Animatronic Hand

-3rd year BTech

Introduction

Implementation of Animatronic Hand using the Arduino microcontroller and control the animatronic hand using the manual hand movements.

This project intends on replication of the manual hand movements as well as recording and re-implementation.

A word about Animatronics:

Animatronics is the use of cable-pulled devices or actuators to animate a replica of a human or an animal, or bring lifelike characteristics to an otherwise inanimate object.

How to replicate Hand movements?

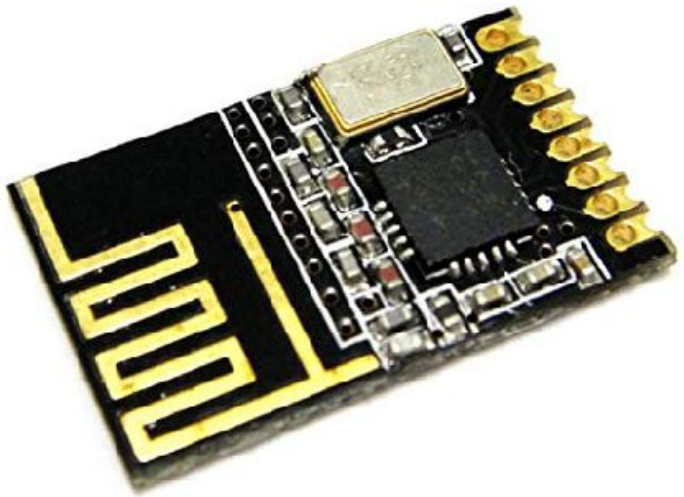
Sensing via Flex sensors, processing and controlling using Arduino, movement using servo motors.

Flex Sensors

A flex sensor or bend sensor is a sensor that measures the amount of deflection or bending. Usually, the sensor is stuck to the surface, and resistance of sensor element is varied by bending the surface.

Since the resistance is directly proportional to the amount of bend it is used as flexible potentiometer. Hence these sensors can be used to sense the bending/movement of the fingers.

The RF-module: nRF24L01



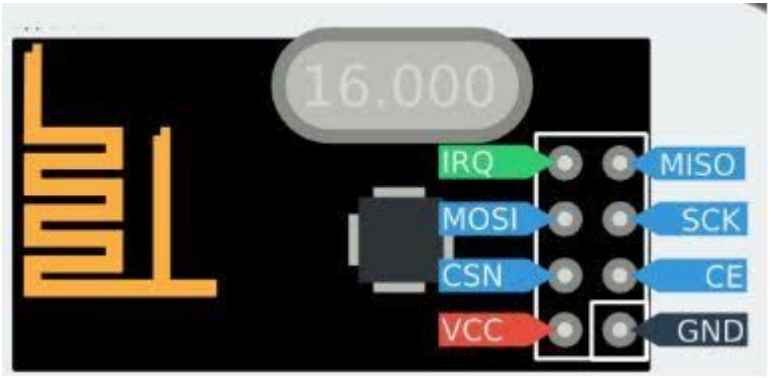
RF module : nRF24L01

A single chip radio transceiver for the world wide 2.4 - 2.5 GHz ISM band.

The transceiver consists of a fully integrated frequency synthesizer, a power amplifier, a crystal oscillator, a demodulator, modulator and Enhanced ShockBurst protocol engine. Output power, frequency channels, and protocol setup are easily programmable through a SPI interface.

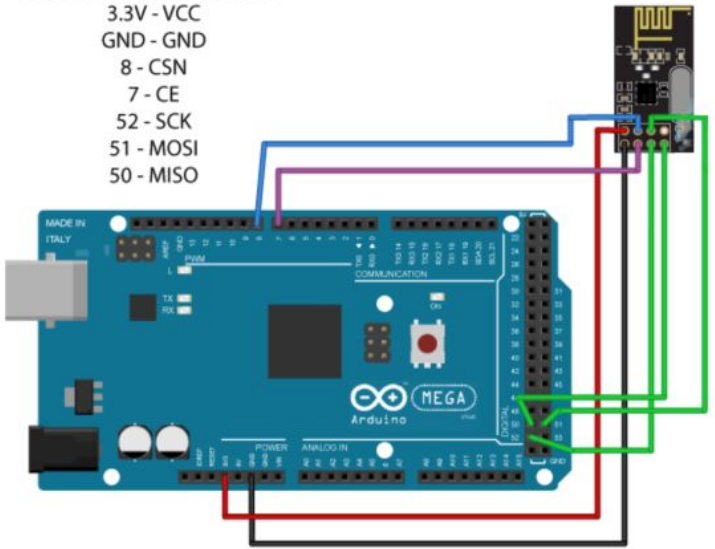
Current consumption is very low, only 9.0mA lesser than an LED. Built-in Power Down and Standby modes makes power saving easily realizable.

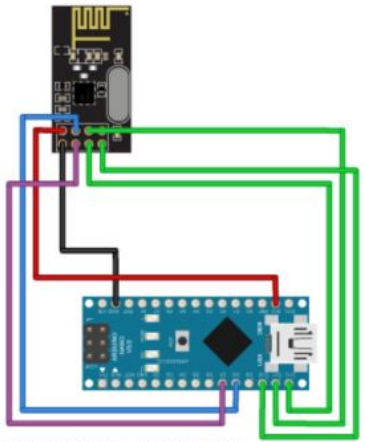
Three of these pins are used for the SPI communication. These will be connected to the SPI pins of the Arduino.



Arduino Mega - NRF24L01

3.3V - VCC
GND - GND
8 - CSN
7 - CE
52 - SCK
51 - MOSI
50 - MISO



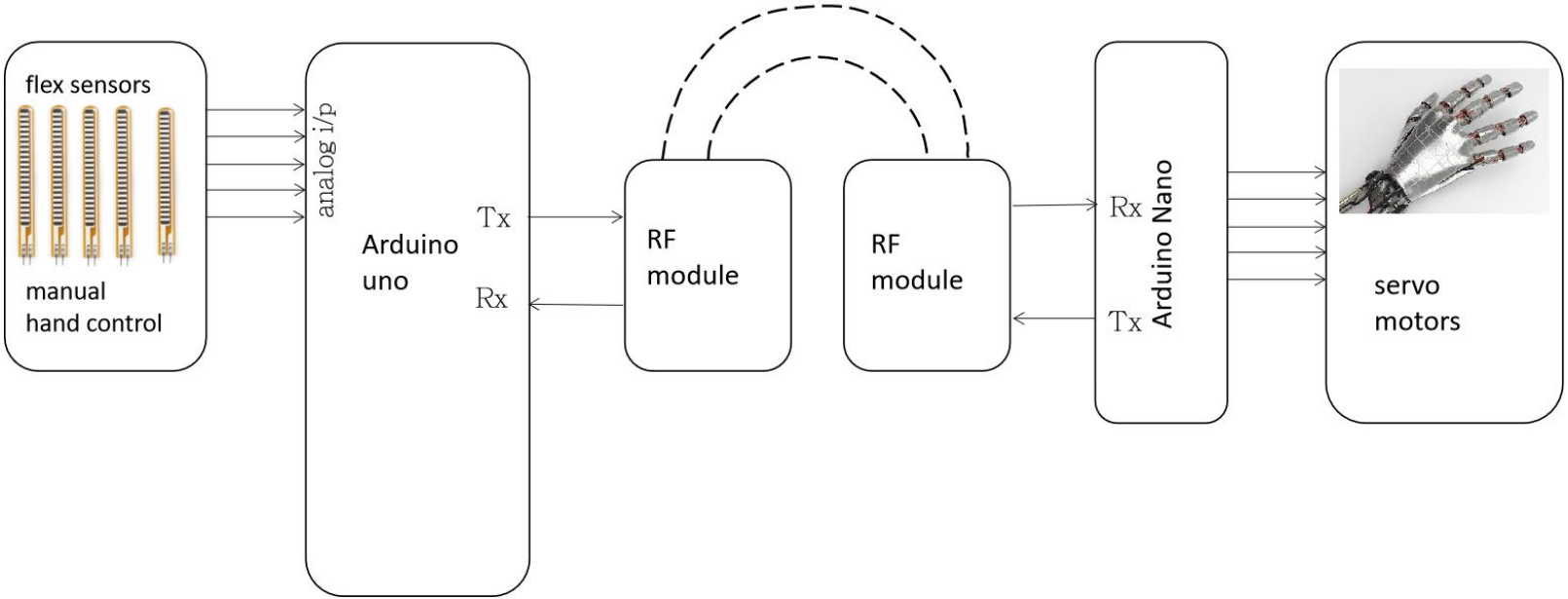


Arduino Uno/ Nano - NRF24L01

3.3V - VCC
GND - GND
8 - CSN
7 - CE
13 - SCK
11 - MOSI
12 - MISO

The working

The Block Diagram



Elements of Block Diagram

1. Sensing
2. Processing
3. Sending and receiving
4. Assessing the received
5. Movement
6. The Buttons

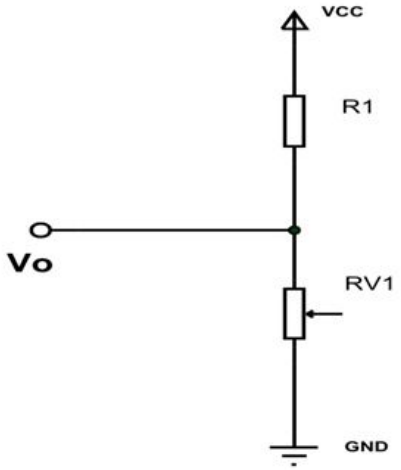
1.Sensing

The flex sensors are attached to the Manual Hand so that the amount of bending can be read from the sensors.

The flex sensors are length dependent resistors, i.e, their resistance changes depending on the amount of strain in their length. The flat resistance is 25k ohms and the bend resistance ranges from 45k ohms to 125k ohms.

Therefore these are used in a voltage divider circuit are the voltage across them is sensed using the Arduino (microcontroller)

1.1 Voltage divider circuit to sensing



2. Processing

The voltage across the flex sensors is connected to the analog pins of the Arduino board and are read in the range of 0000-1023.

This range is mapped to the required amount of “degrees of rotation” to be sent to the servo-controller Arduino (0^o to 180^o).

The mapped data is now sent to the Arduino Nano using nRF24L01, an RF-module.

Sending and Receiving

The sending and receiving are done using the RF-modules in the Arduino UNO and Arduino Nano respectively.

The inputs from flex sensors, after being processed, are sent to the RF-receiver at Arduino NANO.

Assessing the Received Data

The received data is sent to the servo motors as per which servo and how much of the rotation is intended.

Movement

The servos rotate and pull the strings in the animatronic hand. The fingers connected to the strings move accordingly.

Hence desired movement is produced at the animatronic hand.

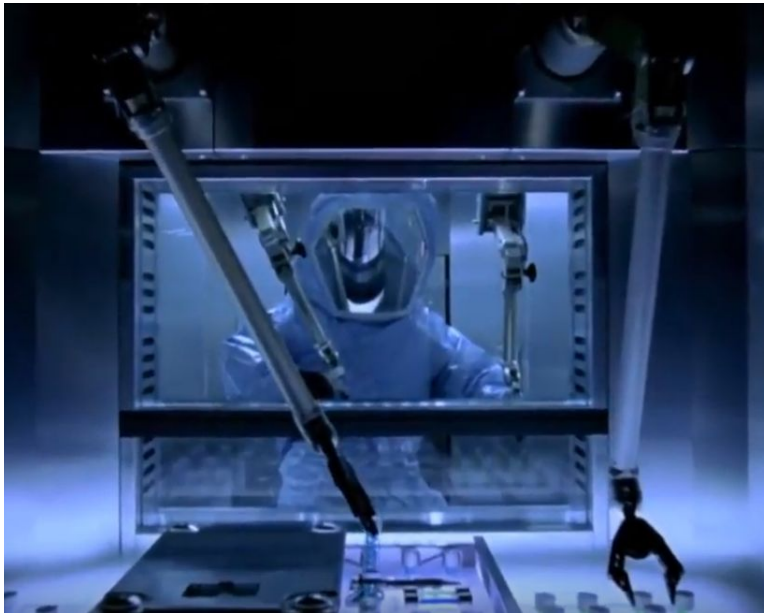
The Buttons

There are three buttons in the circuit. These are used for…

1. Replicate:
    a. When pressed, the Animatronic hand replicates the Manual hand
2. Record:
    a. When pressed, the manual hand movements are recorded in an array.
3. Animate:
    a. When pressed, the recorded hand movements are animated in the Animatronic Hand.

Applications

I) To operate a second hand in order to avoid skin diseases in chemical field by avoiding direct contact.



3) DIFFUSION OF BOMBS WITH THESE ANIMATRONIC HANDS ARE PREFERRED WHERE THERE IS HIGH RISK OF LIVES.

More Applications

- Two hands for the same work can be used at one using the animatronics
- Can be used for space station repairs in space
- Animatronics can be employed in applications where direct human contact can be harmful

MERITS AND DEMERITS

MERITS

- Ease to handle in a simpler manner.
- Requires less maintenance.
- No unemployment issues as it only safeguards the employees either in chemical environment.
- Enables physically challenged differently.

DEMERITS

- High power motors are utilized to compensate many joints(motors).

Conclusion

Thus the multi-versatile animatronic hand can be implemented and can be used for various applications in its advanced design models.

The project, focussed on the basic model of the animatronic hand, thereby can be realised using the concepts of basic mechanics, electronics and arduino alongside.

References

Advanced Microcontrollers subject (EC509)

A paper in IEEE journal “Animatronic Hand Using Arduino” by Jagruti P. Gour, Jayswini K. Shende, Karishma K. Kubde, Samiksha K. Kothekar, Prof. Pankaj S. Taklikar.

skyfilabs.com

Thankyou

Team :

1.	EC17B1010	B MIHIRA MADHAVA	ECE
2.	EC17B1030	N S S PRANATHI	ECE
3.	EC17B1053	S NAVEEN RAJA	ECE
4.	EC17B1054	S BHAVANA	ECE
5.	EC17B1055	SREYA SASIKUMAR	ECE
6.	CS17B1042	M SAI KRISHNA	CSE