Wireless Movable Robotic ARM

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Abstract. In recent years there are many researches has been done in robotics and the development of the robot to for many application in various area for accurate and precise working. In the different form Robots are used in industry for the more and accurate production. Robotic arm is used as prosthetic arm for the amputee person and many other applications of the robotic arm. For this purpose various kind of sensors are required. In the Wireless Movable Robotic Arm the EMG (Electromyography sensor) is used for sensing the Activity and the output of the electromyography sensor is goes to the controller. According to the sensed signal The movement of the fingers of the robotic arm is controlled.

Keywords. Wireless Communication, Electromyography sensor, Robotic Arm

1. Introduction

Sensor in the Robotic Arm on the function of human sensory organs. The Robotic Arm required extensive information about the environment in order to function effectively. Various kind of sensors are used in the Robotic Arm for the controlling the Robotic arm according to the function of the sensors. That sensors are having different ability to sense like sound sensor is use for sound input signal, touch sensor, proximity sensor, all sensor are required according to the application of the robotic arm In such are of operation which are dangerous for the human the robots can be implant it saves the human life and reduces the risk of the human like in the firefighter if the robots are used in those places. In the mining sectors, and in the industries where large production required if the robots are implanted in this sector so that the production can be increased in the very great amount with the minimum accident and the risk of the life. For the amputee person who always depend n the other person for their daily routine so Robots are use for those kind of person so the person will not be depend on the other for the daily routine. In this term the robot means the robotic arm which are used for the make their life easy.

In the wireless Movable Robotic arm the electromyography sensor is used. EMG signals are used in many clinical and biomedical applications. EMG signal is for diagnostics and identifying neuromuscular diseases. EMG are also used as a control signal for prosthetic hand, arm, and lower limbs. In this the EMG sensor is placed on the Am to sensed the muscle signal and then these signals are being filtered and rectified and the output of the EMG signals are send to the controlling for the further operation.

This is the wireless device can be operated from the long distance with the specific range of distance wirelessly. For the wireless communication of NRF24L01 is used this is the wireless transceiver. In this one module can send and receive the signal so that one device can be work as transmitter or receiver. In this two transceiver module are used for the wireless communication. This module works on the 2.4-2.5 GHz ISM band. The transceiver consist of a fully integrated frequency synthesizer, a power amplifier, a crystal oscillator and a modulator.

The controllers are used in this are ARDUINO UNO and ARDUINO NANO the ARDUINO NANO is used at the transmitter section and the ARDUINO UNO is used at the receiving section the output of the EMG sensor is given to the ARDUINO NANO at the transmitter section and according to the EMG signal the ARDUINO UNO send the signal to the receiver and at the output ARDUINO UNO will control the servo motor. The servo motor is used is SG90servo motor used for the movement of the fingers.

2. Literature Review

a. Robotic arm control method using forearm EMG signal

This study designed a manipulator control system based on forearm surface EMG signals. The system has simple control method, good real-time performance and fast response. It realizes the real-time interaction between human and robotic

arm, which proves the feasibility of using surface electromyography signals to control the robotic arm and control external equipment for other physiological electrical signals in the future. Platforms and references provided. However, because the EMG signal is easily affected by factors such as muscle fatigue and sweating, the recognition results are unstable, and the operator needs to maintain a posture for a long time to continue to exert force, which is poor in experience. These factors hinder the superficial muscle-based Development of Electric Control Research. In future research work, reducing the influence of external factors on EMG signals will be the focus of work.

b. Bionic prosthetic hands: A review of present technology and future aspirations

In the middle ages the prosthetic hand was present only as a prop. Today we have bionic hand prostheses that give much better functionality, are acceptable to more patients and are durable and comfortable. However these prostheses still have to overcome considerable hurdles in order to mimic or even improve upon the intrinsic hand and they carry significant economic implications. The progress to bio-artificial organs that are fully integrated into the central nervous system and have capabilities that surpass our own may still sound more like science fiction than science fact but can cohesive work between medicine, engineering and materials science make the 6 Million Dollar Man a reality.

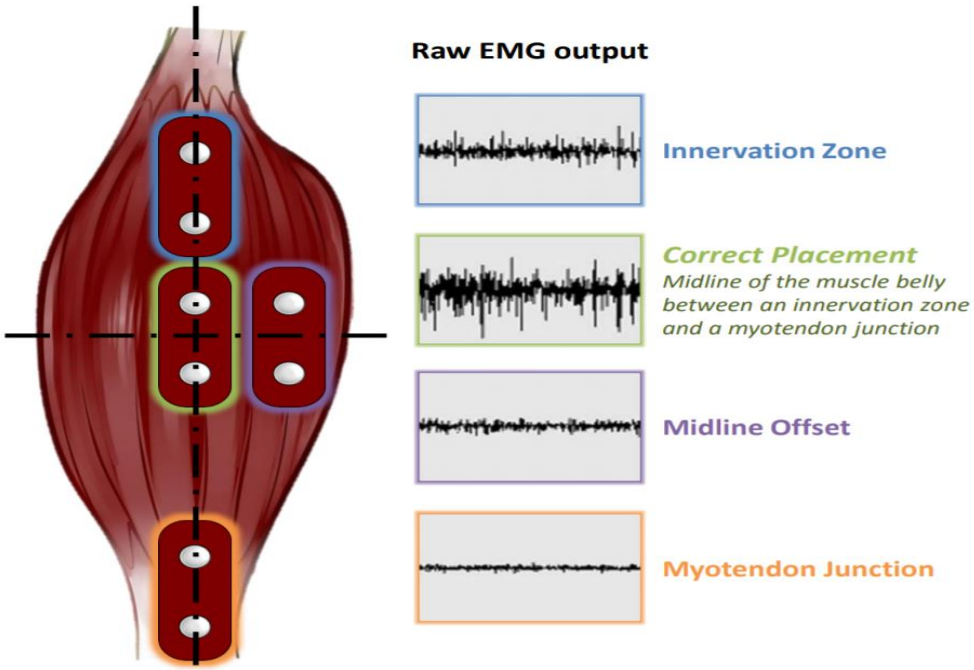
3. Related Work

a) Electromyography

Electromyography sensor is used for the measure the muscle activity of the muscle. The EMG sensor muscle sensor is measure muscle activation via electric potential, referred as a electromyography (EMG), has traditionally been used for medical research and diagnosis of neuromuscular disorders. However with the advent of ever shrinking it mot more powerful microcontroller and integrated circuits, EMG sensor and circuit have found their way in the robotic and the other control system.

b) Placement of the EMG sensor

Position and orientation of the muscle sensor electrodes and the electrodes has a vast effect on the strength of the signal. The electrodes should be aligned with the orientation of the muscle fiber. Placing sensor in the other location will reduce the strength and quality of the sensor's signals due to a reduction of the number of motor units measured and interference attribute to crosstalk.



In this project the myoware muscle sensor is used as the input device placed at the muscle of the arm this sense the muscle activity of the human arm which sense the contraction of the muscle via the potential variation of the potential and send the output is given to the controller unit of the transmitter section.

c) Control section of the transmitter

The control unit of transmitter section contains ARDUINO NANO. Output of the EMG sensor is considered as EMG signals which is given to the ARUINO NANO. According to the input signal the threshold level is being set. If the EMG signal is goes beyond the preset threshold level then the controller send the actuation signal to the servo motor at the receiver section.

d) Wireless Device

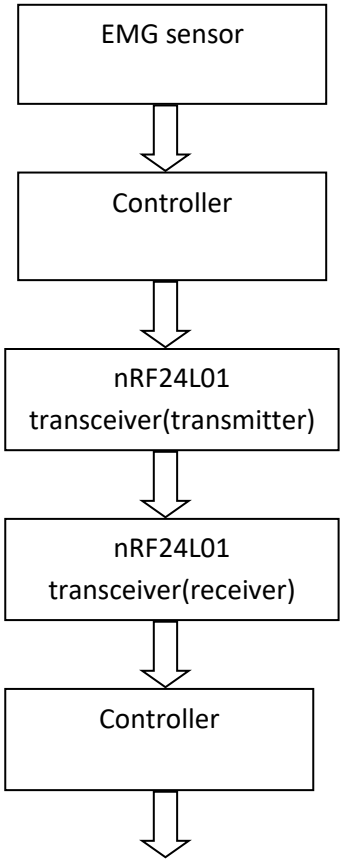
In this project wireless device is used for the communication between the two sections. In this one section myoware EMG sensor is used which sense the input signal and send it to the receiver section. nRF24L01 is used for the wireless communication.

The nRF24L01 is configured and operated through a serial peripheral interface (SPI). Through this interface the register map is available. The register map contains all configuration register in the nRF24L01 and is accessible in all modes of chip. The range of operation of the nRF24L01 is 2.4GHz ISM band operation.

e) Control section of the Receiver

This section contains ARDUINO UNO and servomotors that are controlled by the controller. This section receives the data from the transmitter section and according to the input actuation signal this controller control the servo motor. So that movement of the fingers can be achieved according to the human muscle signal.

4. Block diagram



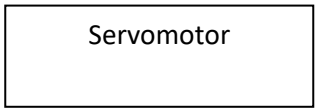


Fig. Block diagram of Wireless Movable Robotic Arm

- Figure shows the block diagram of wireless movable Robotic arm which has the following six blocks EMG sensor is use as input device for the Robotic arm according to the contraction of the human muscle Variations are occurred in the EMG sensor this sensor has two type of output one is Raw input and the integrate signal at the initial stage the signal sensed by the sensor is raw signal then the signal is rectified, filtered and integrated so that the output of the muscle sensor are achieved are integrated that are very efficient for the signal analysis. The output of EMG sensor is given to the controller.
- Wireless Movable Robotic arm is contains two control devices that are used in the transmitter and receiver in the transmitter ARDUINO NANO used in the transmitter which take input from the EMG sensor. This signal is called as EMG signal that are fed to the ARDUINO NANO. This controller is used for analysis and according these signals threshold level is set if the input value is reach above that level then the controller send the control signal to receiver wirelessly.
- nRF24L01 is a wireless device which operated on the frequency range of the 2.4-2.5GHz ISM band this is transceiver module used to send and receive the signal at the same time. In this two modules are used for the wireless communication.
- In the receiver section ARDUINO UNO is Controller this receives the signal from the transceiver module and accordingly to the input signal it sends the control signal to servo motor.
- Servo motor are used for the control the fingers of the Robotic Arm. It has in build motor driver used for control the rotation of the servo motor.

5. Hardware requirement

- 3-lead Muscle sensor
- nRF24L01 Single chip 2.4 GHz transceiver
- ARDUINO UNO
- ARDUINO NANO
- Servo motors
- 16-channel Servo motor driver

6. Conclusion

EMG is compatible for many applications in robotics and as this is used as the control signal of the system so that real time monitoring of the muscle is possible. According to this EMG signal the finger control is achieved. As the Robotic arm is wireless so that the operation of the wireless successfully done. And according to the human muscle activation the movement of the robotic fingers are successfully achieved.

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