EE2509 Lab6: Prologue

Biosignal Measurement

Key Principles:

- Biosignals are produced by the electrical activity that arises from the biological activity that takes place within different tissues and organs of the human body
  - EEG (brain) – exchange of ions creates an electric potential change which creates a current and associated electric field that can be measured with electrodes – signals in the 0.1Hz – 150Hz range
  - EMG (muscle) - depolarization and repolarization of muscle cell membranes creates an electric potential change which creates a current and associated electric field that can be measured with electrodes – signals in the 0 – 500Hz range
  - ECG, EKG (heart muscle) – EMG focused on the heart

Simplified Process:

- Attach appropriate sensors to transduce the electric fields generated to electric signals (voltage)
- Capture the signals using A/D conversion
- Perform real time signal processing or store the sample and perform non-real time signal processing

Biosignal Generation

Key Principles:

- The electrical signals sent from the brain to various body structures can be mimicked using electronic devices and probes (transmitters).
  - EMS – Electrical Muscle Stimulation – causes muscles to contract, which in turn strengthens them or aids in healing
  - Pacemaker – stimulates the heart muscles to contract (beat) if the heart rate becomes too low
  - Defibrillator – stimulates the heart to return to its normal rhythm

Simplified Process:

- Attach appropriate transmitters to the muscle
- Transmit the desired signal

EE2905 Lab 6: Analog Outputs

Objectives

- Use arrays
- Interface to speaker
- Use the PwmOut class
- Use the AnalogOut class

Prelab — **student check off**

- Get a 4.7uF capacitor from the tech center ☐
- Review the Speaker spec ☐
- Review the PwmOut class slides ☐
- Review the RC Circuits notes ☐
- Review the Arrays class slides ☐
- Review the AnalogOut class slides ☐

Assignment

Part 1: Create a program that uses the 10KΩ potentiometer to vary a PWM output's period. The output of the PWM will be used to drive the speaker. Your design should support output frequencies of 20Hz to 15KHz.

Print to the console: a) the potentiometer values in ohms, b) the PWM output frequency in Hz.

Be sure to pick a rational duty cycle value

Main should only control flow – each major process should be in its own function ☐

Whole program

Part 2: Create a program that replicates / manipulates an analog waveform using a DAC output.

Read an analog waveform and store 100 samples into an array. (RC rise/fall)

Allow the user to:

Replicate the waveform scaled from 0 to 1x

Invert the

Reverse th x

Modified – simply replicate the RC rise (or fall) using the DAC and display on the AD2

Once the user rm has been captured, the resulting DAC

Use the analog discovery or a bench scope to show the DAC output waveform

Key parameters:

R = 10KΩ, C = 4.7uF

Original signal sample rate = 250Hz

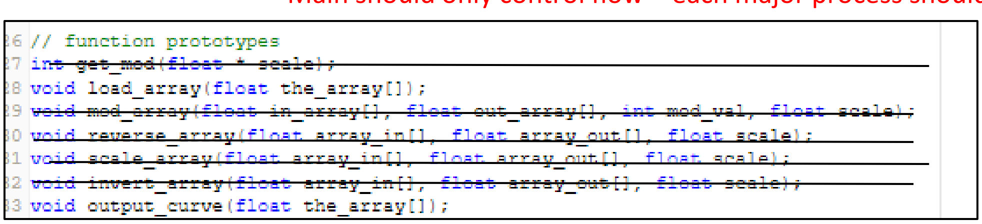
DAC output repetition rate = 2Hz

Capturing either the rising or falling RC (not both) – your choice

You can read the input waveform only once

Main should only control flow – each major process should be in its own function ☐

Main



```
// function prototypes
int get_mod(float * scale);
void load_array(float the_array[]);
void mod_array(float in_array[], float out_array[], int mod_val, float scale);
void reverse_array(float array_in[], float array_out[], float scale);
void scale_array(float array_in[], float array_out[], float scale);
void invert_array(float array_in[], float array_out[], float scale);
void output_curve(float the_array[]);
```

Check Off

- Demo and document your PWM program 50%
- Demo and document your DAC/waveform program 50%

Checkoff due beginning of Lab 7 (in-person or via Teams chat)

Informal Lab Report: flow diagram(2), code(2), schematic(2) - due beginning of Lab 7.