IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 7, Issue 5, May 2019

EMG Based Robot Control

Aishwarya Pachore[1], Kartik Kaul[1], Rohan Awari[1], Radha Chande[1], Prof . R.B.Kakkeri[2]

BE students, Department of Electronics and Telecommunication Engineering,

Sinhgad Academy of Engineering, Pune, India[1]

Professor, Department of Electronics and Telecommunication engineering,

Sinhgad Academy of Engineering, Pune, India[2]

Abstract: The project examines the usability of muscle compressions identified by surface electromyography (EMG) sensors as an input channel for the gestural or inconspicuous control of electric gadgets. A prototype is developed by acquiring signal from the muscles using the electrodes and sensor. This work shapes the reason for further research on utilizing EMG signals for controlling, guideline, and route of robot.

Keywords: EMG, Muscle sensor, Arduino, HC-05, Signals, RF module, signal processing.

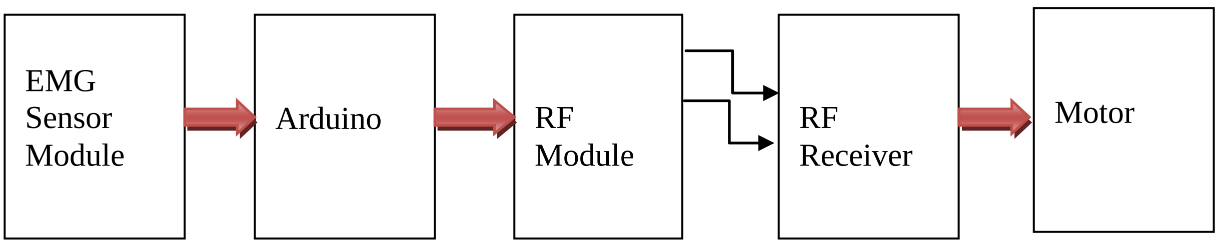
I. INTRODUCTION

In the most recent year's gesture interaction between humans and computers turned out to be increasingly imperative. This is on the grounds that there is an expanded requirement for subtle control systems which makes myoelectric signals interesting. Specifically, in the field of mechanical technology that is robotics such signals are valuable as they can be used to augment a robot performance. In this project, Electromyography (EMG) signals are prepared and identified and an interface is structured and assessed in a control setting of robot. The Electromyography (EMG) controlled robotic vehicle is one of numerous instances of a mechatronics framework. EMG is a procedure that is utilized to record and assess electrical action that is delivered by skeletal muscle driving forces. EMG was originally and being used and designed for medical research and disease diagnosis. However, more recently, EMG has been applied and actualized in control systems, for example, prosthetics and robotics. This innovation enables users to control any mechatronics gadget with little muscle movements without physically stressing the body. EMG can be utilized to control anything like robots or cameras.

II. PROPOSED SYSTEM

Figure 1 shows the system diagram of the proposed EMG-based robot control system, which consists of three main modules: signal measurement, processing and transmitting unit. The signal measurement and processing module measures the raw EMG signals and also filters out the noises. The filtered EMG signals are then sent to ARDUINO to derive their features. It determines the corresponding arm movements and generates the commands to drive the human-assisting robot via RF module. From the resultant robot motion, the operator evaluates the performance and determines next movement. These three modules are described below.

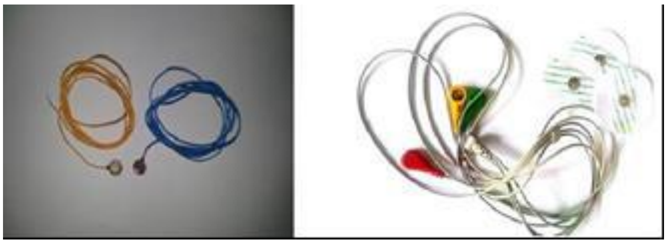
A. Block Diagram



B. Description :

1. Execution of EMG Signal Acquisition Unit: Characteristics of EMG signals have considered to implement the design of acquisition unit. EMG sensor can be utilized for an assortment of control framework. The sensor will ensure the filter, electrical activity of muscle output rectifier 0-V volts, the output relies upon the measure of chosen muscle activity.

2. Selection of Surface EMG Electrodes :
There are two strategies to procure EMG signals to be specific invasive and non-invasive. We have chosen non-intrusive technique because of less ethical issues, insignificant disease transmission and patient comfort. We have tested two types of non-invasive electrodes to obtain EMG signals. At first reusable, non-adhesive electrodes were utilized for EMG signals obtaining which is shown in Fig



Use of gel was an absolute necessity to coordinate impedance among skin and electrode. Plasters were utilized to attached electrode to skin which made patient more uncomfortable. Electrode placement stability wasn't satisfactory. At that point the other sort, single utilize and adhesive electrodes were utilized for EMG signal acquisition which appeared in Figure. These electrodes were gel consolidated and attached to the skin with great stability.

3. Signal Processing Unit :
Arduino will be used for signal processing; it was selected for this research. Apart from other signal processing units it has better advantages. Most importantly it is compatible with MATLAB R2015a software which we used for EMG signal analysis.

4. RF Transceiver :
The TX is an ASK transmitter module. The outcome is magnificent performance in an easy to-utilize. The TX is planned explicitly for remote-control, wireless mouse and vehicle alarm framework operating at 315/433.92 MHz. The RX is a miniature receiver module that receives On-off keyed modulation signal and demodulated to digital signal for the next decoder stage. The outcome is amazing performance in an easy to-use, with an external component count. The RX is structured explicitly for remote-control and wireless security receiver operating at 315/434 MHz.

5. DC Motor :
A dc motor is electric motor that runs on direct current power. In any electric motor, operation is reliant upon simple electromagnetism. A current conveying conductor generates a magnetic field, when this is then set in an outside magnetic field, it will experience a force corresponding to the current in the conductor and to the quality of the outer magnetic field. It is a device which changes over electrical energy to mechanical energy. It works on the fact that a current carrying conductor placed in a magnetic field experiences a force which causes it to rotate with respect to its original position.

III. EXPERIMENTAL RESULT

In order to check the accuracy of the robot navigation control, 500 times of discrimination was performed for each motion. All the members of our group were tested and being monitored. Each observation of the strongest and weakest value obtained from the sensor were recorded. Observations are as below, Table

	Strong signal	Weak signal	Testing
1)	1.79	2.40	1.69
2)	1.69	1.90	0.83
3)	1.73	1.58	2.37
4)	2.17	1.24	1.75

 DOI 10.17148/IJIREEICE.2019.7504

IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 7, Issue 5, May 2019

IV. CONCLUSION

In conclusion, we proposed a new method of robot navigation control through electromyogram and acceleration sensors attached to human arms. This method allowed the user to control the robot remotely by his/her intuitive motion. EMG signal processing decided whether to control the robot or not. Then, the robots took a motion out of 4 possible motions (Forward, backward, left turn, Right turn) that is inferred from sensor. The accuracy of the motion discrimination had the success rate of 99% without any time delay. The whole system was implemented and we verified its utility by humanoid robot demonstration. In this study, however, the robot is limited to move in a fix speed and thus is not able to control itself appropriately in different conditions. We expect that this problem is to be solved when EMG power is directly converted to its speed. In this study, however, the robot is limited to move in a fix speed and thus is not able to control itself appropriately in different conditions. We expect that this problem is to be solved when EMG power is directly converted to its speed.

REFERENCES

[1]. Wu, Yunfen, María Ángeles Martínez Martínez, and Pedro OrizaolaBalaguer. "Overview of the Application of EMG Recording in the Diagnosis and Approach of Neurological Disorders."Overview of the Application of EMG Recording in the Diagnosis and Approach of Neurological Disorders | InTechOpen. InTech, 22 May 2013. Web. 21 Apr. 2017.

[2]. Gil, Jamie Gomez, Israel San-Jose-Gonzalez, Luis Fernando Nicolas-Alonso, and Sergio Alonso Garcia. Steering a Tractor by Means of an EMG-Based Human-Machine Interface. Tech. Department of Signal Theory, Communications and Telematics Engineering, University of Valladolid,, 11 July 2011. Web. 24 Apr. 2017.

[3]. Walsh, Connor J. Herman, Maxwell. Sanah, Siddharth. Galloway, Kevin C. Polygerinos, Panagiotis. “EMG Controlled Soft Robotic Glove For Assistance During Activities of Daily Living.” Harvard Biodesign Laboratory, August 2015.

[4]. Keating, Jennifer. "Relating Forearm Muscle Electrical Activity To Finger Forces." Worcester Polytechnic Institute, May 2014.