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%----- FLORIDA ATLANTIC UNIVERSITY, 2014-----
%-----Biomedical Signal Processing Laboratory-----
%-----KHRYSTSINA NAVUMENKA-----
%
%---Real Time Data Acquisition into MATLAB Workspace---
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% This code has been created to acquire a real time ECG
% signal from a source (in our case, OMAP-L138 LCDK),
% store it in MATLAB workspace and filter the high
% frequencies (>120 Hz) noise out of the recorded data.
%-----

clc;clear;

%-----Find all available DAQ devices-----

f=daq.getDevices

%-----Choose the primary sound capture driver-----
%-----For data acquisition session-----

dev=f(1)

%-----Create data recording session-----
%---In our case, the name of the device is "directsound"

s = daq.createSession('directsound')

%-----Add input channel-----

addAudioInputChannel(s, dev.ID, 1:1)

%-----Specify Sample rate-----
%(512Hz is the standard Fs for ECG sampling, but some DAQ
% devices may have Fs limitations)-----

s.Rate = "Type your Fs value in Hz here";

%---Provide duration of the session value in seconds---

s.DurationInSeconds = "Type your duration value here";

%-----Begin data recording-----

data=s.startForeground;

%---Call the function "lowpass", representing a filter,
%---generated to eliminate high frequency noise from the
%---recorded data-----

G=lowpass(data);

%---Plot recorded ECG signal-----

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plot(G, 'LineWidth', 2);
xlabel('Time, s');
ylabel('Signal Amplitude, V');
title('Real time ECG Sample'), grid

%-----End Program-----

%-----High frequency noise eliminating function---
%--A similar code can easily be generated using -
%--MATlab "filter builder" tool-----

function y = lowpass(x)
%LOWPASS Filters input x and returns output y.

% MATLAB Code
% Generated by MATLAB(R) 8.3 and the Signal Processing Toolbox 6.21.
% Generated on: 16-Jul-2014 14:56:15

persistent Hd;

if isempty(Hd)

    Fpass = 70;    % Passband Frequency
    Fstop = 120;  % Stopband Frequency
    Apass = 1;    % Passband Ripple (dB)
    Astop = 60;   % Stopband Attenuation (dB)
    Fs     = 512; % Sampling Frequency

    h = fdesign.lowpass('fp,fst,ap,ast', Fpass, Fstop, Apass, Astop, Fs);

    Hd = design(h, 'butter', ...
        'MatchExactly', 'stopband', ...
        'SOSScaleNorm', 'Linf');

    set(Hd, 'PersistentMemory', true);

end

y = filter(Hd,x);

%-----End Program-----

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