Review Paper on Wireless Movable Robotic ARM

Rahul Mohadikar[1], Amit Bokade[2], Kalyani Barapatre[3], Sanjana Bagde[4], Dr. J. S. Gawai[5]
[1,2,3,4]*Students, Department of Electronics Engineering, K.D.K.C.E, Nagpur, India*
[5]*Professor & HOD, Department of electronics Engineering, K.D.K.C.E, Nagpur, India*

Abstract **- Robotic arm is widely used for industrial robotics and automation. In recent years there are lots of development has been done in the robotics in terms of controlling the arm, the various methods of sensing the signals has been used such as joystick control, controlling using flex sensors, kinetic sensors, accelerometer and gyroscope, etc. This research paper presents Robotic arm control which controlled using EMG signal detection. The electrode sensor needed to read contraction muscle signals. These signals will be processed in EMG instrumentation amplifier next these signals will send to the controller. And controller processed and then send to the receiver section through the wireless transmitter. At the receiver these signals are received and processed at the controller presents in the receiver according to that processed signals the movement of the fingers are controlled.**

Index Terms **- Robotic arm, wireless communication, Electromyography (EMG).**

1.INTRODUCTION

In the recent years the development in the Robotic arm been in the different level which is been developed from the mechanical control robotic arm and get developed to the potentiometer control robotic arm and switch control then such that this development has gone to the joystick controlled and the control take place by the accelerator and flex sensor, in this project the artificial robotic arm is get controlled by the EMG sensor. In the flex sensor the robotic arm is controlled by the bending of the flex sensor, as the flex sensor bends the resistance of the flex sensor is get change and the variation in the current by this variation the robotic arm is controlled.

In this project the Electromyography (EMG) sensor is used for the recording monitoring of the muscle activity of the human arm. The electromyography is used in medical purpose for the monitoring and diagnosis of the human muscle the electromyography is detect the signal generated in the muscle by the contraction of the muscle, when the muscle is being move or the bend the fingers then there is variation in the muscle signals and this variation and change in the muscle is get detected by the EMG muscle sensor this signal has been send forward to the microcontroller.

The microcontroller chip is being used in the project is ATMEGA 328. This microcontroller read the input signal which is being coming from the EMG sensor and according to the EMG sensor the further operation of the controlling the servo motor will be performed. As the name indicate it is the wireless movable robotic arm this is a wireless so that it can be controlled by the long distance wirelessly. for the wireless communication nRF24L01 transceiver is use which is a transmitter as well as receiver.

2.LITERATURE SERVE

A. Multi-Tasking EMG Controlled Robotic Arm

The proposed work is based on the extraction of the EMG signals from the muscle of the human body. The supply required for the EMG sensor is 0 to 5volts and it has inbuilt ADC unit. The digital data obtain after conversation is utilized to read by microcontroller unit. The data received at the microcontroller is then analyze and according to that control signal is sends to the various motors like stepper motor, servo motor, and DC motors resulting in a mechanical model which is design to organize the robotic arm more versatile with respect to various application. The threshold selection is a careful task and depend on the application. The thresholds are given above are general one and may be not suit to every application. The model may develop for any application like lifting things or any tasks.

B. A Compact-Size Surface EMG Sensor for Myoelectric Hand Prosthesis

In this, a dry electrode-based EMG senor has been designed for upper limb prosthetic uses. The compact

structure of the sensor make it wearable for the long time use for the prosthetic arm socket.

The developed sensor shows better output better parameter such as SNR, sensitivity and response time to commercial sensor.

The sensor was successfully tested on the amputee for the real-time controlled operation of the developed prosthetics hand. Implementation of the proportional control scheme enable the grasping force of the fingers according to EMG signal strength.

C. Hand Gesture Control Robot

The Robotic action by cord consistent by with palm Gesture. The Robot can move up to 300mtr approximately. The excepted efficiency is achieved by the transmitting section. This is the wired system so that it need a long wire to move so in the future scope aim to make the system wireless. This Robotic arm is a gesture-controlled arm so according to the gesture of the human palm the robot will move in accordance to the palm gesture of the human. It can be move forward, backward, Right, left. In the future scope the robot will be wireless so there is no bound of wire to move in the specific range, and the robot will be enable to detect the human and according to that it will be move or avoid the human and find another way to go for the specific place and according to the application the robotic can be modified and used like for the detection of bomb and pick this and defuse or take it to the safe zone these are the future scope of the Robotic arm of the Han Gesture Control Robot.

3.METHODOLOGY

This project deals with introduction of EMG signal from the body which is being generate by the contraction of the muscle and that signal is responsible for the production of movement in the robotic arm, the signal generates by the muscle is send to the ATMEGA 328 microcontroller which is use to perform read the input signal and according to the input signal the servomotor is being controlled. Both hardware and software tools communicate with one another, in order to make correct decision whether it move the arm or not, based upon the intension of the subject involved in the process. The project works with the help of Arduino codes has threshold value that distinguishes between the different EMG values obtained with the arm is able to produce flexion and extension movements accordingly. Initially, the EMG has to be acquired. For this purpose, we have to make use of surface EMG electrodes. Three electrodes are involves in this process. The active electrodes are involved in this placed on the mid muscle and the end muscle region of the biceps respectively. The reference electrode will placed near to the bony surface area of the elbow.

The muscle activity of the arm is detected by the EMG muscle. Proper position of the electrode is necessary for the operation. At same time the electrodes that have been chosen should be capable of picking up desired EMG signals more effectively. Once the signal is being detected then next step is to process the raw EMG signal to get clear result at the end the stages of EMG signal processing involve pre-amplification, rectification, smoothening and post amplification. By this way, the EMG signal conditioning process is carried out using suitable circuitry constructed on a breadboard after this phase our next work to make the resultant EMG signal available for the nano the arduino nano works as a brain of the system that the robotic arm attached with it, to perform the desired action.

An embedded C code program is written for controlling the operation of the arm movements. The code is then uploaded to the arduino nano which is connected o nRF24L01 transceiver which sends the signal to the receiver through the wireless channel and at the receiver the signal is receive the signal is being preprocessed by the arduino uno and according to the received signal the servo motor is controlled and the robotic arm is movement is controlled by controlling servo motor.

4.BLOCK DIAGRAM

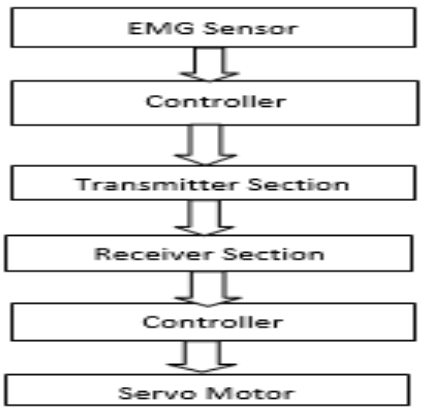

Fig. Block Diagram of Wireless movable robotic arm

Figure shows the block diagram of Wireless movable Robotic Arm it consist of

- EMG sensor
- Controller
- Transmitter section
- Receiver section
- Controller
- Servo motor

EMG sensor

For the Robotic arm the EMG signal is used as the input signal this signal is the output of the EMG sensor. The electromyography is used in the biomedical for the diagnosis and the analysis of the human muscle this sensor is used for the detecting the muscle activity of the human by the contraction of the muscle according to the muscle of the body the emg signal is given to the controller of the transmitter section. In the EMG signal there are two kind of output RAW signal land the integrated signal the RAW signal which is detected by the signal and send to the controller and the other signal is rectified, then the signal is filtered and the output of the is filtered signal which is then fed to the integrator signal land the output of the signal is integrated signal this is the output of the EMG signal.

Controller of the transmitter

In the transmitter section the Arduino nano is used as the controller section, as the arduino nano is the small in the size so that it can be fitted on the human arm with the emg sensor. The output of the emg sensor is given to the arduino nano. According to the input signal the threshold level of threshold level is defined. It is very important to correct determine the threshold level of the signal according to the application of the project so that the accepted output should be achieved. The output of the controller is given to the transceiver of the robotic arm the EMG sensor and the arduino nano is used in the transceiver section of the signal.

Transceiver section

In the wireless movable robotic arm nRF24L01 transceiver module is used for the transmitter section and receiver section both the frequency range of the transceiver is about 2.4 to 2.5GHz ISM band. The robotic arm is about 10m of the operating range. In the transmitter section the output of the Arduino nano is connected to the end the signal to the receiver section.

At the receiver section the signal is received and the output of the receiver I am being fed to the arduino uno which is the controller of the receiver section.

Controller section of the receiver

The arduino uno is used as the controller of the receiver of the section the input to the receiver section is taken from the transceiver module and the and according to the input signal and the threshold level the control signal is send to the servo motor.

Servo motor

In this project five servo motor are used for the controlling the five fingers input signal is taken from the controller of the receiver accordance to the input signal the servo motor will be rotate.

5.HARDWARE REQUIREMENTS

- Arduino uno
- Arduino nano
- EMG sensor
- Servo motor
- 16 channel servo motor driver
- nRF24L01 transceiver module

6.CONCLUSION

In this, the EMG sensor is used as the input for the Robotic arm the robotic Arm is wireless so that it can be controlled by the muscle activity of the human arm and the output wirelessly. In the future scope by some modification it can be fitted on the bot for performing the specific operation and according to the application various kind of sensors and actuators are used and perform the operation. In this according to the muscle the finger movement is achieved.

REFERENCES

[1] Minjiye Chen, Honghai Liu. Robot Arm Control using Forearm EMG Signals MATEC Web of Conferences 309, 04007 (2020).

[2] Benjula Abhi Malar M B, Praveen R, Kavi priya K P Hand Gestures Control Robot. International Journal of Innovative Technology and Exploring Engineering (IJITEE), December 2019.

[3] Waseem Afzal, Shamas Iqbal,zamin Tahira, Mehtab Ejaz Qureshi, Gesture Control Robotic

Arm Using Flex Sensor. Artical in Applied and computational mathematics 2017.

[4] CHEN L L, LI C J, WANG P. Design and implementation of myoelectric prosthetic hand control system based on MYO and Android [J]. Computer Measurement and Control. 2017, 25 (9): 64-67.

[5] Tushar Sushil kulkarni, Rashmi Uddanwadiker. Mechanism and Control of a Prosthetic Arm. Artical in Molecular & cellular biomechanics:MCB 2016.

[6] Jana Utama, Prosthetic Robotic Arm Control System using EMG signal detection. Conference paper November 2015.

[7] Purohit, M. Kakatkar A 9-Dof Robotic Arm Teleportation System using Haptic Technology in international Conference on Pervasive Computing (ICPC), 2015.

[8] ZHANG D H. Research on the Electromyographic Control Method of Bionic Manipulator [D]. Shenyang Ligong University. 2013.

[9] A. K. SANCHETI "Gesture Actuated Robotic Arm" International Journal of Scientific and Research Publications, Volume 2, Issue 12, December 2012.

[10] Angkoon Phinyomark, Chusak Limsakul, and Pornchai Phukpattaranont, "A Novel Feature Extraction for Robust EMG Pattern Recognition", Journal of Computing, Volume 1, issue 1, December 2009, ISSN: 2151-9617.

[11] P. K. Artemiadis and K. J. Kyriakopoulos, "EMG-based teleoperation of a robot arm using low-dimensional representation," in Proc. IEEE/RSJ Int. Conf. Intell. Robots Syst., 2007, pp. 489–495.

[12] B. Crawford, K. Miller, P. Shenoy, and R.P.N. Rao, "Real-time Classification of Electromyographic Signals for Robotic Arm Control", presented at the AAAI, Pittsburgh, PA, 2005.

[13] L. Mesin, D. Farina, "A model for surface EMG generation in volume conductors with spherical inhomogeneities", IEEE Transactions of Biomedical Engineering, vol. 52, no. 12, pp. 1984-1993, 2005.

[14] J. R. Cram and G. S. Kasman, Introduction to Surface Electromyography. Gaithersburg, MD: Aspen, 1998.

[15]]L.Feng, J.Borenstein, D. Wehe, A Completely Wireless Development System for Mobile Robots. ISRAM conferecence, Montpellier, France, May 27- 30, 1996, pp.571-576.