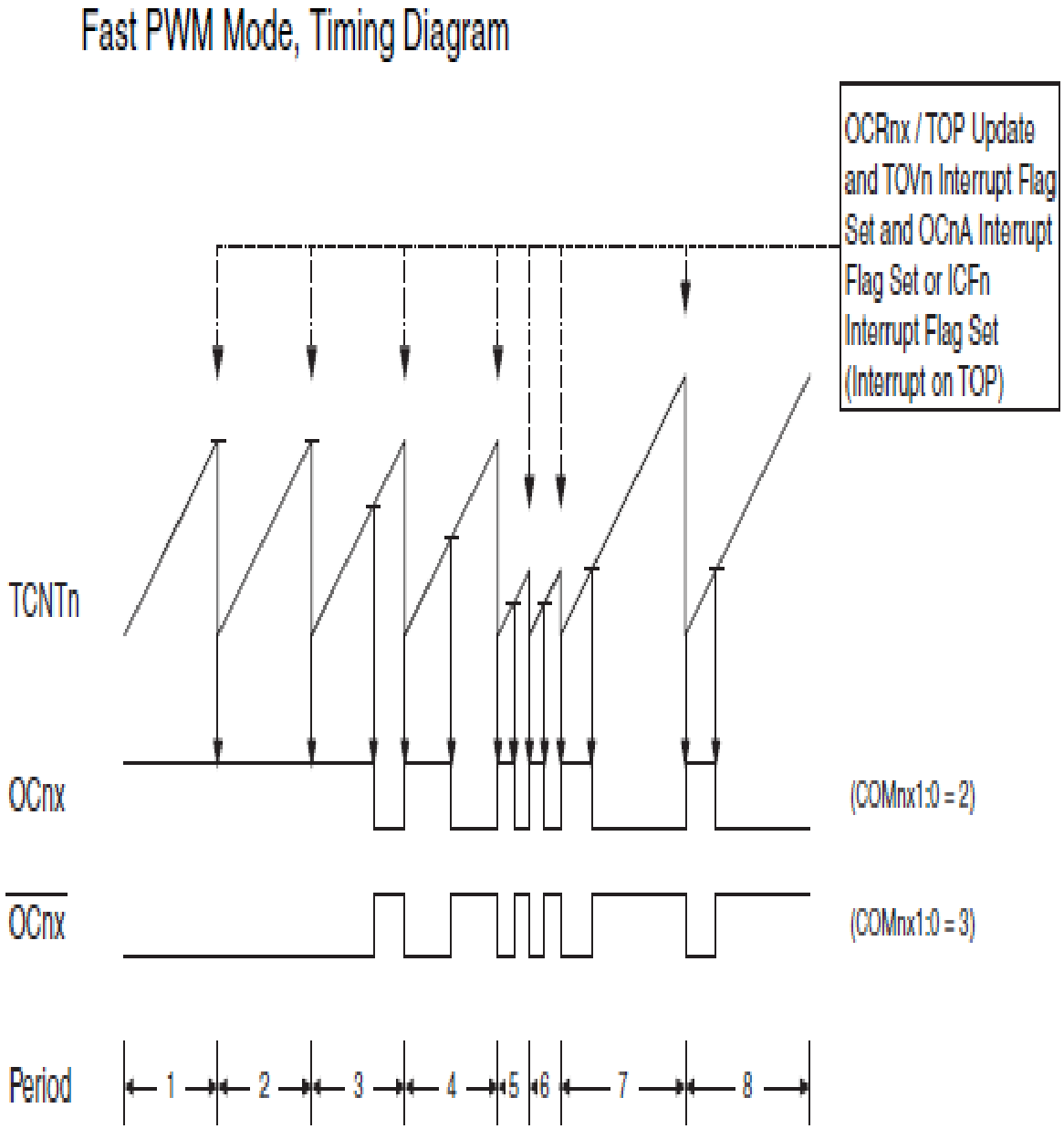
- Inside the Potentiometer are carbon resistive elements within a thin seperated substance.
- More carbon means less resistance.
- When the substrate is rotate the potentiometer produces a resistance output relative to the bend radius-the larger the radius, the higher the resistance value

Activating the Potentiometer:

- Potentiometer first remains at constant mode.

- A positive high signal sent to analog pin of arduino uno to activate the servo motor.

Initializing PWM for driving motors:

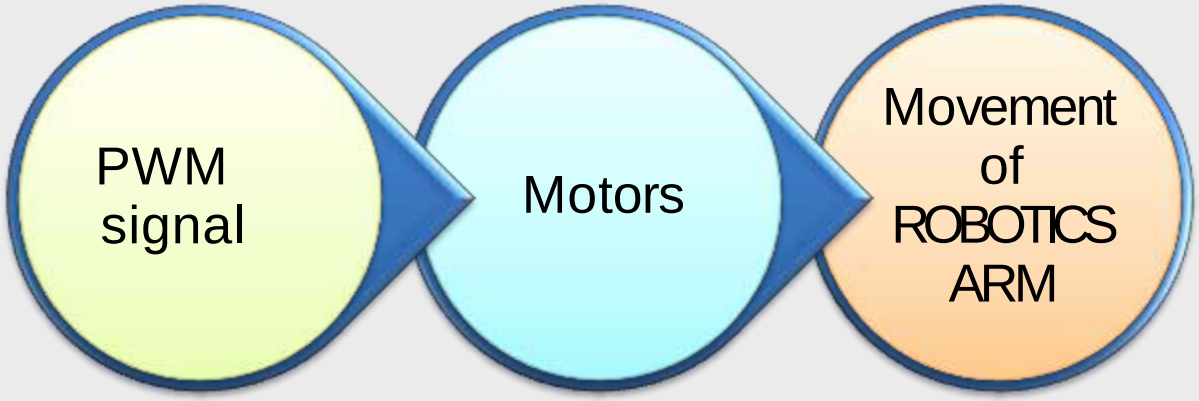


- The Timer/Counter (TCNT1), Output Compare Registers (OCR1A/B), and Input Capture Register(ICR1) are all 16-bit registers.
- The double buffered Output Compare Registers (OCR1A/B) are compared with the Timer/Counter value at all time. The result of the compare can be used by the waveform generator to generate a PWM or variable frequency output on the Output Compare Pin (OC1A/B).
- The 16bit timer/counter1 (TCNT1) is set for fast PWM mode. The time period is set at 20ms. The Timer/Counter can be clocked internally, via the prescalar. Prescalar value is set at 64 division factor
- For output PB1 and PB2 are selected

Collect data and Follow instructions

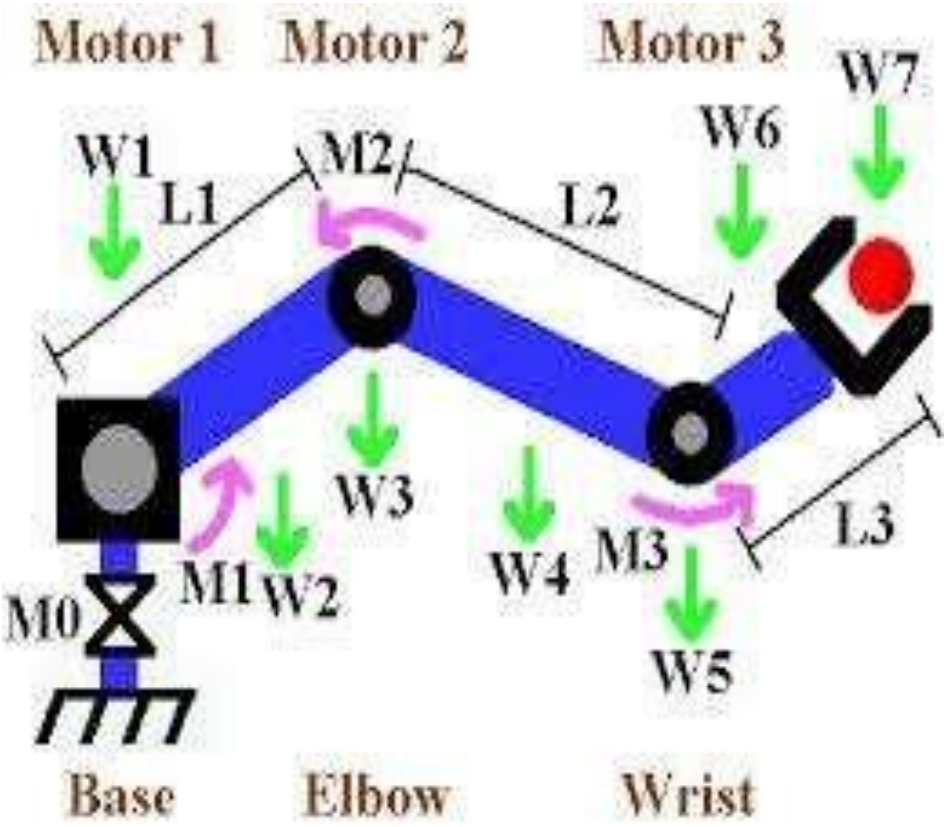
EXECUTION Module

WORKING OF MECHANICAL PART



MOTORS

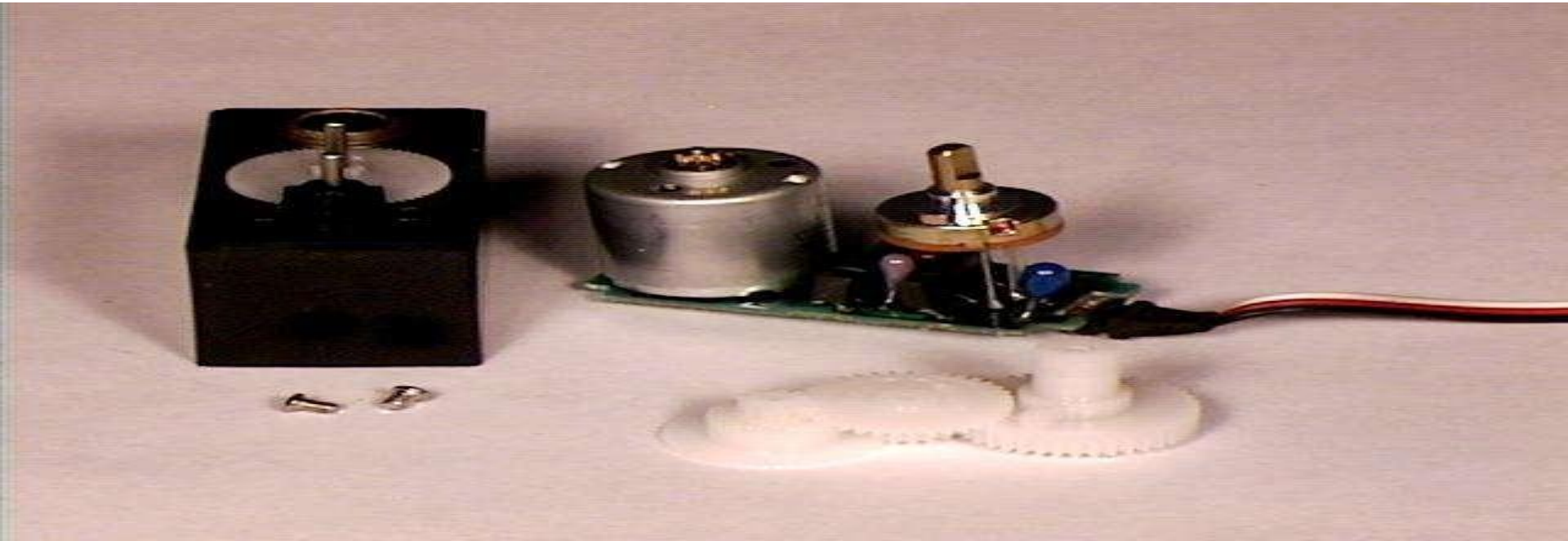
- Motors are used for joint rotation.
- The base consists of a servo motor allowing forward/backward movement.
- The elbow consists of a servo motor allowing up/down movement of the arm.
- The grip consists of motor allowing to grip a object.



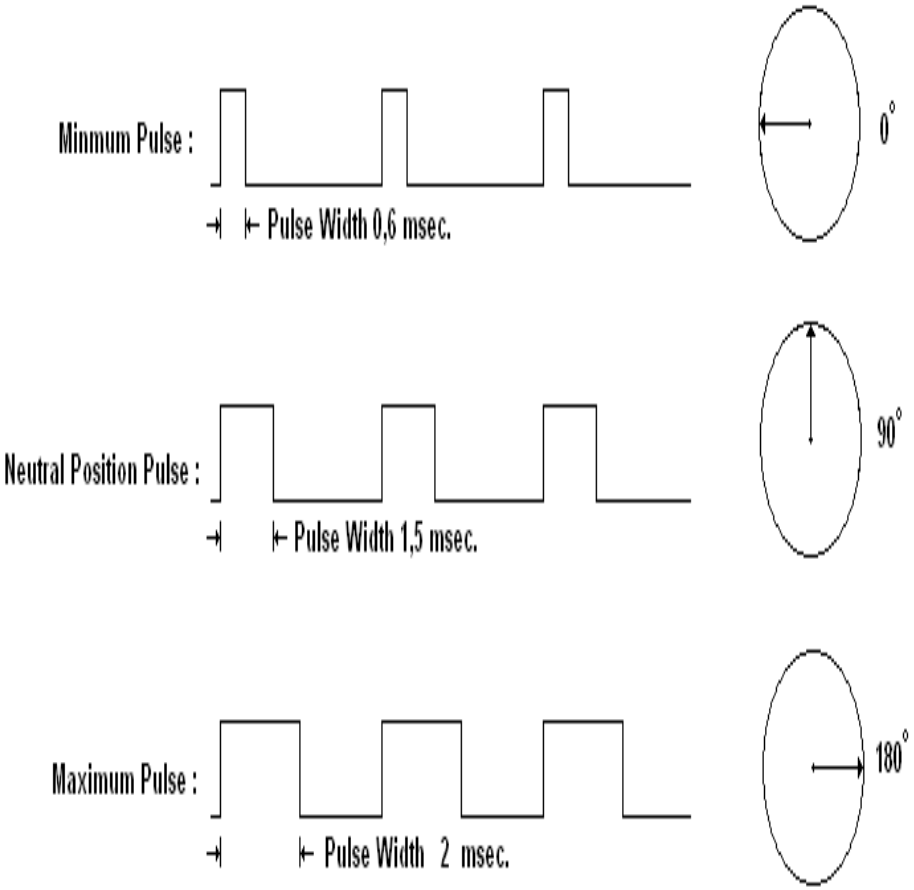
What makes a Servo Motor

Servo motors are constructed out of basic DC motors, by adding:

- some gear reduction
- a position sensor for the motor shaft
- an electronic circuit that controls the motor's operation



How do servo motors work ?



- Servos are controlled by sending an electrical pulse of variable width, or pulse width modulation (PWM), through the control wire.
- There is a minimum pulse, a maximum pulse, and a repetition rate.
- Servo motors can usually only turn 90 degrees in either direction for a total of 180 degree movement.
- The PWM sent to the motor determines position of the shaft, and based on the duration of the pulse sent via the control wire; the rotor will turn to the desired position.
- The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90-degree position. Shorter than 1.5ms moves it to 0 degrees, and any longer than 1.5ms will turn the servo to 180 degrees,

But wait…

There's More!

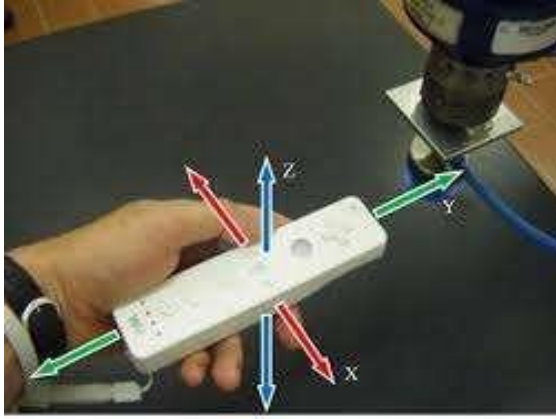
Why we need ROBOTICS ARM???

SOME APPLICATIONS

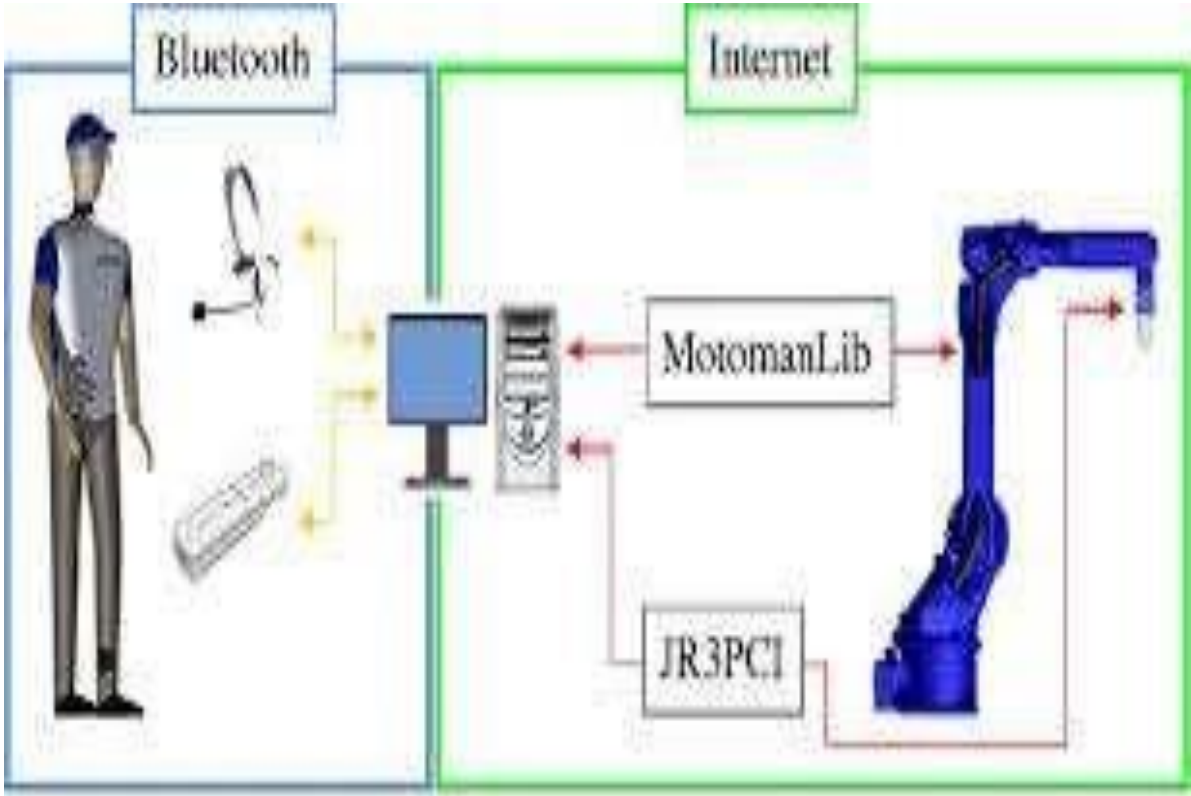
- The robotic arm can be designed to perform any desired task such as welding, gripping, spinning etc.
- The space shuttle Remote Manipulator System have multi degree of freedom robotic arms
- In various industrial or home applications
- In medical science: soft tissue manipulation, needle insertion, suturing, and cauterization.

FUTURE SCOPE

- **MECHANICAL DESIGN**-more efficient,reliable,improved power
- **UNIVERSAL GRIPPER**-capable of doing multiple tasks
- **MOBILITY & NAVIGATION**-mobile,able to move under their own power & navigation systems
- **SENSOR CAPABILITIES**-3 Potentiometers used for shoulder,elbow & wrist movement allowing circular & angular movements
- **TELEPRESENCE**-communicate information about its environment back to a remote "safe" location
- **INTELLIGENCE**-Capable of making decisions about the task it performs.



Note: In both movements the Wii remote is held horizontally



Note: The input devices work without wires (via Bluetooth), giving a greater freedom to the user

CONCLUSION

Robots help people with tasks that would be difficult, unsafe, or boring for a real person to do alone. To conclude, robotic arm, is probably the most mathematically complex robotic part one could ever build.

ACKNOWLEDGEMENT

Our deepest thanks to our mentor, Mr Amir Khan, for helping us out and guiding us with his valuable suggestions and support.

THANK YOU