BBM434 - Embedded Systems Project Proposal

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Abstract

This document is a brief explanation of our project and our methods to achieve the goals of the project.

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2.1. Overview

The purpose of this project is to develop a Drum Pad which also known as Drum Practice Pad. A practice pad or drum pad, is a type of percussion implement utilized by drummers and percussionists to quietly practice or warm up before a performance.

2.2. Outline

Following sections contain informations about hardware and software layers, timeline, responsibilities of group members and budget of the project.
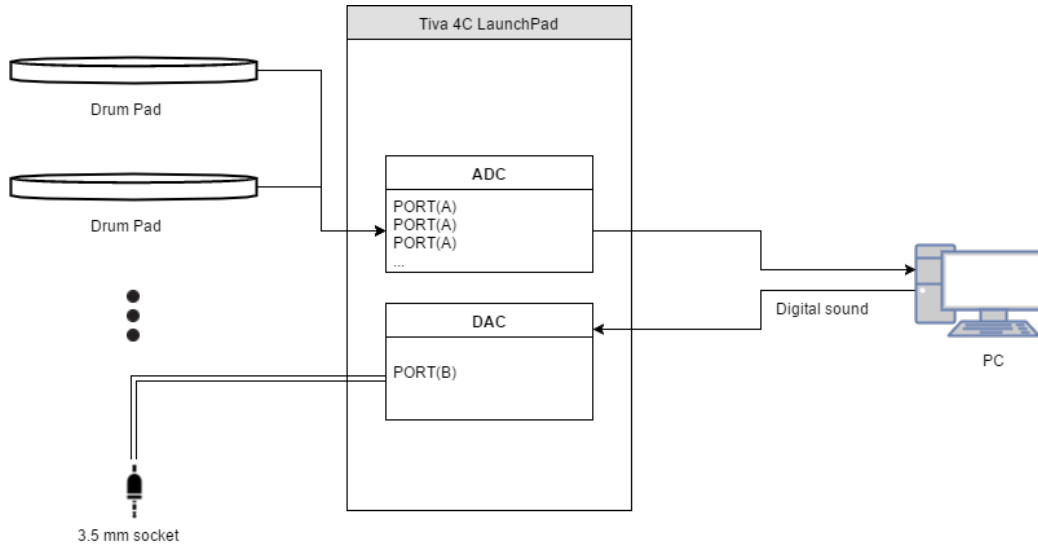
3. Organization

Figura 1: Hardware scheme for the project

3.1. Hardware System

3.1.1. Piezo (Piezoelectric Sensor)

Piezoelectricity is the electric charge that accumulates in certain solid materials in response to applied mechanical stress. The word piezoelectricity means electricity resulting from pressure.

A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge.
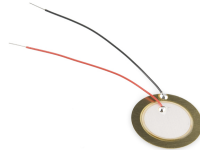

Figura 2: Image of a Piezoelectric Sensor

This device will be used to measure the pressure on the drum pad.

3.1.2. CD (Compact Disk)

A **C**ompact **D**isc is a small, portable, round medium made of molded polymer for electronically recording, storing, and playing back audio, video, text, and other information in digital form.

Figura 3: A CD

We will use CDs for different purpose in our project. Actually we will use them to create more useful pads which is also good-looking.

We will place the Piezoelectric sensors to the center of the CDs.

3.1.3. Mouse pads

A mousepad is a surface for placing and moving a computer mouse. A mousepad enhances the usability of the mouse compared to using a mouse directly on a table by providing a surface.

Figura 4: A Mouse Pad

Purpose of using mouse pads is again create a good-looking drum pad. We will use the mouse pads to cover the CDs.

3.1.4. Tiva 4C LaunchPad and USB Cable

The Tiva-C LaunchPads are inexpensive self-contained, single-board microcontrollers, featuring an ARM Cortex-M4F 32-bit CPU operating at 80 to 120 MHz, manufactured by Texas Instruments.
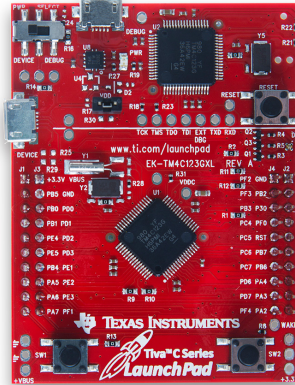

Figura 5: Tiva TM4C123GXL Launchpad

Since our course's main board is Tiva TM4C123GXL, we will use it in our project as main control unit.

3.1.5. 1M Ohm Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active

elements, and terminate transmission lines, among other uses.

We will use resistors to regulate the current on piezo sensors circuits.

3.1.6. Breadboard

A breadboard is used to build and test circuits quickly before finalizing any circuit design.

We will use a breadboard to transmit voltage to our system and we will connect the wires and resistors through this board.

3.1.7. 3.5mm socket

A jack socket is a fixed electrical connector with one or more receptacles for a movable plug, also known as a jack plug. Connecting the plug to the socket allows a user to complete an electrical connection for the purpose of conducting sound, powering a device, or performing other activities.

We will use 3.5 jack socket about to obtain the output signal.

3.2. Software Layer

This project has a multi-stage software architecture (Figure 6.) such as User mode and Kernel mode. User mode is responsible for the connection of the hardware interfaces used in the project to the launchpad, modulation of the electrical signals received from piezo sensors and transmission of the signal to the output signals, while Kernel mode is responsible for digital signal processing of the electrical signals obtained from the user mode and analog signal generation according to the obtained digital signals.
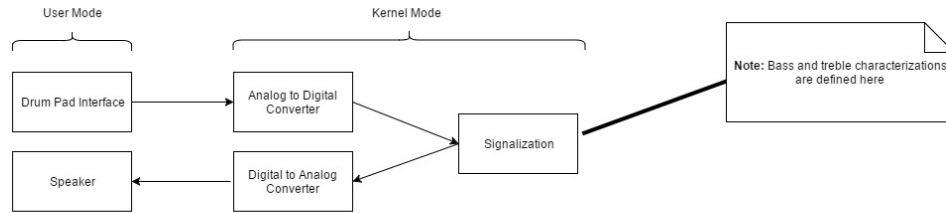

Figura 6: Software layers and explanations

4. Timeline and Responsibilities

4.1. Timeline

For this project, we consider that hardware implementation and programming take 4 weeks and 2 weeks for necessary integrations.

4.2. Responsibilities

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Digital to Analog Converter (DAC) designing, processing the output signal and integration.

Berk Sevgi

Analog to Digital Converter (ADC) designing, setting up and programming the piezo sensors.

5. Budget

- 4 x 27mm Piezo Transducer / Buzzer : 4,40 TRY

- 1 x Tiva^{TM} 4C LaunchPad : 93,50 TRY

- 4 x 1 $M\Omega$ Resistor : 1,00 TRY

- 4 x Compact Disk : 1,00 TRY

- 1 x 3.5mm Audio Jack Socket : 1,50 TRY

- 1 x Solderless Breadboard : 7,00 TRY

- 8 x Mouse Pad : 4,00 TRY

$$Summary : 148, 40 \text{ TRY}$$