# Controller using Myoelectric Signals and IMU
# Electronics Club: Summer Project

## OVERVIEW

Recognition of hand gestures using EMG and IMU, integrating it with a computer interface to control basic devices.
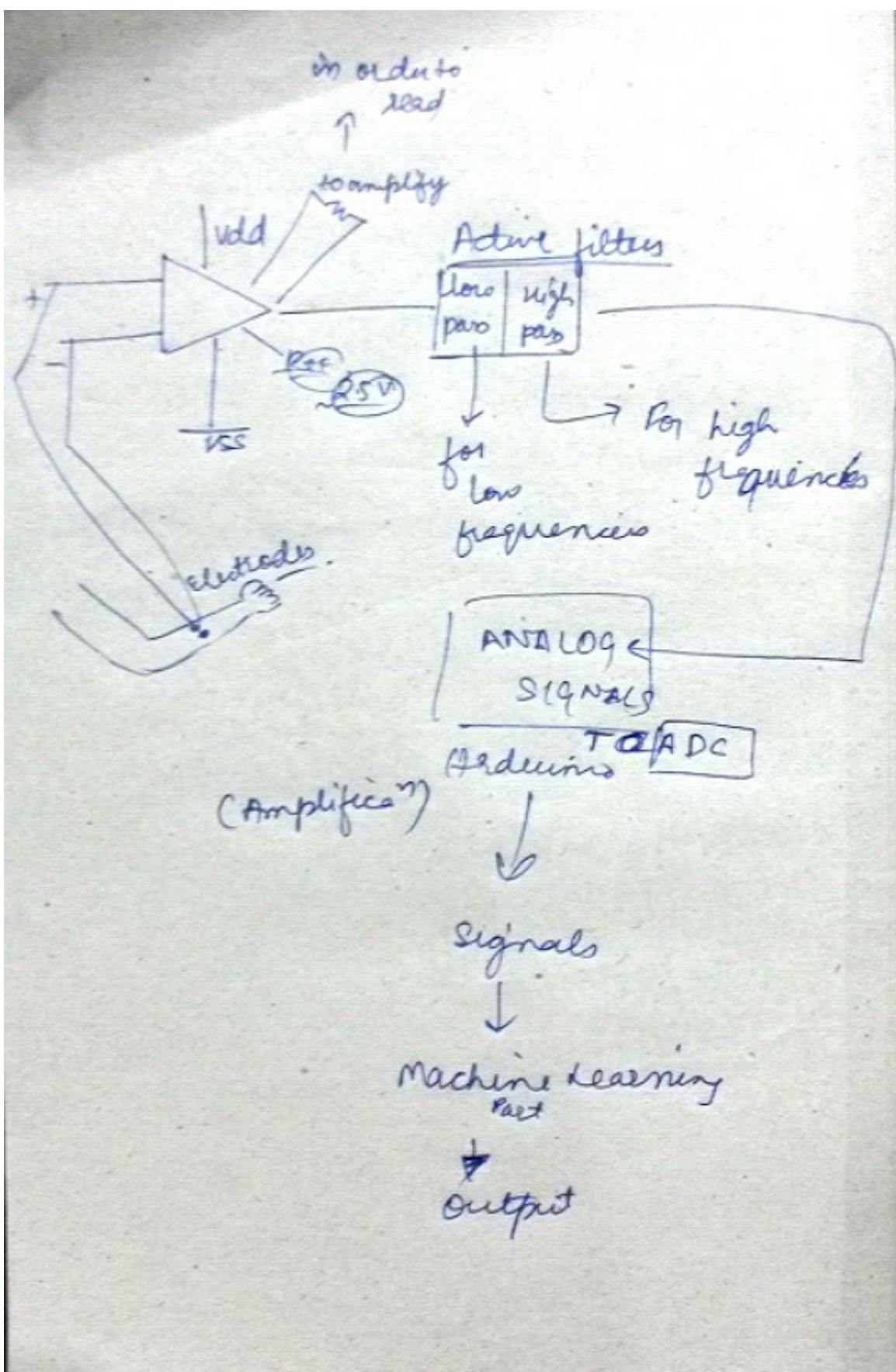
## FEATURES AND IMPLEMENTATION

We will take myoelectric signals using two electrodes ( charged) which will interpret the change caused by the myoelectric signals, and a neutral electrode that shall read the other signals(noise). Also we are planning to use an IMU to find the orientation of the arm at any time and thus increase the functionality. Bend sensors can also be used if we succeed in completing the planned.

We plan to process the input using arduino uno. The analog signals shall be converted to digital and then shall be fed to the computer. Using machine learning, we will teach the computer what gesture signifies what movement, and reciprocate the same, when repeated. The gestures that we intend to conquer are fist motion, arm up-down, left and right, and individual finger contraction, the data of which will be given by bend sensors.

## TIMELINE

For the first 15 days, we will design the hardware and try to take as input, a myoelectrical signal. For the next 15 days, we will work on differentiating different signals and process them to get the required output through machine learning. In the last 10 days, we will try to integrate IMU in the system to get orientation as a source of input.

in order to
read

to amplify

Active filters

Vdd

Low pass | High pass

Ref 2.5V

Vss

For high frequencies

for low frequencies

electrodes.

ANALOG SIGNALS
TO ADC

(Amplifica")  Arduino

Signals

Machine Learning
Part

Output

## HARDWARE REQUIRED

- Arduino uno*
- IMU(inertial Measuring Unit)
- Bend sensors

## Circuit Chips(Buy Link)

- 3x TL072 IC Chip   The JFET-input operational amplifiers in the TL07x series are similar to the TL08x series, with low input bias and offset currents and fast slew rate. The low harmonic distortion and low noise make the TL07x series ideally suited for high-fidelity and audio preamplifier applications. Each amplifier features JFET inputs (for high input impedance) coupled with bipolar output stages integrated on a single monolithic chip.  http://www.ti.com/product/tl072
- 1x INA106 IC Chip  The INA106 is a monolithic Gain = 10 differential amplifier consisting of a precision op amp and on-chip metal film resistors. The resistors are laser trimmed for accurate gain and high common-mode rejection. Excellent TCR tracking of the resistors maintains gain accuracy and common-mode rejection over temperature. http://www.ti.com/product/ina106

## Cables and Electrodes

- 3x Alligator clips
- 3x EMG Electrodes  This sensor will measure the filtered and rectified electrical activity of a muscle; outputting 0-Vs Volts depending the amount of activity in the selected muscle, where Vs signifies the voltage of the power source. It's that easy: stick on a few electrodes, read the voltage out and flex some muscles! http://www.protocentral.com/biomedical/445-muscle-sensor-v3-kit.html

## Power

- 2x 9V Battery
- 2x 9V battery clips

**Capacitors**

- 2x 1.0 uF Tant
- 1x 0.01 uF Ceramic Disc
- 1x 1.0 uF Ceramic Disc

**Resistors**

- 3x 150 kOhm 1%
- 2x 1 MOhm 1%
- 2x 80.6 kOhm 1%
- 6x 10 kOhm 1%
- 1x 100 kOhm Trimmer
- 1x 1 kOhm 1%

**Misc**

- 2x 1N4148 Diode -High speed switching.
  General Applications-Continuous reverse voltage.max 100V.
  Repetitive peak forward current.max 450 A
  Repetitive peak reverse voltage.max 100 V.
http://in.element14.com/fairchild-semiconductor/1n4148/small-signal-diode-100v-200ma/dp/9843680
- Jumper wires   This is a 65-piece pack of male-to-male jumper wires most suitable for breadboard prototyping.
- 3x Alligator clip cables

**Optional**

- 1x Oscilloscope
- 1x Multimeter

*Please verify if Arduino Uno is compatible for our task, else please suggest something better.

## REFERENCES (ALREADY EXISTING DEVICES ETC)

- https://www.youtube.com/watch?v=kiG7CyvRlcI
- https://backyardbrains.com/experiments/emgspikershield#prettyPhoto
- http://myrobotlab.org/content/simple-myo-sensor
- https://www.delsys.com/decomp/2009_EMBS_Nawab_et_al.pdf
- http://developerblog.myo.com/raw-uncut-drops-today/?utm_source=email&utm_medium=email-devnewsletter&utm_campaign=devupdate-191214
- http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1455479/
- https://www.youtube.com/watch?v=aXoDK0EHdzM
- http://www.diybiomechanics.com/wp-content/uploads/2012/01/EMG.pdf

## RESULT

By recognizing the gestures and integrating them with a computer interface, we plan on controlling simple objects by the movement of hand.

## APPLICATIONS

1. To control simple robots, or any device for that matter.
2. Interpretation of sign language for the deaf and dumb to create a complete dictionary that interprets all gestures to form meaningful messages.
3. Smart controller.

## Team Members, Role, and Contact Details

| Afroz Alam | : Programming | : 7755057989 |
| --- | --- | --- |
| Himanshu Kumar | : Electronics | : 7599161486 |
| Jishant Singh | : Electronics | : 7054423823 |
| Krutika Kalkal | : Electronics | : 7755048189 |
| Kunal Kapila | : Programming | : 9005685064 |
| Sagar Chand | : Electronics | : 7755047797 |